

Exhibit A



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(54) **METHOD AND APPARATUS FOR INCOMING CALL REJECTION**

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(51) **Int. Cl.**⁷ **H04M 3/42**

(52) **U.S. Cl.** **455/415; 455/412; 455/567; 379/142**

(58) **Field of Search** 455/404, 33.1, 455/54.1, 90, 525, 550, 422, 567, 455-458, 412-415, 565; 579/142, 127, 67-69, 201, 207, 211, 373, 372, 374, 376, 350, 140, 199-200

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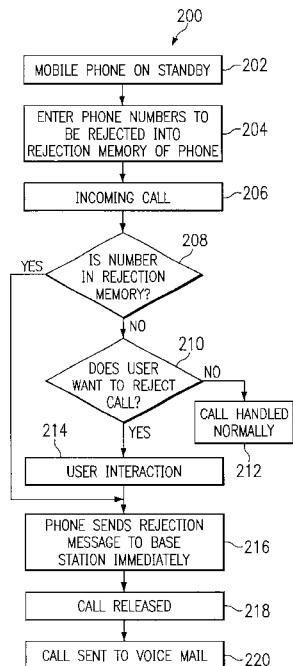
Assistant Examiner—Pablo Tran

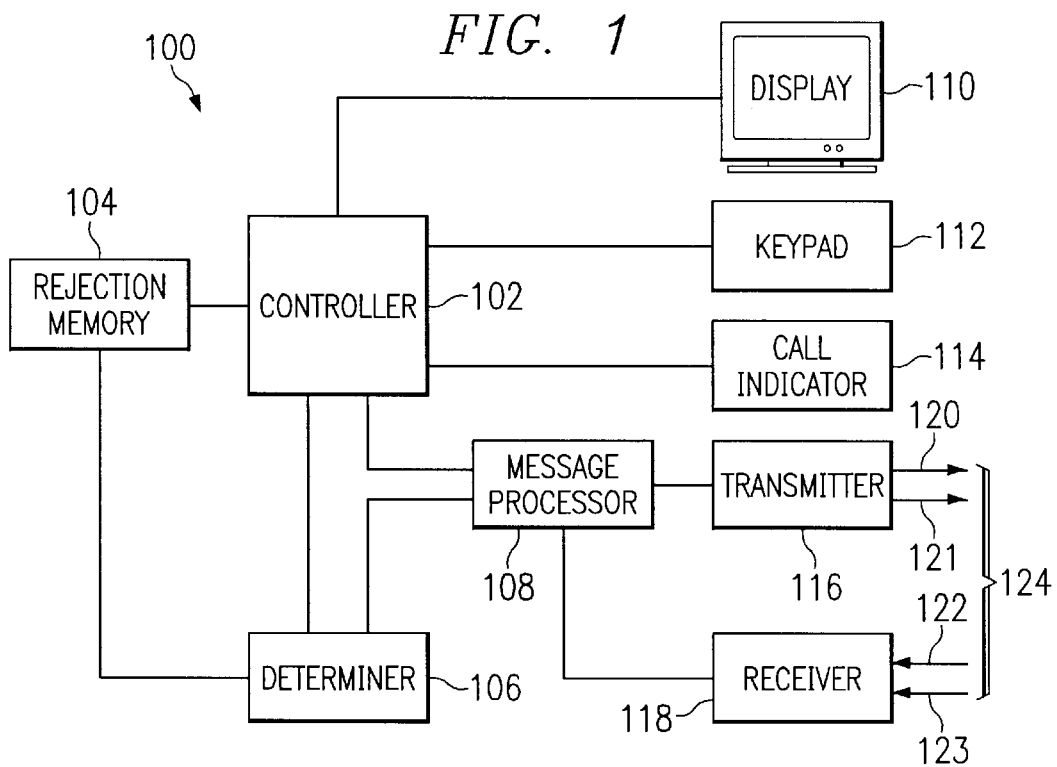
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(57) **ABSTRACT**

A method and apparatus for rejecting incoming calls for use in a mobile communications device. The method and apparatus permit a user of a mobile communications device to automatically reject calls intended to be received by the device. In an exemplary embodiment, a rejection memory within the mobile device is preprogrammed with identification information representative of transmitting stations to be rejected. When a call is incoming, identification information included with the incoming call is compared with identification information contained in the rejection memory. When a match is detected, a rejection message is automatically sent by the mobile communications device to the transmitting station. Upon receipt of the rejection message, the transmitting station terminates the call and may reroute the call to a voice messaging system. Additionally, upon display of the identification information of an incoming call, the user may manually trigger the transmission of the rejection message from the mobile communications device.

15 Claims, 4 Drawing Sheets





300

MESSAGE TYPE	FEATURE DESCRIPTION	RECORD TYPE (BINARY)
FLASH WITH INFORMATION MESSAGE	FEATURE INDICATOR	00000010

FIG. 3a

302

TYPE SPECIFIC FIELD	FEATURE IDENTIFIERS (BITS)
INCOMING CALL REJECTION	0000
RESERVED	XXXX

FIG. 3b

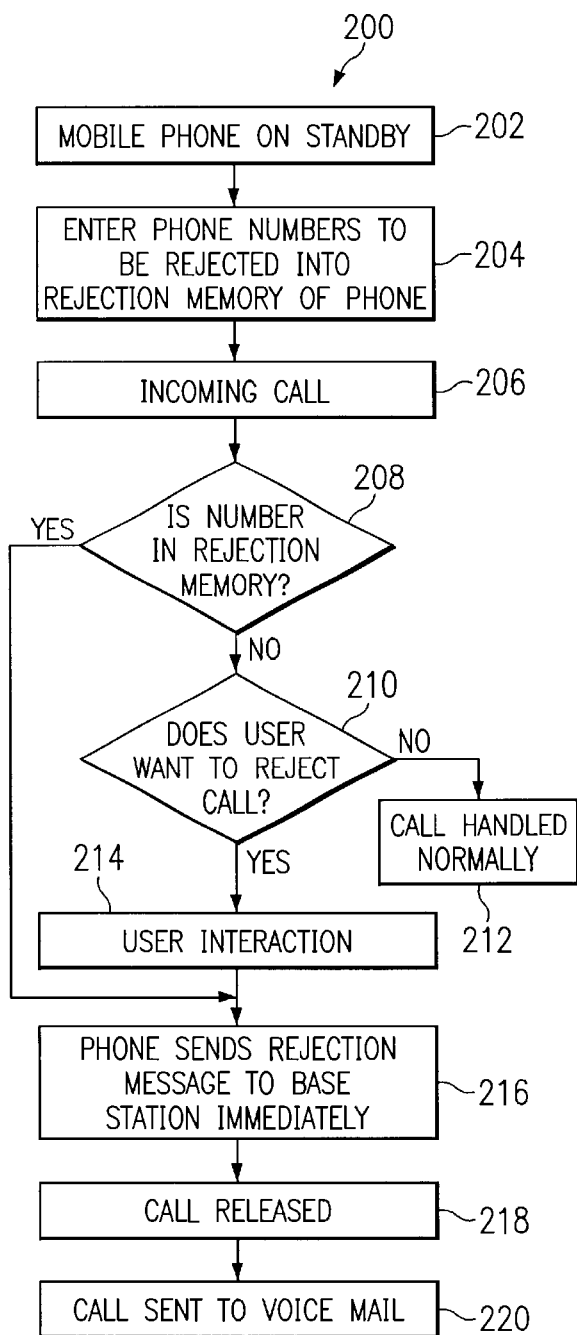


FIG. 2

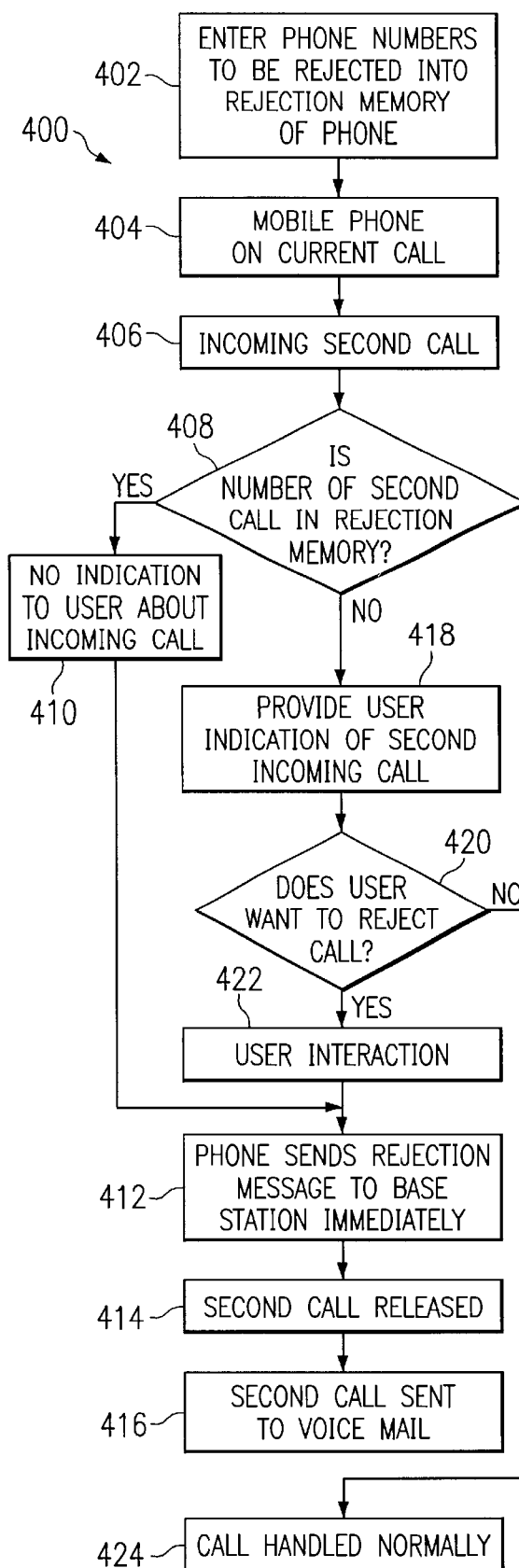
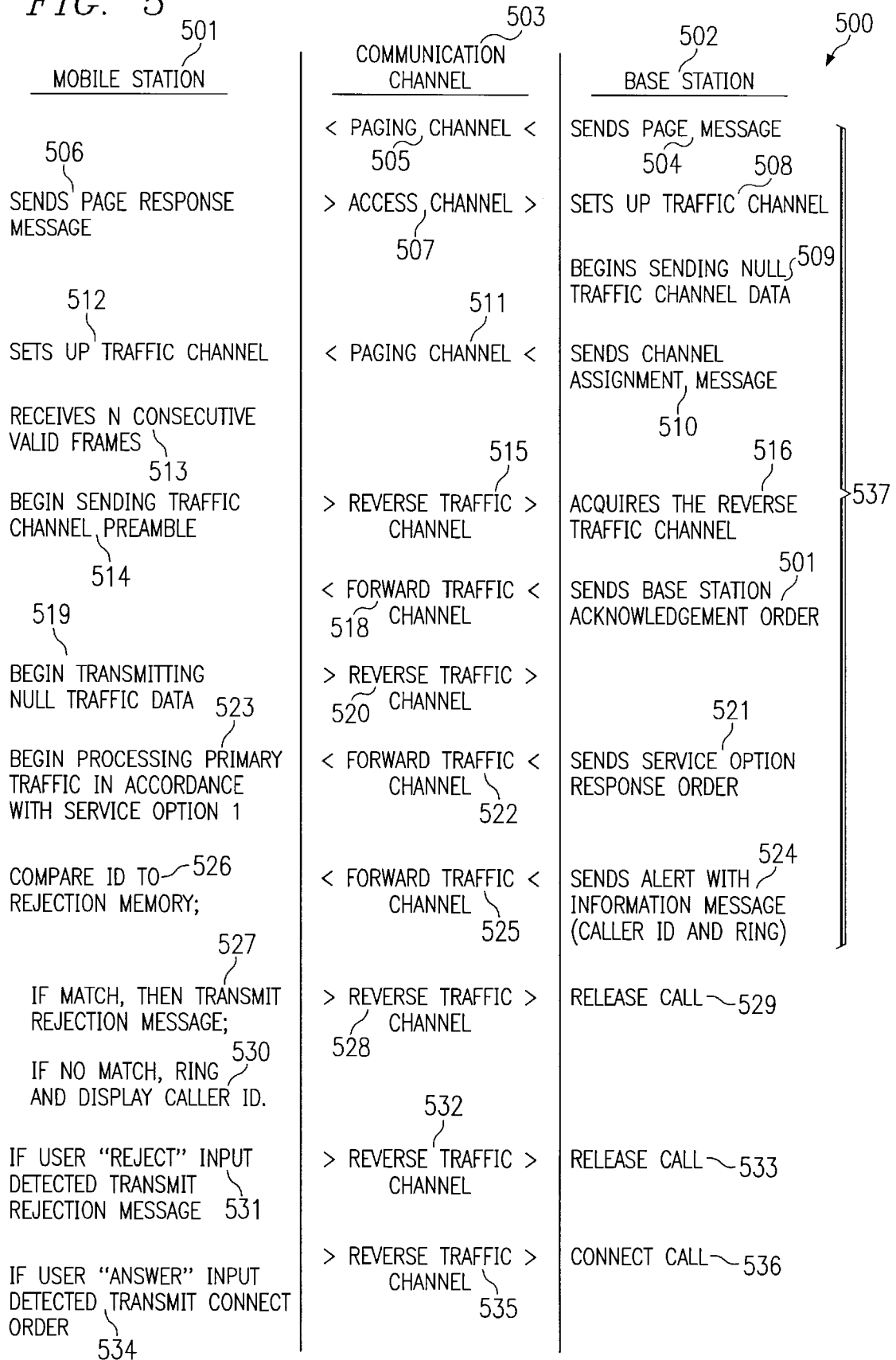


FIG. 4

FIG. 5



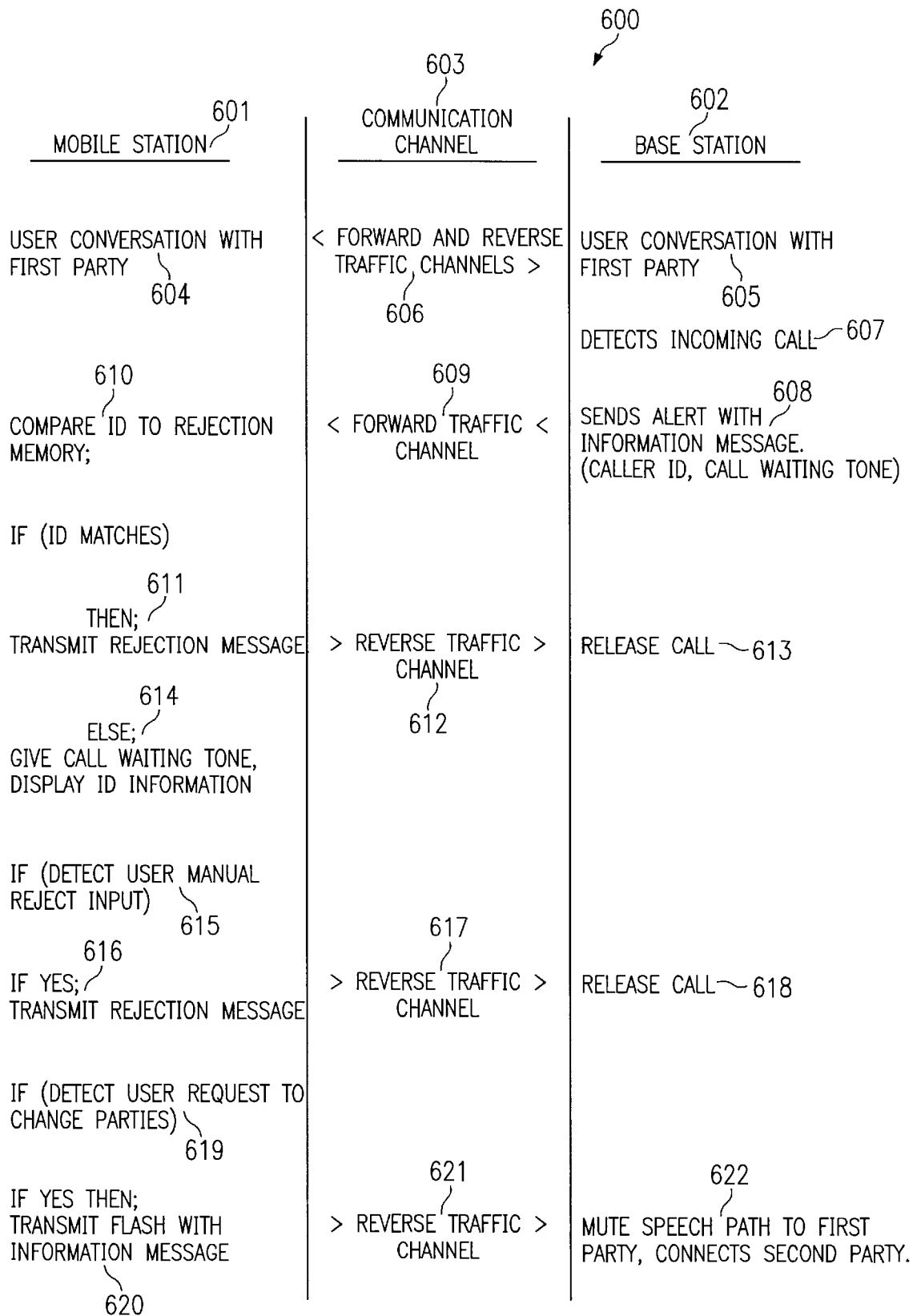


FIG. 6

METHOD AND APPARATUS FOR INCOMING CALL REJECTION

CLAIM OF PRIORITY FROM A COPENDING PROVISIONAL PATENT APPLICATION

Priority is herewith claimed under 35 U.S.C. §119(e) from copending Provisional Patent Application 60/086,032, filed May 19, 1998, entitled "Incoming Call Rejection," by Justin Beghtol and Kenneth Mar. The disclosure of this Provisional Patent Application is incorporated by reference herein in its entirety.

FIELD OF INVENTION

The present invention relates generally to call processing techniques in cellular telecommunications systems. More particularly, the present invention relates to apparatus, and associated method, for rejecting incoming calls to a mobile communications device within a cellular telecommunications system.

BACKGROUND OF THE INVENTION

Wireless telecommunications systems provide a convenient way for users to communicate when landline phones are unavailable. What was once an expensive luxury is now an affordable convenience. By simply carrying a small, lightweight mobile communications device, users may place or receive calls of excellent quality in any geographic region offering such wireless service.

Typically, wireless telecommunications systems are made up of a series of base stations connected to landline telecommunications networks through the use of base station controllers. The base stations have the capacity to communicate with each other via the base station controllers and to establish a fixed number of radio frequency (RF) communications channels with remote mobile phones. The RF communications channels act as a conduit by which the mobile phones may ultimately communicate with landline phones. Thus, as long as a mobile user remains within the geographic coverage area of the wireless system, communication with other mobile and landline users is possible.

To standardize the operation of wireless systems, several communication implementations have been developed. One such implementation, currently used in numerous wireless communication system deployments, is known as Code Division Multiple Access (CDMA). This communication technique is described under the TIA/EIA/IS-95-A standard (IS-95). Accordingly, the IS-95 standard is incorporated by reference in its entirety so as to provide the reader with adequate background information regarding mobile phone operation in an IS-95 telecommunications environment. As defined in the IS-95 standard, analog voice signals are converted to the digital domain, orthogonally encoded and then spread by a pseudo-random spreading signal so as to occupy a 1.23 MHz frequency band. From this spread signal, inphase and quadrature phase signals are generated which are then combined and modulated onto RF carrier signals for transmission between remote mobile stations and fixed base stations.

Current wireless systems allow landline users to place and receive calls with mobile phone users. Additionally, mobile phone users can place and receive calls with other mobile phone users. Fixed base stations facilitate these calls by routing the calls between users and handling necessary overhead activities required to establish the RF communications channels used to conduct the calls.

Typically, when a landline user calls a mobile phone user, the base station acts as an intermediary by alerting the mobile of the attempted call via at least one RF channel. After alerting the mobile, the base station waits for a fixed time period, which defines a ringing cycle, to receive a response from the mobile. The response indicates the mobile is ready to accept the call. If the mobile does not respond within the ringing cycle time period, the base station releases the call by terminating the call alert to the mobile and signaling to the caller that the mobile is unavailable. During the ringing cycle, the mobile phone produces an audible ringing or mechanical vibration to alert the mobile phone user of the incoming call. If the mobile phone user decides to answer the incoming call, a response is sent from the mobile to the base station indicating that the call is to be accepted. The base station then sets up a connection on the existing RF channel or establishes a second RF channel where the call will ultimately be connected.

Included in the call alert to the mobile phone may be identification information about the caller, sometimes referred to as caller ID. This identification information can be displayed by the mobile phone allowing the mobile phone user to determine who is calling before the call is answered. If the mobile phone user decides not to receive calls from specific callers, the identification information can be viewed, and if desired, the incoming call can be left unanswered for the entire ringing cycle.

One of the major benefits to users of mobile phones is the ability to place or receive calls without being restricted to a fixed location as when using a landline phone. So long as the mobile phone maintains an RF communication channel with at least one base station, communication services are generally available. This allows mobile users to send and receive calls when away from their home or office and even while traveling in automobiles.

However, having accessibility to instant communications may at times have undesirable consequences. In particular, unless the mobile phone is powered off, there may be no action a user may take to prevent the phone from proceeding through the entire ringing cycle. This means that for every unanswered incoming call, the phone will ring for the entire ringing cycle until the call is released by the base station. Even if the user is able to mute the audible ringing, the call is still processed by the phone until released, which may prevent the phone from handling other calls. There may also be times when a user desires to refuse all communications from certain callers. Such times may occur when prank callers or telemarketers repeatedly call or when users simply do not want to receive calls originating from specific calling stations. Unfortunately, present systems do not allow mobile phones to refuse to accept calls nor do they provide mobile phone users with a rejection-on-demand capability to immediately reject any incoming call as desired.

Mobile phone systems have also adopted some of the features available in landline systems. For instance, a call-waiting feature may be implemented in a mobile phone system. During operation of call waiting, a user of a mobile phone may be connected and in active communication with a first caller when a second caller attempts a call to the same mobile phone. Instead of the second caller getting an immediate busy signal, a ringing cycle occurs where the mobile phone user receives a call alert indicating that there is an incoming call. The mobile phone user may then switch over to the second call and put the first call on hold, or may ignore the second call and continue on the first call. If the second call is not answered, the call alert to the mobile phone user will continue for a time period defining the ringing cycle.

Unless the mobile phone user answers the second call, there is currently no way to terminate the call alert until the ringing cycle is complete.

There currently exists a need in the mobile communications industry for a method and apparatus wherein a user of a mobile phone has the capability to reject an incoming call. Such a method and apparatus should provide the user an automatic mode of rejection and a manual mode of rejection. The automatic mode should allow the user to preprogram the mobile phone with information descriptive of calling stations whose calls are to be rejected. When an incoming call from a pre-selected calling station is detected, the mobile phone should automatically reject the call. The preprogrammed information should include wild card characters, thereby allowing entire groups of calling stations to be rejected from a single entry. In the manual mode of operation, the method and apparatus should allow a user to manually reject any incoming call as desired. Thus, the user can conveniently and effectively screen incoming calls, prevent undesirable audible ringing and minimize unnecessary utilization of the phone.

OBJECTS OF THE INVENTION

It is, therefore, an object of this invention to provide a method and apparatus for use in a mobile communications device that overcomes the foregoing and other problems.

Another object and advantage of this invention is to provide a method and apparatus allowing mobile phone users to selectively reject incoming calls, wherein the determination process is done at the mobile phone.

It is a further object and advantage of this invention to provide a method and apparatus for automatically rejecting an incoming call.

It is a further object and advantage of this invention to provide a method and apparatus for automatically rejecting incoming calls by utilizing wildcard characters to reject all calls having common identification information.

It is a further object and advantage of this invention to provide a method and apparatus for use in a mobile communications device for allowing a user manually to reject an incoming call.

It is a further object and advantage of this invention to provide a method and apparatus to allow a second call to be rejected, either manually or automatically, while the user is actively involved in a first call.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a method and apparatus for rejecting calls to a mobile communications device. Incoming calls received by the mobile device may contain information that is descriptive of the origin of the call. Based on the descriptive information, automatic rejection can occur. Additionally, a manual rejection feature is provided to allow the user to reject any call as desired.

In an embodiment of the invention, the mobile phone comprises an input actuator, a rejection memory and a message processor. The rejection memory contains information descriptive of calling stations whose calls are to be rejected. In the automatic mode, identification information associated with an incoming call is compared with identification information stored in the rejection memory. A determination is made, and if the incoming call is to be rejected, the message processor automatically transmits a rejection message from the mobile station to the base station. In the manual mode, upon receipt of an incoming call, the user may

immediately actuate the input actuator. This causes the message processor to immediately transmit the rejection message to the base station. Once the base station receives the rejection message, the call is released by the base station and the caller is notified of the unavailability of the mobile. The method and apparatus is especially suited to provide convenience to the mobile user by allowing unwanted calls to be easily rejected.

In these and other aspects, therefore, a method of selectively rejecting an incoming call to a mobile phone is provided. The mobile phone has a transceiver circuit for transmitting and receiving transmissions with a remote transceiver. An incoming transmission is selectively rejected in a process beginning when the incoming transmission from the remote transceiver is received by the mobile phone. A determination is made at the mobile phone whether the incoming transmission is to be rejected. If it is determined that the incoming transmission is to be rejected, a rejection message is transmitted to the remote transceiver, wherein the rejection message indicates to the remote transceiver that the incoming transmission is to be rejected.

BRIEF DESCRIPTION OF THE DRAWINGS

The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached drawings, wherein like reference numerals refer to like parts and in which:

FIG. 1 depicts an apparatus constructed according to the teachings of the present invention;

FIG. 2 depicts a flow diagram representing call processing according to the teachings of the present invention;

FIG. 3a depicts a message as defined under the IS-95 standard known as Flash with Information Message;

FIG. 3b depicts a Rejection Message for use according to the teachings of the present invention;

FIG. 4 depicts a flow diagram representing call processing of an incoming call according to the teachings of the present invention, wherein the mobile communications device is currently processing an active call;

FIG. 5 depicts an exemplary message sequence for rejecting a call according to the teachings of the present invention; and

FIG. 6 depicts an exemplary message sequence for rejecting an incoming call according to the teachings of the present invention, wherein the mobile communications device, while currently processing an active call, may reject a subsequent incoming call.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, therein is depicted apparatus **100** for rejecting an incoming call according to an embodiment of the invention. Apparatus **100** comprises controller **102**, rejection memory **104**, determiner **106**, message processor **108**, display **110**, keypad **112**, call indicator **114**, transmitter **116** and receiver **118**. Transmitter **116** and receiver **118** are used to communicate with a base station over communication channel **124**. Transmitter **116** is capable of transmitting information from the mobile phone to the base station over access channel **120** and reverse traffic channel **121**. Receiver **118** is capable of receiving information transmitted from the base station to the mobile station over paging channel **122** and forward traffic channel **123**. The combination of channels **120**, **121**, **122** and **123** comprise communication channel **124**.

In a telecommunications system operating according to the TIA/EIA/IS-95-A standard, when a remote mobile station is powered on, a registration process occurs. The registration process comprises a series of messages sent between the base station and the remote mobile station over communication channel **124**. Registration allows the mobile station to obtain system parameters from the base station regarding operation of the telecommunications system. Registration also allows the base station to determine which mobile stations are operating in the base station's geographic area. After the registration process is complete, the mobile station may enter a standby mode where it waits to process incoming and outgoing calls. The registration process is well known to those skilled in the art and is not relevant to the disclosed embodiment of the present invention. Therefore, the registration messaging sequence will not be discussed in detail. However, the reader may refer to the IS-95 standard for a complete description.

Referring again to FIG. 1, rejection memory **104** is used to store information identifying callers whose calls are to be automatically rejected. The information in rejection memory **104** may reference individual callers, lists of callers or contain "wild card" characters referencing entire groups of callers. Partial entries may also be used wherein, for example, a few numbers are used, such as **234**, to reject all calls from originating stations having at least the numbers **234** included in their complete numbers. Stored information may also contain alphanumeric characters, such as the name of the calling party or other information used to identify the calling party or calling station. This capability allows the invention to operate more efficiently as more caller identification information becomes available for use. Information may be entered into the rejection memory through user inputs, such as inputs entered on a keypad **112**. These inputs may be received by controller **102** and then input into rejection memory **104**. Additionally, a computer interface such as a hardwired connection or an infrared (IR) link may be used to enter information into rejection memory **104**. Information may also be downloaded to the mobile station from a network such as a wireless telecommunications network for entry into rejection memory **104**. In this method of entry, rejection information is received at receiver **118**, passed to message processor **108**, sent to controller **102** and then entered into rejection memory **104**.

Referring now to FIG. 2, therein is depicted a call processing flow diagram **200** according to an embodiment of the present invention. Call flow diagram **200** illustrates how a call to a mobile station may be automatically or manually rejected. In the embodiment, the mobile station begins in the standby mode at block **202** where it waits to process calls. Entering the standby mode may occur, for example, after completion of the registration process described above. When in the standby mode, the user can enter information descriptive of calls to be automatically rejected into the rejection memory **104** as shown at block **204**. The user can accomplish this through the use of keypad **112**, wherein controller **102** receives user input from keypad **112** and stores the information into rejection memory **104**.

After rejection information has been placed in the rejection memory, an indication of an incoming call may be received as shown at block **206**. The incoming call indication is received at receiver **118** via communication channel **124**. The incoming call indication may contain information about the origin of the call, such as the caller ID information described above. At block **208** a determination is made whether or not to automatically reject the incoming call. The determination can be made when the information about the

incoming call received at receiver **118** is sent to determiner **106** via message processor **108**. In addition, information about calls to be rejected is received at determiner **106** from rejection memory **104**. Determiner **106** then determines if the call is to be rejected by utilizing one or more of the comparison techniques described above. If it is determined that the call is to be rejected, a rejection message is transmitted as shown at block **216** when determiner **106** informs message processor **108** to generate a rejection message and send it to transmitter **116** for transmission to the base station. After receiving the rejection message, the base station releases the call from the mobile as shown at block **218**. The release occurs when the base station sends a release message to the mobile phone over communication channel **124**. Receiver **118** receives the release message and transfers it to message processor **108** and further to controller **102**. After controller **102** receives the release message, it responds by re-initializing the call process to return to block **202** where the phone enters the standby mode again. In the meantime, the base station may terminate the incoming call or transfer the call to a voice messaging system as shown at block **220**.

If a determination is made at block **208** that the call is not to be automatically rejected, a call alert is activated and the user is given the opportunity to manually reject the call at block **210**. The call alert occurs when controller **102** displays the incoming call identification information on display **110** and activates the call indicator **114**. Call indicator **114** is capable of generating rings, tones or other audible sounds, as well as mechanical vibration or other physical indications detectable by the mobile phone user. If the user decides to manually reject the call, the user indicates this to the phone by, for example, pressing a button on keypad **112**, or some other available input actuator, thereby providing a user interaction as shown at block **214**. A user interaction at keypad **112** is received at controller **102** which in turn directs message processor **108** to send the rejection message to transmitter **116** for transmission to the base station. As before, when the base station receives the rejection message, the call will be released.

If the user does not want to manually reject the call at block **210**, the call is processed normally as shown at block **212**. This means the user has the option to answer the call or let it continue to ring. The user may answer the call by entering a user input on keypad **112**, for example. If the user does not answer after a fixed period of time, for example, a ringing cycle, a time out will occur and the base station will release the call.

The rejection message is used to notify the base station that the mobile phone user would like to immediately reject the attempted incoming call. In a cellular system operating according to the IS-95 standard, a rejection message could be incorporated under IS-95 section 6.7.4, Reverse Traffic Channel Information Records. On the reverse traffic channel, information records may be included in a Flash with Information Message. FIG. **3a** depicts an information record type **300** known as a Feature Indicator, which could be used to provide the rejection message in a Flash with Information Message. Under the IS-95 standard, section 6.7.4.1 defines a Feature Indicator message. Referring to FIG. **3b**, therein is depicted message format **302** for the Feature Indicator, which can be used to indicate a rejection message to the base station. In this format, the first four bits may be used to signify call rejection by setting them to the value of "0000." The next four bits are reserved. The rejection message indicates to the base station that the mobile phone user desires to have the attempted incoming call immediately rejected. This is different from merely

indicating to the base station that the mobile phone cannot receive the call because it is busy. By transmitting a rejection message to the base station, the base station can distinguish between a busy message and a rejection message and thereby process the call as appropriate for each situation. For instance, if the mobile phone indicates it is busy, the caller may hear a message indicating this and be given an opportunity to leave a voice message. If the mobile phone indicates that the call is to be rejected as an undesired call, for example, the caller may be given no opportunity to leave a message and the call may be immediately terminated.

Referring to FIG. 4, another embodiment of the invention is depicted by call processing flow graph 400. In this embodiment, the mobile phone user is connected to a current call when the incoming call is attempted. Block 402 functions identically to block 202 of FIG. 2. At block 404, the mobile phone user is connected to a current call. The current call may become active when the phone goes through the stages of call process 200 to reach block 212. At block 212 the user decides to accept the incoming call which is then connected. While processing the connected call, an indication of an incoming call arrives as shown at block 406. The incoming call indication is received at receiver 118 via communication channel 124. The incoming call indication may contain identification information about the origin of the call, such as the caller ID information described above. At block 408 a determination is made whether or not to automatically reject the incoming call. The determination can be made when the information about the incoming call received at receiver 118 is sent to determiner 106 via message processor 108. In addition, information about calls to be rejected is received at determiner 106 from rejection memory 104. Determiner 106 then determines if the call is to be rejected by utilizing one or more of the comparison techniques described above. If a determination is made to reject the incoming call, no indication of the incoming call is given to the user as shown at block 410. Therefore, the user who is on the current call is undisturbed by the attempted incoming call. The mobile phone then automatically sends the rejection message to the base station as shown at block 412. Determiner 106 informs message processor 108 to generate a rejection message and send it to transmitter 116 for transmission to the base station. Alternatively, a user notification may be provided, via call indicator 114, indicating to the user an incoming call was attempted and automatically rejected. In response to receiving the rejection message, the base station releases the incoming call from the mobile phone as shown at block 414, and then the call may be transferred to voice mail as shown at block 416 or simply terminated if desired.

If a determination is made not to reject the incoming call at block 408, the user is then provided an indication of the incoming call at block 418. This indication may be a short beeping in the phone earpiece or other indication, such as a muted ring, to notify the user of the incoming call. The user may still decide to manually reject the incoming call at block 420, by providing some input to the phone at block 422. If this is done, the phone sends out the rejection message as shown at block 412. The base station then releases the call from the mobile phone as shown at block 414 and then may transfer the call to voice mail as shown at block 416.

If the user does not want to manually reject the call at block 420, the call can be accepted as shown at block 424. In this case the currently connected call may be placed in a hold state while the incoming call is connected. The user then has the option to switch between calls or to terminate one call and continue the other.

Referring now to FIG. 5, therein is depicted messaging sequence 500 which can be used to implement an embodiment of the present invention as depicted in FIG. 2. Messaging sequence 500 can be used in a telecommunications system operating in accordance with the IS-95 standard. It will be apparent to those skilled in the art that by substituting the corresponding protocol and processes, the disclosed call rejection invention may be similarly implemented using different message sequencing as found in other types of communications networks.

In the embodiment of FIG. 2, functional blocks 206, 208, 210, 212, 214, 216, 218 and 220 require messages to be transmitted between the mobile phone and the base station to fulfill the specified tasks. These messages are sent via communication channel 124. The following description, which references FIGS. 2 and 5, defines the types of messages that are sent, where they originate and what portion of communication channel 124 they are transmitted on.

Referring again to FIG. 5, mobile station activities are shown at 501 and base station activities are shown at 502. The portion of communication channel 124 used for transmitting messages is shown at 503.

Incoming Call (Block 206)

When a calling party attempts to call the mobile phone, an indication of the incoming call is received by the mobile phone as shown at block 206. This indication is accomplished through a series of messages indicated at 537 between the base station and the mobile phone as can be seen in FIG. 5. The base station acts as a conduit by which calls are routed to the mobile phone. When the base station receives a call whose intended destination is the remote mobile phone, a page message 504 is sent to the mobile phone via paging channel 122 as shown at 505. The page message alerts the mobile that a calling party is attempting a call to the mobile phone user. Upon receipt of the page message 504, the mobile responds by transmitting a page response message 506 over the access channel 120 as shown at 507. The page response message tells the base station that the mobile is available to receive the call. After the page response message 506 is received, the base station sets up a forward traffic channel 123 as shown at 508 where the call may be connected. The base station starts transmitting null data 509 on the newly established channel and then transmits a channel assignment message 510 over the paging channel 122 as shown at 511 to inform the mobile station about the assigned traffic channels where the call may be connected.

Once the mobile receives the channel assignment message 510, it sets up transmitter 116 and receiver 118 to use the assigned traffic channels as shown at 512 and prepares to communicate over the assigned channel by receiving a number (N) of consecutive valid information frames over the assigned forward traffic channel 123 as shown at 513. The number of frames (N) is an operating parameter determined by the telecommunications system. Afterwards, the mobile begins sending a traffic channel preamble 514 to the base station over the assigned reverse traffic channel 121 as shown at 515. The base station acquires the traffic channel preamble 516 and transmits an acknowledgment order 517 over the forward traffic channel 123 as shown at 518. When the mobile receives the acknowledgment order 517, it begins transmitting null traffic data 519 over the reverse traffic channel 121 as shown at 520. The base station continues the call setup process by sending a service option response order 521 over the forward traffic channel 123 as shown at 522. The service option response order is another operating

parameter determined by the telecommunications system. The mobile station responds by processing the primary traffic channel in accordance with the service option selected at 523.

Once a traffic channel is established, the base station provides the mobile phone user information about the incoming call by sending an Alert with Information Message 524 over the forward traffic channel 123 as shown at 525. This message may contain caller ID information as described above and can be used by the mobile phone as an indication of an incoming call wherein the mobile phone may begin a ringing cycle if desired.

Phone Sends Rejection Message (Blocks 208, 216 and 220)

Upon receipt by the mobile phone of the Alert with Information Message 524, the mobile phone may not automatically start a ringing cycle. First, the mobile phone may determine if the incoming call should be automatically rejected. The determination occurs when the mobile phone compares the caller ID information contained in the Information Message 524 to information stored in rejection memory 104 as shown at 526. If a match is detected, the mobile phone transmits a rejection message 527 to the base station over the reverse traffic channel 121 as shown at 528. The rejection message can be formatted as shown in FIGS. 3a and 3b, thereby indicating to the base station that the attempted call is to be rejected. Upon receipt of the rejection message, the base station releases the call as shown at 529 and may transfer the caller to a voice messaging system as shown at block 220. If no match of the identification information is detected as shown at 530, the mobile phone may begin a ringing cycle to alert the mobile phone user of the incoming call by activating call indicator 114. During this time the caller ID information may also be displayed on mobile phone display 110.

Manual Rejection of the Incoming Call (Blocks 210 and 214)

Once the user is alerted to the incoming call, indicating that automatic rejection did not occur, the incoming call can still be rejected if the user provides a manual rejection input as shown at blocks 210 and 214. The messaging sequence for manual rejection is shown in FIG. 5. When the manual rejection input from the user is detected, the mobile phone transmits the rejection message 531 over the reverse traffic channel 121 as shown at 532. When the message is received by the base station, the call will be released as shown at 533.

Connecting the Call (Block 212)

If the call is not automatically or manually rejected, it may be answered or, if desired, ignored. If the user wishes to answer the call, the user may provide an input to the mobile phone indicating that the call is to be answered. This action is shown at block 212 and results in the transmission by the phone of a connect message as shown at 534. A connect order 534 is transmitted to the base station over the reverse traffic channel 121 as shown at 535. When the base station receives this message, the incoming call is connected as shown at 536 to allow communication between the calling party and the mobile phone user. The process of connecting the call allows two-way communication between the mobile phone user and the calling party by utilizing the forward traffic channel 123 and the reverse traffic channel 121.

Referring now to FIG. 6, therein is depicted messaging sequence 600 which can be used to implement an embodiment of the present invention as depicted in FIG. 4. Messaging sequence 600 can be used in a telecommunications system operating in accordance with the IS-95 standard. It will be apparent to those skilled in the art that by substituting the corresponding protocol and processes, the disclosed call

rejection invention may be similarly implemented using different message sequencing as found in other types of communications networks.

In the embodiment of FIG. 4, functional blocks 404, 408, 412, 418, 420, 422 and 424 require messages to be transmitted between the mobile phone and the base station to fulfill the specified tasks. These messages are sent via communication channel 124. The following description, which references FIGS. 4 and 6, defines the types of messages that are sent, where they originate and what portion of communication channel 124 they are transmitted on.

Referring again to FIG. 6, mobile station activities are shown at 601 and base station activities are shown at 602. The portion of communication channel 124 used for transmitting messages is shown at 603.

Mobile Phone on Current Call (Block 404)

When a calling party attempts to call the mobile phone, call processing is dependent on the current state of the mobile phone. In the embodiment of the invention as depicted in FIG. 4, the mobile phone is actively involved in a current conversation as shown at 404. The current conversation comprises information messages shown at 604 and 605, which are transmitted over the forward traffic channel 123 and the reverse traffic channel 121 as shown at 606.

Incoming Call (Block 406)

With the mobile phone actively involved in a first conversation as shown at block 404, an incoming call is received as shown at block 406. The incoming call is detected by the base station as shown at 607. The base station then sends an Alert with Information Message to the mobile phone as shown at 608. This message is sent over the forward traffic channel 123, as shown at 609, to alert the mobile there is an incoming call. The information message may contain caller ID information and can be used by the mobile phone to trigger an alert signal to notify the mobile phone user of the attempted incoming call if desired.

Phone Sends Rejection Message (Blocks 408, 410 and 412)

Upon receipt by the mobile phone of the Alert with Information Message 608, the mobile phone does not automatically alert the mobile phone user of the incoming call. First, the mobile phone may determine if the incoming call should be automatically rejected. The determination occurs when the mobile phone compares the caller ID information contained in the Information Message 608 to information stored in rejection memory 104 as shown in the call flow at 408 and in the message sequence at 610. If a match is detected, the mobile phone transmits a rejection message 611 to the base station over the reverse traffic channel 121 as shown at 612. The rejection message can be formatted as shown in FIGS. 3a and 3b, indicating to the base station that the attempted call is to be rejected. Upon receipt of the rejection message, the base station releases the call as shown at 613 and may transfer the caller to a voice messaging system as shown at block 416 or provide other call processing as desired.

Manual Rejection of the Incoming Call (Blocks 418, 420 and 422)

If the mobile phone fails to detect a match of the identification information as shown at 614, the mobile phone may alert the mobile phone user of the incoming call by activating an audible call waiting tone or a muted ring as shown at 418. During this time, the caller ID information may also be displayed to the mobile phone user on mobile phone display 110.

Once the mobile phone user is alerted of the incoming call, indicating that automatic rejection did not occur, a

manual call rejection can be activated as shown at blocks 420 and 422. If the user decides to manually reject the call, a manual rejection input can be activated as shown in block 422. This manual rejection input is detected as shown at 615. When the manual rejection input is detected, the mobile phone transmits the rejection message 616 over the reverse traffic channel 121 as shown at 617. When the message is received by the base station, the call will be released as shown at 618.

Connecting the Call (block 424)

If the incoming call is not automatically or manually rejected, the user has the option to answer the incoming call. This option is provided at block 424. In this case, the user provides input indicating the incoming call is to be connected. In effect, a call-waiting feature is activated where a first call is placed on hold while a second call is connected. The user input is detected at 619 and results in a flash with information message 620 being transmitted to the base station via the reverse traffic channel 121 as shown at 621. The format of this message will not be discussed in detail as it does not pertain to the present invention. However, this message should comply with the applicable standard for implementing the call-waiting feature. When the base station receives this message, as shown at 622, the speech path of the first party is muted which has the effect of placing the first party on hold. In the meantime, the second party is connected to the mobile phone user, thereby allowing two-way conversation to occur.

Although described in the context of particular embodiments, it will be realized that a number of modifications to these teachings may occur to one skilled in the art. For example, the invention could be readily incorporated into various remote communication devices. Such devices may include, but are not limited to, roadside call boxes, portable computers having detachable cell phone adapters or Personal Assistants (PDA) with cellular link-up capabilities. Thus, while the invention has been particularly shown and described with respect to specific embodiments thereof, it will be understood by those skilled in the art that changes in form and shape may be made therein without departing from the scope and spirit of the invention.

What is claimed is:

1. A method of selectably rejecting an incoming call to a mobile phone, said mobile phone having a transceiver circuit for transmitting and receiving transmissions to and from a remote transceiver on a communication channel in a wireless system, said method comprising the steps of:

receiving at the mobile phone a transmission from the remote transceiver signifying that there is an incoming call;

determining at the mobile phone if said incoming call is to be rejected; and

transmitting from the mobile phone a rejection message to the remote transceiver, in response to a determination being made, during said step of determining, that said incoming call is to be rejected, said rejection message comprising at least one information element indicating to the wireless system that the wireless system is to immediately release the incoming call on the communication channel between the mobile phone and remote transceiver.

2. The method of claim 1, wherein the mobile phone further comprises an actuator operable by a user for inputting a first input, said step of determining comprising the steps of:

notifying the user of said transmission; and

receiving a first input from the actuator, wherein reception of the first input indicates that said incoming call is to be rejected.

3. The method of claim 1, wherein the mobile communications device includes a memory and said transmission includes a first parameter, said step of determining comprising the steps of:

storing a second parameter in the memory;

comparing at least a portion of the first parameter with said second parameter; and

determining whether at least a portion of the first parameter matches said second parameter, wherein if a match occurs, said incoming call is to be rejected.

4. The method of claim 3, wherein the step of transmitting further comprises the step of notifying the user of said incoming call to be rejected.

5. A method of rejecting an incoming call to a mobile phone, said mobile phone having a transceiver circuit for transmitting and receiving transmissions to and from a remote transceiver, said mobile phone in communication with a first calling station via the remote transceiver on a communication channel in a wireless system, said method comprising the steps of:

receiving at the mobile phone, a transmission from the remote transceiver signifying that there is an incoming call;

determining at the mobile phone if said incoming call is to be rejected; and

transmitting from the mobile phone a rejection message to the remote transceiver in response to a determination being made, during said step of determining, that said incoming call is to be rejected, said rejection message comprising at least one information element indicating to the wireless system that the wireless system is to immediately release the incoming call on the communication channel between the mobile phone and remote transceiver.

6. The method of claim 5, wherein the mobile phone includes an actuator operable by a user for inputting a manual input to the mobile phone, said step of determining comprises the step of:

notifying the user of said incoming call; and

receiving a manual input from the actuator, wherein reception of said manual input indicates that said incoming call is to be rejected.

7. The method of claim 5, wherein the mobile phone further comprises a memory and said transmission includes a first parameter, said operation of determining comprising the steps of:

storing a second parameter in the memory;

comparing at least a portion of the first parameter with said second parameter; and

determining whether at least a portion of the first parameter matches said second parameter, wherein if a match occurs, said incoming call is to be rejected.

8. The method of claim 7, wherein the step of transmitting comprises the step of actuating manual transmission of a rejection message to the remote transceiver if a determination is made during said step of determining that said incoming call is to be rejected.

9. The method of claim 7, wherein the operation of transmitting further comprises notifying the user of said incoming call to be rejected.

10. In a mobile communications device, apparatus for selectably rejecting an incoming call, said apparatus comprising:

a transceiver operable to send and receive transmissions to and from a remote transceiver in a wireless system

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on a communication channel, said transceiver for receiving a transmission signifying that an incoming call is being attempted; and

a control processor coupled to said transceiver, said control processor for determining if said incoming call is to be rejected, and, in response to a positive determination, said control processor for outputting a rejection message to said transceiver for transmission to said remote transceiver, wherein said rejection message comprises at least one information element indicating to the wireless system that the wireless system is to immediately release the incoming call on the communication channel between the mobile communications device and remote transceiver.

11. The apparatus of claim **10**, wherein said control processor comprises:

a user notification means;

an actuator for inputting a manual input from the user; and a message processor coupled to said user notification means, said actuator and said transceiver, said message processor for detecting said transmission, wherein when said transmission is detected, said message processor activates said user notification means, wherein upon detecting a manual input from said actuator, said message processor outputs a rejection message to said transceiver for transmission to said remote transceiver.

12. The apparatus of claim **10**, wherein said transmission includes a first parameter, said control processor comprises:

a memory for storing a second parameter;

a determiner coupled to said memory and said transceiver, said determiner for comparing at least a portion of the first parameter with said second parameter, wherein if at least a portion of the first parameter matches said second parameter, said determiner outputs a rejection message to said transceiver for transmission to said remote transceiver.

13. A method of selectably terminating a transmission transmitted from a base station in a wireless system, said base station having a transceiver circuit for transmitting and receiving transmissions to and from at least a first remote station and a second remote station on a communication channel, said method comprising the steps of:

receiving at the base station a first transmission from the first remote station;

transmitting from the base station, in response to receiving said first transmission, a second transmission to the

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second remote station, said second transmission indicating an incoming call to the second remote station from the first remote station;

receiving at the base station a third transmission from the second remote station, said third transmission having a parameter;

detecting at the base station if said parameter has at least one information element indicating that said second transmission is rejected at said second remote station and is to be terminated; and

terminating immediately at the base station said second transmission on the communication channel between said base station and second remote station, if it is determined during said step of detecting that said second transmission is to be terminated.

14. The method of claim **13**, wherein the base station further comprises a message controller, said operation of terminating further comprising the step of transferring control of said first transmission to the message controller if it is determined at said step of detecting that said second transmission is to be terminated.

15. A method for selectably rejecting a transmission in a cellular communications system, said cellular communications system having a base station capable of two-way communication over a radio communication channel with a remote station, said method comprising the steps of:

transmitting a first transmission from the base station to the remote station;

determining at the remote station if said first transmission is to be rejected;

transmitting a rejection message from the remote station to the base station if it is determined at said step of determining that said first transmission is to be rejected;

receiving said rejection message at the base station;

detecting whether said rejection messages has at least one information element indicating that said first transmission is to be terminated; and

terminating immediately at the base station said first transmission to the remote station on the communication channel between said base station and the remote station if it is determined at said step of detecting that said first transmission is to be terminated.

* * * * *

Exhibit B



US006427078B1

(12) **United States Patent**
Wilka et al.

(10) **Patent No.:** **US 6,427,078 B1**

(45) **Date of Patent:** **Jul. 30, 2002**

(54) **DEVICE FOR PERSONAL COMMUNICATIONS, DATA COLLECTION AND DATA PROCESSING, AND A CIRCUIT CARD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/807,322**

(22) Filed: **Feb. 27, 1997**

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(30) Foreign Application Priority Data

Jun. 12, 1995 (FI) 942334

(51) **Int. Cl.**⁷ **H04B 1/38**

(52) **U.S. Cl.** **455/550**; 455/556; 455/557; 455/558; 348/14.02; 348/231; 348/552

(58) **Field of Search** 455/90, 403, 550, 455/556, 557, 558, 566, 575; 348/14, 231, 552, 14.01, 14.02, 14.13, 14.14; 395/800.14

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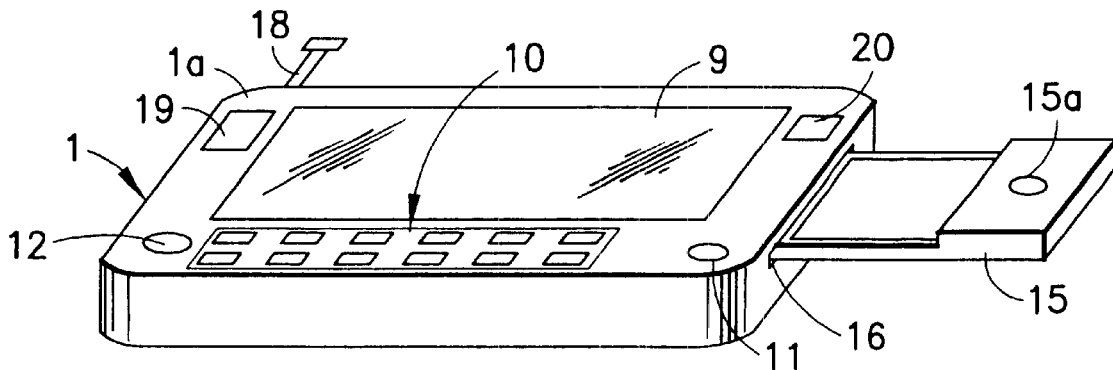
Primary Examiner—Nay Maung

(74) *Attorney, Agent, or Firm*—Perman & Green, LLP

(57) ABSTRACT

The object of the invention is a device for personal communication, data collection and data processing, which is a small-sized, portable and hand-held work station comprising a data processing unit (2); a display (9); a user interface (10, 11); a number of peripheral device interfaces (12, 17); at least one memory unit (13); a power source, preferably a battery (3); and an application software. According to the invention the device also comprises a camera unit (14). The camera unit (14) comprises a camera (14a), preferably a semiconductor camera, and optics (14b) connected thereto, which are placed in the housing (1) of the device. Alternatively, the camera unit (14) is fitted on a PCMCIA card (15) which can be connected to the PCMCIA card slot (16) of the device. An object of the invention is also a PCMCIA card (15) provided with a camera unit (14).

76 Claims, 3 Drawing Sheets



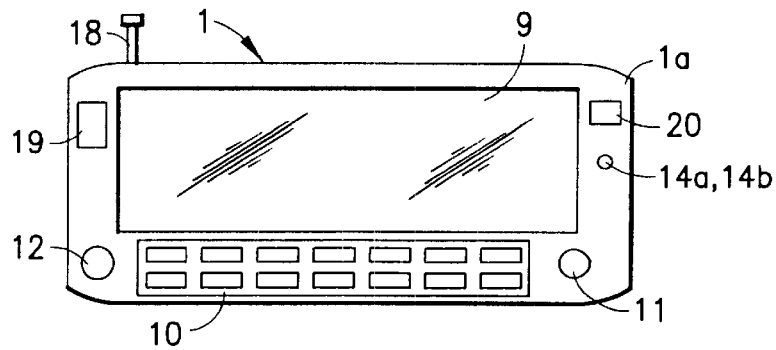


FIG. 1

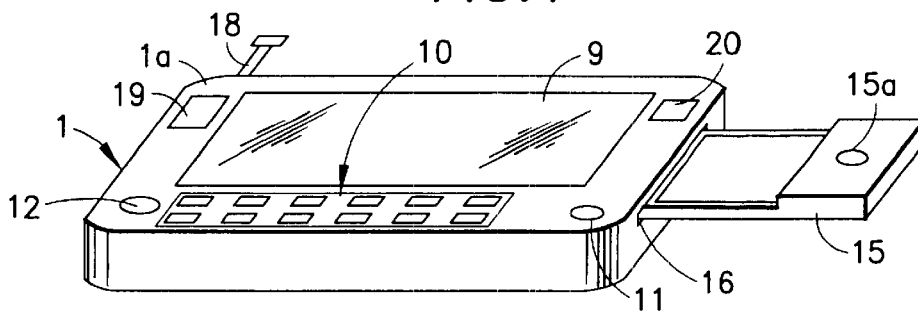


FIG. 2

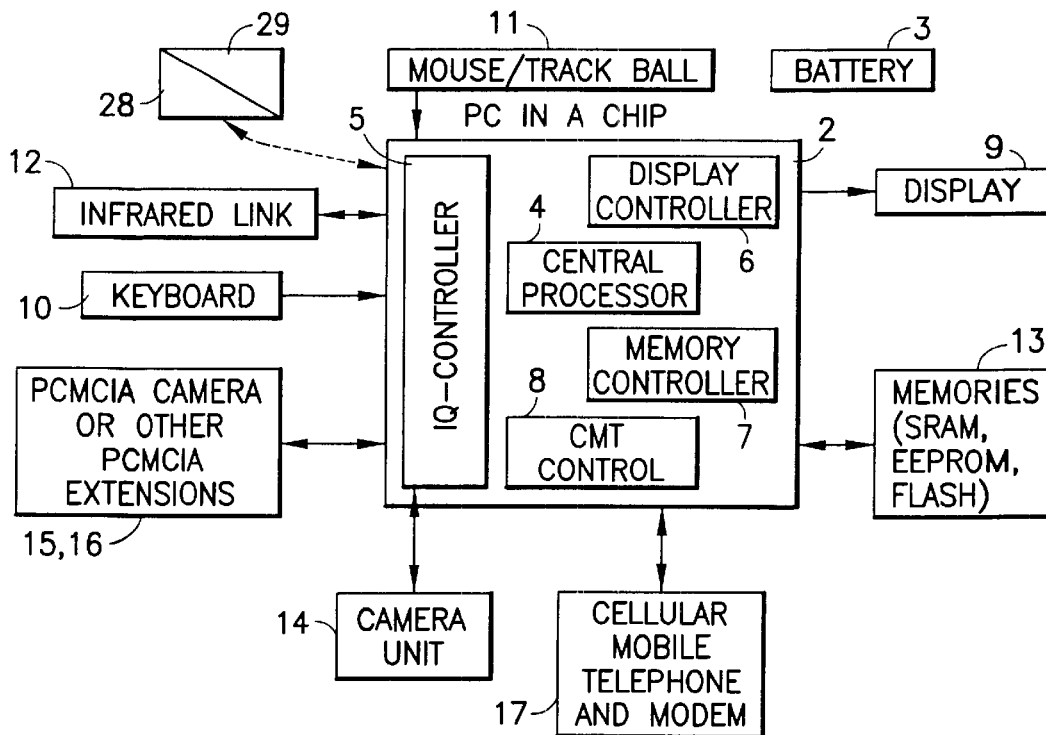


FIG. 3

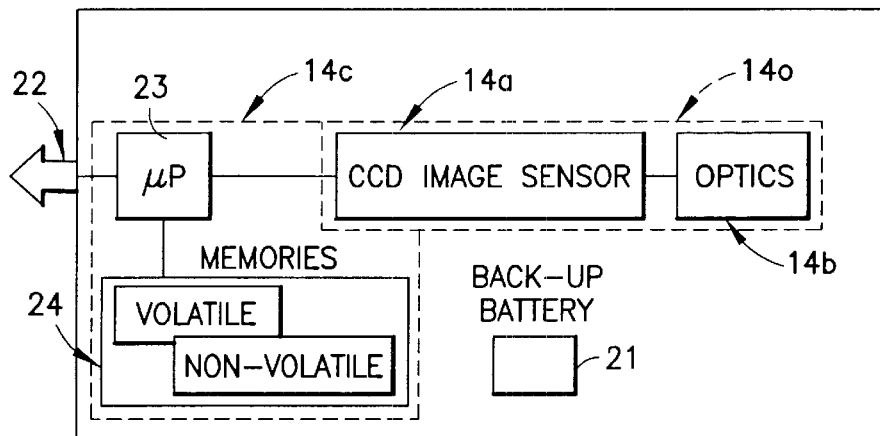
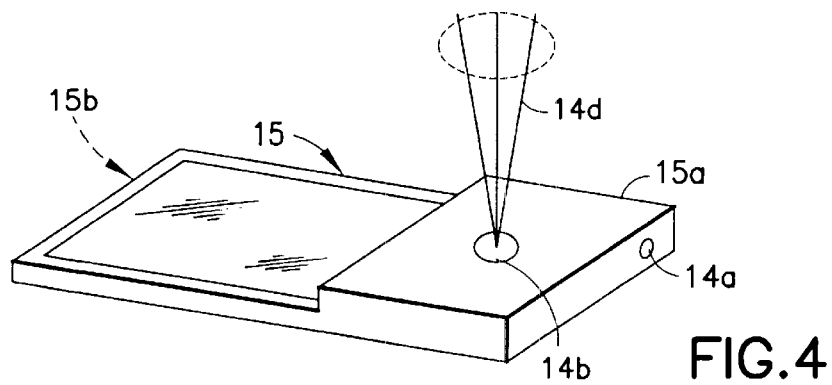


FIG. 5

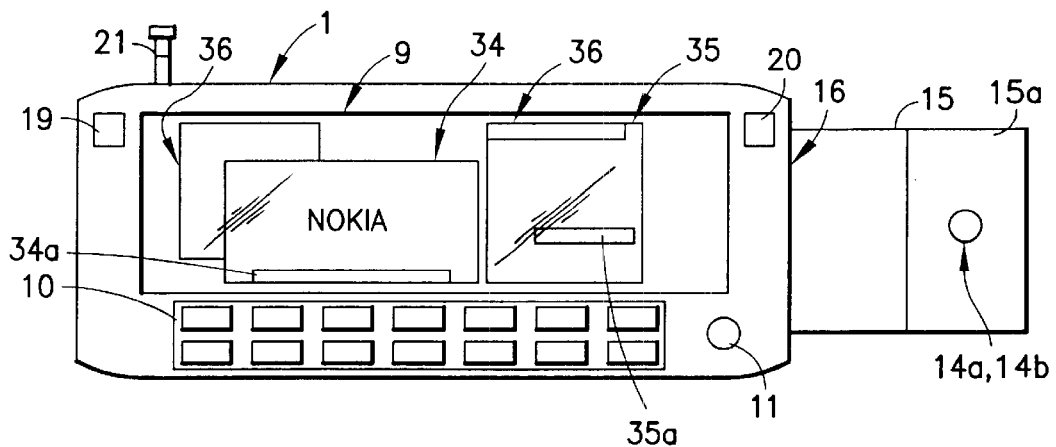
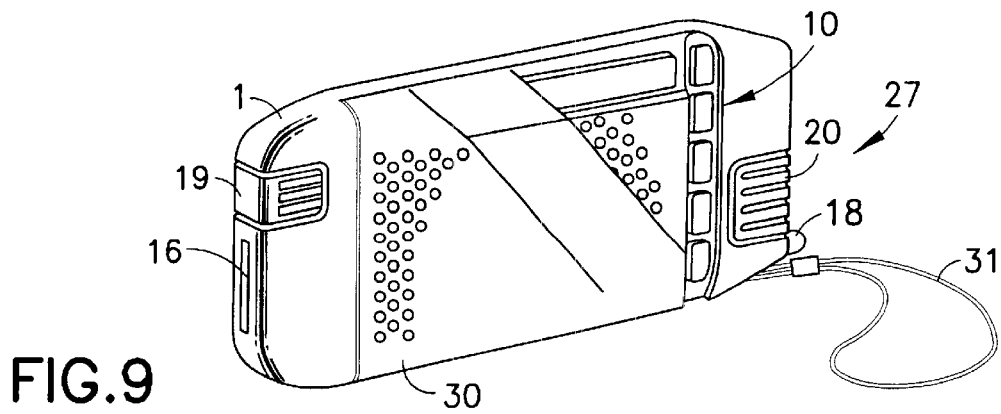
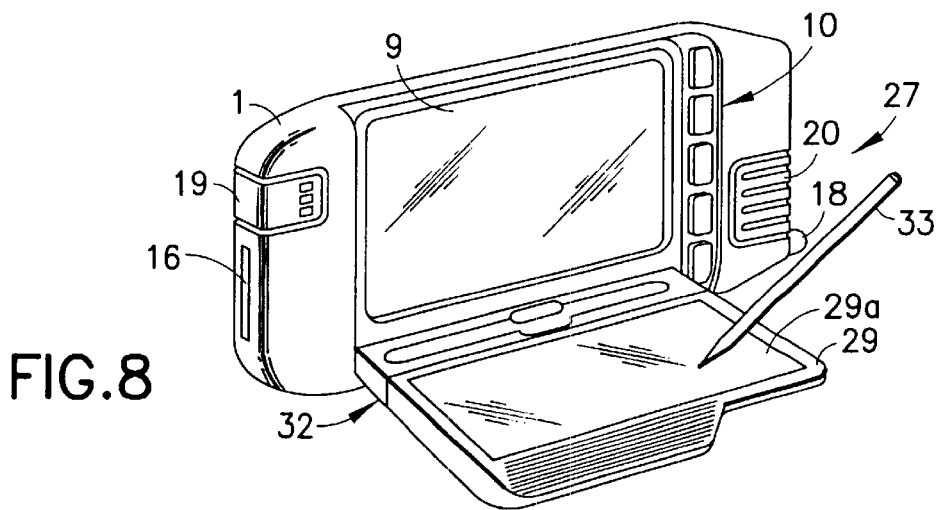
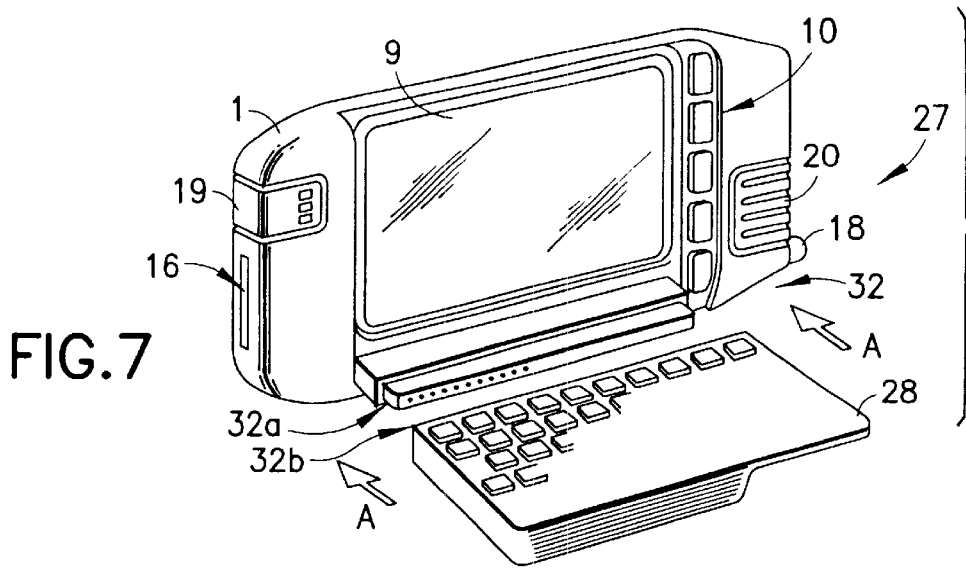


FIG. 6



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**DEVICE FOR PERSONAL
COMMUNICATIONS, DATA COLLECTION
AND DATA PROCESSING, AND A CIRCUIT
CARD**

This is a continuation of copending application Ser. No. 08/444,224 filed on May 18, 1995.

BACKGROUND OF THE INVENTION

The object of the invention is a device according to the introductory part of claim 1 for personal communication, data collection and data processing. The device consists of a small-sized housing comprising a data processing unit which contains a data processor with peripheral circuits and memory units, a display, a user interface, a number of peripheral device interfaces, a power source, preferably a battery, and application software.

Another object of the invention is a circuit card according to the introduction of claim 8 which can be fitted to the card slot arranged in connection with a device intended for personal communication, data collection and processing, in particular.

Personal communication devices and/or mobile organisers, such as notebook computers and the like, known from before, are small, light-weight, portable and hand-held or laptop workstations. A number of accessories and application programs which offer service functions can be installed in such personal devices, when necessary. A such notebook computer is disclosed in international patent application WO-93/14458.

The notebook computer can be equipped with an electronic scanner by means of which both text and figures can be read into the memory of the computer. This helps to eliminate the drawbacks of small keyboards, in particular. Data required in many connections, such as contact information included in business cards, can be read into the memory of the computer. However, electronic scanners comprise fine-mechanical parts which wear and may cause problems. Especially paper feeding arrangements fitted in small notebook computers are problematic.

The general purpose of this invention is to provide a new device for personal communication, data collection and processing which improves communication especially between a user and the device. A special purpose of the invention is to provide a device for personal communication, data collection and processing which makes it possible to collect data efficiently and to communicate with the environment. This is accomplished by the characteristic features of the invention, disclosed in appended claims 1-7.

Another purpose of the Invention is to provide a new interface card which makes it possible to improve the data collection systems of small microcomputers, in particular. This is accomplished by the characteristic features of the invention, disclosed in claim 8.

An advantage of the invention is that one and the same device, personal communications, data collection and processing comprises an easy-to-use data collection device, efficient data processing equipment (programs) and data transmission equipment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in the following in more detail with reference to the appended drawings in which:

FIG. 1 shows a device according to the invention for personal communication, data collection and processing, in

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which the data collection device is implemented by means of an integrated camera unit;

FIG. 2 shows another device according to the invention for personal communication, data collection and processing, in which the data collection device is implemented by a camera unit arranged in a PCMCIA card;

FIG. 3 shows a device for personal communication, data collection and processing, in the form of a block diagram;

FIG. 4 shows a PCMCIA card, i.e., a PCMCIA camera card comprising a camera unit as an essential part thereof;

FIG. 5 shows a block diagram of the camera unit;

FIG. 6 shows a device according to the invention, whose display illustrates an example of an application related to the camera unit;

FIG. 7 shows a device according to the invention for personal communication, data collection and processing, comprising a replaceable keyboard;

FIG. 8 shows a device according to FIG. 7, comprising a digitizer pad instead of the keyboard; and

FIG. 9 shows the device of FIG. 7 when closed.

**DETAILED DESCRIPTION OF THE
INVENTION**

FIGS. 1 and 2 show two application examples of the device according to the invention for personal communication, data collection and processing. A block diagram of such device is shown in general form in FIG. 3. The device according to the invention is called a notebook computer in the following.

A notebook computer is a small, portable work station. The external dimensions of its housing 1 are preferably in the order of 170 mm×85 mm×30 mm (length×width×height) and the weight 1000 g at the most, preferably 800 g or less. The device is preferably arranged to operate by one or more batteries 3 (FIG. 3) which are fitted replaceably inside housing 1.

The notebook computer comprises data processing unit 2 (FIG. 3) which is preferably arranged on one semiconductor chip. Data processing unit 2 comprises processor 4 which is preferably a low power RISC processor. Data processing unit 2 further comprises input/output controller 5, display controller 6, memory controller 7 and cellular mobile phone controller 8. In addition, data processing unit 2 comprises connection buses and cables between different controllers and the data processor which are not separately shown in the block diagram of FIG. 3.

The notebook computer further comprises display 9 which is arranged, in the application examples of FIGS. 1 and 2, fixedly in connection with housing 1 on large side 1a thereof which is essentially of a rectangular shape. Display 9 is provided, for example, by a liquid crystal display, The resolution of which is at least 640×200 pixels² and the dimensions in the order of 130 mm×70 mm. Display 9 is connected to display controller 6.

The notebook computer also comprises keyboard 10 and/or mouse/track ball 11 as a user interface. Keyboard 10 and track ball 11 in this application are arranged fixedly to the notebook computer in the vicinity of display 9. The notebook computer preferably comprises Infrared link 12 by means of which the connection with peripheral devices, such as a printer, another microcomputer or the like is provided. Keyboard 10, mouse/track ball 11 and infrared link 12 are connected to input/output controller 5, as shown in FIG. 3.

The notebook computer further comprises one or more memory units 13. The memory unit can be implemented by

means of SRAM, EEPROM and/or FLASH memory circuits, for instance. The operating system and preferably at least part of the application programs are recorded in memory unit 13. In addition, memory unit 13 contains a sufficient amount of read-write memory space.

The notebook computer further comprises a data collection device which is implemented by means of a camera unit. The embodiment of FIG. 1 represents camera unit 14 (FIG. 3) fitted in housing 1 of the notebook computer as a stationary part thereof. In this application, camera 14a of camera unit 14 and related optics 14b are arranged on the same side of the housing as display 9, though a different disposition is also possible. Camera unit 14 is connected via input/output controller 5 to data processing unit 2 (FIG. 3). Camera unit 14, which is represented in the form of a block diagram in FIG. 5, consists of camera arrangement 140 which comprises camera 14a provided with suitable optics 14b, and image processing unit 14c connected to the camera arrangement. This data collection unit can be used to transfer data presented on paper or the like as well as an image taken of the surroundings, for instance of a person, to the notebook computer to be processed further.

In the notebook computer application of FIG. 2 camera unit 14 is fitted in a circuit card, preferably in PCMCIA card 15. Camera 14a and optics 14b of camera arrangement 140 are integrated in this card 15 together with their peripheral electronics, i.e., the image processing unit 14c (FIG. 5). The circuit card, i.e., camera card 15, in turn, can be fitted into the card slot, such as PCMCIA card slot 16, of the mobile organiser. Camera 14a of the embodiment of both FIG. 1 and FIG. 2 is implemented as a semiconductor camera, preferably as a small CCD (Charge Coupled Device) camera. The adapter in PCMCIA card slot 16 is connected to input/output controller 5, as illustrated in FIG. 3. It is obvious that other corresponding, applicable PCMCIA cards, which meet the standards drawn up for card slots, can also be fitted into this card slot 16.

The notebook computer further comprises a radiotelephone, i.e., cellular mobile phone unit 17, preferably as an integrated part thereof. It is connected to cellular mobile phone controller 8 of data processing unit 2 and to receiver/transmitter antenna 18. In the case of a telephone set operating in an analogue cellular network, a modem is preferably connected to cellular mobile phone unit 17. Cellular mobile phone unit 17 is based on the standard cellular mobile phone technology. Both data and speech can be transmitted via integrated cellular mobile phone unit 17. The data transmission properties are based on an analogue modem and the GSM data interface, for instance, the technology of both of them being conventional. For a speech connection, miniature speaker 19 and microphone 20 can be arranged in the housing of notebook computer 1 on both sides of display 9. The notebook computer can then be used in the same way as a conventional hand-held telephone.

An additional part of the notebook computer is software applied for it. It is recorded in memory unit 13. Using the software, the user controls different functions of the mobile organiser as required. The functions related to the notebook computer include, for instance: telephone services which are based on the cellular mobile phone (data transmission and/or speech transmission properties), facsimile services, electronic mail, short message service/SMS, a calendar and scheduler software, a clock with alarm clock functions, camera functions to record images and paper documents, as well as computer i.e., PC interface functions for transferring information to PC applications.

Camera unit 14 operating as the data collection device is considered more closely in the following. Camera 14a and

optics 14b connected thereto are fitted to PCMCIA card 15 in the camera unit. The Personal Computer Memory Card International Association, i.e., the PCMCIA was formed in order to advance the exchangeability of integrated circuit cards in computers and other electronic devices. Consequently, the PCMCIA cards are standardized cards which are applicable for both memory cards and expansion cards of peripheral circuits, i.e., for input/output cards. Camera card 15 described herein is based on the standard mentioned above in which camera arrangement 140 and peripheral circuits required by it are integrated in the standard card. FIG. 4 shows a physical model of a possible PCMCIA card 15 in which camera unit 14 is fitted in the thickened part 15a of the card. Camera 14a, such as a CCD (Charged Coupled Device) camera, is preferably a camera focused on a fixed distance and it is preferably fitted to the centre part of the enlargement 15a of the card. Camera 14a with its optics 14b is arranged so that the image field 14d of the camera opens up perpendicular to the surface of card 15. Adapters 15b are arranged at the other end of card 15 to connect the card to the PCMCIA card slot 16 in the notebook computer and to the counter connectors in the card slot.

In principle, the structure of both camera card 15 and camera unit 14 conforms to the block diagram shown in FIG. 5. By example, camera card 15 consists of camera arrangement 140 which comprises camera 14a and optics 14b, image processing unit 14c, battery 21 and interface 22 to external systems which in this case is a standard PCMCIA Interface concerning camera card 15. Image processing unit 14c comprises microprocessor 23 and a number of memory units 24. Optics 14b are provided by a suitable lens arrangement, by means of which a sharp image is obtained of the object to be scanned in on the image plane of camera 14a. Camera 14a is preferably implemented as a CCD camera comprising a two-dimensional light-sensitive CCD sensor, the resolution of which is from 250 k pixel as high as to 26.2 Mpixel. Memory units 24 preferably comprise two kinds of memory units: volatile memory units, such as DRAM and SRAM units used as scratch pad storages, and non-volatile memory units, such as FLASH and EPROM units which are used as base program memories. Power to the PCMCIA card. is supplied via the PCMCIA interface from the notebook computer. Battery 21 is mainly used to ensure that images are maintained in the volatile memory units if the PCMCIA card is detached from the card slot. Battery 21 can be also used for the same purpose in camera unit 14 (FIG. 1) integrated in the notebook computer.

Camera unit 14 functions in the following way, whether it is fixedly integrated to the notebook computer or connectable to the card slot of the notebook computer as camera card 15: a picture of a document or three-dimensional environment taken by camera 14a through optics 14b is transferred to image processing unit 14c and through its microprocessor 23 to memory unit 24, such as RAM. When the user wishes to view the picture thus taken on display 9 of the notebook computer, he/she can do that immediately. The desired image information is read from memory unit 24 by means of microprocessor 23 of camera card 15, and the image information is transmitted to processor 4 of the mobile organiser along PCMCIA interface 22 or a corresponding interface and further to display 9 via display controller 6. Image processing unit 14c processes the image information into a suitable form to be presented to the user by the mobile organiser.

The image information recorded in camera card 15 can be scanned in either by the mobile organiser or by another computer and/or device provided with a PCMCIA interface

or the like. It is possible to edit the picture by an external computer and the modified picture can be recorded again in memory unit **24** of camera card **15**. By virtue of battery **21**, the operation of microprocessor **23** of image processing unit **14c** and that of memory unit **24** is assured in all circumstances.

Camera unit **14** comprises a character recognition software which is similar to that used in computers provided with pen interfaces, for instance. Previously known pattern recognition software can be used to recognise graphical objects, After a text and/or an image has been scanned in the notebook computer, the user can start an application program to process the data to suit his/her purposes.

The application program of camera unit **14** functions, e.g., in the following way: business card handler application **36** (FIG. **6**) is selected for the application program. The user first scans in the business card by camera **14a**, then the picture of the business card and the information contained in it are transferred from camera unit **14** to memory unit **13** of the notebook computer and via data processing unit **2** to display **9**. After the scanned image **34** of the business card is visible on display **9**, the user opens business card handler application **36** and key fields **35** of this application appear on display **9**, as illustrated in FIG. **6**. Key fields **35** have been recorded in the database. The user selects a suitable field **34a** from the business card and drops it to the correct key field **35a** of the business card handler application, The selection and dropping are made by means of the mouse or track ball **11**. The fields required are selected from picture **34** of the business card and dropped to corresponding fields **35** of business card handler application **36**. After the above-described procedures have been carried out, the information contained in the business card can be used as address directory for letters, as telephone memo information or for other suitable purposes.

Other kinds of information can also be scanned in the notebook computer by means of camera unit **14**. The document can be a note written on a paper by hand, for instance. The user scans in the document, stores it in the memory unit of the notebook computer and processes it as required. A graphics handler software can be arranged to function with camera unit **14**. It can function in the following manner: the user draws a graphical object, such as a circle or a line, on a paper. The images are scanned in by camera **14a** to memory unit **13** of the notebook computer and the user starts the graphics handler software using the keyboard or the mouse. The scanned picture of the graphical object is then shown on the display. The user can select a picture on the display and modify the object by means of the graphics handler application to look like a desired object, such as a regular circle.

The user can also select the character recognition software after the picture on the paper is scanned in the notebook computer by camera unit **14**. The character recognition software converts the hand written text into ASCII characters. Indistinct characters are guessed by the software or the user is asked for further information.

The simplest alternative is to store the information scanned in memory unit **13** of the mobile organiser by camera unit **14**, in the form of a bitmap. This type of image information is used in facsimile/telex transmission. The same kind of image storing can also be used for storing incoming telex messages.

The telex functions can be implemented in the following way: the user writes notes on a paper and the characters on the paper are scanned in memory unit **13** of the notebook

computer by camera unit **14**. The user selects the telex application from the application programs and defines a receiver for the message. Next the picture of the notes is transmitted as a bitmap and a telex message from the mobile organiser's memory unit via cellular mobile phone unit **17** comprising a telex modem. Incoming telex messages are received in a corresponding manner via cellular mobile phone **17** and stored in the mobile organiser's memory as bitmaps. After the picture is ready, it is output on display **9** of the mobile organiser by means of the telex program. All the images stored in the mobile organiser's memory can be viewed on the display using an operating program which applies the said bitmap.

When a user interface based on camera unit **14** is integrated in connection with the notebook computer and especially its housing **1**, obvious advantages are accomplished. With such camera unit **14** the user can scan different written and/or drawn information into the memory of the notebook computer quickly and easily. The use of camera unit **14** is faster and easier than writing with a pen, for instance. Information on business cards, as already mentioned, printed material and hand written notes, etc., can be scanned into the memory of the notebook computer by using camera unit **14**.

FIGS. **7** and **8** show a notebook computer **27** according to the invention, in which keyboard **28** for writing texts and digitizer pad **29** can be installed replaceably. FIG. **9** shows the notebook computer according to FIGS. **7** and **8** in which keyboard/digitizer pad **30** is turned against the display of the notebook computer and locked in its place. In this way it is easy to carry notebook computer **27** along and to even put it in the pocket. Alternatively, the notebook computer can be carried by wrist strap **31**.

Notebook computer **27** comprises essentially the same parts and units as shown above in the embodiments according to FIGS. **1** or **2**. Consequently, the parts of notebook computer **27** which are visible externally include housing **1**, display **9**, keyboard **10**, miniature speaker **19** and microphone **20** as well as antenna **18** (cf. FIGS. **1** and **2** and the block diagram in FIG. **3**).

The external keyboard **28** of notebook computer **27** is used for writing. In spite of the small size, keyboard **28** comprises all the necessary characters, such as letters, numbers and a number of function keys. An advantage of such normal, external keyboard **28** is that the user is familiar with the keyboard itself and he/she can use it in a conventional way for writing and feeding texts to the notebook computer.

External keyboard **28** is connected to notebook computer **27** by means of connector **32**. In the case of FIGS. **7** and **8**, the male part **32a** of connector **32** is in connection with housing **1** of the notebook computer, while the female connector part **32b** is in connection with external keyboard **28**. In addition, male part **32a** of connector **32** is hinged to the lower part of display **9** or to the elongated side of housing **1**, whereby it can be turned up by at least 90° with respect to the surface of the display so that the keyboard can be turned up to cover display **9**, as shown in FIG. **9**, for instance. The female connector parts **32b** of keyboard **28** are pushed to male connector parts **32a** in the direction of arrows **A**, as shown in FIG. **7**, when the external keyboard is connected to notebook computer **27**. Keyboard **28** is automatically connected to input/output controller **5** of notebook computer **27** and to data processing unit **2** (cf. FIG. **3**).

Digitizer pad **29** can be used advantageously instead of the above-described keyboard **28** in connection with notebook computer **27**, as illustrated in FIG. **8**. A similar

connector part 32b to that of external keyboard 28 is connected to digitizer pad 29, whereby digitizer pad 29 can be installed directly in place of external keyboard 28 in a corresponding manner, when external keyboard 28 is removed.

Digitizer pad 29 is based on a known technique. The user can write texts or draw figures on viewing screen 29a in the digitizer pad using pen 33, and digitizer pad 29 recognises the touch of pen 33 simultaneously and converts the drawn figure into a bitmap. The bitmap is shown on viewing screen 29a of the digitizer pad until the user accepts it. After this the accepted digitised image is to be displayed on display 9 of notebook computer 27. The functions of digitizer pad 29 include an erase function of the drawn figure, which can be implemented in a known manner in various ways. For instance, digitizer pad 29 can include a function key by means of which the mode of digitizer pad 29 can be converted from the drawing mode into the erase mode and back again. In the drawing mode, figures can be drawn on viewing screen 29a of the digitizer pad, while in the erase mode these figures can be removed in a desired way.

An advantage of digitizer pad 29 is that texts or figures can be written or drawn on it almost in the same way as on a piece of paper. It is easy to edit the drawn figures or texts into an appropriate form using the application programs included in notebook computer 27.

A text or a figure written or drawn on digitizer pad 29 of notebook computer 27 can be stored later as an image in memory unit 13 of the notebook computer or fed to the character/object recognition software for further processing. Hand written texts can be converted into ASCII texts by the character recognition software, and graphical characters can be converted easily in the same way as is done by the recognition software. The operating modes of these software are described above in connection with the camera unit.

The bitmap images or converted ASCII texts/graphics transferred to the memory from digitizer pad 29 of notebook computer 27 can be later forwarded via telefax or electronic mail services, as disclosed above in the description of the invention. The files stored in the memory of notebook computer 27 can also be edited by means of external keyboard 28 and/or digitizer pad 29.

The notebook computer according to the invention comprises a number of facilities and/or application programs, by means of which the possibilities of the notebook computer can be utilised effectively. Such tools include, for instance: electronic calendar, phone list and note pad, fully integrated with each other and to the communications, data collection and data processing functions of the notebook computer. The services used most frequently include functions related to speech communications, telefax function, electronic mail, paging, data bank services and on-line information service connections. When transmitting electronic mail or telefax messages, the user can digitise the message on the display of the notebook computer and to simply select the recipient information from the phone list. The phone list is generally an application which offers an easy way to select the address information of the recipient for a chosen electronic contact as well as for a possible written letter. The user can input address information and telephone number information of different people in the memory of the notebook computer by means of the camera unit functioning as the data collection device and by means of suitable utility functions related to the camera unit. The address file may include different additional information, such as a telephone number, telefax number, e-mail address as well as other necessary

information, in addition to the name and address. It depends on the application selected for the notebook computer, which information the user chooses from the phone list and connects to the message to be transmitted.

When cellular mobile phone unit 17 of the notebook computer and the related cellular mobile phone controller 8 are implemented as a digital GSM system, the user can transmit SMS messages (Short Message Service). The user writes the message to the notebook computer using the keyboard or a pen on the digitizer pad, or the message reading is read by the data collection device such as camera unit 14. After the message has been transmitted via a cellular mobile phone to a GSM short message centre, it is forwarded to the recipient. The recipient is chosen from the phone list or the user inputs it manually.

An electronic mail message is implemented in the same way as the SMS message above, but the electronic mail message may be longer.

A device in accordance with the invention may also be a radiotelephone comprising a microprocessor, a display, a user interface, a microphone, a speaker, and a camera unit.

It is possible to place other cards according to the PCMCIA standard into the PCMCIA card slot of the notebook computer. For instance, a hard disc, an additional memory and a PCMCIA radio module are viable. The PCMCIA radio module provides a possibility to use the notebook computer in all cellular mobile phone systems. In this case, only an appropriate radio module card is installed in the PCMCIA card slot.

The notebook computer can communicate with another personal computer via a serial and/or parallel port or via a PCMCIA interface. The interface between the notebook computer and another computer can be implemented by means of an infrared link or a cable connection. Infrared link 12 can be used for communication between the notebook computer and a PC or other peripheral devices. For instance, the writing of a file can be implemented so that the file is transferred to the printer by means of the Infrared link and then printed.

The invention is described above with reference to some preferred embodiments thereof, but it is obvious that the invention can be modified in various ways within the inventive idea defined by the appended claims.

What is claimed is:

1. A device for personal communication, data collection and data processing, which is a small-sized, portable and hand-held work station including a housing and comprising a data processing unit, a display, a user interface, a number of peripheral device interfaces, at least one memory unit; a power source, and application software, wherein the device also comprises:

a camera unit for obtaining and outputting image information comprising:

a camera for receiving image information; optics connected to said camera for passing said image information to the camera;

at least one memory unit for storing said image information; and

an output coupled to said data processing unit for outputting image information from said memory unit to the processing unit;

and wherein at least a portion of said camera unit is located within said housing, and

said data processing unit processes image information output by said camera unit, and

wherein said device further comprises means for transmitting image information processed by said processing unit to another location using a radio frequency channel.

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2. A device according to claim 1, wherein said means for transmitting image information comprises a cellular mobile phone unit.

3. A device according to claim 2, wherein the cellular mobile phone unit comprises equipment required by speech communications, such as a microphone and a loudspeaker, wherein said equipment is fitted in the housing of the device.

4. A device according to claim 2, wherein the cellular mobile phone unit comprises a telefax modem.

5. A device according to claim 1, further comprising an infrared link for data transmission between external devices and the device.

6. A device according to claim 1, wherein the power source is a battery.

7. A device according to claim 1, wherein the camera is a semiconductor camera.

8. A device according to claim 1, wherein said camera unit further comprises means for processing image information from an image received by said camera and means for storing at least a portion of the processed image information in said at least one memory unit of said camera unit for later recall.

9. A device according to claim 1, further comprising a replaceable keyboard coupled to one of said number of peripheral device interfaces of the device.

10. A device according to claim 1, further comprising a digitizer pad adapted to couple to one of said number of peripheral device interfaces of the device.

11. A device according to claim 1, further comprising a replaceable keyboard and a digitizer pad adapted to couple to the device via a same physical and electrical interface.

12. A device according to claim 1, further comprising a manual user input interface adapted to be physically and electrically coupled to and decoupled from at least two types of user input device.

13. A device according to claim 12, wherein a first type of user input device is comprised of a keyboard, and wherein a second type of user input device is comprised of a digitizer pad.

14. A device according to claim 12, wherein said manual user input interface is rotatably attached to the housing of said device such that said user input device that is coupled to said device can be rotated.

15. A device according to claim 14, wherein said user input device can be rotated to cover the display of said device.

16. A device according to claim 1, wherein said means for transmitting image information comprise means for facsimile transmission of at least a portion of said image information.

17. A device according to claim 1, wherein said means for transmitting image information comprise means for transmission of at least a portion of said image information as a Short Message Service message.

18. A device according to claim 1, wherein the camera unit is located entirely within the housing of the device.

19. A device according to claim 1, further comprising means for performing a character recognition task on at least a portion of said image information.

20. A device according to claim 19, wherein said means for performing a character recognition task comprises an application program stored in said at least one memory unit of the device.

21. A device according to claim 20, wherein said application program is a business card handling application.

22. A device according to claim 1, further comprising means for modifying at least a portion of said image information.

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23. A device according to claim 22, wherein said means for modifying at least a portion of said image information comprises a graphics handler application program.

24. A device for personal communication, data collection and data processing, which is a small-sized, portable and hand-held work station including a housing and comprising a data processing unit; a display; a user interface; a number of peripheral device interfaces; at least one memory unit; a power source; and an application software, wherein the device also comprises:

a camera unit for obtaining and outputting image information, said camera unit comprising:

a camera;

optics connected to said camera;

at least one memory unit;

an output coupled to said data processing unit such that said data processing unit processes image information output by said camera unit; at least a portion of said camera unit being located within said housing; and

wherein said device further comprises:

means for transmitting image information processed by said processing unit to another location using a radio frequency channel; and

a replaceable keyboard and a digitizer pad which are both adapted to couple to a same physical and electrical interface to the device.

25. A circuit card, which can be fitted to a card slot of a device for personal communication, data collection and data processing, comprising a camera unit having at least a portion thereof integrated in the circuit card for obtaining and outputting image information, said camera unit comprising:

camera with optics connected thereto, an image processing unit for processing and outputting image information obtained by said camera for use with said device, and

an output for coupling image information, processed and output by said image processing unit for use with said device, to means in said device for processing image information output by said camera unit for transmission to another location using a radio frequency channel.

26. A circuit card according to claim 25, wherein the camera is a semiconductor camera.

27. A circuit card according to claim 25, wherein the circuit card is a PCMCIA card, and wherein the card slot is a PCMCIA card slot.

28. A circuit card according to claim 27, wherein the circuit card has physical dimensions corresponding substantially with those of a standard PCMCIA card.

29. A portable radiotelephone comprising:

solid-state camera unit for receiving image information, a display for presenting image information received by the camera unit to a user,

a microprocessor adapted to control the operations of the camera unit and to process image information received by the camera unit, and

means for transmitting image information processed by said microprocessor from said radiotelephone to another location using a radio frequency channel, and wherein the camera unit comprises:

a camera, and

means for processing and for storing at least a portion of the image information received by the camera unit for later recall and processing.

30. A device for personal communication, data collection and data processing, which is a small-sized, portable and

hand-held work station comprising a data processing unit; a display; a user interface; a number of peripheral device interfaces; at least one memory unit; a power source; a card slot; and application software, wherein the device also comprises:

a circuit card electrically couplable to said card slot;
 a camera unit for obtaining image information, including a camera (14a), optics (14b), and an output, and with at least a portion of the camera unit integrated in said circuit card that is electrically couplable to the card slot of the device, and wherein said data processing unit is coupled to said output for processing image information output by said camera unit (14) while said circuit card is electrically coupled to said card slot of said device, and

means for transmitting image information processed by said data processing unit from said device to another location using a radio frequency channel.

31. A device according to claim 30, wherein the camera is a semiconductor camera.

32. A device according to claim 30, wherein the circuit card is a PCMCIA card, and wherein the card slot is a PCMCIA card slot.

33. A device according to claim 32, wherein the circuit card has physical dimensions corresponding substantially with those of a standard PCMCIA card.

34. A device according to claim 2, wherein the cellular mobile phone unit is for transmitting at least one of data and speech.

35. A device according to claim 30, wherein said camera unit is integrated completely into said circuit card.

36. A portable notebook computer having a housing, comprising:

a camera unit for recording an image of a selected object, and having at least one memory unit for storing an image recorded by said camera unit;

means, coupled to said camera unit, for processing an image recorded by said camera unit, and

means for transmitting an image processed by said processing means to another location using a radio frequency channel;

wherein at least a portion of said camera unit is integrated in one of said housing of said notebook computer and a circuit card.

37. A portable notebook computer according to claim 36, wherein said camera unit further comprises means for performing character recognition of characters appearing in an image recorded by said camera unit.

38. A portable notebook computer according to claim 36, further comprising means, coupled to said processing means, for displaying at least a portion of an image recorded by said camera unit.

39. A portable notebook computer according to claim 38, further comprising: means for selectively modifying an image appearing on said display.

40. A portable notebook computer according to claim 36, wherein said transmitting means comprises means for transmitting a facsimile transmission of at least a portion of an image processed by said processing means.

41. A portable notebook computer according to claim 36, further comprising:

means, coupled to said processing means, for receiving a facsimile from a transmitting station.

42. A portable notebook computer according to claim 36, further comprising means for performing at least one of transmitting an electronic mail message, paging, and connecting to an on-line information service.

43. A portable notebook computer according to claim 36, wherein the circuit card is a PCMCIA card.

44. A portable notebook computer according to claim 43, wherein in the PCMCIA card has physical dimensions corresponding substantially with those of a standard PCMCIA card.

45. A portable notebook computer according to claim 36, further comprising means for transmitting a Short Message Service (SMS) message including at least a portion of an image taken by said camera unit.

46. A portable notebook computer according to claim 36, wherein said camera unit is located entirely within the housing of the portable notebook computer.

47. A portable notebook computer according to claim 36, wherein said camera unit is integrated completely within said circuit card.

48. A portable notebook computer according to claim 36, further comprising means for performing character recognition of characters appearing in an image recorded by said camera unit.

49. A portable notebook computer according to claim 36, further comprising a digitizer pad that is removably coupled to said portable notebook computer via an electrical and mechanical interface such that it can be replaced with another type of manual input device.

50. A portable notebook computer according to claim 36, further comprising a keyboard that is removably coupled to said portable notebook computer via an electrical and mechanical interface such that it can be replaced with another type of manual input device.

51. A portable notebook computer according to claim 36, further comprising a removable keyboard and a digitizer pad that are both coupled to a same electrical and mechanical interface of the portable notebook computer.

52. A portable notebook computer according to claim 36, further comprising an infrared link for data transmission between the portable notebook computer and an external device.

53. A portable notebook computer having a housing, comprising:

a camera unit for recording an image of a selected object, and having at least one memory unit for storing an image recorded by said camera unit;

means, coupled to said camera unit, for processing an image recorded by said camera unit; and

means for transmitting an image processed by said processing means to another location using a radio frequency channel;

wherein at least a portion of said camera unit is integrated in one of said housing of said notebook computer and a circuit card; and

further comprising a digitizer pad that is removably coupled to said processing means such that it can be replaced with another type of manual input device.

54. A method for recording and processing an image of a selected object using a portable notebook computer, the notebook computer having a data processing unit, a facsimile transmitting unit, a housing, and a card slot, comprising the steps of:

integrating a camera unit that is electrically coupled to the data processing unit, in one of said housing of the notebook computer and a circuit card that is fitted into said card slot of the notebook computer, operating the camera unit to record an image of the selected object; and

storing and processing the image recorded by the camera unit to perform character recognition of characters appearing in at least a portion of the recorded image; and

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using the facsimile transmitting unit to transmit a facsimile representation of at least a portion of the recorded image to another location using a radio frequency channel.

55. A portable computer device, comprising:

a data processor coupled to a memory;

an electronic camera unit that is detachably coupled to the data processor through a plug-in interface, said electronic camera unit comprising a solid state camera, a second data processor and a second memory, said second data processor being operable for performing at least a character recognition task on an image obtained by said solid state camera unit to generate a set of recognized characters; and

a radio transceiver unit coupled to said data processor for transmitting data to a remote receiver through a radio frequency channel, said transmitted data comprising at least one of processed image data obtained from said electronic camera unit or at least a portion of said set of recognized characters.

56. A portable computer device according to claim **55**, further comprising a display for displaying at least a portion of an image recorded by said electronic camera unit, and wherein said data processor is responsive to a program stored in said memory and to a user input for selectively modifying a displayed image.

57. A portable computer device according to claim **55**, further comprising a manual user input interface adapted to be physically and electrically coupled to and decoupled from one of at least two types of user input device, wherein a first type of user input device is comprised of a keyboard, and wherein a second type of user input device is comprised of a digitizer pad.

58. A portable computer device according to claim **57**, further comprising a display for displaying information to a user, and wherein said manual user input interface is rotatably attached to a housing of said portable computer device such that said user input device that is coupled to said computer device can be rotated so as cover said display.

59. A portable computer device according to claim **55**, further comprising a manual user input interface adapted to be physically and electrically coupled to and decoupled from one of at least two types of user input device.

60. A portable computer device according to claim **59**, wherein a first type of user input device is comprised of a keyboard, and wherein a second type of user input device is comprised of a digitizer pad.

61. A device for personal communication, data collection and processing, comprising:

a small-sized, portable and hand-held work station;

a housing for said work station;

a data processing unit;

a display;

a user interface;

a number of peripheral device interfaces;

at least one memory unit;

a power source; and

application software;

and further comprising:

means, coupled to said data processing unit, for transmitting image information processed by said data processing unit to another location using a radio frequency channel; and

a camera card for obtaining image information, comprising:

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optics integrated in said camera card for obtaining said image information;

at least one memory unit;

a processor unit for processing said image information; and

an image sensor for obtaining said image information;

and wherein said camera card is at least partially inserted in the device.

62. A device according to claim **61**, further comprising a digitizer pad that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.

63. A device according to claim **61**, further comprising a keyboard that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.

64. A device according to claim **61**, further comprising means for performing a character recognition task on an image obtained by said camera card for generating a set of recognized characters.

65. A device for personal communication and data collection and processing, comprising:

a small-sized, portable and hand-held work station;

a housing for said work station;

a data processing unit;

a display;

a user interface;

a number of peripheral device interfaces;

at least one memory unit;

a power source; and

application software;

and further comprising:

a cellular mobile phone unit, coupled to said data processing unit, for transmitting image information processed by said data processing unit to another location; and

a camera card for obtaining image information, comprising:

optics integrated in said camera card for obtaining said image information;

at least one memory unit;

a processor unit for processing said image information; and

an image sensor for obtaining said image information;

and wherein said camera card is at least partially inserted in the device.

66. A device according to claim **65**, further comprising a digitizer pad that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.

67. A device according to claim **65**, further comprising a keyboard that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.

68. A device according to claim **65**, further comprising means for performing a character recognition task on an image obtained by said camera card for generating a set of recognized characters.

69. A device for personal communication, data collection and data processing, which is a small-sized, portable and hand-held work station with a housing, comprising:

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a data processing unit;
 a display;
 a user interface;
 a number of peripheral device interfaces;
 at least one memory unit;
 a power source; and
 application software;
 wherein the device also comprises:
 means, coupled to said data processing unit, for transmitting image information processed by said data processing unit to another location using a radio frequency channel; and
 a camera unit for obtaining image information, said camera unit comprising:
 optics for obtaining image information;
 an image sensor for obtaining image information, said image sensor being located within the housing of the device; and
 a processor within said camera unit for processing obtained images, said processor being located within the housing of the device.
70. A device according to claim **69**, further comprising a digitizer pad that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.
71. A device according to claim **69**, further comprising a keyboard that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.
72. A device according to claim **69**, further comprising means for performing a character recognition task on an image obtained by said camera unit for generating a set of recognized characters.

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73. A portable cellular mobile phone comprising:
 a built in camera unit for obtaining image information;
 a user interface for enabling a user to input signals to operate the camera unit;
 a display for presenting image information obtained by the camera unit;
 a microprocessor adapted to control the operations of the camera unit in response to input signals from the user interface, and to process image information received by the camera unit; and
 means, coupled to said microprocessor, for transmitting image information processed by said microprocessor to another location using a radio frequency channel;
 and wherein the camera unit comprises:
 optics for obtaining image information;
 an image sensor for obtaining image information; and
 means for processing and for storing at least a portion of the image information obtained by the camera unit for later recall and processing.
74. A portable cellular mobile phone according to claim **73**, further comprising a number of peripheral device interfaces, and a digitizer pad that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.
75. A portable cellular mobile phone according to claim **73**, further comprising a number of peripheral device interfaces, and a keyboard that is removably coupled to one of said number of peripheral device interfaces such that it can be replaced with another type of manual input device.
76. A portable cellular mobile phone according to claim **73**, further comprising means for performing a character recognition task on an image obtained by said camera unit for generating a set of recognized characters.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

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Page 1 of 1

DATED : July 30, 2002

INVENTOR(S) : Kari-Pekka Wilska, Reijo Paajanen, Mikko Terho and Jari Hamalainen

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,

Item [30], **Foreign Application Priority Data,**

“Jun. 12, 1995 (FI).....942334” should read

-- May 19, 1994 (FI).....942334 --.

Column 10,

Line 31, please insert -- , said camera unit -- after “card”.

Line 41, please insert -- and means -- after “unit”.

Line 52, please insert -- a -- before “solid-state”.

Line 52, “f or” should read -- for --.

Column 11,

Line 8, please delete “(14a)” after “camera”.

Line 8, please delete “(14b)” after “optics”.

Line 13, please delete “(14)” after “unit”.

Column 12,

Line 8, “further comprising” should read -- wherein said transmitting means comprises --.

Line 10, “taken by said camera unit” should read -- processed by said processing means --.

Signed and Sealed this

First Day of April, 2003



JAMES E. ROGAN

Director of the United States Patent and Trademark Office

Exhibit C



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(19) **United States**
(12) **Reissued Patent**
Yasuda et al.

(10) **Patent Number: US RE39,231 E**
(45) **Date of Reissued Patent: Aug. 8, 2006**

(54) **COMMUNICATION TERMINAL
EQUIPMENT AND CALL INCOMING
CONTROL METHOD**

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Related U.S. Patent Documents

Reissue of:

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Appl. No.: **08/571,650**
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(30) **Foreign Application Priority Data**

Dec. 19, 1994 (JP) P06-335016

* cited by examiner

(51) **Int. Cl.**

H04Q 7/20 (2006.01)
H04Q 7/32 (2006.01)
H04Q 7/38 (2006.01)

Primary Examiner—Keith Ferguson

(74) *Attorney, Agent, or Firm*—Jay H. Maioli

(52) **U.S. Cl.** **455/567**; 455/564; 455/550.1;
455/403; 455/572; 455/575.1; 455/412.1;
455/343.1; 379/418; 379/355.01; 379/373;
379/373.01; 379/373.02; 340/7.58; 340/7.57;
340/7.6

(58) **Field of Classification Search** 455/403,
455/550.1, 567, 340, 355, 500, 517, 572,
455/427.1, 73, 78, 79; 340/7.62, 7.58, 7.57,
340/5.39

See application file for complete search history.

(57) **ABSTRACT**

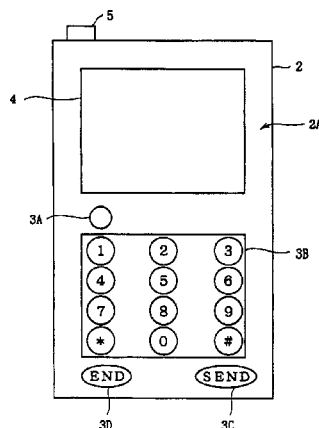
In a communication terminal equipment and in a method of controlling call incoming, unnecessary noises in a period from the start of an alert sound to carrying out of the next operation can be reduced. When a predetermined operation is effected under the condition that an alert sound is ringing, the alert sound is stopped or the volume of the alert sound is reduced at least over a duration of call incoming. Thus, such a fear that persons in the surroundings may be troubled by the continuous ringing of the alert sound can be remarkably reduced. Further, since the situation that a power supply is cut off forcibly during all origination can be avoided, the fear that a person on the call origination side may be given an unpleasant feeling can be eliminated.

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23 Claims, 5 Drawing Sheets



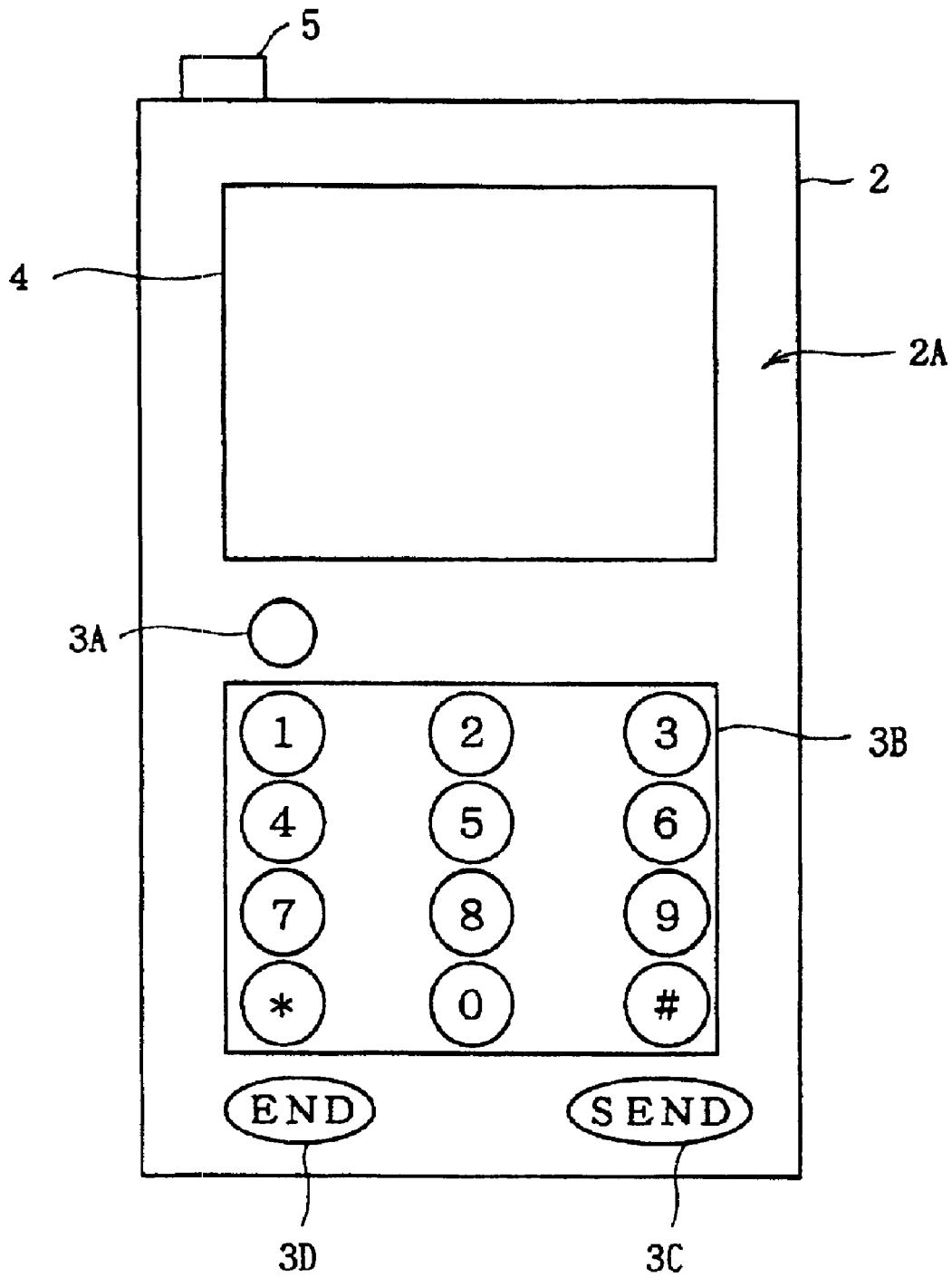


FIG. 1

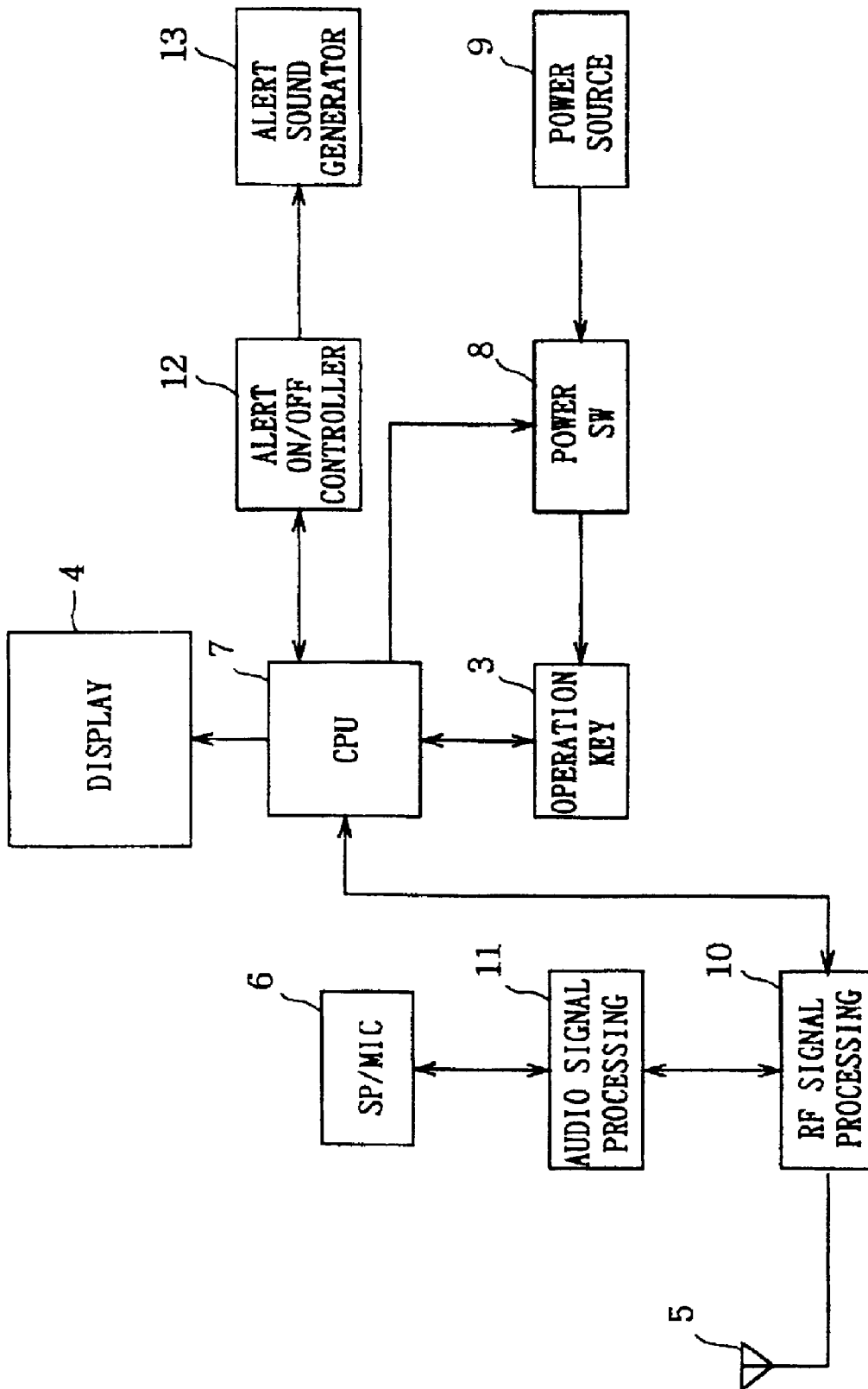


FIG. 2

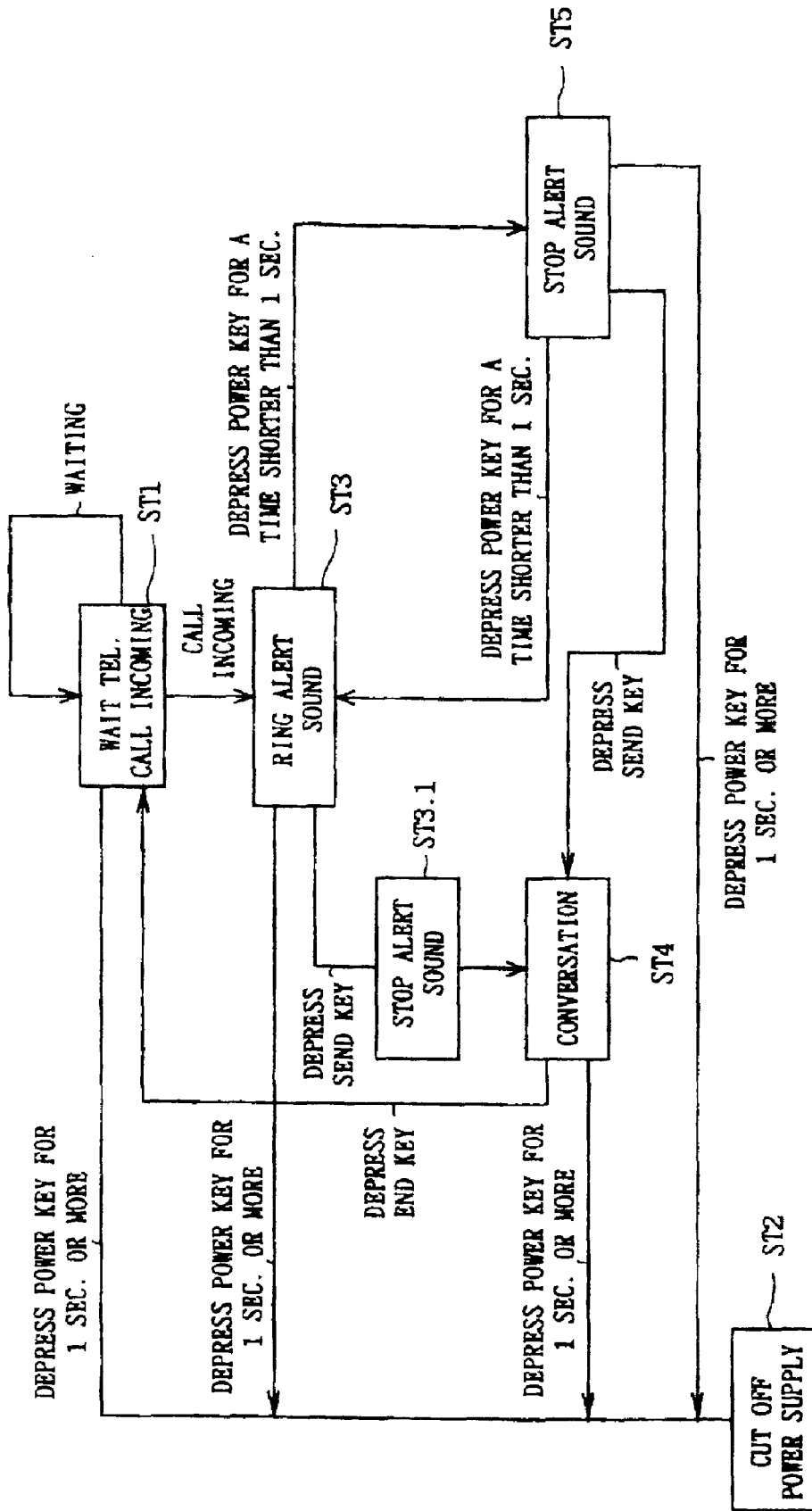


FIG. 3

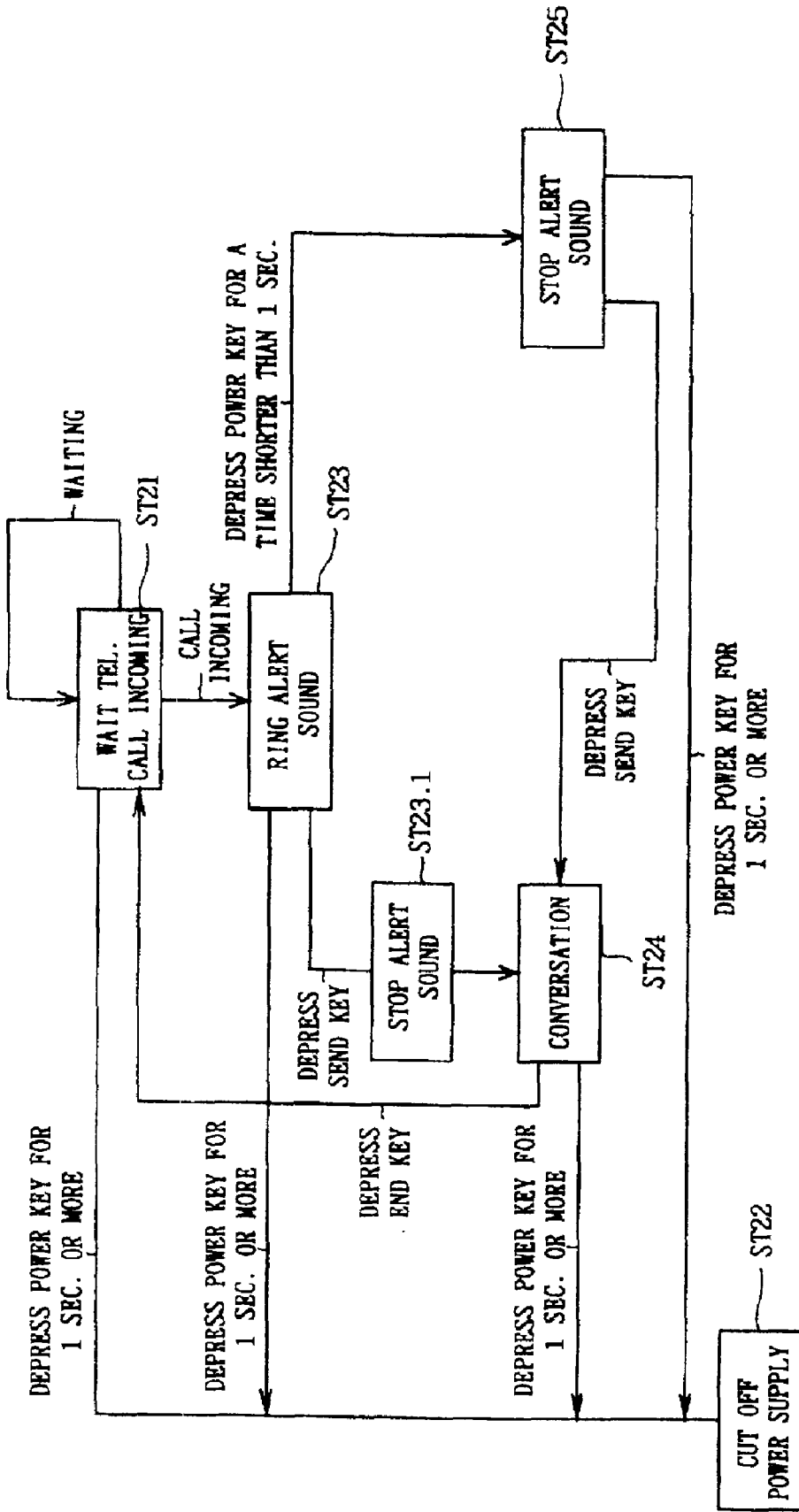


FIG. 5

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**COMMUNICATION TERMINAL
EQUIPMENT AND CALL INCOMING
CONTROL METHOD**

Matter enclosed in heavy brackets [] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a communication terminal equipment, and is applicable to, for example, a portable telephone (such as GSM•USDC•PDC) and a digital cordless telephone (such as PHS•DECT•CT-2).

2. Description of the Related Art

Conventionally, call incoming to a telephone is informed by means of an alert sound. Generally, such an alert sound is designed so that it does not stop ringing before a user effects next operation. Accordingly, when the user cannot give any quick response to the call incoming, there is no way other than the user breaks off the alert sound forcibly by means of going off-hook or leaves the alert sound to continue ringing.

In this case, in the method to forcibly break off the alert sound by means of the off-hook operation, there is a fear that the person on the other side is given an unpleasant feeling because the person on the other side can notice that the circuit was broken off intentionally. On the other hand, in the method to wait until the alert sound stops ringing, there is a fear that persons in the surroundings may be troubled by the alert sound.

Another method is therefore considered in which generation of an alert sound is stopped by a user's operation to intentionally break off power supply while to call is incoming. In this method, however, the turning-on of the power supply again is apt to be forgotten, and there is a possibility of missing the next incoming call. Further, there is a fear that long-time turn-off power supply may be regarded as a failure in an telephone network. Accordingly, this method is a not so preferable measure.

In view of the foregoing, an object of this invention is to provide a communication terminal equipment which is superior in selecting and handling properties for users in comparison with conventional one.

The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings in which like parts are designated by like reference numerals or characters.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a schematic front view showing an example of the communication terminal equipment according to the present invention;

FIG. 2 is a block diagram showing an example of the inner circuit of the communication terminal equipment according to the present invention; and

FIGS. 3 to 5 are schematic diagrams showing the state transition.

DETAILED DESCRIPTION OF THE
EMBODIMENT

Preferred embodiments of the present invention will be described with reference to the accompanying drawings:

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(1) General Configuration

In this embodiment, description will be made about a portable telephone in which an alert sound muting function is allotted to a power key for controlling switching of turning on/off power supply to thereby improve the convenience in handling.

The outline configuration of a portable telephone 1 is shown in FIG. 1.

On a front panel 2A of a body 2 used in this embodiment, there are provided not only operation keys 3 (including a power key 3A, numeral keys 3B, a send key 3C, and an end key 3D), but also a display 4 for displaying a telephone number. On this display 4, a telephone number or the like entered by a user can be displayed. The user can confirm the entered contents or can perform mode selection on a picture screen. Further, in addition to those operation keys 3 and the display 4, an antenna 5 and a speaker/microphone portion 6 (not shown) are provided on the body 2.

FIG. 2 shows the inner configuration of the portable telephone 1. The inner circuit is constituted by a CPU 7 (control means) as a main part so that the CPU 7 controls other parts of the inner circuit. For example, in the case where the user depresses the power key 3A when the user wishes to originate a call, the CPU 7 performs control to close a power switch 8 so that electric power is supplied from a power source 9. Thus, the portable telephone 1 is brought into a state of standing-by awaiting entering of a telephone number of the other party.

For example, if the user enters the telephone number of the other party through the numeral keys 3B in this state, the CPU 7 displays the thus entered telephone number of the other party on the display 4. If the user operates the send key 3C, the CPU 7 begins call origination to the other party through an RF signal processing portion 10 and the antenna 5.

If the other party responds to the call origination and conversation is started, a reception signal received through the antenna 5 is fetched into an audio signal processing portion 11 through the RF signal processing portion 10, and then the signal is outputted from a speaker of the speaker/microphone portion 6 after signal-processed in the audio signal processing portion 11. On the other hand, the user's voice is fetched into the audio signal processing portion 11 through a microphone of the speaker/microphone portion 6, and transmitted from the antenna 5 through the RF signal processing portion 10 after being signal-processed in the audio signal processing portion 11.

On the contrary, when a call is given to this portable telephone 1 from another party, the CPU 7 detects this call and performs control to turn on an alert on/off controller 12 to thereby make an alert sound generator 13 generate an alert sound. Thus, the user is able to notice the call incoming. In this state, if the user depresses the send key 3C, the CPU 7 detects this depression, so that it enables conversation and stops the generation of the alert sound at the same time. This is a case where the user can respond to a call incoming. However, there is a case where the user cannot respond to a call incoming in accordance with the surroundings at the time of the call incoming. To cope with such a case, therefore, there is provided a function to eliminate an alert sound without forcibly cutting-off a circuit under a predetermined operation.

This operation is carried out by the power key 3A. Normally, the power key 3A is used to open the power switch 8 to thereby break off the power supply from the power source 9 under the condition that the power key 3A is depressed for a predetermined time or more (for example,

1 second or more). If the power key 3A is depressed for a time shorter than a predetermined time (for example, shorter than one second) when an alert sound is being generated, the CPU 7 detects this depression and controls the alert on/off controller 12 to make it stop the generation of the alert sound.

(2) State Transition

Next, referring to FIG. 3, description will be made about the operation and the state transition when call incoming is given to the portable telephone 1.

The operation at the time of call incoming begins from the state ST1 of telephone call incoming standing-by. The portable telephone 1 maintains this state ST1 before confirmation of telephone call incoming. Incidentally, if the power key 3A is depressed for one second or more in this state, the operation shifts to power supply cutting off in the state ST2.

If telephone call incoming is confirmed in the state ST1, the operation shifts to the state ST3 in which an alert sound is generated to inform the user of the call incoming. In the case where the user wishes to respond to the call incoming in this state ST3, the user depresses the send key 3C to shift the state ST3.1 to stop the alert sound, thereafter the state shifts to the state ST4 to start conversation.

In this state ST4, if the user depresses the end key 3D, the operation shifts to the call incoming waiting state ST1, while if the user depresses the power key 3A for one second or more, the operation shifts to the state ST2.

Also in the case where the user depresses the power key 3A for one second or more in the state ST3 where an alert sound is being generated, the operation shifts to the state ST2.

If the power supply is broken off forcibly in such a state where an alert sound is being generated, there is a fear that the other party who transmitted the call may be given an unpleasant feeling or a kind of misunderstanding because the other party can notice the fact that the person on the reception side did not respond to the call intentionally. To cope with this point, there is provided a new function to which the state ST5 corresponds.

That is, in the case where it is impossible to allow an alert sound to ring for a long time continuously in view of the characteristic of the portable telephone 1 which is generally used in public spaces, the user may depress the power key 3A for a time shorter than one second in the state ST3. By such an operation, the CPU 7 performs control to turn off the alert on/off controller 12 to only stop the generation of the alert sound. This operation does not give any unnecessary unpleasant feeling to the other party because this operation does not cause cutting-off of the circuit. Further, since the user can stop the alert sound, such a situation that persons in the surroundings are troubled by the alert sound can be avoided.

Incidentally, if the user depresses the power key 3A for a time shorter than one second in the state ST5, the operation is returned to the state ST3 where the alert sound is rung, so that the user can easily confirm whether the call origination is continued or not.

It is a matter of course that, when the user wishes to start conversation in the duration of stopping the alert sound, the user may depress the send key 3C so as to shift the state from the state ST5 to the state ST4 to thereby make it possible to start conversation. Further, if the user depresses the power key 3A for one second or more in the state ST4, the state shifts to the state ST2.

The above is the description about the state transition which the portable telephone 1 can take upon call incoming.

In the above configuration, the user can stop an alert sound without breaking-off connection of the telephone

circuit by depressing the power key 3A for a short time (for a time shorter than one second in this example), so that it is possible to reduce trouble by an alert sound being heard by persons in the surroundings.

The effect is remarkable particularly in the case of such a portable telephone 1 which is generally used in public places gathering many and unspecified persons.

Further, since the design is made such that when the user depresses the power key 3A again for a short time in the duration of stopping an alert sound, the state is returned to the original state, that is, the state ST3, so that the user's selection of use increases and the operation property can be improved.

(3) Other Embodiments

In the aforementioned embodiment, description has been made about a case where not only a telephone number entered by a user but also various mode selection scene are displayed on the picture screen of the display 4. However, the present invention is not limited to such an embodiment but is applicable to a case where the telephone number of the other party is displayed in the case of using a service in which the telephone number of the other party is displayed upon reception of call incoming. If this function is combined with the above-mentioned function of eliminating an alert sound, a user can select suitably a measure so as not to act in an impolite manner in accordance with a person of the other party, so that the user's convenience in handling can be improved.

In the aforementioned embodiments, description has been made about a case where an alert sound is stopped when the power key 3A is depressed for a time shorter than one second in the condition that the alert sound is ringing while the power supply is broken off when it is depressed for a time not shorter than one second in the same condition. However, the boundary value of the depression time is not only limited to one second.

In the aforementioned embodiments, description has been made about a case where an alert sound is stopped when the power key 3A is depressed in the condition that the alert sound is ringing. However, the present invention is not limited to these embodiments but is applicable widely also to a case where the volume of an alert sound is reduced. FIG. 4 shows this state. FIG. 4 is an example of approximately the same state transition as FIG. 3, however, only the state ST15 of FIG. 5 is different from the corresponding state ST5 of FIG. 3, in which the processing of reducing the volume of an alert sound is performed.

In the aforementioned embodiments, description has been made about a case where there is provided a function (toggle function) in which when the power key 3A is depressed again for a short time under the state ST5, ST15 that an alert sound is stopped by the alert sound stopping function allotted to the power key 3A, the state is returned to the state ST3, ST13 where the alert sound can be rung. However, the present invention is not limited to these embodiments but the state transition may be set to be one way. More specifically, as shown in FIG. 5, there is no change under the state ST25 even if the power key 3A is depressed for a time shorter than one second. In this example, a user cannot ring an alert sound again after having stopped the alert.

In this example, the situation can be prevented where the user rings an alert sound erroneously by user's misoperation, therefore, persons in the surroundings being troubled by an alert sound can be avoided. It can be said that this example has another effect from FIG. 3.

Further, in the aforementioned embodiments (FIGS. 3 to 5), description has been made about a case where an alert

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sound is stopped or the volume of an alert sound is reduced continuously from immediately after the power key 3A is depressed for a short time under the condition that the alert sound is ringing. However, this duration is not only limited to just when the power key 3A is depressed but may be when after predetermined time.

In the aforementioned embodiments, description has been made about a case where the alert sound stopping function and the volume reducing function is allotted to the power key 3A which is designed to cut off the power supply when the power key 3A is depressed for a predetermined time or more. However, the present invention is not limited to these embodiments but an additional key may be further provided so that the alert sound stopping function or the volume reducing function is allotted exclusively to this additional key, or the alert sound stopping function or the volume reducing function is allotted to any one of the abovementioned keys other than the power key 3A.

In the aforementioned embodiments, description has been made about a case where a display having a function to display various information is provided with a portable telephone 1 in one body.

However, the present invention is not limited to this case but is widely applicable to portable telephones not having such a display.

Further, in the aforementioned embodiments, description has been made about a portable telephone 1. However, the present invention is not limited to such a portable telephone but is widely applicable to information terminal equipment having a communication function, as well as to hard-wire telephones.

According to the present invention, as described above, configuration is made such that when a user effects a predetermined operation under the condition that an alert sound is ringing, the alert sound is stopped or the volume of the alert sound is reduced at least over a duration of call incoming, so that such a fear that persons in the surroundings may be troubled by the continuous ringing of the alert sound can be remarkably reduced.

Further, the situation that power supply is cut off forcibly during call origination can be avoided, so that such a fear that a person on the call origination side may be given an unpleasant feeling can be reduced.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made, therefore, the appended claims are provided to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A communication terminal for informing a user of a received call from a remote caller by an alert sound, comprising:

an alert sound generator for generating the alert sound when the call is received from the remote caller;

control means for controlling said alert sound generator; and

means for specifying a predetermined operation by the user,

wherein when said alert sound generator is generating the alert sound and said means for specifying said predetermined operation is operated by the user, said control means controls said alert sound generator to change a volume of the generated alert sound only for the received call, without affecting the volume of the alert sound for future received calls, while leaving a call ringing state, as perceived by the remote caller, of the call to the terminal from the remote caller unchanged.

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2. The communication terminal according to claim 1, wherein

said control means controls the state of said alert sound generator to stop the sound.

3. The communication terminal according to claim 1, wherein

said control means controls the state of said alert sound generator to reduce the volume of the sound.

4. The communication terminal according to claim 1, wherein said predetermined operation is an operation depressing a predetermined operation key.

5. The communication terminal according to claim 4, wherein said operation key is a power key to turn on or break off connection between said terminal and a power supply.

6. The communication terminal according to claim 5, wherein said control means includes disconnection means for turning off power supplied by said power supply when said power key is depressed for at least a predetermined period of time and wherein said predetermined operation occurs when said power key is depressed for a time shorter than said predetermined period of time.

7. The communication terminal according to claim 6, wherein said predetermined period of time for depressing said power key is substantially equal to one second.

8. The communication terminal according to claim 6, wherein said control means again changes the state of said alert sound generator when said predetermined operation occurs again, after said predetermined operation has occurred a first time.

9. The communication terminal according to claim 8, wherein

said control means controls the state of said alert sound generator to stop an alert sound and then to generate the sound again.

10. The communication terminal according to claim 8, wherein said control means controls the state of said alert sound generator to reduce an audible volume levels of the sound and subsequently to restore said volume level of the sound to an unreduced level.

11. The communication terminal according to claim 1, further comprising display means for displaying information regarding said remote caller.

12. The communication terminal according to claim 1, further comprising:

RF signal processing means for transmitting and/or receiving radio waves; and

an antenna for transmitting and/or receiving said radio waves, wherein said communication status between said apparatus and said remote caller is established by said transmitted and/or received radio waves.

13. A method of informing a user of a received call from a remote caller to a communication apparatus, comprising the steps of:

waiting to receive a call;

generating an alert sound upon receiving said call; and changing a volume of the generated alert sound only for said call when the alert sound is being generated and a predetermined operation is specified by the user, without affecting the volume of the alert sound for subsequent future received calls, while leaving a call ringing status, as perceived by the remote caller, of the call from the remote caller to the communication apparatus unchanged.

14. The method of informing a user of a received call according to claim 13, wherein said predetermined operation comprises depressing a predetermined key for a time shorter than a predetermined period of time.

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15. The method of informing a user of a received call according to claim 14, wherein said predetermined key is a power key to turn on or break off a supply of power to said communication apparatus.

16. The method of informing a user of a received call according to claim 14, wherein said predetermined period of time is substantially equal to one second.

17. The method of informing a user of a received call according to claim 13, wherein said step of changing the state of the alert sound includes the step of toggling said predetermined operation.

18. The method of informing a user of a received call according to claim 13, wherein said state of the alert ringing sound is changed to the state where said alert sound is stopped.

19. The method of informing a user of a received call according to claim 13, wherein said state of the alert ringing sound is changed to the state where a volume level of said alert sound is reduced.

20. A communication terminal with a function to inform a received call by an alert sound comprising:

an alert sound generator configured to generate an alert sound when the received call is received;

a first operation key configured to operate a predetermined operation; and

a controller, wherein

said controller measures a time period of depressing said first operation key when said first operation key is

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depressed while the received call is being received, controls a state of said alert sound generator when the time period of depressing said first operation key is shorter than a predetermined time period, and operates said predetermined operation when the time of depressing said operation key is longer than a predetermined time period.

21. The communication terminal according to claim 20, wherein said predetermined operation is an operation of disconnecting a power supply of the communication terminal.

22. The communication terminal according to claim 20, wherein said controller controls the state of said alert sound generator such that the alert sound is one of stopped and reduced in volume.

23. The communication terminal according to claim 20, further comprising:

a communication circuit configured to communicate with a second party; and

a second operation key configured to enable a conversation with said second party;

wherein

said controller controls said communication circuit so as to communicate with said second party when said second operation key is depressed while said controller is controlling the state of said alert sound generator.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : RE 39,231 E
APPLICATION NO. : 09/998426
DATED : August 8, 2006
INVENTOR(S) : Hiroshi Yasuda et al.


Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the face of the patent, (56) References Cited, "4,504,701" should read --4,504,707--.

Signed and Sealed this

Seventeenth Day of April, 2007

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive style.

JON W. DUDAS

Director of the United States Patent and Trademark Office

Exhibit D



US005737394A

United States Patent [19]

[11] Patent Number: **5,737,394**

Anderson et al.

[45] Date of Patent: **Apr. 7, 1998**

[54] **PORTABLE TELEPHONE APPARATUS HAVING A PLURALITY OF SELECTABLE FUNCTIONS ACTIVATED BY THE USE OF DEDICATED AND/OR SOFT KEYS**

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[75] Inventors: **Geoffrey T. Anderson**, San Diego, Calif.; **Sophie Klym**, Lincoln Park, N.J.; **Andrew Todd Zidel**, Hawthorne, N.J.; **Masaaki Akahane**, Mahwah, N.J.; **Eduardo Sciammarella**, Hoboken, N.J.

“Displayphone: Telephone and Terminal Combine in a Compact Desk-Top Unit”, Rod Adkins et al., *Telesis* (Canada), 1982—four, pp. 2-7.

“Smart Phones”, Christopher O’Malley, *Popular Science*, Jan. 1992, pp. 70-73 & 94.

“The Future is Now”, *Popular Science*, Jan. 1995, pp. 68-73, 81 & 82.

[73] Assignees: **Sony Corporation**, Tokyo, Japan; **Sony Electronics**, Park Ridge, N.J.

Primary Examiner—Thomas W. Brown

Attorney, Agent, or Firm—William S. Frommer; Alvin Sinderbrand

[21] Appl. No.: **597,292**

[22] Filed: **Feb. 6, 1996**

[51] Int. Cl.⁶ **H04M 1/56; H04M 11/08**

[52] U.S. Cl. **379/88; 379/93.17; 379/396; 379/354; 455/412**

[58] **Field of Search** 379/89, 88, 59, 379/96, 110, 354, 396, 57, 67, 93.17, 93.18, 110.01, 142; 455/412, 426, 413

[57] ABSTRACT

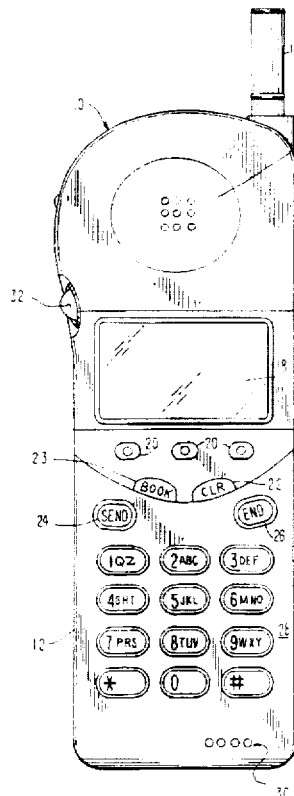
A telephone apparatus having a plurality of dedicated keys, a plurality of changeable keys each having at least one respective dedicated function associated therewith, and a display for displaying a plurality of lines of data. The telephone apparatus is adapted to perform a plurality of main functions including so-called menu, message, pad and book functions. Each of such main functions may be directly accessed by depressing only one of the keys. Further, the telephone apparatus enables messages, including voicemail and text data messages, to be received and stored therein. Messages or responses to received messages may be produced and transmitted from the telephone apparatus.

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26 Claims, 15 Drawing Sheets



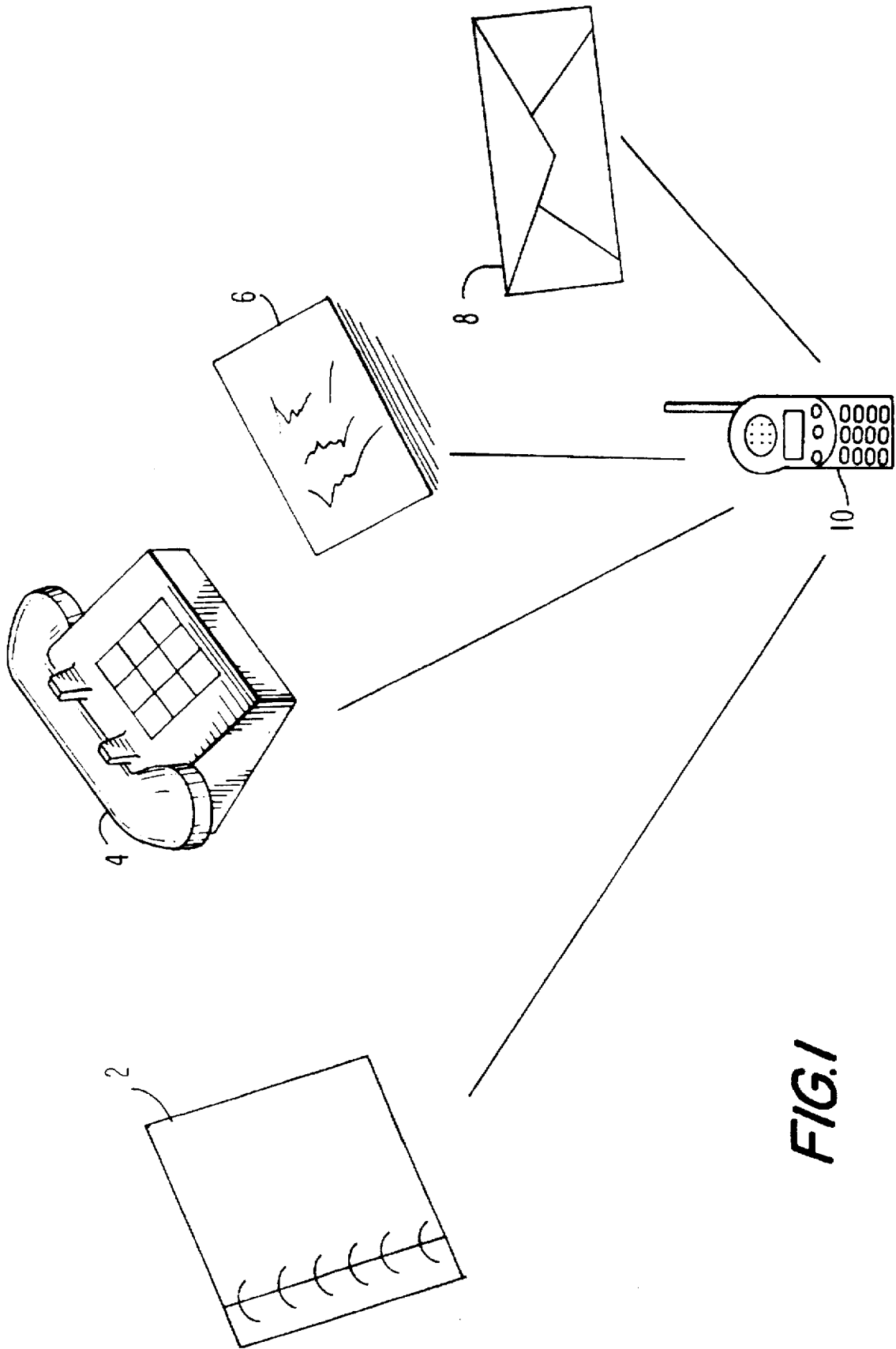


FIG. 1

FIG. 2A

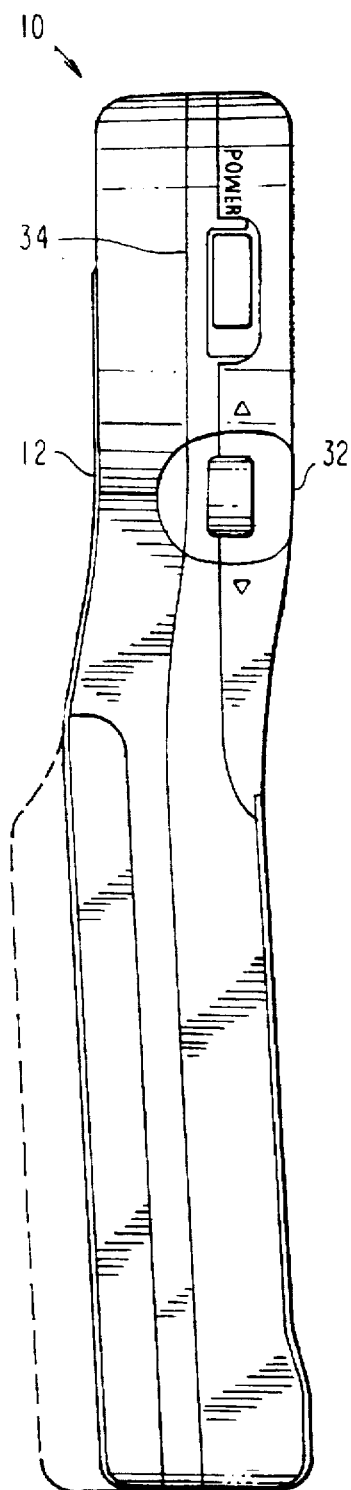
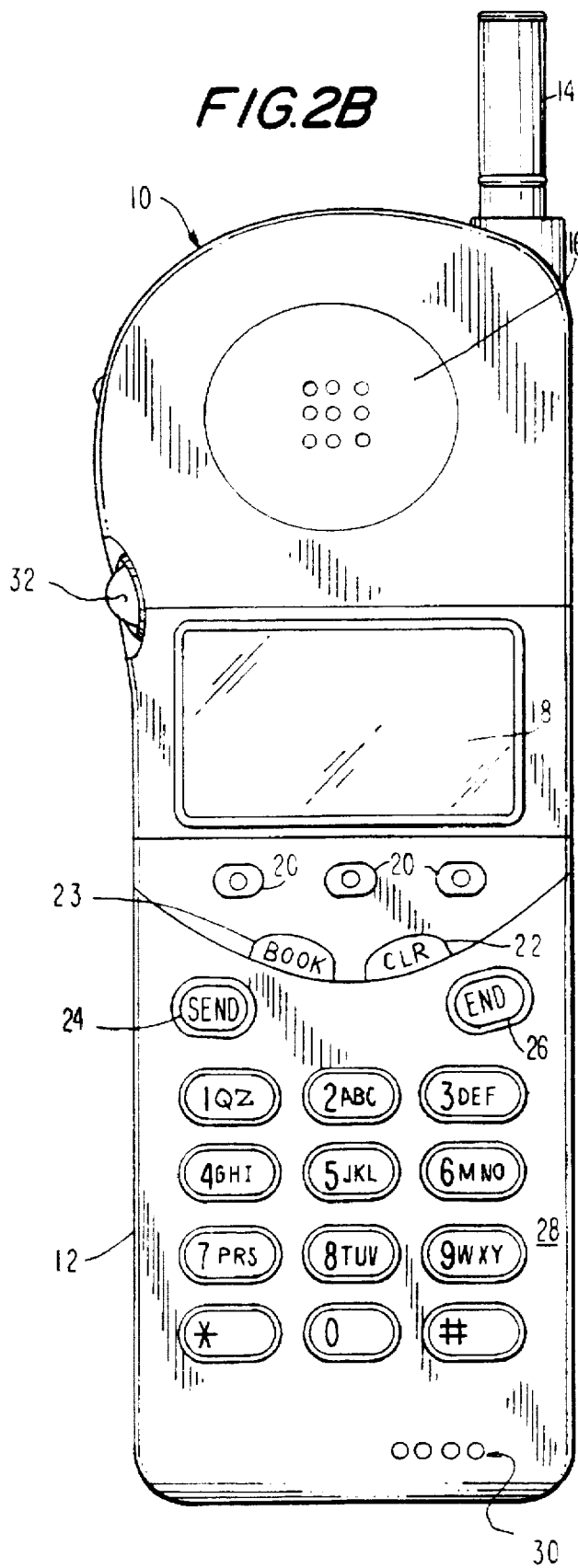


FIG. 2B



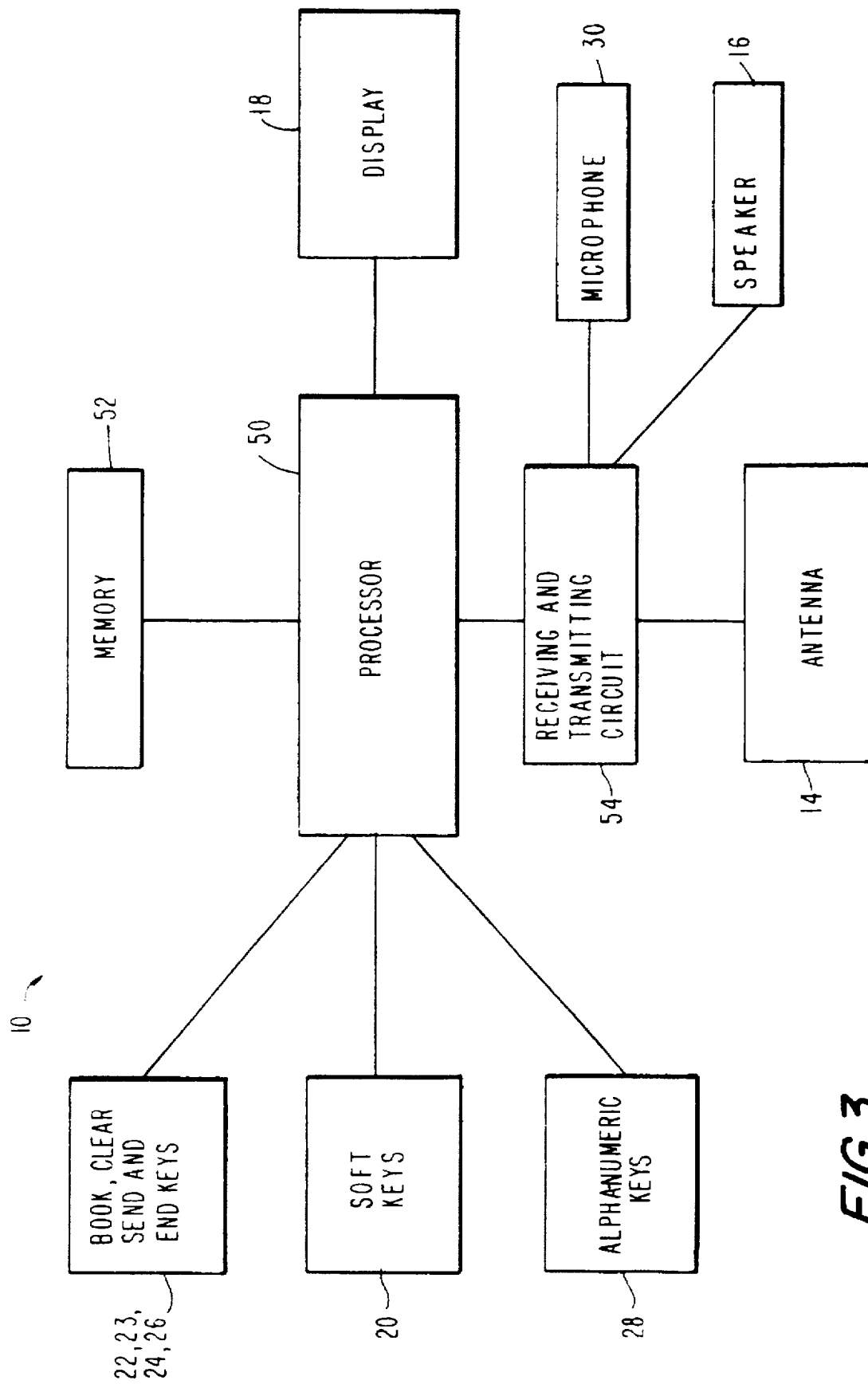


FIG. 3

FIG. 4

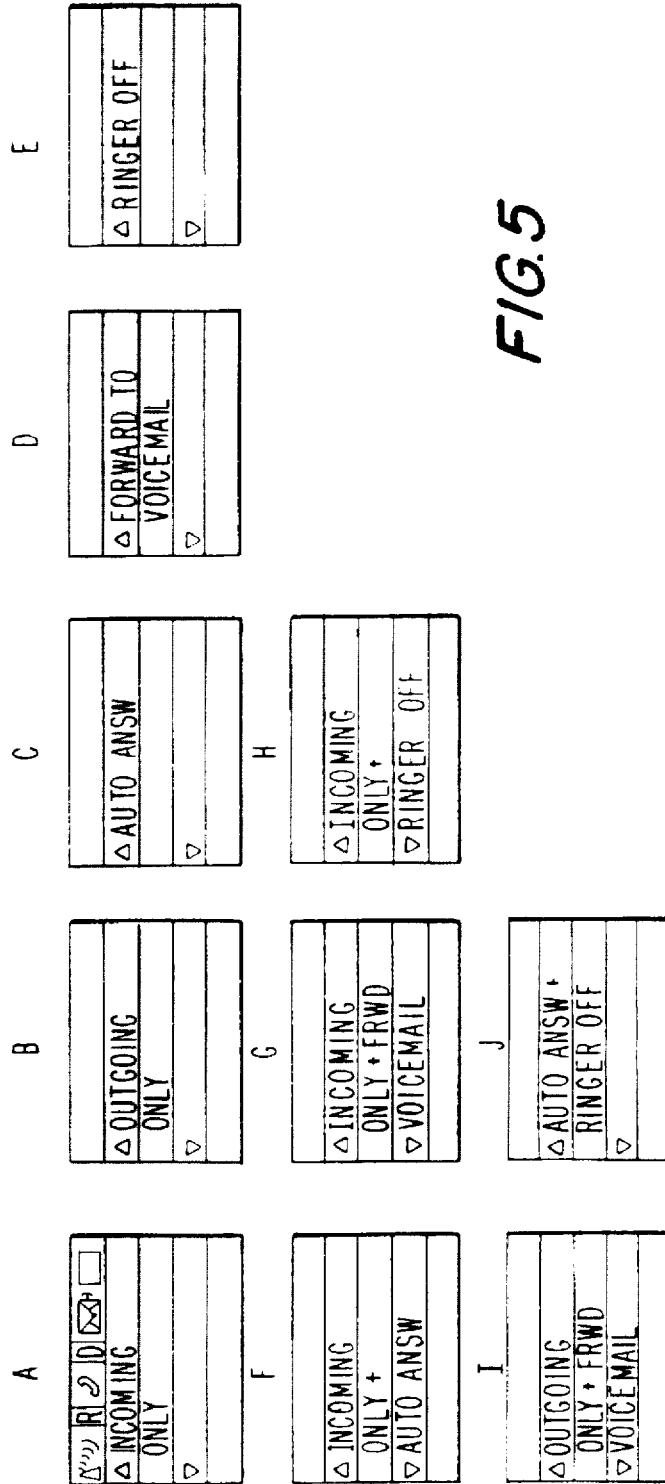
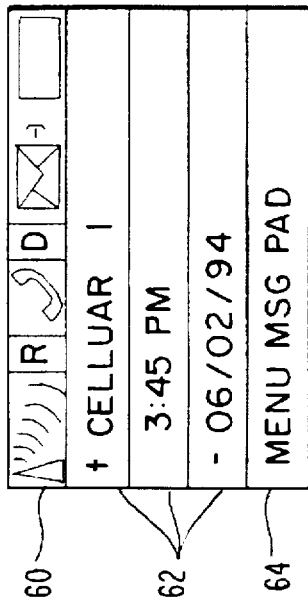


FIG. 5

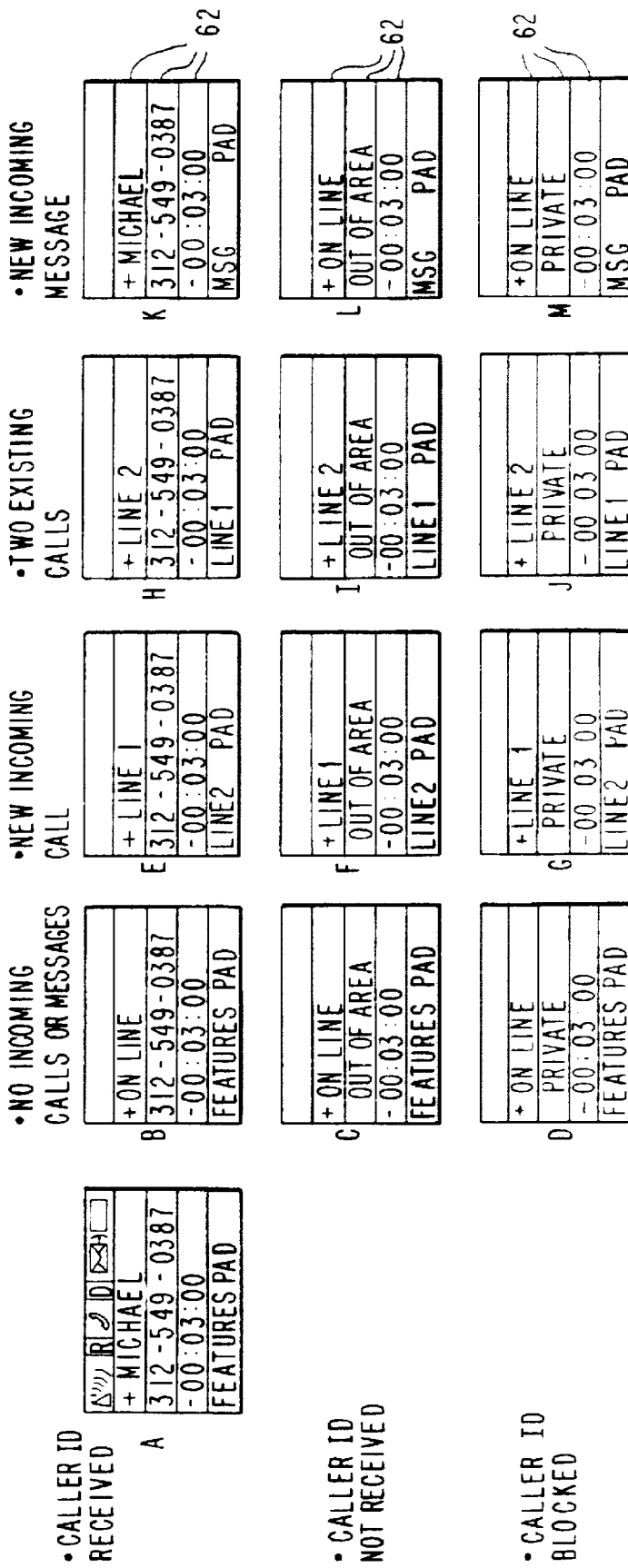
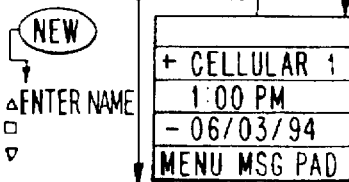
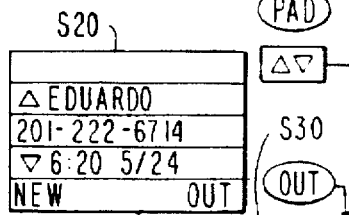
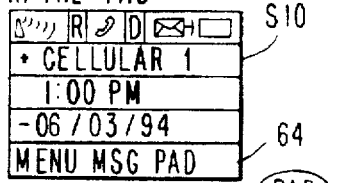
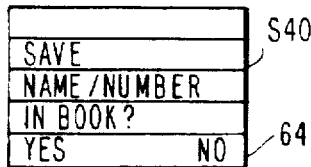


FIG.6

• TO 'PAD' FROM STAND-BY MODE
 • ACCESSING THE 'PAD' FROM THE STAND-BY MODE, BRINGS YOU TO THE MOST RECENT ENTRY IN THE 'PAD'



• BY PRESSING THE BOOK-'HARD' BUTTON WHEN IN THE 'PAD' THE USER CAN MOVE THE 'PAD' 'MEMORY PAGE' INTO THE 'BOOK'



YES NO
 OPEN 'BOOK'

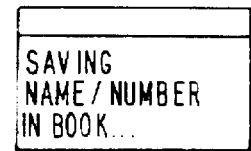
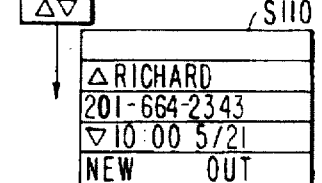
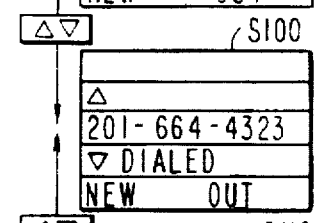
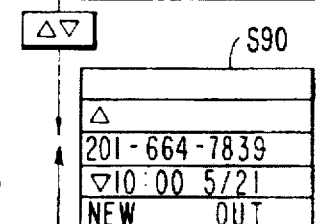
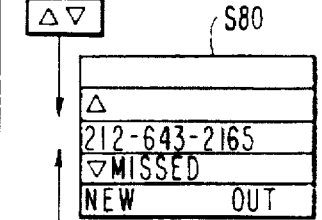
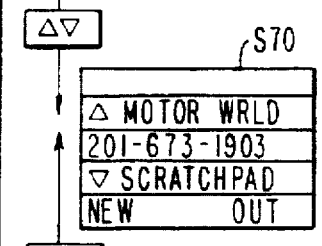
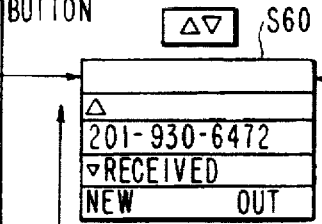


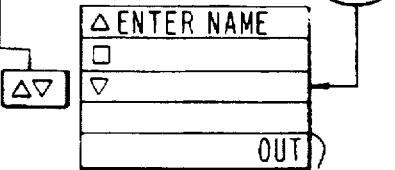
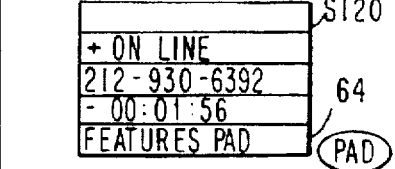
FIG. 7

• TO REVIEW ENTRIES IN THE 'PAD' USE THE 'SCROLL' BUTTON

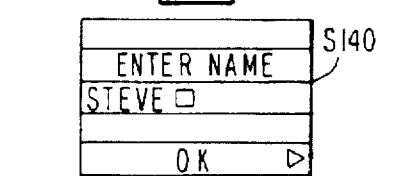


• THE LAST LINE OF EACH 'PAD' 'MEMORY PAGE' WILL ALTERNATE EVERY 1-1.5 SECONDS BETWEEN THE TIME DAY STAMP AND WHETHER IT WAS DIALED, RECEIVED, MISSED, OR SCRATCHPAD

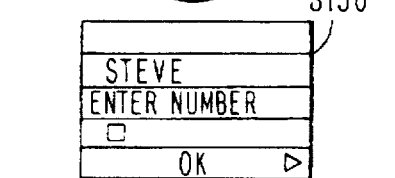
• TO 'PAD' FROM CONVERSATION MODE
 • ACCESSING THE 'PAD' FROM THE CONVERSATION MODE OPENS A NEW 'MEMORY PAGE'; WHEN THE 'MEMORY PAGE' IS COMPLETED, AND THE USER PRESSES THE OK-'SOFT' BUTTON, THE OLDEST SCRATCHPAD-'MEMORY PAGE' IS DELETED.



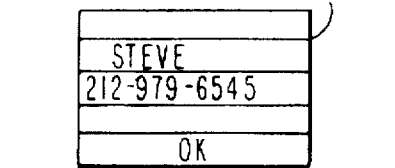
A-Z



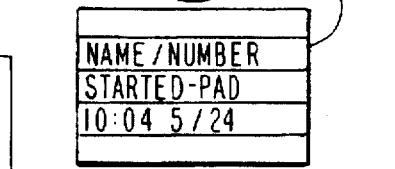
OK



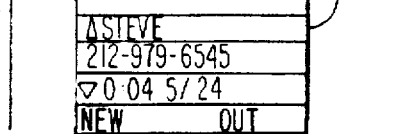
0-0



OK



. 1 SEC



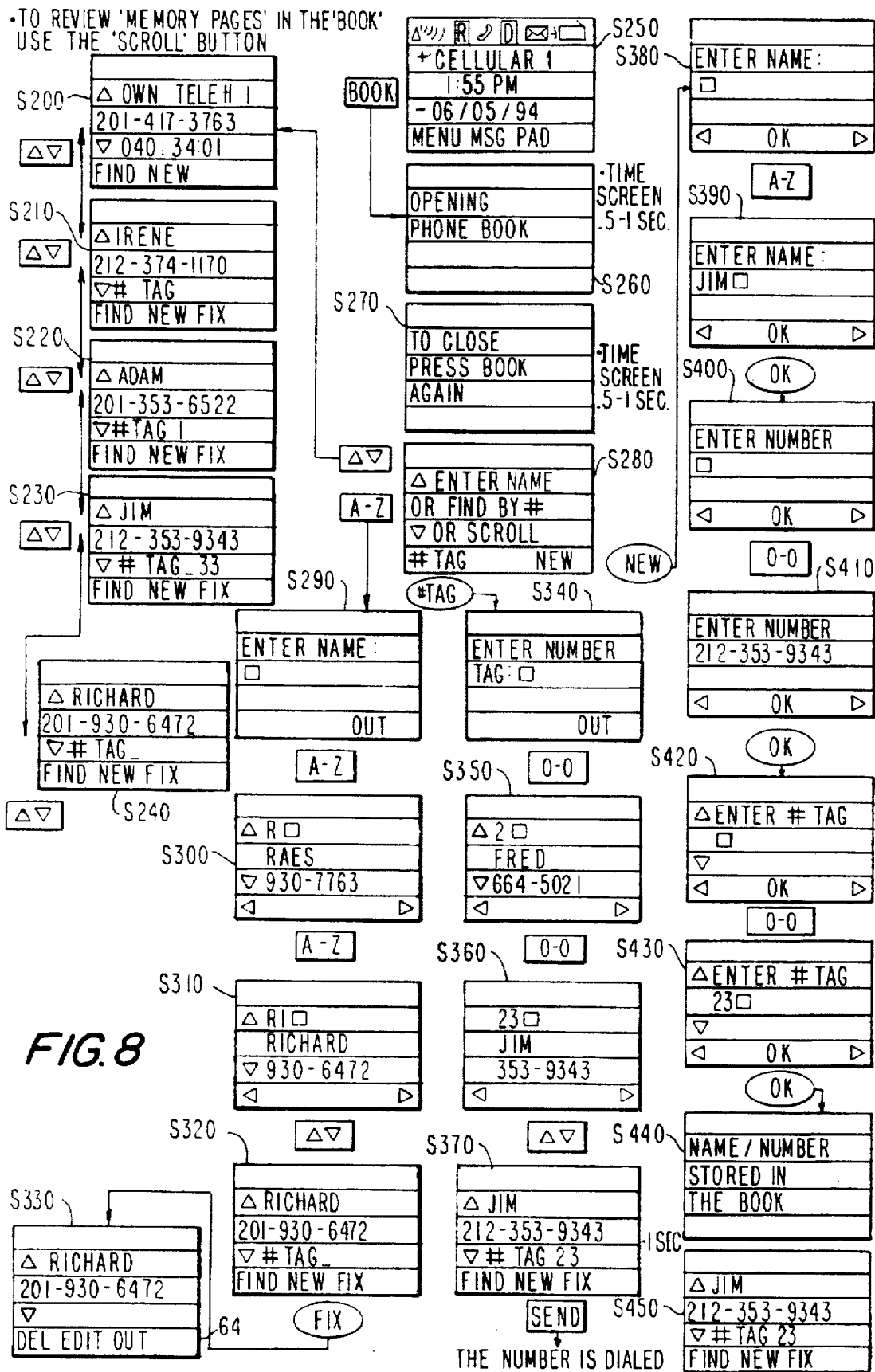


FIG. 8

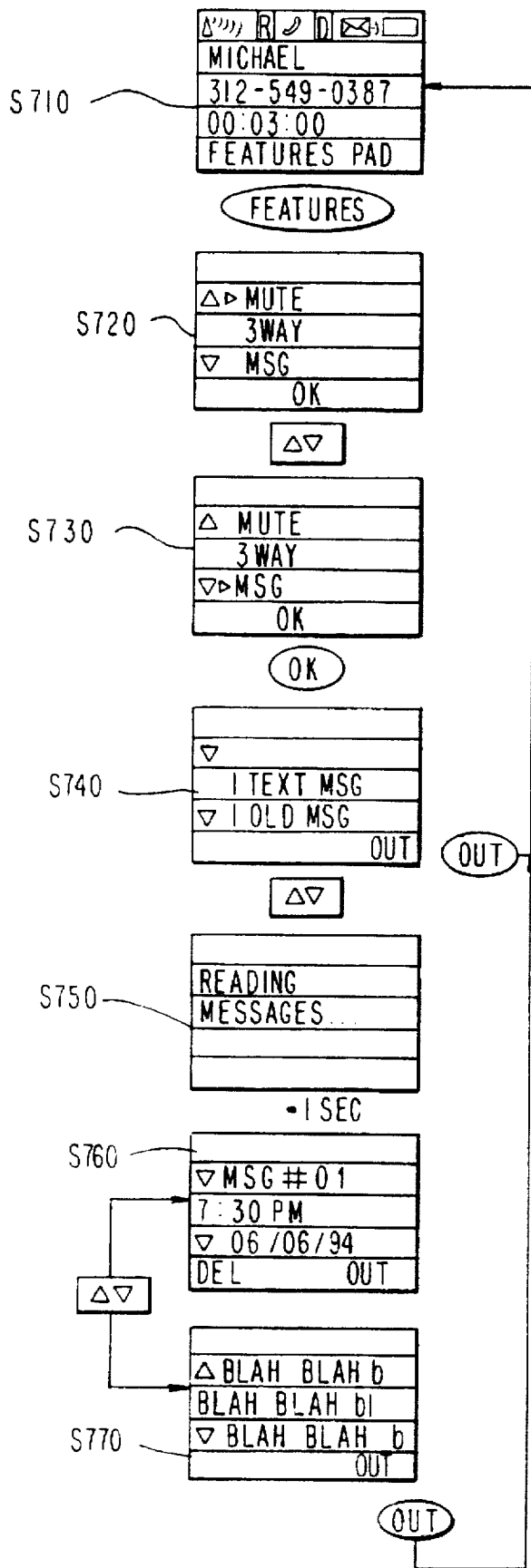
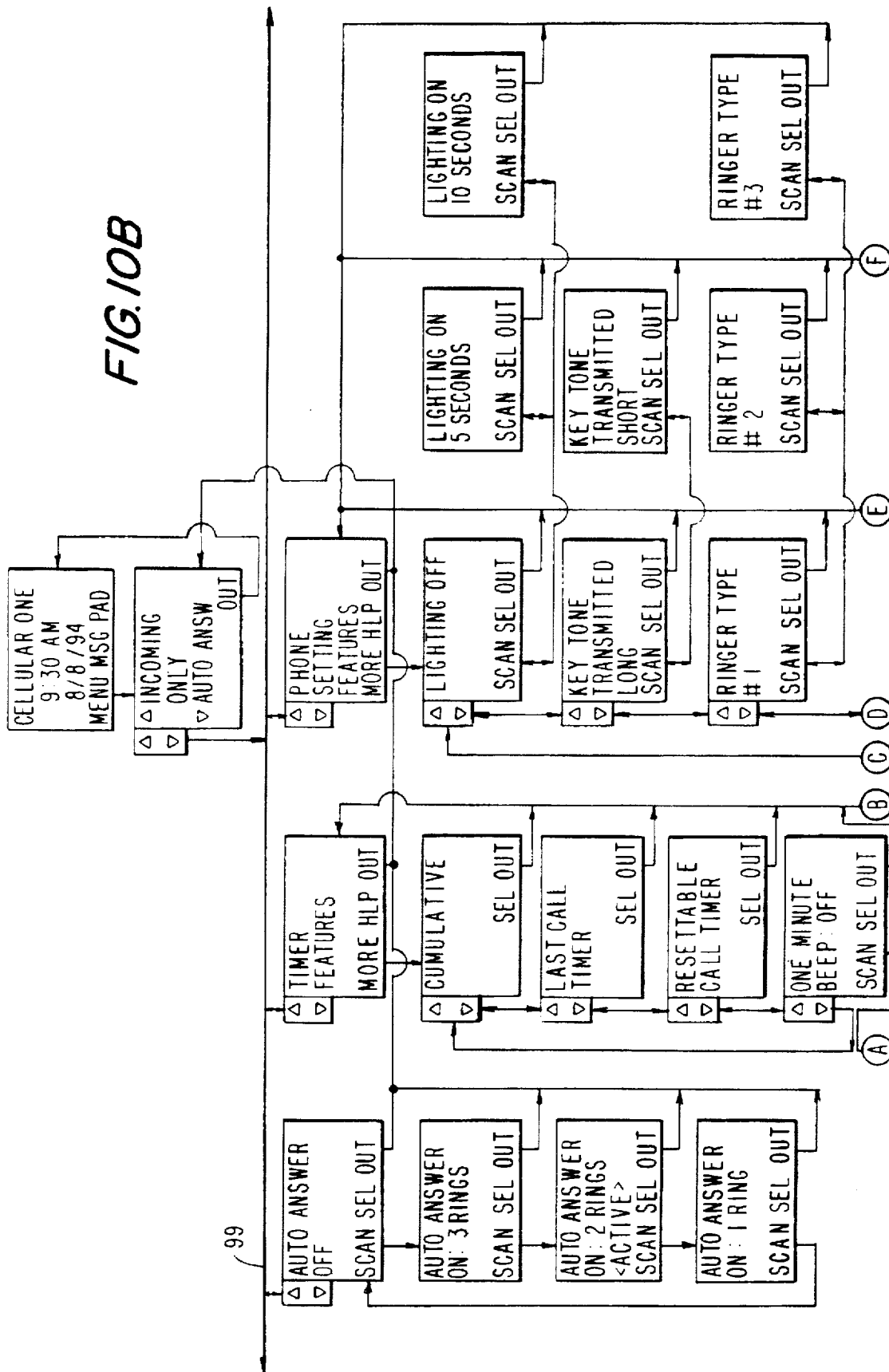


FIG.9B

FIG. 10B



99

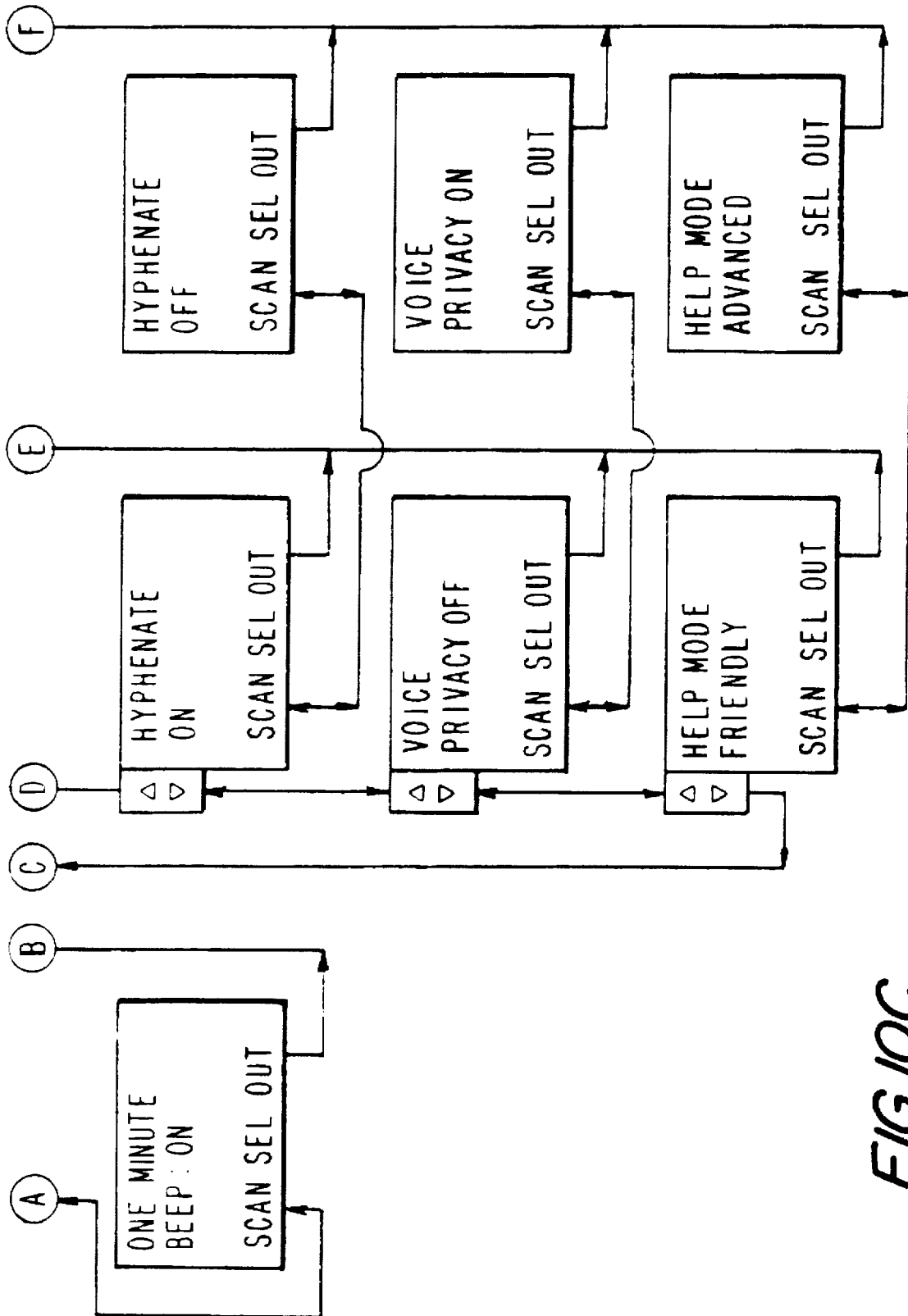
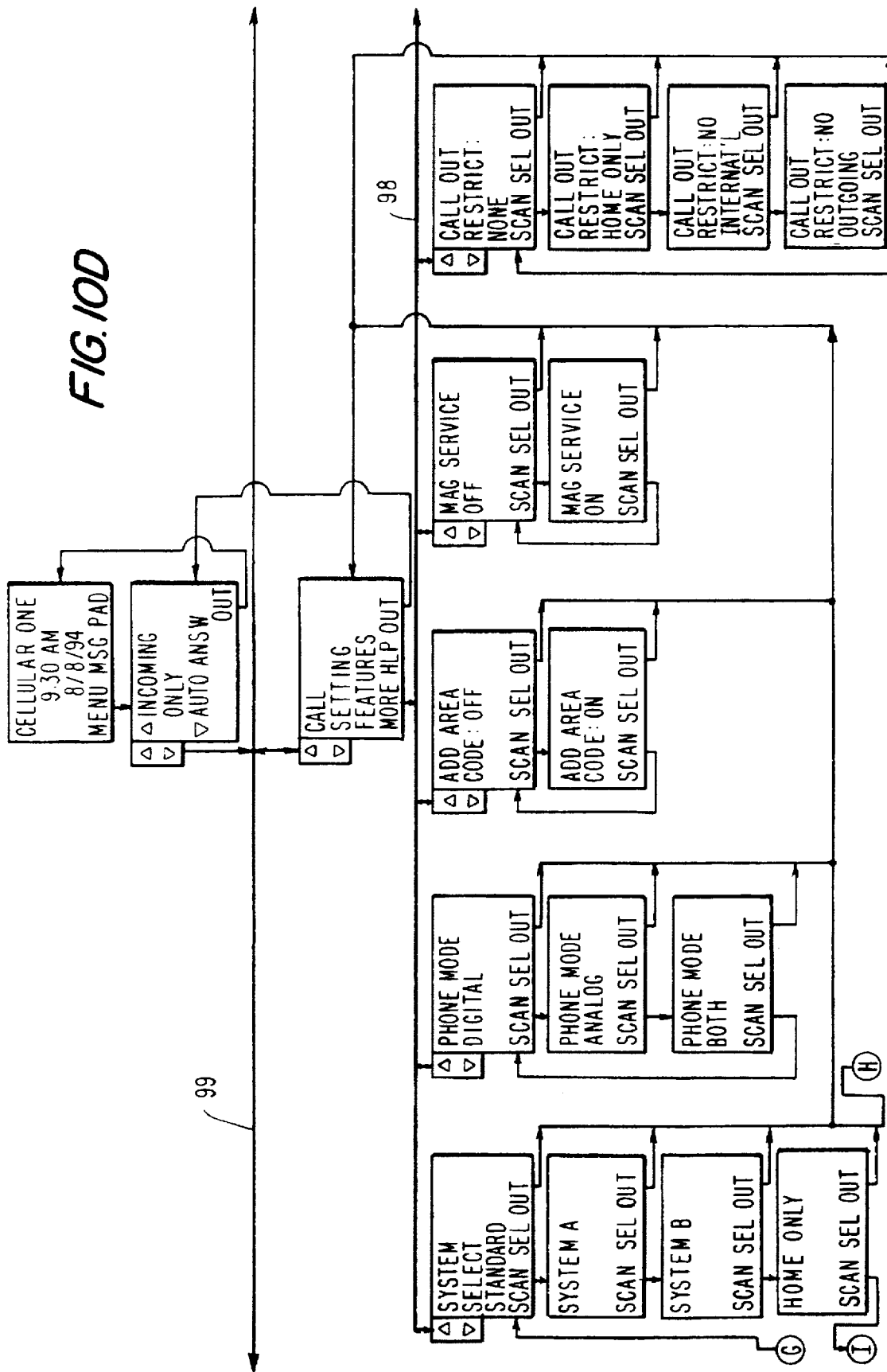


FIG. 10C



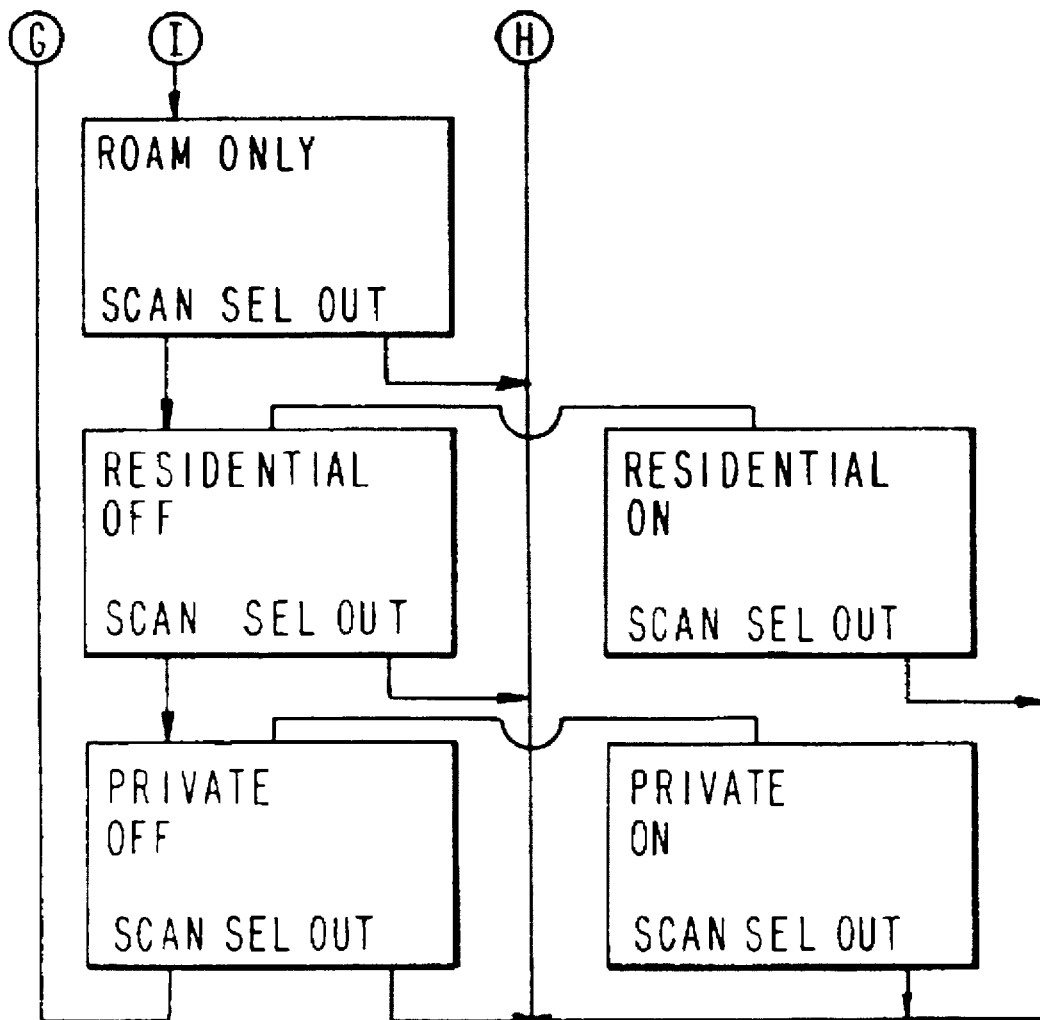


FIG. 10E

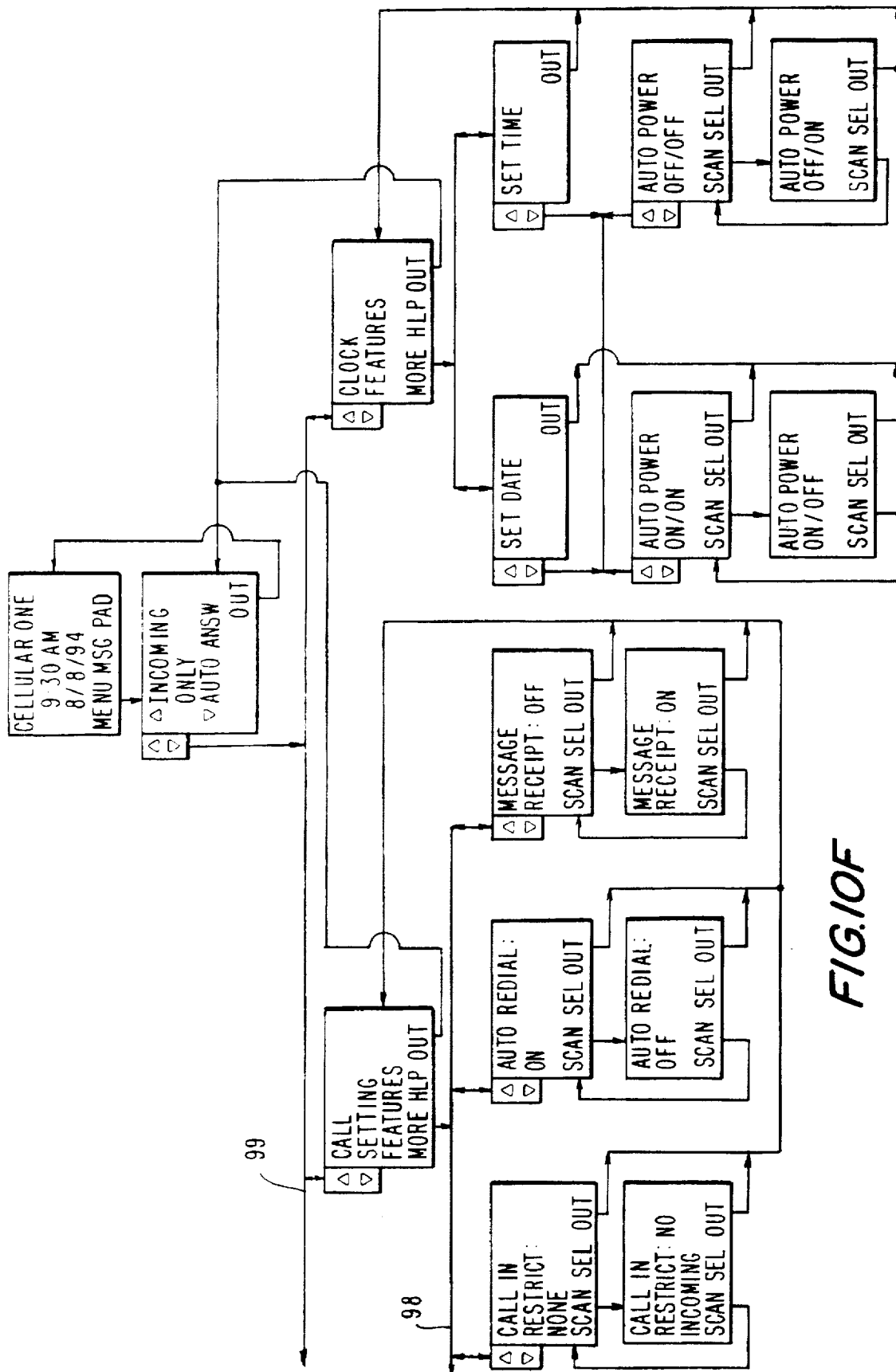


FIG. 10F

**PORTABLE TELEPHONE APPARATUS
HAVING A PLURALITY OF SELECTABLE
FUNCTIONS ACTIVATED BY THE USE OF
DEDICATED AND/OR SOFT KEYS**

BACKGROUND OF THE INVENTION

The present invention relates to a telephone apparatus and, more particularly, to such telephone apparatus having a plurality of dedicated and changeable keys which enables an operator to readily select a desired function.

Typically, portable telephones, such as cordless telephones, cellular telephones and the like, include a multiplicity of keys or buttons. Such keys may include 10 alpha-numeric keys, which when activated provide an indication of a desired number and/or letter. As is to be appreciated, these keys may be utilized to call a desired telephone number or to provide a specific signal such as in response to a inquiry or question. In addition to the alpha-numeric keys, these portable telephones may provide one or more functions. For example, the telephone may have a so-called "menu" function which identifies or list various other functions or features. In addition to identifying such features, the menu may be utilized to review or change the settings or parameters associated with these features and to provide access to desired one(s) of these features.

Two functions which may be accessed by way of the menu include a so-called "book" and "pad" functions. The book may be used to store information, such as, telephone numbers, and to provide such stored information upon request. The pad may be used to store information, such as, the numbers of the dialed telephone calls and the received telephone calls.

Therefore, an operator may only access the book or pad functions by use of the menu. Accordingly, as is to be appreciated, this indirect access to the book and pad functions is cumbersome and lengthy. Further, such indirect access may be confusing and, as a result, relatively difficult to use. That is, to gain access to the book or pad, after gaining access to the menu, the operator may need to depress or activate a number of keys which may not be readily apparent. Accordingly, the operator may be required to either memorize the correct selection of keys or constantly refer to an instruction manual.

Furthermore, such portable telephones may provide other features. However, these other features often require depressing or activating keys which may not otherwise be readily apparent. For example, these portable telephones may provide a feature which allows the operator to answer a second call while engaged with a first call. However, to answer such second call, the operator may be required to depress or activate a so-called "send" key. As is to be appreciated, it would not be readily apparent to most operators to depress a send key in order to receive a second call while the operator is engaged with a first call. Accordingly, as with the book and pad functions, the operator may be required to either memorize the correct selection of keys for using these other features or constantly refer to an instruction manual.

Thus, although the above-described portable telephones may provide a plurality of functions or features, to activate these functions or features often requires depressing a selection of keys which may not be readily apparent to the operator. As such, to use these telephones, and all of the functions or features they provide, normally requires the operator to memorize the selection of keys for each function or feature or to constantly refer to an instruction manual.

**OBJECTS AND SUMMARY OF THE
INVENTION**

An object of the present invention is to provide a telephone apparatus which is relatively easy to operate.

More specifically, it is an object of the present invention to provide a telephone apparatus having a plurality of main functions, including a menu function, with a plurality of features associated therewith which are relatively easy to access and activate by an operator.

Another object of the present invention is to provide a telephone apparatus as aforesaid wherein the main functions and the associated features are readily available when an operator may need them.

A further object of the present invention is to provide a telephone apparatus as aforesaid wherein each of the main functions is directly accessible without first accessing any of the other main functions such as the menu function.

A still further object of the present invention is to provide a telephone apparatus as aforesaid which includes a plurality of changeable or soft keys having functions or features associated therewith which change in accordance with a selected mode (such as a stand-by mode and a conversation mode), function or feature.

Yet another object of the present invention is to provide a telephone apparatus as aforesaid wherein one of the main functions includes a so-called "message" function wherein voice and text messages may be received and stored within the telephone apparatus for later retrieval by the operator and wherein the operator may transmit a message, such as a reply to a received message, to a desired person.

In accordance with an aspect of the present invention, a telephone apparatus is provided which comprises a plurality of keys; a device for performing a plurality of main functions including a menu function wherein available features of the telephone apparatus are reviewed and parameters thereof changed, a message function in which messages are received and transmitted from and to a person, a pad function in which telephone numbers that have been dialed, received and missed by the telephone apparatus are reviewed, and a book function wherein names and corresponding telephone numbers are stored and retrieved from storage; and a device for directly accessing each of such main functions by depressing only a respective one of the keys.

In accordance with another aspect of the present invention, a telephone apparatus adapted for communicating between a user and at least one person is provided. The apparatus comprises a plurality of dedicated keys each having at least one respective dedicated function associated therewith, a device for performing a plurality of operational functions including a message function in which text-data messages are received and transmitted from and to a person, and at least one changeable key each having at least one respective changeable function associated therewith. The function of each changeable key is changed in response to the operational function currently being performed. The apparatus further comprises a display for displaying a plurality of lines of digital data including a received text-data message and a transmitted text-data message.

Other objects, features and advantages according to the present invention will become apparent from the following detailed description of the illustrated embodiments when read in conjunction with the accompanying drawings in which corresponding components are identified by the same reference numerals.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram to which reference will be made in explaining the present invention;

FIGS. 2A and 2B are side and front views, respectively, of a telephone apparatus according to an embodiment of the present invention;

FIG. 3 is a block diagram of the telephone apparatus of FIGS. 2A and 2B;

FIG. 4 is a diagram illustrating an example of a screen which may be provided by a display of the telephone apparatus of FIGS. 2A and 2B;

FIGS. 5A–J are diagrams of wake-up/status screens;

FIGS. 6A–M are diagrams of conversation screens;

FIG. 7 is a diagram to which reference will be made in explaining screens which may be displayed during operations in the pad function;

FIG. 8 is a diagram to which reference will be made in explaining screens which may be displayed during operations in the book function;

FIGS. 9A and 9B are diagrams to which reference will be made in explaining screens which may be displayed during operations in the message function while the present telephone apparatus is in a stand-by mode and a conversation mode, respectively; and

FIGS. 10A–F are diagrams of screens which may be displayed while the present telephone apparatus is operating in the menu function.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A telephone apparatus 10 according to an embodiment of the present invention includes a plurality of main functions. As shown in FIG. 1, such main functions may include a so-called "book" function 2, a menu function 4, a so-called "pad" function 6, and a so-called "message" function 8. As hereinafter more fully described, each of these main functions is arranged with equal priority. In other words, when available, any of these main functions may be directly accessed or activated without having to first access (or go through) another of the main functions (such as the menu function) or any other function. For example, during a stand-by mode, all four of the main functions (i.e., the book, menu, pad and message functions) may be directly accessed by an operator by depressing a respective button or key on the telephone apparatus 10. As a result, in this situation, the operator may gain access to a desired one of the main functions directly by depressing or activating a respective key on the telephone apparatus 10.

More detailed views of the telephone apparatus 10 are illustrated in FIGS. 2A and 2B. As shown therein, the telephone apparatus 10 generally includes a housing 12, an antenna 14, a speaker 16, a display 18, a plurality of changeable keys 20, a clear (CLR) key 22, a book key 23, a send key 24, an end key 26, a plurality of keys 28, a microphone 30, a scroll button 32, and a power key 34.

The housing 12 is adapted to hold or retain all of the parts or elements of the telephone apparatus 10 including the antenna 14, speaker 16, display 18, soft keys 20, hard keys 22, 23, 24 and 26, keys 30, microphone 30, scroll button 32 and power key 34. The housing 12 may be constructed of two or more portions, in which each portion may be formed from a plastic-type material. Such portions are coupled together by the use of adhesive, screws, or other types of fasteners in a well known manner.

The display 18 is preferably a liquid crystal display (LCD) which is adapted to display a plurality of lines of information. That is, the LCD display 18 may display five lines of information, in which the top line displays one or more icons which provide respective information to the operator, the middle three lines display dynamically changing information, and the last line displays indications of the functions associated with the soft keys 20.

FIG. 4 illustrates an example of a display provided by the LCD display 18. As shown therein, a top line 60 displays a plurality of icons (in particular, six icons). The left-most icon is a signal strength icon, which may be referred to as a RSSI icon. The signal strength icon appears when the telephone apparatus 10 is on or activated and is adapted to provide the operator with an indication of the signal strength. That is, the signal strength icon may include from one to five semi-circular bands or arcs, in which the number of such arcs provides an indication of the signal strength. The greater the number of arcs, the greater the signal strength. For example, five arcs indicates a relatively strong signal, whereas one arc indicates a relatively weak signal.

The icon adjacent to the signal strength icon is a roam icon which appears when the telephone apparatus 10 is in use and is registered on a system other than the operator's home system. The icon to the right of the roam icon is a phone or in-use icon which appears whenever the telephone apparatus 10 is engaged in an active call. The icon to the right of the in-use icon is a digital mode icon which, when present, indicates that the telephone apparatus 10 is operating on a digital traffic or digital voice channel.

The icon to the right of the digital mode icon is a text/voicemail message waiting icon. The envelope portion of this icon refers to a text message, while the semi-circular arc portions refer to a voicemail message. When the envelope portion of this icon is displayed, it indicates that short message service is available to the operator, as hereinafter more fully described. On the other hand, when the envelope portion is not displayed, it indicates that such short message service is not so available. Further, when the envelope portion is displayed and is blinking, it indicates that a new text message has been received by the telephone apparatus 10 and stored therein as hereinafter more fully described. Furthermore, voicemail message capability is normally available. When the semi-circular arc portions are blinking, it indicates that a new voicemail message has been received by the telephone apparatus 10 and stored therein.

The right-most icon is a battery level icon which appears when the telephone apparatus 10 is in the on state. The battery level icon has a plurality of segments of a battery. That is, the battery level icon may include from one to four segments of a battery, in which the number of such segments provides an indication of the battery level. The greater the number of segments, the greater the battery level. For example, four segments (which represents a complete battery) indicates a relatively high battery level, whereas one segment indicates a relatively low battery level.

The above-described arrangement of icons provides a relatively large distance between three of the anticipated most commonly utilized icons, that is, the battery level icon, the in-use icon and the signal strength icon. As is to be appreciated, such arrangement enables the operator to easily view these three icons. Further, although only one arrangement of icons was described, these icons may be arranged in a number of other acceptable arrangements. For example, the location of any of the signal strength icon, the in-use icon and the battery level icon could be switched with another of

these icons. Similarly, the location of any of the roam icon, the text/voicemail icon and the digital mode icon could be switched with another of these icons.

Each of middle lines 62 may display a plurality of characters (such as up to 12 characters). The middle three lines 62 are utilized for dynamically changing information, that is, information which may change during the operation of the telephone apparatus 10. More specifically, these three lines may display names, numbers, an indication of the system or type of system to which the telephone apparatus 10 is registered, time and date information, text messages, menu features and so forth as hereinafter more fully described. For example, the top line of the middle lines 62 may display "CELLULAR 1" which indicates the system to which the telephone apparatus 10 is registered, and the second and third of the middle lines 62 may display the current time and date.

A bottom line 64 of the display of FIG. 4 may display a plurality of characters (such as 12 characters). As previously described, the bottom line is utilized for providing indications of the functions associated with the soft keys 20. To more easily differentiate between the middle three lines 62 and the bottom line 64, the bottom portion of the display 18 (which corresponds to the bottom line 64) may have a color different from that corresponding to the middle lines. For example, such bottom portion may have a pink color transparent ink printed thereon so that the bottom line is displayed with a pink color tint, thereby distinguishing the bottom line from the middle lines 62. As is to be appreciated, a color other than pink may be utilized. Alternatively, another portion or portions of the display 18 may have a pink color (or other color) transparent ink printed thereon. For example, the portion corresponding to the middle lines 62 may have such pink color, whereupon the portion corresponding to the bottom line 64 is clear. As another alternative, two or more portions of the display 18 may each have a respective color associated therewith.

Referring back to FIG. 2B, the telephone apparatus 10 includes a plurality of soft keys 20, such as three soft keys. These soft keys may be utilized to activate functions or operations which are available depending upon the current mode of operation of the telephone apparatus 10. That is, each of the soft keys 20 may activate different functions at different times during the operation of the telephone apparatus 10. To enable a user to identify which function may be activated by each of the soft keys, the bottom line 64 (FIG. 4) displays the currently available functions which may be activated if any of the soft keys are depressed.

As an example, assume that the telephone apparatus 10 is in a stand-by mode. In such mode, the display 18 may provide a display such as that illustrated in FIG. 4. As shown therein, the bottom line 64 indicates "MENU", "MSG" and "PAD" in this order. Such arrangement indicates that the left-most soft key 20 (as viewed in FIG. 2B) corresponds to the "MENU" indication shown on the bottom line 64, the middle soft key corresponds to the "MSG" indication, and the right-most soft key corresponds to the "PAD" indication. Accordingly, during this stand-by mode, if a user wishes to activate the menu function, the user merely depresses the left-most soft key 20. Similarly, if the user wishes to activate either of the message or pad functions, the user merely depresses the appropriate one of the middle or right-most soft key.

Referring back to FIG. 2B, the book key 23 is a dedicated or so-called hard key and is utilized to access the book function. As hereinafter more fully described, such book

function enables names and numbers to be stored in a memory of the telephone apparatus and to be retrieved therefrom.

The clear (CLR) key 22 has two functions associated therewith. In the first function, the clear key is utilized to clear entered digits and characters displayed on the display 18. By momentarily depressing the clear key, the last character or digit entered is erased, and by continuously holding down the clear key, the entire entry is erased. In the second function, the clear key is utilized to return the telephone apparatus 10 to the stand-by or conversation mode from any other operations which the telephone apparatus may currently be in, such as the book function. When the clear key is used in this latter manner, all changes and/or selections revert to the previous configuration which the telephone apparatus was in when it left the stand-by or conversation mode. In other words, no such changes and/or selections are saved. As an example, consider the situation in which the user is entering data into a memory of the telephone apparatus 10. If the user momentarily depresses the clear key 22 once, the last entered digit is erased; and if the user continues depressing the clear key, the remaining digits are erased. A subsequent depression of the clear key within a predetermined time period, such as within 2 seconds, causes the telephone apparatus 10 to revert back to the stand-by or conversation mode.

The send key 24 is utilized to initiate a telephone call and to execute a dialing procedure.

The end key 26 is primarily used to terminate an active telephone call. Additionally, the end key may be utilized for paused dialing, for storing paused numbers into a memory page, and for linking existing memory pages as hereinafter more fully described. When a pause is created in the dialing sequence by depressing the end key, the send key 24 may be depressed to resume the sending of DTMF tone signals.

The keys 28 are utilized for entering digits and alpha characters depending upon the current mode of operation of the telephone apparatus 10. That is, the keys 28 will be placed in the appropriate mode, that is, either in an alpha or numeric mode, depending upon the type of data requested by the telephone apparatus. When entering alpha characters, a single depression of a respective one of the keys 28 corresponds to the first letter assigned to that key, a second depression of this key corresponds to the second letter assigned to this key, and so forth. The desired numeric data may be entered by depressing the respective key one more time than the number of letters assigned to the key. For example, depressing the 2ABC key four times would display the number "2". The alpha-numeric assignment to the twelve keys 28 is as follows:

(QZ1), (ABC2), (DEF3),
(GHI4), (JKL5), (MNO6),
(PRS7), (TUV8), (WXY9),
(*()!), (0), (#!):

Due to a predetermined default parameter, letters are displayed in lower case. If an upper case letter is desired, the respective key is depressed for a predetermined time period, such as for 1 second. Alternatively, the default parameter could be arranged so as to display upper case letters. Further, predetermined letters may be automatically displayed in upper case, such as the first letter of a name or of a new message. Furthermore, when entering data (such as alphanumeric data), two soft keys may be assigned as an arrow left key and an arrow right key. These arrow left and right keys enable the user to move a cursor across digits and/or letters without changing them, thereby facilitating desired correction and editing operations.

The scroll button 32 may be utilized for controlling or performing a plurality of different operations. For example, the scroll button 32 may be used to control the volume of a ringer (not shown) of the telephone apparatus 10 or the volume of the keys 28 when the telephone apparatus 10 is in the stand-by mode, and may be used to control the volume of the speaker 16 when the telephone apparatus is in the conversation mode. Additionally, the scroll button 32 may be used to enable the user to scan and scroll through memory pages of the book and pad, through text messages, and through menu features, as hereinafter more fully described.

The antenna 14 may be a retractable-type antenna or, alternately, may be a fixed length type antenna. The power key 34 is used to control the power on and off so as to activate or de-activate the telephone apparatus 10. The speaker 16 and the microphone 30 are adapted to operate in a well known manner.

In addition to the elements described above, the telephone apparatus 10 further includes a processor 50, a memory 52 and a receiving and transmitting circuit 54 as shown in FIG. 3. As shown therein, the processor 50 is coupled to the keys (that is, the soft keys 20, the clear key 22, the book key 23, the send key 24, the end key 26 and the alpha-numeric keys 28), the memory 52, the receiving and transmitting circuit 54 and the display 18. The processor is adapted to receive signals from the receiving and transmitting circuit 54 and/or the keys (that is, signals generated upon depressing one or more of the keys), and to process the received signals in a predetermined manner. During such processing, the processor 50 may request data from the memory 52 which had been previously stored therein, or may cause data to be stored therein. As a result of this processing, the processor 50 may generate and supply a control or data signal to the appropriate device or devices, whereupon the desired operation is performed.

As an example, consider the situation in which the user wishes to store a name and telephone number into the book of the telephone apparatus 10. In this situation, the user may depress the book key 23, the appropriate alpha-numeric keys 28 and one or more soft keys 20 in a manner as hereinafter more fully described. Signals corresponding to the depressed keys are supplied to the processor 50 which, in turn, processes these signals and, in accordance therewith, generates and supplies control or data signals to the display 18 and the memory 52. As a result, the name and telephone number are displayed on the display 18 and stored into a book portion of the memory 52. Further, in this situation, the processor 50 may generate and supply other control signals to the display so as to cause the bottom line 64 (FIG. 4) to display the appropriate functions which may be respectively activated by the soft keys 20, such as those which may be used to store information in the book.

The receiving and transmitting circuit 54 is coupled to the processor 50, the microphone 30, the speaker 16 and the antenna 14 and is adapted to receive signals therefrom. Such received signals may be processed by the circuit 54 in a predetermined manner for supply to the desired device(s). For example, signals from the processor 50 to be transmitted may be supplied to the receiving and transmitting circuit 54 and modulated thereat and thereafter transmitted by way of the antenna 14. Alternatively, such processing may be performed by the processor 50 and supplied directly therefrom to the appropriate device(s), whereupon the circuit 54 may be omitted.

The memory 52 is adapted to receive and store information for later retrieval therefrom. The memory 52 is organized in a plurality of so-called memory pages each having

a respective size which may differ from each other. Each memory page may include a name, telephone number, and a numeric tag. The name of each memory page is limited to a predetermined number of characters. For example, each name may be limited to the number of characters available on the top line of the respective memory page, which may be 11 characters. The telephone number may occupy more than one line of the respective memory page. The information pertaining to a memory page may be displayed on one or more screens of the display 18.

The memory 52 may be arranged in an alpha-based manner, that is, the memory pages may be stored in alphabetical order based on the names associated with each of the pages. Access to a desired memory page may be obtained by utilizing a searching technique and the name of the respective memory page. Alternatively, such searching technique may use the corresponding numeric tag of the respective memory page. Additionally, access to a desired memory page may be obtained by scrolling up or down through the memory pages by use of the scroll button 32 (FIGS. 2A and 2B). Furthermore, the contents of each memory page may be scrolled up or down as displayed on the display 18 by use of the scroll button 32.

A number of the memory pages may be dedicated for use with the book and pad functions. That is, in a preferred embodiment, the memory 52 may have 239 memory pages, in which 40 memory pages are dedicated to the pad function and 199 memory pages are dedicated to the book function.

With regard to the 40 memory pages of the pad, 10 such memory pages are for dialed telephone numbers, 10 memory pages are for so-called scratchpad telephone numbers, 10 memory pages are for missed telephone numbers and 10 memory pages are for received telephone numbers. Each telephone number included in the pad memory pages may be tagged or provided with an indication that the respective number is a dialed, scratchpad, missed or received number. Scrolling through the pad provides a listing on the display 18 of the activities of the telephone apparatus 10 as they occurred over time.

With regard to the 199 memory pages of the book, each of the numbers stored on these pages have an alpha address (i.e., an address corresponding to the respective name associated with the page) or, alternatively, may have a numeric tag. Predetermined numbers of the 199 memory pages may be designated as so-called one touch numbers and super speed dialing numbers. For example, any 9 numbers in the book may be one touch numbers and any 89 numbers in the book may be super speed dialing numbers. The 9 one touch numbers may each have an alpha address and a numeric tags from 1-9, and the 89 super speed dial numbers may each have an alpha address and a numeric tag from 10-99.

If desired, access to the memory may be restricted. For example, a restriction or lock may be imposed in which the names and numbers in the book may only be read and cannot be revised. As another example, a password or code may be required to gain any access to the book (including reading and/or writing of entries). These restrictions and passwords may be implemented by use of the menu feature.

Storing a number in the book or pad is relatively simple. For example, the following sequence may be performed to store a number in the book:

- the book key 23 (FIG. 2B) is depressed, whereupon a soft key identified as "new" is available;
- the "new" soft key is depressed;
- the name or initial of the person, company or so forth is entered by using the keys 28;
- upon completing the entering of the name or initial, a soft key identified as "OK" is depressed;

the telephone number is entered by use of keys **28**; and upon completing the entering of the telephone number, the "OK" soft key is depressed.

If a numeric tag is to be stored, it may be entered after the above last step by use of the keys **28** after which the "OK" soft key is depressed. Use of a numeric tag from 1-9 may identify the respective number as a one touch number, and use of a numeric tag from 10-99 may identify the respective number as a super speed dial number. (That is, a one touch number may be dialed by depressing the desired one of the key pads **28** for a predetermined time period such as 1 second, and super speed dial numbers may be dialed by depressing the appropriate two digits and the send key **24**.) Furthermore, the sequence for storing a number into the pad is substantially the same as that for the book except that numeric tags are not utilized.

The numbers stored in the book and/or pad may be easily reviewed, cleared, linked and edited. That is, by depressing the book key **23** or the pad soft key and then the appropriate one(s) of the keys **28**, the soft keys **20** or by scrolling, a user may readily perform any of these operations. In any event, prior to performing any of these operations, a searching operation is performed so as to locate a desired name. In performing such searching operation, the telephone apparatus **10** utilizes an automatic searching operation wherein as the user enters the letters or digits of the desired name or number, the page closest to the letter(s) or digit(s) entered is retrieved. As such, the more letters or digits entered, the more accurate is the search. As is to be appreciated, such searching arrangement may permit a user to enter a lesser number of letters or digits than in the respective name or digit and still obtain an accurate search. Further, searching in the pad feature is accomplished by using the scroll button **32** (FIGS. **2A** and **2B**).

With regard to the clearing operation for the pad, the pad has an automatic dumping procedure which follows the last in first out rule for the four types of memory pages stored in the pad (i.e., dialed number pages, scratchpad number pages, received number pages and missed number pages). For example, if all 10 pages allocated for the dialed number pages are filled and a new dialed number is stored in the pad, then the first or oldest dialed number is dumped.

The linking feature enables information contained on two or more memory pages to be combined or linked together. For example, suppose it is desired to link two pages from the book. In this example, the book key **23** is depressed, one of the two names or pages is located, the end key **26** is depressed, the other name or page is located, and a soft key identified as "OK" is depressed.

Upon locating a desired memory page, the editing operation may be performed by directing a cursor to the desired position and thereafter performing the desired editing. Movement of the cursor may be controlled by use of the scroll button **32** which moves the cursor to a desired line of the memory page and by use of soft keys identified as left and right arrows which respectively move the cursor in the left and right directions along the respective line.

During normal operation, the telephone apparatus **10** may be in either a stand-by mode or a conversation mode. Each of these modes and the screens which may be displayed on the display **18** (FIG. **2B**) during such modes will now be described below.

The telephone apparatus **10** is placed in the stand-by mode when power is applied to the telephone apparatus and none of the features or functions of the telephone apparatus are being utilized. When the telephone apparatus **10** is in the stand-by mode, a stand-by screen may be displayed on the

display **18**. Such stand-by screen may display an indication of the type of system in which the telephone apparatus **10** is currently registered with, and may also display the current time and date. The stand-by screen may further provide additional information, such as an indication of incoming calls and incoming messages. From the stand-by screen, a user may access the features or functions of the telephone apparatus **10** including the menu, the message, the pad, the book, volume controls for the ringer and the keys, and so forth. An example of a stand-by screen is illustrated in FIG. **4**.

Prior to displaying the stand-by screen, a so-called wake-up screen may be displayed on the display **18**. Such wake-up screen may appear for a predetermined amount of time, such as 3-4 seconds, after the telephone apparatus **10** receives power. Additionally, after the telephone apparatus **10** has been on for a predetermined amount of time, a status screen may be displayed by an initial depression of the menu soft key. (Accordingly, the status screen may be the first screen displayed when in the menu.) By depressing a soft key identified as "out", such status screen may be removed so as to return to the previous function or screen. Alternately, as in the wake-up screen, the status screen may be removed after a predetermined time, such as 3-4 seconds. The wake-up and status screens provide the user with information pertaining to the settings or configuration of the telephone apparatus **10** which may be crucial to the user's intended operations. For example, the wake-up/status screen may indicate that the ringer of the telephone apparatus **10** is off such that the user may not hear a ringing sound when a call has been received. Examples of wake-up/status screens are illustrated in FIGS. **5A-J**.

The telephone apparatus **10** is in the conversation mode whenever the telephone apparatus is being utilized for an active call. When the telephone apparatus **10** is in the conversation mode, the pad soft key and a soft key identified as "features" may be available. Depressing the features soft key provides access to features available in the conversation mode, such as mute, 3-way, the message, the menu and so forth. The mute feature permits a user to mute the microphone **30** (FIG. **2B**), the 3-way feature enables a 3-way conference call, and the message feature enables a user to access text messages which may have been previously received and stored within the memory. If an incoming call arrives while the user is engaged in a conversation, the features soft key is changed to a "line 2" soft key which, if depressed, enables the new incoming call to be answered. Similarly, if a message arrives while the user is engaged in a conversation, the features soft key is changed to a "msg" (message) soft key which, if depressed, enables the user to access the received message. Depressing the pad soft key accesses the pad function which will be more fully described hereinafter.

A conversation screen may be displayed on the display **18** when the telephone apparatus **10** is in the conversation mode, that is, when an incoming call has been answered or the user has initiated a call. The conversation screen may indicate the person and the telephone number to whom the user is speaking, the length of the conversation and other such information. Examples of the conversation screens are illustrated in FIGS. **6A-M**. These examples will now be briefly described. During an outgoing call, the top line of the three middle lines **62** may display the caller's name, as shown in FIG. **6A**, if the number dialed matches a number previously stored in the memory of the telephone apparatus **10** along with the corresponding name. A name may be similarly displayed during an incoming call provided caller

identification information is received. If no name is available, the top middle line may display "on line" when there is only one call (as shown in FIGS. 6B-D), or the top middle line may display "line 1" (as shown in FIGS. 6E-G) or "line 2" (as shown in FIGS. 6H-J) or some combination thereof during a 3-way call or call waiting. The middle line of the lines 62 may display the number connected to the telephone apparatus 10, as shown in FIGS. 6A, B, E, H and K. In particular, such number is always available during an outgoing call and accordingly is displayed; such number may be displayed during an incoming call if caller identification is received (FIGS. 6A, B, E, H and K) and "out of area" may be displayed if it is not received as shown in FIGS. 6C, F, I and L; and "private" may be displayed if the caller identification is blocked as shown in FIGS. 6D, G, J and M. The bottom line of lines 62 may display the elapsed time of the current call.

The pad, book, message and menu functions along with the screens displayed during these functions will now be more fully described below.

The pad function, as previously described, has memory pages (i.e., dialed, received, missed and scratchpad memory pages) and may be accessed by depressing the soft pad key (which may be the right soft key 20) as displayed in the stand-by and conversation screens. The pad function is substantially similar whether the telephone apparatus 10 is operating in the stand-by or conversation modes. That is, the pad may be used to review numbers which have been dialed, received, missed or entered into the scratchpad or to store numbers into the scratchpad. Such numbers may be displayed in chronological order such that the pad provides an indication of the telephone apparatus's use over time.

Two soft keys may appear when operating in the pad, that is, a "new" soft key and an "out" soft key. Depressing the new soft key may enable a new name and number to be entered into the scratchpad and, if all of the scratchpad pages are full, may cause the oldest (or first in) scratchpad memory page to be dumped. Depressing the out soft key may return the user from the current pad operation to the prior stand-by or conversation screen.

During the pad function, the top line of the middle lines 62 may display the name associated with the respective telephone number, and the middle line of lines 62 may display the respective number. (The display of such name and number with regard to their availability may operate in a similar manner to that previously described with reference to the conversation screens.) The bottom line of lines 62 may alternately display at predetermined time intervals (such as 1-1.5 seconds) an indication of the type of memory page (i.e., dialed, received, missed or scratchpad) and the time it was stored in memory.

When the pad is accessed from the stand-by screen, the most recently entered memory page may be displayed. After which, other memory pages may be displayed by depressing the scroll button 32 up or down. The memory pages may be coupled in a cyclical manner, such that the first page follows the last page entered. When the pad is accessed from the conversation screen, a new memory page may be made available. If, however, a specific page is desired, the user may utilize the scroll button 32 to locate it. Scroll symbols or arrows may be displayed during this time and may disappear when a name is entered.

A memory page may be moved from the pad to the book by depressing the book key 23. Since pages in the book contain names, such memory page will be moved as is to the book if it contains a name. However, if such memory page does not contain a name, then a name is added prior to storing such page in the book.

FIG. 7 illustrates screens which may be displayed during various operations in the pad. Screen S10 illustrates a screen which may be displayed during the stand-by mode. As indicated on the bottom line 64 of the screen S10, the pad function may be activated by depressing the right-most soft key. Upon depressing such soft key, the screen S20 (which may be the most recently entered memory page) may be displayed. As shown therein, the bottom line 64 indicates that the "new" and "out" soft keys are available. Depressing the out soft key may return the user to the stand-by screen S30. Depressing the new soft key may enable a new name and number to be entered into the scratchpad in the manner previously described. From the screen S20, the user may move the memory page into the book by depressing the book key 23, whereupon screen S40 may appear. As shown in the bottom line 64 of the screen S40, soft keys "yes" and "no" are available. Accordingly, if the page is to be saved into the book, then the yes soft key is depressed, whereupon screen S50 may appear. If, however, the page is not to be saved, then the no soft key is depressed.

Returning to screen S20, by depressing the scroll button 32, the user may scroll through the entries in the pad as shown in screens S60, S70, S80, S90, S100 and S110.

Screen S120 illustrates a screen which may be displayed during the conversation mode. As indicated on the bottom line 64 of the screen S120, the pad function may be activated by depressing the right-most soft key. Upon depressing such soft key, the screen S130 may be displayed. The user may either scroll through the pages (screens S60-S110) or may enter new information on a new memory page and depress an "OK" soft key when completed as shown in screens S140, S150, S160, S170 and S180.

The book function, as previously described, may have memory pages (e.g., 199 pages) and may be accessed by depressing the book key 23 (FIG. 2B) in either the stand-by or conversation modes (or screens). The book function enables names and associated numbers to be stored in memory and enables stored names and numbers to be retrieved.

Several soft keys may be available while operating in the book and, if depressed, may activate or initiate various operations. That is, a "find" soft key may initiate a search for a specific memory page by utilizing either the respective name or numeric tag in the manner previously described. A "#tag" may be used in sequence with the find soft key to find a memory page by using the respective numeric tag. (Using the respective name may be the default finding technique in the book.) A "new" soft key may initiate the process of adding a new memory page, wherein the user is first prompted to enter the name (the key pads 28 may be automatically placed in an alpha-mode) and is next prompted to enter the number (the key pads 28 may be automatically placed in a numeric-mode). After which, the user may enter a numeric tag (such as 1-99 as previously described and/or if available). If such numeric tag is not entered, the user may depress an "OK" soft key. A "fix" soft key may provide another screen having other available features or soft keys, such as a "del" soft key and an "edit" soft key. Depressing the del soft key deletes a memory page and depressing the edit soft key enables a memory page to be edited. An "OK" soft key may be used to confirm the entry of names, numbers and/or numeric tags when creating a new memory page. An "out" soft key may return the display to the prior screen (e.g., the find, new or fix screen) from the current screen (e.g., the del or edit screen).

While operating in the book, the top line of the middle lines 62 may contain a name, the middle line of lines 62 may

include the telephone number corresponding to the name, and the bottom line of lines 62 may have a numeric tag.

Thus, operating in the book is relatively simple. That is, an initial depression of the book key 23 may activate or open the book. Thereafter, for example, a find soft key may be depressed so as to initiate a search after which a name may be entered by use of the key pads 28 or a numeric tag is entered; a new soft key may be depressed so as to initiate the process of adding a new memory page after which a name, number and numeric tag may be entered; a fix soft key may be depressed so as to access other functions such as a delete and edit functions; or the scroll button 32 may be utilized to review a memory page or pages. Further, the user may review his/her number from the stand-by or conversation screen by depressing the book key 23 and the scroll button 32.

FIG. 8 illustrates screens which may be displayed during various operations in the book. Screen S250 illustrates a screen which may be displayed during the stand-by mode. Depressing the book key 23 accesses the book function as shown in screens S260 and S270. From screen S280, the memory pages in the book may be reviewed by utilizing the scroll button 32 as shown in screens S200, S210, S220, S230 and S240.

Returning to screen S280, a name search may be performed as shown in screens S290, S300, S310 and S320. (Note in screen S300, the page displayed is that closest to the first letter inputted, that is, "r". After the second letter is entered in screen S310, the correct page is displayed.) If the fix soft key is depressed in screen S320, then the other available functions (i.e., delete and edit) are displayed in the line 64 as shown in screen S330.

Returning to screen S280, a numeric tag search may be performed by depressing the #tag soft key and then the respective tag number as shown in screens S340, S350, S360 and S370. (Note in screen S350, the page displayed is that closest to the first digit inputted, that is, "2". After the second digit is entered in screen S360, the correct page is displayed.) Thereafter, the send key 24 may be depressed so as to dial the number displayed on screen S370.

Returning to screen S280, a new memory page may be added by depressing the new soft key after which the desired name, telephone number and numeric tag are entered as shown in screens S380, S390, S400, S410, S420, S430, S440 and S450. After the correct name, telephone number and numeric tag are entered, the OK soft key is depressed so as to indicate that each has been properly and completely inputted as shown in screens S390, S410 and S430, respectively.

The message function may be accessed by depressing the "msg" soft key. The message function enables messages, such as voicemail or text messages, to be received and stored within the telephone apparatus 10 and enables messages and/or responses to received messages to be transmitted from the telephone apparatus. An indication that a new message has been received may be provided by an audible sound and/or the text/voicemail message waiting icon, as previously described with reference to FIG. 4. For example, the message waiting icon and the msg soft key may blink when a new message has been received. Further, a message waiting indication screen may appear when a new message has been received. For example, such message waiting indication screen may appear during the conversation mode when a new message has been received. In addition to indicating that a new message has been received, such message waiting indication screen may indicate the other information, such as the type of message (e.g., text or voice

mail messages) and the quantity of messages. If the user does not attend to the new message within a predetermined time period (such as 3 seconds) after the message waiting indicating screen is displayed, then the previously displayed screen may be displayed.

Upon depressing the msg soft key, numerous options may be available depending upon the current operating mode, whether new messages have been received, or whether a new message is to be created. For example, if the most recently received messages are new text messages, then two scroll arrows which are blinking and pointing downward may appear on the display 18. On the other hand, if the most recently received messages are voicemail messages, then a "vm" soft key may be blinking. If the msg soft key is depressed when the telephone apparatus 10 is in the stand-by mode, and there are neither new nor old messages, the scroll arrows may point towards each other. If the telephone apparatus 10 is not in the conversation mode, the "new" soft key may be available so as to create a new message for transmission. An "out" soft key may be depressed to return to the prior stand-by or conversation screen.

After reviewing a received message, various options may be available to a user. For example, the user may delete such message or may transmit an answer or response to the received message. If the user decides to answer the received message, an "answ" soft key may be depressed, whereupon a list of responses are displayed on the display 18. Such responses may include a predetermined set of responses which were previously stored in a memory (such as the memory 52) of the telephone apparatus 10. Upon receiving a message, the stored set of responses are supplied to the display 18. Alternatively, the received message may include one or more responses. In either event, the user may scroll through these responses and select an appropriate response. Such response may be edited by depressing the "edit" soft key. The selected or modified response is placed in the middle of the lines 62, whereat an arrow is pointing to the right. Afterwards, an "OK" soft key may be depressed to indicate that the response is acceptable. Such response may thereafter be sent or transmitted. If the response is in reply to a received message, depressing the send key 24 may transmit the response to the party who sent the message. On the other hand, if the message being sent is a new message or is not in response to a received message, then the desired telephone number is provided. Such telephone number may either be entered or retrieved from the pad or the book.

FIGS. 9A and 9B illustrate screens which may be displayed during various operations of the message function while the telephone apparatus 10 is in the stand-by mode and the conversation mode, respectively.

With regard to FIG. 9A, screen S500 illustrates a screen which may be displayed during the stand-by mode. Depressing the msg soft key accesses the message function, whereupon if new or old messages have been received screen S510 may be displayed and if no new or old messages have been received screen S610 may be displayed. Depressing the vm soft key at screen S510 activates the voicemail feature so that such voicemail messages may be reviewed as shown in screen S520. Depressing the out soft key at screen S510 returns the display to the prior stand-by screen as shown in screen S530. The user may scroll through the text messages indicated in screen S510 as shown in screens S540, S550 and S560.

At screen S560, the del soft key may be depressed so as to delete the message as shown in screen S570. By depressing an "undo" soft key at screen S570, such deletion may be undone as shown in screens S580 and S590. Depressing the

out soft key at screen S570 returns the display to a prior screen (such as screen S510) as shown in screen S600. In a similar manner, depressing the out soft key at screen S560 returns the display to a prior screen (such as screen S510) as shown in screen S605. Also at screen S560, an "answ" soft key may be depressed, whereupon previously stored answers or responses may be reviewed by scrolling as shown in screens S650 and S660. Upon finding an acceptable response, it is placed on the middle line of lines 62 and an OK soft key is depressed at screen S660, whereupon such response may be sent by depressing the send key 24 as shown in screens S680 and S690. After which, the display may return to a prior screen (such as screen S550) as shown in screen S700. A selected response may be edited by depressing the edit soft key in screen S660 and, when the modified response is acceptable, an OK soft key is depressed as shown in screens S665 and S667. Such modified response may thereafter be transmitted. At screen S660, depressing an out soft key returns the display to a prior screen (such as screen S560) as shown in screen S670.

Returning to screen S610, depressing the vm soft key enables voicemail messages to be reviewed as shown in screen S620. Further, depressing the new soft key at screen S610 enables a new message to be created as shown in screen S640. Furthermore, the display or screen S610 may be returned to the prior stand-by screen by depressing the out soft key as shown in screen S630.

With regard to FIG. 9B, screen S710 illustrates a screen which may be displayed during the conversation mode. Depressing the features soft key may provide screen S720 which indicates available features, that is, the mute feature, the 3-way telephone conversation feature and the message feature or function. The message function may be selected by use of the scroll button 32 and the OK soft key, whereupon an indication of the received messages may be provided as shown in screens S730 and S740. These messages may be reviewed by utilizing the scroll button 32 as shown in screens S750, S760 and S770. Depressing the out soft key may return the display to screen S710. Furthermore, a message may be deleted as indicated at screen S760 (and such deletion may be undone) in a manner similar to that previously described.

The menu function is a list of features which may vary from network features to settings for the telephone apparatus 10. Accessing the menu enables such features to be reviewed or parameters or settings thereof to be changed. The menu may be configured as an arrangement of groups, wherein a user may move from group to group by use of the scroll button 32. Further, such groups may be arranged in a circular fashion such that a user may move from the last group to the first group. Upon entering a group, a user may move between features of that group by utilizing the scroll button 32. Features within a group and parameters or settings of a feature may also be arranged in circular fashion. A particular feature may be reviewed by depressing a "scan" soft key.

In addition to the scroll button 32 and the scan soft key, numerous soft keys may be available in the menu. For example, a "more" soft key may provide access to a specific group within the menu. A "sel" soft key may enable a user to select or change settings/parameters of a feature in the menu. A "help" soft key may provide an explanation of a respective group or features including how they may be used. An "out" soft key may return the user to the stand-by mode.

FIGS. 10A-F illustrate screens which may be displayed during various operations of the book function. Line 99 is a continuous line which represents that the features coupled

thereto are arranged in a circular fashion in the manner previously described. In other words, the line 99 is continuous from FIG. 10A to FIG. 10B to FIG. 10D to FIG. 10F. In a similar manner, line 98 extends from FIG. 10D to FIG. 10F. Based upon the above description, the screens illustrated in FIGS. 10A-F and the flow therebetween are believed to be self-explanatory. Accordingly, in the interest of brevity, no further explanation is provided herein.

Therefore, the present invention provides a telephone apparatus which is relatively easy to operate. That is, the present telephone apparatus includes menu, pad, book and message functions which may be directly accessed without having to access another function. Further, the present telephone apparatus provides a plurality of changeable or soft keys which have functions or features associated therewith which may change in accordance with the operation currently being performed by the telephone apparatus. An indication of which of the soft keys is currently available and the current function associated with each available soft key are conveniently displayed. Furthermore, the present telephone apparatus uses readily understandable language in its displays and in identifying its keys. As a result, an operator may readily and easily use the present telephone apparatus without having to constantly refer to an instruction manual or memorize numerous operations.

Furthermore, the present telephone apparatus enables voice and text messages to be received and stored therein for review at a later time. A response to a received message, such as a previously stored response, may be transmitted from the telephone apparatus. Additionally, a previously stored or transmitted response may be modified or a new message may be generated and transmitted from the telephone apparatus.

Although the present telephone apparatus was described as having a specific number of soft keys (such as 3 soft keys) and dedicated keys, the present telephone apparatus is not so limited. Instead, any number of soft and dedicated keys may be utilized.

Although preferred embodiments of the present invention and modifications thereof have been described in detail herein, it is to be understood that this invention is not limited to these embodiments and modifications, and that other modifications and variations may be effected by one skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A portable telephone apparatus having a plurality of selectable functions for enabling a number of types of communication in a wireless manner between an operator and at least one person, said apparatus comprising:

a plurality of dedicated keys each having at least one respective dedicated function associated therewith;

one or more changeable keys each having at least one respective changeable function associated therewith, in which the function of each said changeable key is changeable in response to a selected function;

means for receiving a first message from a first person while said operator is engaged in a telephone conversation with a second person in which said first message is any of a voice message or a text data message and for storing the received first message for subsequent retrieval by said operator;

means for transmitting a second message to said second person; and

display means for displaying a plurality of lines of data including the received first message or the transmitted second message.

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2. A portable telephone apparatus according to claim 1, wherein said received first message and said transmitted second message include alpha-numeric data.

3. A portable telephone apparatus according to claim 1, wherein said display means displays five lines of said data in which one of said lines displays one or more icons each respectively representing information relating to the telephone apparatus and its operation, three of said lines display informational data, and one of said lines displays an indication of each said changeable key which is currently available.

4. A portable telephone apparatus according to claim 3, wherein each said icon is displayed in an upper line of said display means, said indication of each said changeable key is displayed in a lower line of said display means, and said informational data is displayed in a middle three lines between said upper line and said lower line of said display means.

5. A portable telephone apparatus according to claim 4, wherein said informational data displayed in said middle three lines includes one of said received first message and said transmitted second message.

6. A portable telephone apparatus according to claim 2, wherein said received first message is one of a plurality of types of messages.

7. A portable telephone apparatus according to claim 6, wherein said plurality of types of messages include a voice-data type message and a text-data type message.

8. A portable telephone apparatus according to claim 3, wherein the receiving means receives one or more first messages and wherein each of said first messages is one of a plurality of types of messages and wherein said informational data indicates a quantity of the received first messages and the type of each said received first message.

9. A portable telephone apparatus according to claim 3, wherein said first message invites a response thereto and wherein said apparatus further comprises means for providing said response and for transmitting said response to a desired person.

10. A portable telephone apparatus according to claim 9, wherein said providing means includes means for producing a plurality of predetermined responses and means for selecting an appropriate one of said plurality of predetermined responses.

11. A portable telephone apparatus according to claim 10, wherein said providing means further includes means for revising a selected one of said plurality of predetermined responses.

12. A portable telephone apparatus for enabling a number of types of communication between a user and at least one person, said apparatus comprising:

- a plurality of dedicated keys each having at least one respective dedicated function associated therewith;
- means for performing a plurality of operational functions including a message function in which a first message which is any of a first text-data message and a first voice message is received from a first person while said user is engaged in a telephone conversation with a second person and in which a second message which is any of a second text data message and a second voice message is transmitted to said second person, a pad function which enables telephone numbers that have been any of dialed by said operator, received by said apparatus, and missed by said operator to be reviewed, a book function which enables names and corresponding telephone numbers to be stored and retrieved from storage, and a menu function which enables available

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features of said telephone apparatus to be reviewed and parameters thereof changed;

one or more changeable keys each having at least one respective changeable function associated therewith, in which the function of each said changeable key is changed in response to the operational function currently being performed; and

display means for displaying a plurality of lines of digital data representing the received first message or the transmitted second message.

13. A portable telephone apparatus according to claim 12, wherein said display means displays five lines of said data in which one of said lines displays one or more icons each respectively representing information relating to the telephone apparatus and its operation, three of said lines display informational data including said received first message and said transmitted second message, and one of said lines displays an indication of each said changeable key which is currently available.

14. A portable telephone apparatus according to claim 13, wherein each said icon is displayed in an upper line of said display means, said indication of each said changeable key is displayed in a lower line of said display means, and said informational data is displayed in a middle three lines between said upper line and said lower line of said display means.

15. A portable telephone apparatus according to claim 14, wherein said received first message invites a response thereto and wherein said apparatus further comprises means for providing said response and for transmitting said response to a desired person.

16. A portable telephone apparatus according to claim 15, wherein said providing means includes means for producing a plurality of predetermined responses and means for selecting an appropriate one of said plurality of predetermined responses.

17. A portable telephone apparatus according to claim 16, wherein said providing means further includes means for revising a selected one of said plurality of predetermined responses.

18. A telephone apparatus for communicating between an operator and a plurality of people, said apparatus comprising:

- a plurality of dedicated keys each having at least one respective dedicated function associated therewith;
- a plurality of changeable keys each having at least one respective changeable function associated therewith, in which the function of at least one of said changeable keys is changeable to another function when said operator receives information from one person while said operator is communicating with another person; and
- display means for displaying the current function associated with each of said changeable keys.

19. A telephone apparatus comprising:

- a plurality of keys;
- means for performing a plurality of main functions including a menu function wherein available features of said telephone apparatus are reviewed and parameters thereof changed, a message function in which messages are received and transmitted from and to one or more persons, a pad function which enables telephone numbers that have been any of dialed by an operator, received by said telephone apparatus, and missed by said operator are reviewed, and a book function which enables names and corresponding telephone numbers to be stored and retrieved from storage; and

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means for directly accessing each of said menu function, said message function, said pad function, and said book function by depressing only a respective one of said keys after power has been applied to said telephone apparatus.

20. A telephone apparatus according to claim 19, wherein said plurality of keys includes a plurality of changeable keys each having at least one respective dedicated function associated therewith.

21. A telephone apparatus according to claim 20, further comprising display means for displaying a plurality of lines of data.

22. A telephone apparatus according to claim 21, wherein said display means displays five lines of said data in which one of said lines displays one or more icons each respectively representing information relating to the telephone apparatus and its operation, three of said lines display informational data including information pertaining to the received or transmitted messages, and one of said lines displays an indication of each said changeable key which is currently available.

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23. A telephone apparatus according to claim 22, wherein each said icon is displayed in an upper line of said display means, said indication of each said changeable key is displayed in a lower line of said display means, and said informational data is displayed in a middle three lines between said upper line and said lower line of said display means.

24. A telephone apparatus according to claim 23, wherein a received message invites a response thereto and wherein said apparatus further comprises means for providing said response and for transmitting said response to a desired person.

25. A telephone apparatus according to claim 24, wherein said providing means includes means for producing a plurality of predetermined responses and means for selecting an appropriate one of said plurality of predetermined responses.

26. A telephone apparatus according to claim 25, wherein said providing means further includes means for revising a selected one of said plurality of predetermined responses.

* * * * *

Exhibit E



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United States Patent [19] Masui

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[54] TEXT INPUT DEVICE AND METHOD

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Nov. 25, 1996 [JP] Japan 8-314010

[51] Int. Cl.⁶ **G09G 5/00**

[52] U.S. Cl. **345/173**; 340/825.19; 345/179;
345/345; 707/531; 707/532

[58] Field of Search 340/825.19; 345/146,
345/173, 179, 352, 354; 707/531, 532

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Primary Examiner—Mark R. Powell

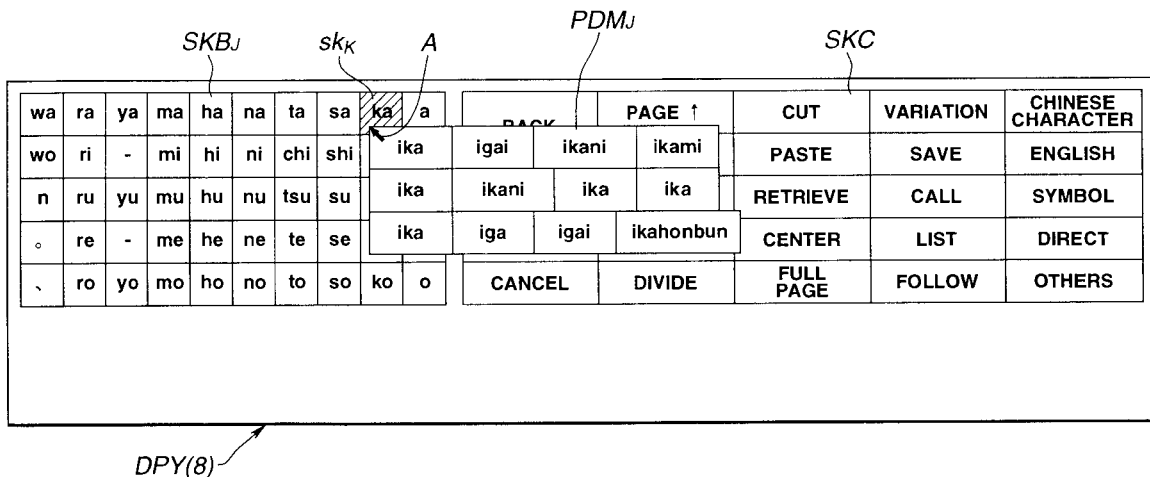
Assistant Examiner—Vincent E. Kovalick

Attorney, Agent, or Firm—Limbach & Limbach LLP; Seong-Kun Oh

[57] ABSTRACT

A text input device and method is disclosed which enables efficient and high-speed input of text in a pen-input computer. A pen-input computer has a liquid crystal display panel, a ROM storing plural words and plural exemplary phrases, a pressure-sensitive tablet and an input pen for performing input to a soft keyboard displayed on the liquid crystal display panel and selection of candidate words displayed as a pull-down menu or pop-up menu, and a CPU for retrieving a candidate word displayed on the liquid crystal display panel on the basis of the input from the pressure-sensitive tablet and the input pen and/or a determined character array, so that text input is performed by selecting a desired word by the pressure-sensitive tablet and the input pen from the candidate words displayed on the liquid crystal display panel.

33 Claims, 27 Drawing Sheets



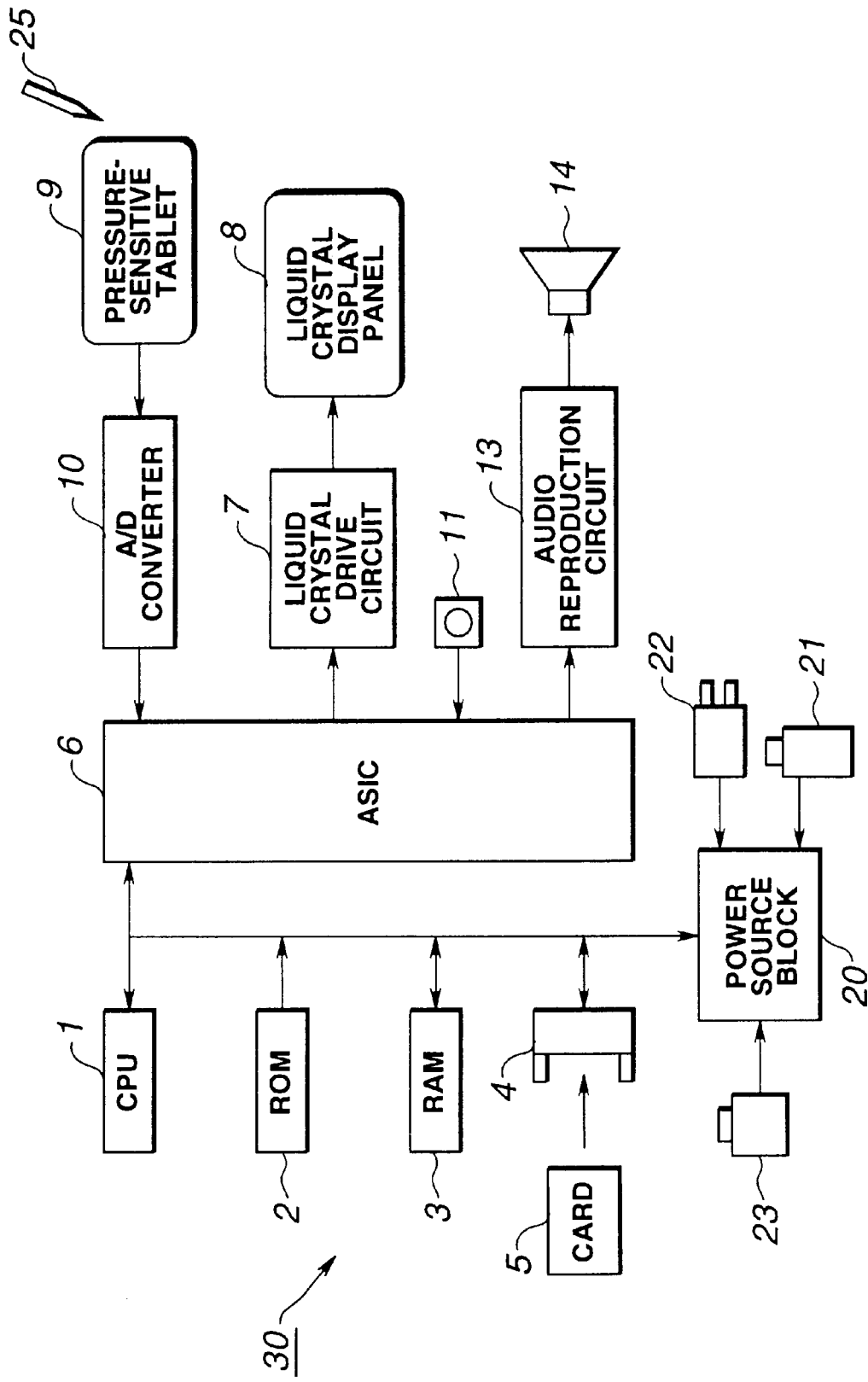


FIG.1

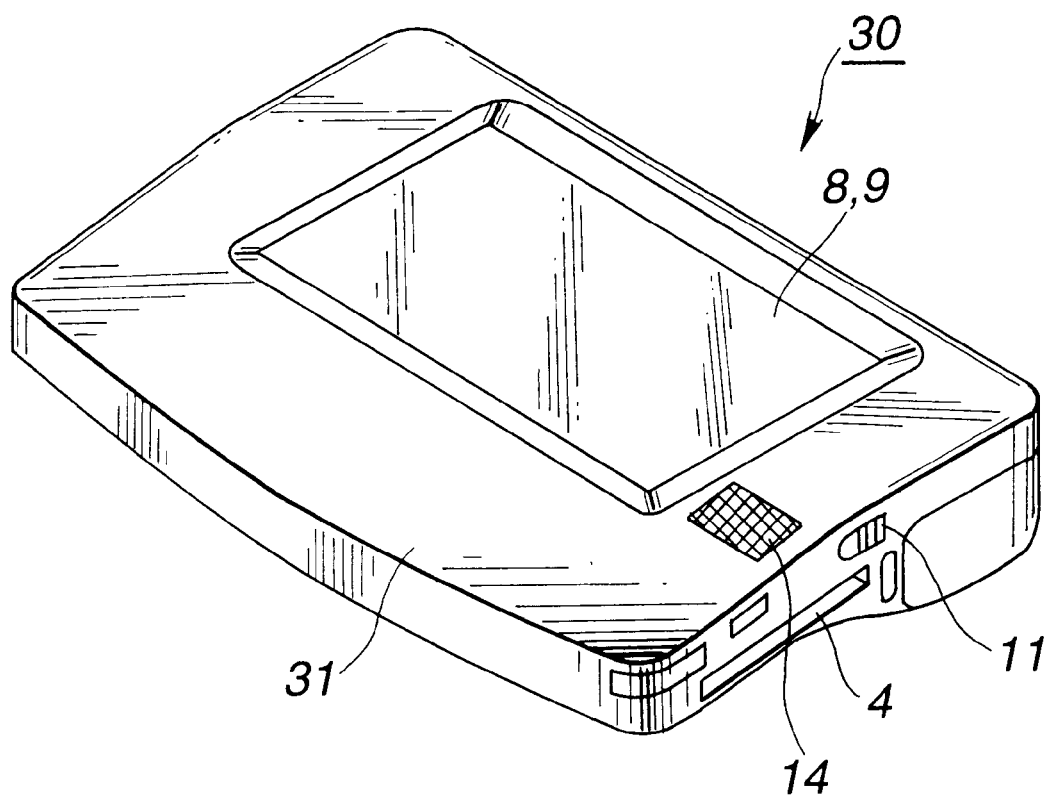


FIG.2

										SKC				SKBJ																																			
														wa	ra	ya	ma	ha	na	ta	sa	ka	a	wo	ri	-	mi	hi	ni	chi	shi	ki	i	n	ru	yu	mu	hu	nu	tsu	su	ku	u	o	re	-	me	he	ne
										BACK SPACE										PAGE ↑		CUT		VARIATION		CHINESE CHARACTER																							
																				LINE ↑		PASTE		SAVE		ENGLISH																							
										ENTER										LINE ↓		RETRIEVE		CALL		SYMBOL																							
																				PAGE ↓		CENTER		LIST		DIRECT																							
										CANCEL										DIVIDE		FULL PAGE		FOLLOW		OTHERS																							

DPY(8)

FIG.3

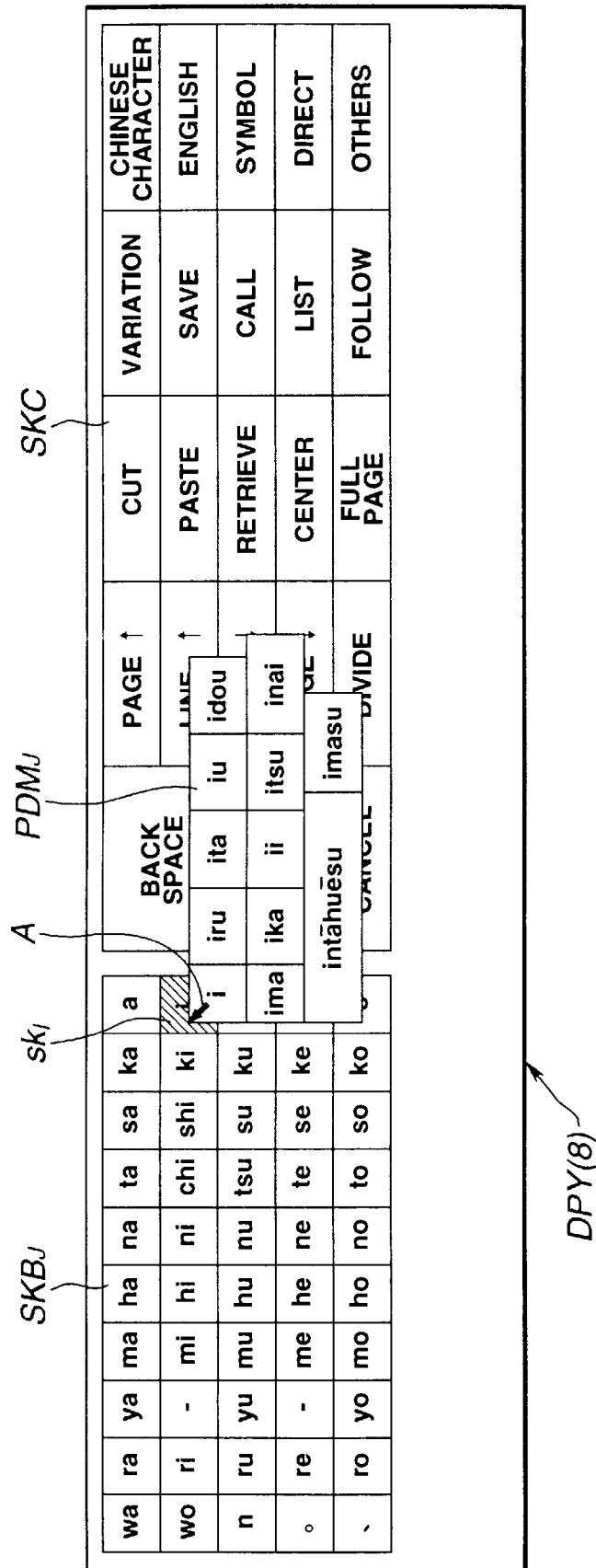


FIG.4

SKB _J										SKC						
wa	ra	ya	ma	ha	na	ta	sa	ka	a	BACK SPACE		PAGE ↑	CUT	VARIATION		CHINESE CHARACTER
wo	ri	-	mi	hi	ni	chi	shi	ki	i	ENTER		LINE ↑	PASTE	SAVE	ENGLISH	
n	ru	yu	mu	hu	nu	tsu	su	ku	u	CANCEL		LINE ↓	RETRIEVE	CALL	SYMBOL	
o	re	-	me	he	ne	te	se	ke	e			PAGE ↓	CENTER	LIST	DIRECT	
,	ro	yo	mo	ho	no	to	so	ko	o			DIVIDE	FULL PAGE	FOLLOW	OTHERS	
i	ima	intāhuēsu		iru		ika	ita	ii	iu	itsu						
imasu	idou	inai	identeki	iki	itsumo	izen	imi									
DPY(8) PUM _J																

FIG.5

SKBJ										SKK		A		PDMJ		SKC		CHINESE CHARACTER	
wa	ra	ya	ma	ha	na	ta	sa	ka	a	BACK		PAGE ↑		CUT		VARIATION		CHINESE CHARACTER	
wo	ri	-	mi	hi	ni	chi	shi	ika	ika	igai	ikani	ikami	PASTE	SAVE	ENGLISH				
n	ru	yu	mu	hu	nu	tsu	su	ika	ika	ikani	ika	ika	RETRIEVE	CALL	SYMBOL				
o	re	-	me	he	ne	te	se	ika	ika	iga	igai	ikahonbun	CENTER	LIST	DIRECT				
,	ro	yo	mo	ho	no	to	so	ko	o	CANCEL		DIVIDE		FULL PAGE		OTHERS			

DPY(8)

FIG.6

wa		ra	ya	ma	ha	na	ta	sa	ka	a	PAGE ↑	CUT	CHINESE CHARACTER
wo	ri	-	mi	hi	ni	chi	shi	ika	ika	ikaga			
n	ru	yu	mu	hu	nu	tsu	su	ito	ikari	ikanimomo	ikan	RETRIEVE	SYMBOL
o	re	-	me	he	ne	te	se	ikari	iga	igai	ikahonbun	CENTER	DIRECT
,	ro	yo	mo	ho	no	to	so	ko	o	CANCEL	DIVIDE	FULL PAGE	OTHERS

SKBJ

PDMU mki

SKC

DPY(8)

A

FIG.7

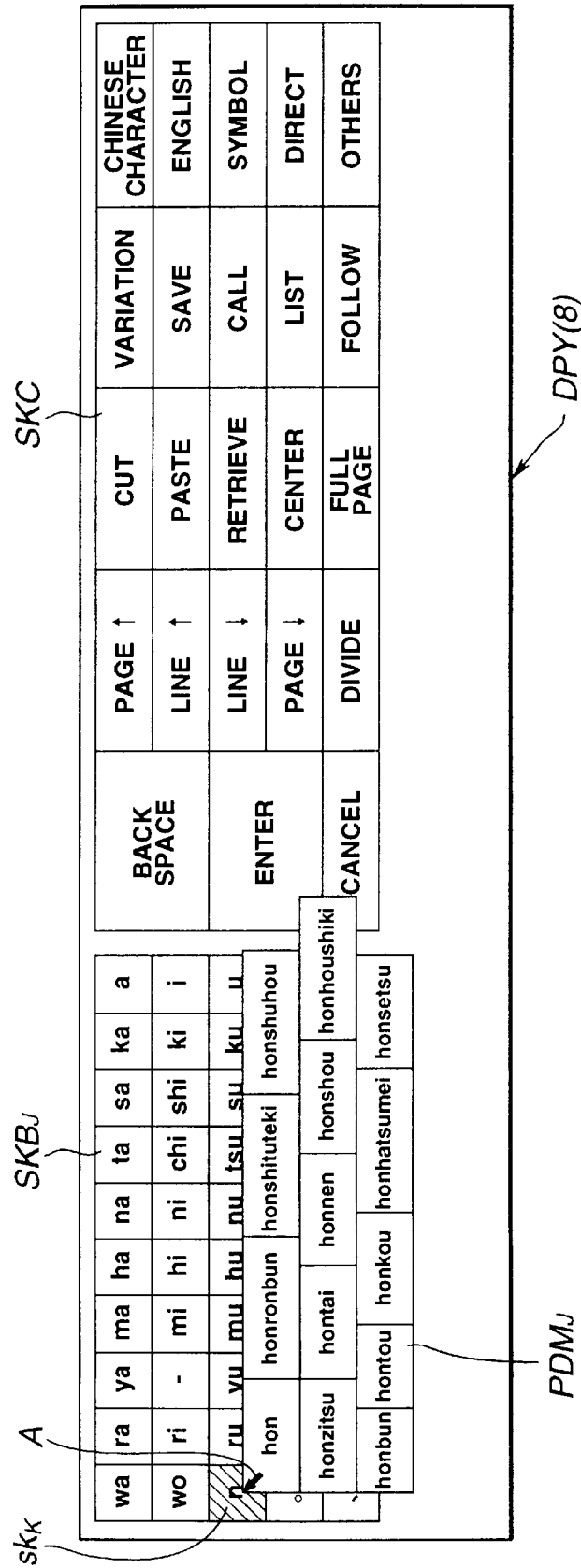


FIG.8

SKB _J										SKC																													
wa	ra	ya	ma	ha	na	ta	sa	ka	a	PAGE ↑		CUT		VARIATION		CHINESE CHARACTER																							
wo	ri	-	mi	hi	ni	chi	shi	ki	i	LINE ↑		PASTE		SAVE		ENGLISH																							
n	ru	yu	mu	hu	nu	tsu	su	ku	u	LINE ↓		RETRIEVE		CALL		SYMBOL																							
o	re	-	me	he	ne	te	se	ke	e	PAGE ↓		CENTER		LIST		DIRECT																							
,	ro	yo	mo	ho	no	to	so	ko	o	DIVIDE		FULL PAGE		FOLLOW		OTHERS																							
BACK SPACE										ENTER		CANCEL																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>wa</td><td>wo</td><td>wobunshohenshū</td><td>niyori</td><td>woteian</td><td>watanjun</td><td>no</td><td>ga</td><td>womochiite</td><td>to</td><td>wotekiyou</td><td>ni</td> </tr> <tr> <td colspan="2">nokirikae</td><td colspan="2">A</td><td colspan="2">PUM_J</td><td colspan="2">mko</td><td>nitsuite</td><td>noyūgou</td><td>de</td><td></td> </tr> </table>										wa	wo	wobunshohenshū	niyori	woteian	watanjun	no	ga	womochiite	to	wotekiyou	ni	nokirikae		A		PUM _J		mko		nitsuite	noyūgou	de		DPY(8)					
wa	wo	wobunshohenshū	niyori	woteian	watanjun	no	ga	womochiite	to	wotekiyou	ni																												
nokirikae		A		PUM _J		mko		nitsuite	noyūgou	de																													

FIG.9

										SKC				CHINESE CHARACTER									
														VARIATION		CHINESE CHARACTER							
										PAGE ↑		CUT		SAVE		ENGLISH							
										LINE ↑		PASTE		RETRIEVE		SYMBOL							
										LINE ↓		RETRIEVE		CALL		DIRECT							
										PAGE ↓		CENTER		LIST		OTHERS							
										DIVIDE		FULL PAGE		FOLLOW									
										CANCEL													
SKB _J										BACK SPACE		PAGE ↑		CUT		CHINESE CHARACTER							
wa										ta		sa		ka		a							
wo										chi		shi		ki		i							
n										tsu		su		ku		u							
o										te		se		ke		e							
、										to		so		ko		o							
PUM _J										tekiyou		teian		tsukau		heiyou		sentaku		sentakushi		mochii	
bunshohenshū										mochiite		okona		nyūryoku		yosoku		sakusei		okonau		zikkou	
shiyoushi										tsukawa		mochiita		A		DPY(8)							
										mk _M													

FIG.10

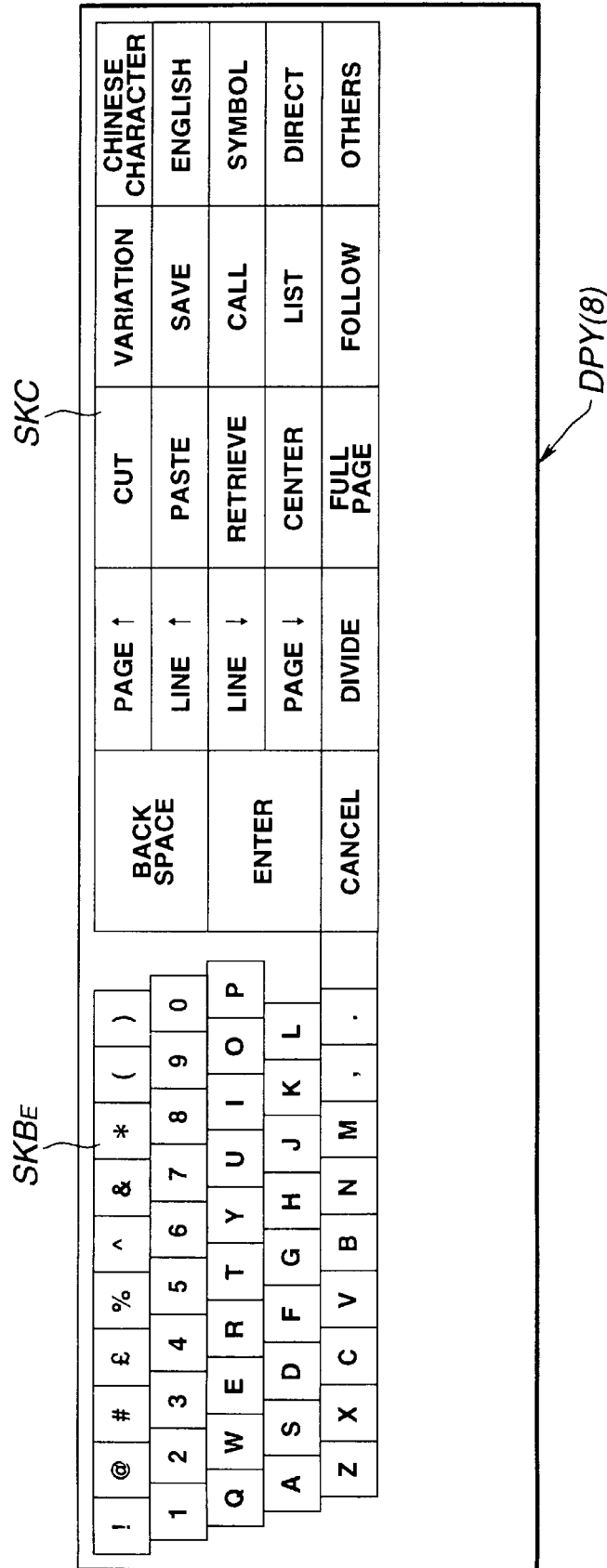


FIG.11

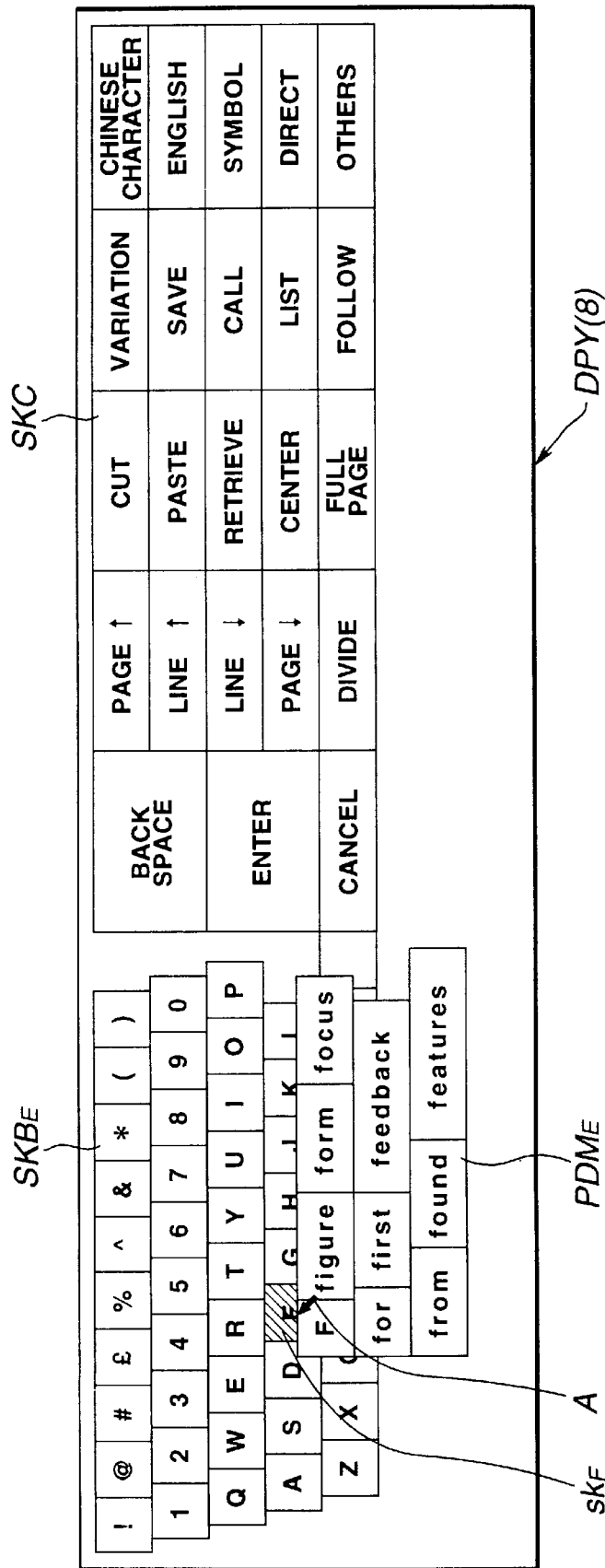


FIG.12

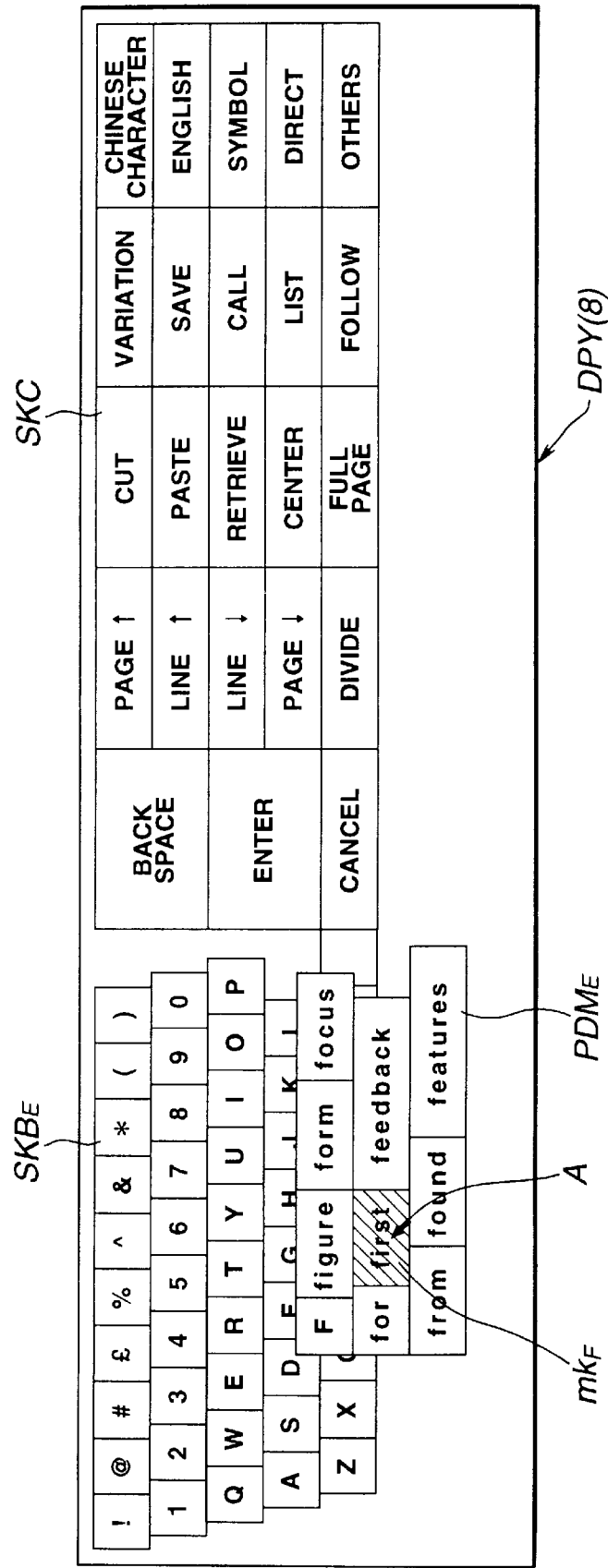


FIG.13

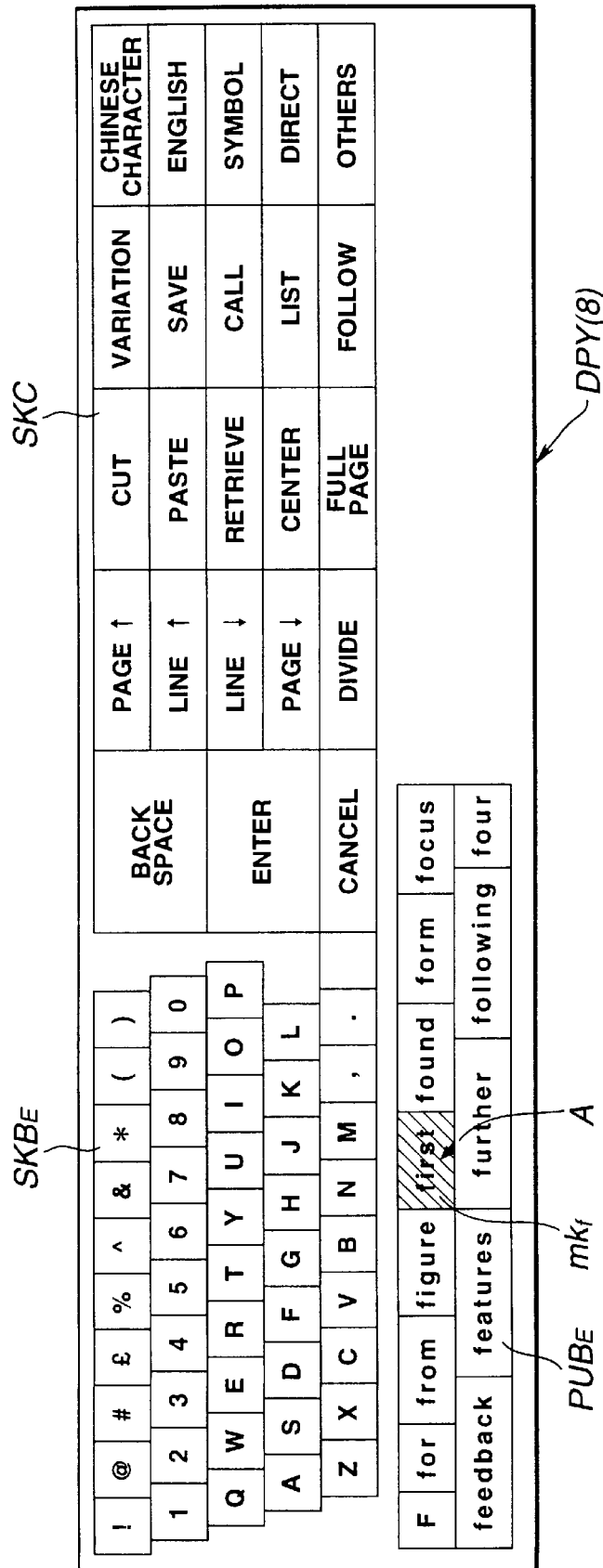


FIG.14

suru / suru
shisutemu / shisutemu
sousa / sousa
masui / masui
yūza / yūza

FIG.15

iru / yatte / iru
inai / yatte / inai
masu / kake / masu
kake / ga / kake
ka / bunshou / ga

FIG.16

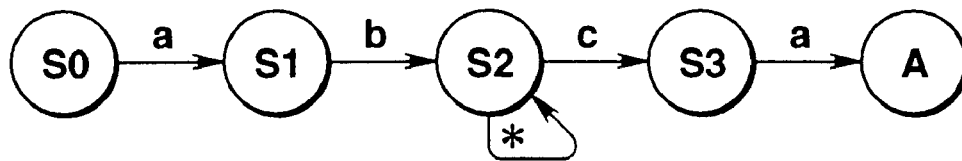


FIG.17

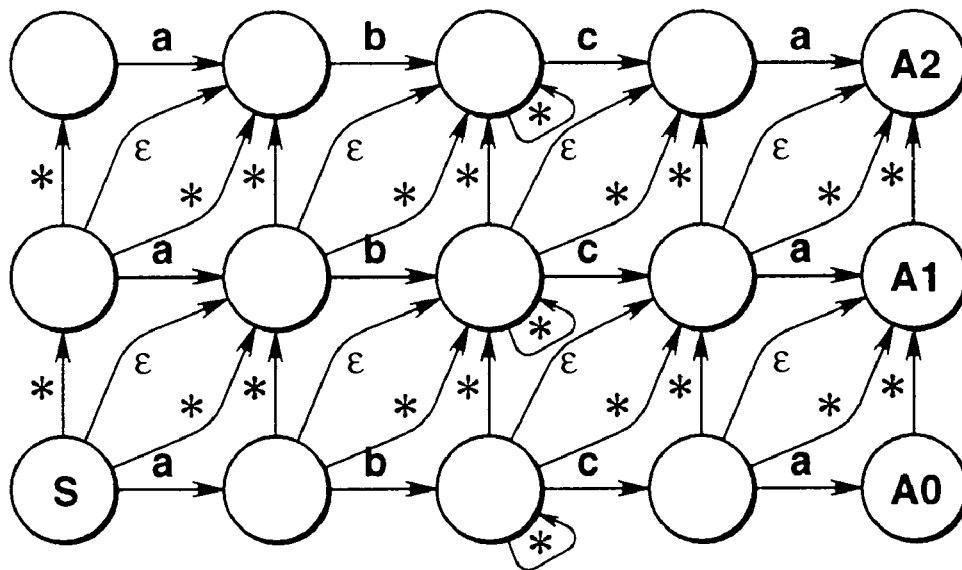


FIG.18

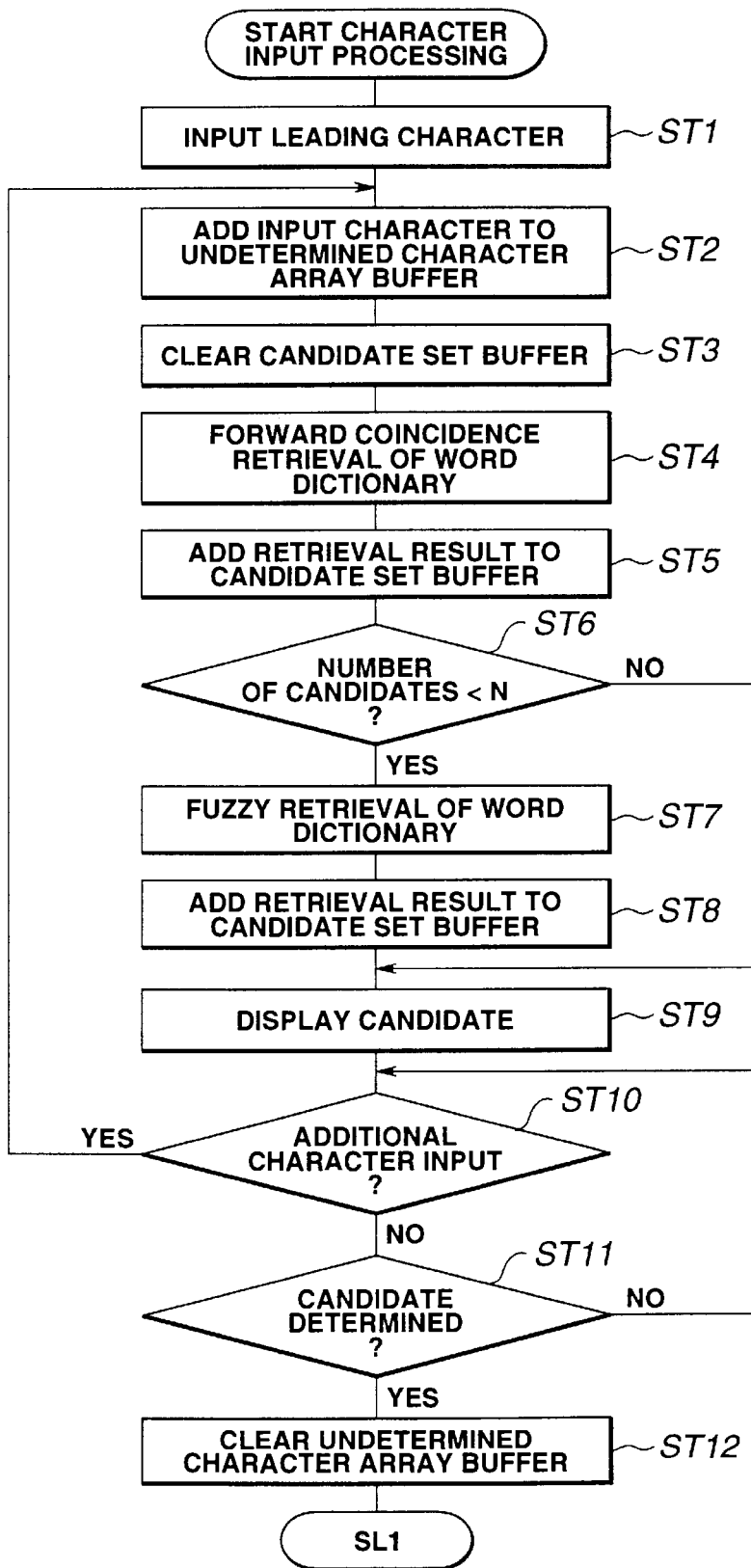


FIG.19

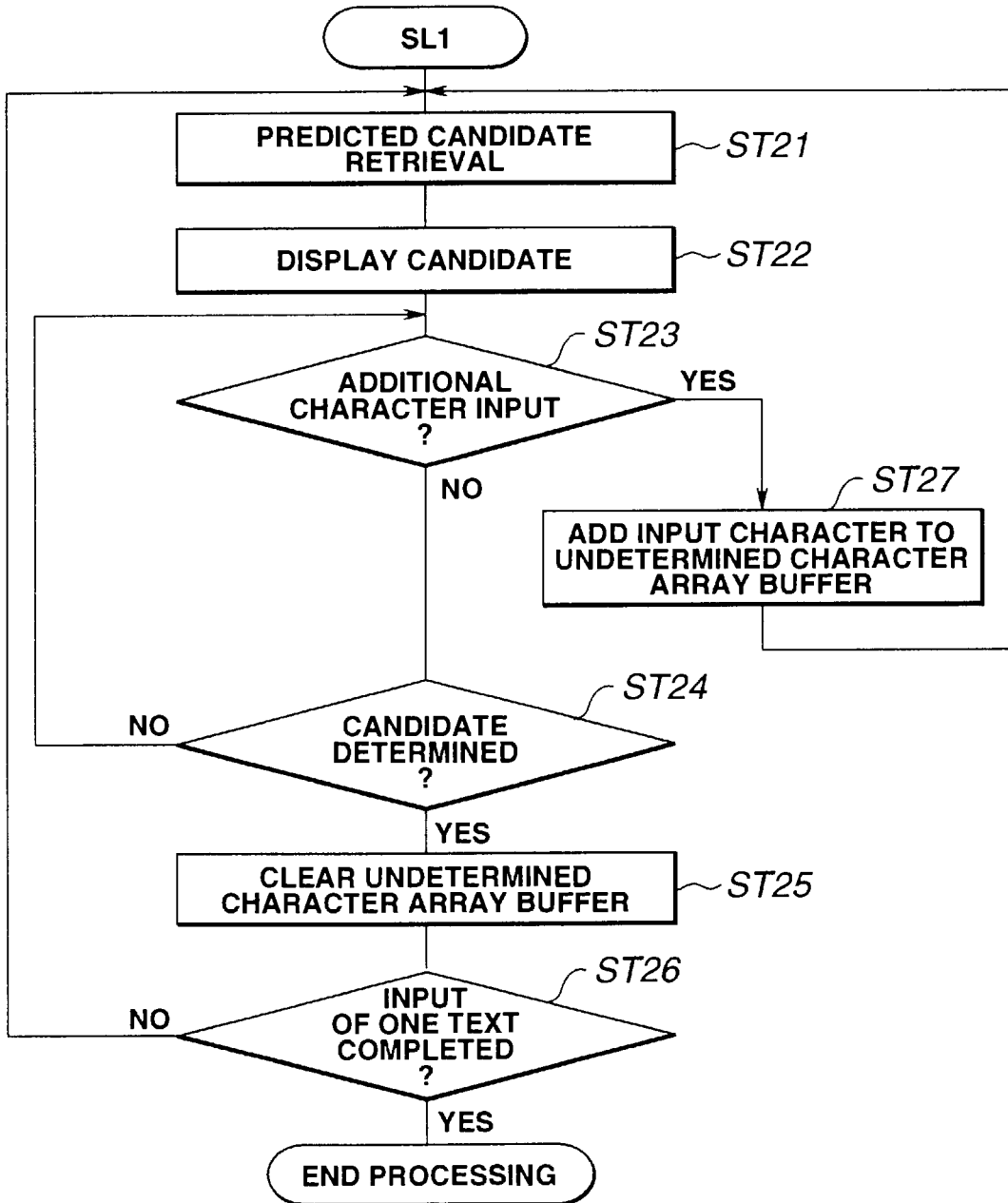


FIG.20

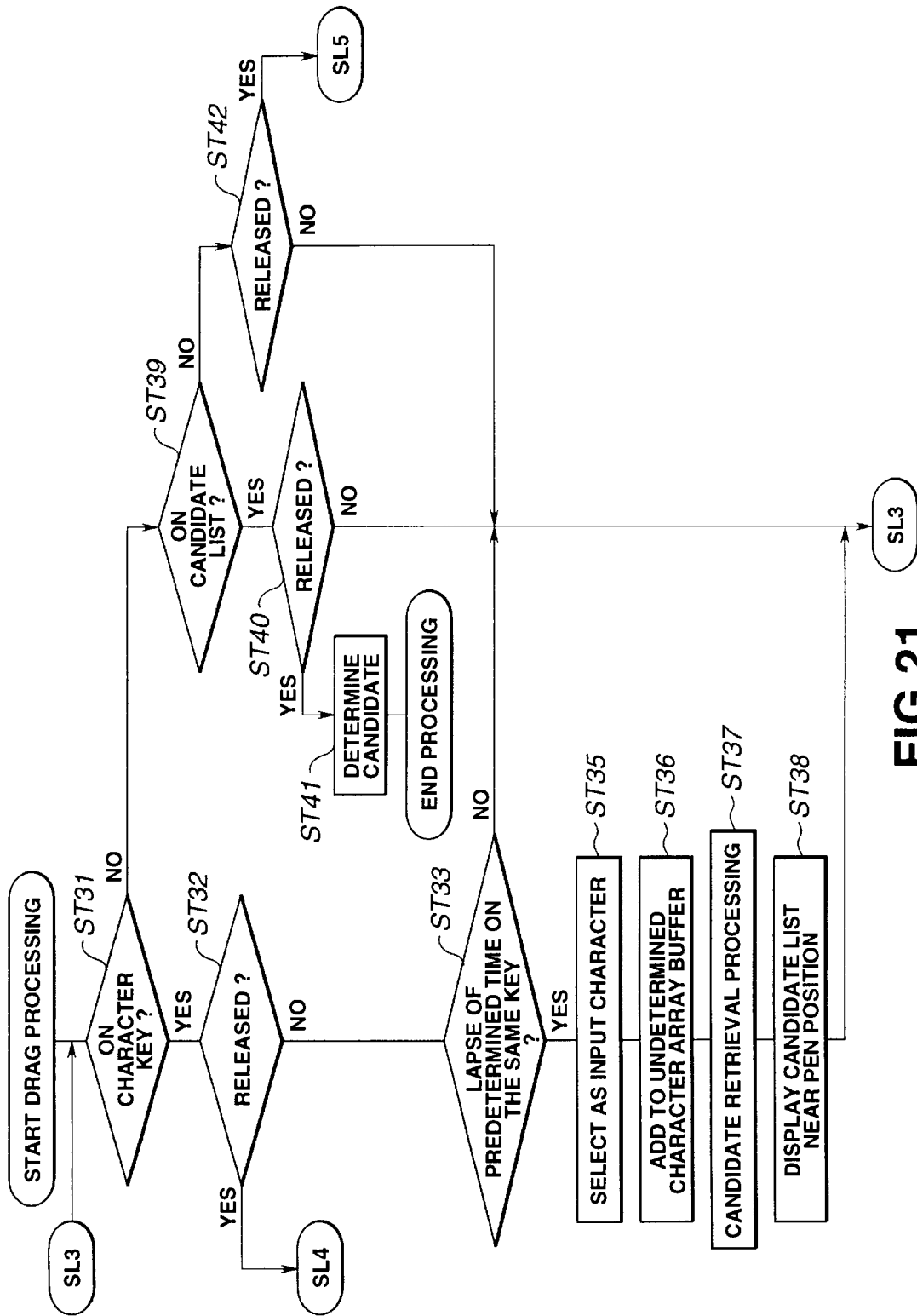


FIG. 21

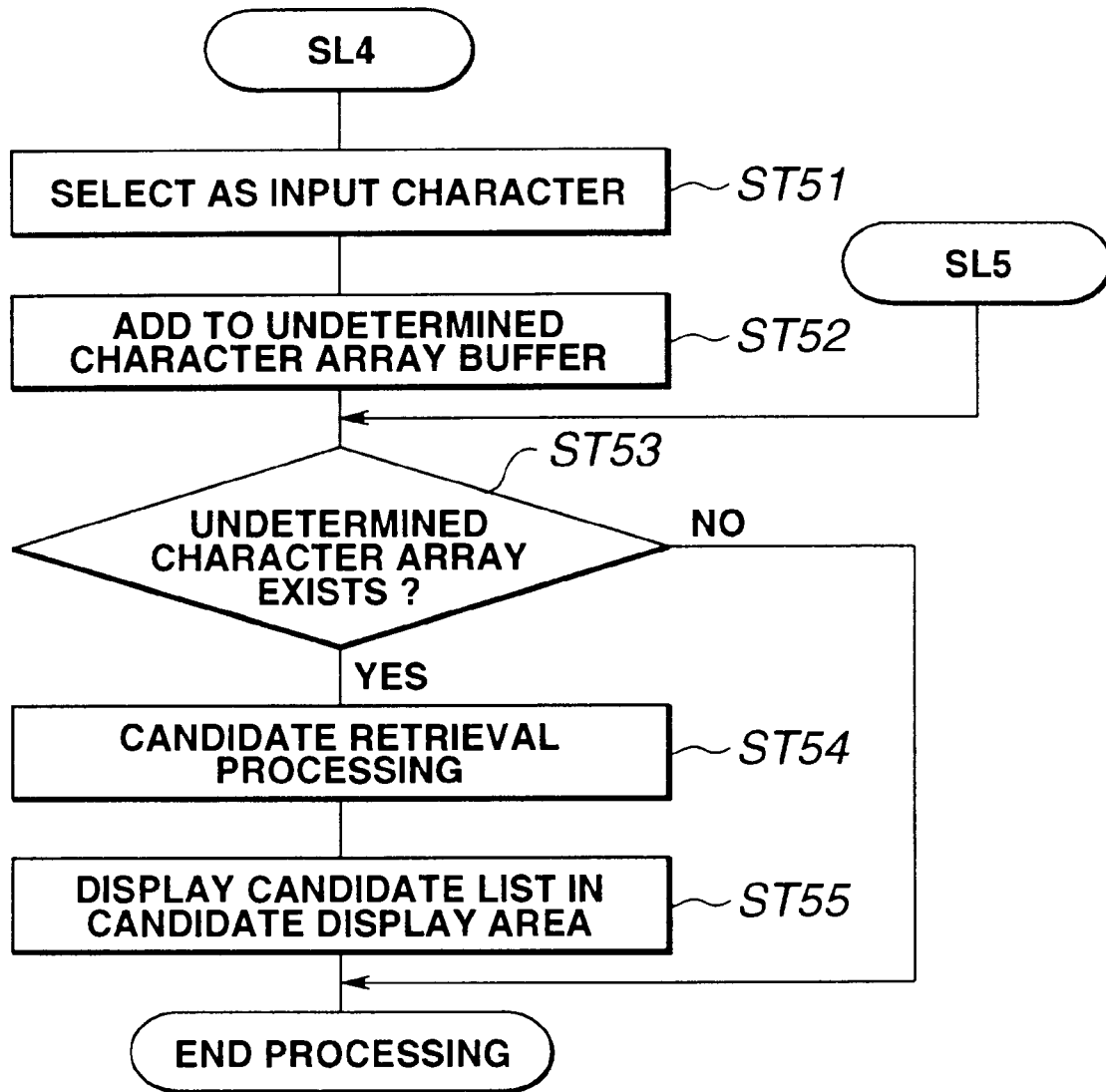


FIG.22

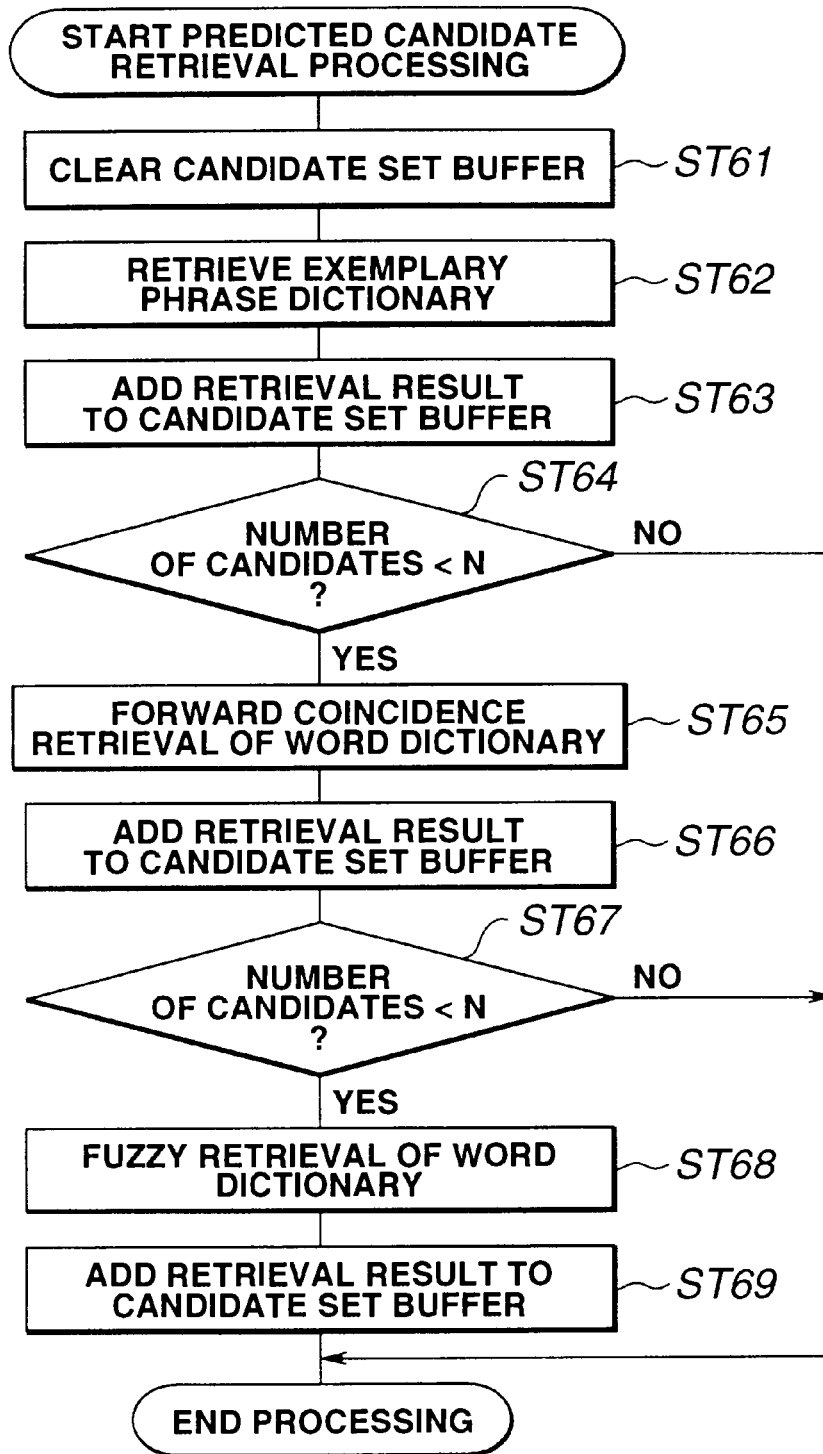


FIG.23

INPUT METHOD	INPUT TIME
METHOD OF PRESENT INVENTION	120 SECONDS (64 CHARACTERS / MINUTE)
COMPANY A'S PDA SOFT KEY + CONVERSION	290 SECONDS (27 CHARACTERS / MINUTE)
COMPANY B'S PDA HANDWRITTEN CHARACTER RECOGNITION	300 SECONDS (26 CHARACTERS / MINUTE)
COMPANY C'S PORTABLE PC SOFT KEY + CONVERSION	260 SECONDS (30 CHARACTERS / MINUTE)
COMPANY D'S PORTABLE PC HANDWRITTEN CHARACTER RECOGNITION	320 SECONDS (24 CHARACTERS / MINUTE)

FIG.24

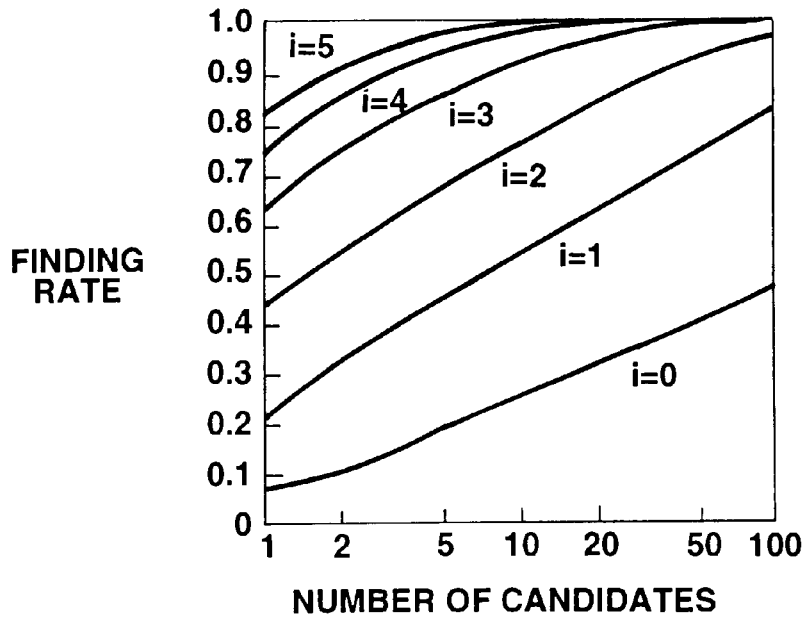


FIG.25

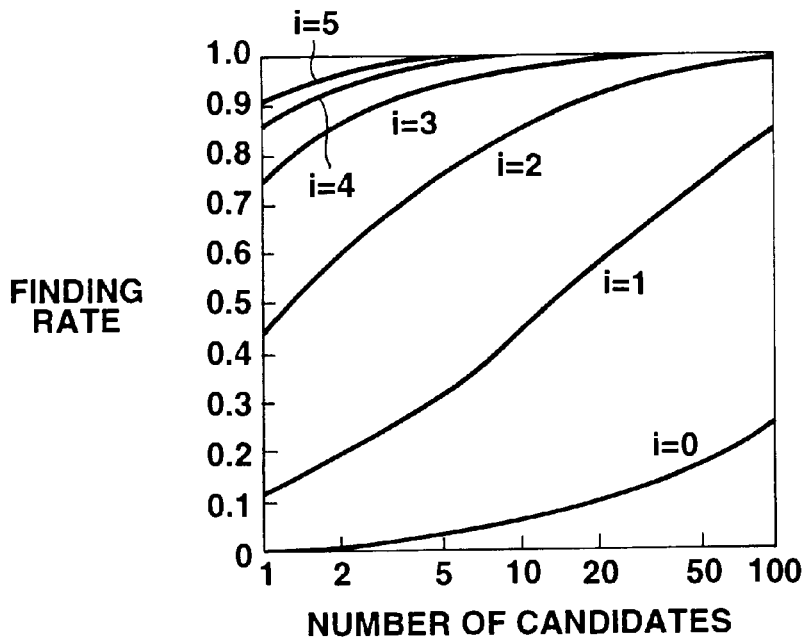


FIG.26

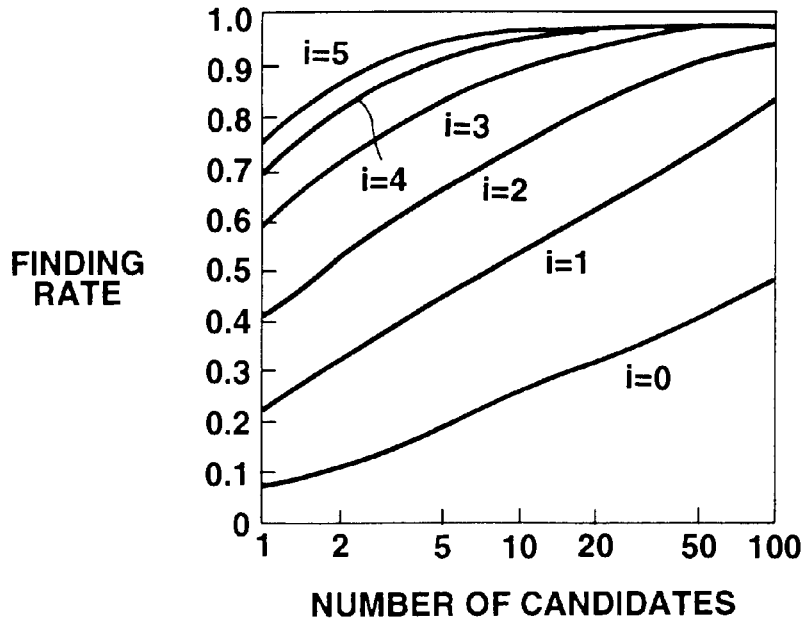


FIG.27

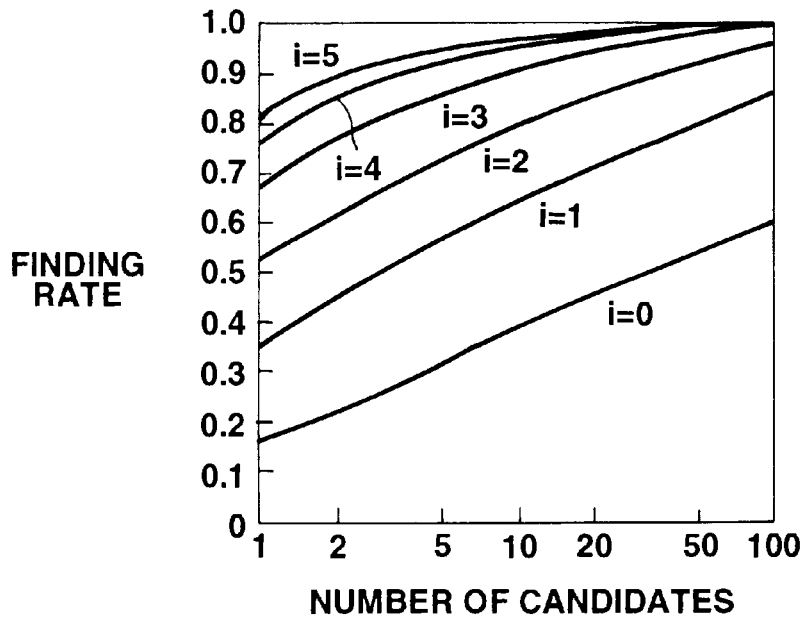


FIG.28

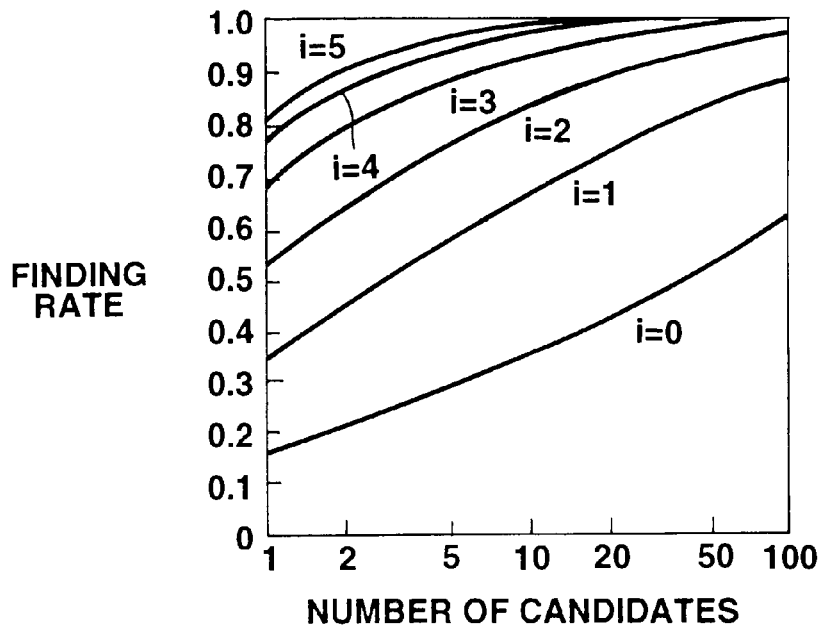


FIG.29

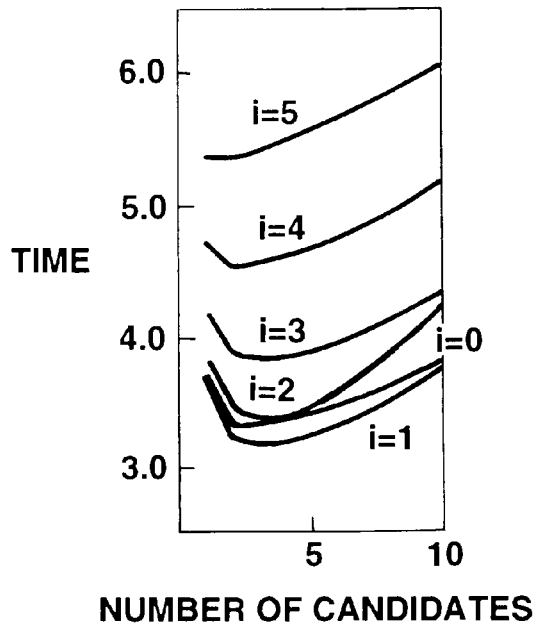


FIG.30

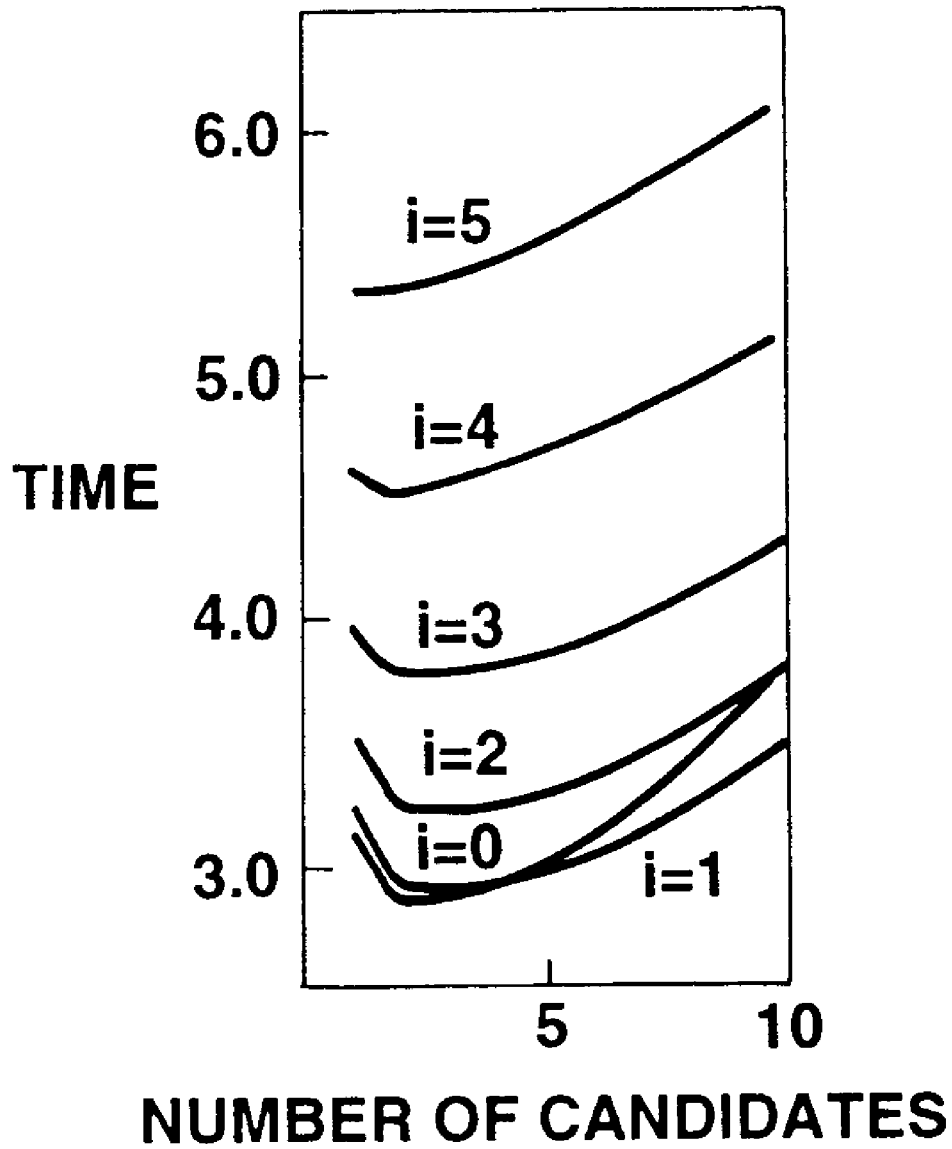


FIG.31

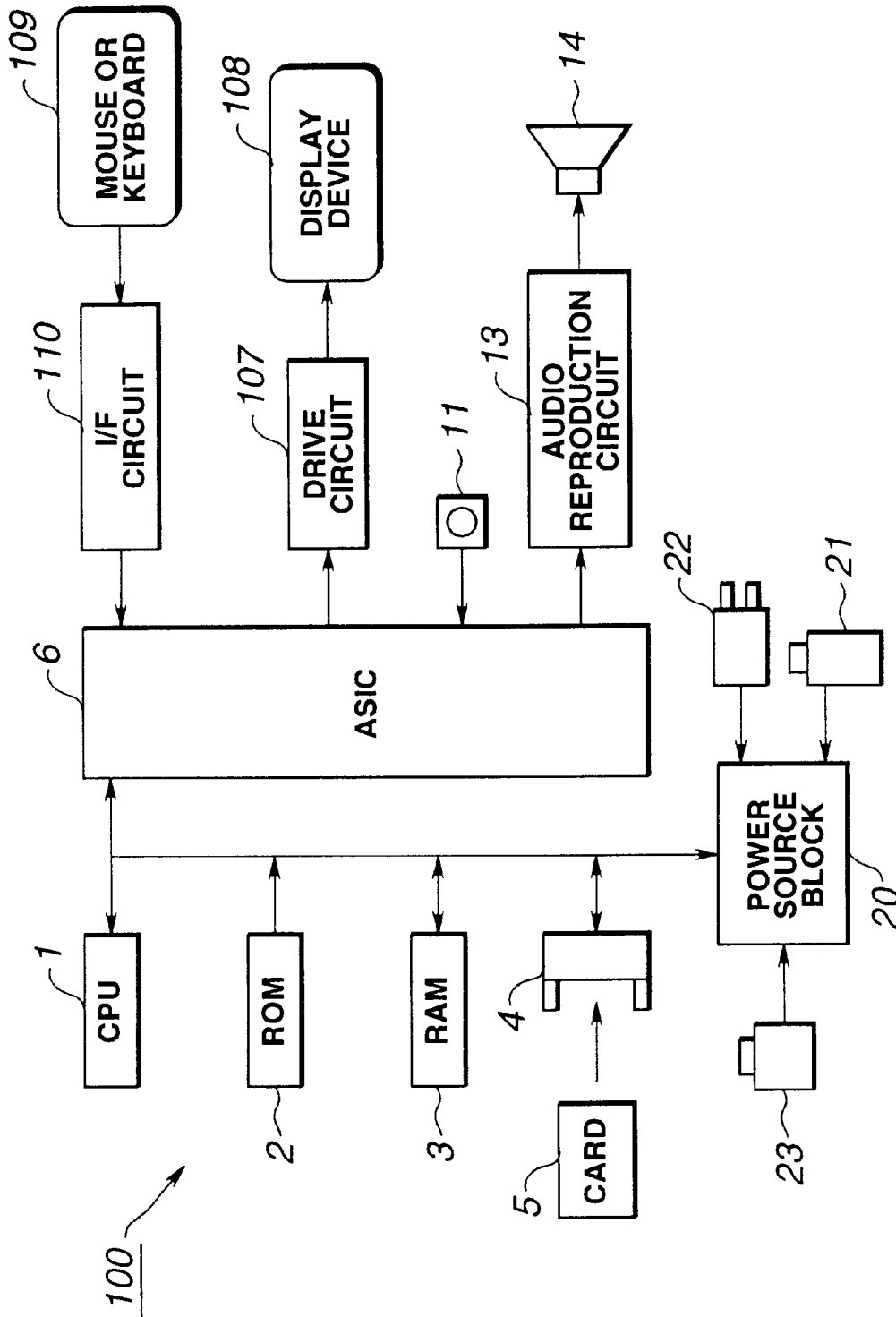


FIG.32

TEXT INPUT DEVICE AND METHOD

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a computer capable of at least inputting text, that is, a text input device, and a text input method suitable for efficiently inputting text in the computer.

2. Description of the Related Art

Recently, improvement in computer performance and miniaturization techniques have allowed various portable computers to be used broadly. Particularly, a so-called pen-input computer without having a hardware keyboard is convenient for portable use and is utilized as a general-purpose computer for an increasing number of occasions.

Most of the currently commercialized pen-input computers employ a handwritten character recognition system or a character input system using a so-called soft keyboard on the screen, as the system for performing text input. The soft keyboard realizes substantially the same function as the hardware keyboard by displaying a keyboard image on the screen in which key images corresponding to "hiragana" or "katakana" characters (both are Japanese characters) and alphabetic characters are arrayed in a predetermined order, and then pointing a key on the displayed keyboard image using a pointing device, for example. With respect to the keyboard image, in the case of hiragana characters, the keys are arrayed in the order of the Japanese syllabary, and in the case of alphabetic characters, the keys are arrayed in the alphabetical order.

However, in the case of the handwritten character recognition, since the character input speed of handwriting is limited and correction of false recognition of a handwritten character by the computer is troublesome, it is essentially difficult to improve the input speed significantly. It is considered that the character input speed of the current pen-input computer capable of handwritten character recognition is approximately 30 characters per minute at most. In addition, in the case of the handwritten character input, the user's hand will be fatigued with input of a large volume of text.

Also, in the character input system using the soft keyboard, "kana-kanji" (Japanese character to Chinese character) conversion is performed with respect to a character inputted by using the soft keyboard. In this system, since characters on the small keyboard (soft keyboard) displayed on the screen must be continuously picked up accurately, the user's eyes and nerves may be fatigued, and the input and conversion are time-consuming.

Thus, in view of the foregoing state of the art, it is an object of the present invention to provide a text input device and method which enable efficient and high-speed input of text.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a text input device including: display means capable of displaying a virtual keyboard having at least a plurality of keys for character input; input means for pointing at least each key on the virtual keyboard to perform key input; dictionary storage means storing a plurality of candidate words and a plurality of exemplary phrases; and retrieval means for retrieving a plurality of candidate words from the dictionary storage means, using the key input from the virtual keyboard as a retrieval condition; the retrieval condition and the candidate words being dynamically changed in accordance with a change in a key input operation state of the virtual keyboard.

According to the present invention, there is also provided a text input method including: a display step of displaying a virtual keyboard having at least a plurality of keys for character input; an input step of pointing at least each key on the virtual keyboard to perform key input; and a retrieval step of retrieving a plurality of candidate words from a dictionary storing a plurality of candidate words and a plurality of exemplary phrases, using the key input from the virtual keyboard as a retrieval condition; the retrieval condition and the candidate words being dynamically changed in accordance with a change in a key input operation state of the virtual keyboard.

That is, the present invention provides the text input device and method suitable for a pen-input computer based on retrieval and prediction of characters, words, and sentences, etc. Thus, the present invention enables efficient and high-speed input of text by repeating the operation of selecting a word from a set of candidate words which are selectively collected by partial designation of reading and prediction from a character array immediately before the input position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block circuit diagram showing a schematic circuit structure of a pen-input computer of an embodiment of the present invention.

FIG. 2 is a perspective view showing the pen-input computer of the embodiment of the present invention, obliquely viewed from above.

FIG. 3 illustrates an example of an initial display screen of a liquid crystal display panel at the time of Japanese language input in the embodiment of the present invention.

FIG. 4 illustrates an example of the display screen (pull-down menu) in the case where a retrieval condition (reading) of "i" is designated.

FIG. 5 illustrates an example of the display screen (pop-up menu) in the case where the retrieval condition (reading) of "i" is designated.

FIG. 6 illustrates an example of the display screen (pull-down menu) in the case where a retrieval condition (reading) of "ika" is designated.

FIG. 7 illustrates selection of a candidate word "ikani" from candidate words of the pull-down menu in the case where the retrieval condition (reading) of "ika" is designated.

FIG. 8 illustrates an example of the display screen (pull-down menu) in the case where a retrieval condition (reading) of "hon" is designated.

FIG. 9 illustrates selection of a candidate word "wo" from candidate words of a pop-up menu displayed in the case where a character array of "ikani honshuhou" is determined.

FIG. 10 illustrates selection of a candidate word "mochiita" from candidate words of a pop-up menu displayed in the case where a character array of "ikani honshuhou wo" is determined.

FIG. 11 illustrates an example of an initial display screen of the liquid crystal display panel in English language input in the embodiment of the present invention.

FIG. 12 illustrates an example of the display screen (pull-down menu) in the case where a retrieval condition (reading) of "F" is designated.

FIG. 13 illustrates selection of a candidate word "first" from candidate words of the pull-down menu in the case where the retrieval condition (reading) of "F" is designated.

FIG. 14 illustrates selection of a candidate word "first" from candidate words of a pop-up menu in the case where the retrieval condition (reading) of "F" is designated.

FIG. 15 illustrates a format of word dictionary used in the pen-input computer of the embodiment of the present invention.

FIG. 16 illustrates a format of exemplary phase dictionary used in the pen-input computer of the embodiment of the present invention.

FIG. 17 illustrates a basic structure of a state transition machine used for explaining fuzzy retrieval.

FIG. 18 illustrates an extended structure of the state transition machine used for explaining fuzzy retrieval.

FIG. 19 is a flowchart showing the former half of character input processing in the pen-input computer of the embodiment of the present invention.

FIG. 20 is a flowchart showing the latter half of the character input processing in the pen-input computer of the embodiment of the present invention.

FIG. 21 is a flowchart showing the former half of drag processing.

FIG. 22 is a flowchart showing the latter half of the drag processing.

FIG. 23 is a flowchart of predicted candidate retrieval processing.

FIG. 24 illustrates measurement results of input time in the case where an exemplary sentence of 128 characters is inputted using the pen-input computer of the embodiment of the present invention and an existing pen-input computer.

FIG. 25 illustrates the relation between the number of pen operating times, the number of candidates displayed on the menu, and the probability that a desired word will exist in the menu, in the case where English language input is performed.

FIG. 26 illustrates the relation between the number of pen operating times, the number of candidates displayed in the menu, and the probability that a desired word will exist in the menu, in the case where Japanese language input is performed.

FIG. 27 illustrates the relation between the number of pen operating times, the number of candidates displayed in the menu, and the probability that a desired word will exist in the menu, in the case where English language input is performed while predicted candidate retrieval is not performed.

FIG. 28 illustrates the relation between the number of pen operating times, the number of candidates displayed in the menu, and the probability that a desired word will exist in the menu, in the case where English language input is performed while predicted candidate retrieval is performed.

FIG. 29 illustrates the relation between the number of pen operating times, the number of candidates displayed in the menu, and the probability that a desired word will exist in the menu, in the case where English language input is performed while predicted candidate retrieval and adaptive retrieval using the dictionary are performed.

FIG. 30 illustrates the relation between the number of pen operating times, the number of candidates displayed in the menu, and the time until a desired candidate word is selected from the menu display and determined, in the case where text input is performed without performing predicted candidate retrieval.

FIG. 31 illustrates the relation between the number of pen operating times, the number of candidates displayed in the

menu, and the time until a desired candidate word is selected from the menu display and determined, in the case where text input is performed while predicted candidate retrieval is performed.

FIG. 32 is a block circuit diagram showing a schematic circuit structure of another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention will now be described with reference to the drawings.

As an embodiment of the text input device and method according to the present invention, the structure of a pen-input computer is shown in FIG. 1.

A pen-input computer 30 of this embodiment shown in FIG. 1 is a portable pen-input computer which includes a small-sized portable casing with a relatively large liquid crystal display panel provided therein, and is thus capable of displaying characters and figures based on data inputted thereto, on the liquid crystal display panel.

The pen-input computer 30 shown in FIG. 1 has a central processing unit (CPU) 1 for controlling the entire constituent elements therein. The CPU 1 is connected with a read-only memory (ROM) 2 storing therein a basic program referred to as a so-called operating system (OS), a text input program for realizing pen input, as later described, a word dictionary and an exemplary phase dictionary. The CPU 1 is also connected with a RAM 3 adapted for temporarily storing input data and provided as various buffer memories as later described. The CPU 1 is also connected with a card slot 4 to which a memory card 5 as external storage means may be connected. The CPU 1 performs processing of data stored in the RAM 3 in accordance with the basic program stored in the ROM 2. In addition, the CPU 1 reads and transfers data from the memory card 5 connected to the card slot 4 to the RAM 3, or transfers the data stored in the RAM 3 to the memory card 5, in accordance with the basic program. Thus, the storage area of the RAM 3 is also used as a work area for the data to be processed in accordance with the basic program. In order to enable version up in the pen-input computer 30, it is desired that the ROM 2 is a static rewritable memory, such as, a flash memory.

The CPU 1 is also connected with a liquid crystal drive circuit 7 via a so-called application specific integrated circuit (ASIC) 6 as an interface. The CPU 1 performs display control of a liquid crystal display panel 8 connected to the liquid crystal drive circuit 7.

On the surface of the liquid crystal display panel 8, a pressure-sensitive tablet 9 is provided. When the surface of the pressure-sensitive tablet 9 is touched by an input pen 25 or the like, the pressure-sensitive tablet 9 generates a coordinate position signal indicating the coordinate of a position touched by the input pen 25. The coordinate position signal generated by the pressure-sensitive tablet 9 is converted to digital data (coordinate position data) by an analog/digital converter 10, and is sent to the CPU 1 via the ASIC 6. On the basis of the coordinate position on the liquid crystal display panel 8 of the contents actually displayed on the liquid crystal display panel 8 and the coordinate position data inputted from the pressure-sensitive tablet 9, the CPU 1 judges what information is inputted from the input pen 25.

The pen-input computer 30 also has an audio reproduction circuit 13 and a speaker 14 to which an output of the audio reproduction circuit 13 is supplied. Under the control of the CPU 1, as audio data stored in the ROM 2 or the RAM 3 is

supplied to the audio reproduction circuit 13, the audio data is outputted as sounds from the speaker 14.

In addition, the pen-input computer 30 has a power button 11 indicating ON/OFF state of a power source. When power ON operation is performed at power button 11, the power obtained from a main battery 21 or an AC adaptor 22 is supplied to each constituent element via a power source block 20 as a power circuit. The pen-input computer 30 also has a back-up battery 23 for the RAM 3. When the power cannot be obtained from the main battery 21 or the AC adaptor 22, the back-up battery 23 backs up the RAM 3 so as to prevent erasure of the data stored in the RAM 3.

FIG. 2 shows schematic appearance of the pen-input computer 30 of the present embodiment.

In FIG. 2, the pen-input computer 30 of the present embodiment has the circuit portion of FIG. 1 provided within a casing 31. On the top side of the casing 31, the speaker 14 and the liquid crystal display panel 8 having the pressure-sensitive tablet 9 on the surface thereof are arranged. The liquid crystal display panel 8 is located substantially at the center on the top side of the casing 31. By touching the pressure-sensitive tablet 9 provided on the liquid crystal display panel 8 using the input pen 25, for example, input by the pen is enabled. On the right lateral side of the casing 31, for example, the power button 11 and the card slot 4 are arranged.

The basic idea in the case where the text input method of the present invention is applied to the pen-input computer of the present embodiment having the above-described structure will now be explained.

In the text input method of the existing pen-input computer, it is normal that the user provides a large amount of information relating to an input character array. Specifically, as described above, in the pen-input computer employing the handwritten character recognition system, input of a character is regarded as being done only when the user writes the character correctly. In the pen-input computer employing the soft keyboard and kana-kanji conversion system, kana-kanji conversion is performed only when complete reading of a character array is inputted from the soft keyboard.

On the contrary, by picking up a plurality of candidate characters, words and phrases (hereinafter collectively referred to as words) as retrieval conditions with respect to partial information about a character array to be inputted, such as, a leading character of the character array to be inputted or several characters included in the character array, then selecting necessary words from these candidates and connecting the obtained words, text input is enabled without providing complete information about the character array to be inputted.

That is, particularly in the pen-input computer, the selecting operation may be performed at a high speed though the character input operation cannot be performed as speedily as the computer having the hardware keyboard. Therefore, it is considered that high-speed character input may be performed in the pen-input computer by employing at least the following four policies different from those of the computer having the hardware keyboard.

A first policy is to provide retrieval conditions by a simple operation.

A second policy is to dynamically change a set of candidate words in accordance with a change in the retrieval conditions so as to retrieve and display the candidate words, and use these candidate words as selection objects.

A third policy is to select a target word from the plural candidates displayed as retrieval results.

A fourth policy is to calculate the likelihood of appearance of words from a determined character array immediately before the input position of the word or the general appearance frequency of the word and the context, and display the candidates in the order of likelihood of appearance.

In order to realize these four policies, specifically, the following method is employed.

In the designation of retrieval conditions, a part of reading of the input character array is designated as a retrieval condition using the soft keyboard displayed on the screen. That is, the retrieval condition for retrieving a word to be inputted is designated by selecting a key corresponding to a leading one character of the word to be inputted or keys corresponding to several characters from the leading character or several characters intermittent from the leading character, instead of the entire reading of the word, from the keys on the soft keyboard using the input pen. As the method for designating the retrieval condition, it is also possible to designate plural characters indicating the reading by a single operation.

In the retrieval and display of candidate words and selection thereof, at the moment when a part of reading of the input character array is designated, a set of candidate words starting with that reading is presented as selection objects. That is, when the retrieval condition (the above-mentioned reading) for retrieving the word to be inputted is designated, plural words corresponding to the retrieval condition (reading) are displayed as candidates. However, if the designation of retrieval condition is altered, the display of candidate words is immediately changed. In addition, in the retrieval of candidate words, a prepared exemplary phrase is used to predict the input word from the character array already determined immediately before the word input position and present this predicted word preferentially. For example, when reading of "o" is designated by the input pen in the case where the character array already determined immediately before the word input position ends with "yoroshiku", a word "onagai" is preferentially presented as a candidate. In this retrieval of candidate words, when there is no exemplary phrase matched with the retrieval condition (reading), a word of a high use frequency or a word matched with the reading among the recently selected words is preferentially presented as a candidate word. When there is no word matched with the retrieval condition, fuzzy retrieval as later described is performed so that a word proximate to the retrieval condition is presented as a candidate. The plural candidate words thus obtained become selection objects in selecting the word to be inputted. The set of candidate words in this case is displayed as a menu at a position near the soft keys or at a predetermined position.

On the basis of the above-described four policies and specific methods thereof, text input in the pen-input computer 30 of FIG. 1 is hereinafter described in detail with reference to FIGS. 3 to 14.

A specific example of the case where a Japanese sentence of "ikani honshuhou wo mochiita . . ." is inputted is described with reference to FIGS. 3 to 10. In FIGS. 3 to 14, the position of the input pen is indicated by an arrow A.

FIG. 3 shows an initial screen of a Japanese soft keyboard SKBJ in the order of the Japanese syllabary displayed on a screen DPY of the liquid crystal display panel 8 of FIGS. 1 and 2. In the soft keyboard SKB, hiragana soft keys in the order of the Japanese syllabary composed of unit characters "a" to "n" (including punctuation marks. ""and";") and general edit command soft keys SKC including "Back

Space”, “Enter” and “Cancel” are provided. The hiragana soft keys are arrayed substantially in the order of the Japanese syllabary.

In this state of the initial screen, as shown in FIG. 4, when a soft key SK_i of “i” is pressed by the input pen (arrow A), this “i” is designated as a retrieval condition (reading). When “i” is thus designated as a retrieval condition, a set of plural candidate words starting with “i” are displayed as a pull-down menu PDM on the screen DPY, as shown in FIG. 4. The pull-down menu is generally a menu display system for displaying a list of selectable work items on the screen in designating a work to the computer and allowing the user to select a target work from the list. In this system, the menu of work items appears on the screen as if a scroll were pulled out. In the present embodiment, the candidate words are displayed in the pull-down menu in place of the work items.

As the pull-down menu PDM_j of FIG. 4, among words starting with “i”, approximately 10 candidate words from the word of the highest appearance frequency (for example, “i”, “ima”, “intahuesu”, “u”, “ika”, “ita”, “ii”, “iu”, “itsu”, “idou”, “inai”, “imasu”, etc.) are displayed as menu items. In the following description, each menu item of each displayed candidate word is referred to as a menu key. As a matter of course, the number of candidate words displayed as the pull-down menu PDM_j is not limited to approximately 10 and may be smaller or greater. The number of displayed candidate words is determined in consideration of the size of the screen DPY and the proportion to other display contents. When the pull-down menu PDM_j is displayed, the display of the soft keyboard SKB_j is disturbed. Therefore, it is also possible to perform menu display of the same contents as the pull-down menu PDM_j in a place other than the display area of the soft keyboard SKB_j (preferably, at a position not disturbing other display contents).

In the state of the display of FIG. 4, if the input pen is released, the candidate words which have been displayed in the pull-down menu PDM_j of FIG. 4 are now displayed as a pop-up menu PUM_j at a lower part of the screen DPY, as shown in FIG. 5, and the display of the pull-down menu PDM_j of FIG. 4 is extinguished. The pop-up menu is a menu display system of the same type as the pull-down menu and is adapted for displaying a menu at an arbitrary position on the screen. In the present embodiment, the pop-up menu is displayed at the lower part of the screen DPY as shown in FIG. 5. However, it may be displayed at other positions and preferably at a position not disturbing other display contents.

In this pop-up menu PUM_j of FIG. 5, too, candidate words are arrayed sequentially from a word of the highest appearance frequency. Since the pop-up menu PUM_j in this case is displayed outside of the soft keyboard SKB_j, the number of displayed candidate words may be greater than in the case of the pull-down menu PDM_j of FIG. 2. In the case of FIG. 5, candidate words of “i”, “ima”, “intahuesu”, “iru”, “ika”, “ita”, “ii”, “iu”, “itsu”, “imasu”, “idou”, “inai”, “identeki”, “ichi”, “iki”, “itsumo”, “izen”, “imi”, etc. are displayed.

In the state of the display of FIG. 5, if a menu key corresponding to a desired candidate word on the pop-up menu PUM_j is touched with the pen, the candidate word corresponding to the menu key is selected. Thus, the selected candidate word may be inputted. After the candidate word is selected, the display of the pop-up menu PUM_j is extinguished.

In addition, when the pen is released in the state of the display of FIG. 4, it is also possible to maintain the display

of the pull-down menu PDM_j of FIG. 4 and select the desired candidate word from the pull-down menu PDM_j, instead of displaying the pop-up menu PUM_j of FIG. 5.

On the other hand, if “i” is first designated as a retrieval condition as shown in FIG. 4 and the input pen (arrow A) is moved in contact with the screen DPY onto a soft key skK of “ka” as shown in FIG. 6, “ika” is designated as a retrieval condition. This designation of plural characters by moving the input pen in contact with the screen DPY is referred to as drag processing. When the reading of “ika” is thus designated as a retrieval condition by the drag processing, a set of candidate words starting with “ika” are displayed as a pull-down menu PDM_j on the screen DPY, as shown in FIG. 6.

As the pull-down menu PDM_j of FIG. 6, among words starting with “ika”, plural candidate words (for example, “ika”, “ito”, “ikari”, “igai”, “ikani”, “iga”, “ikaga”, “ikanimo”, “igai”, “ikasu”, “ikan”, “ikahonbun”, etc) are displayed sequentially from the word of the highest appearance frequency. Thus, in the embodiment of the present invention, when the input pen is moved onto another character (another soft key) while being in contact with the screen DPY, the retrieval condition and the candidate words are dynamically changed.

In the case of the display of FIG. 6, similar to the above-described case, the pull-down menu PDM_j may be displayed at a position other than the display area of the soft keyboard SKB_j (preferably at a position not disturbing other display contents).

By releasing the pen in the state of the display of FIG. 6 and selecting a menu key corresponding to a desired candidate word from the pull-down menu PDM_j, as shown in FIG. 7, input of the selected candidate word is performed. In the case of FIG. 7, a menu key mk_j displayed as “ikani” is selected from the pull-down menu PDM_j by the input pen (arrow A).

When the pen is released in the state of the display of FIG. 6, the candidate words which have been displayed in the pull-down menu PDM_j of FIG. 6 may be displayed as the pop-up menu PUM_j at the lower part of the screen DPY as shown in FIG. 5.

By procedures similar to those described above, when the drag processing is performed to designate a soft key skN of “n” without releasing the input pen from the screen DPY after a soft key of “ho” is pressed with the pen, “hon” is designated as a retrieval condition. As the reading of “hon” is thus designated as a retrieval condition, a set of candidate words starting with “hon” is displayed as a pull-down menu PDM_j on the screen DPY, as shown in FIG. 8.

As the pull-down menu PDM_j of FIG. 8, among words starting with “hon”, candidate words (for example, “hon”, “honzitsu”, “honbun”, “honronbun”, “hontai”, “hontou”, “honshitsuteki”, “honnen”, “honkou”, “honshou”, “honhat sumei”, “honshuhou”, “honhoushiki”, “honsetsu”, etc.) are displayed sequentially from the word of the highest appearance frequency. In the present embodiment, for example, a menu key displayed as “honshuhou” is selected from the pull-down menu PDM_j by the pen.

By the foregoing procedures, the character array determined at this point is “ikani honshuhou”. The character array thus determined is displayed at a position on the screen where the soft keyboard, the edit command soft keys, the pull-down menu and the pop-up menu are not displayed.

Next, on the screen DPY, a set of candidate words in the order from a word which most frequently appears immediately after the determined character array of “ikani honshu-

hou” is displayed as a pop-up menu PUM_J, as shown in FIG. 9. The set of candidate words which frequently appear immediately after the determined character array of “ikani honshuhou” includes “wa”, “wo”, “wo bunshohenshu”, “wa tanjun”, “no”, “ga”, “wo mochiite”, “to”, “wo tekiyou”, “ni”, “no kirikae”, “niyori”, “wo teian”, “wo tsukau”, “nituite”, “no yugou”, “de”, etc. These candidate words are displayed as the pop-up menu PUM_J of FIG. 9. In the present embodiment, as a menu key mkO displayed as “wo” is selected by the pen (arrow A) from the pop-up menu PUM_J in the state of the display of FIG. 9, the determined character array becomes “ikani honshuhou wo”.

As shown in FIG. 9, “wo”, “wa” and the like on the pop-up menu PUM_J are candidate words which frequently appear immediately after the determined character array of “ikani honshuhou”. Each candidate word displayed at this point is displayed as the pop-up menu PUM_J even though the user does not designate the retrieval condition as the reading by the soft keyboard SKB_J. Each candidate word may be directly selected from the candidate words displayed on the pop-up menu PUM_J by using the input pen 25.

Next, on the screen DPY, a set of candidate words in the order from a word which most frequently appears immediately after the determined character array of “ikani honshuhou wo” is displayed as a pop-up menu PUM_J, as shown in FIG. 10. The set of candidate words at this point includes “bunshohenshu”, “mochiite”, “tekiyou”, “teian”, “tsukau”, “heiyou”, “sentaku”, “sentakushi”, “mochii”, “shiyoushi”, “tsukawa”, “mochiita”, “okona”, “nyuryoku”, “yosoku”, “sakusei”, “okonau”, “zikkou”, etc. These candidate words are displayed as the pop-up menu PUM_J of FIG. 10. In the present embodiment, as a menu key mkm displayed as “mochiita” is selected by the pen (arrow A) from the pop-up menu PUM_J in the state of the display of FIG. 10, the determined character array becomes “ikani honshuhou wo mochiita”.

In the case of FIG. 10, too, the candidate words which frequently appear immediately after the determined character array “ikani honshuhou wo” are displayed as the pop-up menu PUM_J even though the user does not designate the retrieval condition as the reading by the soft keyboard SKB_J. Therefore, each candidate word may be directly selected from the candidate words displayed on the pop-up menu PUM_J by using the pen.

By the above-described procedures, the character array of “ikani honshuhou wo mochiita” may be determined.

In the text input procedures according to the present invention up to this point, it can be seen that the character array of “ikani honshuhou wo mochiita” is inputted by six operations, on the assumption that one operation includes the operation of touching the screen DPY with the pen and releasing the pen.

On the contrary, in the case where the character array of “ikani honshuhou wo mochiita” is to be inputted by using the existing pen-input computer employing the handwritten character recognition system, the total of about 40 operations are required. In the case of the pen-input computer employing the soft keyboard and the kana-kanji conversion system, at least about 20 operations are required. In the case where the character array of “ikani honshuhou wo mochiita” is to be inputted by using the conventional pen-input computer employing the soft keyboard and the kana-kanji conversion system, soft keys of “i” and “ka” are first designated and then a soft command key “Convert” for kana-kanji conversion is designated to determine the character array “ika” (i.e., three operations). Next, a soft key of “ni” is

designated and then a soft command key “Determine” is designated to determine the character “ni” (i.e., two operations). Next, soft keys of “ho” and “n” are designated and then the soft command key “Convert” is designated to determine the character “hon” (i.e., three operations). Subsequently, soft keys of “shi” and “yu” are designated and a soft command key “Character Convert” for converting the character “yu” into a small letter is designated (i.e., three operations). Next, soft keys of “ho” and “u” are designated and then the soft command key “Convert” is designated to determine the character array “shuhou” (i.e., three operations). Then, a soft key of “wo” is designated and then the soft command key “Determine” is designated to determine the character “wo” (i.e., two operations). Finally, soft keys of “mo”, “chi”, “i” and “ta” are sequentially designated and then the soft command key “Convert” is designated (i.e., five operations). Thus, input of the character array of “ikani honshuhou wo mochiita” is determined. In this manner, with the conventional pen-input computer employing the soft keyboard and the kana-kanji conversion system, the total of 21 operations (=3+2+3+3+3+2+5) are required for inputting the character array of “ikani honshuhou wo mochiita”.

FIGS. 3 to 10 show the operations and exemplary displays in the case of Japanese language input. However, in the case of English input, operations and displays as shown in FIGS. 11 to 14 are carried out. The reference numerals in FIGS. 11 to 14 correspond to those in FIGS. 3 to 10.

FIG. 11 shows an initial screen of a soft keyboard SKB_E composed of unit characters including alphabetic characters and numeric characters displayed on the screen DPY of the liquid crystal display panel 8. In the soft keyboard SKB_E, alphabetical soft keys of “A” to “Z” (including symbolic characters “(”, “)”, “#”, etc.) and general edit command soft keys SKC including “Back Space”, “Enter” and “Cancel” are provided. The edit command soft keys SKC may be displayed also in Japanese or other languages.

In this state of the initial screen, as shown in FIG. 12, if a soft key skF of “F”, for example, is pressed by the input pen (arrow A), “F” is designated as a retrieval condition (reading). When “F” is thus designated as a retrieval condition, a set of plural candidate words starting with “F” is displayed as a pull-down menu PDM_E on the screen DPY, as shown in FIG. 12.

As the pull-down menu PDME of FIG. 12, among words starting with “F”, approximately 10 candidate words from the word of the highest appearance frequency (for example, “F”, “for”, “from”, “figure”, “first”, “found”, “form”, “focus”, “feedback”, “features”, etc.) are displayed as menu items (menu keys). In the state of the display of FIG. 12, a desired candidate word is selected from the candidate words displayed as the pull-down menu PDM_E. For example, if a menu key mk_F of “first” is selected, the character “first” is determined, as shown in FIG. 13.

In the state of the display of FIG. 12, by releasing the input pen, the candidate words which have been displayed in the pull-down menu PDM_E of FIG. 12 may be displayed as a pop-up menu PUM_E at a lower part of the screen DPY, as shown in FIG. 14. In this pop-up menu PUM_E of FIG. 14, too, candidate words are arrayed sequentially from a word of the highest appearance frequency. In the pop-up menu PUM_E in FIG. 14, for example, candidate words of “F”, “for”, “from”, “figure”, “first”, “found”, “form”, “focus”, “feedback”, “features”, “further”, “following”, “four”, etc. are displayed. In the state of the display of FIG. 14, a desired candidate word is selected from the candidate words displayed in the pop-up menu PUM_E. In the case of FIG. 14, a menu key mk_F of “first” is selected.

In the above-described English input, similar to the previous case of Japanese input, English text input may be carried out by simple selection operations.

Thus, the text input method according to the present invention is not only effective for the input accompanying conversion operations (such as, hiragana-kanji conversion and alphabetic character to hiragana and kanji conversion) as in Japanese input, but also applicable to text input in a language not requiring conversion operations, such as, English, French or German. Particularly, in the text input method of the present invention, since an English word or the like is inputted by selecting the word from the plural candidate words as described above, it is anticipated that the spell check operation which is necessary for ordinary English text input becomes substantially unnecessary.

In the case where the determined text is to be corrected or erased, the edit command soft keys SKC are used.

Meanwhile, in order to effectively realize the text input method of the embodiment as described above, a word dictionary and an exemplary phrase dictionary of high quality are required.

For example, as the word dictionary used in the embodiment of the Japanese input, a format of word dictionary as shown in FIG. 15 may be considered. The word dictionary of the format shown in FIG. 15 has a list structure which includes reading (reading of a candidate word) as a first element on the left side in FIG. 15 and the candidate word as a second element on the right side in FIG. 15.

As the exemplary phrase dictionary for the Japanese language input used in the embodiment, a format of exemplary phrase dictionary as shown in FIG. 16 may be considered. The exemplary phrase dictionary of the format shown in FIG. 16 has a list structure which includes a first element indicating a determined character array as a retrieval condition on the left side in FIG. 16, the reading of a candidate word as a second element at the center of FIG. 16, and the candidate word as a third element on the right side in FIG. 16. Specifically, in the exemplary phrase dictionary shown in FIG. 16, in the case where the character array of the second element is matched with the character array immediately before the input position, the character array of the third element shown on the right side in FIG. 16 is determined as the candidate word when the retrieval condition (reading) of the first element shown on the left side of FIG. 16 is designated.

In the present embodiment, when retrieval of a candidate word is performed in response to the retrieval condition, the above-described retrieval policies may be realized simply by carrying out matching operation from the leading part of the dictionaries shown in FIGS. 15 and 16.

These dictionaries of FIGS. 15 and 16 have such structures as to allow easy retrieval of a text produced before. That is, since words and exemplary phrases selected at the time of producing a text are added to the leading parts of these dictionaries, the words and exemplary phrases added to the leading parts are preferentially displayed as candidates in the next retrieval. For example, it is easy to input a text similar to the text which is inputted immediately before.

In the case where 10 candidate words, for example, are to be displayed in the pull-down menu or pop-up menu using a word dictionary containing 22000 words, for example, 471 candidate words may be selected by selection of the reading of the first one character and selection of a menu key, and 8611 candidate words may be selected by selection of the reading of the first two characters and selection of menu keys. In the case where 10 candidate words are to be

displayed in the pull-down menu or pop-up menu, the probability that a candidate word to be selected in the exemplary phrase among the 471 candidate words will appear on the pull-down menu or pop-up menu by performing selection of the reading of the first one character and selection of the menu key is 44%, and the probability that the candidate word to be selected in the exemplary phrase among the 8611 candidate words will appear on the pull-down menu or pop-up menu by performing selection of the reading of the first two characters and selection of the menu keys is 85%. In addition, by performing selection of the reading of the first three characters and selection of the menu keys, the probability that the candidate word to be selected in the exemplary phrase will appear on the menu is increased to 97% or higher. Thus, with the retrieval processing of the candidate word in the text input method of the present embodiment, almost all candidate words required at the time of text input may be selected, simply by designating the reading of one or two characters.

However, these probabilities of appearance frequency are calculated on the assumption that predicted candidate retrieval for predicting a candidate word of the highest appearance frequency from the determined character array as described with reference to FIGS. 9 and 10 is not used. Actually, as the predicted candidate retrieval functions, the appearance frequency of the required candidate word is increased further, and in a greater number of cases, the word may be inputted without designating the reading as the retrieval condition as in the case of FIGS. 9 and 10.

In addition, in the present embodiment, different dictionaries may be used in accordance with the type and context of the text to be produced, thus enabling more effective text input. For example, input of addresses in producing a name list database is facilitated by using, as a dictionary, a place name list containing the names of places as candidate words. Also, exemplary phrases in producing a letter may be easily retrieved by using an exemplary phrase dictionary containing a set of exemplary phrases as candidate words. In the case of the dictionary of place name list, the names of places as candidate words may be easily retrieved and designated by forming a hierarchical structure in the order of, for example, prefecture, county, city, town, village, and street number.

In the above description, the dictionaries for the Japanese language input are explained. However, similar effects may be obtained in the case of the English language input. As a matter of course, the similar effect may be obtained not only in the case of the Japanese language input using the above-described soft keyboard of Japanese hiragana characters, but also in the case of the Japanese language input based on so-called Roman character input using the soft keyboard of alphabetic characters.

In the above-described Japanese language input and English input, the fuzzy retrieval is not performed. However, if there are few or no candidate words starting with the reading designated as a retrieval condition, the pen-input computer of the present embodiment performs the fuzzy retrieval. Specifically, in the Japanese language input, if the reading of "teke", for example, is designated as a retrieval condition, since there are few words starting with "teke", fuzzy retrieval using "te" and "ke" as retrieval conditions is performed. This fuzzy retrieval enables display of a word "densouken" or the like as a candidate word. In the English language input, for example, a word "pithecanthropus" may be inputted simply by designating "p", "t", "p" and "s".

Using an example of the English language input, retrieval of a correct candidate word by the fuzzy retrieval will now be described.

In the text input method of the present embodiment, two types of regular expression recognition algorithms are used together in the word dictionary in order to perform fuzzy retrieval at a high speed. For example, when a character array of "ab ca" ("ab.*cd" in regular expression) is to be retrieved, a state transition machine for recognizing this character array pattern of "ab ca" may be expressed as shown in FIG. 17. The symbol "*" may indicate any input character. In the state transition machine of FIG. 17, an initial state S0 is shifted to a next state S1 by an input character "a", and the state S1 is shifted to a state S2 by an input character "b". The state S2 is not shifted by an input character "*" but is shifted to a state S3 by an input character "c", and the state S3 is shifted to a state A by an input character "a". This state A is referred to as a final state or acceptance state, which indicates whether the input character array "ab ca" has been accepted or not. When the input characters "a", "b", "*", "c" and "a" are not provided, the states S0, S1, S2, S3 and A are extinguished.

The state transition machine expressed as in FIG. 17 may be extended to a machine allowing mismatch (wrong word/omitted word/wrong insertion) by increasing the number of states as shown in FIG. 18. Specifically, a state A0 in FIG. 18 is an acceptance state which does not allow mismatch while a state A1 is an acceptance state allowing one wrong character and a state A2 is an acceptance state allowing two wrong characters.

As a method for the fuzzy retrieval, a technique of performing pattern matching using shift operation is described in Ricardo A. Baeza-Yates and Gaston H. Connet, A new approach to text searching, Communications of the ACM, Vol.35, No.10, October 1992, pp.74-82, and Sun Wu and Udi Manber, Agrep—a fast approximate pattern—matching tool, In Proceedings of USENIX Technical Conference, San Francisco, Calif., January 1992, pp.153-162. Also, realization of the fuzzy retrieval by hardware is described in Hachiro Yamada, Kosuke Takahashi, Masaki Hirata, and Hajime Nagai, Character array retrieval LSI capable of fuzzy retrieval, Nikkei Electronics, No.422, Jun. 1, 1987, pp.165-181. In addition, the inventor of the present application has already disclosed a method of fuzzy retrieval in a paper (Information Processing Society of Japan, January 1996, pp. 13-23), etc. Therefore, the method of fuzzy retrieval will not be described in detail here. In the fuzzy retrieval, it is also possible to retrieve a candidate word by inputting several arbitrary characters in the character array in the appearing order within the character array, instead of inputting the leading character of the character array.

Hereinafter, flows of processing in the structure of FIG. 1 for realizing the specific text input as described above will be described with reference to flowcharts of FIGS. 19 to 23. The processing of these flowcharts is realized as the CPU 1 controls each constituent element and performs data processing in accordance with the text input program stored in the ROM 2. That is, the text input program stored in the ROM 2 is a program for the CPU 1 to execute the processing of the flowcharts. FIGS. 19 and 20 show an entire flow of character input processing in the pen-input computer 30 having the structure of FIG. 1. Although FIGS. 19 and 20 should be presented in one drawing, the flow is divided into two parts because of the limited space. FIGS. 21 and 22 shows a flowchart of the case where plural characters are continuously inputted as retrieval conditions in the character input processing (i.e., the drag processing). Although FIGS. 21 and 22, too, should be presented in one drawing, the flow is divided into two parts because of the limited space. FIG.

23 shows a specific flow of predicted candidate retrieval processing within the flowchart of the character input processing.

First, referring to FIG. 19, a leading character of a character array to be inputted is inputted as the retrieval condition, at step ST1. That is, from among the soft keys of the respective characters on the soft keyboard, the reading of the leading character is inputted by the input pen 25 for designating the retrieval condition, as described above.

When the input of the leading character is done, the CPU 1 stores data of this input character into an undetermined character array buffer provided within the RAM 3 of FIG. 1, at step ST2, and clears a buffer for storing a set of candidate words (hereinafter referred to as candidate set buffer) provided within the RAM 3, at step ST3. The undetermined character array buffer is a buffer in which a character array designated as a retrieval condition is stored. The retrieval condition is constituted by not only one character but also a character array of two or more characters. Since the character array is not determined until the candidate word is selected, in this embodiment, the buffer for storing the character array designated as the retrieval condition is referred to as the undetermined character array buffer.

At step ST4, the CPU 1 performs retrieval of candidate words having a character (or character array) stored in the undetermined character array buffer as a leading character (or character array) from the word dictionary. Such retrieval using the leading character (or character array) as a keyword is referred to as forward coincidence retrieval. At step ST5, the CPU 1 stores the candidate words obtained by forward coincidence retrieval of the word dictionary at step ST4, into the candidate set buffer.

At step ST6, the CPU 1 judges whether or not the number of retrieved candidate words is smaller than a predetermined number N. This number N corresponds to the number which may be displayed on the screen DPY as described above, for example, the number of candidate words displayed as the pull-down menu PDM or the pop-up menu PUM. If it is judged at step ST6 that the number of candidate words is N or greater (i.e., NO), the operation proceeds to step ST9 as later described. If it is judged that the number of candidate words is smaller than N (i.e., YES), the operation proceeds to step ST7.

At step ST7, since the number of retrieved candidate words is still smaller than the number N which may be displayed on the screen DPY, further retrieval of candidate words from the word dictionary is performed. The retrieval in this case is the fuzzy retrieval. The number of candidate words retrieved by the fuzzy retrieval may be the number defining the number which may be displayed on the screen DPY, together with the number of previously retrieved candidate words. After the fuzzy retrieval of step ST7, at step ST8, the CPU 1 adds the obtained retrieval results (the set of candidate words) to the candidate set buffer. At step ST9, the CPU 1 reads out the set of candidate words stored in the candidate set buffer and displays the candidate words as a menu (the pull-down menu or the pop-up menu) on the liquid crystal display panel 8.

At step ST10, the CPU 1 judges whether there is input of an additional character or not, that is, whether or not one character (reading) to be added as a retrieval condition is newly inputted by the input pen 25, or whether or not a character array is inputted by the drag processing. If there is input of an additional character at step ST10 (i.e., YES), the operation returns to step ST2, where the added character is added to the character (or character array) previously stored

in the undetermined character array buffer and is stored in the undetermined character array buffer. After that, the processing from step ST3 to step ST10 is similarly performed, using the character array stored in the undetermined character array buffer as the retrieval condition. Similar processing is performed when there is further input of an additional character at step ST10.

If it is judged that there is no input of an additional character at step ST10, the CPU 1 judges at step ST11 whether the candidate word has been determined or not, that is, whether or not the correct candidate word has been selected from the pull-down menu or the pop-up menu displayed on the screen DPY. If the candidate word has not been determined at step ST11 (i.e., NO), the operation returns to step ST10. If the candidate word has been determined (i.e., YES), the operation proceeds to step ST12.

As the candidate word has been determined, the CPU 1 clears the undetermined character array buffer at step ST12 in order to proceed to the next character input processing. Then, the CPU 1 performs the processing of step ST21 and subsequent steps in FIG. 20. Since the input of at least one word has already been determined by the processing of the flowchart of FIG. 19, predicted candidate retrieval for predicting a candidate word which should follow the determined word (for example, a candidate word having the highest appearance frequency) is performed on the basis of the determined word (character array), at step ST21 of FIG. 20. As a set of candidate words is obtained by the predicted candidate retrieval, the CPU 1 displays the set of candidate words on the liquid crystal display panel 8 at step ST22.

At step ST23, the CPU 1 judges whether there is input of an additional character or not, that is, whether or not one character to be added as a retrieval condition is newly inputted by the input pen 25, or whether or not a character array is inputted by the drag processing.

If there is input of an additional character at step ST23 (i.e., YES), the newly added character is added to the character (or character array) stored in the undetermined character array buffer and is stored in the undetermined character array buffer at step ST27. After that, the processing from step ST21 to step ST23 is performed similarly, using the character array stored in the undetermined character array buffer as the retrieval condition. Similar processing is performed when there is further input of an additional character at step ST23.

If it is judged that there is no input of an additional character at step ST23, the CPU 1 judges at step ST24 whether determination of the candidate word has been completed or not, that is, whether or not the correct candidate word has been selected from the pull-down menu PDM or the pop-up menu PUM displayed on the screen DPY. If it is judged at step ST24 that the candidate word has not been determined (i.e., NO), the operation returns to step ST23. If the candidate word has been determined (i.e., YES), the operation proceeds to step ST25.

The CPU 1 clears the undetermined character array buffer at step ST25, and then proceeds to step ST26. At step ST26, the CPU 1 judges whether input of one text has been completed or not. If it is judged at step ST26 that the input has not been completed (i.e., NO), the operation returns to step ST21 and the processing from step ST21 to step ST26 is repeated until it is judged at step ST26 that the input has been completed. When it is judged at step ST26 that the input has been completed (i.e., YES), the character input processing ends.

Referring to FIGS. 21 and 22, the flow of the drag processing is hereinafter described.

First, in FIG. 21, the CPU 1 judges at step ST31 whether or not the input pen 25 is located on the screen DPY of the liquid crystal display panel 8, that is, on the soft keyboard SKBJ (more specifically, whether or not the input pen 25 is located on the pressure-sensitive tablet 9 corresponding to the character soft key sk on the soft keyboard SKBJ). If it is judged at this step ST31 that the input pen 25 is located on the character soft key sk (i.e., YES), the operation proceeds to step ST32. If it is judged that the input pen 25 is not located on the character soft key sk (i.e., NO), the operation proceeds to step ST39.

As it is judged at step ST31 that the input pen 25 is located on the character soft key sk, the CPU 1 judges at step ST32 whether the input pen 25 has been released from the screen DPY or not (more specifically, whether the input pen 25 has been released from the pressure-sensitive tablet 9 or not). If it is judged that the input pen has not been released, the operation proceeds to step ST33. If it is judged that the input pen has been released, the operation proceeds to step ST51 of FIG. 22.

When it is judged at step ST32 that the input pen 25 has not been released from the screen DPY, the CPU 1 judges at step ST33 whether or not a predetermined time has lapsed since the input pen 25 was put on the same character soft key sk. If it is judged at step ST33 that the predetermined time has not lapsed, the operation returns to step ST31. If it is judged that the predetermined time has lapsed, the operation proceeds to step ST35.

As it is judged at step ST33 that the predetermined time has lapsed since the input pen 25 was put on the same character soft key sk, the CPU 1 selects the character of that soft key sk as an input character, at step ST35. At step ST36, the CPU 1 stores the character into the undetermined character array buffer (or adds this character if any character has already been stored).

At step ST37, the CPU 1 performs candidate word retrieval processing using the character array stored in the undetermined character array buffer. In addition, at step ST38, the CPU 1 displays a set of candidate words obtained by the retrieval onto the screen DPY. The display position of the set of candidate words is set near the character soft key on which the input pen 25 is located, as in the above-described pull-down menu PDM. After the processing of step ST38 is completed, the operation returns to step ST31.

On the other hand, if it is judged at step ST31 that the input pen 25 is not located on the character soft key sk, the CPU 1 judges at step ST39 whether or not the input pen 25 is located on the pull-down menu PDM or the pop-up menu PUM in which the set of candidate words is displayed (more specifically, whether or not the input pen 25 is in contact with the pressure-sensitive tablet 9 corresponding to the menu key mk displaying the candidate word on the menu). If it is judged at step ST39 that the input pen 25 is located on the menu key mk, the operation proceeds to step ST40. If it is judged that the input pen 25 is not located on the menu key mk, the operation proceeds to step ST42.

As it is judged at step ST39 that the input pen 25 is located on the menu key mk, the CPU 1 judges at step ST40 whether or not the input pen 25 has been released from the screen DPY. If it is judged that the input pen has been released, the operation proceeds step ST41. If it is judged that the input pen has not been released, the operation returns to step ST31.

When it is judged at step ST40 that the input pen 25 has been released from the screen DPY, the CPU 1 assumes that selection of the candidate word is completed at step ST41 and ends the drag processing.

On the other hand, when it is judged at step ST39 that the input pen 25 is not located on the menu key mk, the CPU 1 judges at step ST42 whether or not the input pen 25 has been released from the screen DPY. If it is judged that the input pen has been released, the operation proceeds to step ST53 of FIG. 22. If it is judged that the input pen has not been released, the operation returns to step ST31.

Moreover, when it is judged at step ST32 that the input pen 25 has been released from the screen DPY, the CPU 1 selects the character on the character soft key sk as an input character at step ST51 of FIG. 22. At the next step ST52, the CPU 1 stores that character into the undetermined character array buffer (or adds that character if any character has already been stored).

After that, the operation of the CPU 1 proceeds to step ST53. Also in the case where judgment YES is made at step ST42 of FIG. 21, the operation proceeds to this step ST53.

At step ST53, the CPU 1 judges whether or not a character array as the retrieval condition is stored in the undetermined character array buffer. If it is judged that the character array is not stored, the drag processing ends. If it is judged that the character array is stored, the operation proceeds to step ST54.

At step ST54, the CPU 1 performs candidate word retrieval using the character array stored in the undetermined character array buffer. At step ST55, the CPU 1 displays a set of candidate words obtained by the retrieval, in a menu, and then ends the drag processing.

The flow of predicted candidate retrieval processing at step ST21 of FIG. 20 is hereinafter described with reference to the flowchart of FIG. 23.

In FIG. 23, the CPU 1 first clears the candidate set buffer at step ST61, and performs retrieval of the above-described exemplary phrase dictionary at the next step ST62. After the retrieval of the exemplary phrase dictionary, the CPU 1 stores candidate words obtained by the retrieval into the candidate set buffer (or adds the candidate words if any candidate word has already been stored), at step ST63.

At step ST64, the CPU 1 judges whether the number of retrieved candidate words is smaller than the predetermined number N or not. If it is judged at step ST64 that the number of candidate words is N or greater, the predicted candidate retrieval processing ends. If it is judged that the number of candidate words is smaller than N, the operation proceeds to step ST65.

At step ST65, the CPU 1 performs the forward coincidence retrieval of the word dictionary. At the next step ST66, the CPU 1 stores candidate words obtained by the retrieval into the candidate set buffer (or adds the candidate words if any candidate word has already been stored).

After that, at step ST67, the CPU 1 judges again whether the number of retrieved candidate words is smaller than the predetermined number N or not. If it is judged at step ST67 that the number of candidate words is N or greater, the predicted candidate retrieval processing ends. If it is judged that the number of candidate words is smaller than N, the operation proceeds to step ST68.

At step ST68, the CPU 1 performs the fuzzy retrieval of the word dictionary. At the next step ST69, the CPU 1 stores candidate words obtained by the retrieval into the candidate set buffer (or adds the candidate words if any candidate word has already been stored). Thus, the predicted candidate retrieval processing ends.

Next, results of measurement of text input time and operability test at the time of portable use, using the pen-

input computer realizing the above-described text input method of the present embodiment will be described in comparison with the text input using the conventional pen-input computer.

FIG. 24 shows the results of measurement of the time required for inputting an exemplary phrase composed of 128 characters, using the pen-input computer of the present embodiment and the existing pen-input computer. The results are obtained on the assumption of the same testee.

From FIG. 24, it is understood that the pen-input computer of the embodiment to which the text input method of the present invention is applied enables input of the exemplary phrase of 128 characters in 120 seconds (64 characters/minute). On the contrary, with the existing pen-input computer, the input of the exemplary phrase of 128 characters takes at least 260 seconds (30 characters/minute) and 320 seconds (24 characters/minute) in the worst case. From these results, it is understood that the pen-input computer of the present embodiment achieves a significantly higher text input speed than the existing pen-input computer.

Also, the pen-input computer enables easy text input and editing even in a shaky environment as in a moving train and even though the user is standing in the train, while input by the existing pen-input computer for handwritten input is difficult in a shaky environment as in a moving train.

Thus, the pen-input computer of the present embodiment realizes the high-speed text input method with the pen utilizing dynamic retrieval of candidate words and prediction from exemplary phrases.

Referring to FIGS. 25 to 31, the word finding rate and the finding speed at the time of candidate retrieval in the pen-input computer of the embodiment of the present invention will now be described briefly.

FIGS. 25 to 29 show the relations between the number of pen operating times i ($i=0, 1, 2, 3, 4, 5$), the number of candidates displayed in the menu on the screen, and the probability that a desired word will exist in the menu in the case where text input is performed. FIG. 25 illustrates the case where English language input is performed. FIG. 26 illustrates the case where Japanese language input is performed. FIG. 27 illustrates the case where English language input is performed while predicted candidate retrieval is not performed. FIG. 28 illustrates the case where English language input is performed while predicted candidate retrieval is performed. FIG. 29 illustrates the case where English language input is performed while predicted candidate retrieval and adaptive retrieval using the dictionary are performed. From FIGS. 25 to 29, it is understood that a desired candidate word may be found with a small number of pen operating times and may be found more easily by predicted candidate retrieval and the like.

FIGS. 30 and 31 shows the relation between the number of pen operating times i ($i=1, 2, 3, 4, 5$), the number of candidates displayed in the menu on the screen, and the time until a desired candidate word is selected from the menu display and determined. FIG. 30 illustrates the case where predicted candidate retrieval is not performed. FIG. 31 illustrates the case where predicted candidate retrieval is performed. From FIGS. 30 and 31, it is understood that a desired candidate word may be found with a small number of pen operating times and may be found more easily by predicted candidate retrieval and the like.

Finally, FIG. 32 shows the schematic structure of a computer 100 for realizing the text input method according to the present invention by using a so-called mouse or hardware keyboard. In FIG. 32, constituent elements similar

to those of FIG. 1 are denoted by the same reference numerals and will not be described further in detail.

In the structure of FIG. 32, as means for performing designation of the retrieval condition and selection of the candidate word, a mouse or keyboard 109 and an interface circuit 110 with the computer body are provided in place of the pressure-sensitive tablet 9 and the analog/digital converter 10 of FIG. 1, and a display drive circuit 107 and a display device 108 are used in place of the liquid crystal drive circuit 7 and the liquid crystal display panel 8 of FIG. 1. The display device 108 is a cathode ray tube which is often used for a desk-top computer, or a liquid crystal display used for a portable computer. Therefore, the drive circuit 107 and the display device 108 of the structure of FIG. 32 need not necessarily replace but may be the same as the liquid crystal drive circuit 7 and the liquid crystal display panel 8 of FIG. 1.

In the structure of FIG. 32, in the case where the mouse is used, a soft keyboard and edit command soft keys similar to those described above are displayed on the display device 108, and a cursor as an indication mark operated by the mouse is also displayed. Thus, by shifting the mouse cursor onto a desired soft key of the soft keyboard and clicking the mouse there, designation of the soft key, that is, designation of the retrieval condition may be performed. Similarly, in the case of candidate word selection, selection of a desired candidate word may be realized by shifting the mouse cursor onto a desired menu key and clicking the mouse there.

In addition, in the structure of FIG. 32, in the case where the hardware keyboard is used, the hardware keyboard operates as the soft keyboard so that designation of the retrieval condition may be performed by operating the keys on the hardware keyboard. When the retrieval condition is thus designated, for example, a menu for displaying the candidate words is displayed on the screen. To select a desired candidate word from the menu, the mouse cursor or the cursor shift keys provided on the hardware keyboard are operated to shift the cursor onto the desired candidate word and selection of the candidate word is executed by a determination key (return key), for example. In the case where hardware structure keys which are the same as the edit command soft keys are provided on the hardware keyboard, the keys are used to perform editing or the like.

With the structure of FIG. 32, too, effects similar to those in the embodiment of FIG. 1 may be obtained.

As a matter of course, the present invention may be applied to a pen-input computer for so-called handwritten input. In the case of handwritten input, a handwritten input area is provided on the screen of the pen-input computer so that which character is indicated by a gesture drawn in the area is recognized, thus performing designation of the retrieval condition and selection of the candidate word, similar to those described above, in accordance with the recognition results.

As is clear from the above description, the present invention provides the text input device and method suitable for a pen-input computer based on retrieval and prediction of characters, words, and sentences, etc. By repeating the operation of selecting a word from a set of candidate words which are selectively collected by partial designation of reading and prediction from a character array immediately

before the input position, the present invention enables text input at a high speed which is twice or more of the speed of the conventional character input method based on handwritten character recognition and kana-kanji conversion.

What is claimed is:

1. A text input device comprising:

display means capable of displaying a virtual keyboard having at least a plurality of keys for character input; input means for pointing at least each key on the virtual keyboard to perform key input by the virtual keyboard; dictionary storage means storing a plurality of candidate words and a plurality of exemplary phrases; and retrieval means for retrieving a plurality of candidate words from the dictionary storage means, using the key input performed from the virtual keyboard by the input means as a retrieval condition;

the retrieval condition and the candidate words being dynamically changed in accordance with a change in a key input operation state of the virtual keyboard by the input means.

2. The text input device as claimed in claim 1, wherein when the same key on the virtual keyboard is continuously pointed by the input means for a predetermined time, the retrieval means performs retrieval using the pointed key input as the retrieval condition.

3. The text input device as claimed in claim 1, wherein when two or more keys on the virtual keyboard are pointed in a continuous key input operation state by the input means, the retrieval means performs retrieval using the pointed two or more key inputs as the retrieval condition.

4. The text input device as claimed in claim 1, wherein the plurality of candidate words retrieved by the retrieval means are displayed as menu items on the display means, and

a desired candidate word is selected by the input means from the plurality of candidate words displayed as the menu items on the display means, thereby performing text input.

5. The text input device as claimed in claim 4, wherein the retrieval means retrieves the plurality of candidate words to be displayed as the menu items on the display means from the dictionary storage means on the basis of the input from the input means and/or an already determined character array.

6. The text input device as claimed in claim 5, wherein the retrieval means predicts and retrieves a plurality of candidate words appearing subsequently to the already determined character array.

7. The text input device as claimed in claim 6, wherein the retrieval means predicts and retrieves the plurality of candidate words sequentially from a candidate word having the highest frequency of appearing subsequently to the already determined character array.

8. The text input device as claimed in claim 6, wherein the retrieval means retrieves the plurality of candidate words to be predicted and retrieved, sequentially from a candidate word selected in the temporally nearest past.

9. The text input device as claimed in claim 4, wherein the input means has coordinate position corresponding means for causing a physical coordinate position on the display means to correspond to a display coordinate position on the display means, and coordinate position input means for inputting the physical coordinate position to the coordinate position corresponding means,

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the physical coordinate position being inputted, thereby indicating the display coordinate position of each of the keys on the virtual keyboard displayed on the display means and the display coordinate position of each of the menu items displayed on the display means.

10. The text input device as claimed in claim 9, wherein the coordinate position corresponding means is a pressure-sensitive tablet for causing the physical coordinate position to correspond to the display coordinate position, and the coordinate position input means is an input pen for inputting the coordinate position to the pressure-sensitive tablet.

11. The text input device as claimed in claim 1, wherein the retrieval means retrieves from the dictionary storage means a plurality of candidate words having a key input character inputted from the virtual keyboard by the input means as a leading character.

12. The text input device as claimed in claim 11, wherein the retrieval means retrieves the plurality of candidate words having the key input character inputted from the virtual keyboard by the input means as the leading character, sequentially from a candidate word having the highest appearance frequency.

13. The text input device as claimed in claim 11, wherein the retrieval means retrieves the plurality of candidate words having the key input character inputted from the virtual keyboard by the input means as the leading character, sequentially from a candidate word selected in the temporally nearest past.

14. The text input device as claimed in claim 1, wherein the retrieval means retrieves from the dictionary storage means a plurality of candidate words, each containing a plurality of key input characters inputted from the virtual keyboard by the input means as constituent elements.

15. The text input device as claimed in claim 14, wherein the retrieval means retrieves the plurality of candidate words, each containing the plurality of key input characters sequentially inputted from the virtual keyboard by the input means as constituent elements in the order of the input.

16. The text input device as claimed in claim 14, wherein the retrieval means retrieves the plurality of candidate words, each containing the plurality of key input characters inputted from the virtual keyboard by the input means, sequentially from a candidate word having the highest appearance frequency.

17. The text input device as claimed in claim 14, wherein the retrieval means retrieves the plurality of candidate words, each containing the plurality of key input characters inputted from the virtual keyboard by the input means, sequentially from a candidate word selected in the temporally nearest past.

18. A text input method comprising:

a display step of displaying a virtual keyboard having at least a plurality of keys for character input;

an input step of pointing at least each key on the virtual keyboard to perform key input by the virtual keyboard; and

a retrieval step of retrieving a plurality of candidate words from a dictionary storing a plurality of candidate words and a plurality of exemplary phrases, using the key input performed from the virtual keyboard at the input step as a retrieval condition;

the retrieval condition and the candidate words being dynamically changed in accordance with a change in a key input operation state of the virtual keyboard at the input step.

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19. The text input method as claimed in claim 18, wherein when the same key on the virtual keyboard is continuously pointed for a predetermined time at the input step, retrieval is performed using the pointed key input as the retrieval condition.

20. The text input method as claimed in claim 18, wherein when two or more keys on the virtual keyboard are pointed in a continuous key input operation state at the input step, retrieval is performed using the pointed two or more key inputs as the retrieval condition.

21. The text input method as claimed in claim 18, wherein the plurality of candidate words retrieved at the retrieval step are displayed as menu items at the display step, and

a desired candidate word is selected at the input step from the plurality of candidate words displayed as the menu items at the display step, thereby performing text input.

22. The text input method as claimed in claim 21, wherein at the retrieval step, the plurality of candidate words to be displayed as the menu items at the display step are retrieved from the dictionary on the basis of the input by the input step and/or an already determined character array.

23. The text input method as claimed in claim 22, wherein at the retrieval step, a plurality of candidate words appearing subsequently to the already determined character array are predicted and retrieved.

24. The text input method as claimed in claim 23, wherein at the retrieval step, the plurality of candidate words are predicted and retrieved sequentially from a candidate word having the highest frequency of appearing subsequently to the already determined character array.

25. The text input method as claimed in claim 23, wherein at the retrieval step, the plurality of candidate words to be predicted and retrieved are retrieved sequentially from a candidate word selected in the temporally nearest past.

26. The text input method as claimed in claim 21, wherein at the input step, a display coordinate position of each of the keys on the virtual keyboard displayed at the display step and a display coordinate position of each of the menu items displayed at the display step are indicated.

27. The text input method as claimed in claim 21, wherein at the retrieval step, a plurality of candidate words having a key input character inputted from the virtual keyboard at the input step as a leading character are retrieved from the dictionary.

28. The text input method as claimed in claim 27, wherein at the retrieval step, the plurality of candidate words having the key input character inputted from the virtual keyboard at the input step as the leading character are retrieved sequentially from a candidate word having the highest appearance frequency.

29. The text input method as claimed in claim 27, wherein at the retrieval step, the plurality of candidate words having the key input character inputted from the virtual keyboard at the input step as the leading character are retrieved sequentially from a candidate word selected in the temporally nearest past.

30. The text input method as claimed in claim 21, wherein at the retrieval step, a plurality of candidate words, each

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containing a plurality of key input characters inputted from the virtual keyboard at the input step as constituent elements, are retrieved from the dictionary.

31. The text input method as claimed in claim **30**, wherein at the retrieval step, the plurality of candidate words, each containing the plurality of key input characters sequentially inputted from the virtual keyboard at the input step as constituent elements in the order of the input, are retrieved.

32. The text input method as claimed in claim **30**, wherein at the retrieval step, the plurality of candidate words, each containing the plurality of key input characters inputted

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from the virtual keyboard at the input step, are retrieved sequentially from a candidate word having the highest appearance frequency.

33. The text input method as claimed in claim **30**, wherein at the retrieval step, the plurality of candidate words, each containing the plurality of key input characters inputted from the virtual keyboard at the input step, are retrieved sequentially from a candidate word selected in the temporally nearest past.

* * * * *

Exhibit F



US006070068A

United States Patent [19] Sudo

[11] Patent Number: **6,070,068**
[45] Date of Patent: **May 30, 2000**

[54] **COMMUNICATION TERMINAL DEVICE AND METHOD FOR CONTROLLING A CONNECTING STATE OF A CALL INTO A DESIRED CONNECTION STATE UPON A PREDETERMINED OPERATION BY A USER**

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[73] Assignee: **Sony Corporation**, Tokyo, Japan

[21] Appl. No.: **08/818,564**

[22] Filed: **Mar. 14, 1997**

[30] Foreign Application Priority Data

Mar. 19, 1996 [JP] Japan 8-090079

[51] Int. Cl.⁷ **H04Q 7/32**

[52] U.S. Cl. **455/414; 455/422; 379/142**

[58] Field of Search 455/566, 415;
379/201, 204, 205, 215, 213, 428, 433,
915

[56] References Cited

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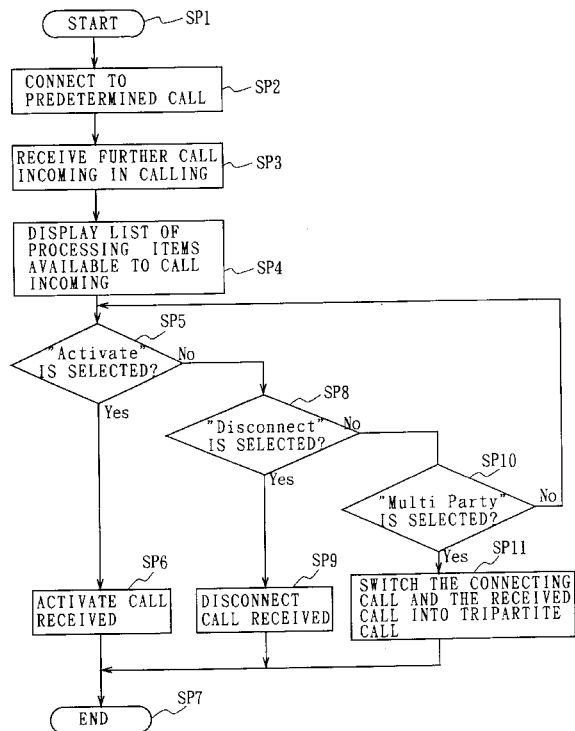
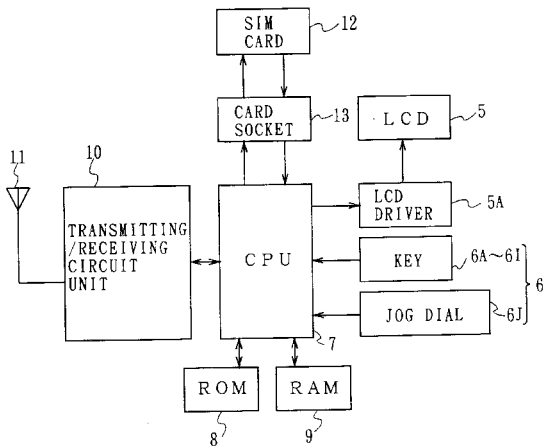
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Primary Examiner—William Cumming
Attorney, Agent, or Firm—Jay H. Maioli

[57] ABSTRACT

In a communication terminal device, the connecting state of a call can certainly and easily be controlled without learning troublesome operating methods which are different depending on the connecting state of a call by providing controller for displaying processing items available to a call a display and controlling the call into the connecting state corresponding to the processing item which is selected and determined by the user's operation of an input unit, the user can control the connecting state of the call by merely selecting the desired processing item.

32 Claims, 10 Drawing Sheets



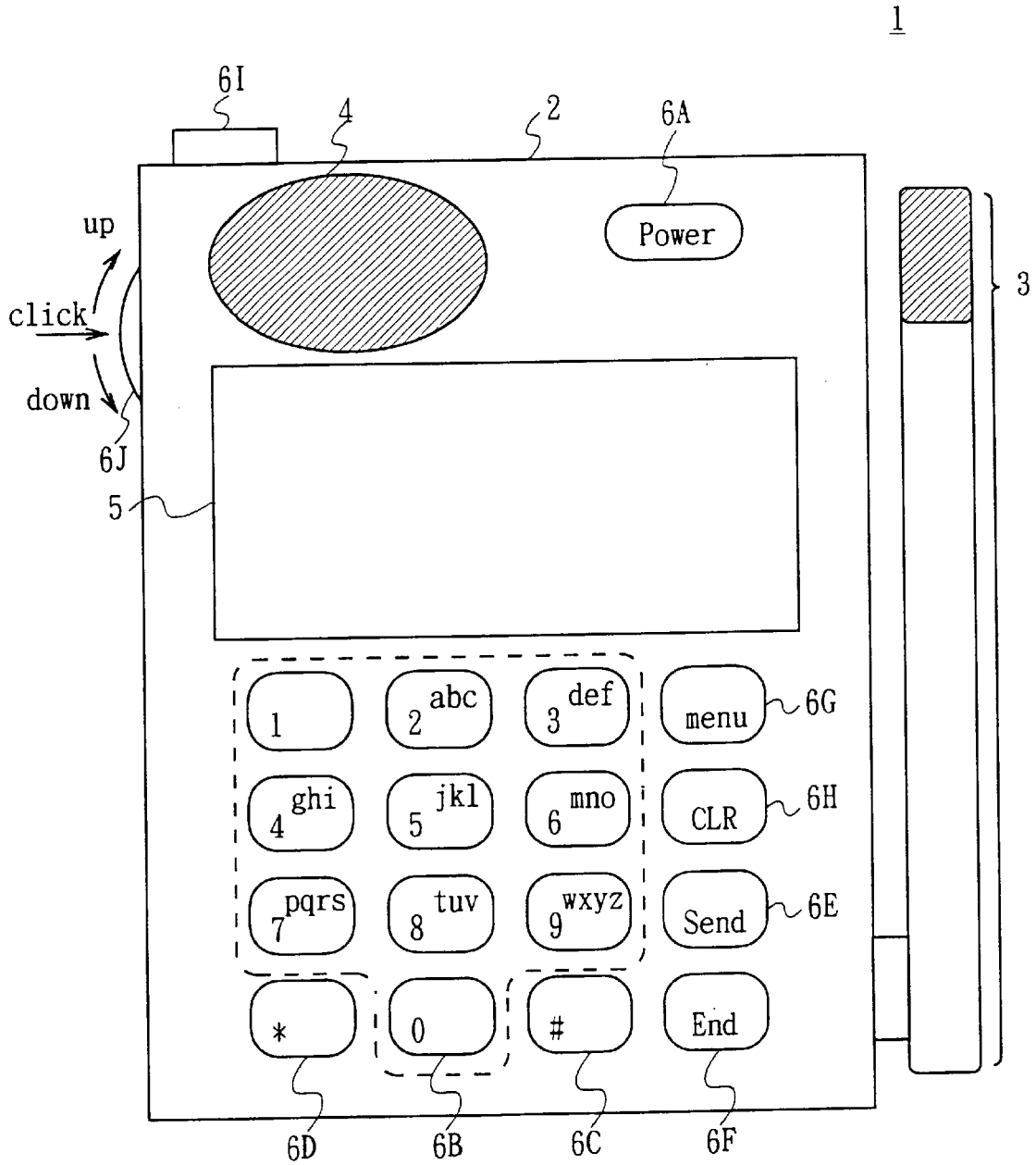


FIG. 1

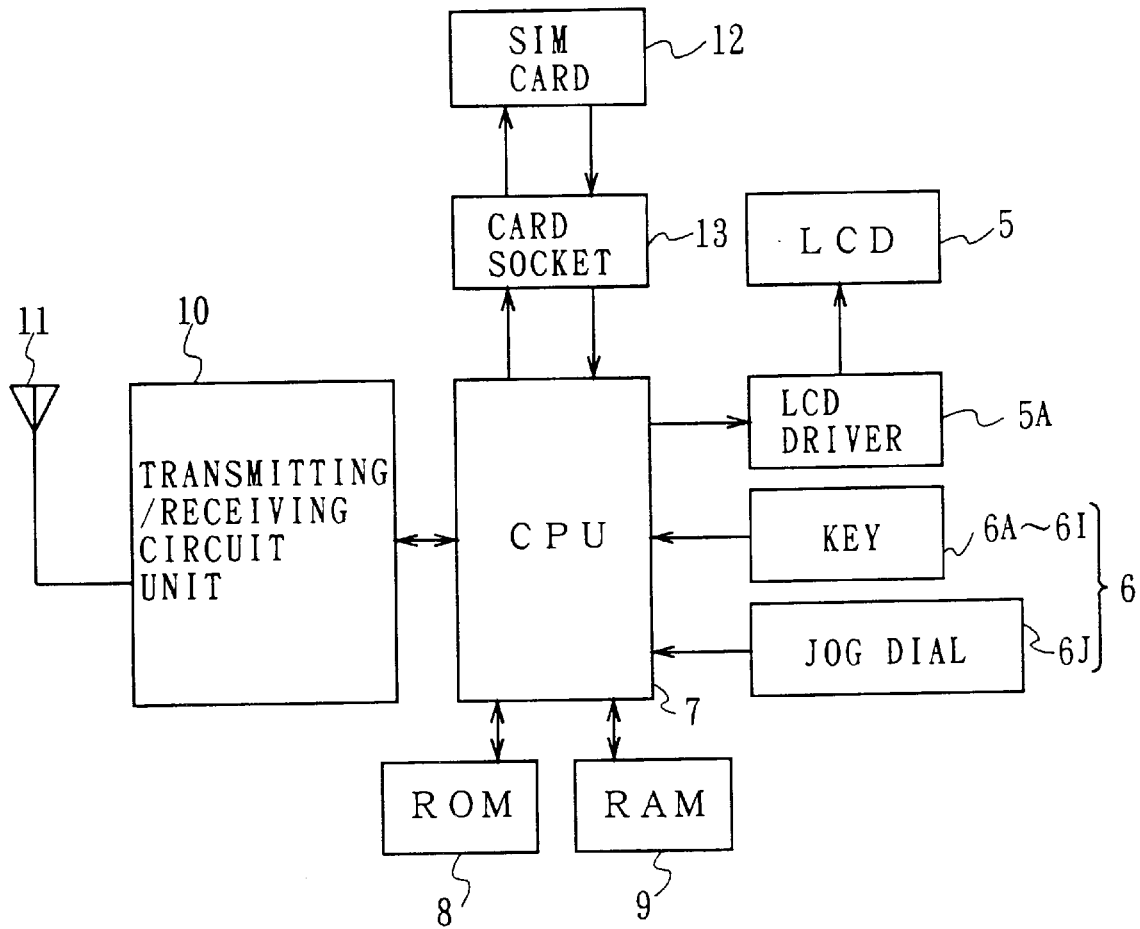
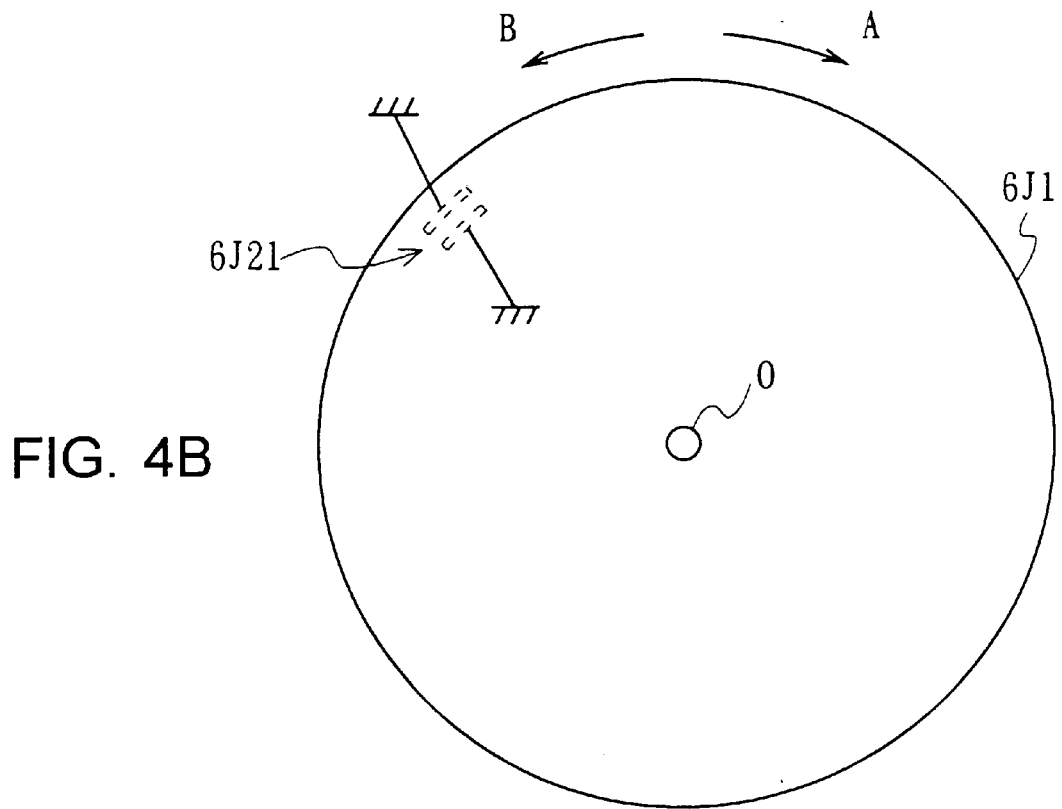
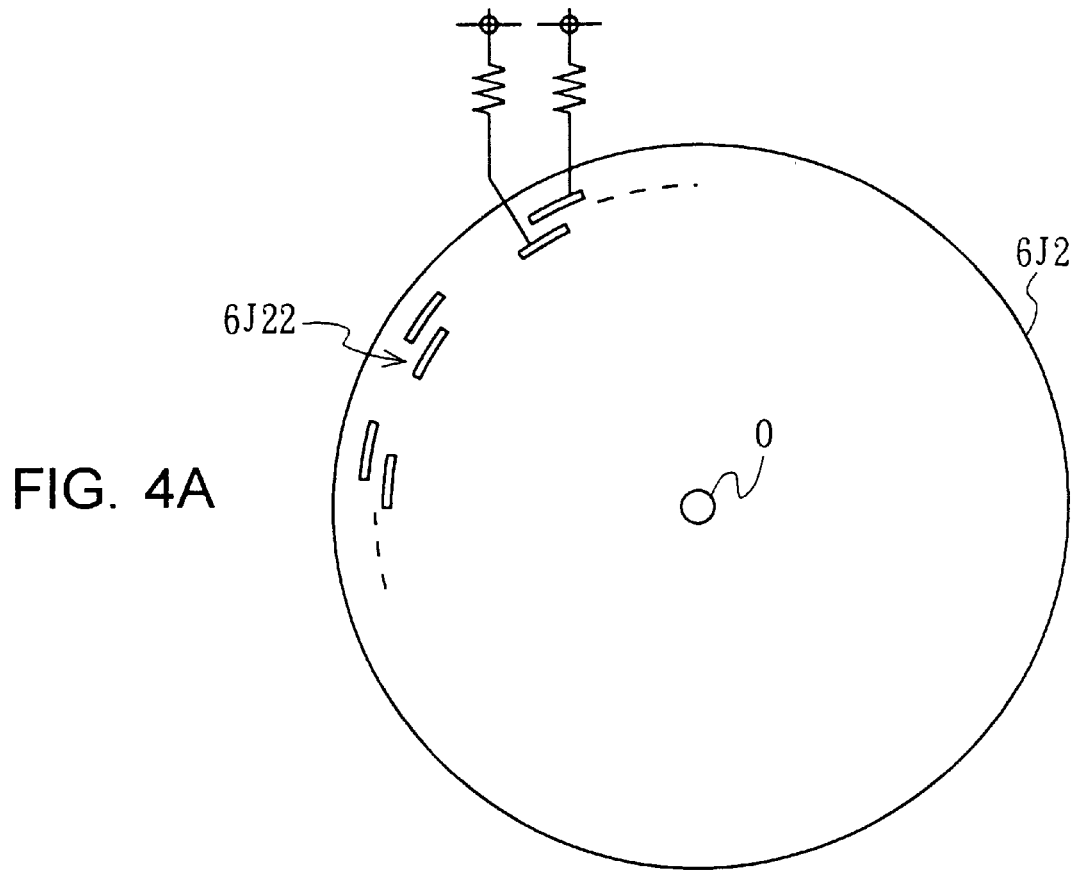


FIG. 2



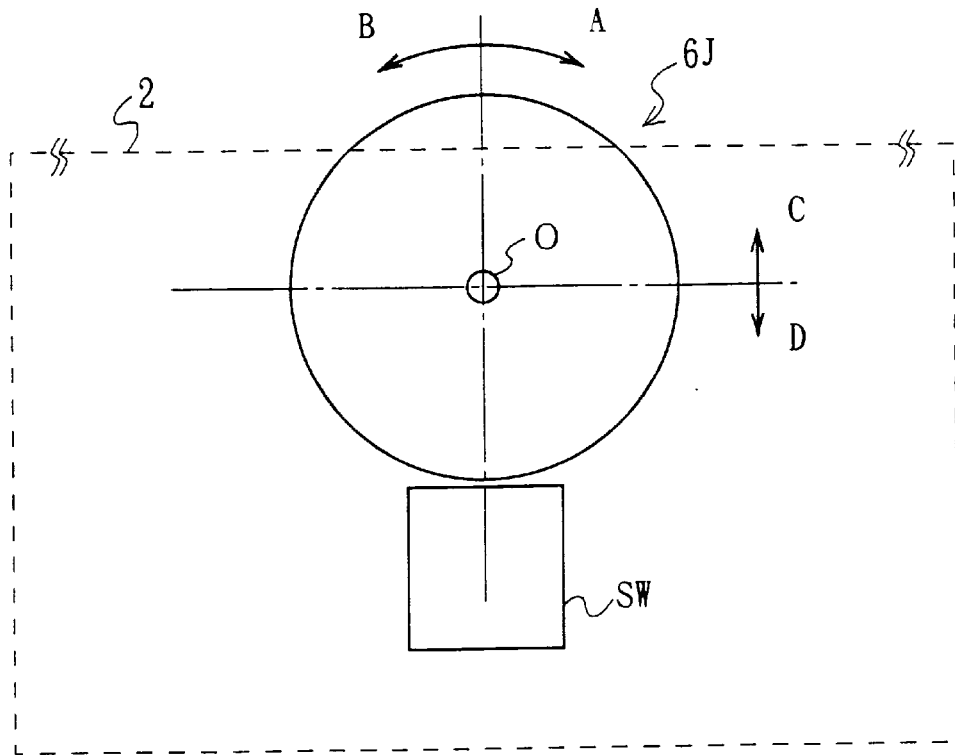


FIG. 3

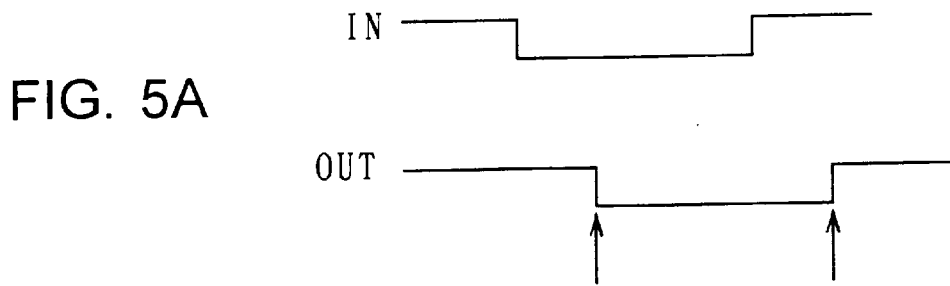


FIG. 5A

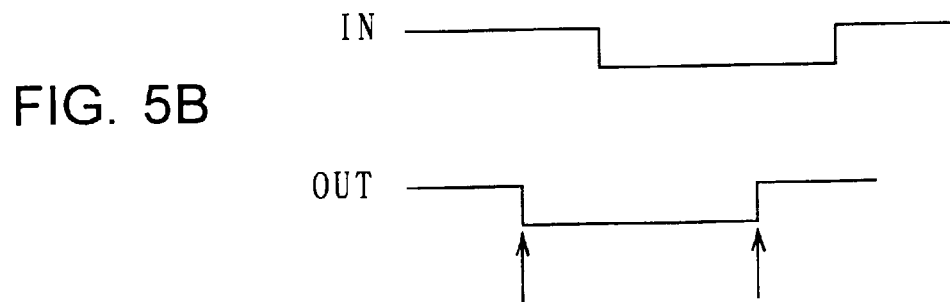


FIG. 5B

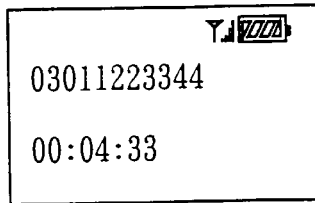


FIG. 6A ↓ CALL INCOMING

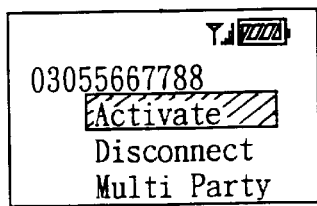


FIG. 6B ↓ CLICK

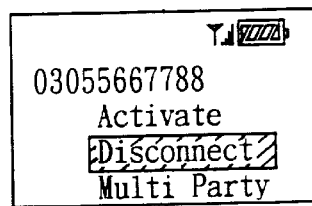


FIG. 6D ↓ CLICK

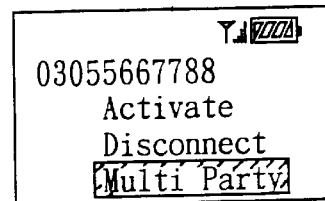


FIG. 6F ↓ CLICK

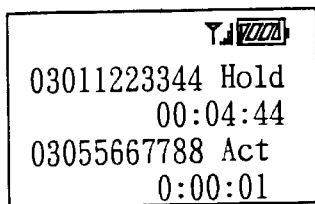


FIG. 6C

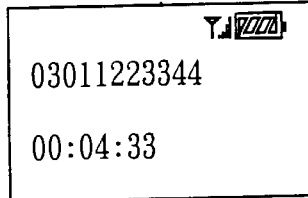


FIG. 6E

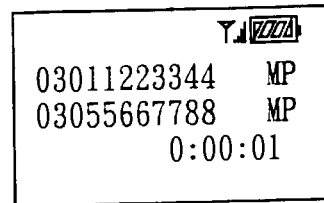


FIG. 6G

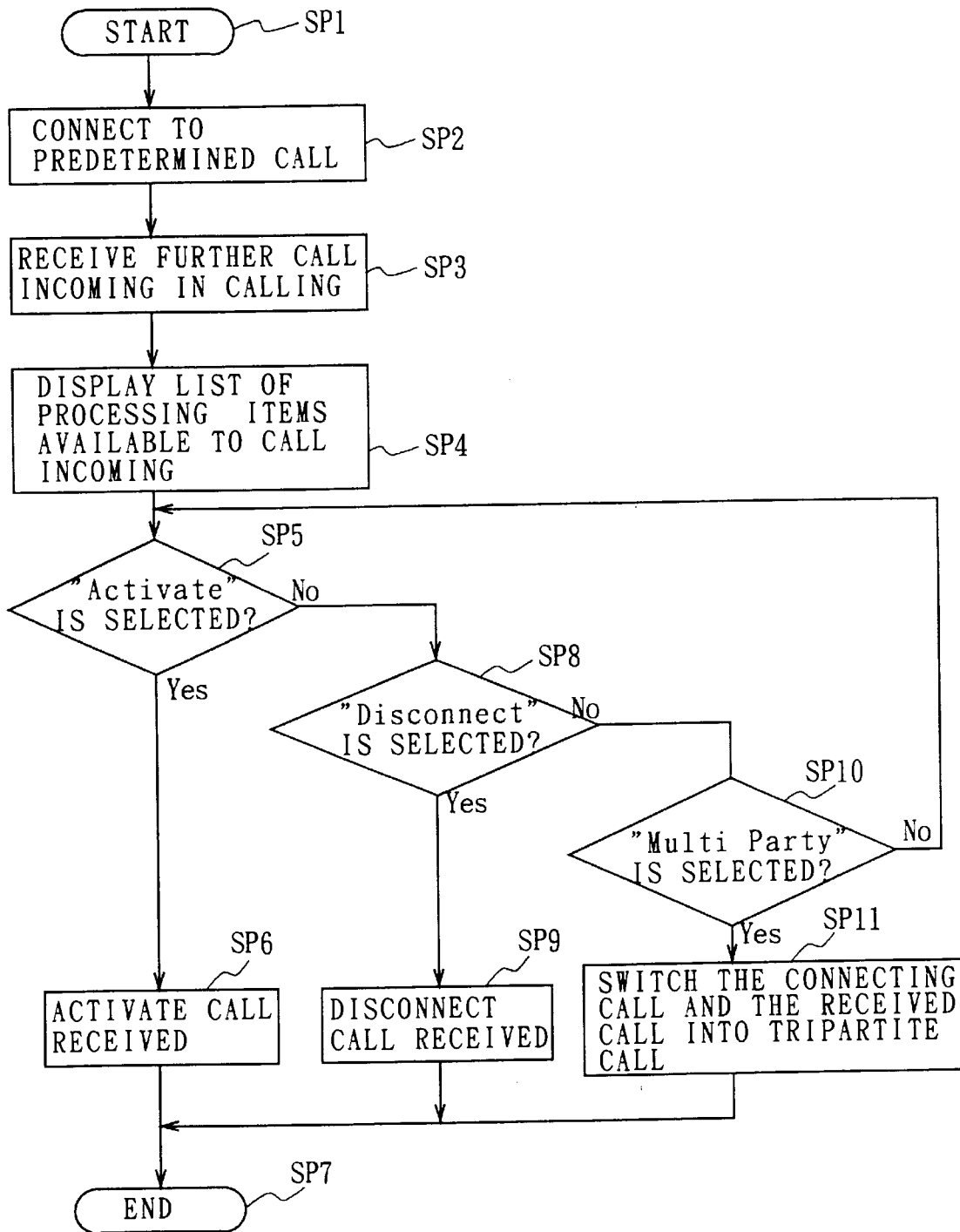
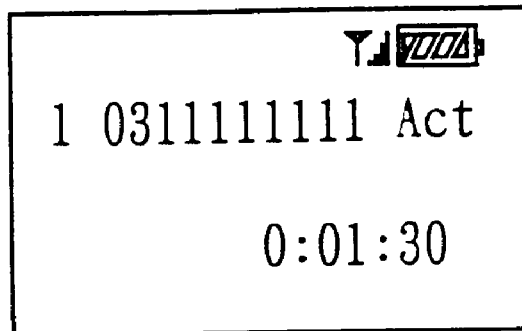


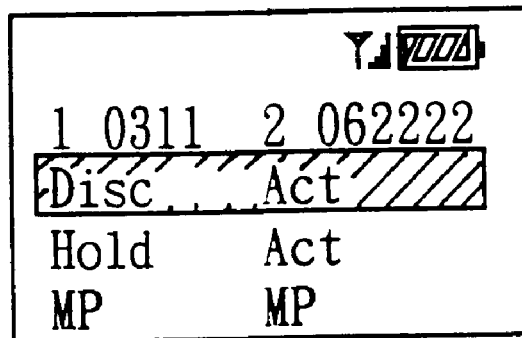
FIG. 7

FIG. 8A



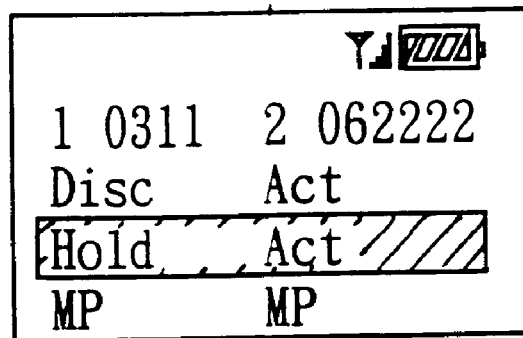
↓ CALL INCOMING

FIG. 8B



↓ DOWN

FIG. 8C



↓ CLICK

FIG. 8D

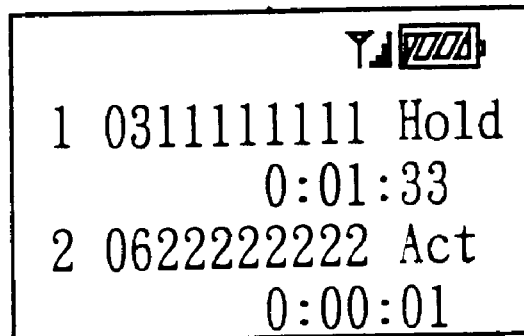
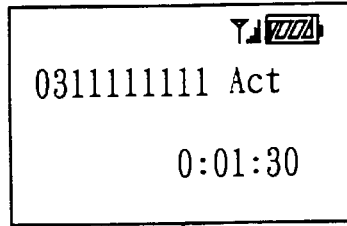
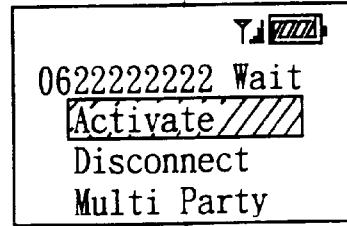


FIG. 9A



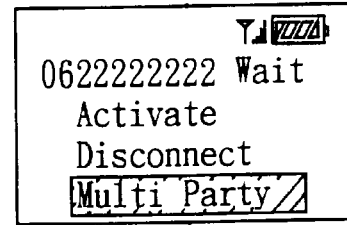
↓ CALL INCOMING

FIG. 9B



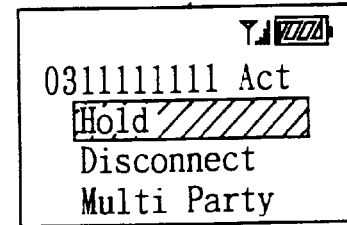
↓ DOWN, DOWN

FIG. 9C



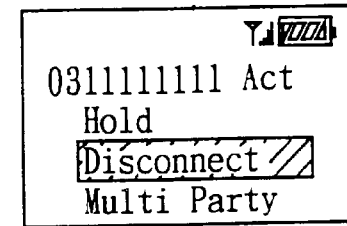
↓ DOWN

FIG. 9D



↓ DOWN

FIG. 9E



↓ CLICK

FIG. 9F

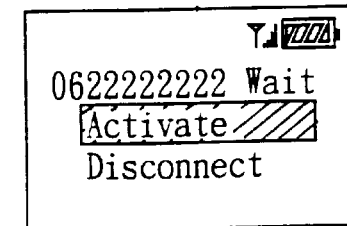


FIG. 10A

Y	
1 0311111111	Act
	0:01:30
2 0622222222	Hold
	0:02:44

↓ TURN ON CALL CONTROL KEY

FIG. 10B

Y	
1 0311	2 062222
Disc	Act
Hold	Act
MP	MP

↓ DOWN

FIG. 10C

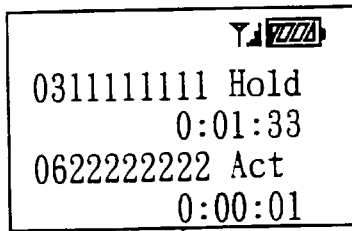
Y	
1 0311	2 062222
Disc	Act
Hold	Act
MP	MP

↓ CLICK

FIG. 10D

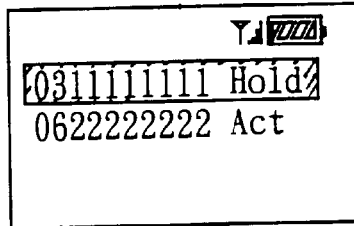
Y	
1 0311111111	Hold
	0:01:33
2 0622222222	Act
	0:00:01

FIG. 11A



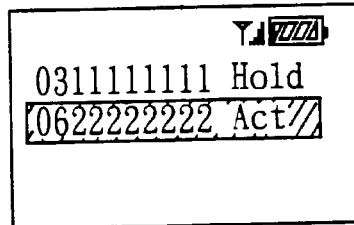
↓ TURN ON CALL CONTROL KEY

FIG. 11B



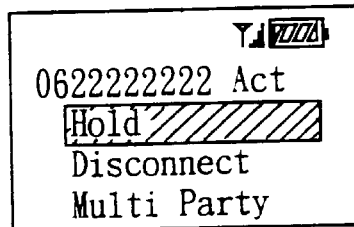
↓ DOWN

FIG. 11C



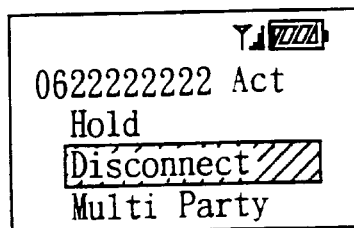
↓ CLICK

FIG. 11D



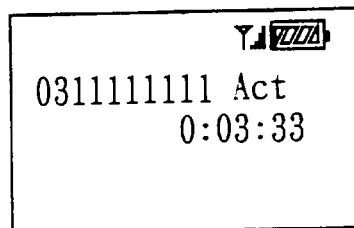
↓ DOWN

FIG. 11E



↓ CLICK

FIG. 11F



**COMMUNICATION TERMINAL DEVICE
AND METHOD FOR CONTROLLING A
CONNECTING STATE OF A CALL INTO A
DESIRED CONNECTION STATE UPON A
PREDETERMINED OPERATION BY A USER**

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a communication terminal device and the method, and more particularly, is applicable to a portable telephone apparatus of the Global System for Mobile communications (GSM) which has been standardized in Europe.

2. Description of the Related Art

In recent years, the diffusion of portable telephone apparatuses is remarkable, and, in proportion to it, a great variety of functions are added to the portable telephone apparatus. For example, in a portable telephone apparatus of the GSM system described above, if a call incoming from the third party is received when talking, the call in progress and the call newly received can be call-controlled respectively into the desired connecting state (hereinafter, it is referred to as a call waiting service). For instance, the call in progress can be suspended and a newly received call can be connected, or disconnecting the call presently talking and connect with the newly received call, or including the call received among the present call and talk with two parties at the same time, i.e., switching into a tripartite call, or disconnecting the call received and can continue talking with the present call.

The above call controls are executed by performing a predetermined operation determined by a standard in the GSM system. For instance, in case of suspending the call in progress and talk with the call received, "send" key should be pushed after pushing "2" key, and in the case of disconnecting the call in progress and talk with the call received, "send" key should be pushed after pushing the "1" key. Furthermore, to switch into a tripartite call, "3" key should be pushed and then the send key must be pushed, and to disconnect the call received and continue the call in progress "0" key should be pushed and then the send key.

The operating methods of these call controls have been disclosed in detail in the standard literature, "European digital cellular telecommunications system (Phase 2): Man-Machine Interface (MMI) of the Mobile Station (MS) (GSM 02.30)" issued by the European Telecommunication Standard Institute (ETSI).

The aforementioned call waiting service is a very convenient function. However, it cannot necessarily be said that it is a good function in usability from the user's point of view because the numeral to be entered varies depending on the connecting state of a call. Practically, these operating methods of call controls are very difficult to learn for the user, and often cause erroneous operations. It is no problem provided that erroneous operation does not trouble the other party, but if one of the parties were cut off by mistake when switching into a tripartite talk, for example, it causes the other party much trouble.

As a method for solving this problem, it is considered that the user carries a simple handbook explaining call control operating methods with him. However, it does not improve the usability of the user, and it seems that this is not a sufficient solution.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of this invention is to provide a communication terminal device in which the connecting state of a call can certainly and easily be controlled without learning the troublesome operating methods which are different depending on the connecting state of the call.

The foregoing object and other objects of the invention have been achieved by the provision of a communication terminal which provides control means for displaying processing items available to a call on display means and controlling the call into the connecting state corresponding to the processing item which is selected and determined by the user's operation of input means.

Thus, since the processing items available to the call is displayed on the display means and the user selects a desired processing item out of the processing items, the user can control the connecting state of the call by merely selecting the desired processing item.

The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings in which like parts are designated by like reference numerals or characters.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a schematic diagram showing the general construction of a portable telephone apparatus according to an embodiment of the present invention;

FIG. 2 is a block diagram showing a circuit configuration provided in the portable telephone apparatus;

FIG. 3 is a schematic diagram showing the general mechanism of a jog dial;

FIGS. 4A and 4B are schematic diagrams showing the construction of a rotary encoder;

FIGS. 5A and 5B are output waveform diagrams illustrating output waveforms from the rotary encoder;

FIGS. 6A to 6G are schematic diagrams showing the screen layout of a call control screen according to the first embodiment;

FIG. 7 is a flowchart showing a call control process according to the first embodiment;

FIGS. 8A to 8D are schematic diagrams showing the screen layout of a call control screen according to the second embodiment;

FIGS. 9A to 9F are schematic diagrams showing the screen layout of a call control screen according to the third embodiment;

FIGS. 10A to 10D are schematic diagrams showing the screen layout of a call control screen according to the fourth embodiment; and

FIGS. 11A to 11F are schematic diagrams showing the screen layout of a call control screen according to the fifth embodiment.

**DETAILED DESCRIPTION OF THE
EMBODIMENT**

Preferred embodiments of this invention will be described with reference to the accompanying drawings:

Firstly, the general construction and circuit configuration of a portable telephone apparatus 1 applying the present invention will be described with reference to FIGS. 1 and 2. This portable telephone 1 is mainly composed of the body of apparatus 2 and an arm microphone 3 attached to the side of the body and being adjustable (opens and closes freely). Therefore, the size of the portable telephone apparatus 1 can be further reduced by closing the arm microphone 3 except when in use.

In the arm microphone 3, in addition to the function to control on-hook or off-hook by linking to the open/close operation, a function to cancel operations other than a specific key when in a closed state (hereinafter, it is referred

to as key lock function) is provided. In this connection, this key lock state can be canceled by opening the arm microphone **3**.

By providing such key lock function, an erroneous operation such as pushing the operation key by mistake can be prevented when the portable telephone apparatus **1** is put in a pocket or a bag.

On the other hand, various operation keys and processing circuits are provided in the body of apparatus **2**. On the surface of the body of apparatus **2**, a liquid crystal display (LCD) **5** and a plurality of operation keys **6** to which various functions are allocated are provided in addition to a speaker **4** coupled with the arm microphone **3**. And, a central processing unit (CPU) **7** which uses these as input/output devices is built in the apparatus body.

The CPU **7** controls the liquid crystal display **5** via a liquid crystal display driver **5A** and displays various kinds of information with the font of suitable sizes. Further, the CPU **7** controls a transmitting/receiving circuit unit **10** and transmits and receives various kinds of information (e.g., an audio signal or various control signals to/from the base station device through an antenna **11** connected to the transmitting/receiving circuit unit **10**. The CPU **7** operates based on the program stored in a read only memory (ROM) **8** and the data read in a random access memory (RAM) **9**.

Moreover, a card socket **13** is connected to the CPU **7**, and all of management information on the subscriber will be read out from a subscriber ID card **12** (in this embodiment, it is the subscriber identity module (SIM) card) inserted to the card socket and utilized for controlling.

In this connection, the liquid crystal display **5** in which pixels of thirty-two dots by ninety-seven dots are arrayed in a matrix is used for, and information can be displayed with two kinds of fonts in utilizing these dots. One is a small font in which one character is displayed with seven dots by five dots, and the other is a large font with fifteen dots by eight dots. Accordingly, if the small font is used, four characters by sixteen characters can be displayed, and if the large font is used, 2 characters by 10 characters can be displayed.

Here, the large font is used for displaying the character entered by the user, and the small font is used for the message from the device side, as a rule. However, if the number of characters inputted by the user exceeds the fixed number (e.g., approximately twenty characters), the font size is automatically shifted from the large font to the small font.

By providing such font shifting function, the user can input characters with the large characters confirming the input contents when the number of characters entered is small and thus input errors can be reduced. On the other hand, even if the number of characters is large, input information on the same item can be confirmed on one screen, and thus input contents can be easily grasped.

Secondly, the operation keys **6** provided on the body of apparatus **2** will be described. In this embodiment, the operation key **6** consist of ten keys, i.e., a power key **6A**, numeral keys **6B** of "0" to "9", "#" key **6C**, "*" key **6D**, send key **6E**, end key **6F**, menu key **6G**, clear key **6H**, record key **6I**, and jog dial **6J**. Of these keys, the operation keys **6A** to **6H** are placed on the front of the apparatus body **2**, and the remaining two operation keys **6I** and **6J** are placed on the side of the apparatus body **2**.

The main function allocated to each operation key is as follows: The power key **6A** is a key for supplying power to the internal circuits of the apparatus body **2**, and the power is supplied by the first push operation and the power supply is cut off by the second push operation. However, if a personal identity number (PIN) is not inputted by the user in thirty seconds after the power is turned on by the power key **6A**, the CPU **7** detects this and automatically turns the power

off. Thus, the apparatus can be prevented from its power remaining ON due to the error operation.

Then, ten numeral keys **6B** will be described. These ten numeral keys **6B** are used for inputting letters in addition to numerals. In this embodiment, plural letters are allocated to eight numeral keys "2" to "9" respectively exclusive of "0" and "1" keys, and the letters can be entered by these. For example, "a" to "c" are allocated to the "2" key, and "d" to "f" to the "3" key—also other letters are allocated to the other keys in the same manner.

In the case of inputting letters, letters can be entered in succession by pushing the key, i.e., a first letter can be entered by pushing the same key once, a second letter can be entered by pushing the same key twice, and a third letter can be entered by pushing the same key three times. Furthermore, these numeral keys **6B** can be used for selecting a display items, and also when a predetermined number is pushed while the telephone number list is displayed, the screen can be switched to an item corresponding to the number and a cursor display can be moved on that item.

The send key **6E** is a key for inputting an operation start command when making a call to the telephone number manually entered with the numeral keys **6B** and the telephone number of the other party selected from the telephone list screen. This key is also used for calling up the past dial record.

The end key **6F** is a key for inputting a call end command. In this connection, the call end command can be entered also by closing the arm microphone **3**.

The menu key **6G** is a key which is used for switching the screen to be displayed on the liquid crystal display **5** between the initial screen and the menu screen. In the portable telephone apparatus **1**, time is displayed as the initial screen. If the menu key **6G** is pushed in this state, the display can be switched to the menu screen for displaying various setting items. Furthermore, in this state, if a predetermined operation would be conducted with the jog dial **6J** that will be described later, the menu screen can be switched one by one as if turning pages. Furthermore, in this state, if the clear key **6H** is pushed, the screen can be returned to the preceding screen one by one as if turning of pages.

Moreover, if the menu key **6G** is pushed while the menu screen is displayed, it can be returned immediately to the initial screen no matter where the screen is.

Furthermore, a function as the only operation key capable of unlocking the key lock state is assigned to the menu key **6G**. More specifically, as described above, in the state where the arm microphone **3** is closed, it is normally in a key lock state. However, if the menu key **6G** is pushed, it can be shifted from the key lock state to the key active state.

The record key **6I** is a key for recording a conversation on a call and playing back the recorded conversation. The key **6I** is attached to the opposite side to the arm microphone **3** on the upper surface of the main body of apparatus **2** so that it can be operated with the hand holding the main body **2**.

Lastly, the jog dial **6J** having the main function in ten operation keys will be described. The jog dial **6J** is provided in the vicinity of the speaker **4**, and on the upper part of the opposite side to the arm microphone **3** of the main body of apparatus **2** and can be operated with the hand holding the main body of apparatus **2** similar to the record key **6I**.

This jog dial **6J** can be operated independently in the circumferential direction and in the radial direction. And as shown in FIG. **3**, this is composed of a disc member (forming a rotary encoder) rotating in the circumference direction centering around a rotary shaft O (an arrow A and an arrow B), and a slide board (not shown) capable of sliding in the radial direction (an arrow C and an arrow D), and a slide switch SW.

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In this connection, the slide board and the slide switch SW are urged to the arrow C direction. The rotary shaft O is fixed to the slide board. Thus, if the jog dial 6J is pushed in the arrow D direction, the rotary encoder slides together with the slide board and pushes down the slide switch SW so as to control into an ON state. The CPU 7 judges whether the jog dial 6J was clicked or not by detecting the ON/OFF state of the slide switch SW.

The rotary encoder which slides with the slide board is composed of two discs 6J1 and 6J2 as shown in FIG. 4A and 4B. The disc 6J1 is a movable member layered on the upper surface of the disc 6J2 in, and is attached to the disc 6J2 fixed to the slide board so as to be movable relatively. Here, a pair of opposed electrodes 6J21 is provided on the disc 6J1 on the movable side. When assembled this opposed electrodes 6J21 pair can be connected to twenty pairs of opposed electrodes 6J22 which are provided along the circumference of the disc 6J2. In this connection, the position of the opposed electrodes 6J22 provided on the fixed side of the disc 6J2 are slightly shifted from each other between the inner circumference side and the outer circumference side.

Therefore, if the jog dial 6J is turned in the arrow A direction, the potential outputted from the opposed electrodes 6J22 on the inner circumference side first falls down to the earth potential as shown in FIG. 5A. On the contrary, if the dial 6J is turned in the arrow B direction, the potential on the outer circumference side first falls down to the earth potential as shown in FIG. 5B. In utilizing that, the rotating direction of the jog dial 6J is detected by detecting which of the potential on the inner circumference side or the outer circumference side, first falls down. And the amount of rotation of the jog dial 6J can be detected by counting the number of pulses to be output from the electrodes on the outer circumference side.

A typical operational example using the jog dial 6J will be described. The cursor displayed on the liquid crystal display 5 can be moved upward and downward by turning up and down the jog dial 6J in the circumferential direction in the state where various list screens are displayed on the liquid crystal display 5. In this case, if the jog dial 6J is pushed in the radial direction in this condition (hereinafter, it is referred to as click), an item put the cursor on can be determined and the read out of detailed information concerning the item can be instructed to the CPU.

Furthermore, the volume of receiving tone can be controlled by turning the jog dial 6J in the circumferential direction while talking on the line. Also, it can be muted by clicking the jog dial 6J while the call is in progress.

The portable telephone apparatus 1 is a communication terminal complying with the standard of the GSM system. That is, the user can receive a call waiting service offered in the GSM system freely if the user conducts the fixed operation. The operating method of receiving the call waiting service will be described.

In the portable telephone apparatus 1, if an incoming call arrives while talking with a predetermined call, the screen of the liquid crystal display 5 is automatically switched from the calling screen to the call control screen by triggering the incoming call (hereinafter, it is referred to as trigger). At this time, a list in which all of processings available to the call are listed and itemized is displayed as the call control screen (i.e., a processing item list available to the call is displayed). In the portable telephone apparatus 1, by selecting a desired processing item from the processing item list, a call can be controlled into a connecting state corresponding to the item thus selected. Thereby, in the portable telephone apparatus 1, the connecting state of a call can be certainly and easily controlled by merely selecting the desired item out of processing items displayed on the screen without learning troublesome operating methods in which numerals to be

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entered differ depending on the call connecting state as the conventional device.

Here, an operating method of call control in the portable telephone apparatus 1 will be concretely described below with reference to diagrams of screen layouts.

In the portable telephone apparatus 1, a screen shown in FIG. 6A is displayed on the liquid crystal display 5 as a calling screen when talking with a predetermined call. More specifically, the telephone number of the other party, "03011223344", and the calling time with the other party, "00:04:33", are displayed. In this condition, if a call arrives from the third party, a call control screen shown in FIG. 6B will be displayed triggering the incoming call.

The telephone number of the other party newly received, "03055667788", is displayed on the first line of the call control screen and processings available to the call arrived are list-displayed on the second to fourth lines of the screen. In this case, the following processings available to the incoming call received can be considered, i.e., a processing to hold the call in progress and connect to the incoming, a processing to disconnect the call in progress and connect with the call received, a processing to disconnect the incoming call received and continue the call now talking, and a processing to include the incoming call received into the call and switch to a tripartite call. However, it is decided here that three processings can be conducted exclusive of the processing to disconnect the call in progress and connect the call received, and these three processing items are list-displayed. In practice, the words "Activate", "Disconnect" and "Multiparty" showing those processings will be displayed on the liquid crystal display 5 as shown in FIG. 6B.

Furthermore, when the call control screen is displayed at first, the cursor showing the item now selected presently (the part where black and white are reversed on the screen, in this figure it is shown by oblique lines) is displayed on the "Activate" in the second line.

At this point, if the jog dial 6J is operated up and down, the cursor showing the item selected can be moved freely upward and downward. For example, if the jog dial 6J is turned down once in the state shown in FIG. 6B, the cursor can be moved to the "Disconnect", one line lower as shown in FIG. 6D. Furthermore, if the jog dial 6J is down operated once in the state shown in FIG. 6D, the cursor can be moved to the "Multi Party" that is one line lower as shown in FIG. 6E. On the other hand, if the jog dial 6J is up operated, the cursor can be moved upward contrary to the above.

When the jog dial 6J is clicked after moving the cursor to the desired processing item by up or down operating the jog dial 6J, in the portable telephone apparatus 1, the processing item is determined and the call control will be executed corresponding to the processing item.

For example, when the jog dial 6J is clicked in the state where the cursor is on the "Activate" as shown in FIG. 6B, the processing for holding the call talking and connecting the incoming call received will be executed (that is, the portable telephone apparatus 1 executes the same processing as that has been executed upon receiving the push operation of the "2" key and the send key in the conventional device, and call-controls by executing a predetermined control process between the base station device (not shown)). In addition to this processing, the screen showing the state of calls obtained by the above processing is displayed on the liquid crystal display 5 as shown in FIG. 6C. More specifically, in the upper part of the screen, the telephone number of the other party talked until now, "03011223344", "Hold" showing that the other party is in a hold state, and the total calling time when the other party has been connected to the present time, "00:04:44", are displayed. Also, in the lower part of the screen, the telephone number of a newly

received call, "03055667788", an "Act" showing that the call is in a calling state, and call duration of the call received, "0:00:01" are displayed.

On the other hand, if the jog dial 6J is clicked in the state where the cursor is on the "Disconnect" as shown in FIG. 6D, processing of disconnecting the call received and continuing call with the present call will be executed (that is, the portable telephone apparatus 1 performs the same processing as that has been executed by receiving the push operation of the "1" key and the send key in the conventional device). In addition to this processing, a screen showing the state of the call obtained by the above processing is displayed on the liquid crystal display 5 as shown in FIG. 6E. More specifically, the telephone number of the other party to be continued the call, "03011223344", and the calling time with the other party, "00:04:33", are displayed (that is, a screen like FIG. 6A is displayed) on the screen.

Furthermore, when the jog dial 6J is clicked in the state where the cursor is on the "Multi Party" as shown in FIG. 6F, the processing for including the incoming call received in the conversation and switching into a tripartite call is executed (that is, the portable telephone apparatus 1 performs the same processing as that has been executed upon receiving the push operation of the "3" key and send key in the conventional device). In addition to this processing, a screen showing the state of call obtained by the above processing is displayed on the liquid crystal display 5 as shown in FIG. 6G. More specifically, in the upper part of the screen, the telephone number of the other party talked until now, "03011223344", and "MP" showing that the other party is in the tripartite call. In the lower part of the screen, the telephone number of the incoming call received "03055667788", and "MP" showing that the call is in the tripartite call. Also, in farther lower part, call duration of the tripartite call "0:00:01" is displayed.

In this manner, in this portable telephone apparatus 1, if an incoming call arrives in calling, the screen of the liquid crystal display 5 is automatically switched to the call control screen and processing items available to the newly received call will be list-displayed. As a result, the user can easily call-control by simply selecting the desired processing item out of the processing items for the incoming call received.

Here, displaying the above call control screen will be executed by the display control of the liquid crystal display 5 by the CPU 7, and the processing of the selected processing item will be also executed by the CPU 7. The process at this time will be described below with reference to a flowchart shown in FIG. 7.

Assuming that at the step SP2 entered from the step SP1, a call with the predetermined call is started by a call originating from the portable telephone apparatus 1 or a call incoming to the portable telephone apparatus 1. In this state, at the following step SP3, if a call incoming from the other call arrives, it receives this and proceeds to the following step SP4. At the step SP4, processings available to the call received is list-displayed as a call control screen. And, if there is anything which cannot be processed under this situation, that processing item will be deleted and only the item which can be practically processed will be displayed.

In the following steps, processing items displayed of which item is selected by the user is detected. That is, in step SP5, it is detected whether the "Activate", in which the call in progress is held and the incoming call is connected, is selected or not. In step SP8, it is detected whether the "Disconnect", in which the incoming call is disconnected and the call with the present call is continued, is selected or not. And in step SP10, it is detected whether the "Multi Party", in which the incoming call is included to the present call and it is switched into a tripartite call, is selected or not.

As a result, when it is detected that "Activate" has been selected in step SP5, it proceeds to step SP6 and as well as

holding the call in progress and connecting the incoming call received, displays the state of each call on the liquid crystal display 5.

When it is detected that the "Disconnect" has been selected in step SP8, it proceeds to step SP9 and disconnecting the incoming call received continues the call presently connected call and also displays the screen talking on line before the call control screen is displayed on the liquid crystal display 5.

On the other hand, when it is detected that the "Multi Party" has been selected in step SP10, it proceeds to step SP11 to include the incoming call received and the call is switched into a tripartite call and also displays the state of each call on the liquid crystal display 5.

After executing the above processing corresponding to the selected item, it proceeds to step SP7 to terminate the above processing steps.

According to the construction described above, in the portable telephone apparatus 1, if receiving an incoming call arrives in calling, the screen of the liquid crystal display 5 is switched from the calling screen to the call control screen by triggering the call incoming. In this case, processings available to the incoming call are list-displayed itemized as the call control screen. The user moves the cursor on the desired processing item out of the processing items displayed by turning up or down the jog dial 6J and click it while watching the screen. Thereby, the portable telephone apparatus 1 executes call control corresponding to the processing selected by the user.

Accordingly, in the portable telephone apparatus 1, if a call incoming arrives in calling, processings available to the call arrived are displayed on the liquid crystal display 5 in order that the user can select the desired processing out of processing items and executes the call control corresponding to the selected processing. Thereby, the user can control the call by merely selecting the desired processing out of processings displayed on the liquid crystal display 5, and it becomes unnecessary for the user to learn troublesome operating methods in which the numerals to be entered differ depending on the connecting state of the call as the conventional device. Accordingly, in the portable telephone apparatus 1, call control for the call arrived can be certainly and easily performed without learning these troublesome operating methods; thus the usability can be further improved comparing with the conventional apparatus.

Furthermore, in the portable telephone apparatus 1, the processing result after the call control is displayed on the liquid crystal display 5. Accordingly, the user can easily know the situation after the call controlled at a glance.

In this connection, in the case of this embodiment, only the processings available to the incoming call received are displayed as the processing items because there are two calls to be controlled, and if the processing to be conducted to the call received is determined, the processing for the call in calling will be naturally determined. Therefore, in the case of this embodiment, only processing items available to the call arrived are displayed to simplify the operation.

According to the construction described above, if an incoming call arrives in calling, processings available to the incoming call arrived are displayed on the liquid crystal display 5 making the user to select the desired processing out of the processing items and control the call. Thereby, the user can easily and certainly control the call by merely selecting the desired item based on that display.

The first embodiment described above has described the case of displaying only processings for the incoming call received as the call control screen. In the second embodiment, however, processings for the call in progress and the incoming call are arrayed and displayed in a matrix

for the user to select. This point will be described more specifically below with reference to screen layouts.

In the case of this embodiment, a screen calling shown in FIG. 8A is displayed on the liquid crystal display 5 when calling with the predetermined call. That is, the telephone number of the other party, "0311111111", "Act" showing that the call is in the calling state, and also the call duration with the other party, "0:01:30" are displayed.

As an identifier for identifying the call, "1" is displayed at the front of the telephone number of the other party. This identifier is also added to the incoming call received later in the order of arrival.

In the case of this embodiment, since the telephone number of the other party, the state of call, and the identifier of the call are displayed on the same line, figures of the telephone number that can be displayed on the line becomes less, and the first ten figures will be de displayed among the actual telephone number.

When a call incoming from the third party arrives in this state, a call control screen shown in FIG. 8B is displayed by triggering the call incoming.

As the call control screen, the identifier "1" of the call talking until now and the first four figures of the telephone number of the call, "0311", are displayed on the first half of the first line of the screen, and an identifier of the newly received call, "2", and the first six figures of the telephone number of the call, "062222", are displayed on the latter half of the first line of the screen.

On the screen from the second to fourth lines, combination of processings for each call will be displayed under the heading two call names displayed on the first line. That is, on the second line of the screen, "Disc" is displayed at the lower part of the name of call talking and "Act" is displayed at the lower part of the name of the incoming call arrived, so that the processing to disconnect the call talking and connect the incoming call will be displayed. Furthermore, on the third line of the screen, "Hold" is displayed at the lower position of the name of the call talking and "Act" is displayed at the lower position than the name of the incoming call arrived so that the processing to hold the call in progress and to connect the incoming call will be displayed. And on the fourth line of the screen, by displaying "MP" at the lower position of the name of call talking and also displaying "MP" at the lower position of the name of the incoming call arrived, the processing to include the incoming call arrived to the call and to switch into a tripartite call will be displayed.

Since only three lines are reserved as a display area for displaying the combination of calls, only three processings are displayed on the screen. However, there is the other processing to disconnect the incoming call arrived and continue the call with the call talking, and that processing will be displayed on the screen by turning down the jog dial 6J. In this connection, this processing is shown by displaying "Act" at the lower position of the name of the call talking and "Disc" at the lower position of the name of the incoming call arrived.

At this point, if the jog dial 6J is clicked after moving the cursor to the desired processing by turning up and down the jog dial 6J, the processing is determined and the call control corresponding to that processing will be executed. For example, if the jog dial 6J is down operated in the state shown in FIG. 8B and clicked after putting the cursor on the line of "Hold" showing the call talking is on "Hold" state and "Act" showing the incoming call arrived is on "Act" state, as shown in FIG. 8C, the processing is determined and the call in progress is held and the incoming call arrived is connected. In addition to the execution of this processing, the screen showing the state of call obtained by the process-

ing is displayed on the screen of the liquid crystal display 5 as shown in FIG. 8D. That is, the identifier of the call in progress until now, "1", its telephone number "0311111111" and "Hold" showing that the call is in a hold state are displayed on the upper part of the screen. And the total calling time when the call has been connected to the present, "0:01:33", is displayed on the following line. Further, the identifier of the incoming call, "2", its telephone number, "0622222222", and "Act" showing that the call is in a calling state are displayed on the lower part of the screen, and call duration of the call, "0:00:01", is displayed in the following line.

Accordingly, in the case of this embodiment, if an incoming call arrives while the call is in progress, the call control screen is displayed on the liquid crystal display 5 by triggering the call incoming. In the case of this embodiment, both names of the call connected until now and the call newly received are displayed and a combination of processings for each call will be displayed under the heading of these call names as the call control screen. The user selects and determines the desired processing out of the processings displayed by operating the jog dial 6J. Thus the processing is executed and the call control is executed. Accordingly, in the case of this embodiment, the user can perform the call control by merely selecting the desired processing out of the processings displayed on the liquid crystal display 5, thus the call control can be easily and certainly performed without learning troublesome operating methods such as the conventional device.

In this connection, in the case of this embodiment, since the processing for the incoming call arrived is not only displayed but also the processing for the call called until now is displayed as the call control screen, how processing will be done for each call can be clearly grasped. Thereby, the usability can be further improved comparing with the first embodiment.

According to the above structure, when the incoming call arrives, both names of the calls, called until now and the call newly received, are displayed and a combination of processings for each call will be displayed under the heading of the call names and make the user to select the desired processing out of the processings and the call will be controlled. Thereby, the user can control the call easily and certainly by merely selecting the desired processing according to the display.

Furthermore, according to the above structure, since the processing for the call in progress is displayed in addition to the processing for the incoming call newly arrived, the call-control can be performed upon clearly grasping the processings to be performed for each call.

The second embodiment described above, has dealt with the case of displaying the processings for the call in progress and the incoming call in a matrix as the call control screen. In the third embodiment, however, processings available to the calls are list-displayed for each call so that these can be shifted by page scrolling. Then, the desired processing is selected out of the processings for each call and the call control corresponding to it will be executed. This point will be described below with reference to screen layout diagrams.

In the case of this embodiment, when making a call with the predetermined call, a screen is displayed on the liquid crystal display 5 as shown in FIG. 9A. That is, the telephone number of the other party "0311111111", "Act" showing that the call is in progress, and the calling time with the other party, "0:01:30", are displayed.

In this connection, also in the case of this embodiment, the first ten figures of the telephone number will be displayed.

If a call incoming from the third party arrives under this condition, a call control screen shown in FIG. 9B is displayed by triggering the call incoming.

In the case of this embodiment, the call control screen consists of two pages; i.e., the first page shows the processing of the incoming call arrived, and the next page shows the processing of the call in progress. As the call control screen, the first page is displayed first.

In the first page to be displayed at first, the telephone number of the call newly received, "0622222222", and "Wait" showing that the call is waiting to be processed will be displayed on the first line of the screen, as shown in FIG. 9B. And processings for the incoming call newly arrived are list-displayed according to items from the second to fourth lines of the screen: i.e., from the top to downward, "Activate" for connecting the incoming call newly arrived, "Disconnect" for disconnecting the incoming call arrived, and "Multi Party" for including the incoming call newly received to the call are displayed.

Furthermore, a cursor showing the item now selected is displayed on the "Activate" in the second line of the screen.

Under this condition, if the jog dial 6J is down operated, the cursor can be gradually moved downward. For example, if the jog dial 6J is down operated twice, the cursor can be moved to "Multi Party" as shown in FIG. 9C. If the jog dial 6J is further down operated in the state where the cursor is at the end of the processing items, the second page of the call control screen is displayed as shown in FIG. 9D as if turning over the pages.

In the second page of the call control screen, the telephone number of the call called until now, "0301111111", and "Act" showing that the call is in the calling state are displayed on the first line of the screen. Furthermore, processings for the call called until now is list-displayed according to items from the second line to fourth line on the screen: i.e., from the top to downward, "Hold" for holding the call talking, "Disconnect" for disconnecting the call talking, "Multi Party" for talking together with the incoming call arrived are displayed.

The cursor showing the item selected presently will be displayed on "Hold" in the second line of the screen. If the jog dial 6J is down operated in this state, the cursor can be gradually moved downward. For example, if the jog dial 6J is down operated once, the cursor can be moved to "Disconnect" as shown in FIG. 9E.

If the jog dial 6J is clicked after moving the cursor to the desired processing by operating the jog dial 6J as the above, the processing item will be determined. For example, if the jog dial 6J is clicked in the state where the cursor is on "Disconnect" as shown in FIG. 9E, "Disconnect" will be determined as the processing for the call in progress.

If the processing for one call is determined in this manner, the screen of the liquid crystal display 5 is automatically switched to display the processing for the other call. For example, in the case where "Disconnect" is determined for the call in progress as shown in FIG. 9E, the screen is automatically switched to the screen showing the processing for the incoming call received (i.e., the first page of the call control screen). In this case, it is clear from FIG. 9F that the "Multi Party" is excluded from the processing for the incoming call received; and only "Activate" and "Disconnect" are displayed. This is because "Disconnect" has been selected as the processing for the call in progress, and naturally the processing of "Multi Party" becomes impossible. In the case where the processing for one call is determined and then the processing for the other call is displayed, possible processings only are displayed not displaying the processing which becomes impossible due to the processing determined earlier. Thereby, erroneous operations such that user selects the impossible processing can be prevented.

As shown in FIG. 9F, after the screen is switched to the screen showing the processing for the call received, when

the cursor is moved to the desired processing item by operating the jog dial 6J and then the jog dial 6J is clicked, the processing is determined as the processing for the incoming call received. Thus, if processings for the call in progress and the incoming call received are selected and determined, the call control corresponding to thus selected and determined processings will be executed. In this connection, it will not be shown in figure in particular here. However, in the case of this embodiment, the screen showing the state of the call is displayed after the call-control has been conducted just as in the case with the first and second embodiment,s described above.

In this manner, in the case of this embodiment, if an incoming call arrives, the call control screen is displayed on the liquid crystal display 5 by triggering the incoming call. As the call control screen, the processing for the incoming call is displayed in the first page, and the processing for the call talking is displayed in the second page, and processings for each call will be list-displayed severally. The user sequentially selects and determines the desired processing out of the processings which are displayed severally for each call by operating the jog dial 6J. Thereby, the processings are executed and the call control is performed. Accordingly, in the case of this embodiment, the user can control the calls by merely selecting the desired processing out of the processings displayed on the liquid crystal display 5, and thus the call control can be easily and certainly executed without learning troublesome operating methods as the conventional device.

Furthermore, in the case of this embodiment, when the processing for the other call is displayed after the processing for one call has been determined, available processings only are displayed without displaying the processing which become impossible due to the processing determined earlier. Thereby, erroneous operations such as that the user selects impossible processing can be prevented.

According to the above structure, in the case of receiving an incoming call, processings for the call in progress and the call newly received are list-displayed for each call and permit the user to be select the desired processing out of processings displayed for each call and the calls will be controlled. Thereby, the user can control the call easily and certainly by merely selecting the desired item in accordance with the displays.

The first to third embodiments described above, have dealt with the case of automatically displaying the call control screen by triggering the incoming call. In this fourth embodiment, however, an operation key called as a call control key is provided on the predetermined position of the main body 2 of the portable telephone apparatus 1 so that the call control screen is displayed when the user operates the call control key. Thereby, the call control screen can be called up by operating the call control key, even after the call has been controlled once, and the call control can be performed at any time. This point will be described in detail below with reference to a screen layout diagram.

For example, assuming that two calls are received now, one is connected and the other is held. In this case, generally a screen shown in FIG. 10A is displayed on the liquid crystal display 5 as a screen talking. That is, the telephone number of the call with the identifier "1", "0311111111", and "Act" showing that the call is connected are displayed in the first line of the screen. And the total calling time, "0:01:30", is displayed on the following line.

Furthermore, the telephone number of the call having the identifier "2", "0622222222", and "Hold" showing that the call is held are displayed on the third line of the screen. And the total calling time when the call has been connected to the present, "0:02:44", is displayed on the next lower line.

In this connection, also in the case of this embodiment, the first ten figures of the telephone number are displayed.

When the call control key is pushed by the user in this state, a call control screen shown in FIG. 10B is displayed. In this case, as in the call control screen, a list in which processings for each call are arranged in a matrix is displayed just as the case with the second embodiment. That is, the identifier of the call called until now, "1", and the first four figures of the telephone number of the call, "0311", are displayed on the first half of the first line of the screen, and the identifier of the waiting call, "2", and the first six figures of the telephone number of the call, "062222", are displayed on the latter half of the first line of the screen.

Moreover, a combination of the processings for each call is displayed under the heading of two calls displayed on the first line from the second to fourth lines of the screen. That is, "Disc" is displayed at the lower part of the name of the call talking and "Act" is displayed at the lower part of the call waiting on the second line so that the processing for disconnecting the call talking and connect the call waiting will be displayed. Also, "Hold" is displayed at the lower part of the name of the call talking and "Act" is displayed at the lower part of the name of the call waiting on the third line so that the processing to hold the call talking and connect the call waiting will be displayed. And "MP" is displayed at the lower part of the name of the call talking and also by displaying "MP" at the lower part of the name of the call waiting on the fourth line the processing to include the call waiting into the call and switch into the tripartite call will be displayed.

After moving the cursor to the desired processing, if the jog dial 6J is clicked in the state where the call control screen is displayed, the processing is determined and executed. For example, if the click operation is conducted after moving the cursor onto "Hold" on the call talking and "Act" on the call waiting as shown in FIG. 10C, the processing is determined and the call talking is held and the call waiting is connected.

Furthermore, as this processing is conducted, the screen showing the state of call obtained by the processing will be displayed on the screen of the liquid crystal display 5 as shown in FIG. 10D. That is, the identifier "1" of the call called until now, its telephone number, "031111111", and "Hold" showing that the call is in a hold state are displayed. The total calling time when the call has been connected to the present, "0:01:33", is displayed on the following line. Furthermore, the identifier "2" of the call switched into a call, its telephone number, "062222222", and "Act" showing that the call is connected are displayed at the lower part of the screen. And the calling time with the call, "0:00:01", is displayed on the further lower line.

Thus, in the case of this embodiment, the call control key is provided so that the call control screen will be displayed when the call control key is operated by the user. Thereby, the call control screen can be called up at any time to perform the call control.

In this connection, the embodiment described above has dealt with the case of calling up the call control screen in case of controlling assuming that two calls exist already. However, the call control screen may be called up by operating the call control key when a call incoming arrives. At this time, if the arrival of incoming call incoming would be displayed on the liquid crystal display 5, the user can operate the call control key by watching the display and can control the call by calling up the call control screen.

According to the above structure, since the call control key is provided and displaying the call control screen, the user selects the desired processing by operating the call control key, the call control screen can be displayed and the user can control the call at any time by simply operating the call control key.

The fourth embodiment described above has dealt with the case of arraying and displaying the processings available

to the calls in a matrix when the call control key is operated. In this fifth embodiment, however, processings available to the calls are displayed separately for each call when the call control key is operated. This point will be described specifically below with reference to a screen layout diagram.

Firstly, also in this embodiment, it is assumed that two calls are received now, one is presently connected and the other is put on hold. In this case, a screen shown in FIG. 11A is displayed on the liquid crystal display 5 as the calling screen. That is, the telephone number of the call waiting, "0311111111", and "Hold" showing that the call is held are displayed on the first line of the screen. Also, the total calling time when the call has been connected to the present time, "0:01:33", is displayed on the following line.

The telephone number of the call talking, "0622222222", and "Act" showing that the call is in a calling state are displayed on the third line of the screen. And the calling time of the call, "0:00:01", is displayed on the further lower line.

In this connection, also in the case of this embodiment, the first ten figures of the telephone number will be displayed.

When the call control key is pushed by the user in this state, a call control screen shown in FIG. 11B will be displayed. In this case, two calls presently receiving are displayed at first as the call control screen so that the user selects one of two calls as an object to be controlled. That is, the telephone number of the call waiting, "0311111111", and "Hold" showing that the call is held are displayed on the first line of the screen. The telephone number of the call connected now, "0622222222", and "Act" showing that the call is connected are displayed on the second line. If the jog dial 6J is up or down operated in the state where two calls are displayed, the cursor can be moved onto the desired call. For example, if the jog dial 6J is down operated once, the cursor can be moved onto the call presently talking.

Thus, when the jog dial 6J is clicked by moving the cursor to the desired call, the call is determined and processing items for the call are list-displayed. For example, if click operation is conducted by moving the cursor to the call connected now as shown in FIG. 11C, the call connected is determined and processing items for that call are displayed as shown in FIG. 11D. As it is apparent from this FIG. 11D, the telephone number of the call determined as the control object, "0622222222", and "Act" showing that the call is connected are displayed on the first line of the screen, and processings available to the call are list-displayed from the second to fourth lines of the screen. That is, "Hold" to hold the call talking is displayed on the second line of the screen, "Disconnect" for disconnecting the call talking is displayed on the third line of the screen, and "Multi Party" to include the call waiting to the connecting call in progress is displayed on the fourth line.

If the jog dial 6J is up or down operated in the state where each processing is displayed, the cursor can be moved to the desired processing. For example, if the jog dial 6J is down operated once, the cursor can be moved to "Disconnect" as shown in FIG. 11E. If the jog dial 6J is clicked after moving the cursor to the desired processing as described above, the processing is determined and executed. For example as shown in FIG. 11E, if the jog dial 6J is clicked by moving the cursor to the "Disconnect", "Disconnect" is determined and executed. Thus, the call in progress is disconnected and the call waiting is switched into the connecting state. Furthermore, with this processing, the state of call obtained by the processing is displayed on the screen as shown in FIG. 11F. That is, the telephone number of the call remained, "0311111111", and "Act" showing that the call is connected are displayed on the screen. Furthermore, the total calling time when the call has been connected to the present, "0:03:33", is displayed on the following line.

Thus, in this embodiment, the call control key is provided in order that on the call control screen the processings

available to the call are separately displayed for each call and make the user to select the desired processing when the call control key is operated by the user. Thus, also in this case, the call control screen can be called up any time and call control can be executed.

In this connection, the embodiment described here has dealt with the case of calling up the control screen when call-controlling these calls assuming that two calls exist already. However, the call control screen can be called up by operating the call control key if call incoming arrives. At this time, if the arrival of incoming call is displayed on the liquid crystal display **5**, the user can operate the call control key by watching the display and can control the call by calling up the call control screen.

According to the above structure, the call control key is provided and processings available to each call are separately displayed on the call control screen and permit the user to select the described processing by the user if the call control key is operated by the user, thereby, the call control screen can be displayed and call control can be performed at any time provided that the user operate the call control key.

Note that, in the fifth embodiment described above, the other call is automatically connected when "Disconnect" is selected for one call, however, the present invention is not limited thereto and the processing of the other call can be also selected by the user after selecting the processing of one call as the third embodiment. More specifically, as the third embodiment, the desired processing can be selected by the user by displaying processings available to the call for each call.

In this connection, in the case where the processings available to the call are displayed for each call, two methods can be considered, one method is to return the screen to the normal calling screen after the processing to be executed for one call is determined; the other method is after the processing for one call is determined, processings available to the other call will be list-displayed on the screen in order to select the processing to be executed for the other call. In this case, either of of methods can be utilized.

Further, in the fourth and fifth embodiments, the call control screen is displayed when the call control key is operated, however, the present invention is not limited to thereto and the call control screen can be displayed when a menu key is operated. In short, the same effects as those of the above cases can be obtained by displaying the call control screen when the predetermined operation key is operated by the user.

Further, in the aforementioned embodiments, two calls of control objects have been received, however, the present invention is not limited thereto and the same effects as those of the above cases can be obtained by displaying the call control screen such as the above, and make the user to select the desired processing even if three or four calls to be controlled are received. In short, the number of calls to be controlled is not limited in this invention.

However, in the case where the number of calls is increased, it is considered that it is desirable to list-display processings available to the call for each call rather than arraying and displaying in a matrix. This is because if the horizontally wide liquid crystal display **5** is used it can cope with the case where the number of calls is increased even in matrix display, however, in the portable telephone apparatus **1**, the size of the liquid crystal display **5** is restricted and the size cannot be often enlarged.

Further, in the aforementioned embodiments, a call is shown by displaying the telephone number of the call, however, the present invention is not limited thereto and if the call is originated from the telephone list, the name of the other party is apparent, thus the call can be shown by utilizing that.

Further, in the aforementioned embodiments, the call control screen is displayed by triggering the incoming call or the call control screen is displayed in response to the operation of the call control key, however, the present invention is not limited thereto and the call control screen can be displayed always in the case where the predetermined call is connected. Thus, call control can be performed at any time without operating the call control key.

Further, in the aforementioned embodiments, processings available to the call are list-displayed, or arranged and displayed in a matrix, however, the present invention is not limited thereto and the processings available to the call can be displayed with the other method. In short, the same effects as these of the above case can be obtained by displaying the processings available to the call and permitting the user to select the desired processing and executing the call control corresponding to the processing thus selected.

Further, the aforementioned embodiments, the jog dial **6J** is used as a means of selecting and determining the processing item displayed, however, the present invention is not limited thereto and the other input means can be used provided that the input means is capable of inputting a direction and amount of movement for moving the cursor in the predetermined direction and the determination information for determining the item on which the cursor is displayed.

For example, a jog shuttle equipped with a clicking function in which an angle of rotation is restricted to a predetermined angle, a track ball with a clicking function, or a joy stick with a clicking function can be used.

Further, in the aforementioned embodiments, the display control on the liquid crystal display **5** and the call control corresponding to the selected processing item are conducted by the CPU **7**, however, the present invention is not limited thereto and the same effects as those of the above can be obtained by providing the control means for controlling the call into a connecting state corresponding to the processing item selected and determined by the user's operation as well as displaying processing items available to the call on display means.

Furthermore, in the aforementioned embodiments, the present invention is applied to the portable telephone apparatus of the GSM system, however, the present invention is not limited thereto and the present invention can be widely applied to the other communication terminal device in which the connecting state of a call can be controlled into the desired connecting state by a predetermined operation.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A communication terminal device for controlling a connecting state of a call into a desired connecting state upon a predetermined operation by a user, comprising:

display means for displaying processing items available to the user relative to a call;

input means for selecting and determining a desired processing item out of said processing items displayed on said display means; and

control means for controlling displaying of the processing items available to the user relative to a present call and to an incoming call on said display means and controlling the present call and the incoming call into a respective connecting state corresponding to the processing item selected and determined by the operation

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of said input means by a user, wherein said control means controls said display means to display said processing items on said display means when a predetermined operation key of said input means is pushed by the user.

2. The communication terminal device according to claim 1, wherein said control means controls said display means to display said processing items on said display means when an incoming call is received.

3. The communication terminal device according to claim 2, wherein said control means controls said display means to display a list of said processing items available to the user on said display means for each call.

4. The communication terminal device according to claim 3, wherein

when a processing for one call is determined by the user and a processing for another call is naturally determined, said control means controls said display means to display a list of only processing items available to the user relative to said one call on said display means.

5. The communication terminal device according to claim 3, wherein determining the processing for said one call, said control means controls said display means to display a list of only processings practically available as said processing items of said another call by excluding the unavailable processing from the list.

6. The communication terminal device according to claim 2, wherein

said control means controls said display means to display a combination of processings for each call on said display means as said processing items.

7. The communication terminal device according to claim 1, wherein

said control means controls said display means to display a list of said processing items available to the user on said display means for each call.

8. The communication terminal device according to claim 7, wherein

when a processing for one call is determined by the user and a processing for another call is naturally determined, said control means controls said display means to display a list of only processing items available to the user relative to said one call on said display means.

9. The communication terminal device according to claim 7, wherein

if a processing available to said other calls generated by said input means determining the processing for said one call, said control means controls said display means to display a list of only processings practically available as said processing items of said another call by excluding the unavailable processing.

10. The communication terminal device according to claim 1, wherein said control means controls said display means to display a combination of processings for each call on said display means as said processing items.

11. The communication terminal device according to claim 1, wherein

said control means always controls said display means to display said processing items on said display means during a time when a predetermined call is connected.

12. The communication terminal device according to claim 11, wherein

said control means controls said display means to display a list of said processing items available to the user on said display means for each call.

13. The communication terminal device according to claim 12, wherein

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when a processing for one call is determined by the user and a processing for the other call is naturally determined, said control means controls said display means to display a list of only processing items available to the user relative to said one call on said display means.

14. The communication terminal device according to claim 12, wherein

if a processing unavailable to said other call is generated by said input means determining the processing for said one call, said control means controls said display means to display a list of only processings practically available as said processing items of said another call by excluding the unavailable processing.

15. The communication terminal device according to claim 11, wherein

said control means controls said display means to display a combination of processings for each call on said display means as said processing items.

16. The communication terminal device according to claim 1, wherein:

said display means displays a cursor showing the processing item selected by the user; and

said input means includes means for controlling a direction and amount of movement of said cursor in a predetermined direction and includes determining information for determining that the processing item where said cursor is displayed can be entered by the user.

17. A communicating method for controlling a connecting state of a call into a desired connecting state upon a predetermined operation by a user, comprising the steps of: displaying processing items available to the user relative to the call on a display;

selecting and determining a desired processing item out of said processing items displayed on said display by the user operating an input unit; and

controlling the processing items being displayed on said display and controlling the call into a connecting state corresponding to the processing item selected and determined by the operation of said input unit by the user, wherein said step of controlling the processing items includes displaying said processing items on said display when a predetermined selection operation is made by the user.

18. The communication method according to claim 17, wherein

said step of controlling said processing items on said display includes displaying said processing items on said display when a predetermined call is received.

19. The communicating method according to claim 18, wherein

said step of controlling the processing items includes listing said processing items available to the call on said display for each call.

20. The communicating method according to claim 19, wherein

in the case where a processing for one call is determined by the user and a processing for another call is naturally determined, said step of controlling the processing items includes listing only processing items available to said one call on said display.

21. The communicating method according to claim 19, wherein

if a processing unavailable to the another call is generated by determining the processing for said one call, said

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step of controlling the processing items includes listing only processings practically available as said processing items of said other call by excluding the unavailable processing from the listing.

22. The communicating method according to claim 18, 5 wherein

said steps of controlling the processing items includes displaying a combination of processings for each call on said display as said processing items.

23. The communicating method according to claim 17, 10 wherein

said step of controlling the processing items includes listing said processing items available to the call on said display for each call.

24. The communicating method according to claim 23, 15 wherein

when a processing for one call is determined by said step of selecting and a processing for another call is naturally determined, said step of controlling said processing items includes listing only processing items available to said one call on said display. 20

25. The communicating method according to claim 23, 25 wherein

if a processing unavailable to said other call is selected by determining the processing for said one call, said step of controlling said processing items includes listing only processings available as said processing items of said another call by excluding the unavailable processing items. 30

26. The communicating method according to claim 17, 30 wherein

said step of controlling said processing items includes displaying a combination of processings for each call on said display means as said processing items.

27. The communicating method according to claim 17, 35 wherein

said step of controlling the display of said processing items includes always displaying said processing items on said display during a time when a predetermined call is connected.

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28. The communicating method according to claim 27, wherein

said step of controlling the display of said processing items includes listing said processing items available to the user on said display for each call.

29. The communicating method according to claim 28, wherein

in the case where a processing for one call is determined by said step of selecting and a processing for another call is naturally determined, said step of controlling the display of said processing items includes listing only processing items available to said one call on said display.

30. The communicating method according to claim 28, wherein

if a processing unavailable to said another call is generated by said step of selecting and determining the processing for said one call, said step of controlling the display of said processing items includes listing only processings available as said processing items of said another call by excluding the unavailable processing items.

31. The communicating method according to claim 27, 25 wherein

said step of controlling the display of said processing items includes displaying a combination of processings for each call on said display as said processing items.

32. The communicating method according to claim 17, 30 wherein:

said step of displaying includes displaying a cursor showing the processing item selected in said step of selecting;

determining a direction and amount of movement for moving said cursor in a predetermined direction; and determining information for determining the processing item on which said cursor is displayed can be selected by the user.

* * * * *

Exhibit G



US006393430B1

(12) **United States Patent**
Van Ryzin

(10) **Patent No.:** **US 6,393,430 B1**
(45) **Date of Patent:** ***May 21, 2002**

(54) **METHOD AND SYSTEM FOR
AUTOMATICALLY RECORDING MUSIC
DATA FILES BY USING THE HARD DRIVE
OF A PERSONAL COMPUTER AS AN
INTERMEDIATE STORAGE MEDIUM**

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(73) Assignees: **Sony Corporation**, Tokyo (JP); **Sony
Electronics Inc.**, Park Ridge, NJ (US)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/074,681**

(22) Filed: **May 8, 1998**

(51) Int. Cl.⁷ **G06F 17/30**

(52) U.S. Cl. **707/104; 707/102; 709/217;
345/339; 345/352**

(58) Field of Search **707/200, 102,
707/104, 10; 369/30, 29; 345/339, 146,
352; 709/217**

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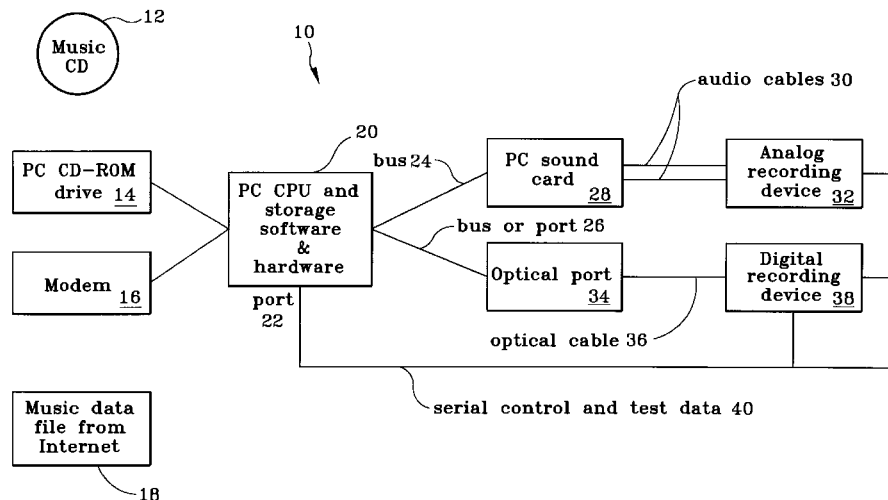
Primary Examiner—Jean R. Homere

(74) Attorney, Agent, or Firm—Harold T. Fujii

(57) **ABSTRACT**

A method and system for the creation of a custom playlist of various audio/visual tracks that are to be automatically recorded to a storage medium is disclosed. The user communicates with personal computer (PC) software by means of a graphical user interface (GUI). The GUI allows the user to create a custom playlist and to signal the intent that a recording of that custom playlist to a storage medium be made. Once the user has indicated the custom playlist is to be recorded, the software automatically records the custom playlist with no further user interaction required. In this manner, a minimum amount of user interaction is required.

23 Claims, 7 Drawing Sheets



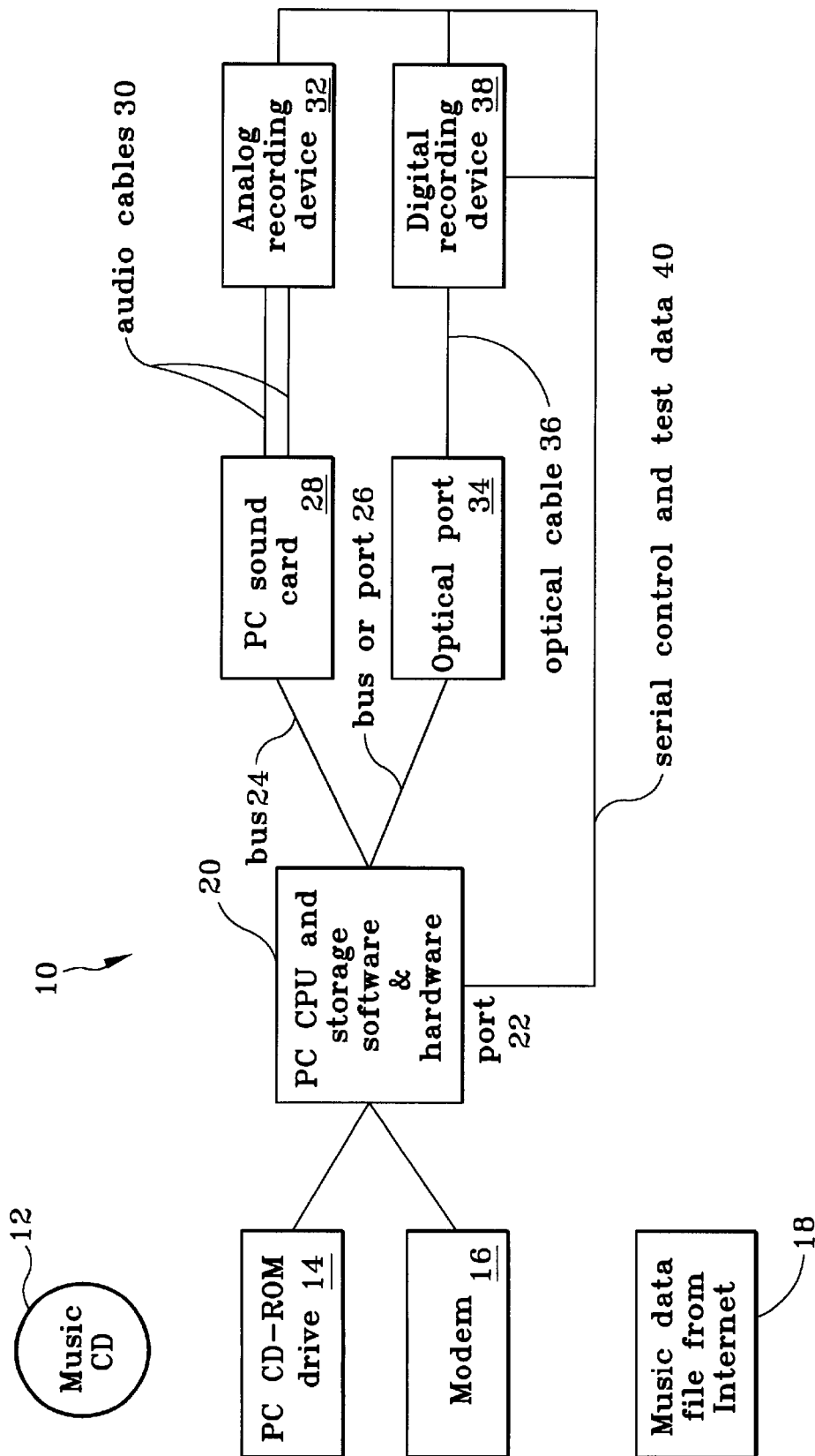


Figure 1

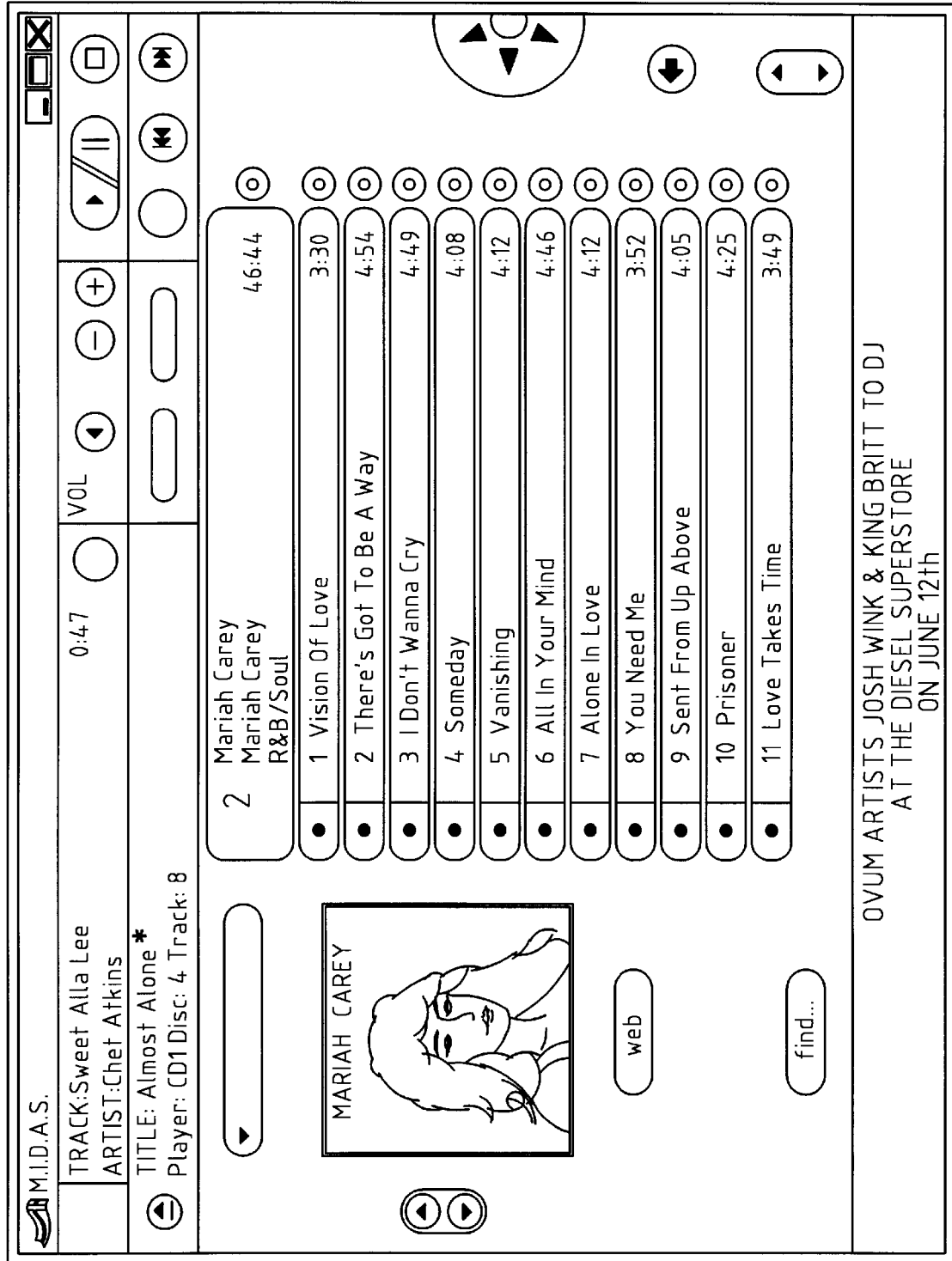


Figure 2

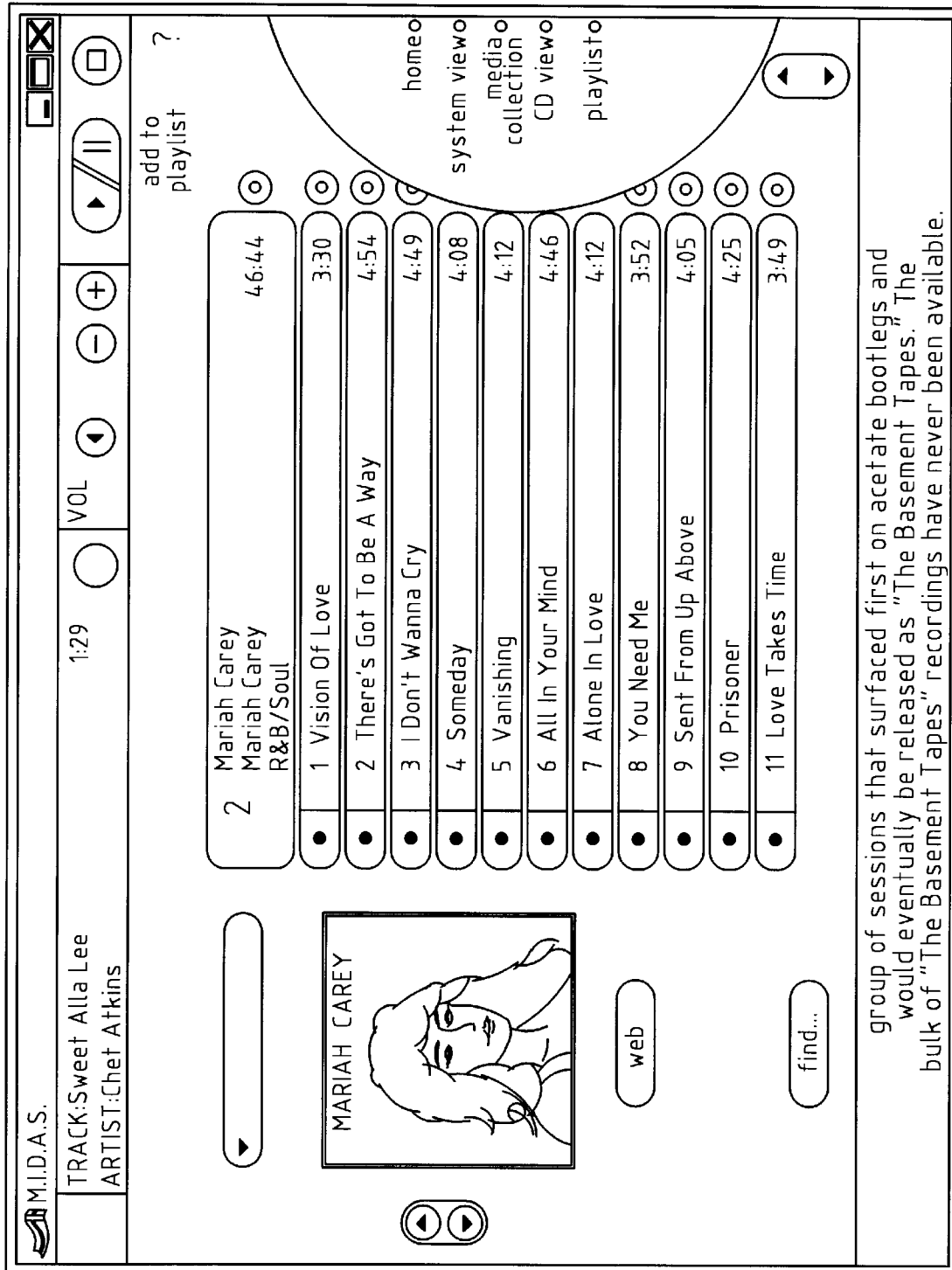


Figure 3

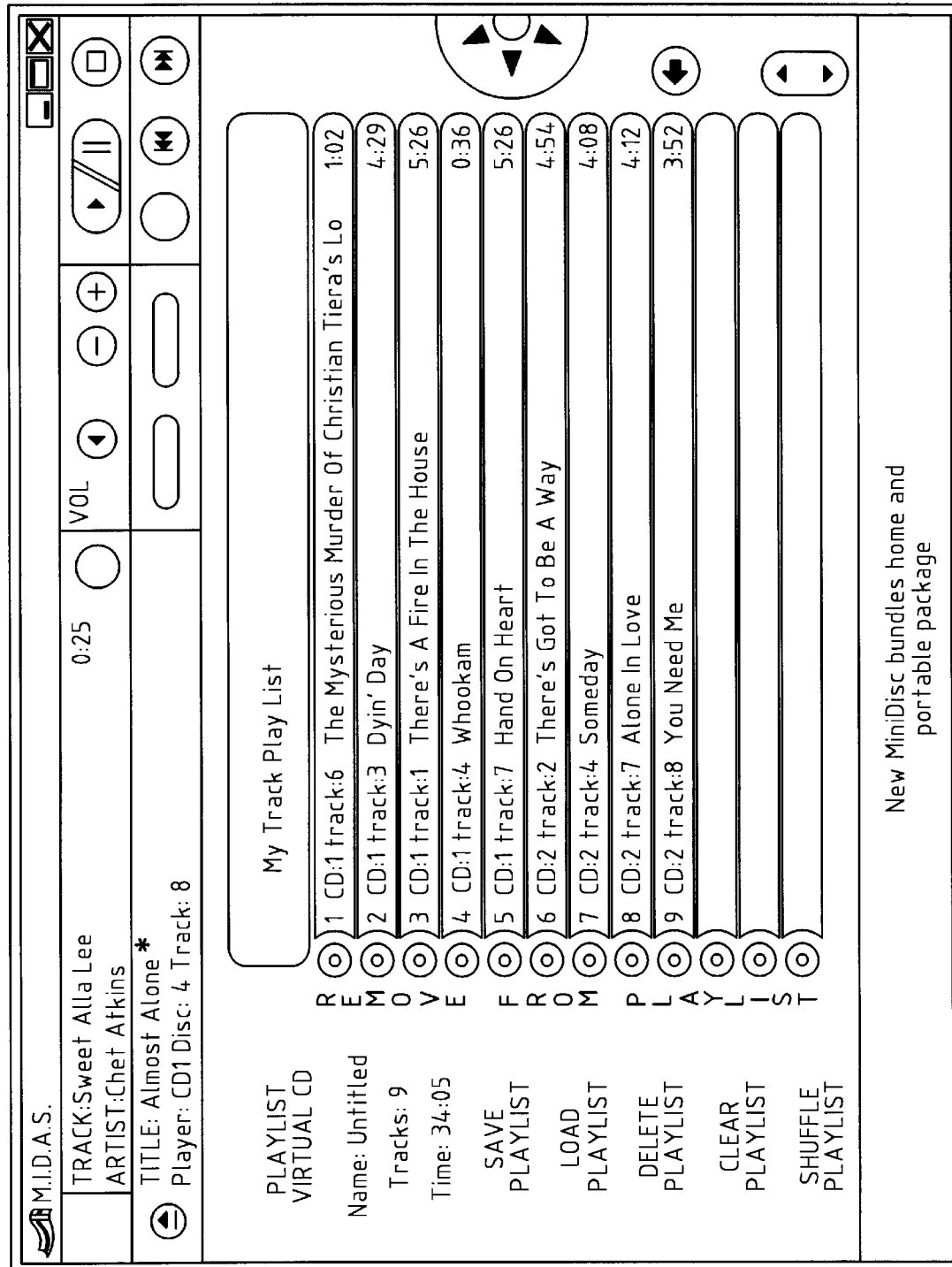


Figure 4

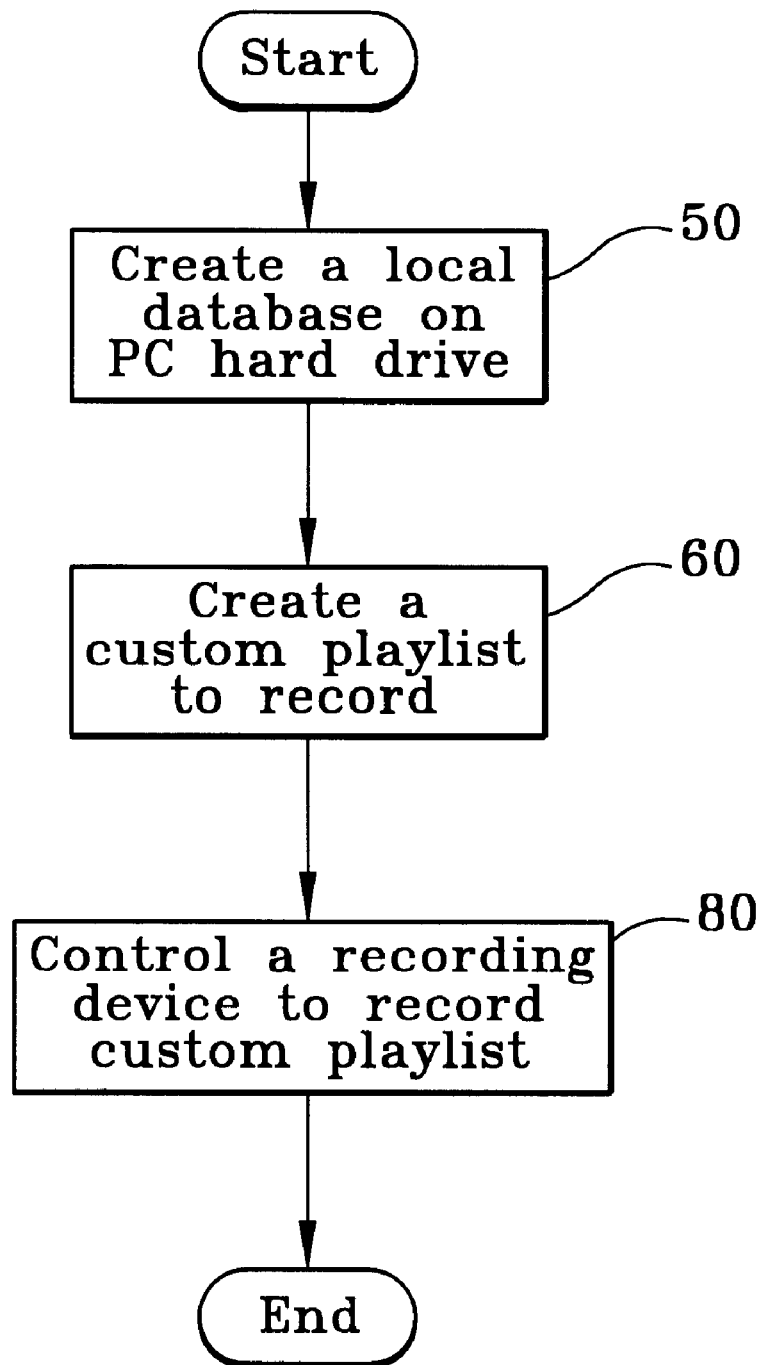


Figure 5

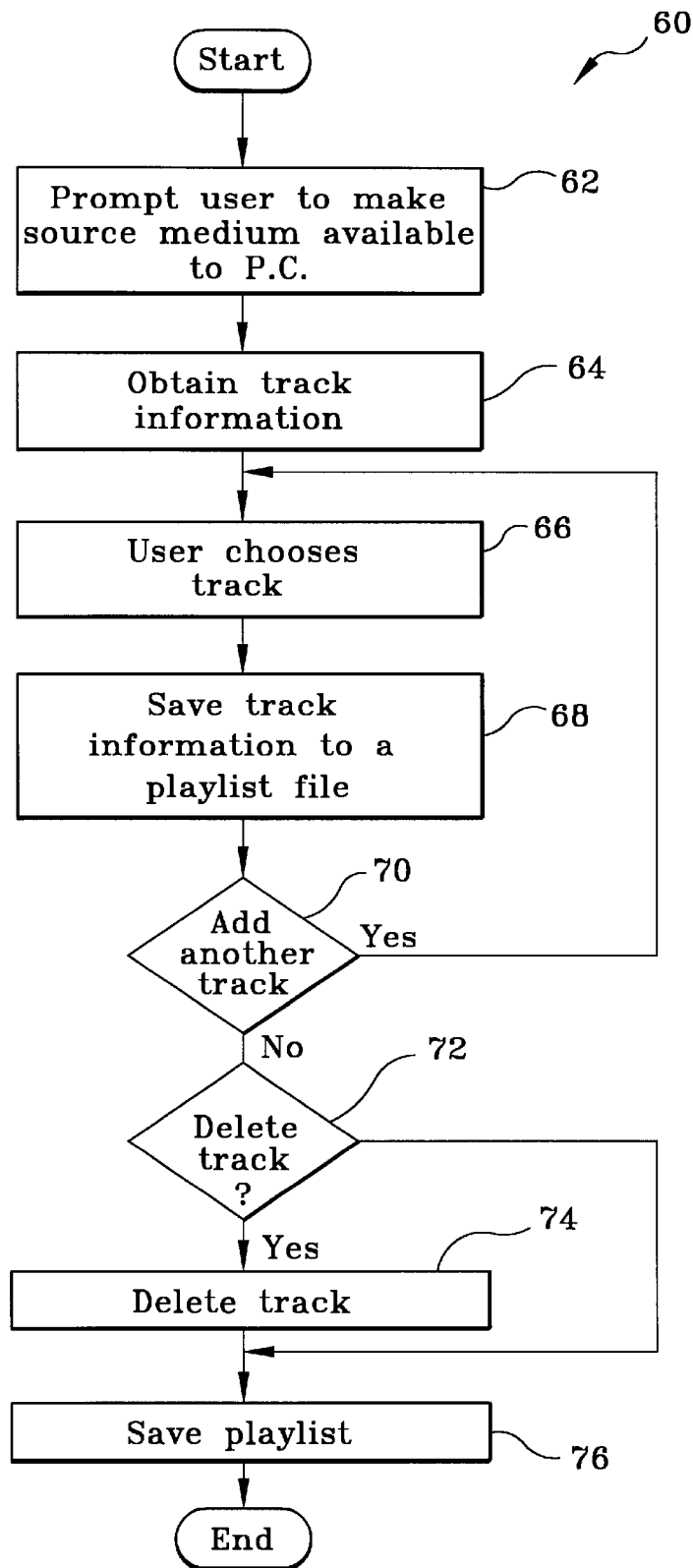


Figure 6

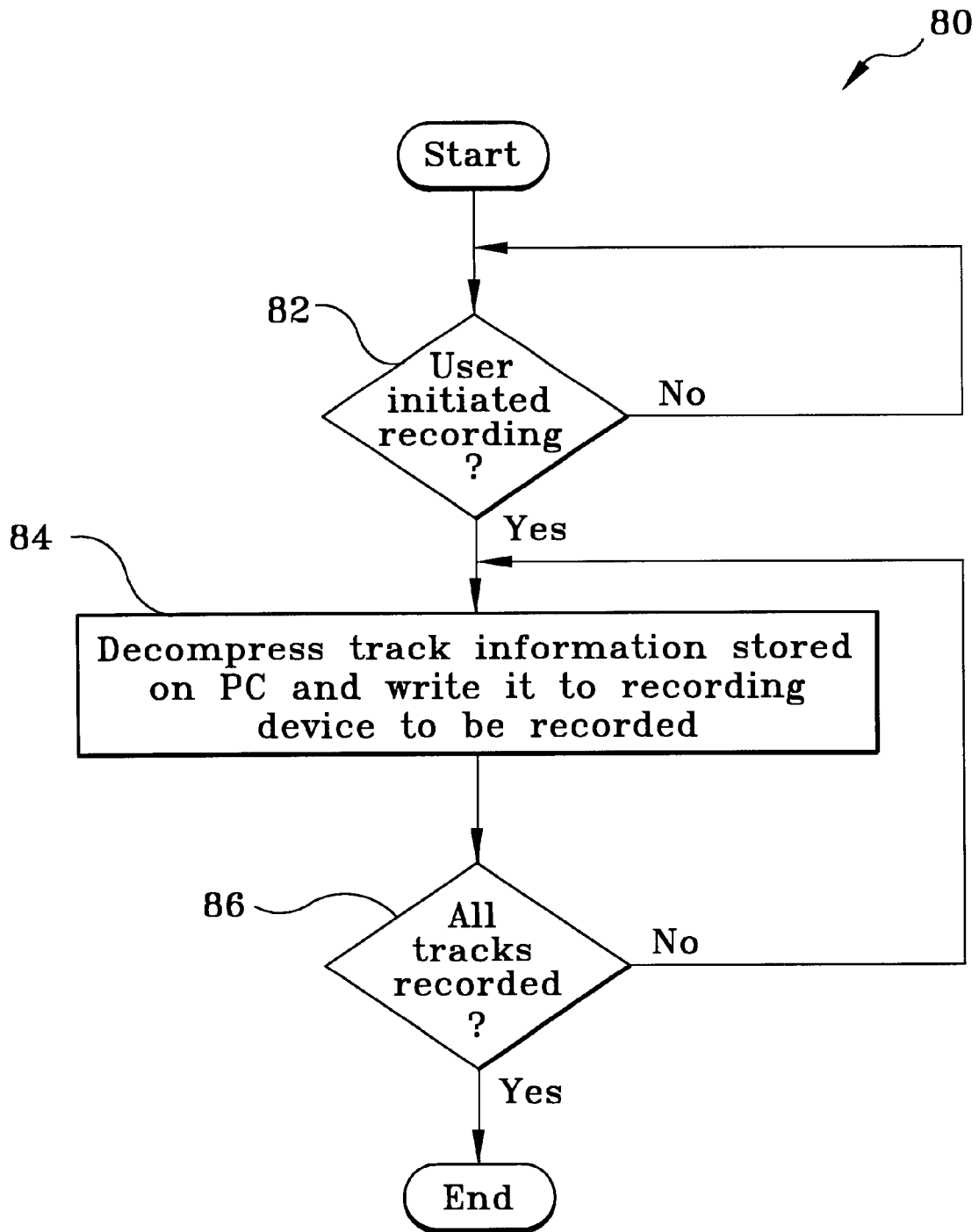


Figure 7

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**METHOD AND SYSTEM FOR
AUTOMATICALLY RECORDING MUSIC
DATA FILES BY USING THE HARD DRIVE
OF A PERSONAL COMPUTER AS AN
INTERMEDIATE STORAGE MEDIUM**

CROSS REFERENCE TO RELATED
APPLICATIONS

The subject matter of the present application is related to copending U.S. application Ser. No. 09/074,683, filed Oct. 31, 2001 contemporaneously with this application and assigned to Sony Corporation and to Sony Electronics, which is expressly incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to audio/visual recording devices and, more particularly, to a method and system for creating playlists that are automatically recorded to a recording medium.

BACKGROUND OF THE INVENTION

Users of audio/visual products, such as music and video tracks, often desire to record these products on storage mediums for replay at some future time. A person may desire to create a playlist of music tracks from various compact discs (CDs) by recording the music tracks to a minidisc, tape or other recording medium, for instance. Audio/visual products suitable for recording include, but are not limited to, music, video, and movie selections that are available from actual storage devices as well as electronically over the Internet.

The current manner of recording audio/visual products to create a customized playlist is a time consuming, labor intensive task. The user must designate a track and record it before the next track to be recorded can then be designated and recorded. The user, in other words, must both select the track to be recorded and initiate the recording process of that track before the next track to be recorded can be selected. This required interaction means that the user must be available to oversee the entire recordation operation from stop to finish.

Suppose, for example, that a user wishes to record five music selections, with the first selection from a first CD, the second selection from a second CD, the third selection from the first CD, the fourth selection from the first CD, and the fifth selection from a third CD. Prior to recording the first selection, the user would have to place the first CD in the recording device prior to recording the first selection. After recording the first selection, the user would then remove the first CD, insert the second CD into the recording device, record the second selection, and then remove the second CD. The third and fourth selection would be recorded after placing the first CD back into the recording device. Finally, the fifth selection could be recorded only after the user removes the first CD and inserts the third CD into the recording device.

In the above method of creating a custom playlist, a major disadvantage is that in addition to selecting the track to be recorded, the user must also be present for the actual recording of all but the last audio/visual product to be recorded since the user has to initiate each recording operation. This requires the presence of the user for the duration of the entire selection and recording operation so that the user can choose and then record the appropriate product. There therefore exists a need in the art for a user to be able

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to choose and record desired tracks of audio/visual product to a storage medium for later access with a minimum amount of user interaction and supervision required. In this way, the user can be freed up to engage in more productive and less tedious tasks if so desired.

SUMMARY OF THE INVENTION

It is accordingly an object of the invention to be able to choose and record desired tracks of audio/visual product to a storage medium for later access with a minimum amount of user interaction and supervision required.

Therefore, according to the present invention, a method and system for the creation of a custom playlist of various audio/visual tracks that are to be automatically recorded to a storage medium is disclosed. The user communicates with personal computer (PC) software by means of a graphical user interface (GUI). The GUI allows the user to create a custom playlist and to signal the intent that a recording of that custom playlist to a storage medium be made. Once the user has indicated the custom playlist is to be recorded, the software automatically records the custom playlist with no further user interaction required. In this manner, a minimum amount of user interaction is required.

The methodology for the present invention, through coordination of user interaction with the GUI, creates a custom playlist of audio/visual tracks and automatically records the custom playlist by performing the steps of creating the custom playlist and controlling a recording device to record the custom playlist to a storage medium. A step of creating a local database of track information on a hard drive of the personal computer is performed either simultaneously with or before creating the custom playlist. Creating the custom playlist comprises obtaining information about a plurality of tracks that are available to be added to the custom playlist, selecting one or more tracks of the plurality of tracks to be added to the custom playlist, adding the one or more tracks to the custom playlist by saving an identifier of each track of the one or more tracks to a playlist file, and saving the playlist file.

The system of the present invention that provides for creating the custom playlist of audio/visual tracks and automatically recording the custom playlist comprises the following: a personal computer defined as having a central processing unit, a storage capability, and an information accessing unit for accessing audio/visual tracks; a recording device that receives the custom playlist from the personal computer and records the custom playlist to a storage medium; a communications link between the personal computer and the recording device that enables the recording device to receive the custom playlist from the personal computer; and software that runs on the personal computer that communicates with a user through a graphical user interface to create the custom playlist of audio/visual tracks and to control the recording device to record the custom playlist to the storage medium.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the claims. The invention itself, however, as well as the preferred mode of use, and further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawing(s), wherein:

FIG. 1 is a block diagram of a system that allows a user to choose and record desired tracks of audio/visual product to a storage medium for later access, according to the present invention;

FIG. 2 is an example of a table of contents (TOC) database, as it might appear on a GUI of a PC, according to the present invention;

FIG. 3 is a GUI representation of the playlist icon, according to the present invention;

FIG. 4 is a GUI representation of various options available for modifying the playlist, according to the present invention;

FIG. 5 is an overall flow of the methodology that allows a user to choose and record desired tracks of audio/visual product to a storage medium for later access, according to the present invention;

FIG. 6 illustrates the methodology for creating the custom playlist, according to the present invention; and

FIG. 7 illustrates the methodology for automatically recording the custom playlist to a storage medium.

DESCRIPTION OF THE INVENTION

The present invention describes a method and a system for the creation of a custom playlist of various audio/visual tracks that are to be automatically recorded to a storage medium. The custom playlist is a collection of information tracks capable of being played on a digital audio/visual actuator device, such as a compact disc (CD) player, digital audio tape (DAT) player, VCR, digital visual disc, cassette recorder, the digital visual disc/mini disc (DVD/MD) player, and stereo components such as stereo receivers. Using the present invention, the tracks specified by the user in the custom playlist may be automatically recorded, providing the user with the ability to make custom recordings in a manner that does not require the user to be present for the recording of the custom playlist. Upon creation of the custom playlist, the recording operation is automatic once the user indicates an intent to create the recording; the recording operation does not therefore require any user intervention.

The user accomplishes creation of the custom playlist and recording of the tracks identified in the custom playlist by use of a graphical user interface (GUI) of a personal computer (PC). Through the GUI, the user creates the custom playlist and then initiates the recording procedure of all tracks on the playlist by simply selecting the "record" feature of the GUI.

The following example of making and then recording a custom music CD playlist will be presented and may be better understood by reference to FIG. 1. A user may make custom recordings, for example, on a minidisc recorder from their own music CD collection, represented by music CD 12, or from music data files 18 that are purchased electronically via the Internet by means of modem 16. To do this, the user creates the custom playlist, a list of music CD tracks, to record through proper interaction with a GUI representation of software resident on the PC central processing unit (CPU) and storage 20; in the case of a music CD 12 as the source medium, the software copies audio track information from the music CD 12 that has been placed in the user's PC CD-ROM drive 14 to the PC's hard drive.

After prompting the user to insert music CD's 12 into the PC's CD-ROM drive 14, the software reads the CD's table of contents (TOC) in order to present to the user the contents of that CD. For a lower-end application, the TOC will simply indicate the track numbers on the CD. For a higher-grade application, the TOC indicates both the track numbers and the track names. For an even higher-grade application, the TOC will provide the CD cover art in addition to his

information. In this way, the software will search for the title and track names on the CD using the TOC in a database file that comes with the software. An example of the TOC database, as it might appear on a GUI of a PC, is illustrated in FIG. 2. It can be seen that the number of tracks, the name and duration of each track, and the CD cover art of each CD is provided to the user.

Before or during the user's creation of the custom playlist, the software creates a local database on the PC's hard drive that represents the user's music collection. This is done using a CD's TOC as an index to a CD title and track text database that is shipped with the software. The database has the title and track names of current CD's in the marketplace. When a new CD is used, this text information will be read from the "text entry" field on the music CD contained in the PC CD-ROM drive 14. In addition, if the CD is not contained in the CD title and track text database and is not "text ready," the software, through the GUI, will allow the user to type in the title and track names manually. In this manner, as new music CD's are placed into the PC CD-ROM drive 14, the software builds up a user's collection database. The title and track information of the custom playlist will be transferred by the software to the recording device via a connection between the PC and the recording device. As shown in FIG. 1, the recording device could be an analog recording device 32 or a digital recording device 38.

Once a local collection database has been created on the PC's hard drive, the user can make one or more custom playlists from the local collection database for recording. The custom playlists could be saved on the PC and retrieved by the user at a later date. The custom playlist is created on a PC, for instance, by pointing and clicking on icons of a graphical user interface (GUI) that are representative of desired CD tracks, thereby selecting those tracks to be added to the playlist. FIG. 3 provides an example of what the GUI on a PC might look like; in FIG. 3, on the right side of the screen, the icon for selecting the playlist function is clearly shown. Tracks are easily identified by their track index in the TOC of a CD, a database containing the number of tracks and length of each track on the CD. The reader is referred again to FIG. 2 which shows a GUI example of a TOC of a music CD, by way of example. Using the TOC and track index, it is possible to place a certain track of a CD in any position of the custom playlist being created.

Once created, the custom playlist may be modified in a variety of ways. Modification of the playlist may include deleting tracks from the playlist, rearranging tracks in the playlist, and adding tracks to the playlist. Referring to FIG. 4, a sample GUI illustrates the various options for modifying the playlist, including saving, loading, deleting, clearing, or shuffling the playlist.

The software controls a recording device that will record the custom playlist. The recording device may be an analog recording device 32 or an analog recording device 38, both illustrated in FIG. 1. Once the custom playlist has been created, the user can click on record. The user is given the option of having the audio output on the PC be either to a PC sound card 28 or to an optical output cable 36 through optical port 34. If the analog recording device 32 is to be used, the software of PC CPU 20 communicates to PC sound card 28 via bus 24. PC sound card 28 communicates with analog recording device 32 by way of audio cables 30 for tape. If the digital recording device 38 is to be used to record, software communicates to optical port 34 by means of bus 26. Optical port 34 communicates to digital recording device 38 by optical cable 36, for minidisc, for instance.

Either analog recording device **32** or digital recording device **38** receive serial control and text data **40** from the software and data files of PC CPU and storage unit.

The software reads the raw audio track data from the CD, compresses it to save hard drive space, and writes them to the hard drive **14**. Once an entire playlist is saved to the hard drive **14** and the user selects the record function, the software de-compresses the audio information and writes the data to either the PC's sound card **28** or a PC port **26** that has a LED and fiber optic audio output cable **36**. One skilled in the art will recognize that the software could control the recording device **32** or **38** via a serial or a parallel port as well.

Once the creation of the custom playlist is complete and all of the tracks are compiled by software into a single file on the hard drive, the user can click on a "record" function of the GUI and the software automatically starts the recording. Once the user has initialized the record operation, he is then free to walk away until the recording is done. From the user's perspective, this operation appears to be a high-speed dub because they can quickly make a list of tracks for the custom playlist, press record, and not be present while the software automatically completes the recording operation.

As previously mentioned, the user may obtain tracks to be recorded from the Internet. It is therefore envisioned that the software would provide the additional functionality of a browser that would allow the user to purchase music tracks **18** via the Internet connection through modem **16**.

This methodology of the present invention for creating and recording a custom playlist is demonstrated by the flowcharts of FIGS. 5-7. Referring to FIG. 5, an overall flow of the present invention is shown. First, at Block **50**, the PC software creates a local database on the PC's hard drive of the collection of tracks which are available to the user and from which the custom playlist may be created. Track information from the source medium is copied to the PC storage, the hard drive of the computer. The software reads the raw track data from the storage medium (CD), compresses it, and writes it to the PC hard drive. At Block **60**, the user, through communication with the PC GUI creates the custom playlist. This creation process will be further described in FIG. 6. It should be noted that the step of creating a local database on the PC's hard drive identified at Block **50** could be performed before or simultaneous with the creation of the custom playlist in Block **60**. Finally, at Block **80** the software controls a recording device to record the tracks identified in the custom playlist to a storage medium. When the user indicates the custom playlist is to be recorded, the track information stored in the PC hard drive is decompressed and written to the recording device.

It should be noted that the track data can be written to the PC hard drive much faster than it can be actually recorded by the recording device. The rate at which the track information is written to the PC hard drive is approximately 24 times or more faster than the same information can be recorded by the recording device. The present invention uses a minimum of user time by copying very rapidly to the PC hard drive track information the user wishes to later copy; when the custom playlist is actually copied by the recording device, the user need not be present and it is therefore not critical that the rate at which the tracks are recorded by the recording device is substantially slower than the rate at which the information was it saved to the PC's hard drive.

Referring now to FIG. 6, the various steps for creating the custom playlist will be described. First, at Block **62** the software prompts the user to make the source medium, from

which the track is to be recorded, available. In other words, the track the user wishes to add to the custom playlist must be accessible to the PC. This may take the form of the software GUI prompting the user to place a CD containing the track to be added to the custom playlist in the PC's CD-ROM drive, for instance. Next, information about the source medium and tracks contained therein must be obtained so that it may be accessed by the software as shown in Block **64**. Accessing this information includes, in the case of the source medium being a CD, reading the CD's TOC. The user can additionally browse the collection of information available by searching for title and track names using the TOC in a database file that comes with the software. Optionally, the software can read "text ready" track and title text information from the CD or prompt the user to enter title and track names manually through the GUI. Accordingly, when a new source medium, such as a new CD, is used, the text information of the new CD is read from the "text entry" field on the CD in the PC's CD-ROM drive. Additionally, if the CD is not in the database and is not "text ready," the user can manually type in the title and track names. In this manner, the software builds upon the user's collection database.

Next, at Block **66**, the user chooses a track to be added to the custom playlist. Information about this track is saved to a playlist file at Block **68**. Decision Block **70** inquires as to whether the user wishes to add another track to the custom playlist. If yes, the flow returns to prior to Block **66**; if no, the flow continues to Decision Block **72**. Decision Block **72** inquires as to whether the user wishes to delete a track of the custom playlist. If so, the track is deleted at Block **74**; if not, the flow skips to Block **76**. At Block **76** the custom playlist is saved.

Referring to FIG. 7, the methodology for automatic recording **80** of the custom playlist by the PC software is shown. At Decision Block **82**, the inquiry is whether the user has initiated recording of the custom playlist. The user would initiate the recording by clicking on a "record" icon of the GUI. If the user has indicated the playlist is to be recorded, at Block **84** the software decompresses the track information of the next track to be recorded and then writes this information to the recording device. The recording device structure and connection is illustrated in FIG. 1. Decision Block **86** ensures that this occurs for each track of the custom playlist. The present invention thus automatically records the custom playlist to a storage medium once the user indicates that the recording operation is to commence.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method of automatically recording audio/visual selections included in a custom playlist, comprising the steps of:

- selecting one or more audio/visual selections, including titles and contents, to be added to the custom playlist from at least one source medium;
- obtaining information about the selected audio/visual selections;
- saving the obtained information for each of the selected audio/visual selection to a playlist file in order to add the selected audio/visual selections to the custom playlist;

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modifying the saved information for the selected audio/visual selections in the playlist file in order to manipulate the audio/visual selections in the custom playlist saving the playlist file and the selected audio/visual selections to a storage device of the personal computer; and

controlling a recording device that is physically connected to the personal computer to record the selected audio/visual selections included in the custom playlist from the storage device to a recordable medium.

2. The method of claim 1, wherein the step of obtaining information about the selected audio/visual selections comprises reading the table of contents of each source medium that contains an audio/visual selection of the plurality of audio/visual selections.

3. The method of claim 1, wherein the step of obtaining information about the selected audio/visual selections comprises searching a collection of audio/visual selections for title and audio/visual selection names.

4. The method of claim 3, wherein the collection of audio/visual selections is contained in a database file of a personal computer software.

5. The method of claim 3, wherein the collection of audio/visual selections is obtained from an external information source.

6. The method of claim 5, wherein the external information source is the Internet.

7. The method of claim 3, wherein the collection of audio/visual selections is contained in at least one source medium that are accessed by the personal computer.

8. The method of claim 7, wherein the source medium is a compact disc (CD).

9. The method of claim 1, wherein the obtained information contains an identifier which is a track index of an audio/visual selection.

10. The method of claim 1, further comprising the step of: deleting any audio/visual selection of the custom playlist that is no longer to be in the custom playlist prior to saving the obtained information to a playlist file.

11. The method of claim 1, wherein saving the selected audio/visual selections to the storage device of the personal computer comprises the step of:

creating a local database of audio/visual selection information on a hard drive of the personal computer, wherein the step of creating the local database of audio/visual selection information is performed simultaneously with the step of creating the custom playlist.

12. The method of claim 1, wherein saving the selected audio/visual selections to the storage device of the personal computer comprises the step of:

creating a local database of audio/visual selection information on a hard drive of the personal computer, wherein the step of creating the local database of audio/visual selection information is performed prior to the step of creating the custom playlist.

13. The method of claim 1, wherein a user performs the step of creating the custom playlist by interacting with a graphical user interface (GUI) of software on the personal computer.

14. The method of claim 1, wherein the step of controlling the recording device that is physically connected to the personal computer to record the selected audio/visual selections included in the custom playlist from the storage device to a recordable medium comprises the steps of:

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receiving an indication from a user that the custom playlist is to be recorded;

decompressing audio/visual selection information for each audio/visual selection included in the custom playlist; and

writing the audio/visual selection information for each audio/visual selection included in the custom playlist to the recording device; and

recording each audio/visual selection included in the custom playlist to the recordable medium by the recording device.

15. The method of claim 1, wherein the step of controlling the recording device that is physically connected to the personal computer to record the selected audio/visual selections included in the custom playlist from the storage device to a recordable medium is initiated by a user indicating that the custom playlist is to be recorded.

16. The method of claim 15, wherein the user indicates that the custom playlist is to be recorded by selecting a record icon of a graphical user interface (GUI) of software on the personal computer.

17. A system that provides for automatic recording of audio/visual selections included in a custom playlist, comprising:

a personal computer defined as having a central processing unit, a storage device, and an information accessing unit for accessing available audio/visual selections, including titles and contents of the audio/visual selections, from at least one source medium;

a recording device that receives the audio/visual selections included in the custom playlist from the personal computer and records the audio/visual selections to a recordable medium, the recording device being physically connected to the personal computer;

a direct communications link between the personal computer and the recording device that enables the recording device to receive the audio/visual selections included in the custom playlist from the personal computer; and

software that runs on the personal computer that communicates with a user through a graphical user interface to create the custom playlist of audio/visual tracks and to control the recording device to record the audio/visual selections included in the custom playlist to the recordable medium, the software being configured (a) to select one or more audio/visual selections; (b) to obtain information about the selected audio/visual selections, (c) to save the obtained information for each of the selected audio/visual selection to a playlist file in order to add the selected audio/visual selections to the custom playlist; (d) to modify the saved information for the selected audio/visual selections in the playlist file in order to manipulate the audio/visual selections in the custom playlist; and (e) to save the playlist file and the audio/visual selections included in the custom playlist to the storage device of the personal computer prior to controlling the recording device to record the audio/visual selections from the storage device to the recordable medium.

18. The system of claim 17, wherein the information accessing unit for accessing audio/visual selections is a modem of the personal computer.

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19. The system of claim **17**, wherein the information accessing unit for accessing audio/visual selections is a CD-ROM drive of the personal computer.

20. The system of claim **17**, wherein the recording device is an analog recording device.

21. The system of claim **20**, wherein the direct communications link is a PC sound card connected to the analog recording device by audio cables.

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22. The system of claim **21**, wherein the communications link is an optical port connected to the digital recording device by an optical cable.

23. The system of claim **22**, wherein the direct communications link is a PC sound card connected to the analog recording device by audio cables.

* * * * *

Exhibit H



US006441828B1

(12) **United States Patent**
Oba et al.

(10) **Patent No.:** **US 6,441,828 B1**

(45) **Date of Patent:** **Aug. 27, 2002**

(54) **IMAGE DISPLAY APPARATUS**

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(73) Assignee: **Sony Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(22) Filed: **Sep. 8, 1999**

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Jan. 25, 1999 (JP) 11-016215

(51) **Int. Cl.⁷** **G09G 5/34**

(52) **U.S. Cl.** **345/659; 345/905; 348/794**

(58) **Field of Search** 345/10, 126, 1-2, 345/905, 326-327, 329, 330; 361/681, 683, 686-687; 348/333.01, 333.02, 333.03, 333.04, 333.11, 333.12, 232, 222, 207, 211, 552, 794, 373, 14.09; 725/109, 112-113, 118, 133, 141; 382/103; 709/204

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Primary Examiner—Richard Hjerpe

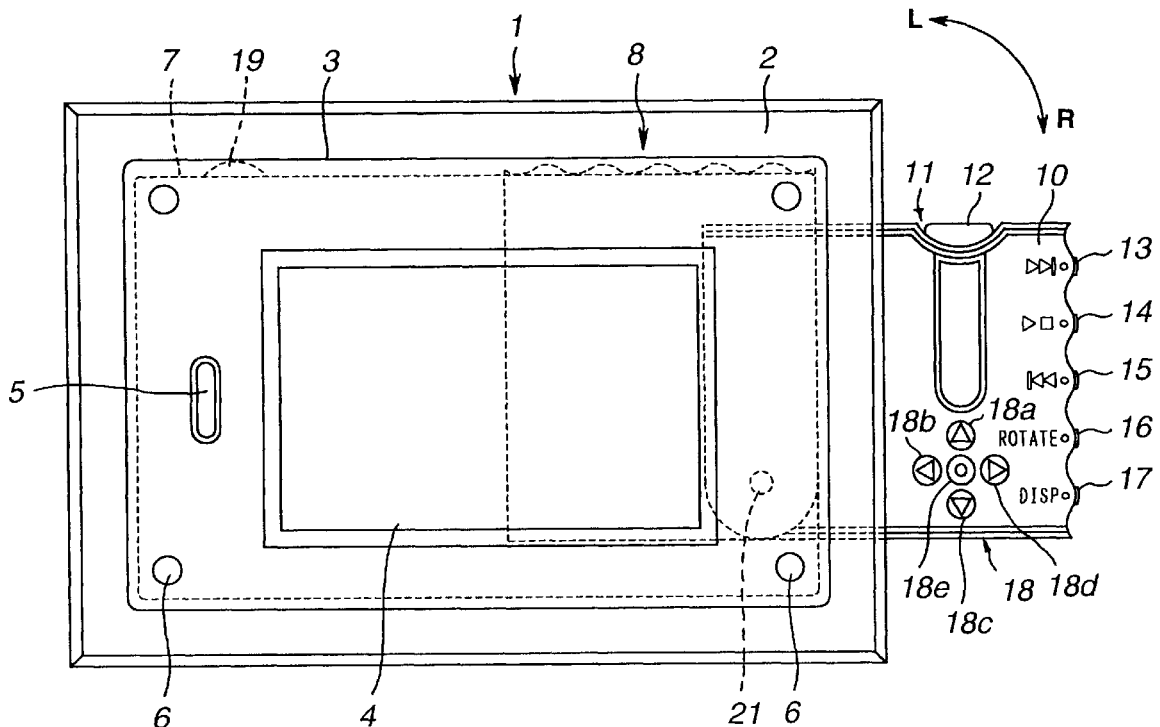
Assistant Examiner—Francis Nguyen

(74) *Attorney, Agent, or Firm*—Jay H. Maioli

(57) **ABSTRACT**

In an image display apparatus, information on a direction in which an image is to be displayed on a display panel is recorded in a memory card, and a to-be-displayed image signal corresponding to the displaying-direction information read from the memory card is displayed on the display panel. The displaying-direction information relates to a direction in which the image is to be displayed on the display panel. More particularly, it is information indicative of a direction designated by the user of the apparatus pressing a rotate button on an operation panel and in which image information initially read from the memory card is displayed on the display panel. Pressing the rotate button a maximum of three times for one image will rotate the image clockwise, for example, whereby it is possible to designate a desired direction in which the image is to be displayed. Thus an image can be displayed in a correct direction even with no designation for an image's normal direction regardless of whether the image display apparatus itself is placed with the shorter or longer side down.

18 Claims, 13 Drawing Sheets



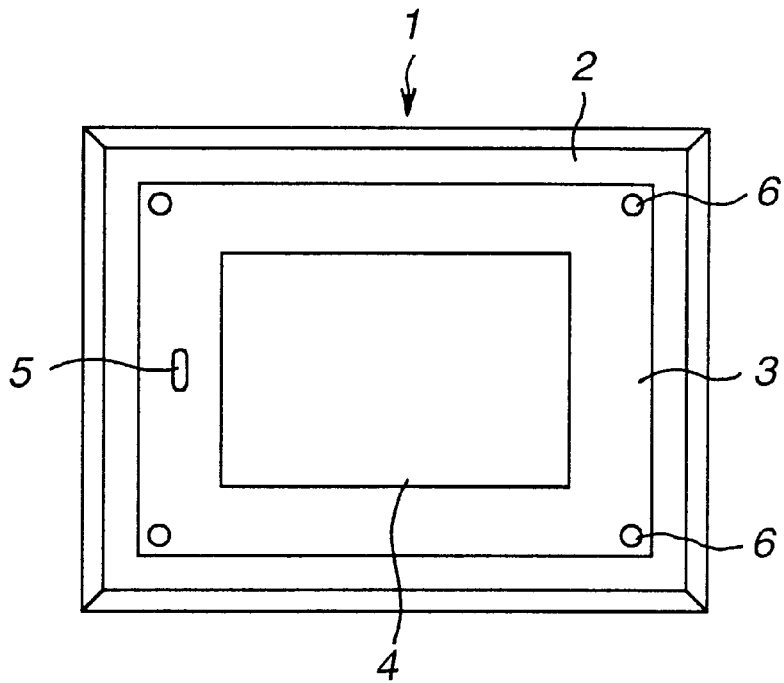


FIG. 1

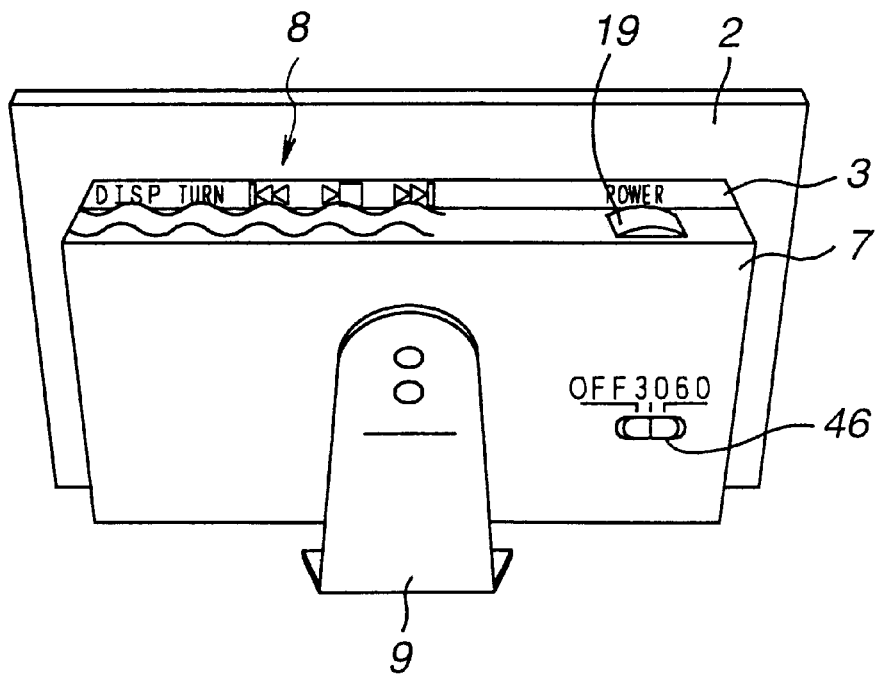


FIG. 2

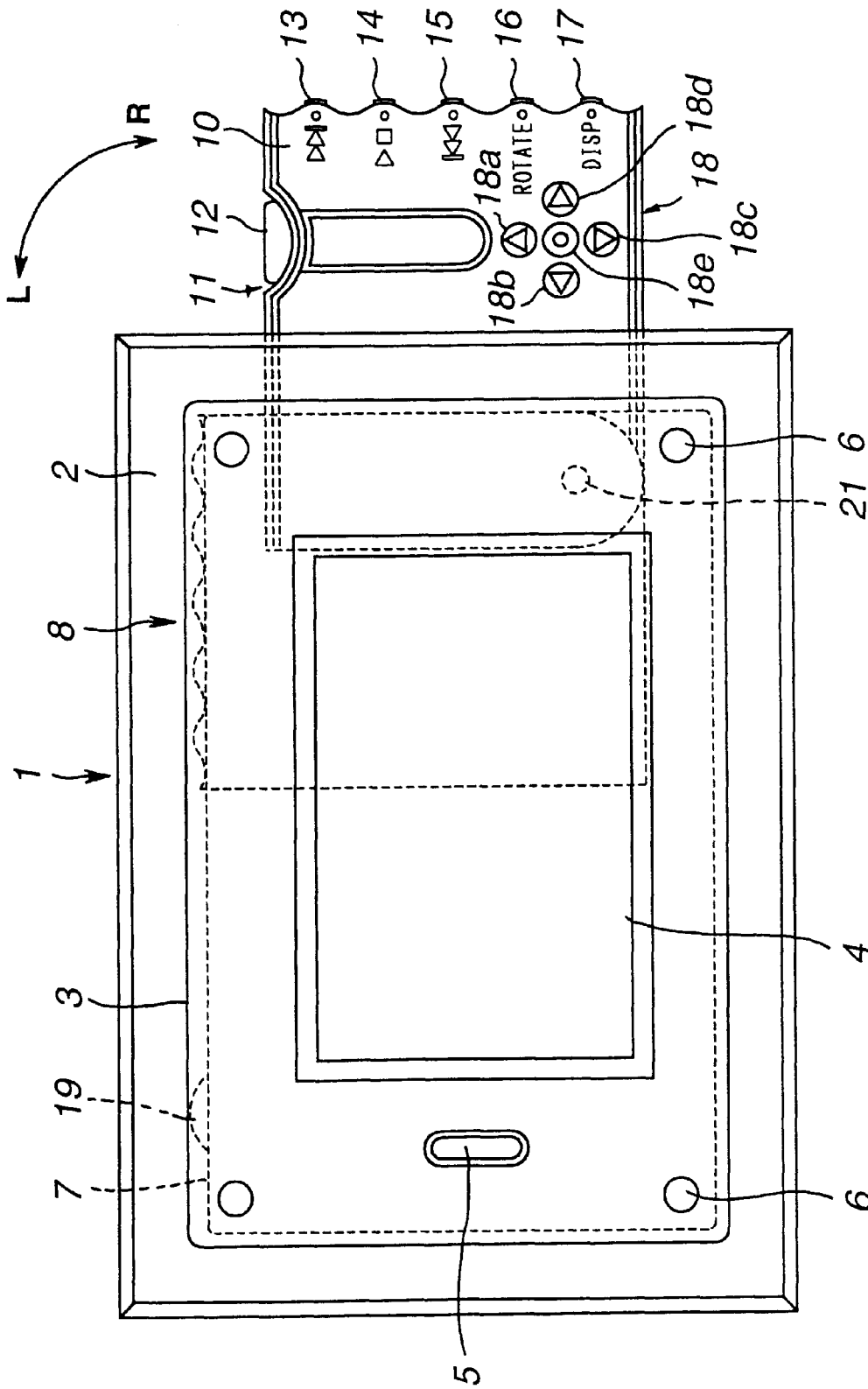


FIG.3

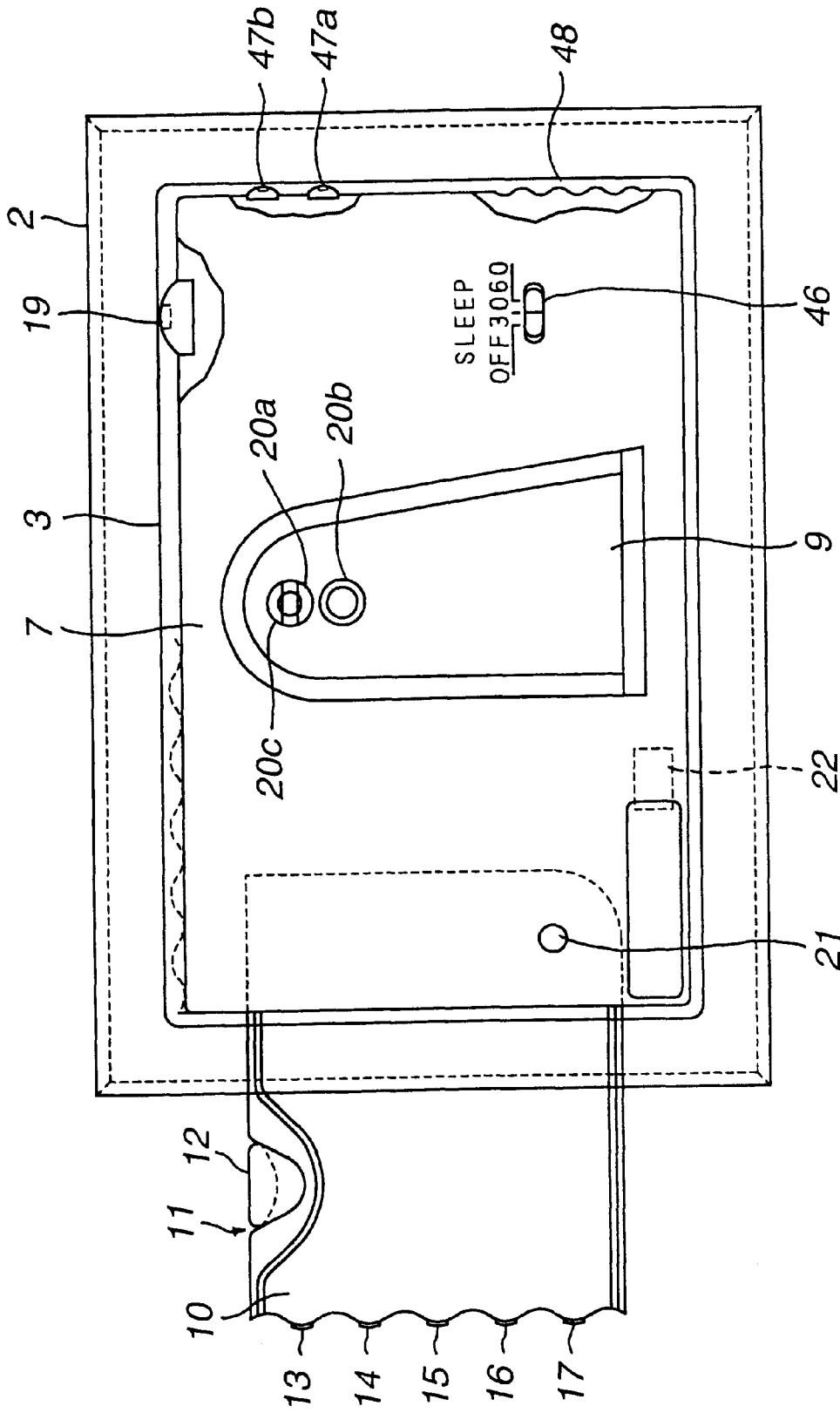


FIG.4

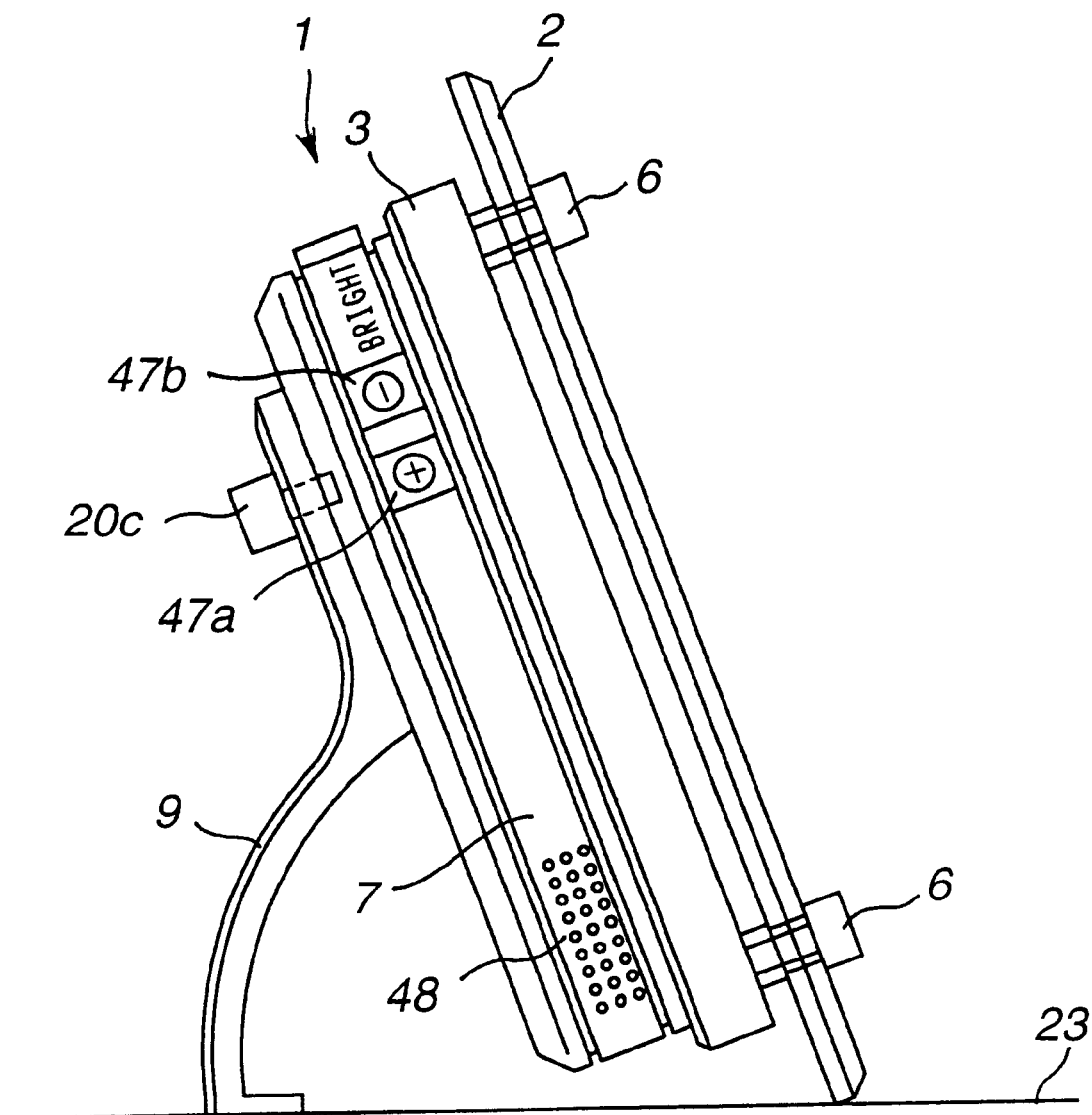


FIG.5

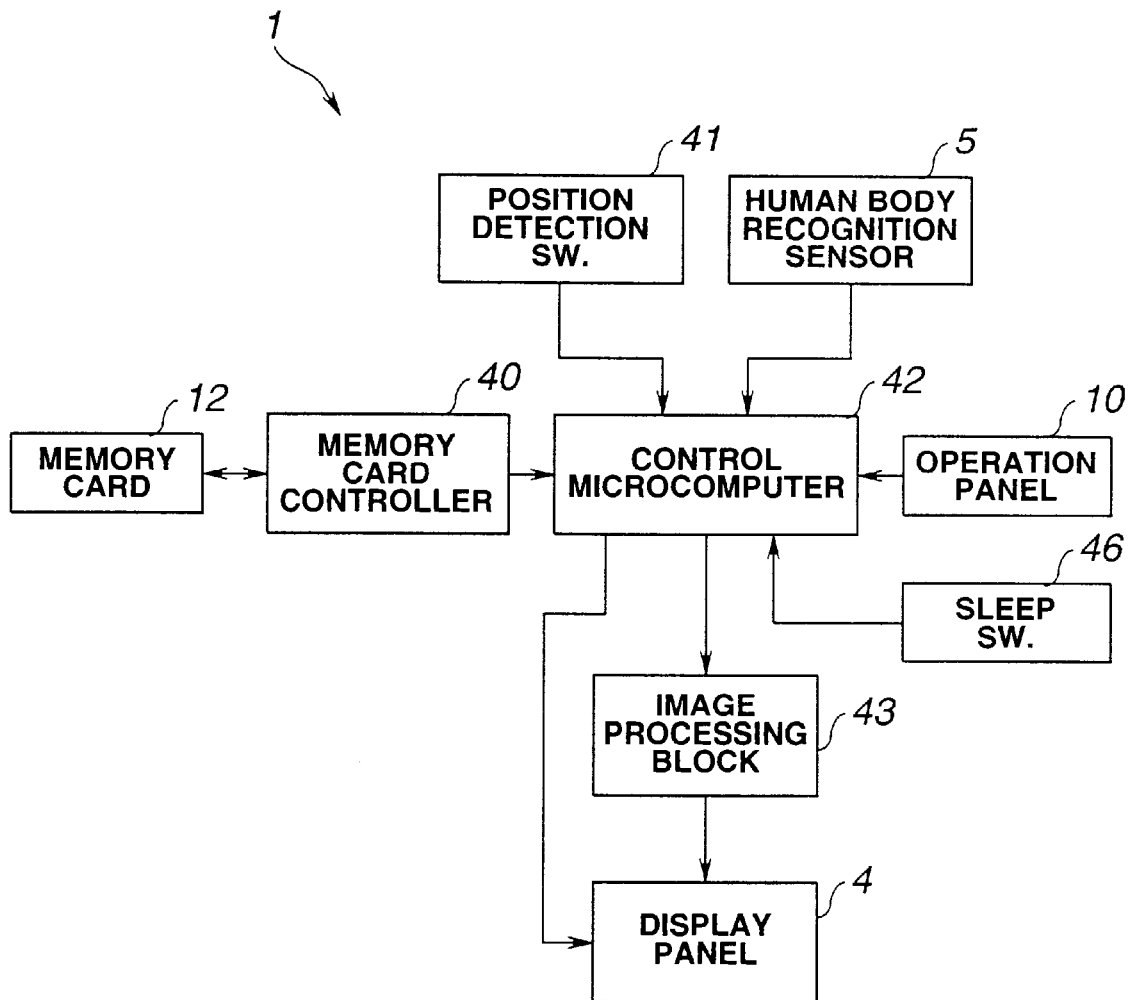


FIG.6

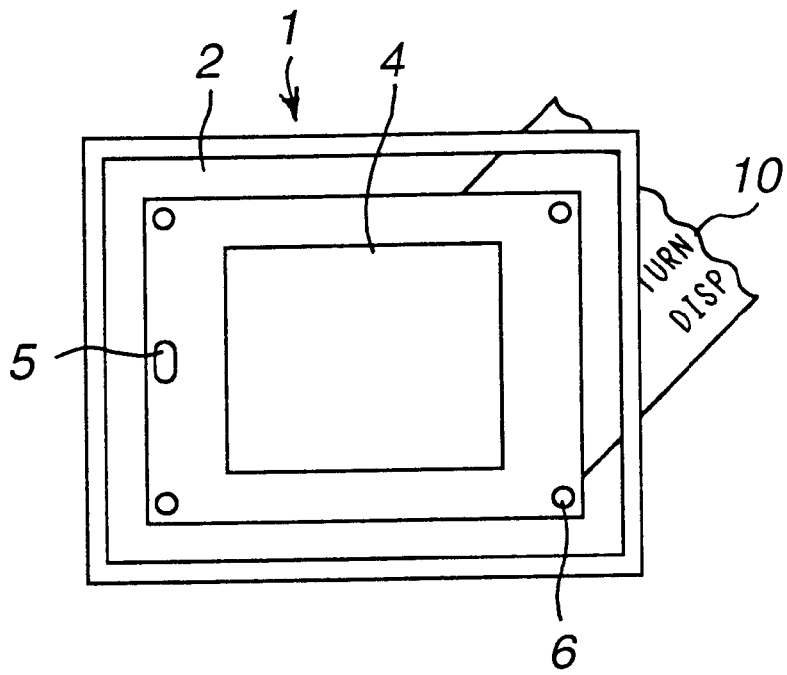


FIG. 7

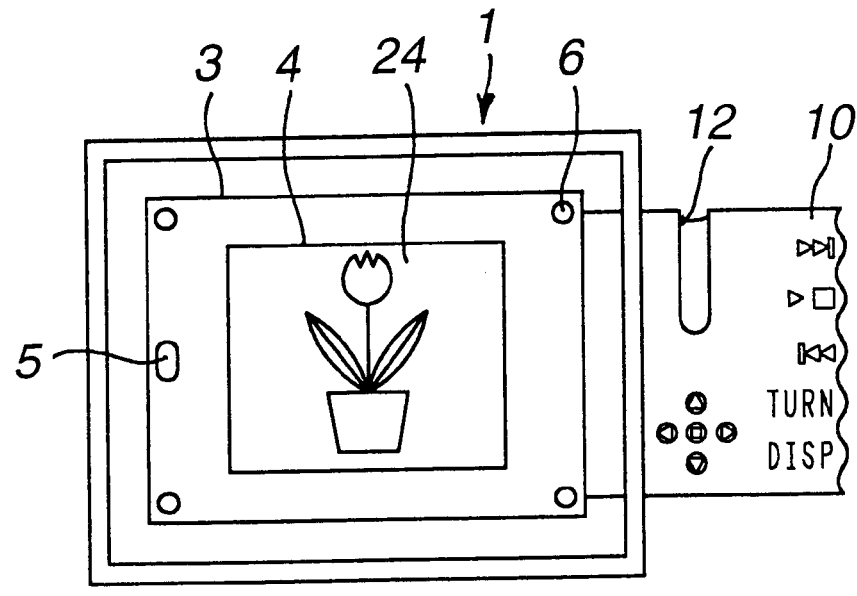


FIG. 8

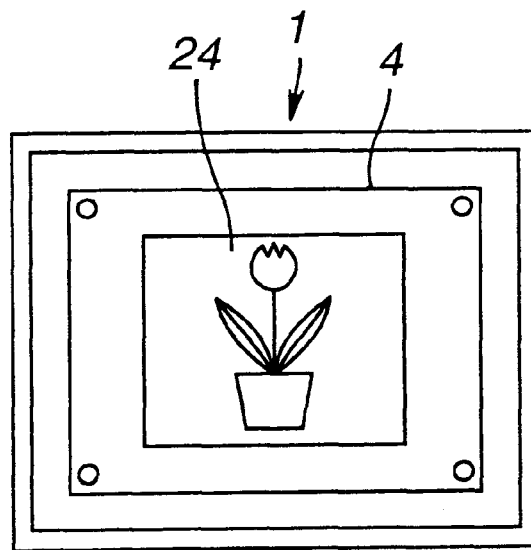


FIG. 9

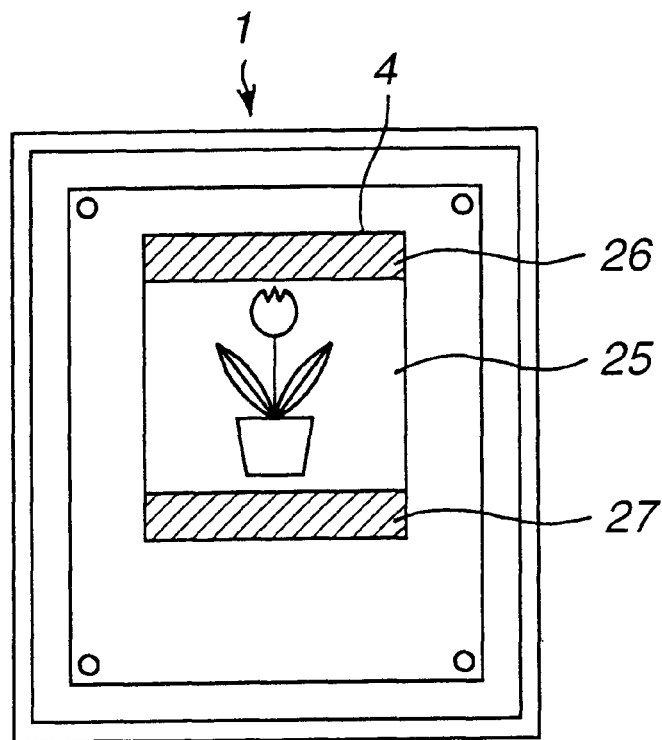


FIG. 10

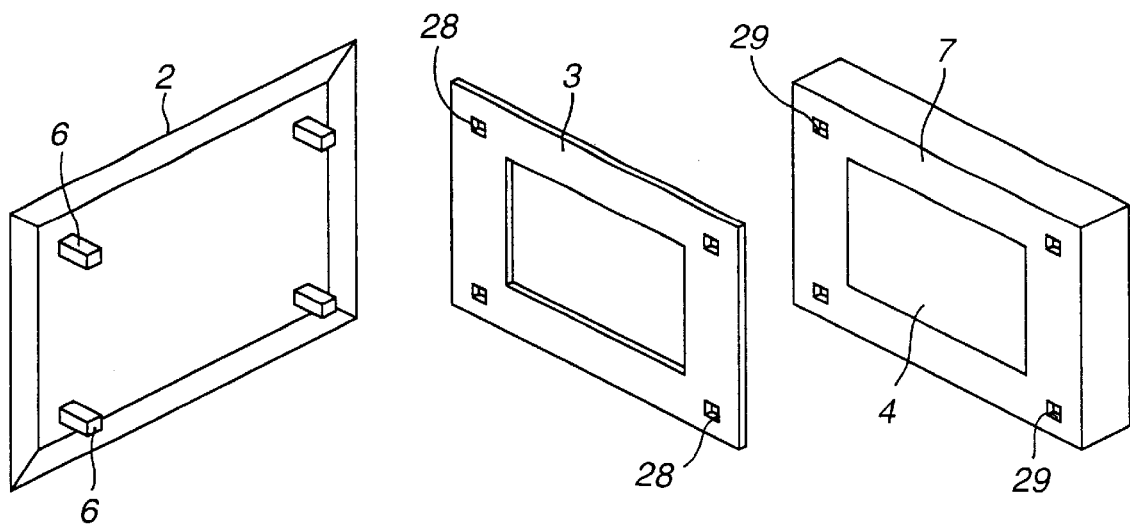


FIG.11

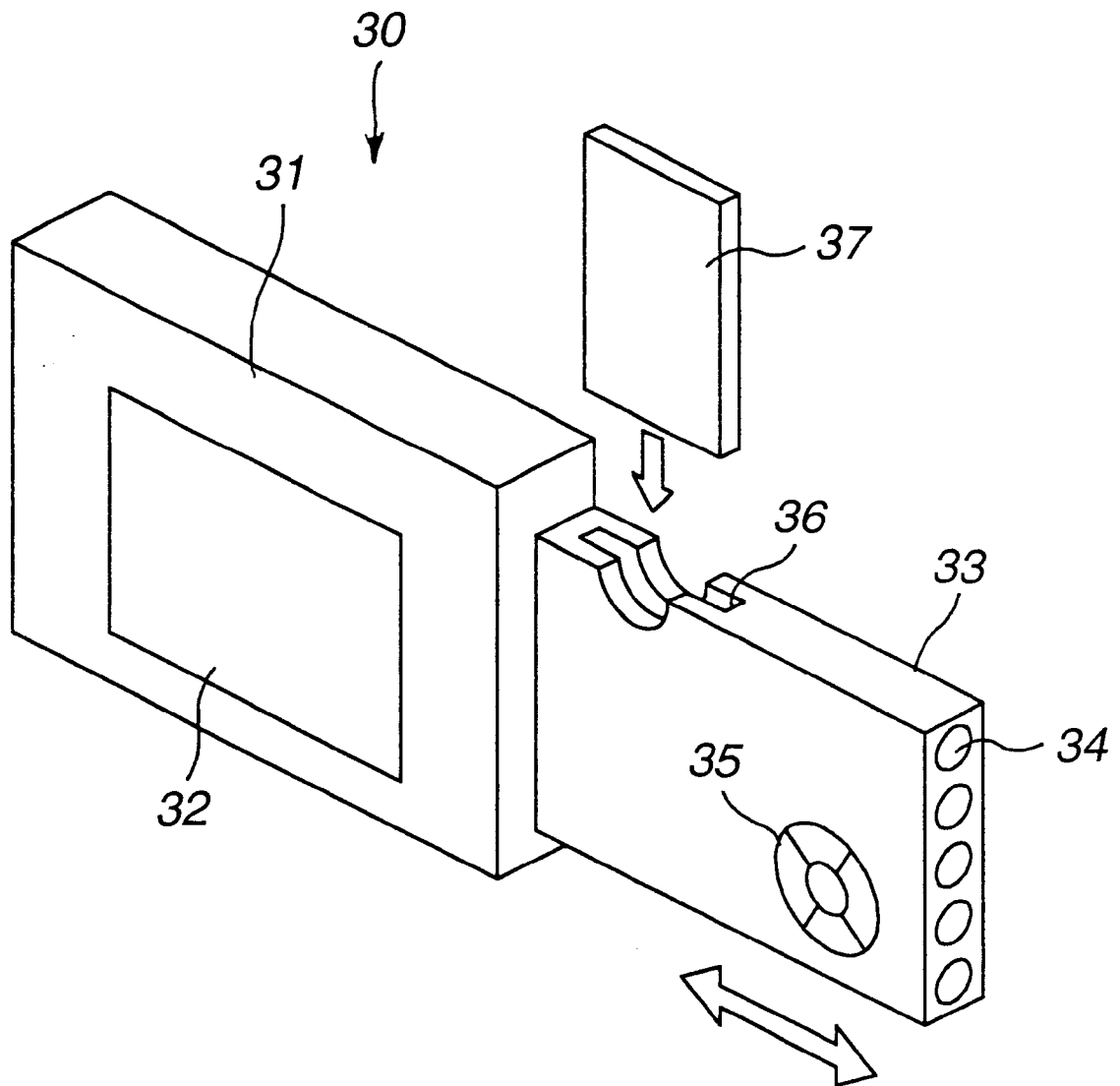


FIG. 12

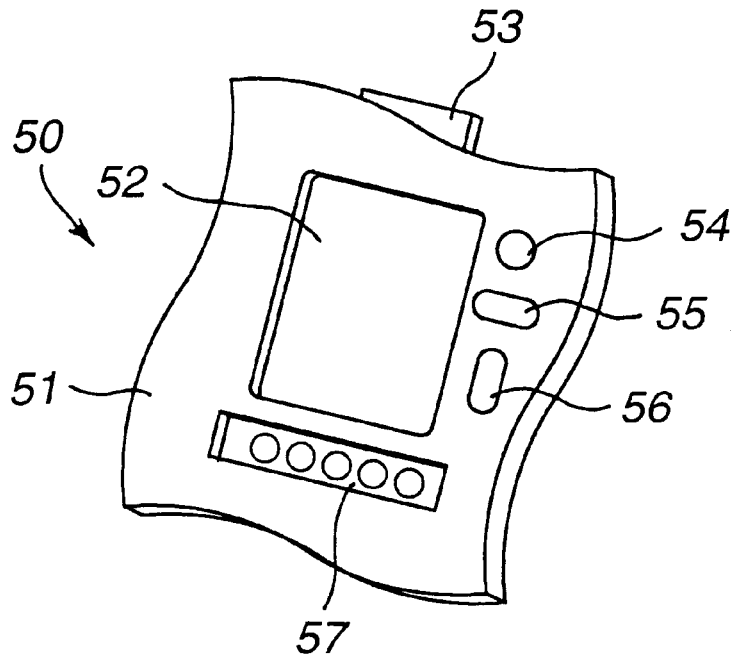


FIG.13

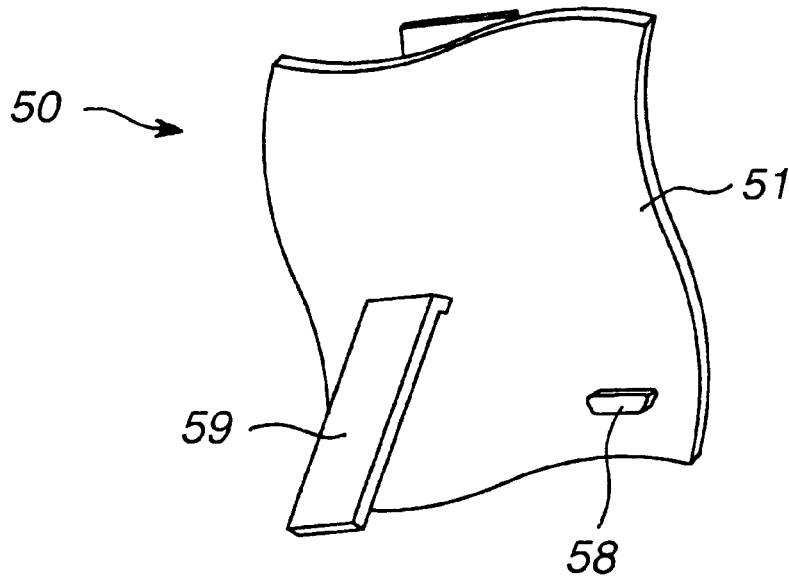


FIG.14

FIG.16A

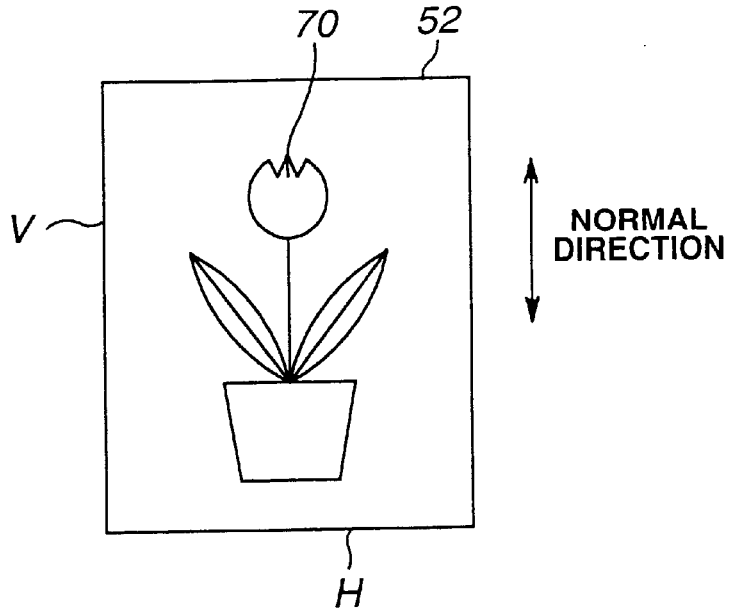
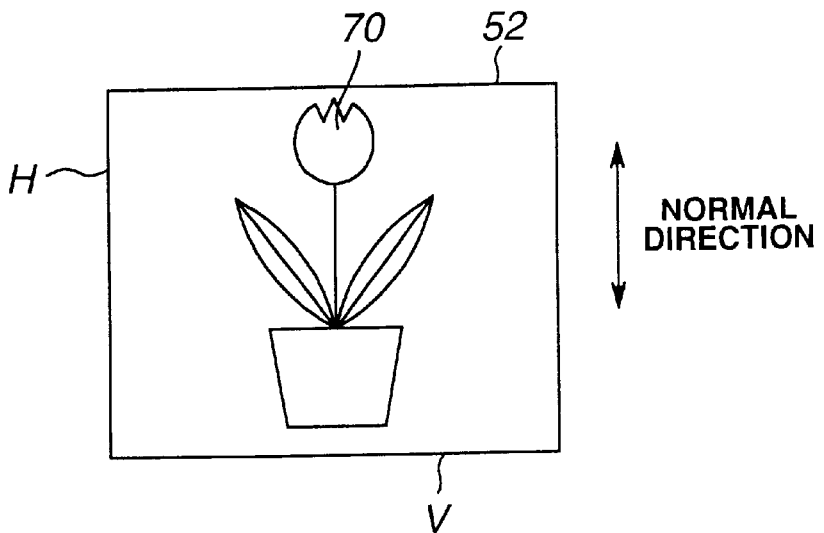


FIG.16B



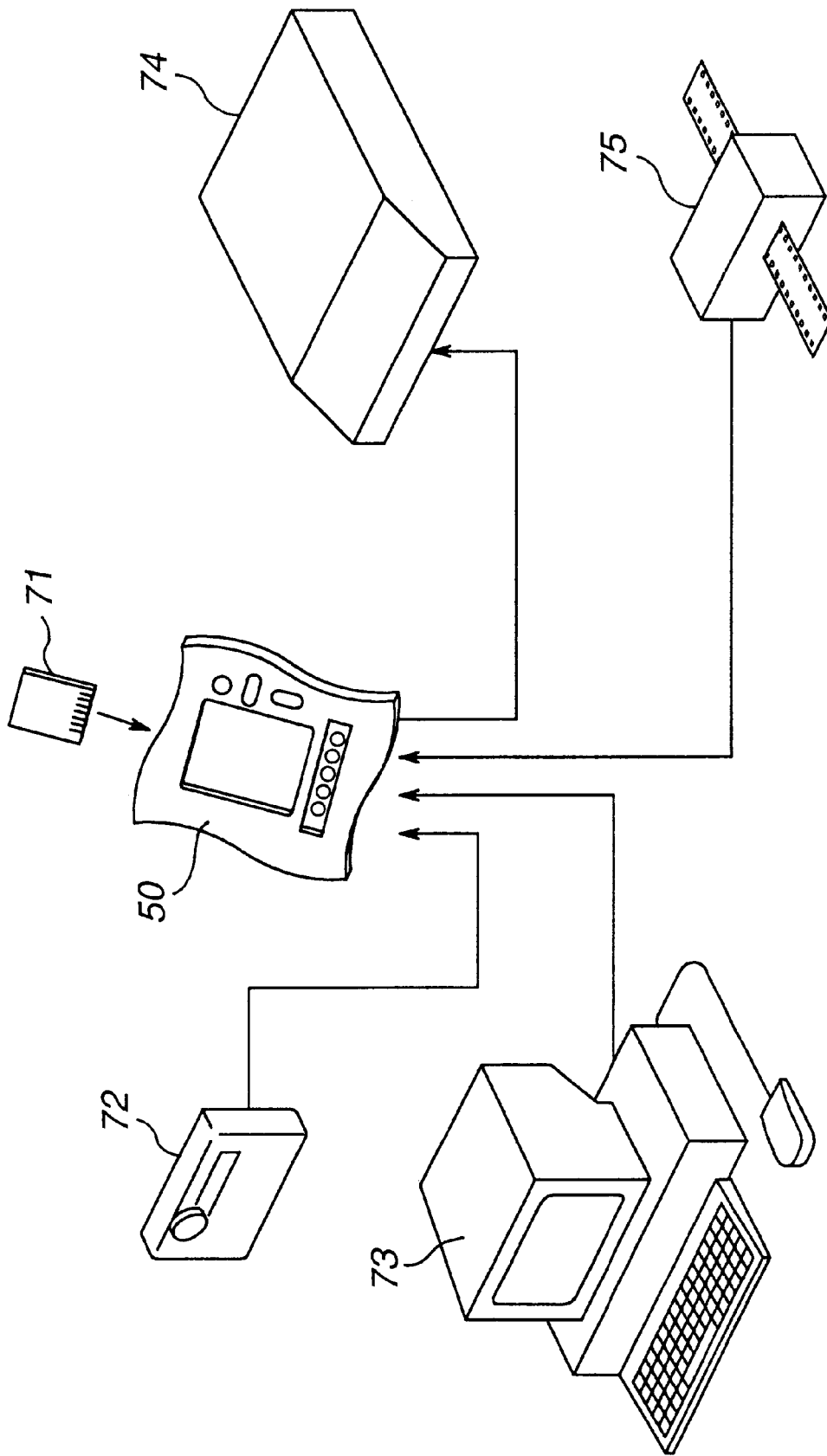


FIG. 17

IMAGE DISPLAY APPARATUS**BACKGROUND OF THE INVENTION**

1. Field of the Invention

The present invention relates to an image display apparatus to display a digital image acquired by means of a digital still camera, for example.

2. Description of Related Art

Conventionally, images photographed by a silver-film camera, electronic still camera (including digital still camera), etc. are viewed or enjoyed in various manners as will be described below.

An image photographed with a silver-film camera is viewed or enjoyed in various ways. Namely, the image is printed on a photographic paper to produce a picture. Usually, the picture is put in a photo mount or frame, for example, or filed in a album for storage and later viewing or enjoyment. Alternatively, a positive film produced based on the developed negative silver film is used in a slide projector to project the image onto a screen for enlarged viewing.

An image acquired with an electronic still camera (including a digital still camera) can be viewed, for example, by displaying it on a display apparatus connected to a personal computer or on a display screen or panel, if any, provided on the electronic still camera.

Once an image acquired with a silver-film camera is put in a photo mount or frame, no other image cannot be viewed in the mount or frame. For viewing another image in the photo mount, it is replaced with the existing one. Also, once such an image is filed in a photo album, the album has to be taken out from a storage place and many pages have to be turned to access a desired. For viewing 36 pictures, for example, so many album pages have to be turned. Namely, desired images cannot easily be accessed if they are filed in an album. When viewing an image projected on a screen from a slide projector using a positive film produced based on a negative silver film, it cannot be viewed clearly in a bright place, a projection screen is necessary, and a relatively large space has to be available for an enlarged image projection. The place should be provided with blackout curtains which would be required to view the image clearly in a day time, for example.

On the other hand, viewing an image photographed by an electronic still camera (including a digital still camera) needs no replacement of one image with any other desired one, no turning of album pages in viewing a plurality of pictures printed from a silver film and no slide projector and screen, but a display apparatus connected to a personal computer. In case the electronic still camera is a camera provided with an image playback display apparatus or display panel, however, images cannot be viewed unless the display apparatus is available. Recently, there are commercially available external recording media each having digitally recorded therein a photo collection of a celebrity. However, to view such digital images recorded on such an external recording medium, for example, a personal computer and a display apparatus connectable to the personal computer are required. No dedicated apparatus easy to operate for display of such images has yet been proposed.

SUMMARY OF THE INVENTION

Accordingly, the present invention has an object to provide an image display apparatus capable of displaying an image in a normal (erect) direction whether the apparatus is placed with the shorter or longer side down and without

giving the apparatus any special command for the normal direction of the image.

The present invention has another object to provide an image display apparatus allowing an easy viewing of digital images even without any personal computer and other display apparatus and also an easy viewing of digital images supplied via an external recording medium having recorded therein a photo collection of a celebrity, and which can be designed to have a decorative feature like a photo mount or frame for a silver-film image.

The above object can be attained by providing an image display apparatus destined to display image data read from a recording medium, comprising:

- means for generating image signal by processing image data from the recording medium in a predetermined manner;
- means for displaying the image signal supplied from the image processing means; and
- a controlling means for recording into the recording medium information on a direction in which the image signal is to be displayed on the image displaying means and displaying the image signal on the image displaying means in a direction corresponding to the displaying-direction information read from the recording medium.

Also the above object can be attained by providing an image display apparatus destined to display image data read from a recording medium, comprising:

- means for generating image signal for display based on image information read from the recording medium;
- means for displaying the to-be-displayed image signal produced by the image signal generating means; and
- means for determining a direction in which the image is to be displayed on the image displaying means according to a posture in which the apparatus is placed.

These objects and other objects, features and advantages of the present intention will become more apparent from the following detailed description of the preferred embodiments of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of an embodiment of image display apparatus according to the present invention;

FIG. 2 is a perspective view, from the rear, of the image display apparatus in FIG. 1;

FIG. 3 is a front view of the image display apparatus in FIG. 1 with the operation panel full turned to the right;

FIG. 4 is a rear view of the image display apparatus in FIG. 1 with the operation panel full turned to the left;

FIG. 5 is a side elevation of the image display apparatus in FIG. 1;

FIG. 6 is a schematic block diagram of the image display apparatus;

FIG. 7 shows the image display apparatus with the operation panel going to be removed;

FIG. 8 shows the procedure from turning on the power switch after removal of the operation panel until the memory card is inserted;

FIG. 9 shows the image display apparatus placed with the longer side down to reproduce an image;

FIG. 10 shows the image display apparatus placed with the shorter side down to reproduce an image;

FIG. 11 is an exploded perspective view of the image display apparatus, showing a separated transparent cover plate, ornamental plate and apparatus enclosure;

FIG. 12 is a perspective view of a variant of the image display apparatus in which the operation panel is designed for sliding insertion into or extraction from inside the apparatus enclosure;

FIG. 13 is a perspective view, from the front, of another embodiment of image display apparatus;

FIG. 14 is a perspective view, from the rear, of the image display apparatus in FIG. 13;

FIG. 15 is a schematic block diagram of the image display apparatus shown in FIGS. 13 and 14;

FIG. 16 shows an operation for determining a direction in which an image is displayed on the display panel of the image display apparatus in FIGS. 13 and 14; and

FIG. 17 shows the connection between the image display apparatus in FIGS. 13 and 14 and various external apparatuses and external recording media.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1 being a front view and FIG. 2 being a rear perspective view, there is illustrated a first embodiment of image display apparatus according to the present invention. The image display apparatus is generally indicated with a reference 1. The image display apparatus 1 is adapted to display on a display panel image data recorded in a memory card which is an external recording medium.

The image display apparatus 1 is an assembly of an acrylic-made transparent cover plate 2, an ornamental plate 3 having formed therein an opening through which a display panel 4 is viewed and a hole through which a human body recognition sensor 5 which will further be described later is exposed, and an apparatus enclosure 7 having the display panel 4 and human body recognition sensor 5, in this order as counted from the front. The cover plate 2 and ornamental plate 3 are fixed to the apparatus enclosure 7 with fixtures 6 as shown.

The display panel 4 is a thin, lightweight structure such as an LCD display or plasma display to display an image based on a to-be-displayed image signal supplied from an image processing block which will further be described later.

FIG. 2 shows the image display apparatus 1 placed with the longer side down. As shown in FIG. 2 (also see FIG. 3), the apparatus enclosure 7 has an operation panel 10 provided thereon with a group of control buttons 8 and a power switch 19. The apparatus enclosure 7 has provided on the rear side thereof in a place near the right end a slide switch 46 to set a sleep time as will further be described later. The image display apparatus 1 has further a support leg 9 fixed to the apparatus enclosure 7 with a screw, and thus the apparatus 1 is supported by the leg 9 and transparent cover plate 2 on a desk top, for example.

FIG. 3 is a front view of the image display apparatus 1 with the operation panel 10 full turned to the right. The operation panel 10 can be turned 90 deg. about a pivot 21 in relation to the apparatus enclosure 7. FIG. 3 shows the apparatus 1 with the operation panel 10 turned 90 deg. in the direction of arrow R. From this position, the operation panel 10 can be turned 90 deg. in the direction of arrow L for accommodation into the apparatus enclosure 7.

The operation panel 10 is provided with a memory card slot 11 through which a memory card 12 can be introduced from outside into the operation panel 10. The memory card slot 11 has provided therein a memory card connector for connection of the memory card 12.

The memory card 12 is a recording medium capable of storing at least digital image data such as a memory card,

miniature card or the like using a flash EEPROM (electrically erasable and programmable ROM), abbreviated as so-called SSFDC (solid-state floppy disc card).

The group of control buttons 8 on the operation panel 10 includes, as counted from the upper right with the operation panel 10 turned to the right, a fast forward/search button 13, play start/stop button 14, fast backward/search button 15, rotate (ROTATE) button 16 and a display (DISP) button 17. Also the operation panel 10 has a set of select and set keys 18 provided thereon below the memory card slot 11 (when the operation panel 10 is turned to the right) or at the left of the memory card slot 11 (when the operation panel 10 is accommodated in the apparatus enclosure 7).

The fast forward button 13 is used for fast forward access to and search of image information recorded in the memory card 12. The play start/stop button 14 starts and stops playback of image information recorded in the memory card 12. The fast backward /search button 15 is provided for fast backward access to and search of image information recorded in the memory card 12. The ROTATE button 16 is used to record into the memory card 12 displaying-direction information on an image to be displayed on the display panel 4. The DISP button 17 turns on and off display of photography data and index information, for example, added to the image information. The set of select and set keys 18 is used to select and set a desired one of items displayed on the display panel 4. The set of select and set keys 18 includes keys 18a, 18b, 18c and 18d for designating the upward, rightward, downward and leftward directions, and a click button 18e provided in the middle among the keys to set the selected item.

When the image display apparatus 1 is placed as shown in FIG. 3, the character and symbol markings provided by the buttons on the control panel 10 are frontally viewable from the user of the apparatus 1. The user can operate the group of control buttons 8 of the apparatus 1 while viewing the display panel 4. When the operation panel 10 is turned in the direction of arrow R, it lies with its longer side down. So, each of the buttons 8 can be operated without the necessity of placing the apparatus 1 with the shorter side down, while viewing an image displayed with the apparatus 1 placed its longer side down. When the operation panel 10 is turned 90 deg. in the direction of arrow L, the buttons 13 to 17 come to the top of the apparatus enclosure 7 as shown in FIG. 2. Namely, they come to the position of the group of control buttons 8 shown in FIGS. 2 and 3. The character and symbol markings for the respective buttons 13 to 17 are also provided on the top of the ornamental plate 3. Therefore, the buttons 13 to 17 can easily be operated by the user even when the operation panel 10 is accommodated in the apparatus enclosure 7.

Since the memory card slot 11 is provided on the operation panel 10 as mentioned above, it will not be exposed outside when the operation panel 10 is accommodated in the apparatus enclosure 7.

FIG. 4 is a rear view of the image display apparatus 1 with the operation panel 10 turned 90 deg. in relation to the apparatus enclosure 7.

As shown, the support leg 9 has two fixing holes 20a and 20b, upper and lower, formed therein along the length thereof. To use the full effective length of the support leg 9, a screw 20c is used in the upper fixing hole 20a to fix the support leg 9 to the apparatus enclosure 7. On the other hand, when the screw 20c is used in the lower fixing hole 20b to secure the support leg 9 to the apparatus enclosure 7, the effective length of the support leg 9 will be shorter. The

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support leg 9 thus secured to the apparatus enclosure 7 works with the transparent cover plate 2 to support the apparatus 1 on a flat surface such as desk top surface. Namely, when the support leg 9 is fixed to the apparatus enclosure 7 using the upper fixing hole 20a therein, its larger effective supporting length is usable so that the display panel 4 will form a correspondingly larger angle with the surface of the desk top. On the other hand, when the lower fixing hole 20b is used to fix the support leg 9 to the apparatus enclosure 7, the display panel 4 will define a correspondingly smaller angle with the desk top surface. Thus, the angulation of the surface of the display panel 10 can be selected for the user to have an easier viewing of an image on the display panel 4. Further, the center of the bottom side of the support leg 9 is deviated from a straight line through the upper and lower fixing holes 20a and 20b, and the bottom side is somewhat extended to the right as viewed from the rear, which is intended to stably support the image display apparatus 1 placed with the shorter side down.

The apparatus enclosure 7 has further disposed thereon controls which are fixed, not movable like the group of control buttons 8 (including the buttons and keys 13 to 18). That is, as previously mentioned, the power switch 19 is provided on the top of the apparatus enclosure 7 and the slide switch 46 operable by the user to set a time for which a displaying status is to be continuously kept or a sleep time is provided on the back of the apparatus enclosure 7. In addition, the apparatus enclosure 7 has provided on an lateral side thereof opposite to the side where the operation panel 10 is located brightness control buttons 47a and 47b (BRIGHT+ and -) to adjust the screen brightness of the display panel 4. The button 47a increases the screen brightness while the button 47b decreases it. Further, a speaker 48 is provided at the lateral lower portion of the apparatus enclosure 7. Also, a connector 22 for connection of a DC source is provided at the lower left portion of the apparatus enclosure 7 as viewed from the rear.

FIG. 5 is a side elevation of the image display apparatus 1, showing the lateral side of the apparatus enclosure 7 on which the speaker 48 is provided in addition to the aforementioned brightness control buttons 47a and 47b. Supported by the support leg 9 and transparent cover plate 2, the image display apparatus 1 is placed on a surface 23 of a desk top as shown.

FIG. 6 is a schematic block diagram of the image display apparatus 1. The image display apparatus 1 is internally constructed as will be described below with reference to FIG. 6:

The memory card 12 has already recorded therein image information acquired as compressed image data by means of an electronic still camera.

For playback of an image recorded in the memory card 12, a control microcomputer 42 reads the compressed image data from the memory card 12 via a memory card controller 40 and stores it into a built-in DRAM. The compressed image data is expanded or decompressed in an image processing block 43 and stored back into the DRAM. The image data thus stored back in the DRAM is processed by the image processing block 43 for display on the display panel 4.

More specifically, in the image display apparatus 1, the control microcomputer 42 is used to record a displaying-direction information on an image to be displayed on the display panel 4 into the memory card 12 via the memory card controller 40 while displaying on the display panel 4 a to-be-displayed image signal corresponding to the displaying-direction information read from the memory card 12.

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The displaying-direction information relates a direction in which an image is to be displayed on the display panel 4. More particularly, the information is entered by the user pressing the ROTATE button 16 on the operation panel 10 to designate the normal direction of the image when image information is initially read from the memory card 12 for display on the display panel 4. By pressing the ROTATE button 16 a maximum of three times for one image, the user can rotate the image clockwise to designate his or her desired normal direction of the image.

The control microcomputer 42 writes into the memory card 12 a displaying-direction information generated via the image processing block 43 by pressing the ROTATE button 16 for image rotation, along with image information. The memory card 12 having written therein the displaying-direction information may be inserted into the same image display apparatus 1 as it is, or into any other image display apparatus.

With the memory card 12 kept inserted in the same image display apparatus 1, the user can display an image on the display panel 4 in a normal direction corresponding to the displaying-direction information. Even with the image display apparatus 1 placed in a different position from that when the displaying-direction information is recorded in the memory card 12, the image can be displayed in the same normal direction. More specifically, a position detection switch 41 is provided to detect whether the image display apparatus 1 is placed with the longer or shorter side down, and send a detection signal to the control microcomputer 42 which will read the displaying-direction information from the memory card 12 via the memory card controller 40. Thus the image can be displayed in the same normal direction. The position detection switch 41 may be either a type of which a moving element is moved in two directions or a type of which a pendulum type element is moved in all directions.

The procedure from recording of the displaying-direction information into the memory card 12 up to display of an image corresponding to the displaying-direction information will further be described below with reference to FIGS. 7 to 10:

First, the operation panel 10 is turned to appear out of the apparatus enclosure 7 as shown in FIG. 7, the power switch 19 shown in FIG. 8 is turned on, the ROTATE button 16 is pressed a maximum of 3 times to determine a normal displaying direction for each image 24 on the display panel 4, and information related to the normal displaying direction is recorded as the displaying-direction information along with the image 24 into the memory card 12.

Thereafter, even with the image display apparatus 1 placed with the longer side down as in FIG. 9 or with the shorter side down as in FIG. 10, the image can be displayed in a correct direction with no designation of normal direction for each image. When the apparatus 1 is placed with the shorter side down, however, nondisplay areas 26 and 27 take place at the upper and lower portions, respectively, of the screen of the display panel 4.

Further the image display apparatus 1 is provided with the human body recognition sensor 5 shown in FIGS. 1 to 6. When the human body recognition sensor 5 recognizes a human body existing near the apparatus 1, it changes the displaying status of the display panel 4. The human body recognition sensor 5 may be a recognition sensor such as an ultraviolet sensor to detect ultraviolet ray coming from a human body, ultrasound sensor to transmit an ultrasound and receive a reflected sound from a human body or object existing near the apparatus 1, light sensor to emit a light

from a laser or LED (light-emitting diode) and detect a return light from a human body or object existing near the apparatus 1, or the like. In this image display apparatus 1, the human body recognition sensor 5 is detects the hand of a user or a part of the user's body, for example, at a distance of 20 cm or less from the front of the sensor 5 and provides a detection signal which will be sent to the control micro-computer 42.

When the control microcomputer 42 supplied with the detection signal from the human body recognition sensor 5, it will turn on and off supply of power from a power supply block (not shown) to the display panel 4. More specifically, when the human body recognition sensor 5 detects the user's hand placed in front thereof, the detection signal is supplied to the control microcomputer 42 which will allow the power supply block to supply the power to the display panel 4. The display panel 4 will thus be turned on.

If a display time of 30 or 60 min, for example, is set using the continuous display/sleep select slide switch 46 disposed on the back of the apparatus enclosure 7, the display panel 4 is kept turned on for the time of 30 to 60 min after the user's hand placed at a position of 20 cm or less from the human body recognition sensor 5 is detected by the latter.

As shown in FIG. 11, the image display apparatus 1 can be disassembled into the transparent cover plate 2, ornamental plate 3 and apparatus enclosure 7. The ornamental plate 3 may be replaced with another selected from ones different in color and design according to the atmosphere in a location of installation, for example, a room, where the apparatus 1 is used. The transparent cover plate 2, ornamental plate 3 and apparatus enclosure 7 can be assembled together by inserting the fixtures 6 each into a fixture retainer 29 in the apparatus enclosure 7 through a hole 28 in the ornamental plate 3.

In the first embodiment having been described in the foregoing, the operation panel 10 is extracted by turning 90 deg. about the pivot 21 as shown in FIGS. 3 and 4. However, the image display apparatus 1 may be modified as shown in FIG. 12 which is a perspective view of a variant of the image display apparatus 1. In this variant, the operation panel is designed for sliding insertion into or extraction from inside the apparatus enclosure. The variant of the image display apparatus 1 according to the present invention is generally indicated with a reference 30.

More specifically, the image display apparatus 30 comprises an apparatus enclosure 31 having a display panel 32, and an operation panel 33 provided with controls 34 and 35, as shown in FIG. 12. The operation panel 33 is designed for sliding insertion into or extraction from the apparatus enclosure 31. As shown, the operation panel 33 has formed therein a memory card slot 36 through which a memory card 37 is to be inserted into the operation panel 33. Thus, also in this image display apparatus 30, the memory card slot will not be exposed so long as the operation panel 33 is accommodated into the apparatus enclosure 31.

Next, a second embodiment of the present invention will be described herebelow with reference to FIGS. 13 and 14. The image display apparatus is generally indicated with a reference 50. FIG. 13 is a front perspective of the image display apparatus 50, and FIG. 14 is a rear perspective view of the image display apparatus 50 in FIG. 13.

As shown in FIG. 13, the image display apparatus 50 comprises an enclosure 51 like a photo holder or mount having a decorative design. The enclosure 51 has provided on the front side thereof a display panel 52, infrared communication element 54, light sensor 55, human body rec-

ognition sensor 56, and operation panel 57, and on the top thereof a socket 53 in which a memo card as an external recording medium is to be set.

As shown in FIG. 14, the enclosure 51 has provided on the back thereof a support leg 59 to support the enclosure 51 in upright position, and a terminal 58 for connection of a serial cable which will further be described later. In the enclosure 51 shown in FIGS. 13 and 14, there is provided a dry cell or secondary cell as a power source. Therefore, this image display apparatus 50 is not provided with any power cord. In case the apparatus 50 is to be supplied with an external power, a power cord will of course be provided on the back thereof, for example.

Although the apparatus enclosure 51 is formed like a photo mount having a decorative design as in FIGS. 13 and 14, it may be designed like a photo.

FIG. 15 is a schematic block diagram of the image display apparatus 50, showing its internal construction. As in FIG. 15, the terminal 58 is provided for connection of a serial cable, for example. The infrared communication element (IrDA) 54 is an I/O port for communication using infrared rays. Therefore, the image display apparatus 50 is connectable via the terminal 58 or infrared communication element 54 to an external apparatus such as a digital still camera, personal computer, film scanner or the like from which at least a digital image data is supplied to the image display apparatus 50. The image display apparatus 50 receives a digital image data from an external apparatus via the terminal 58 or infrared communication element 54. It should be noted that the infrared communication element 54 is normally selected for data communication between the image display apparatus 50 and external apparatus.

There is also provided a communication mode select switch 61 to selectively switch the data communication by the terminal 58 and that by the infrared communication element 54 between them to pass a received image data to a communication block 62. In the image display apparatus 50, the data communication by the infrared communication element 54 is normally selected as mentioned above. When a serial cable is connected to the terminal 58, however, the communication mode select switch 61 is activated to set up a data communication via the terminal 58.

Receiving data from an external apparatus via the infrared communication element 54 or terminal 58 and further via the communication mode select switch 61, the communication block 62 supplies it to a built-in memory 63 in a predetermined manner.

The socket 53 is provided for connection of an external recording medium such as a memory card as having previously been described. The image display apparatus 50 can be connected to the external recording medium via the socket 53. The socket 53 for receiving a memory card is designed to have a memory card slot. Receiving a digital image data from the external recording medium via the socket 53, the image display apparatus 50 sends it to a communication/medium select switch 64. It should be noted that the image display apparatus 50 may be provided with a plurality of such sockets 53. In this case, data communication can be made between a plurality of external recording media set in the sockets 53, respectively.

The memory 63 is built in the image display apparatus 50. It is a rewritable one to temporarily save digital image data supplied from an external apparatus via the terminal 58 or infrared communication element 54 and further the communication mode select switch 61 and communication block 62, and sends the saved digital image data to the

communication/medium select switch **64**. Since the built-in memory **63** is rewritable, digital image data existing therein can be replaced with another digital image data from the external apparatus as necessary.

The communication/medium select switch **64** is provided to selectively switch, for transmission to an image processing block **65**, a digital image data supplied from an external recording medium in the socket **53** and one read from the built-in memory **63** between them. The image display apparatus **50** is adapted such that a digital image data read from the built-in memory **63** is normally sent to the image processing block **65**. When an external recording medium is set in the socket **53**, however, the communication/medium select switch **64** is activated to select a digital image data supplied from the external recording medium via the socket **53**.

The image processing block **65** processes in a predetermined manner a digital image data read from the built-in memory **63** and supplied via the communication/medium select switch **64** or a one supplied from the socket **53** and sent via the communication/medium select switch **64**, to generate image signal for display on the display panel **52**.

The display panel **52** is a thin, lightweight display such as an LCD display, plasma display or the like to display an image based on a to-be-displayed image signal supplied from the image processing block **65**.

There is also provided a position detection switch **66** to determine a direction in which an image is to be displayed on the display panel **52** according to the posture of the enclosure **51** of the image display apparatus **50**. In particular, the position detection switch **66** is a direction select switch to allow the user to selectively set a direction in which an image is to be displayed, an automatic position detector provided with a gravity sensor or the like to automatically detect in which position the image display apparatus **50** is placed and set a position in which an image is to be displayed, or the like. Note that to save the user's labor to select such a displaying direction, the automatic position detector should desirably be adopted in the position detection switch **66**. A position detection signal from the position detection switch **66** is sent to the image processing block **65**.

Therefore, the image processing block **65** determines a direction in which an image is to be displayed on the display panel **52** according to the position detection signal, and allows to display the image on the display panel **52** in the determined direction. Namely, in case the display panel **52** has a rectangular screen having one side indicated with a reference V and other side indicated with a reference H as shown in FIG. 16, when the position detection signal indicates that the image display apparatus **50** is placed with the shorter side down, the image processing block **65** determines a direction in which an image **70** is to be displayed on the display panel **52** so that the side V of the screen of the display panel **52** is vertical while the side H is horizontal, for example, as shown in FIG. 16A, and allows to display the image **70** on the display panel **52** in the determined direction. On the other hand, in case the display panel **52** has a rectangular screen having one side indicated with a reference V and other side indicated with a reference H, when the position detection signal indicates that the image display apparatus **50** is placed with the longer side down, the image processing block **65** determines a direction in which an image **70** is to be displayed on the display panel **52** so that the side H of the screen of the display panel **52** is vertical while the side V is horizontal as shown in FIG. 16B, and allows to display the image **70** on the display panel **52** in the determined direction.

In the example shown in FIG. 16, the rectangular screen of the display panel **52** has the side V longer than the side H. However, the rectangular screen of the display panel **52** may have the side H longer than the side V. Also, the display panel **52** may have a square screen of which the sides V and H are equal in length to each other. Further, the screen of the display panel **52** may have a polygonal shape such as circular, elliptical, trapezoidal or the like. In any case, however, the normal direction of the image **70** displayed on the display panel **52** is determined according to the posture in which the image display apparatus **50** is placed. In other words, even if the screen of the display panel **52** of the image display apparatus **50** has a circular, hexagonal or octagonal shape for which it is not easy to determine the vertical and horizontal directions as in the rectangular shape, the normal direction in which the image **70** is displayed on the display panel **52** can be determined according to a posture in which the image display apparatus **50** is placed. Of course, the apparatus **50** may be adapted so that no displaying direction will be determined according to a posture in which the image display apparatus **50** is placed.

There is also provided a power supply block **67** to supply a power to the image display apparatus **50**. It converts an AC power supplied via a power cord to a DC power of a predetermined voltage before the power is supplied to the image display apparatus **50**. It should be noted that the power supply block **67** may be a secondary cell or dry cell which would be able to supply a DC power of the predetermined voltage to the image display apparatus **50**.

The human body recognition sensor **56** is provided to detect a human body or object existing within a predetermined range from the image display apparatus **50** and supply a detection signal to the image display apparatus **50**. More particularly, the human body recognition sensor **56** may be a recognition sensor such as an ultraviolet sensor to detect ultraviolet ray coming from a human body, ultrasound sensor to transmit an ultrasound and receive a reflected ultrasound from a human body or object existing near the apparatus **1**, light sensor to emit a light from a laser or LED and detect a return light from a human body or object existing near the apparatus **50**, or the like

A power switch **68** is also provided between the power supply block **67** and enclosure **51** of the image display apparatus **50** to switch on and off power supply from the power supply block **67** to the apparatus itself depending upon a detection signal from the human body recognition sensor **56**. More specifically, only when the human body recognition sensor **56** detects a human body existing within the predetermined range from the image display apparatus **50**, the power switch **68** allows to supply the power from the power supply block **67** to the image display apparatus **50** itself. When the human body is not detected within the predetermined range from the image display apparatus **50** by the human body recognition sensor **56**, the power switch **68** will not allow to supply the power from the power supply block **67** to the image display apparatus **50** itself. Thus, since no display is made on the display panel **52** when not necessary (when there is a low likelihood that a user stands near the image display apparatus **50** to view a displayed image), the power consumed by the image display apparatus **50** can be saved. Namely, an energy saving is attained.

The light sensor **55** is provided to detect the brightness around the image display apparatus **50** and supply a light detection output to a display brightness controller **69**.

The display brightness controller **69** is provided to adjust the brightness of the display panel **52** so that the display on

the display panel 52 is turned on or off depending upon the light detection output from the light sensor 55. That is, when the light sensor 55 detects an amount of light around the image display apparatus 50, which is larger or smaller than predetermined, the display brightness controller 69 will turn on the display panel 52. The reason why the display panel 52 is turned on when the detected amount of light is larger than predetermined is that in the day time or when an intense light of illumination exists, namely, while the amount of light is larger than predetermined, the human being is normally active and some one possibly views an image displayed on the display panel 52. Therefore, when a large amount of light is detected around the image display apparatus 50, the display panel 52 is turned on. On the other hand, it is considered that in the night or when the illumination is weak, the display on the display panel 52 is not easy to see. That is why the display panel 52 is turned on when the detected amount of light around the image display apparatus 50 is smaller than predetermined.

The display brightness controller 69 may be a one which can adjust the display brightness of the display panel 52 according to the light detection output from the light sensor 55. More specifically, the display panel 52 is made easier to view in a bright environment as in the day time by increasing its display brightness, and in a relative dark environment as in the night or evening by decreasing the display brightness somewhat. When the light sensor 55 detects a larger amount of light (in the day time, for example) than predetermined, the display brightness controller 69 will increase the display brightness of the display panel 52. On the other hand, when the light sensor 55 detects a smaller amount of light (in the night or evening, for example) than predetermined, the display brightness controller 69 will decrease the brightness of a display on the display panel 52.

The control panel 57 has provided thereon control buttons which are used by the user to control the operation of the image display apparatus 50. While the image processing block 65 allows operation menu items to be displayed on the display panel 52, the user selects a desired one of the menu items by using a corresponding control button on the operation panel 57 to operate the image display apparatus 50 in the selected mode. Note that the operation menu items may include a function to switch on/off the human body recognition sensor 56 and light sensor 55, slide show of a digital image, fade display and the like.

Digital image data stored in the built-in memory 63 can be printed out by a printer. In this case, a digital image data stored in the built-in memory 63 is sent via the infrared communication element 54 to an infrared communication type printer which will print out the digital image data, or via the terminal 58 to a serial cable-connectable printer which will print out the digital image data.

As having been described in the foregoing, the image display apparatus 50 comprises an enclosure shaped to have the form of a photo mount for a silver-film photo and thus has a decorative design. Also a displayed image can easily be changed to other without the time and labor for replacement of a photo with another as with a silver-film photo mount since a to-be-displayed image is supplied from an external apparatus or external recording medium.

Referring now to FIG. 17, there is schematically illustrated a data communication between the image display apparatus 50 and various external apparatuses and recording media.

As shown in FIG. 17, the image display apparatus 50 is connectable to a digital still camera 72, personal computer

73, film scanner 75, printer 74 and the like each as an external apparatus. Data communication between these external apparatuses and image display apparatus 50 is done via the infrared communication element 54 and serial cable terminal 58. Also, the memory card 71 as an external recording medium can be set in the socket 53 of the image display apparatus 50.

As mentioned above, the built-in memory 63 of the image display apparatus 50 can be supplied with digital image data from the external apparatuses such as the digital still camera, not via the personal computer. So other than a user of a personal computer can also be provided with a displayed digital image. Thus, the image display apparatus 50 according to the present invention is superior in portability to the personal computer as long as the limited function, namely, viewing of displayed images, is concerned.

Since an external recording medium such as a memory card can be removably set in the socket 53 of the image display apparatus 50, digital image data recorded in the external recording medium can be displayed on the display panel 52. With a plurality of such sockets 53 provided on the image display apparatus 50, data communication can be made between the plurality of external recording media. Further, when a photo collection of a celebrity (photos by a professional photographer, for example) is recorded in a memory card as an external recording medium, such digital images can easily be read from the memory card and displayed on the display panel 52 for viewing. Namely, the image display apparatus 50 can be used for playback of such a photo collection.

The image display apparatus 50 is provided with the infrared communication element 54 and serial cable terminal 58, which enable an infrared data communication and serial data communication, respectively. Thus, data (digital image data) in the built-in memory 7 can easily be rewritten.

Further, the image display apparatus 50 is provided with the operation panel 57 at which various operation menu items can be selected for some modes of digital image display.

Also, the image display apparatus 50 comprises the decoratively designed enclosure as shown in FIGS. 13 and 14, which provides for a piece of decoration.

As having been described in the foregoing, the image display apparatus according to the present invention can record in a recording medium information on a direction in which an image signal is to be displayed on the image displaying means and read it from the recording medium for use when an image is displayed. Therefore, an image can be displayed in a correct direction on the apparatus placed with the shorter or longer side down without any designation of a normal displaying direction for the image.

Also, a digital image can easily be viewed even with no personal computer or display apparatus, for example. In addition, digital images such as a photo collection of a celebrity supplied via an external recording medium can easily be viewed. Moreover, the image display apparatus according to the present invention can be designed to have a decorative feature such as a silver-film photo mount or frame.

What is claimed is:

1. An image display apparatus for displaying image data read from a recording medium, comprising:
 - image processing means for generating an image signal by processing image data read from the recording medium in a predetermined manner;
 - image displaying means for displaying the image signal generated by the image processing means;

controlling means for recording into the recording medium information on a direction in which an image of the image signal is to be displayed on the image displaying means and displaying the image on the image displaying means in a direction corresponding to the displaying-direction information read from the recording medium; and

an operation panel provided with play start/stop control buttons for recording the displaying-direction information into the recording medium and image information access/search control buttons for searching the image information, wherein

the operation panel is accommodable in an enclosure of the apparatus.

2. The apparatus as set forth in claim 1, further comprising means whereby the recording medium is set into the apparatus from outside.

3. The apparatus as set forth in claim 1, further comprising means for recognizing a human body existing near the apparatus and providing a detection signal based on which a displaying status of the image displaying means is changed.

4. The apparatus as set forth in claim 3, further comprising time setting means for setting an expiration time at which the displaying status of the image displaying means is changed, wherein

the controlling means continuously holds the displaying status of the image displaying means for a time set by the time setting means.

5. The apparatus as set forth in claim 1, further comprising mounting means whereby the operation panel is accommodable into the apparatus enclosure by pivoting or sliding.

6. An image displaying apparatus for displaying image data read from a recording medium, comprising:

image signal generating means for generating an image signal for display based on image information read from the recording medium;

image displaying means for displaying the image signal produced by the image signal generating means; and

means for determining a direction in which an image of the image signal is to be displayed on the image displaying means according to a posture in which the apparatus is placed and information on a direction in which an image of the image signal is to be displayed read from the recording medium.

7. The apparatus as set forth in claim 6, further comprising means whereby the recording medium is set into the apparatus from outside.

8. The apparatus as set forth in claim 6, further comprising:

means for communication with an external apparatus to transmit and receive image data to and from the external apparatus;

an image memory for storage of image data transmitted via the means for communication with the external apparatus; and

means for communication with the recording medium to transmit and receive image data to and from the recording medium, wherein

the image signal generating means generates the image signal based on image data stored in the image memory or on image data transmitted via the means for communication with the recording medium.

9. The apparatus as set forth in claim 8, wherein the means for communication with the recording medium includes means for communicating with a plurality of recording media to transmit and receive data to and from the plurality of recording media.

10. The apparatus as set forth in claim 8, wherein the means for communication with the external apparatus includes infra-red ray communication means for communication with the external apparatus to transmit data to and from the external apparatus using infra-red rays.

11. The apparatus as set forth in claim 10, wherein the means for communication with the external apparatus includes:

serial-cable communication means for data communication over a serial cable; and

communication mode switching means for selectively switching between the infrared-ray communication means and the serial-cable communication means.

12. The apparatus as set forth in claim 11, wherein the communication mode switching means is adapted to change, when the external apparatus is connected to the serial-cable communication means, the data communication by the infrared-ray communication means over to the data communication by the serial-cable communication means.

13. The apparatus as set forth in claim 8, further comprising means for selectively switching between image data stored in the image memory and image data supplied via the means for communication with the recording medium and for sending the selected image data to the image signal generating means.

14. The apparatus as set forth in claim 13, wherein the means for selectively switching between image data read from the image memory and the image data supplied via the means for communication with the recording medium, is adapted to change, when the recording medium is connected to the means for communication with the recording medium, image data stored in the image memory to image data supplied via the means for communication with the recording medium and to send the selected image data to the image signal generating means.

15. The apparatus as set forth in claim 6, further comprising:

means for detecting an amount of light around the apparatus; and

means for adjusting an operation of the image displaying means based on a detection signal from the light detecting means.

16. The apparatus as set forth in claim 6, further comprising:

recognizing means for recognizing a human body or an object near the apparatus; and

means for controlling power supply to the apparatus based on a detection signal from the recognizing means.

17. The apparatus as set forth in claim 6, further comprising display mode selecting means for selecting one of a plurality of image displaying modes.

18. The apparatus as set forth in claim 17, wherein the image signal generating means generates an image for each of a plurality of menu items indicating the plurality of image displaying modes, and

one of the plurality of menu items is selected by the display mode selecting means.

Exhibit I



US006446080B1

(12) **United States Patent**
Van Ryzin et al.

(10) **Patent No.: US 6,446,080 B1**

(45) **Date of Patent: Sep. 3, 2002**

(54) **METHOD FOR CREATING, MODIFYING, AND PLAYING A CUSTOM PLAYLIST, SAVED AS A VIRTUAL CD, TO BE PLAYED BY A DIGITAL AUDIO/VISUAL ACTUATOR DEVICE**

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(73) Assignees: **Sony Corporation**, Tokyo (JP); **Sony Electronics Inc.**, Park Ridge, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/074,683**

(22) Filed: **May 8, 1998**

(51) **Int. Cl.**⁷ **G06F 17/30**

(52) **U.S. Cl.** **707/104; 707/10; 707/102; 345/346; 345/352; 369/29; 369/30; 709/219**

(58) **Field of Search** **707/200, 102, 707/104, 10; 369/27, 29, 30, 32; 345/146, 339, 346, 352; 709/219**

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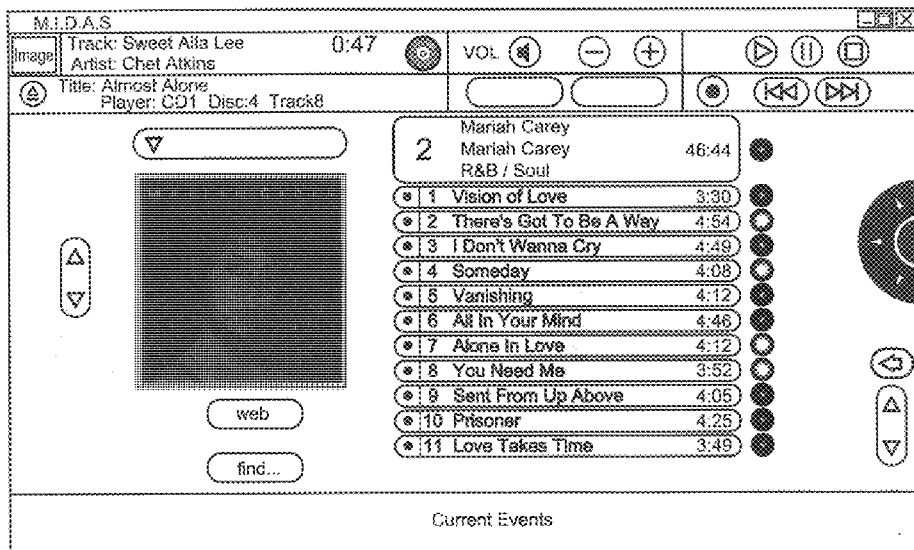
Primary Examiner—Jean R. Homere

(74) *Attorney, Agent, or Firm*—Harold T. Fujii

(57) **ABSTRACT**

A custom playlist to be played by a digital audio/visual actuator device may be easily created and modified through use of an effective human interface on an external device, such as a personal computer. Tracks, easily identifiable by their track index identifier and the TOC of the digital storage device on which they are stored, are selected by the user or by an automated method and added to a playlist file. Once the playlist is created, the playlist file is stored to non-volatile memory of the digital audio/visual actuator device. The playlist may then be easily modified if so desired by performing such functions as adding tracks, deleting tracks, and rearranging tracks of the playlist through the interface of the external device. The playlist may be played by the digital audio/visual actuator device at any time after it has been created and the digital audio/visual actuator device may be controlled by a remote control unit to actuate the playlist if so desired.

23 Claims, 11 Drawing Sheets



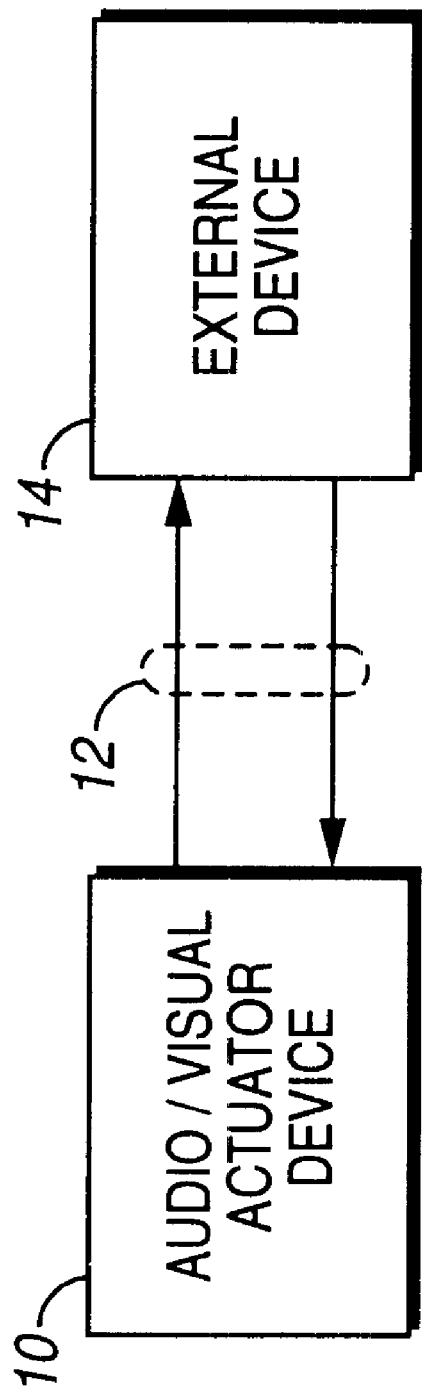


FIG. 1

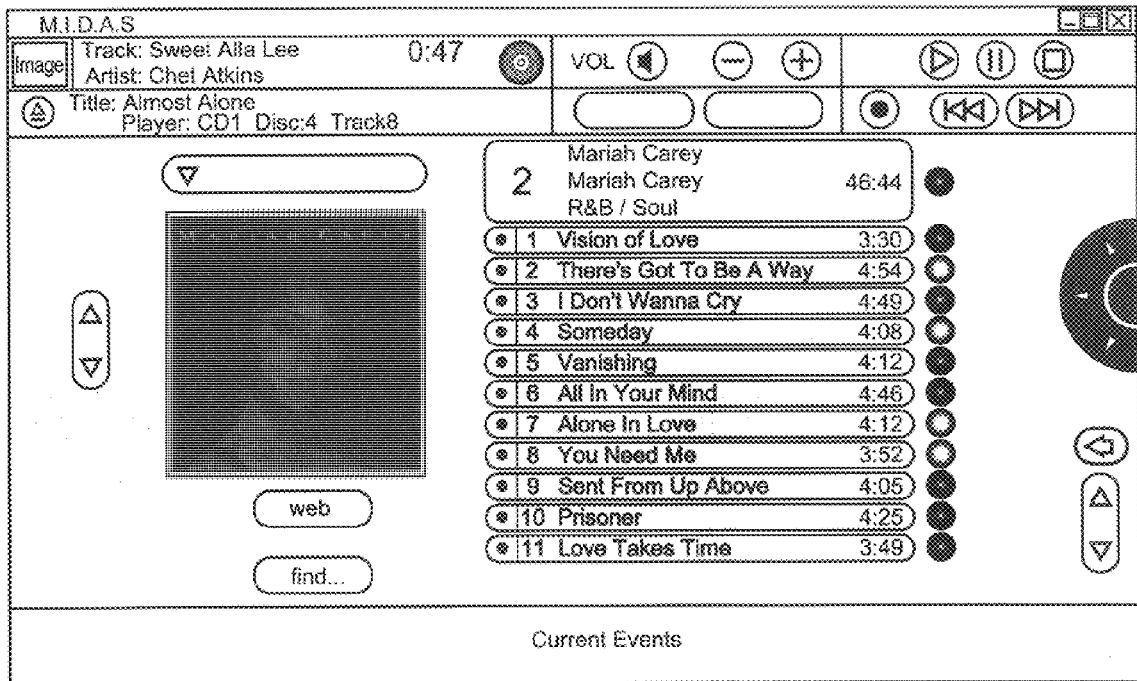


FIG. 2

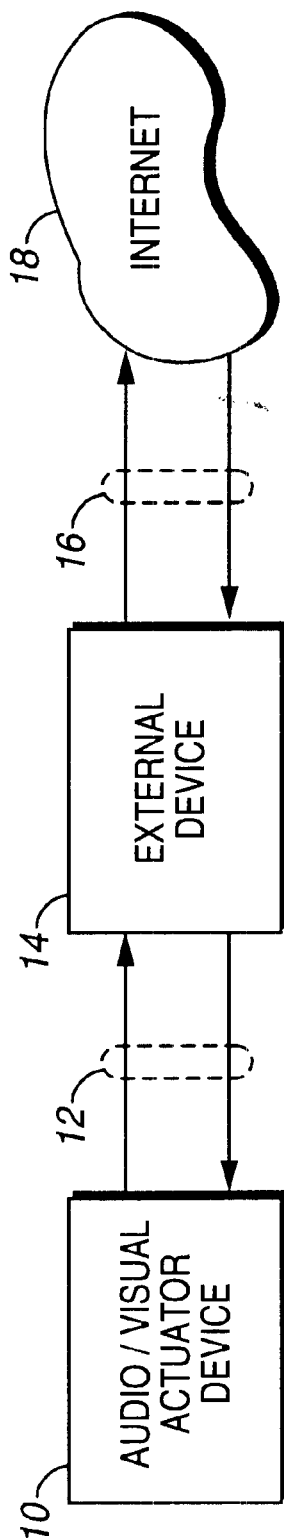


FIG. 3

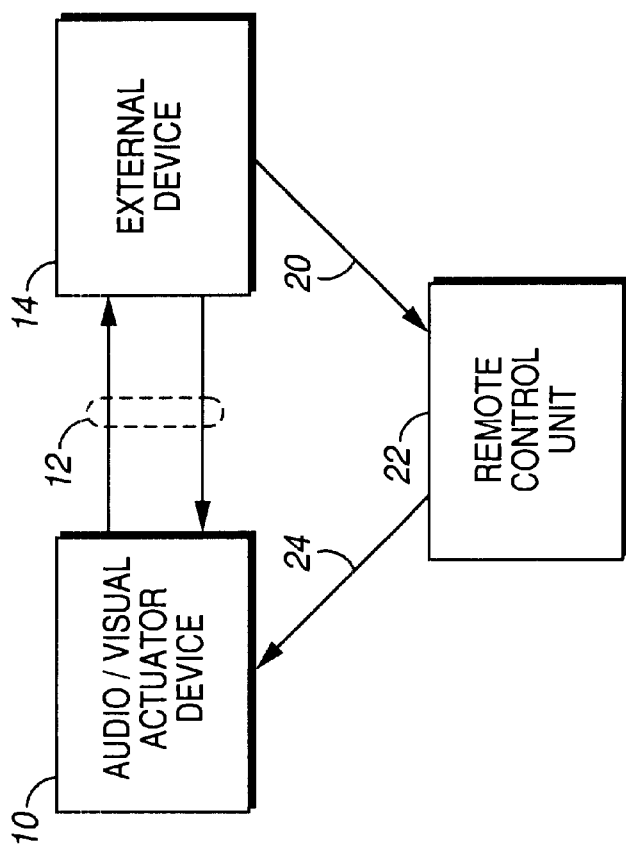


FIG. 4

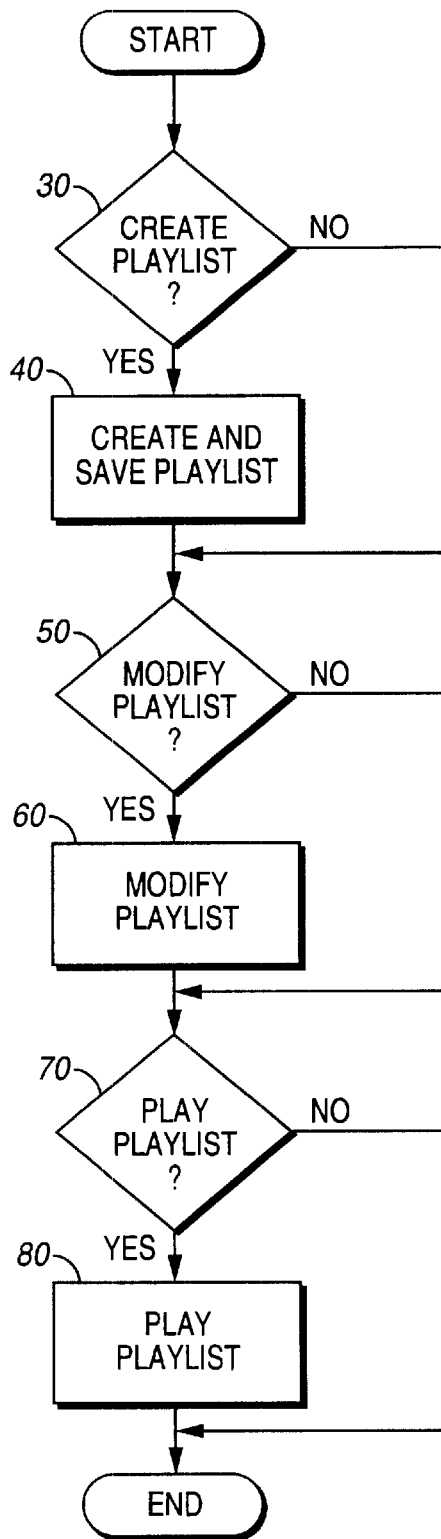


FIG. 5

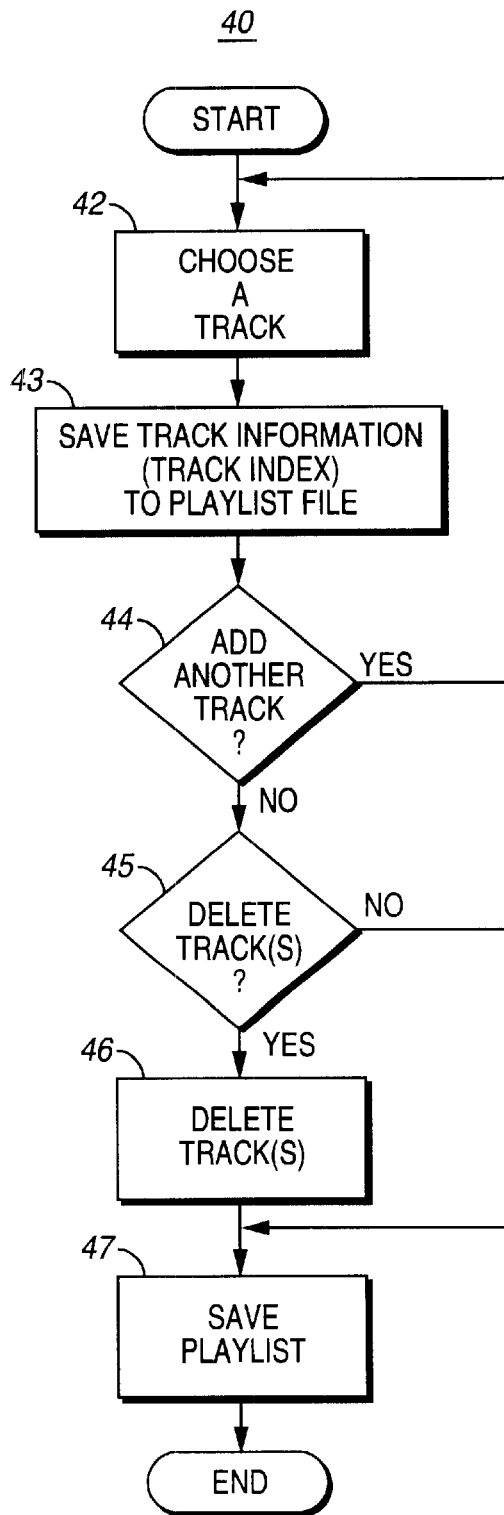


FIG. 6

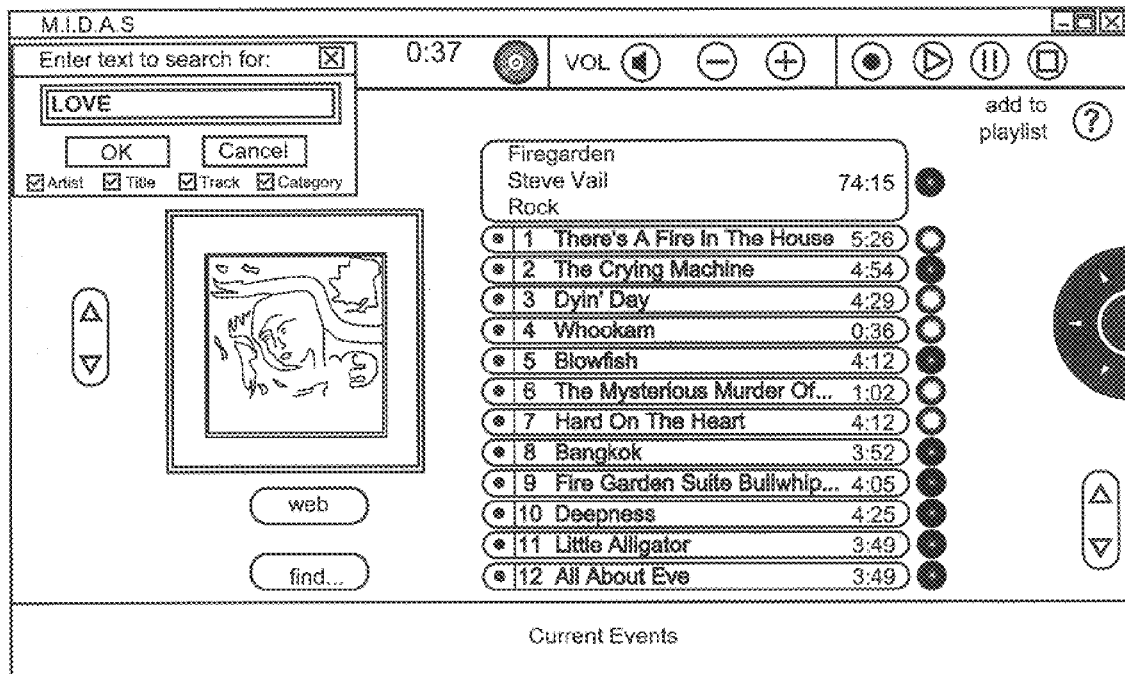


FIG. 7a

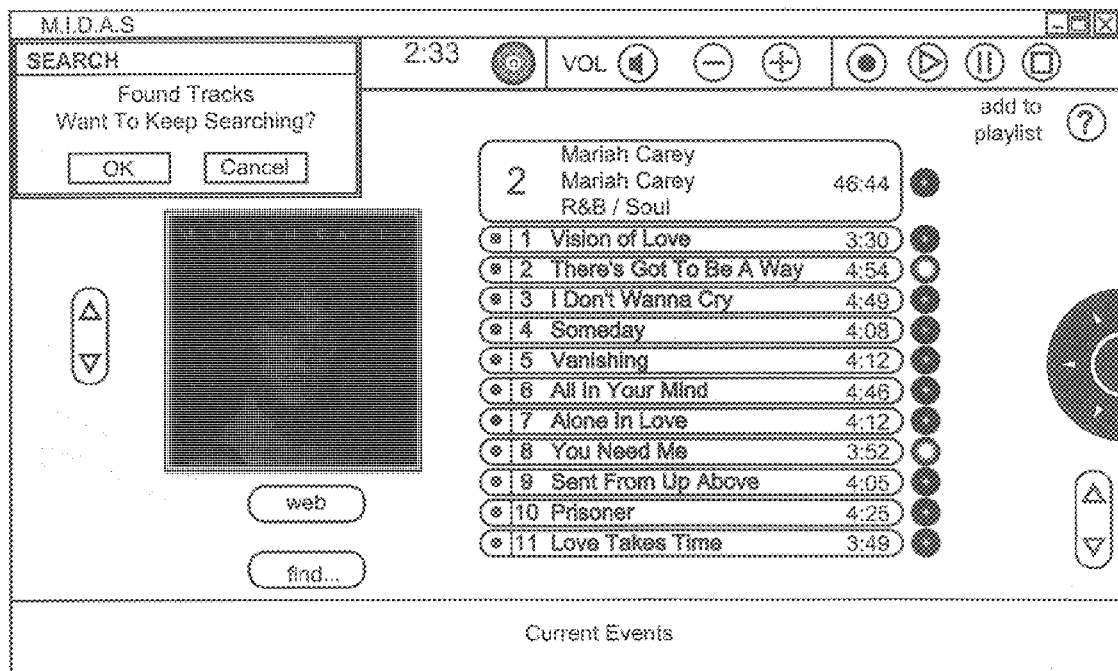


FIG. 7B

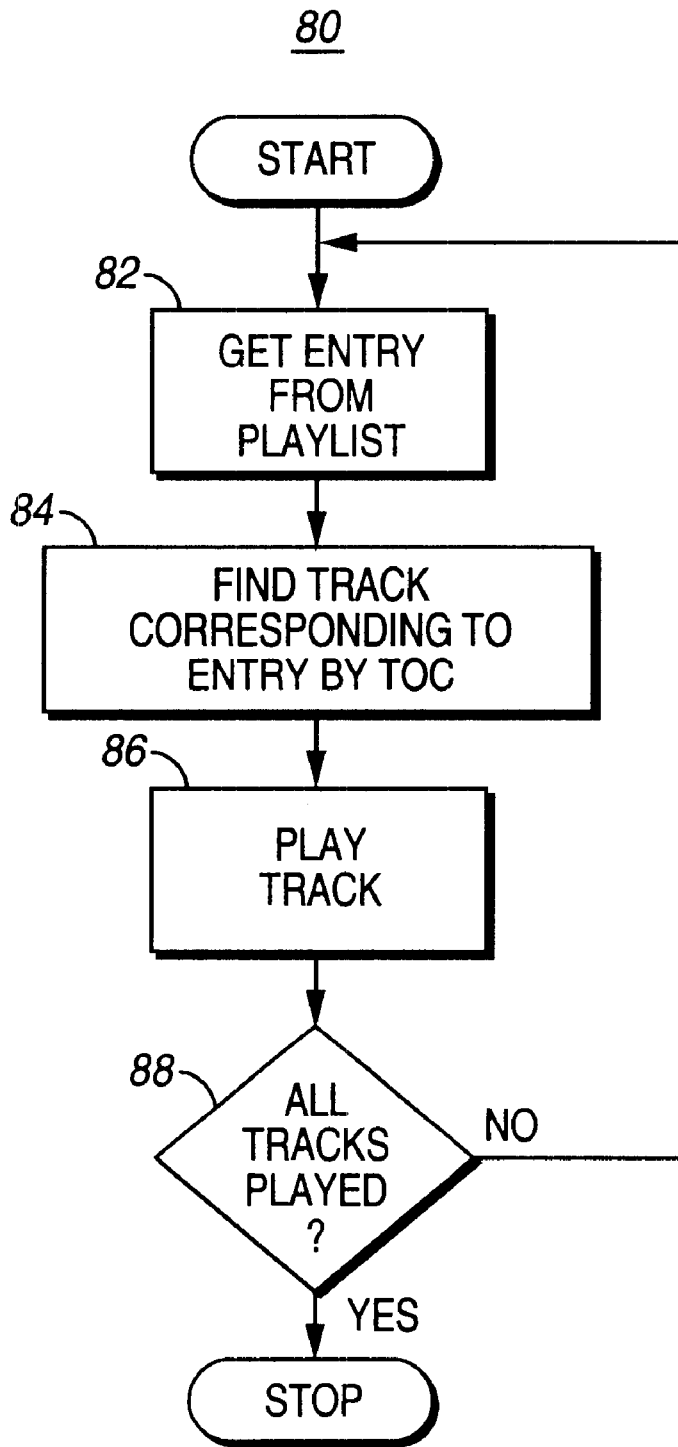


FIG. 8

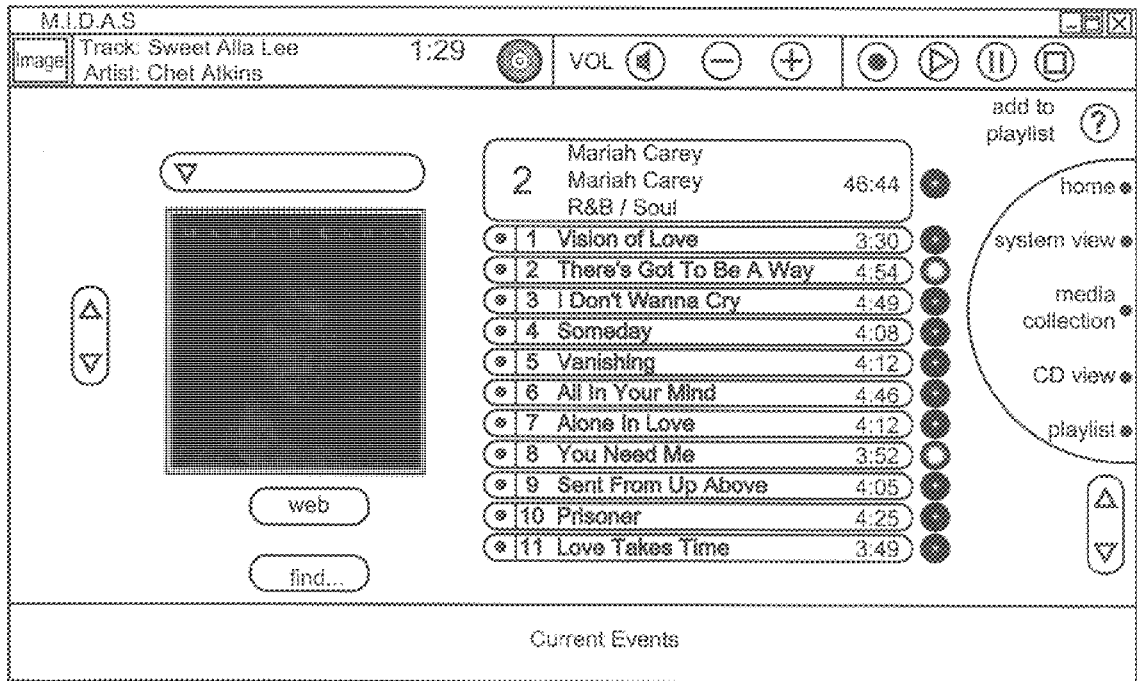


FIG. 9

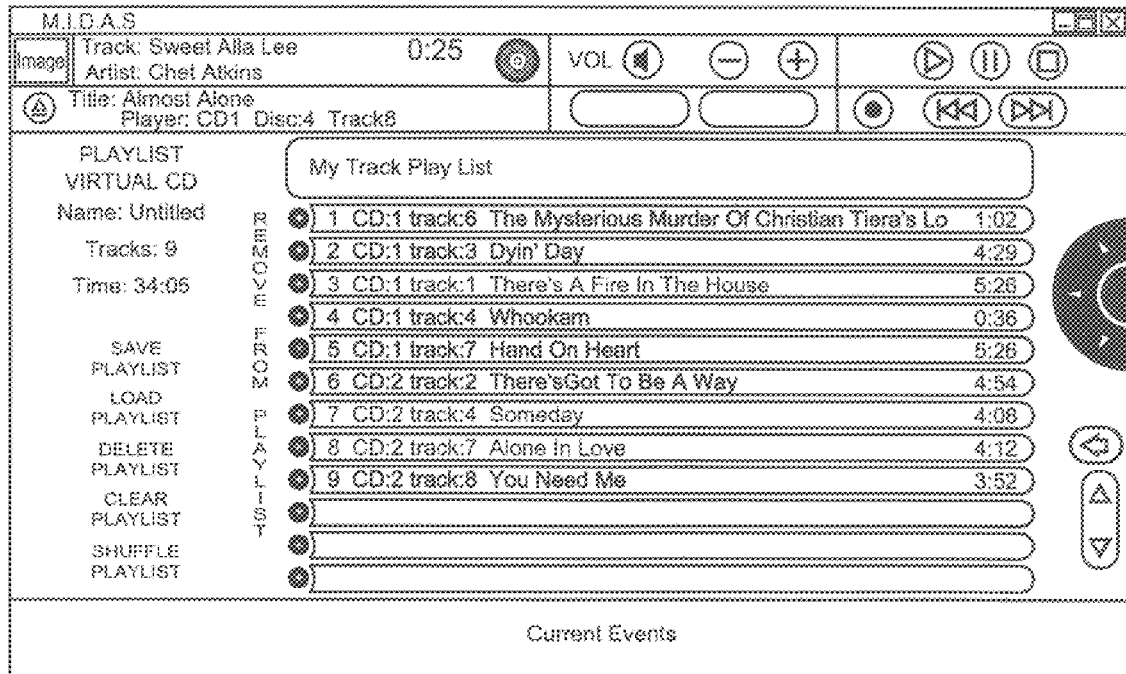


FIG. 10

**METHOD FOR CREATING, MODIFYING,
AND PLAYING A CUSTOM PLAYLIST,
SAVED AS A VIRTUAL CD, TO BE PLAYED
BY A DIGITAL AUDIO/VISUAL ACTUATOR
DEVICE**

**CROSS REFERENCE TO RELATED
APPLICATIONS**

The subject matter of the present application is related to copending U.S. application Ser. No. 09/074,681, filed contemporaneously with this application and assigned to Sony Corporation and to Sony Electronics, which is expressly incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to digital audio/visual actuation devices, and more particularly to an improved method for creating, modifying, and playing a customized playlist that may be utilized by such digital audio/visual actuation devices at any later time.

BACKGROUND OF THE INVENTION

A problem commonly encountered with digital audio/visual actuation devices capable of playing two or more "tracks", or collections of information, in a consecutive manner is how to play tracks in an order other than the order in which the tracks are normally to be played, as usually dictated by the order in which the tracks are stored on a digital storage device such as a compact disc (CD). This concern is addressed by creating "playlists" to be played by the digital audio/visual actuator device that may be customized to the tastes and needs of the individual user. The tracks that comprise the playlist may be songs or other audio clips, video clips, or audio/visual clips and are typically identified by the table of contents (TOC), a database containing such information as the number of tracks and length of each track. Digital audio/visual actuator devices include, but are not limited to, optical actuator devices, video actuator devices, audio actuator devices, or combinations thereof, such as, for instance, boomboxes. Examples of such digital audio/visual actuator devices include the compact disc (CD) player, the digital audio tape (DAT) player, the cassette recorder, the digital visual disc/mini disc (DVD/MD) player, and other audio/visual equipment.

Consider, as an example, the creation of a playlist for a CD player. As is known in the art, the CD player function may be fulfilled by a CD player having no other function or by audio/visual (AN) equipment having a compact disc player function, as well as other AN functions. The user of a CD player may create a customized playlist that selects tracks to be played in an order different from their chronological order on a CD. This may include, in the case of a single CD, rearranging the order in which tracks of the CD are played and additionally, in the case of a multiple CD player capable of housing multiple CDs simultaneously, selecting tracks from the multiple CDs in an order other than the order in which the tracks are stored on the CD and also in an order that is not bound by the position of one CD vis-a-vis another CD. The user of the CD player may accordingly create a customized playlist that lists CD tracks in the order in which the user would like to hear them played regardless of the order in which they are stored on one or more CDs housed in the CD player.

CD players may possess the means for the user to create a custom playlist. Typically, however, CD players, as is the

case with other digital audio/visual actuator devices, offer an extremely weak and cumbersome human interface for this task. The user must rely on the front panel controls of the CD player itself to create a playlist. The front panel controls of a CD player are awkward and counterintuitive to use, especially when one considers that they typically have multiple functions that cannot be dedicated just to the task of creating a playlist. As a result, keys on the front panel of the CD player may not be dedicated to the playlist creation function and thus may be counterintuitive to use for this purpose. Exacerbating this awkwardness is the fact that keys to be used for creating a playlist may not even have alpha-numeric properties.

A further difficulty with utilizing a custom playlist is that the created playlist is itself stored in volatile memory of the digital audio/visual actuator device and not in a permanent digital storage device such as a CD. Because the playlist is stored in volatile memory, it is lost whenever power to the CD player is lost, whether by turning off the digital audio/visual actuator device or accidentally losing power. The playlist must therefore be recreated every time power is lost to the digital audio/visual actuator device. Moreover, storing the created playlist in the volatile memory of the digital audio/visual actuator device requires that the playlist must be actuated by the digital audio/visual actuator device itself and not by a more convenient means, such as a remote control unit.

In light of the above discussion, it is clear that there exists a need in the art for several improvements over the prior art way of creating a customized playlist to be played by a digital audio/visual actuator device. First, there is a need to be able to overcome the problems associated with the typically weak and cumbersome human interface required to create a customized playlist on a digital audio/visual actuator device so that the user may easily and readily create the customized playlist. Second, there is a need to be able to create a customized playlist that is permanently available to the user, unlike the prior art playlist that is stored in volatile memory. Third, there is a need in the art to be able to actuate the customized playlist by means, such as a remote control unit, other than the digital audio/visual actuator device.

SUMMARY OF THE INVENTION

It is accordingly an object of the invention to create a customized playlist to be played by a digital audio/visual actuator device.

It is further an object of the invention to be able to easily create the customized playlist to be played by a digital audio/visual actuator device, thereby overcoming the problems associated with the weak human interface required by the prior art to create a playlist.

It is yet another object of the invention to create a customized playlist for a digital audio/visual actuator device that is permanently available to the user, unlike the prior art in which the playlist is stored in volatile memory.

It is still yet another object of the invention to create a customized playlist to be played by a digital audio/visual actuator device that may be actuated by means other than by the digital audio/visual actuator device, such as by a remote control unit.

Therefore, according to the present invention, a custom playlist capable of being played by a digital audio/visual actuator device may be easily created and modified by an external device that uses a user interface, such as a graphical user interface, characterized as being user-friendly. Alternately, the software of the digital audio/visual actuator

device can create and modify the custom playlist with a minimum of user intervention required. The custom playlist is created by adding one or more desired tracks to a custom playlist file that is then saved in non-volatile memory of the digital audio/user actuator device.

Once the playlist is created, it may then be easily modified if so desired at any future time by performing such functions as adding tracks, deleting tracks, and rearranging tracks of the playlist through the external device. Again, these functions may be performed by the user through the interface of the external device or by software resident on the digital audio/visual actuator device. Following any modification of the playlist, it is again saved to non-volatile memory of the digital audio/visual actuator device. The playlist may be played by the digital audio/visual actuator device at any time after it has been created and saved. According to an aspect of the present invention, the digital audio/visual actuator device may also play the playlist upon receipt of appropriate commands from a remote control unit in communication with the digital audio/visual actuator device.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the claims. The invention itself, however, as well as the preferred mode of use, and further objects and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawing(s), wherein:

FIG. 1 is a block diagram of communications between an audio/visual actuator device and an external device, according to the present invention;

FIG. 2 is an example of a table of contents (TOC) database, as it might appear on a GUI of a PC, according to the present invention;

FIG. 3 is a block diagram of communications between an audio/visual actuator device, an external device, and the Internet, according to the present invention;

FIG. 4 is a block diagram of communications between an audio/visual actuator device, an external device, and a remote control unit, according to the present invention;

FIG. 5 is a flow chart of the steps for creating, modifying and playing a custom playlist, according to the present invention;

FIG. 6 is a flow chart of the steps for creating and saving a custom playlist, according to the present invention;

FIGS. 7a and 7b are GUI representations of a searching operation that may be performed to limit the number of tracks from which the playlist is to be created, according to the present invention;

FIG. 8 is a flow chart of the steps for playing a custom playlist, according to the present invention;

FIG. 9 is a GUI representation of the playlist icon, according to the present invention; and

FIG. 10 is a GUI representation of various options available for modifying the playlist, according to the present invention.

DESCRIPTION OF THE INVENTION

The present invention creates a playlist, a collection of information tracks capable of being played on a digital audio/visual actuator device, on a device external to the digital audio/visual actuator device. The entire playlist or individual tracks of the playlist may be downloaded from the

external device to the digital audio/visual actuator device which can then play the created playlist immediately or at some future time. The tracks that comprise the playlist may be songs or other audio clips, video clips, or audio/visual clips. Digital audio/visual actuator devices include, but are not limited to, optical actuator devices, video actuator devices, audio actuator devices, or combinations thereof, such as, for instance, boomboxes. Examples of such digital audio/visual actuator devices include the CD player, the digital audio tape (DAT) player, the cassette recorder, the digital visual disc/mini disc (DVD/MD) player, and other audio/visual equipment.

The playlist is created on an external device, typically a personal computer (PC), and then is downloaded from the external device to the digital audio/visual actuator device for use at some later time. The external device communicates the playlist to the digital audio/visual actuator device by downloading the playlist file from the external device to the CD player via a connection between the two, such as by a physical cable, a radio frequency (RF) or wireless connection, or an infra-red (IR) connection. The digital audio/visual actuator device has storage capability sufficient to receive and permanently store the playlist file for later use. The software on the digital audio/visual actuator device is enhanced, if necessary, so that it is capable of accepting one or more playlists, storing and playing them as if they were playlists of actual digital storage devices, such as CDs. Once the playlist is stored, it may be played by the digital audio/visual actuator device at any time as if it were a playlist of an actual digital storage device. Unlike the prior art, the playlist file is not stored in volatile memory, so that even after turning off the digital audio/visual actuator device or otherwise losing power the playlist file is available for selection or modification. Playlists may therefore be later modified as desired.

Referring to FIG. 1, a block diagram of communications between an audio/visual actuator device **10** and an external device **14**, such as a PC, according to the present invention, is shown. Audio/visual actuator device **10** is capable of playing a custom playlist to be created on the external device **14**. Two-way communications between audio/visual actuator device **10** and external device **14** are accomplished by a two-way communications link **12** which may be a physical cable, a radio frequency (RF) or wireless connection, or an infra-red (IR) connection. The two-way communications link between audio/visual actuator device **10** and external device **14** facilitates creation of the custom playlist. Information about the tracks that may be added or deleted from the playlist, such as the table of contents (TOC) database containing information such as the number of tracks and length of each track, is provided to external device **14** from audio/visual actuator device **10**. An example of the TOC database, as it might appear on a GUI of a PC, is illustrated in FIG. 2. Once the playlist is created or modified, it is downloaded by external device **14** to audio/visual actuator device **10**.

Referring to FIG. 3, it will be noted that external device **14** may also receive information pertinent to creating or modifying the playlist from external information sources **18**, such as the Internet or world wide web, over two-way communications link **16**. For instance, music CDs are now available over the Internet and tracks from such CDs may be added to the custom playlist to be played by audio/visual actuator device **10**. It should be further noted that, as shown in FIG. 4, external device **14** may download the custom playlist to remote control unit **22** via communications link **20** in addition to downloading the playlist to audio/visual

actuator device **10**. In this way, it is possible for remote control unit **22** to control audio/visual actuator device **10** by sending to it appropriate control commands concerning playing the playlist.

FIG. **5** is a flowchart that illustrates the steps for creating, playing and modifying a custom playlist, according to the present invention. Decision Block **30** inquires as to whether the user desires to create a custom playlist using the present invention. If the response is yes, then a custom playlist is created on external device **14** and saved to non-volatile memory in the digital audio/visual actuator device **10** at Block **40**. If the response is no, the flow proceeds to Decision Block **50**. At Decision Block **50**, the user must decide whether the playlist that has been created and saved is to be modified. If the playlist is to be modified, then, at Block **60**, the playlist is modified and again saved. Next, at Decision Block **70**, the user must decide whether to play the playlist. The playlist is played at Block **80** or the flow terminates if the playlist is not to be played.

Creation of the playlist **40** will now be described. Referring to FIG. **6**, at Block **42** the user chooses a track to be added to the playlist file that will be saved by the digital audio/visual actuator device. Selection of tracks to be added to the playlist may be accomplished in any number of ways. For instance, the user may choose to limit the number of tracks from which the playlist may be created by limiting the number of available tracks to those sung by a certain artist, i.e. "Elvis", or those having a title that contains the certain term, i.e. "love". This step is illustrated in the GUI representations of FIGS. **7a** and **7b** in which the word "love" is searched for in the title of various tracks available to be added to the playlist. Identifying information about this track, such as the track index from the TOC of the digital storage device on which the track is stored, that is capable of identifying the track is saved to the playlist file at Block **43**. Next, the user must decide whether another track is to be added to the playlist at Decision Block **44**. If another track is to be added to the playlist, the flow returns to Block **42**. If, however, another track is not to be added to the playlist the flow continues to Decision Block **45**. At Decision Block **45**, the user is given the opportunity to delete any tracks added to the playlist that the user wishes to now delete from it. This is accomplished at Block **46**. If no tracks are to be deleted from the playlist, the flow proceeds to Block **47**. At Block **47**, the playlist is saved in non-volatile memory in digital audio/visual actuator device **10**.

Alternately, the playlist may be created with little user intervention at all. The digital audio/visual actuator device can be programmed to recognize those tracks that are played the most frequently and to create the custom playlist to include them. For instance, the digital audio/visual actuator device can choose the ten tracks that the user has played the most within a given time period, such as within the last week. The digital audio/visual actuator device may further have a select button on its control panel that the user may press to add a track that is being played to the playlist. Additionally, the playlist may be created by a shuffle operation that simply shuffles in random order a number of tracks. The shuffle operation may be accomplished using a random number generator, for instance, in the manner known in the art.

The custom playlist may be modified, or edited, in any number of ways. Referring back to FIG. **5**, after the playlist is created and saved the user may modify the playlist before it is played, as shown at Blocks **50** and **60**. As with creation of the playlist, modification of the playlist is performed by the external device **14**. The external device **14** has a human interface that is much more conducive to this operation than is the control panel of digital audio/visual actuator device **10**. The playlist may be edited by deleting tracks from it,

rearranging the tracks, or adding tracks to it. Rearranging the tracks may be accomplished by a shuffle operation, previously discussed. It is understood that modification of the playlist may also occur after the playlist is played.

After the playlist has been created, modified, if so desired, and stored to the digital audio/visual actuator device, it may be played at any time in the future by the digital audio/visual actuator device **10**. Because the playlist has been saved to non-volatile memory of the digital audio/visual actuator device, unlike the prior art, the user need not worry about the playlist being lost. Referring now to FIG. **8**, the steps of Block **80** for playing the playlist are shown. First, at Block **82**, the entry of the next track to be played is obtained from the playlist stored in digital audio/visual actuator device **10**. The track is found by the TOC and track index unique to it, as shown at Block **84**. Next, at Block **86**, the track is played by digital audio/visual actuator device **10**. At Decision Block **88**, if not all tracks of the playlist have been played, the flow is returned to Block **82**. If, however, all tracks of the playlist have been played, the flow is terminated. The above steps for playing the playlist will typically be handled by digital audio/visual actuator device **10** with no user intervention required.

The following example, in which it is assumed that the digital audio/visual actuator device is a CD player and the external device is a PC, illustrates operation of the present invention. The external device is capable of collecting and managing information about many different CDs that may be contained in the CD player. Playlists are created on a PC, for instance, by pointing and clicking on icons of a graphical user interface (GUI) that are representative of desired CD tracks, thereby selecting those tracks to be added to the playlist. FIG. **9** provides an example of what the GUI on a PC might look like; in FIG. **9**, on the right side of the screen, the icon for selecting the playlist function is clearly shown. Tracks are easily identified by their track index in the TOC of a CD, a database containing the number of tracks and length of each track on the CD. The reader is referred again to FIG. **2** which shows a GUI example of a TOC of a music CD, by way of example. Using the TOC and track index, it is possible to place a certain track of a CD in any position of the custom playlist being created.

Once the playlist has been created, the PC communicates the playlist to the CD player by downloading the playlist file from the external device PC to the CD player via a physical cable, a radio frequency (RF) or wireless connection, or an infra-red (IR) connection. For instance, the PC can communicate via an RS232 port connected to an interface device capable of facilitating communications between two serial devices, such as a PC VISION TOUCH box that uses an AI protocol or an S-Link protocol standard. The CD player contains storage capability, such as a random access memory (RAM), and a central processing unit (CPU) so that the playlist may be received and permanently stored for later use. The software on the CD player is enhanced to accept one or more playlists, store them and play them just as if they were virtual CDs. Once the playlist is stored, it may be played by the CD player at any time as if it were a virtual CD. Alternatively, the external device, such as a PC, could be used to command the CD player to play a certain track, one at a time.

As previously discussed, the custom playlist may be modified in a variety of ways. Modification of the playlist is performed by external device **14** and may include deleting tracks from the playlist, rearranging tracks in the playlist, and adding tracks to the playlist. Referring to FIG. **10**, a sample GUI illustrates the various options for modifying the playlist, including saving, loading, deleting, clearing, or shuffling the playlist.

An important feature of the present invention is the ease with which a customized playlist may be created, modified

and played. The external device, such as a PC or other similar device, is used to manage the CD collection in the CD player so that the tracks of each CD in the CD player is known. Thus, the external device knows, at any given time, the location of each track on a CD in the CD player. A graphical user interface (GUI) of the external device, such as a PC GUI, provides for the creation, modification, and selection of a customized playlist to be made with simplistic ease. This is quite different from the prior art approach that does not use a GUI but instead relies on the front panel controls of the CD player which are typically counter-intuitive and awkward to use, as noted above. The present invention is especially useful when creating a recording of information contained within a digital storage device of a first digital audio/visual actuator device to a second digital audio/visual actuator device. An example of this would be to use a CD player to record songs from a playlist of music CDs to a mini disk (MD) player or a cassette tape recorder.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A method for generating a custom playlist in a non-volatile memory of a digital audio/visual actuator device, said playlist suitable to be played by the digital audio/visual actuator device, comprising the steps of:

creating the custom playlist on an external device with a graphical user interface;

transferring the custom playlist to the digital audio/visual actuator device by downloading a playlist file that contains the custom playlist from the external device to the digital audio/visual actuator device over a communications link between the external device and the digital audio/visual actuator device; and

saving the custom playlist in said non-volatile memory of the digital audio/visual actuator device.

2. The method of claim 1, wherein creating the custom playlist comprises the steps of:

obtaining information about a plurality of tracks that are available to be added to the custom playlist;

selecting one or more tracks of the plurality of tracks to be added to the custom playlist;

adding the one or more tracks to the custom playlist by saving an identifier of each track of the one or more tracks to a playlist file; and

saving the playlist file.

3. The method of claim 2, wherein the step of obtaining information about the plurality of tracks comprises the external device receiving information about the plurality of tracks from the digital audio/visual actuator device.

4. The method of claim 3, wherein the external device receives information about the plurality of tracks from a digital storage device in the digital audio/visual actuator device.

5. The method of claim 2, wherein the step of obtaining information about the plurality of tracks comprises the external device receiving information about the plurality of tracks from an external information source having a two-way communications link with the external device.

6. The method of claim 5, wherein the external information source is the Internet.

7. The method of claim 2, wherein the step of selecting the one or more tracks to be added to the custom playlist comprises searching the plurality of tracks for a characteristic.

8. The method of claim 2, wherein the identifier is a track index of the track.

9. The method of claim 2, wherein prior to saving the playlist file, comprising the additional step of:

deleting any track of the custom playlist that is no longer to be in the custom playlist.

10. The method of claim 1, wherein the communications link is a cable.

11. The method of claim 1, wherein the communications link is a wireless connection.

12. The method of claim 1, wherein the communications link is an infra-red connection.

13. The method of claim 1, wherein the communications link is a two-way communications link.

14. The method of claim 1, wherein after saving the custom playlist comprising the further step of:

modifying the custom playlist to create a modified custom playlist.

15. The method of claim 14, wherein after modifying the custom playlist comprising the further step of:

saving the modified custom playlist.

16. The method of claim 1, wherein after saving the custom playlist comprising the further step of:

playing the custom playlist on the digital audio/visual actuator device.

17. The method of claim 16, wherein the step of playing the custom playlist is actuated by a remote control device in communication with the digital audio/visual actuator device.

18. The method of claim 16, wherein playing the custom playlist comprises the steps of:

a. obtaining an entry from the custom playlist that corresponds to a track of the custom playlist to be played;

b. identifying the track by the entry from the custom playlist;

c. playing the track on the digital audio/visual actuator device; and

d. repeating steps a-c above for each track of the custom playlist until each track of the custom playlist is played.

19. The method of claim 1, wherein after providing the custom playlist to the digital audio/visual actuator device comprising the further step of:

playing the custom playlist on the digital audio/visual actuator device.

20. The method of claim 19, wherein the step of playing the custom playlist is actuated by a remote control device in communication with the digital audio/visual actuator device.

21. The method of claim 19, wherein playing the custom playlist comprises the steps of:

a. obtaining an entry from the custom playlist that corresponds to a track of the custom playlist to be played;

b. identifying the track by the entry from the custom playlist;

c. playing the track on the digital audio/visual actuator device;

d. repeating steps a-c above for each track of the custom playlist until each track of the custom playlist is played.

22. The method of claim 1, wherein after creating the custom playlist on an external device, comprising the further step of:

modifying the custom playlist to create a modified custom playlist.

23. The method of claim 22, wherein after modifying the custom playlist comprising the further step of:

saving the modified custom playlist.

Exhibit J



US006549942B1

(12) **United States Patent**
Janky et al.

(10) **Patent No.:** **US 6,549,942 B1**
(45) **Date of Patent:** ***Apr. 15, 2003**

(54) **ENHANCED DELIVERY OF AUDIO DATA FOR PORTABLE PLAYBACK**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/613,025**

(22) Filed: **Jul. 10, 2000**

Related U.S. Application Data

(63) Continuation of application No. 09/124,584, filed on Jul. 29, 1998, now abandoned, which is a continuation-in-part of application No. 08/642,963, filed on May 7, 1996, now Pat. No. 5,841,979, which is a continuation-in-part of application No. 08/450,818, filed on May 24, 1995, now Pat. No. 5,914,941.

(51) **Int. Cl.**⁷ **G11B 20/10; H04M 11/00**

(52) **U.S. Cl.** **709/219; 709/227; 370/313; 370/486; 375/240; 725/70; 369/29.02**

(58) **Field of Search** **709/217-219, 709/237, 227-229; 375/240; 370/485, 486, 313; 434/308, 319; 705/26; 725/70, 91, 112, 114; 369/24.01, 25.01, 29.02; 704/270-278**

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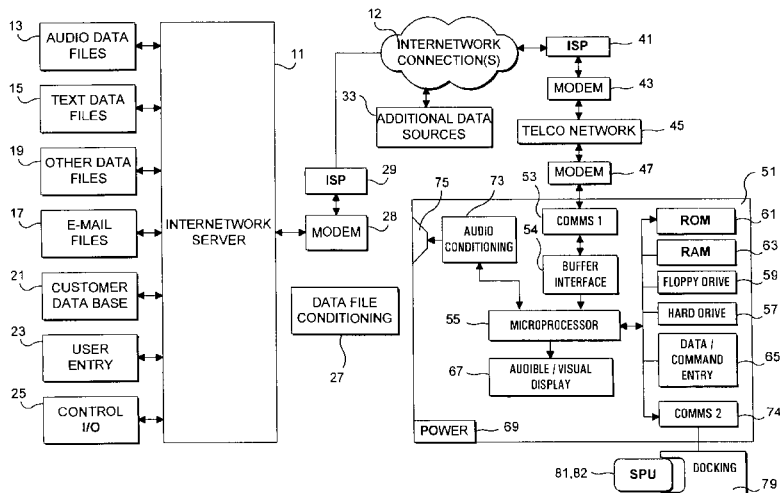
Primary Examiner—Tuan Q. Dam

(74) *Attorney, Agent, or Firm*—Cooper & Dunham LLP; William E. Pelton; Donald S. Dowden

(57) **ABSTRACT**

A system for selection by a user and delivery to the user over an internetwork transmission channel of selected audio data files at a delivery rate of at least twice the delivery rate for normal, audibly perceptible playback of an audio data file. The user registers the user's selection of audio material with a central library of audio and/or text data files, and a digitized and optionally compressed omnibus file containing the user's selections is prepared and transmitted to the user at a high data transfer rate. The user receives/downloads the selected data files to a personal computer or to a portable storage and playback unit (SPU) that may store and play back digitized text or audio data, using a docking station. The user carries this SPU until the user has an opportunity to audio process and play back the text or audio data files in audibly perceptible form.

23 Claims, 4 Drawing Sheets



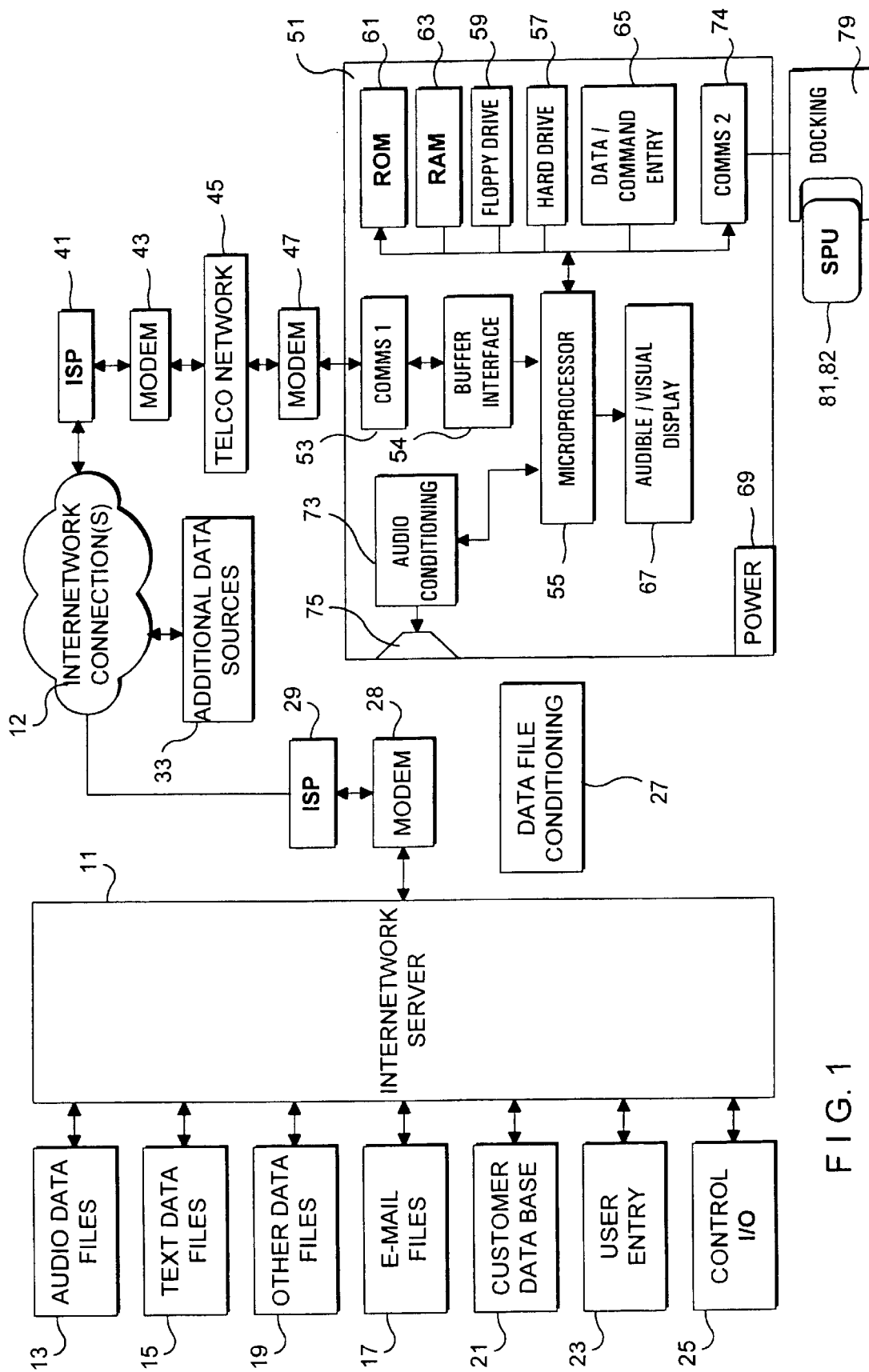


FIG. 1

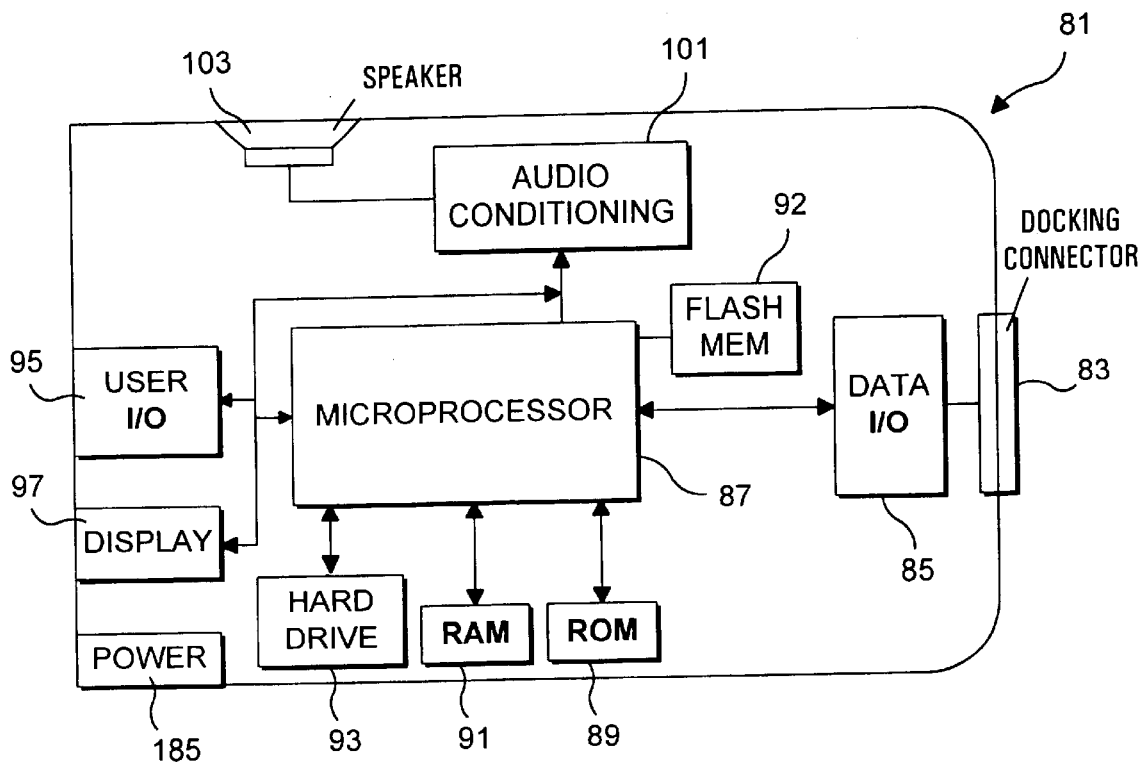


FIG. 2

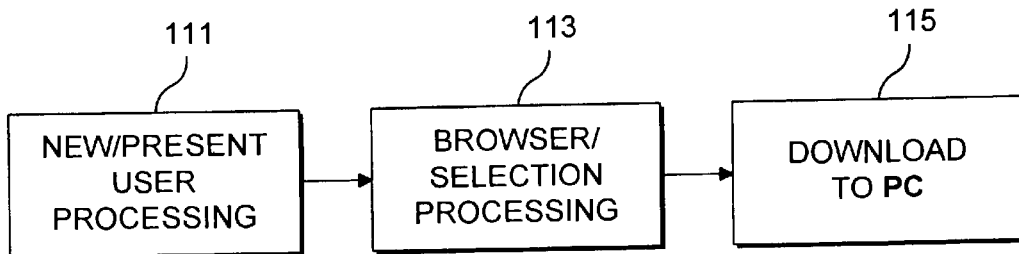


FIG. 3

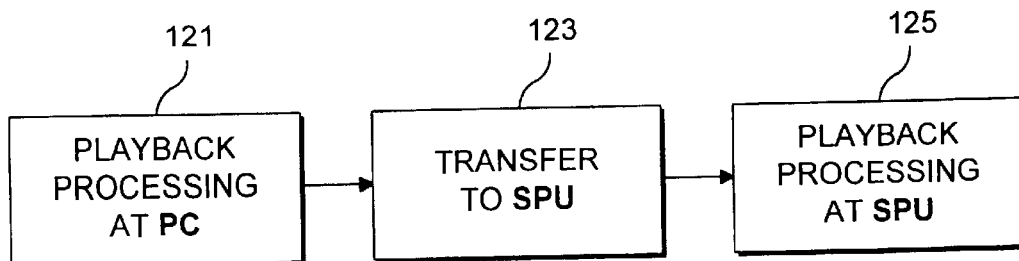


FIG. 4

<u>AUDIO/TEXT SOURCES</u>	<u>FIRST PROCESSING</u>	<u>SECOND PROCESSING (OPTIONAL)</u>	<u>SERVER TYPE</u>	<u>PLAYBACK</u>
AUDIO FILE(S)	DIGITIZE	COMPRESSION, ENCRYPTION	AUDIO FILE(S)	AUDIO
TEXT FILE(S)	PASS-THROUGH	COMPRESSION, ENCRYPTION	TEXT FILE(S)	TEXT-TO-SPEECH +AUDIO
TEXT/VISUAL FILE(S)	SCANNING, OCR PROCESSING, DIGITIZATION	COMPRESSION, ENCRYPTION	TEXT FILE(S)	TEXT-TO-SPEECH +AUDIO
TEXT FILE(S)	DIGITIZATION, TEXT-TO-SPEECH CONVERSION		AUDIO FILE(S)	AUDIO
TEXT/VISUAL FILE(S)	SCANNING, OCR, DIGITIZATION, TEXT-TO- SPEECH CONVERSION		AUDIO FILE(S)	AUDIO

FIG. 5

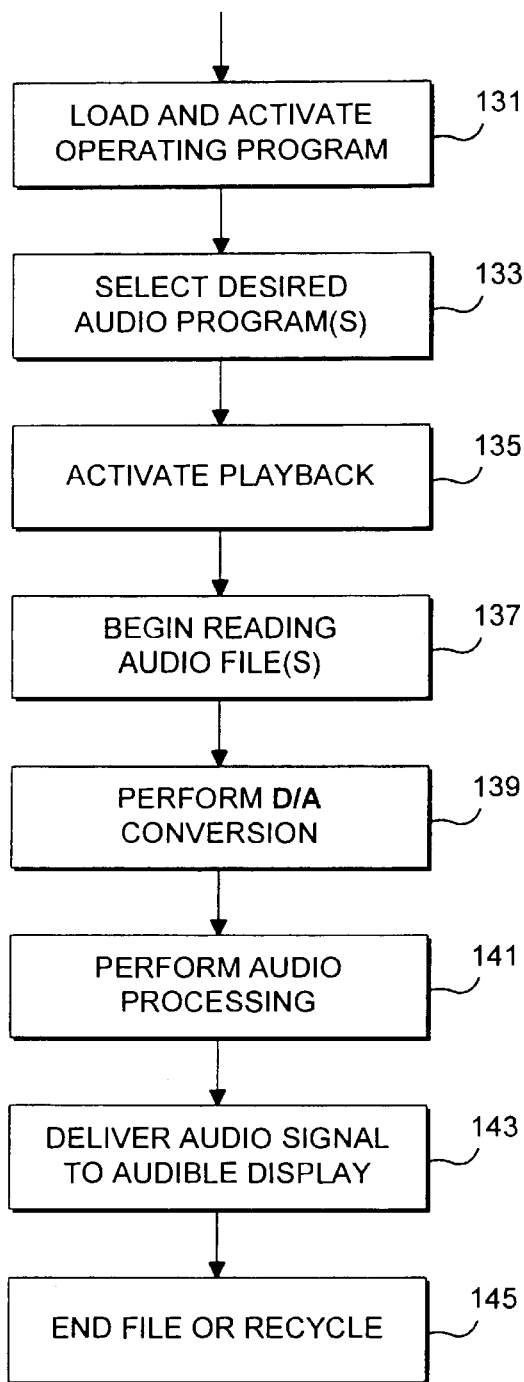


FIG. 6

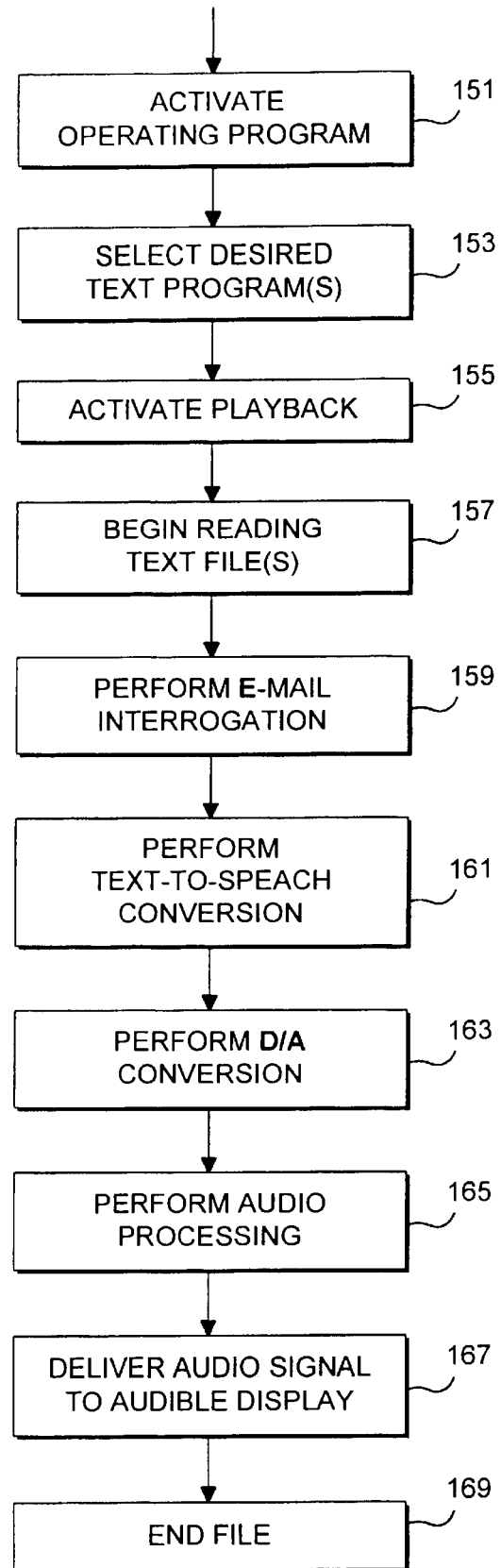


FIG. 7

ENHANCED DELIVERY OF AUDIO DATA FOR PORTABLE PLAYBACK

This application is a continuation of patent application Ser. No. 09/124,584 filed Jul. 29, 1998, now abandoned, which is a continuation in part of a patent application entitled "Enhanced Delivery of Audio Data," U.S. Ser. No. 08/643,963, filed on May 7, 1996, now U.S. Pat. No. 5,841,979, which is a continuation in part of a patent application entitled "Portable Information Storage/Playback Apparatus Having A Universal Data Interface," U.S. Ser. No. 08/450,818, filed on May 24, 1995, now U.S. Pat. No. 5,914,941, both assigned to the Assignee of this application.

FIELD OF THE INVENTION

This invention relates to delivery of compressed digital audio data, potentially at rates much faster than the real time rate, for conversion to speech for portable audible reception in recreational or educational activities.

BACKGROUND OF THE INVENTION

Available information that is relevant to operation of a business or of a household increases at an exponential growth rate. A user of such information must become concerned with how to find the time, in an already crowded workday, to absorb the most relevant of such information. A menu of such information can be provided on a subscription basis, for individual selection by each user, as discussed in U.S. Ser. No. 08/643,963. One useful medium for delivery and reception of such information is sound, which requires use of the ears and of a portion of the user's brain but does not require simultaneous use of other senses. Previous systems have usually provided this information as a combination of video and audio in which the audio information was often treated as an afterthought.

The approaches disclosed by previous workers in this field usually combine video and audio data so that the video requirements control the choice of transmission system, or the selection of audio information is limited to features closely associated with use of a telephone. These approaches do not provide transmission and storage of a wide variety of audio-only information in a format that takes advantage of unique features of audio format information.

Also, these approaches do not take advantage of the possibility of using an available transmission medium, such as an internet that already provides for inter-communication between millions of homes, offices and other facilities. Use of a particular internet may reduce the number of signal formats that must be recognized and dealt with, and it may be possible to optimize the audio signal processing for the limited number of (or one) formats in which the audio signals are received.

What is needed is a procedure for packaging, delivery, reception, storage and playback of audio files in a format that (1) allows for potential transmission of the audio files at transfer rates many times higher than the normal audio playback rates, (2) allows receipt and storage of the audio files in compressed formats that can store several hours of normal audio programming in a playback medium of modest size, (3) allows transmission of audio files to the user at times and manners that are convenient for both the sender and the recipient, and (4) allows the user to conveniently transport the stored audio files, for playback at a time chosen by the user.

Preferably, the procedure should be adjustable to receive and process the audio (or text data) files using a signal processing procedure that is optimizable or optimized for the format, or limited number of formats, in which the audio (or text data) files are delivered to audio playback apparatus.

SUMMARY OF THE INVENTION

The invention meets these needs by providing a portable digital audio playback module for digital audio file receipt and storage, D/A conversion and playback. The audio programming material ("audio data files" herein) are digitized and optionally compressed before transfer over a hardwired or wireless communication internetwork channel to the storage/playback module, using any suitable compression algorithm. The module is capable of receiving and recording compressed, digitized audio programming at a transfer rate that may be faster than the normal audible playback rate so that, for example, ten hours of playback material may be transferred in a time interval of between less than ten minutes and a few hours, optionally using transfer procedures and times that do not interfere with the user's normal workday. The rate of data transfer depends upon the communications link used and will depend upon the Internet delivery rate vis-a-vis the playback rate. These communications links include POTS (plain old telephone service) lines, ISDN lines, cable television links, satellite broadcast links and other similar links that are suitable for internet communication. The audio data files are received by a user having a personal computer (notebook, laptop, desktop, etc.), modem, and docking station, and the audio data files are preferably processed and downloaded to a portable (e.g., handheld) storage and playback unit ("SPU") at the docking station. Once an audio data file is received by the user, this file can be decompressed and converted to analog format (optional) for playback at a normal rate by the user. The audio data files are received by the user and stored digitally on a non-volatile medium in an SPU, or in a personal computer ("PC") used to make an internet connection. The PC may also be used to play back or display the programming.

Alternatively, the PC or the SPU receives a text data file from the internetwork channel and either passes this file through a text-to-speech conversion process to convert this file to an audio data file, before the audio data file is received or stored or played back, or stores the file as a text file and converts this file to speech on the fly. Alternatively, the received data file can be processed and played back at the PC, rather than being downloaded to, and played back at, the SPU; most PCs have an audio sound system.

In contrast to a conventional digital audio storage system, such as Digital Audio Tape (DAT), the invention uses a different storage medium, provides random access search capability, rather than linear search capability, and optionally receives and stores information in a compressed format that uses a chosen data compression algorithm. In contrast to a writeable audio storage device, such as the Sony recordable mini-CD, the invention uses an SPU for download and playback and optionally may have intentionally limited audio bandwidth; stereo full fidelity is not needed for this programming.

The invention combines the remote data access capability resident in a personal computer, the portability of an SPU, and a set of tailored, streamlined control functions to simplify and automate a seamless process for selecting, receiving, storing and/or playing back audio data files, at times and places chosen by the user, with easily implemented control functions; and with a user interface that allows downloading of the compressed and digitized audio data files in a variety of formats. Storage for subsequent playback occurs first in the PC used to make an internet connection, but the files may be transferred automatically under software control, using a docking station, to the SPU.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a subscription/on-demand information delivery system, illustrating several embodiments of the invention.

FIG. 2 is a schematic view of a portable storage and playback unit (SPU) that can be used to practice the invention.

FIG. 3 illustrates a general procedure for user processing, data file(s) selection by the user, and downloading of the selected file(s) to a PC.

FIG. 4 illustrates a general procedure for playback processing of a data file at a PC, downloading of a data file to an SPU, and playback of the data file at the SPU.

FIG. 5 is a table illustrating processing options for a data file taken from various sources before the data file is played back as an audibly perceptible signal.

FIGS. 6 and 7 are flow charts illustrating the playback according to several embodiments.

DESCRIPTION OF BEST MODES OF THE INVENTION

FIG. 1 is a schematic view of an on-demand information delivery system **10** according to an embodiment of the invention. The system **10** is disclosed in part in the following issued patents, both of which are assigned to Information Highway Media Corporation, the assignee of the present application: N. Schulhof, J. Janky, "System for Distributing Subscription and On-Demand Audio Programming," U.S. Pat. No. 5,572,441; and N. Schulhof, J. Janky, "Apparatus for Distributing Subscription and On-Demand Audio Programming," U.S. Pat. No. 5,557,541.

An audio program distribution system **10** includes an internetwork server **11** that is connected to an internetwork channel **31**, such as the well known Internet or an intra-net serving a smaller group of users. The server **11** is connected to a plurality of data sources, including an audio data file library **13**, a text data file library **15**, E-mail files **17** and other data files **19**, and to a customer database **21** that contains relevant information on subscribers who use the distribution system **10**. The server **11** also receives commands, data and other information from a user entry module **23**, which may be a keyboard, light pen or other data/command entry device or may be an electronic terminal that communicates with a user terminal that may be nearby or remotely located. The server **11** also receives commands and other data from a control I/O module **25**.

The audio data file library **13** and text data file library **15** may be implemented in any known digital storage technology, for example as a plurality of digital storage media, such as hard drives. Audio data material may be deposited in the library **13** from a variety of audio data sources using a variety of data communications media and formats from a plurality of locations, for example via modem transfer from a distributor, such as the Wall Street Journal. Sources for text data material are similarly voluminous. The audio data files and text data files are preferably digitized and optionally compressed and encrypted, using selected compression and encryption algorithms and formats, before such files are deposited in the data files libraries **13** and/or **15**.

An analog audio intended for the internetwork channel **31** is passed through an audio conditioning module **27** (optional) for digitization, optional compression and/or optional encryption and is then passed through a first modem **28** to a first internetwork service provider ("ISP"; optional) **29** before being received by the internetwork channel **31**. The internetwork channel **31** may be connected to, and receive data from, other data sources **33** as well. The data file(s) requested by a user are then received by a second ISP **41** (optional), by a second modem **43**, by a telephone network **45** and by a third modem **47**, before being received by a personal computer ("PC") or other computer-based module **51** utilized by a user.

One important anticipated use of the invention is to provide or implement an audio subscription service, using an internetwork channel to deliver selected audio or text data files that can be downloaded and stored for present or subsequent playback. For example, an audio program, created for radio or television, could be digitized and stored in an audio data file library for subsequent download and playback. Alternatively, selected portions of a daily newspaper, such as the Wall Street Journal or the New York Times, may be scanned in and digitized as an audio version, that is then delivered to the library. Used in this manner, the system **10** may provide daily delivery of a program in audio format that allows a subscriber to listen to the audio material without interruption by commercial breaks or other unwanted communications, that is not truncated to fit into a tight broadcast schedule, and that does not require dedication of the user's sense of sight, touch or other faculties, except for hearing. The user can, optionally, listen to the playback and simultaneously perform other tasks. During data transmission or downloading, audio program files can be transferred from the server **11** to the PC **51** at rates 2-100 times as large as the normal rates (.6-32 kilobits/sec) for real time playback of an audio data file, depending upon the present number of internetwork users.

The data file transmission channel is preferably an internetwork channel **31** capable of connecting hundreds, thousands or even millions of computer sites, including many sources of audio data files. The internetwork channel may, for example, be the World Wide Web that is part of the well known worldwide Internet. This Internet uses TCP/IP (transmission control protocol/internet protocol) or PPP (point-to-point protocol) in access to a website on the Internet. However, any other internet channel or intra-net channel, possibly using a different, but known, protocol, can also be used to gain access to an audio file database, to transmit selections based on on-line menus, and to receive and download and automatically store audio data files corresponding to those selections.

The internetwork channel **31** of the audio data delivery system **10** may be chosen to take advantage of any of several existing data delivery infrastructures for an internetwork. The delivery system **10** is well suited for use with data transmission means, such as plain old telephone service (POTS) or ISDN. Compression of the audio data files may be implemented by use of the G.722 or Dolby AC-2 or AC-3 compression schemes or by other suitable audio compression schemes. Alternatively, the audio data files may be delivered and received using the Ricochet wireless modem offered by Metricom (Los Gatos, Calif.).

The Ricochet system uses a wireless modem with RS-232 serial format and can transfer information at rates up to 128 kbits/sec, using a specially designed, wireless LAN Access Modem. The present modem rate limit is 28.8 kbits/sec. A dynamic address, which can change with each new session, is assigned to a Ricochet user. The Ricochet system acts as a network service provider with its own user pool and with connections to the Internet. Ricochet divides the 902-928 MHz unlicensed band into 162 channels, each 160 kHz wide, for operation. Maximum connect time per subscriber is 100 hours per month and 4 hours per individual session. A Ricochet modem should be within 450 meters (about 0.3 miles) peer-to-peer (another Ricochet modem) or within about 1600 meters of a Ricochet pickup node (located, for example, on selected telephone poles in many communities). E-mail service is available, using POP3 protocol. E-mail file attachments up to 5 Mbytes in size (total message length) can be transferred using Ricochet. San Francisco, Los Angeles, Seattle, Washington, D.C., major airports and many universities and large corporations are now covered by the Ricochet network, with other communities to be added

in the coming years. A high speed network service will be added in 1999.

In practice of the invention, information is loaded into the PC or SPU through a modem **31**, stored, and thereafter played back at a real time rate. The compression algorithms used in the herein-described system are similar (or may be identical) to those developed by the Motion Picture Experts Group, referred to as MPEG-1 and MPEG-2. Other known compression algorithms include G.722, pioneered by AT&T. These compression techniques provide specific algorithms in which audio is digitized and then compressed a great deal. Maximum compression achieved to date that maintains adequate quality programming is about 6–6.5 kilobits/sec. Typical compressed but high-quality audio data rates lie somewhere between 16 and 32 kilobits per second.

The internetwork channel **31** routes the selected audio and/or text data file(s) to the microprocessor **51** using any suitable communication means, as discussed above.

Communications protocols for implementing this service are available and well known in the art. Two examples are point-to-point protocol (PPP) and transmission control protocol/internet protocol (TCP/IP), used for communications on the Internet. The data transmission control process is well understood and is available in software as part of the products offered by Netscape, NetCom, America OnLine and Compuserve, among others. Terminal emulators, such as a microphone and PC phone are available and well known to users of personal computers (PCs). The expansion of Internet activity has led to widespread development of many such communications packages for use on PCs. By design, the transmission protocol used in the transmission and/or downloading channel **29** is matched by a similar protocol that resides in the subscriber's PC. Matching of these two protocols allows connection to a Website source for audio data files.

The data files are received at the PC **51** and buffered by a first communications terminal **53** and by a buffer and data interface **54** (optional) before receipt by a microprocessor **55** and are preferably stored in a hard drive **57** associated with the microprocessor **55**. The PC **51** optionally includes a floppy drive and includes ROM **61**, RAM **63**, a data command entry module **65** for user communication with the PC, an audio/visual display module **67** and a source of electrical power **69**. The data interface **54** may be configured to recognize only one or a few digital formats, such as those that would be presented by a connection to the Internet. Alternatively, the data interface **54** may be a universal data interface that recognizes any of a large number of digital formats that are used with various information packages (packets, frames, cells, etc.). A universal data interface is discussed in U.S. Ser. No. 08/643,963; this discussion is incorporated by reference herein.

Optionally, the microprocessor **55** is connected to, or includes, an audio processing module **73** and a loudspeaker or other audibly perceptible audio data file display **75**. A text data file that arrives at the PC **51** must be converted to an audio data file before playback over the loudspeaker. If the data file is already in audio format, the audio processing module **73** and loudspeaker **75** may receive the converted audio data file (via a D/A converter) directly from the microprocessor **55**, as shown. Optionally, software resident in the microprocessor **55** provides E-mail file interrogation and/or text-to-speech conversion for a received file.

An E-mail file will usually include a routing sub-message, appended as a header at the beginning (or as a trailer at the end) of the file, that specifies the route followed by the audio message in moving from the audio message source (the person or machine that left the message in E-mail form) to the intended recipient's telephone answering machine or service. These routing headers include specification of each

bridge, router, gateway, etc. passed through by the E-mail message and can be quite long. In some instances, the length of a routing header can be many times the length of the useful part of the message. A routing header that requires 16 lines or more of text to print out is not unusual. The E-mail interrogation process examines the routing header, and any other header information that is specified by the user, is stripped from the message so that only the portion of the E-mail message that is of interest to the user is recorded in the computer hard drive **57** or on the storage and playback unit **81**, discussed in the following.

The PC also includes a second communications module **77**, connected to the hard drive **57** and to a docking station **79** that receives a portable, preferably handheld, storage and playback unit ("SPU") **81**. The SPU **81** receives a download of one or more selected audio and/or text data files from the PC, for storage and present or subsequent playback of the selection(s). The audio and/or text data files are downloaded and stored on the SPU **81**, preferably on a PCMCIA card with flash memory (referred to collectively as an "SPU" for convenience here). The characteristics of a PCMCIA card are discussed below.

An SPU **81** is inserted into the SPU docking station **79**, and audio and/or text data files, selected from commands to the host PC, are transferred, in compressed or decompressed format, with or without encryption, onto the SPU for present or future playback. The SPU **81** is carried by the user until the user has an opportunity to play back part or all of the audio and/or text data files on the SPU.

In one embodiment, the SPU **81**, shown in more detail in FIG. 2, includes a docking interface connector **83**, software to implement data transfer from the docking station **79**, a data I/O module **85** connected to the docking connector **83** and to an on-board microprocessor **87**. The microprocessor is connected to a memory unit **82**, such as flash memory, and to a ROM **89** and a RAM **91** and optionally includes a hard drive **93** for additional storage. The transfer commands reside in the host PC, where transfer is activated. Optionally, a user activates a user data/command module **95** and visual or audible display **97** to download data file selections to the SPU **81** and to cause playback of one or more of these selections.

If the downloaded data file is in text format, the data file is first passed through a text-to-speech conversion process (optional), which is preferably implemented in software. The converted data file, now in audio format, is passed through an audio processing module **101** to a loudspeaker or other audibly perceptible display **103** for playback. If the data file received at the SPU **81** is already in audio format, the text-to-speech conversion process is not needed, and the audio data file is converted from digital to analog format and passed directly to the audio processing module **101** and loudspeaker **103** for playback. The SPU **81** can be carried around in the hand, pocket or other receptacle until the user has an opportunity to play back one or more selections that have been downloaded to and stored in the SPU.

FIG. 3 illustrates a general procedure for user processing, data file(s) selection by the user, and downloading of the selected file(s) to a PC. If the user is not already registered with the system, the system interacts with the user in block **111** to obtain registration and to set up a subscription for the (new) user. If a user is already registered and active, the system checks the registration in block **111**. If this registration is confirmed, the system allows the user to proceed to block **113** and to browse and indicate one or more audio or text selections for downloading. After the user indicates one or more selections, the system proceeds to block **115** and downloads these selections to the user's PC, using an internetwork channel for transmission of the selected data files.

FIG. 4 illustrates a general procedure for playback processing of a data file at a PC, downloading of a data file to an SPU, and playback of the data file at the SPU, after the selected data files have been downloaded to the user's PC. In block 121, the user has selected playback processing at the user's PC, and the selected data files are audio processed and playback at the PC for user-initiated playback at the PC. Alternatively, in block 123, the user has selected SPU playback, and the system transfers the selected data files to the SPU for storage. The selected (downloaded) data files are then audio processed at the SPU, in block 125, for user-initiated playback at the SPU.

FIG. 5 is a table illustrating processing options for a data file taken from various sources before the data file is played back as an audibly perceptible signal. In a first option, a selected data file is already in audio format. The data file is digitized (if this has not already been done) in a first processing step, then optionally compressed and/or encrypted for transmission to the user's PC as an audio format file. The received file is processed and played back by the user as an audio format file.

In a second format, the selected data file is in text format, and the file is passed through without further digitization and is optionally compressed and/or encrypted for transmission to the user's PC as a text format file. The received file is passed through a text-to-speech conversion process and is processed and played back by the user as an audio format file.

In a third format, the selected data file is available as a visual text file and is scanned, passed through optical character recognition ("OCR") processing and digitized in a first processing step. This produces a text data file. The selected file is optionally compressed and/or encrypted for transmission to the user's PC as a text format file. The received file is passed through a text-to-speech conversion process and is processed and played back by the user as an audio format file.

In a fourth format, the selected data file is in text format, and the file is digitized and passed through a text-to-speech conversion process in a first processing step. The data file is then optionally compressed and/or encrypted for transmission to the user's PC as an audio format file. The received file is processed and played back by the user as an audio format file.

In a fifth format, the selected data file is available as a visual text file and is scanned, passed through optical character recognition ("OCR") processing, digitized and passed through a text-to-speech conversion process in a first processing step. The selected file is optionally compressed and/or encrypted for transmission to the user's PC as an audio format file. The received file is processed and played back by the user as an audio format file.

FIG. 6 is a flow chart illustrating a playback procedure according to the invention, where the received data file is already in audio format. In step 131, the operating program is loaded and activated. In step 133, one or more stored audio data files is selected for playback. In step 135, playback is activated, and the operating program begins reading an audio data file, in step 137, and performs D/A conversion, in step 139. In step 141, the audio data file is passed through audio processing, and the audio processed data file is delivered to the loudspeaker for audible display (playback) in step 143. The system then ends playback or recycles for another audio data file selection in step 145.

FIG. 7 is a flow chart illustrating a playback procedure according to the invention, where the received data file is in text format. In step 151, the operating program is loaded and activated. In step 153, one or more stored audio data files is selected for playback. In step 155, playback is activated, and

the operating program begins reading a text data file, in step 157. In steps 159, 161 and 163, the system optionally performs E-mail file interrogation, text-to-speech conversion and D/A conversion. In step 165, the data file (now in audio format) is passed through audio processing, and the audio processed data file is delivered to the loudspeaker for audible display (playback) in step 167. The system then ends playback or recycles for another audio data file selection in step 169.

One embodiment of the SPU 81 and its memory unit 82 is a PCMCIA-type format card, with flash memory included in the PCMCIA card. The PCMCIA card, in its present design, is a 68-pin module, with plug-in being provided by pin-and-socket connectors, with the pins being arranged in two rows of 34 pins each. The card operates with a memory-only interface or with an input/output interface. In a memory-only configuration, the pin assignments include j ground pins (1_j_4), k V_{cc} pins (1_k_2), data bit pins 0-15, address bit pins 0-25, m card enable pins (1_m_2), an output enable pin, a write enable pin, a card detect pin, a card reset pin, n programming supply voltage pins (1_n_3), and 7 special purpose pin assignments, including ready/busy pin, write protect pin, register select pin, supply voltage detect pins, write protect pin and reserved pins. In an input/output configuration, the special purpose pins become interrupt request, I/O port bit count (16-bit; yes/no), input port acknowledge, register select, I/O enable, audio digital waveform, card status changed, I/O read and I/O write.

An Execute-In-Place option allows a computer connected to the card to execute programs directly from instructions and/or data provided on the card.

The card uses 3.3 volts or 5 volts supply for V_{cc} and provides 64 Mbytes of memory address space (SRAM, MaskPROM, OTPROM, EPROM, EEPROM or Flash Memory), with retrieval time of 100, 150, 200, 250 or 600 nsec. I/O registers for the PCMCIA card have either 8 bits or 16 bits width. The card thickness may be either 3.3 mm or 5 mm or 10 mm. Card length and width are approximately 85.6 mm and 54 mm, respectively.

The card has five layers of operation standardization. The lowest layer is physical and specifies electrical and card interface characteristics. The second layer, basic compatibility, specifies minimum memory size, minimum memory speed, data structures used, etc., optionally including specification of the Card Information Structure. The third layer, data recording format, specifies how card data are physically organized on the card (blocked vs. unblocked, with or without check sum included, etc.), analogous to format specifications of a floppy disk. The fourth layer, data organization, specifies how data are logically organized on the card, including the operating system used, whether the Execute-In-Place option is used, whether flash file memory is used, and application-specific information. The fifth layer specifies standards that are specific to a particular operating environment. Only compliance with the first two layers is required currently.

A Web page can be designed and implemented to allow a user to interact with the audio data file system and to download selections from an audio library. Design and implementation of a Web page is discussed, from different points of view, by Brian Pfaffenberger, *Publish It On The Web*, Academic Press, New York, Second Edition, 1997, by Roger C. Parker, *Guide To Web Content And Design*, MIS Press, Henry Holt & Co., New York, 1997, and by Andrew Sather et al in *Creating Killer Interactive Web Sites*, Adjacency, 1997. Design of an interactive server is discussed in detail by Stephen Walther in *Active Server Pages Unleashed*, Sams.net Publishing, Indianapolis, 1998, pp. 470-475 and elsewhere, and by Richard Wagner et al in *Java Script Unleashed*, Sams.net Publishing, Indianapolis, Second edition, 1997, pp. 338-359 and elsewhere.

What is claimed is:

1. Portable apparatus for accessing digital audio data stored at a remote location, the apparatus comprising:
 - a storage unit for storing the data; and
 - a playback unit for playing back the data;
 the apparatus being capable of communicating via a docking station with a computer connectable to a communications link for downloading the data from the remote location and uploading the data to the apparatus.
2. Apparatus according to claim 1 further comprising the computer and the communications link.
3. Apparatus according to claim 2 wherein the communications link comprises the Internet.
4. A method comprising the steps of:
 - downloading to a computer digital audio data stored at a remote location;
 - establishing via a docking station an upload connection between the computer and a portable unit having storage and playback capability; and
 - uploading the data to the portable unit for storage therein.
5. A method according to claim 4 comprising the step of breaking the upload connection and playing back the data.
6. Audio information storage and playback apparatus comprising:
 - a computer and associated data interface, programmed to receive and extract an audio data file from an incoming signal over an internetwork channel at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the data file; and
 - a data transfer mechanism adapted for connection to the computer and to a playback module that receives and stores the data file from the computer and provides audibly perceptible playback of the data file, wherein said playback module further comprises:
 - flash memory for receiving and storing said data file from said computer;
 - a playback selection device to select and retrieve at least one selected data file recorded in the flash memory;
 - a digital-to-analog conversion device to convert the selected data file into an audio signal; and
 - an audio processing device to select and retrieve the selected data file from the flash memory and to reproduce the selected data file in audibly perceptible form for playback at a real time delivery rate.
7. The apparatus of claim 6, wherein said flash memory further comprises a PCMCIA card.
8. The apparatus of claim 6, wherein said playback module includes at least one of an audibly perceptible display and a visually perceptible display that displays user information from at least one of the following: (1) an estimated length of time required for real time playback of a user-specified selection recorded on said playback module; (2) a title or phrase describing a user-specified selection recorded on said playback module; and (3) a user-specified category to which a user-specified selection recorded on said playback module is assigned.
9. The apparatus of claim 6, further comprising:
 - a keypad, having at least two keys thereon that are tactilely distinguishable or visually distinguishable, connected to said playback module, that allows a command to be entered that selects said selected data file and that causes said audio processing means to convert said selected data file to an audibly perceptible signal.

10. Audio information storage and playback apparatus comprising:
 - a computer and associated data interface, programmed to receive and extract an audio data file from an incoming signal over an internetwork channel at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the data file; and
 - a data transfer mechanism adapted for connection to the computer and to a playback module that receives and stores the data file from the computer and provides audibly perceptible playback of the data file, wherein said computer further comprises a data file interrogation module, for receiving and examining said data file to determine whether said data file contains at least one E-mail message, for removing the E-mail routing information for each E-mail message that is part of said data file, and for retaining the remainder of the E-mail in said data file.
11. Audio information storage and playback apparatus comprising:
 - a computer and associated data interface, programmed to receive and extract an audio data file from an incoming signal over an internetwork channel at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the data file; and
 - a data transfer mechanism adapted for connection to the computer and to a playback module that receives and stores the data file from the computer and provides audibly perceptible playback of the data file, wherein said audio data file is provided in digitized and compressed format using a compression algorithm drawn from the class of audio compression algorithms consisting of perceptual encoding, Dolby Labs AC-3 and CCITT recommendation G.722.
12. Audio information storage and playback apparatus comprising:
 - a computer and associated data interface, programmed to receive and extract an text data file from an incoming signal over an internetwork channel, where the text data file is received by the computer at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the text data file; and
 - a data transfer mechanism, adapted for connection to the computer and to a playback module that receives and stores the text data file from the computer and provides audibly perceptible playback of the text data file, further comprising said playback module, wherein said playback module comprises:
 - flash memory for receiving and storing said text data file from said computer;
 - a playback selection device to select and retrieve at least one selected data file recorded in the flash memory;
 - a text-to-speech conversion device to receive at least one text data file from the playback selection device and to convert at least one text data file to an output signal that is in audio format;
 - a digital-to-analog conversion device to convert the text-to-speech conversion means output signal into an audio signal; and
 - an audio processing device to receive the digital-to-analog conversion means output signal and to reproduce the output signal in audibly perceptible form for playback at a real time delivery rate.

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13. The apparatus of claim 12, where in said flash memory further comprises a PCMCIA card.

14. The apparatus of claim 12, wherein said playback module includes at least one of an audibly perceptible display and a visually perceptible display that displays user information from at least one of the following: (1) an estimated length of time required for real time playback of a user-specified selection recorded on said playback module; (2) a title or phrase describing a user-specified selection recorded on said playback module; and (3) a user-specified category to which a user-specified selection recorded on said playback module is assigned.

15. The apparatus of claim 12, further comprising:

a keypad, having at least two keys thereon that are tactilely distinguishable or visually distinguishable, connected to said playback module, that allows a command to be entered that selects said selected text data file and that causes said audio processing means to convert said selected text data file to an audibly perceptible signal.

16. The apparatus of claim 12, wherein said playback module further comprises a text-to-speech conversion module that receives and converts said data file to an audio file.

17. The apparatus of claim 12, wherein said data interface is a universal data interface to receive a file as part of an incoming signal, transmitted over an internetwork transmission channel, in digitized format, and to provide automatic data format recognition for this data file.

18. The apparatus of claim 12, wherein said computer comprises a data file interrogation module, for receiving and examining said data file to determine whether said data file contains at least one E-mail message, for removing the E-mail routing information for each Email message that is part of said data file, and for retaining the remainder of the E-mail in said data file.

19. The apparatus of claim 12, further comprising a telephone modem, connected to said data interface, for receiving and converting said incoming signals and for passing the converted incoming signals to said data interface.

20. The apparatus of claim 12, wherein said text data file is converted to a digitized and compressed audio format using a compression algorithm drawn from the class of audio compression algorithms consisting of perceptual encoding, Dolby Labs AC-3 and CCITT recommendation G.722.

21. Audio information storage and playback apparatus comprising:

a computer and associated data interface, programmed to receive and extract an audio data file from an incoming signal over an internetwork channel at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the data file; and

a data transfer mechanism adapted for connection to the computer and to a playback module that receives and stores the data file from the computer and provides

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audibly perceptible playback of the data file, wherein said transfer mechanism further comprises a docking station, connected to said computer and adapted for receiving a playback module that receives and stores said data file from the computer and provides audibly perceptible playback of said data file.

22. Audio information storage and playback apparatus comprising:

a computer and associated data interface, programmed to receive and extract an text data file from an incoming signal over an internetwork channel, where the text data file is received by the computer at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the text data file; and

a data transfer mechanism, adapted for connection to the computer and to a playback module that receives and stores the text data file from the computer and provides audibly perceptible playback of the text data file, wherein said transfer mechanism further comprises a docking station, connected to said computer and adapted for receiving a playback module that receives and stores said text data file from the computer and provides audibly perceptible playback of said text data file.

23. A system for receiving, storing and playing back digital files, the system comprising:

a portable storage and playback device that receives and stores a digital file over an internetwork channel at a transfer rate that is greater than a playback rate for audibly perceptible playback of information contained in the data file;

a personal computer that contains at least one digital file; and

a transfer mechanism connected to the portable storage and playback device and including a signal connection for facilitating transfer of the digital file between the personal computer and the portable storage and playback device,

wherein at least one of the personal computer and the portable storage and playback device includes software to facilitate a transfer of the digital file from the personal computer to the portable storage and playback device, using the connection between the personal computer and the transfer mechanism, and the portable playback and storage device is removed from the transfer mechanism for playback of the digital file,

wherein said transfer mechanism comprises a docking station connected to said portable storage and playback device and includes said signal connection between said personal computer and said portable storage and playback device.

* * * * *

Exhibit K



US006760477B2

(12) **United States Patent**
Ko

(10) **Patent No.:** **US 6,760,477 B2**
(45) **Date of Patent:** **Jul. 6, 2004**

(54) **METHOD AND APPARATUS FOR ENTERING DATA STRINGS INCLUDING HANGUL (KOREAN) AND ASCII CHARACTERS**

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Shin, et al "Implementation of Hangul Automation Processor Based on the Stroke", IEEE, pp. 348-351, 1996.*

(73) Assignees: **Sony Corporation**, Tokyo (JP); **Sony Electronics Inc.**, Park Ridge, NJ (US)

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 231 days.

Primary Examiner—Daniel Mariam
(74) *Attorney, Agent, or Firm*—Thomas F. Lebens; Fitch, Even, Tabin and Flannery

(21) Appl. No.: **09/908,376**

(57) **ABSTRACT**

(22) Filed: **Jul. 18, 2001**

Described are methods for entering and editing data strings that are inputted into cellular telephones having a screen. In one method, all basic Hangul consonants and some of the compound Hangul consonants are included in a candidate consonant list and all basic Hangul vowels and some of the compound vowels are included in a candidate vowel list. The candidate consonant and vowel lists are alternatively displayed on a component display region (906) located on the screen. For form a Korean character, a user can select consonant(s) and vowel from the candidate consonant and vowel lists. To form a compound Hangul component that is not included in either the candidate consonant list or the candidate vowel list, the user selects a basic Hangul component as a first part of the compound Hangul component from either the candidate consonant list or the candidate vowel list. The user then re-displays the candidate consonant list or the candidate vowel list and selects a basic Hangul component as a second part of the compound Hangul component. A compound Hangul component is formed by combing the two selected basic Hangul components and displayed in a data string display region (904) located on the screen. In another method, a data string can be formed using both Hangul and ASCII characters. In yet another method, a data string can include unusual characters that are invalid to the existing cellular telephone. In still another method, editing can be made at any position of a data string that is inputted to the cellular telephones.

(65) **Prior Publication Data**

US 2002/0080137 A1 Jun. 27, 2002

Related U.S. Application Data

(63) Continuation of application No. 09/234,429, filed on Jan. 20, 1999, now Pat. No. 6,430,314.

(51) **Int. Cl.**⁷ **G06K 9/18**

(52) **U.S. Cl.** **382/185**; 382/189; 345/171; 715/535

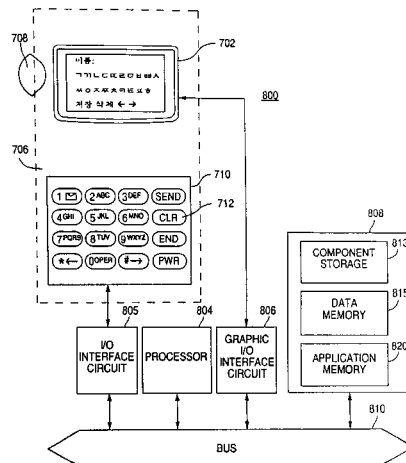
(58) **Field of Search** 382/180, 181, 382/186, 187, 189, 229, 282, 284, 309, 310, 313; 341/28; 345/141, 157, 168, 171, 467; 455/422.1; 715/535, 536, 540

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60 Claims, 13 Drawing Sheets



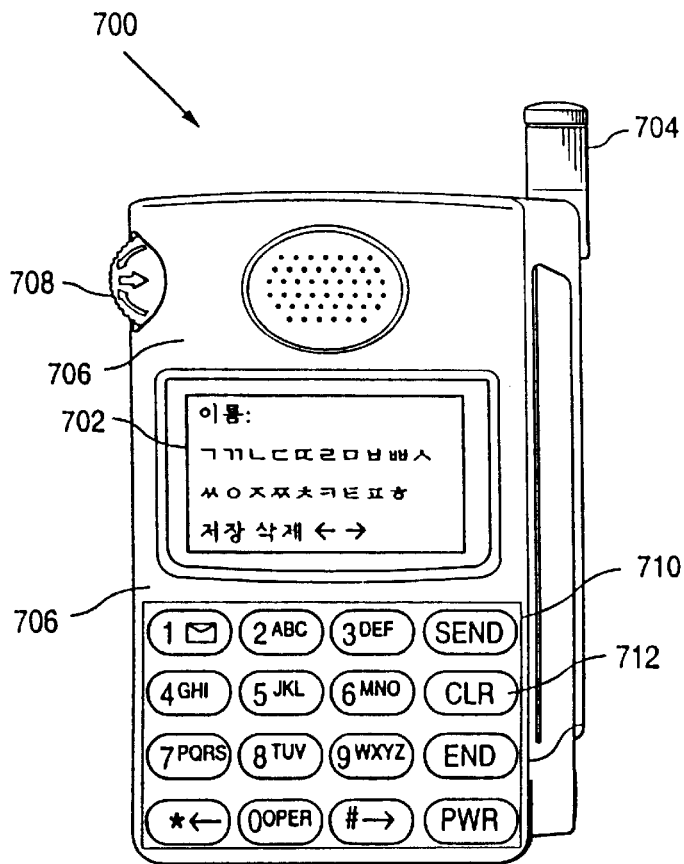


FIG. 7A

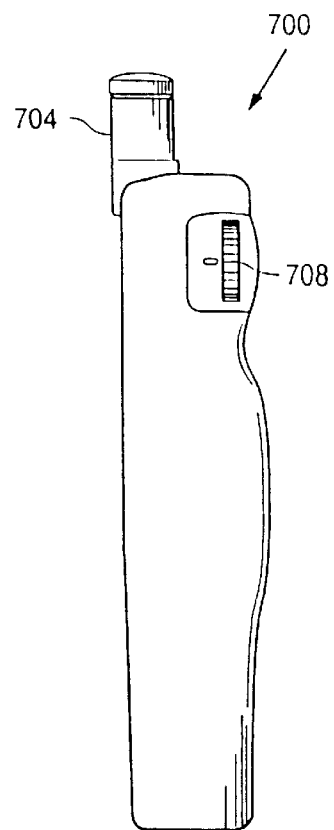


FIG. 7B

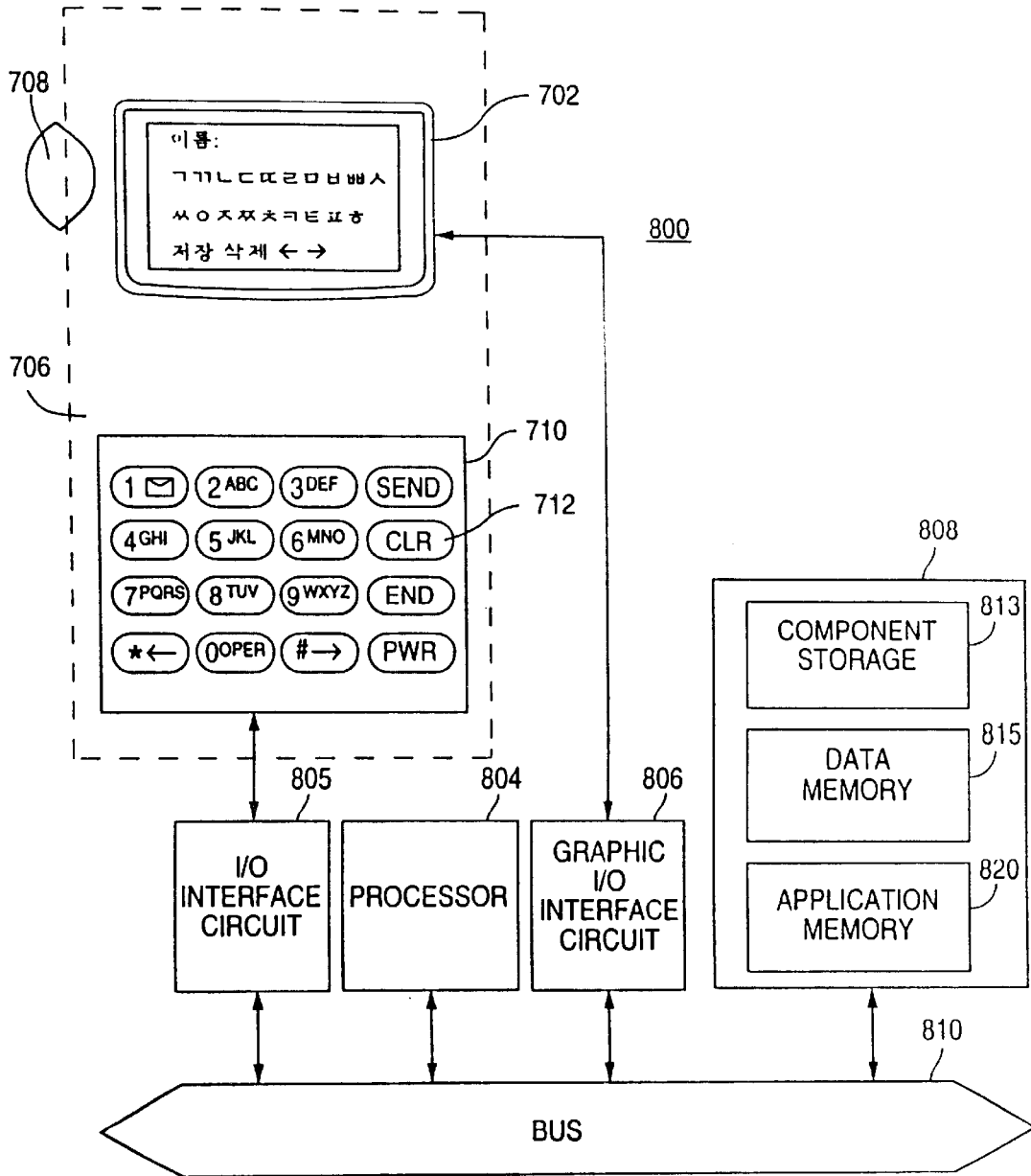
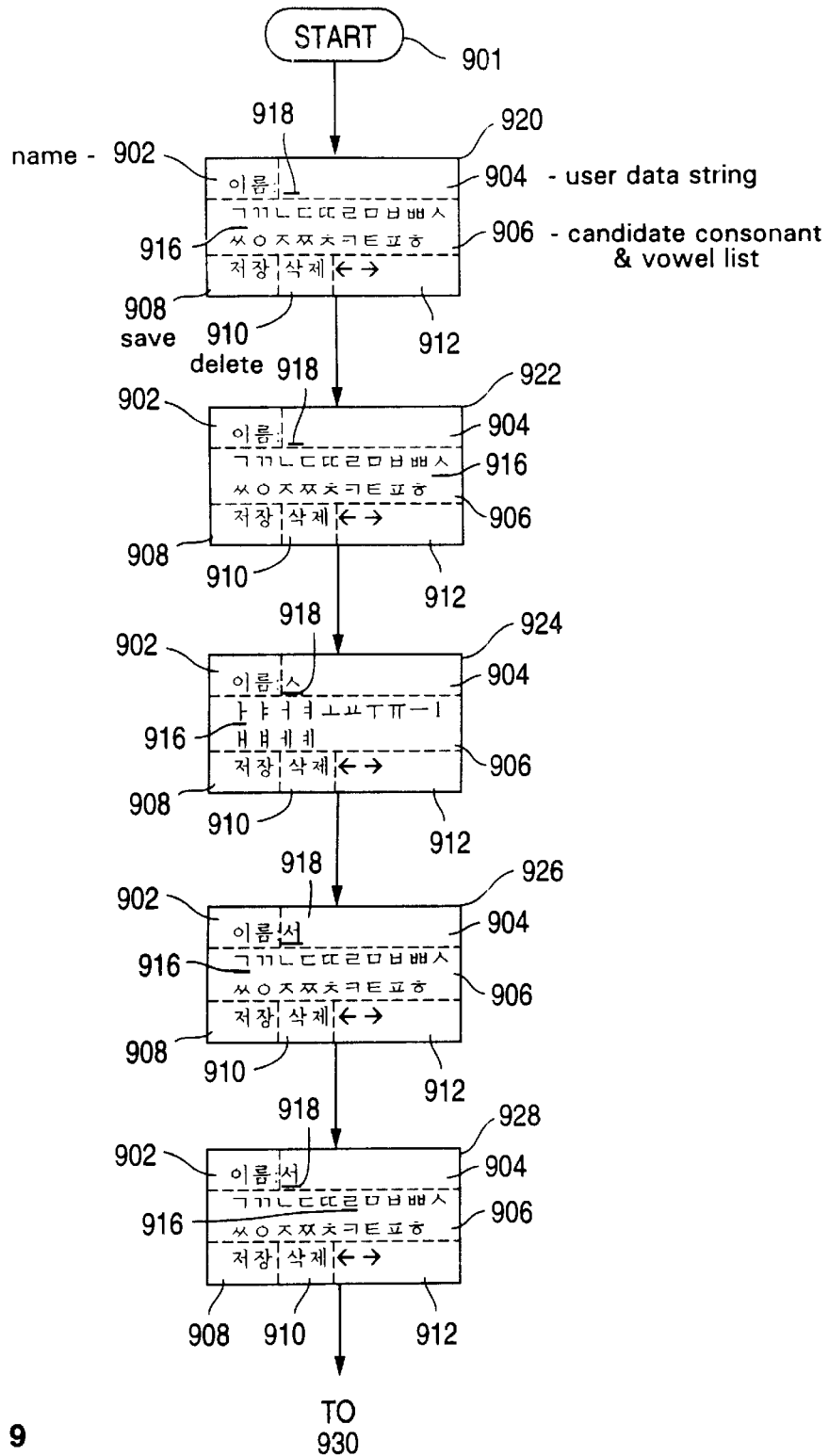


FIG. 8



- FIG. 9A
- FIG. 9B
- FIG. 9C
- FIG. 9D

FIG. 9

FIG. 9A

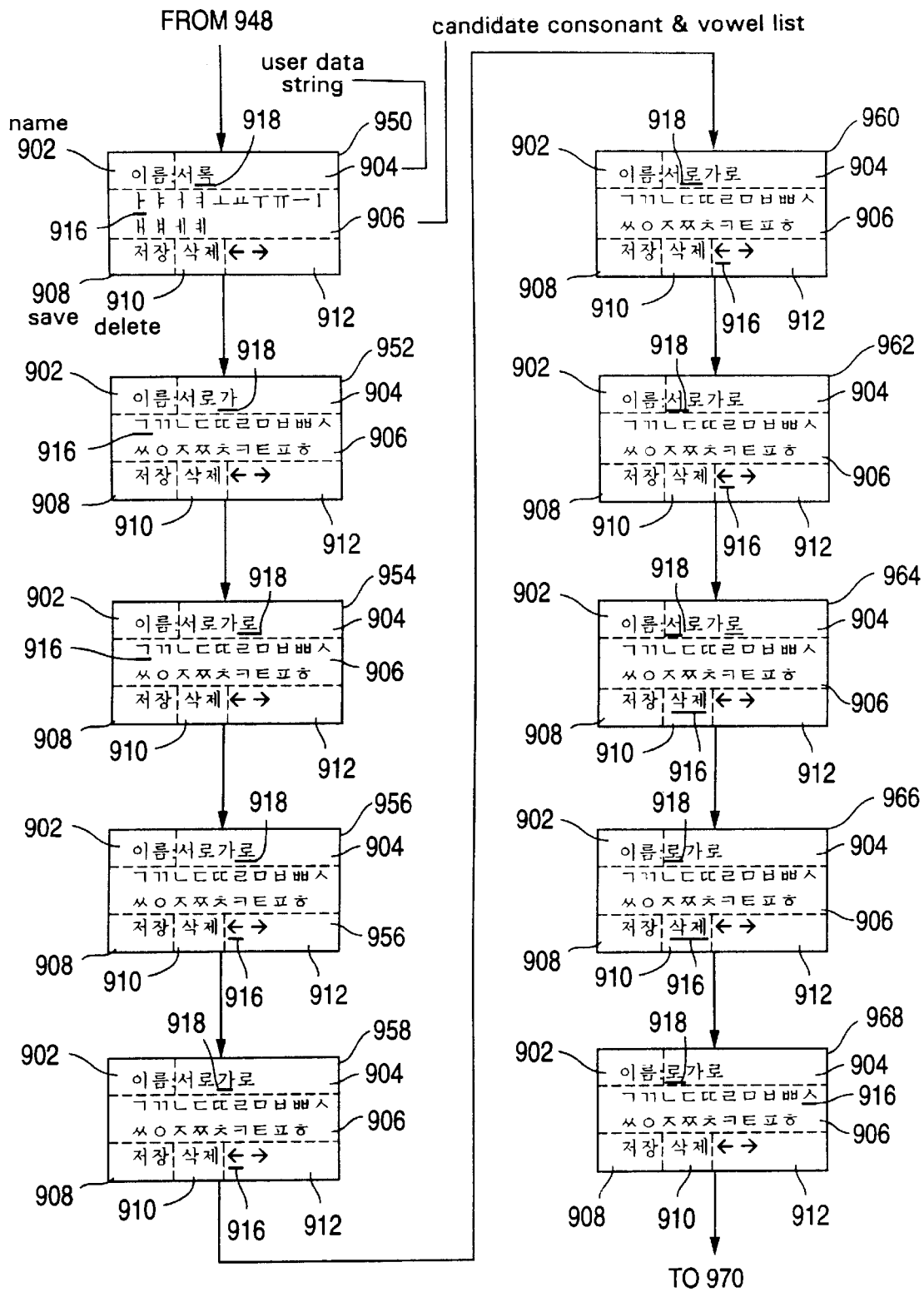


FIG. 9C

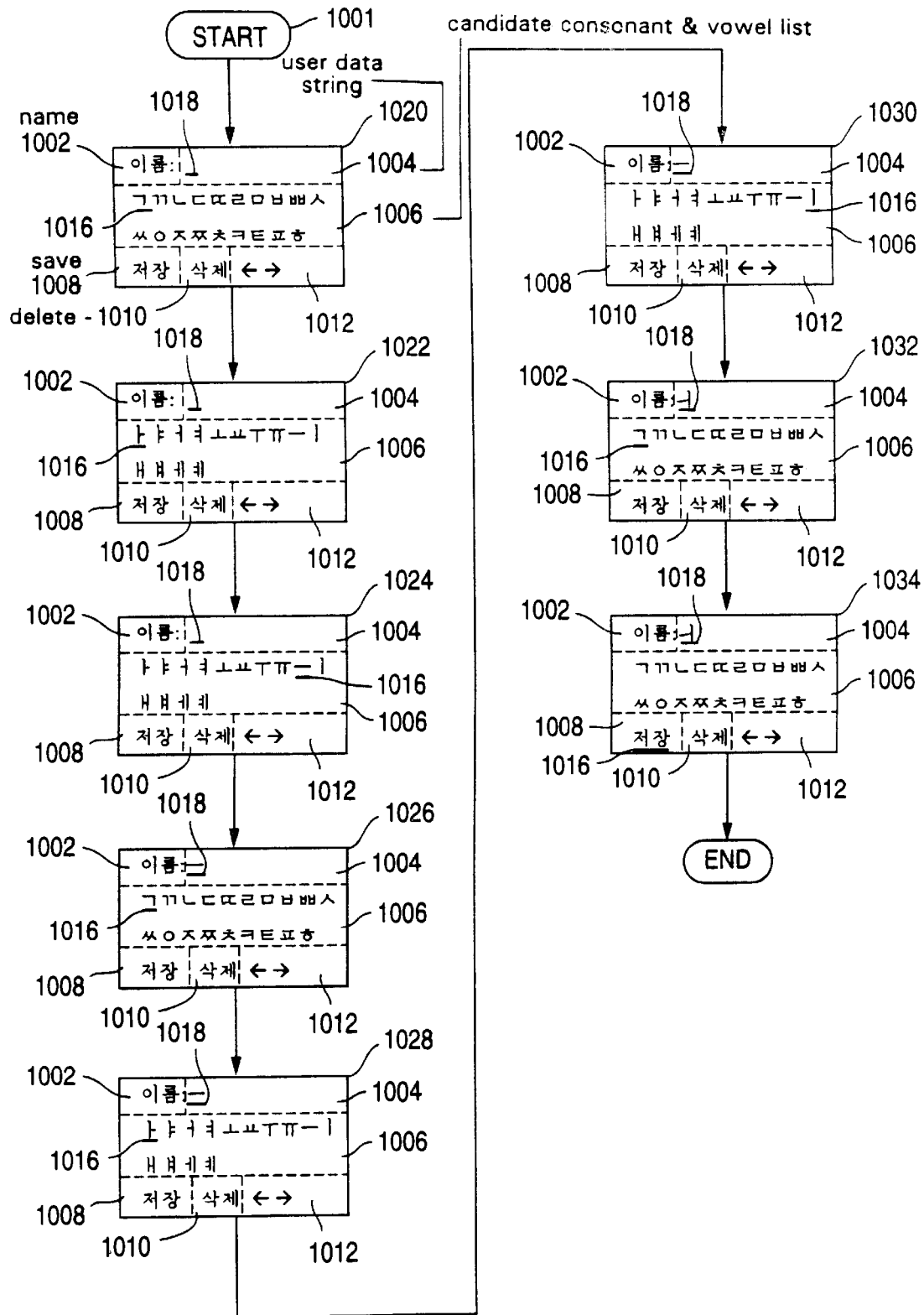


FIG. 10

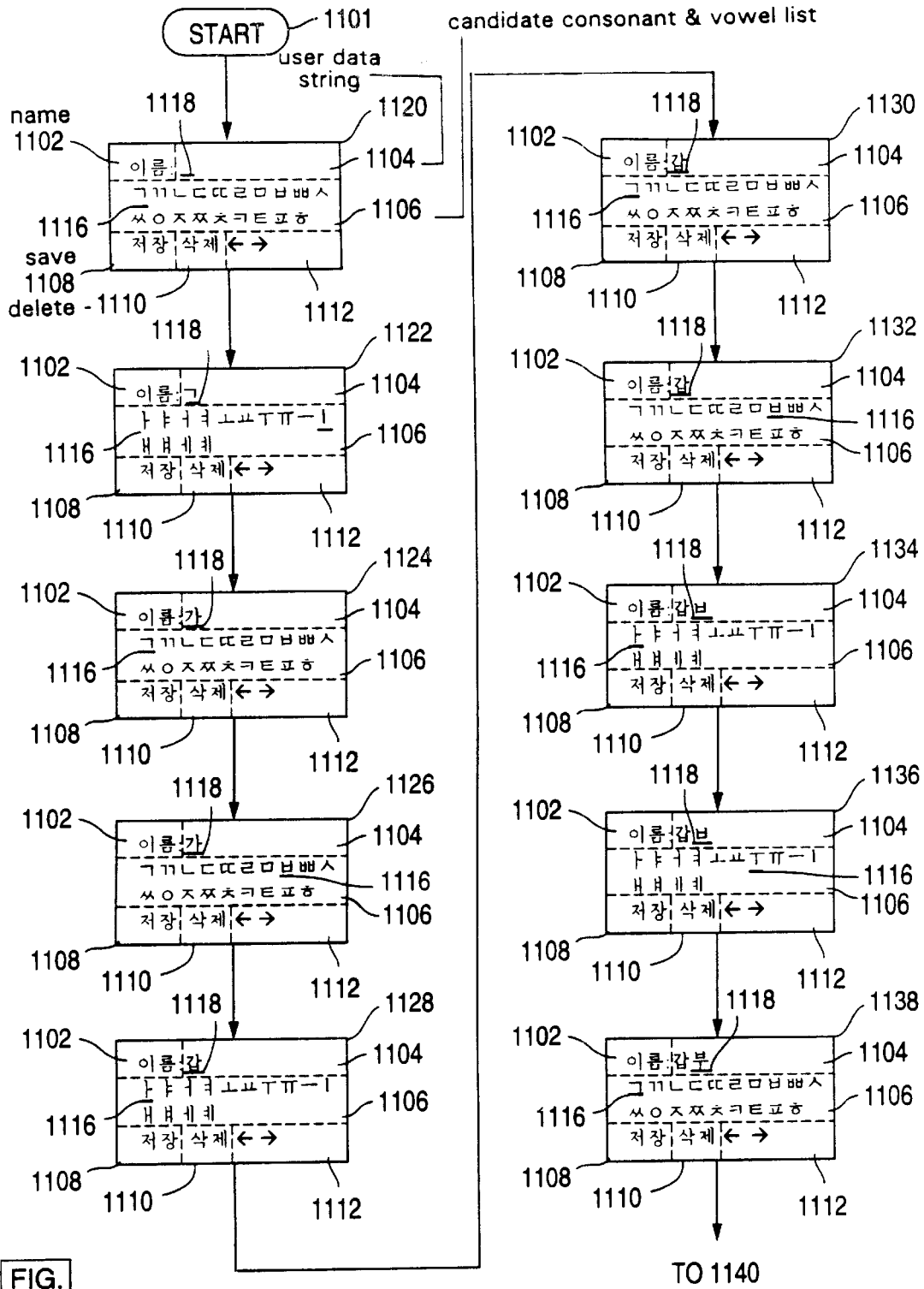


FIG. 11A
FIG. 11B

FIG. 11

FIG. 11A

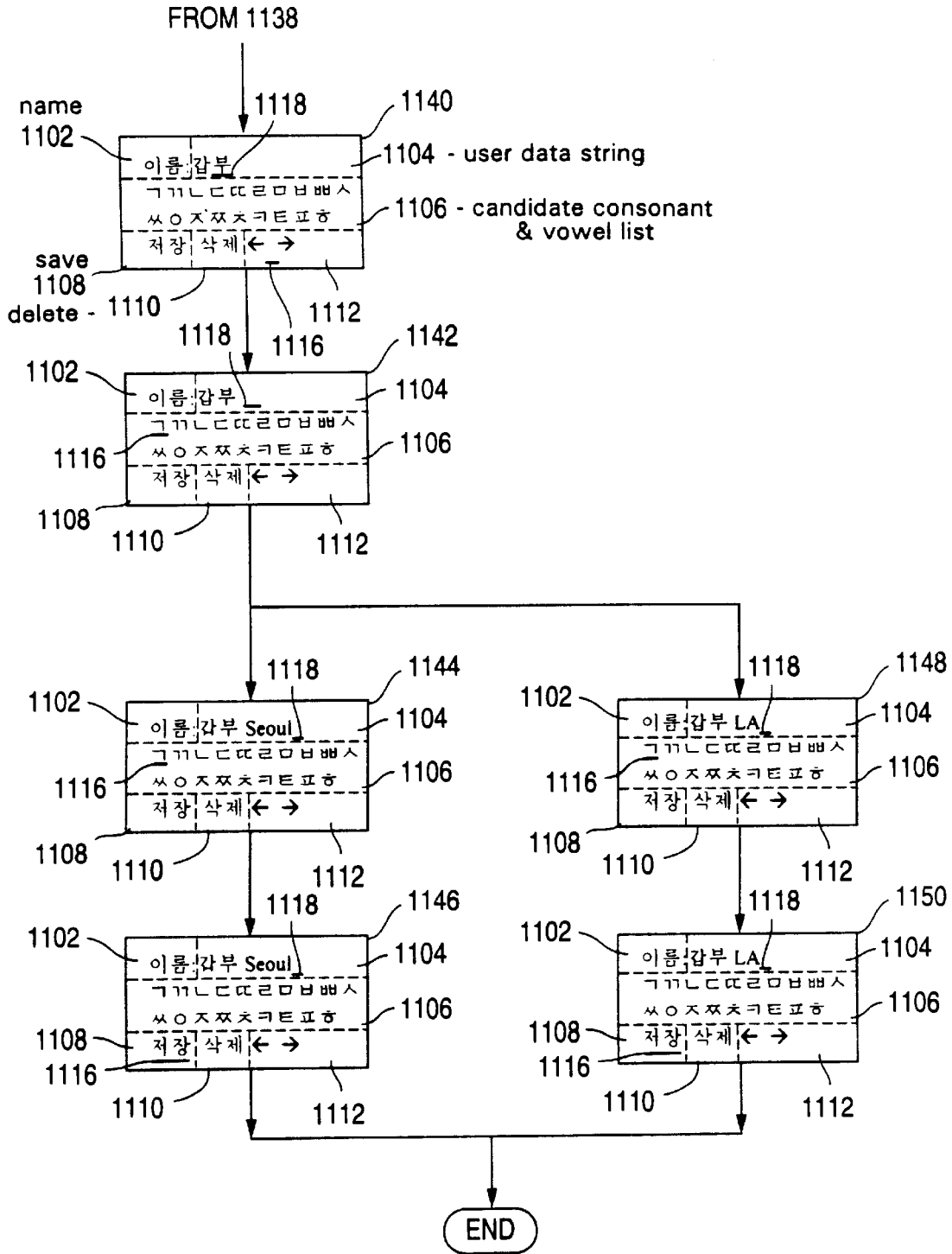


FIG. 11B

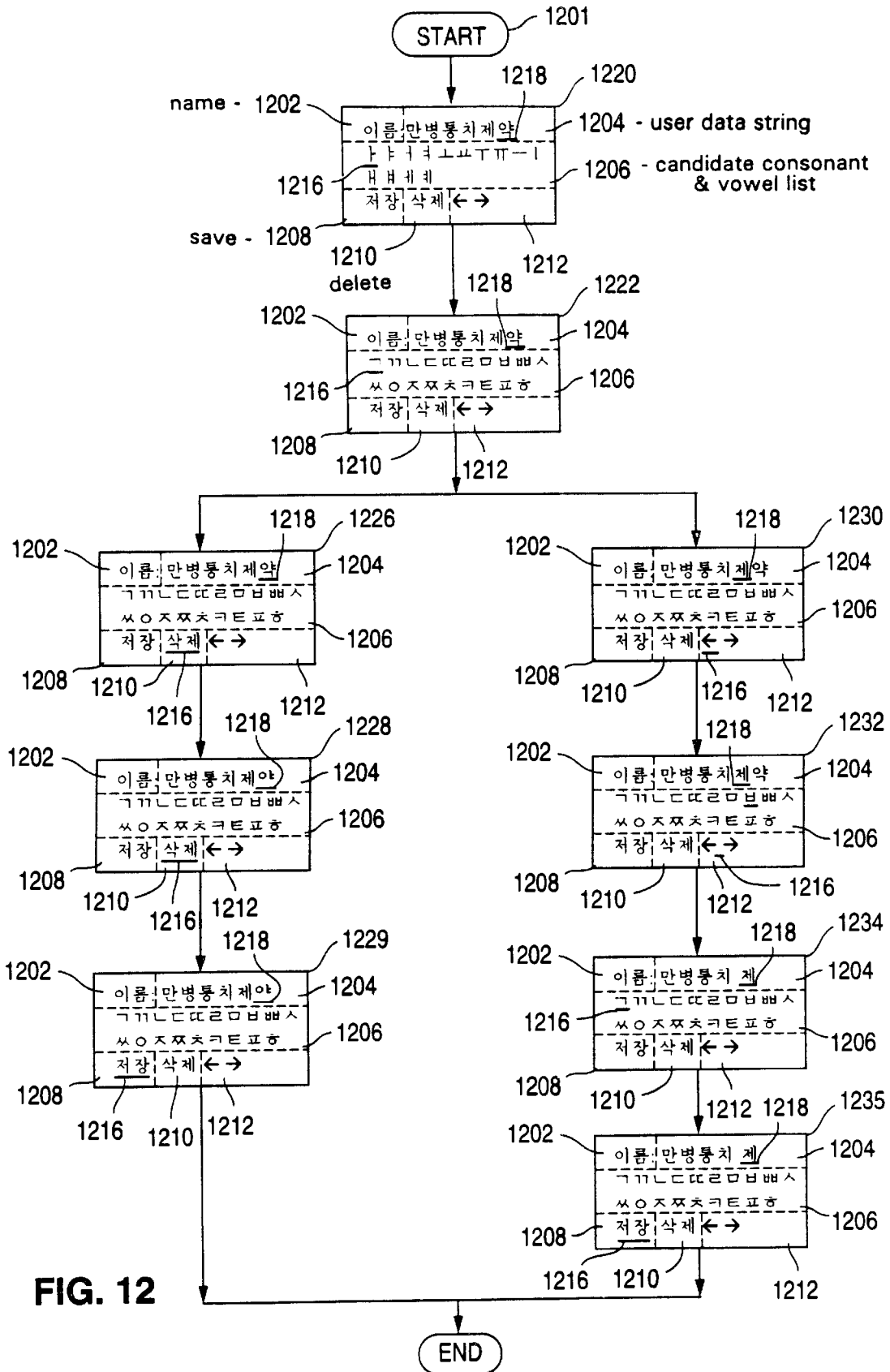


FIG. 12

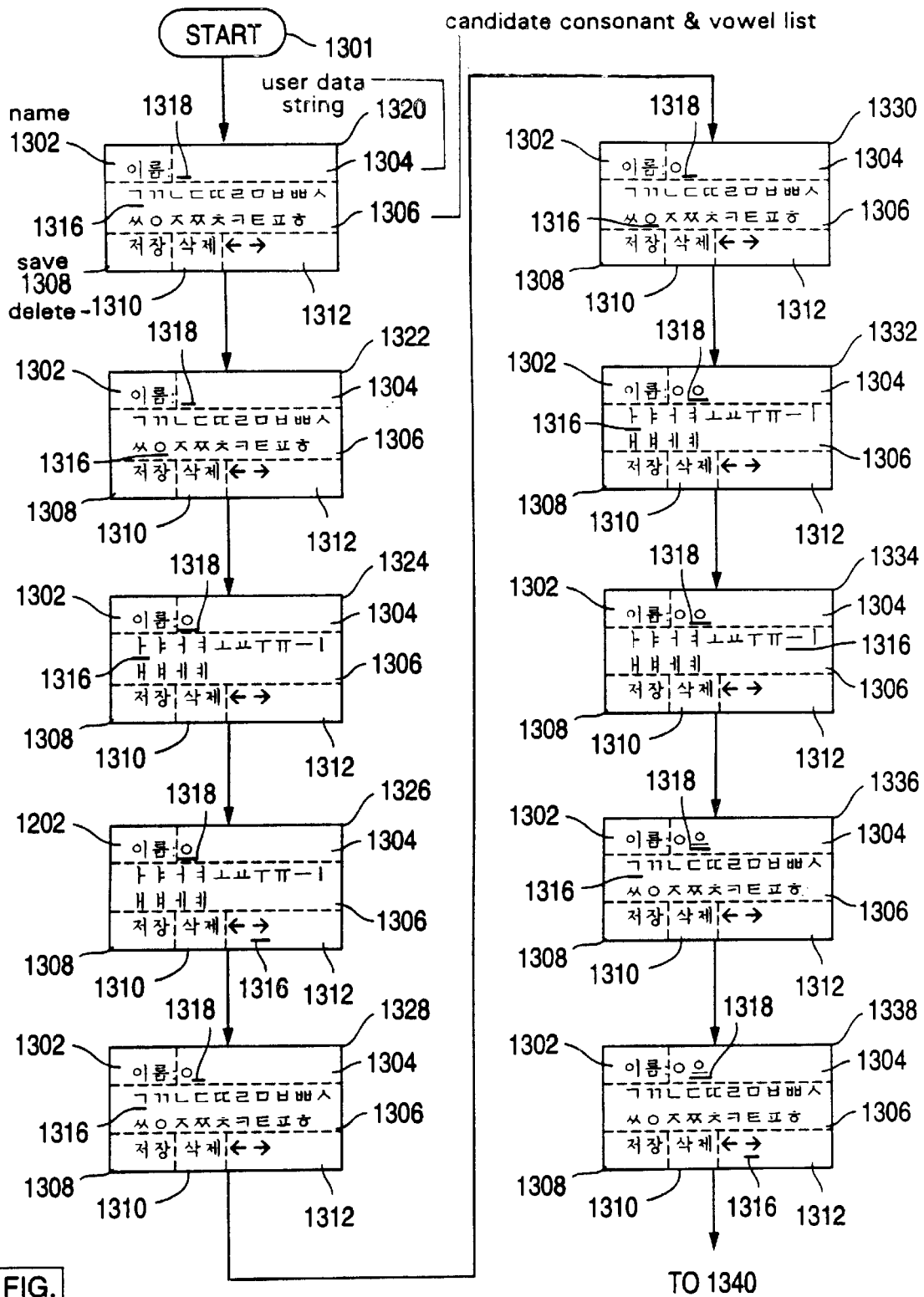


FIG. 13A
FIG. 13B

FIG. 13

FIG. 13A

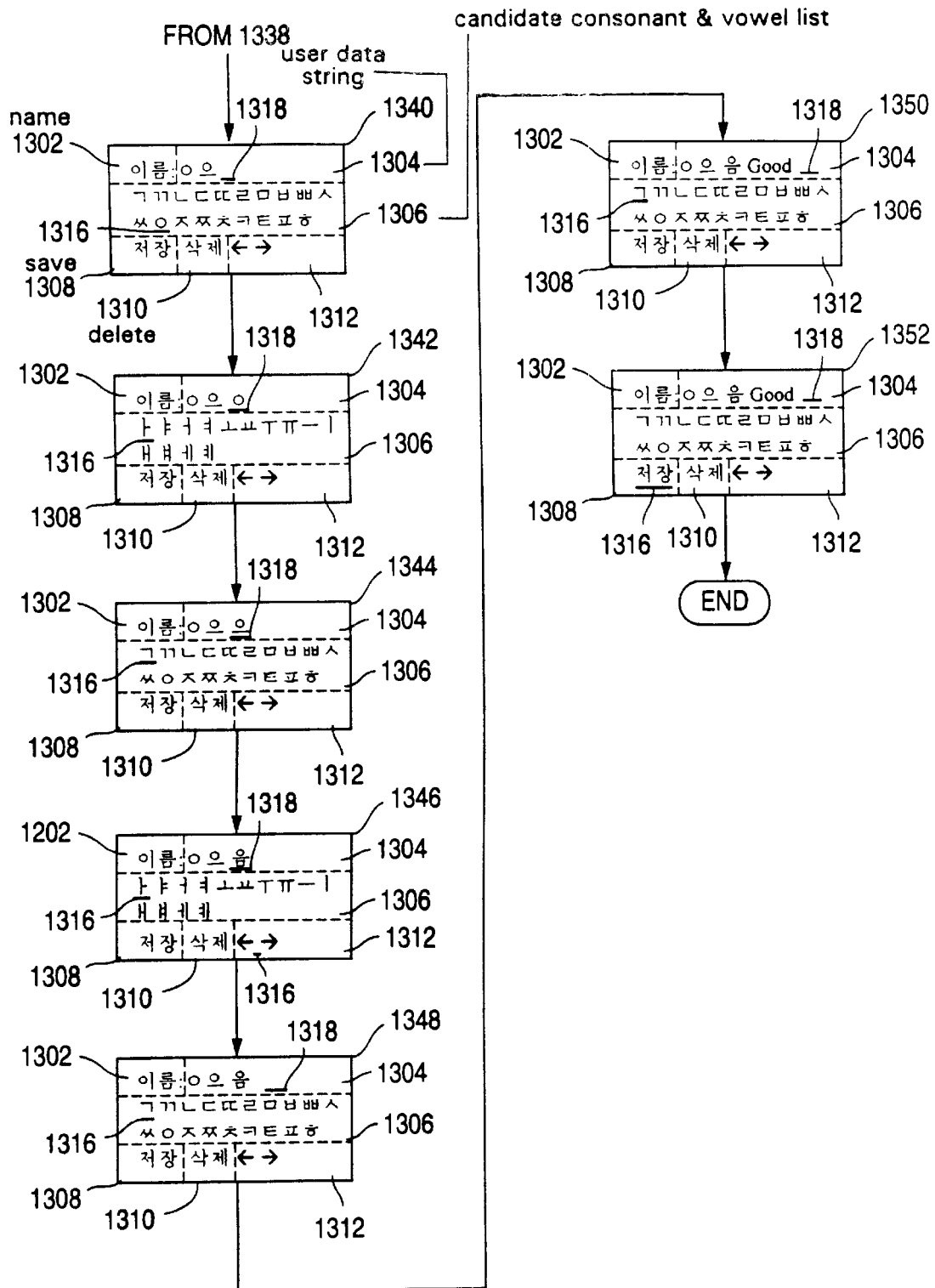


FIG. 13B

METHOD AND APPARATUS FOR ENTERING DATA STRINGS INCLUDING HANGUL (KOREAN) AND ASCII CHARACTERS

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application is a continuation of U.S. patent application Ser. No. 09/234,429 of Soon Ko filed Jan. 20, 1999, now U.S. Pat. No. 6,430,314.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a method and apparatus for entering data strings including Hangul (Korean) and/or ASCII characters into electronic devices and, more specifically, to a method and apparatus for forming data strings by selecting Hangul character components displayed on a relatively small display region and selecting ASCII characters from a key panel.

2. Related Art

To effectively marketing electronic devices such as cellular telephone and personal digital assistant (PDA) in Korean market, the instruction and information displayed on these electronic devices should be primarily in Korean language. The Korean written language uses two types of characters: Hangul and Hanja. Hangul is the native name for the Korean language, and Hanja is the Korean name for ideographic characters of Chinese origin. The Hanja characters are usually used in more formal written communications. Most daily communications are written in Hangul. Therefore, it is necessary to provide a mechanism to allow users to enter Hangul characters into electronic devices, because some information in electronic devices needs to be customized by individual users.

Hangul characters are composed of Hangul components which include thirty consonants and twenty one vowels. Conventionally, the whole set of Hangul consonants and vowels are assigned to the keys on a keyboard. For example, the thirty Hangul consonants and twenty one vowels can be assigned to a computer keyboard having no more than fifty keys when used with the SHIFT and ALT keys. However, the conventional method is not suitable for portable electronic devices which have few keys or do not have a keyboard at all. An external keyboard could be attached to these portable electronic devices. However, it is inconvenient to do so due to the small size of these portable electronic devices. Furthermore, portable electronic devices typically have a relatively small display region. This increases the difficulty of entering Hangul characters into the portable electronic devices.

The existing cellular telephones are not user friendly in entering data strings. Specifically, the existing cellular telephones are unable to enter a data string including both Hangul and ASCII characters. In addition, the existing cellular telephones are only able to accept valid, fully constructed Hangul characters. For example, the existing cellular telephones do not accept one Hangul consonant, two Hangul consonants, or two Hangul vowels as a valid Hangul input. Furthermore, the existing cellular telephone are unable to delete and insert a character in a middle position of a data string. To delete a character in a middle position of a data string, a user has to delete all trailing characters up to that character. Similarly, to insert a character in a middle position of a data string, a user has to delete all characters up to that position, enter the character needed to be inserted,

and then re-enter all the earlier erased trailing characters. These shortcomings are inconvenient for users to entering data strings to cellular telephones.

There is, therefore, a need to provide an improved method and apparatus for entering Hangul characters into electronic devices that have few keys or do not have a key board.

There is another need to provide an improved method and apparatus for entering Hangul characters into electronic devices that have a relatively small display region.

There is also another need to provide an improved method and apparatus for entering a data string including both Hangul and ASCII characters.

There is yet another need to provide an improved method and apparatus for entering unusual Hangul component combinations.

There is still another need to provide an improved method and apparatus for deleting and inserting a character in the middle position of a data string.

The present invention provides the methods and apparatuses to meet these needs.

SUMMARY OF THE INVENTION

To overcome the shortcomings in the available art, the present invention provides novel methods for forming Hangul characters on electronic devices.

In one aspect, the present invention provides a method for selecting Hangul components to form Hangul characters. The Hangul components include a plurality of first type basic components and a plurality of first type compound components. Each of the first type compound components is composed of two first type basic components. The Hangul components further include a plurality of second type basic components and a plurality of second type compound components. Each of the second type compound components is composed of two second type basic components. The method comprises the steps of: (a) forming a first list including all the first type basic components; (b) forming a second list including all the second type basic components; (c) displaying the first list on a first screen region located on a screen, and inputting a first Hangul component by selecting a first type basic component from the first list; (d) if the first Hangul component is a first type compound component, displaying the first list in the first display region, selecting a first type basic component from the first list, and forming the first Hangul component by combining the first type basic component selected in the step (c) with the first type basic component selected in the step (d); and (e) displaying the second list on the first region to replace the first list, and inputting a second Hangul component by selecting a second type basic component.

In another aspect, the present invention provides a method for forming a Hangul character by selecting Hangul components from a consonant group and a vowel group. The consonant group contains a plurality of basic consonants and a plurality of compound consonants. Each of the compound consonants is composed of two of the basic consonants. The vowel group contains a plurality of basic vowels and a plurality of compound vowels. Each of the compound vowels is composed of two of the basic vowels. The method comprises the steps of: (a) forming a consonant list containing all the basic vowels and some of the compound consonants; (b) forming a vowel list containing all the basic vowels and some of the compound vowels; (c) displaying the consonant list on a first screen region located on a screen; (d) selecting a consonant from the consonant list displayed

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on the first screen region; (e) displaying the vowel list on the first screen region to replace the consonant list; (f) selecting a vowel from the vowel list displayed on the first screen region; and (g) forming a Hangul character by combining the selected consonant and vowel.

In also another aspect, the present invention provides a method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel. The method comprises the steps of: displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen; inputting at least one Hangul character by selecting at least one Hangul component from the list displayed in the first region; inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and forming the data string using the inputted Hangul character and the inputted ASCII character.

In yet another aspect, the present invention provides a method for entering a Hangul character into an electronic device having a screen. The method comprises the steps of: displaying a plurality of Hangul consonants; selecting one of the consonants; indicating a completion of the selection; and forming a Hangul character using the selected consonant.

In still another aspect, the present invention provides a method for entering a Hangul character into an electronic device having a screen. The method comprises the steps of: displaying a plurality of Hangul vowels; selecting one of the vowels; indicating a completion of the selection; and forming a Hangul character using the selected vowel.

The present invention also provides the apparatuses for performing the steps in the methods discussed above.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objectives, features and advantages of the invention will be more readily understood upon consideration of the following detailed description of certain preferred embodiments of the invention, taken in conjunction with the accompanying drawings.

FIG. 1 depicts fourteen basic Hangul consonants;

FIG. 2 depicts sixteen compound Hangul consonants;

FIG. 3 depicts ten basic Hangul vowels;

FIG. 4 depicts eleven compound Hangul vowels;

FIG. 5 depicts a candidate consonant list including the fourteen basic Hangul consonants and four of the sixteen compound Hangul consonants, in accordance with the present invention;

FIG. 6 depicts a candidate vowel list including the ten basic Hangul vowels and four of the eleven Hangul compound vowels, in accordance with the present invention;

FIG. 7A depicts the front view of a cellular telephone that has the capability of entering Hangul and ASCII characters, in accordance with the present invention;

FIG. 7B depicts the side view of the cellular shown in FIG. 7A;

FIG. 8 depicts a block diagram, illustrating some components of the cellular telephone shown in FIG. 7A;

FIG. 9 depicts a sequence of screen shots, illustrating a process of selecting Hangul components, forming Hangul characters, and entering the formed Hangul characters into the cellular telephone shown in FIG. 7A, in accordance with the present invention;

FIG. 10 depicts a sequence of screen shots, illustrating a process of constructing a compound vowel, in accordance with the present invention;

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FIG. 11 depicts a sequence of screen shots, illustrating a process of entering a data string including both the Hangul and ASCII characters, in accordance with the present invention;

FIG. 12 depicts a sequence of screen shots, illustrating a process of behavior of the cellular telephone when there is no room for further entering characters, in accordance with the present invention; and

FIG. 13 depicts a sequence of screen shots, illustrating a process of entering a data string containing unusual Hangul consonant combinations that are invalid to conventional cellular telephones but valid to the cellular telephone in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention provides novel methods and apparatuses for entering data strings into electronic devices that have a relatively small display screen and few input keys.

A Hangul character is a single syllabic character formed by combining one or two Hangul consonants with a Hangul vowel. FIG. 1 shows fourteen basic Hangul consonants. FIG. 2 shows sixteen compound Hangul consonants, each of which is formed by combining two or more basic Hangul consonants. FIG. 3 shows ten basic Hangul vowels. FIG. 4 shows eleven compound Hangul vowels, each of which is formed by combining two or more basic Hangul vowels. As shown in FIGS. 1-4, Hangul includes a total thirty of consonants and twenty one vowels. FIG. 5 shows a candidate consonant list including the fourteen basic Hangul consonants and most frequently used four of the sixteen Hangul compound consonants FIG. 6 shows a candidate vowel list including the ten basic Hangul vowels and most frequently used four of the eleven Hangul compound vowels.

In the present invention, the candidate consonant list and the candidate vowel list are alternatively displayed in a display region so that a user can alternatively select a Hangul consonant and a Hangul vowel from these two lists, respectively. To form a Hangul character, a user can select Hangul components from the candidate consonant list and/or the candidate vowel list. To form a compound Hangul consonant that is not included in the candidate consonant list, after selecting a first basic Hangul consonant from the candidate consonant list, the user re-displays the candidate consonant list and selects a second basic Hangul consonant from the candidate consonant list. Similarly, to form a compound Hangul vowel that is not included in the candidate vowel list, after selecting a first basic Hangul vowel from the candidate vowel list, the user re-displays the candidate vowel list and selects a second basic Hangul vowel from the candidate vowel list.

FIG. 7A shows a front view of a cellular telephone 700, which has the capability of entering Hangul and ASCII characters in accordance with the present invention.

As shown in FIG. 7A, the cellular telephone 700 includes a display screen 702, an antenna 704, and a control panel 706. The control panel 706 includes a jog dial wheel 708 and a key panel 710, including twelve alpha/numeric keys. The jog dial wheel 708 can be moved in three directions (turn-up, turn-down, and press-in), as indicated by the three arrows. The cursor 916, 1016, 1116, 1216, or 1316 (as will be discussed in greater detail in connection with FIGS. 9, 10, 11, 12, and 13) displayed on the display screen 702, can be moved to the left and right by turning the jog dial wheel 708 up and down, respectively. A component (or a command)

displayed on the display screen 702 can be selected (or activated) by first moving the cursor 916, 1016, 1116, 1216, or 1316 to the component (or the command) and then pressing-in the jog dial wheel 708.

FIG. 7B shows a side view of the cellular telephone 700 is shown to illustrate the side view of the jog dial wheel 708.

FIG. 8 shows a block diagram 800 to illustrate some components of the cellular telephone 700 shown in FIG. 7A, in accordance with the present invention.

The block diagram 800 includes a processor 804, an I/O (input and output) interface circuit 805, a graphic I/O interface circuit 806, a memory 808, and a bus 810. The processor 804, the I/O interface circuit 805, the graphic I/O interface circuit 806, and the memory 808 are all coupled to the bus 810.

The memory 808 includes: (1) a component storage 813 for storing Hangul components (including Hangul consonants and vowels) and ASCII characters, (2) a data memory 815 for storing data strings entered into the cellular telephone 700, and (3) an application memory 820 for storing an application to form data strings in accordance with the present invention.

The processor 804 controls the operations of the I/O interface circuit 805, the graphic I/O interface circuit 806, the memory 808, and the display region 702. More specifically, the processor 804 is able to: (1) get access to the Hangul components and ASCII characters stored in the component storage 813, (2) interact with the control panel 706 via the I/O interface circuit 805, (3) display the Hangul components and ASCII characters stored in the component storage 813 on the display region 702 via the graphic I/O interface circuit 806, (4) execute the application stored in the application memory 820 to form data strings, and (5) store the data strings in the data memory 815.

In response to a user's movement of the jog dial wheel 708 or a user's press of any key on the key panel 710, the control panel 706 generates a request signal, which is in turn sent to the processor 804 via the I/O interface circuit 805. In response, the processor 804 executes the application stored in the application memory 820, thereby performing a particular function for the request signal.

FIG. 9 shows a sequence of screen shots sequentially displayed on the display screen 702 to illustrate a process of selecting Hangul components, forming Hangul characters, and entering the formed Hangul characters into the cellular telephone 700, in accordance with the present invention.

In describing the process shown in FIG. 9, it is assumed that the cellular telephone is set in a data entering mode for enabling the processor 804 to execute the application stored in the application memory 820, thereby allowing the user to input a first component into the cellular telephone 700. Once the cellular telephone 700 is set in the data entering mode, it can be switched between an appending mode or in an editing mode. The cellular telephone 700 is in an appending mode when the user places new data at the end position of a data string. The cellular telephone 700 remains in the appending mode so long as the newly inputted data is placed at a data string's end position, which does not have pre-existing data. The cellular telephone 700 is in an editing mode when the user either inserts or deletes. The input position change over the previously entered data is considered as an editing mode action. Since the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, and 1318 in FIG. 13) indicates the position of a subsequent operation to a data string, the application can determine whether the cellular telephone 700 should be set in an appending mode

or an editing mode by detecting the position of the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, and 1318 in FIG. 13).

Screen Shot 920:

The screen shot 920 has six display regions 902, 904, 906, 908, 910, and 912. The region 902 displays "name" in Hangul. The regions 904 displays the data string entered by a user. The region 906 alternatively displays the candidate consonant list and the candidate vowel list. The region 908 displays a command "save" in Hangul for saving the data string that are displayed in the region 904. The regions 910 displays a command "delete" in Hangul. In an appending mode, the selection of the "delete" command deletes a Hangul component or an ASCII character which was last entered. However, in an editing mode, the selection of the "delete" command deletes a Hangul character (which may include up to four Hangul components) or an ASCII character indicated by the cursor 918, 1018, 1118, 1218, or 1318.

The region 906 contains a cursor 916 and two display lines. Each display line contains ten full-size spaces, and each full-size space contains two half-size spaces. A Hangul character occupies a full-size space, and an ASCII character occupies a half-size space. Since the cellular telephone 700 is currently set in an appending mode to input a first component of a data string, the region 916 displays the candidate consonant list and the cursor 916 points to the first consonant in the candidate consonant list.

The cursor 916 can be moved to the left and right in the regions 906, 908, 910 and, 912, by turning the jog dial wheel 708 up and down, respectively. Specifically, when the cursor 916 is located at the last space of the first display line, further turning the jog dial wheel 708 down moves the cursor 916 to the first space of the second display line. When the cursor 916 is located at the last Hangul character of the second display line, further turning the jog dial wheel 708 down moves the cursor 916 to the region 908. When the cursor 916 is located in the region 908, continuously turning the jog dial wheel 708 down moves the cursor 916 from the region 908 to the region 912 through the region 910. When the cursor 916 is located at the right arrow "→" icon of the region 912, further turning the jog dial wheel 708 down moves the 916 to the first space of the first display line in the region 906.

Similarly, when the cursor 916 is located in the region 912, continuously turning the jog dial wheel 708 up moves the cursor 916 from the region 912 to the region 908 through the region 910. When the cursor 916 is located in the region 908, further turning the jog dial wheel 708 up moves the cursor 916 to the last Hangul character of the second display line. When the cursor 916 is located at the first space of the second display line, further turning the jog dial wheel 708 up moves the cursor 916 to the last space of the first display line. When the cursor 916 is located at the first display line in the region 906, further turning the jog dial wheel 708 up moves the cursor 916 to the right arrow "→" icon in the region 912.

The region 904 has six full-size spaces and contains a cursor 918. The cursor 918 can be moved a full-size space or a half-size space, depending whether the character to be pointed by the cursor 918 is a Hangul character or an ASCII character.

The region 912 displays three symbols, namely a left arrow "←" icon, a "space" character, and a right arrow "→" icon. The selection of the left arrow "←" moves the cursor 918 (1018 in FIG. 10, 1118 in FIG. 11, 1218 in FIG. 12, or 1318 in FIG. 13) one half-size space or one full-size space to the left in the region 904 (1004 in FIG. 10, 1104 in FIG. 11, 1204 in FIG. 12, or 1304 in FIG. 13), depending on

whether the character to be pointed by the cursor **918** is a Hangul or an ASCII character. The selection of the "space" character appends or inserts an ASCII space character into the region **904** (**1004** in FIG. **10**, **1104** in FIG. **11**, **1204** in FIG. **12**, and **1304** in FIG. **13**). The selection of the right arrow "→" icon moves the cursor **918** (**1018** in FIG. **10**, **1118** in FIG. **11**, **1218** in FIG. **12**, and **1318** in FIG. **13**) one half-size space or one full-size space to the right in the region **904** (**1014** in FIG. **10**, **1104** in FIG. **11**, **1204** in FIG. **12**, and **1304** in FIG. **13**), depending on whether the character to be pointed by the cursor **918** is a Hangul or an ASCII character. In an appending mode, the selection of right arrow "→" icon also inserts a delimiter indicating completion of a Hangul character.

In the process of entering a Hangul character, the region **906** alternatively displays the candidate consonant and vowel lists without requiring a user's intervention. To re-display a Hangul candidate list previously displayed, a user can press-in and holds the jog dial wheel **708**, indicating a request to re-display the previous Hangul candidate list. In response, the processor **804** executes the application to switch to the Hangul candidate list previously displayed.

In FIG. **9**, all other screen shots have the same layout as screen shot **920**.

Screen Shot **922**:

To select the tenth Hangul consonant from the candidate consonant group, the user moves the cursor **916** to the tenth full-size component of the first display line in the display region **916** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application stored in the application memory **820** to select the tenth Hangul consonant from the candidate consonant list and display the selected Hangul consonant in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **924**:

In the screen shot **924**, the consonant selected from the screen shot **922** is displayed in the region **904**. In the region **906**, the candidate consonant list in the screen shot **922** is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel in the candidate vowel list. To select the third vowel from the candidate vowel list, the user moves the cursor **916** to the third full-size component of the first display line in the display region **906** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the third Hangul vowel from the candidate vowel list and displays the Hangul vowel selected in the screen shot **924**, together with the Hangul consonant selected in the screen shot **922**, in the region **904**. The processor **804** then executes the application to display the candidate consonant list in the region **906**.

Screen Shot **926**:

In the screen shot **926**, a character constructed from the two components selected in the screen shots **922** and **924** is displayed in the region **904**. In region **906**, the candidate vowel list in the screen shot **924** is automatically replaced by the candidate constant list, and the cursor **916** automatically points to the first vowel in the candidate vowel list.

Screen Shot **928**:

To select the sixth consonant from the candidate consonant list, the user moves the cursor **916** to the sixth full-size component of the first display line in the region **906** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the sixth Hangul consonant from the candidate consonant list and displays the

Hangul consonant selected in the screen shot **928**, together with the Hangul components selected in the screen shots **922** and **924**, in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **930**:

In the screen shot **930**, a character constructed from the three components selected in the screen shots **922**, **924** and **928** is displayed in the region **904**. In the region **906**, the candidate consonant list is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel in the candidate vowel list. At the screen shot **930**, the process can be led to four paths:

- (1) path one, including the screen shots **932**, **934**, and **935**, to enter an explicit delimiter to indicate the completion of a character;
- (2) path two, including the screen shots **936**, **938**, and **939**, to delete the last component previously entered;
- (3) path three, including the screen shots **940**, **942**, **944**, and **945**, to construct a compound consonant; and
- (4) path four, including **946**, **948**, **950**, **952**, **954**, **956**, **958**, **960**, **962**, **964**, **966**, **968**, **970**, **972**, **974**, **976**, **978**, **980**, **982**, **984**, and **986**, to further enter Hangul and ASCII characters.

Screen Shot **932**:

To indicate that the three selected components has formed the first Hangul character, the user moves the cursor **906** to the right arrow "→" icon in the region **912** and presses-in the jog dial wheel **708**. The right arrow "→" icon is an explicit delimiter to indicate the completion of a character. In response, the processor **804** executes the application to move the cursor **918** one full-size space to the right in the region **904**. The processor then executes the application to display the candidate consonant list on the region **906**.

Screen Shot **934**:

In the screen shot **934**, the cursor **918** is moved a full-size space to the right, and the candidate vowel list in the screen shot **932** is automatically replaced by the candidate consonant list.

Screen Shot **935**:

To save the data string shown in the screen shot **934**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **934** into the data memory **815**.

Screen Shot **936**:

To delete the Hangul component that was last entered, the user moves the cursor **916** to the region **910** and presses-in the jog dial wheel **708**. Since the cellular telephone **700** is now in an appending mode, the processor **804** executes the application to delete the last Hangul component previously entered. The processor **804** then executes the application to display the candidate consonant list in the region **906**.

Screen Shot **938**:

As shown in the screen shot **938**, the last Hangul component previously entered is deleted. The candidate vowel list in the screen shot **936** is automatically replaced by the candidate consonant list.

Screen Shot **939**:

To save the data string shown in the screen shot **938**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **938** into the data memory **815**.

Screen Shot **940**:

The screen shot **940** is the continuation of the screen shot **930**. To construct a compound consonant, the user presses-in

and holds the jog dial wheel **708**. The application is able to recognize that this act is a request to construct a compound Hangul component. Since the previously entered Hangul component is a consonant, the application recognizes that the user wishes to construct a compound consonant. Thus, the processor **804** executes the application to re-display the candidate consonant list.

Screen Shot **942**:

In the screen shot **942**, the candidate consonant list is re-displayed in the region **906**. To select the seventh consonant from the candidate consonant list, the user moves the cursor **916** to the seventh full-size component of the first display line in the region **906** and presses-in the jog dial wheel **708**. It should be noted that, to the existing cellular telephones, two consecutively entered consonants are invalid as a whole independent Hangul character. However, the application stored in the application memory **820** is able to recognize that these two consecutively entered consonants here are meant to construct a compound consonant. Thus, the processor **804** executes the application to: (1) select the seventh consonant from the candidate constant list, (2) combine the consonant selected in the screen shot **928** with the consonant selected in the screen shot **942** to construct a compound consonant, (3) display the constructed consonant, together with the two components in the screen shots **922** and **924**, in the region **904**, and (4) display the candidate vowel list in the region **906**.

Screen Shot **944**:

In the screen shot **944**, a character constructed from the components selected in the screen shots **922**, **924**, **928** and **942** is displayed in the region **904**. The two consonants selected in the screen shots **928** and **842** forms a compound consonant. The candidate consonant list in the screen shot **942** is automatically replaced by the candidate vowel list.

Screen Shot **945**:

To save the data string shown in the screen shot **944**, the user moves the cursor **916** to the region **908** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to save the data string shown in the screen shot **944** into the data memory **815**.

Screen Shot **946**:

The screen shot **946** is the continuation of the screen shot **930**. To select the fifth vowel from the candidate vowel list, the user moves the cursor **916** to the fifth full-size component of the first display line in the region **906** and then presses-in the jog dial wheel **708**. Even though no explicit delimiter is entered in the screen shot **930**, the application is able to recognize the consonant last entered is the first consonant for the vowel selected in the screen shot **946**. Therefore, the processor **804** executes the application to: (1) move the last consonant from the preceding character, (2) select the fifth vowel from the candidate vowel list, (3) display the vowel selected in the screen shot **946**, together with the moved consonant, in the position indicated by the cursor **918** in the region **904**, and (4) display the candidate consonant list in the region **906**.

Screen Shot **948**:

As shown in the screen shot **948**, the vowel selected in the screen shot **946**, together with the consonant moved from the preceding Hangul character, is now displayed in the second full-size space in the region **904**. The candidate vowel list in the screen shot **946** is automatically replaced by the candidate consonant list, and the cursor **916** automatically points to the first consonant in the candidate consonant list. To select the first consonant from the candidate consonant list, the user presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the first

consonant from the candidate consonant list and display it, together with the two components previously selected, in the region **904**. The processor **804** then executes the application to display the candidate vowel list in the region **906**.

Screen Shot **950**:

In the screen shot **950**, a second Hangul character is constructed and displayed in the second full-size space in the region **904**. The candidate consonant list in the screen shot **948** is automatically replaced by the candidate vowel list, and the cursor **916** automatically points to the first vowel of the candidate vowel list. Without entering a delimiter, the user presses-in the jog dial wheel **708** to select the first vowel of the candidate vowel list. Even though no explicit delimiter is entered for the preceding Hangul character, the application is able to recognize that the consonant last entered is the first consonant for the vowel selected in the screen shot **950**. Therefore, the processor **804** executes the application to: (1) move the last consonant from the preceding character, (2) select the first vowel from the candidate vowel list, (3) display the selected vowel, together with the moved consonant, in the position indicated by the cursor **918** in the region **904**, and (4) display the candidate consonant list in the region **906**.

Screen Shot **952**:

As shown in the screen shot **952**, a third Hangul character is constructed and displayed in the third full-size space in the region **904**. The candidate vowel list in the screen shot **950** is automatically replaced by the candidate consonant list, and the cursor **916** automatically points to the first consonant in the candidate consonant list. The user can now use the same steps as shown in the screen shots **948** and **950** to enter a fourth Hangul character shown in the screen shot **954**.

Screen Shot **954**:

In the screen shot **954**, the fourth Hangul character is displayed in the region **904**. If needed, the user can add consonant(s) on the fourth character making the fourth character to be different from the second character. At this point, assume that the user recognizes the first Hangul character was erroneously entered.

Screen Shot **956**:

To delete the Hangul character located in the first full-size space in the region **904**, the user moves the cursor **916** to the left arrow “←” icon in the region **912** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the cursor **918** one full-size space to the left in the region **904**. Since the cursor **918** is moved to a position where a pre-existing character exists, the application realizes the user wishes to make changes to the data string that was entered. Thus, the processor executes the application to switch the cellular telephone **700** from an appending and an editing mode.

Screen Shot **958**:

As shown in the screen shot **958**, the cursor **918** is moved from the fourth full-size space to the third full-size space in the region **904**. To further move the cursor **918**, the user presses-in the jog dial wheel **708** again while the cursor **916** is still on the left arrow “←”. In response, the processor **804** executes the application to move the cursor **918** from the third full-size space to the second full-size space in the region **904**.

Screen Shot **960**:

As shown in the screen shot **960**, the cursor **918** is moved from the third full-size space to the second full-size space in the region **904**. To further move the cursor **918**, the user presses-in the jog dial wheel **708** again while the cursor **916** is still on the left arrow “←”. In response, the processor **804** executes the application to move the cursor **916** from the second full-size space to the first full-size space in the region **904**.

Screen Shot 962:

As shown in the screen shot 962, the cursor 918 is moved from the second full-size space to the first full-size space in the region 904.

Screen Shot 964:

To delete the character located in the first full-size space in the region 904, the user moves the cursor 916 to the region 910 and then presses-in the jog dial wheel 708. Since the cellular telephone is now in the editing mode, the processor 804 executes the application to delete the first character (which may include more than one Hangul components) from the first full-size space and move the remaining three characters one full-size space to the left in the region 904.

Screen Shot 966:

In the screen shot 966, the first Hangul character shown in the screen shot 964 is deleted, and the remaining three Hangul characters are moved one full-size space to the left in the region 904.

Screen Shot 968:

To select the tenth consonant from the candidate consonant list, the user moves the cursor 916 to the tenth full-size component of the first display line in the region 906 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to: (1) move the existing three characters one full-size space to the right in the region 904, (2) insert the selected consonant into the first full-size space in the region 904, and (3) display the candidate vowel list in the region 906.

Screen Shot 970:

In the screen shot 968, the three existing characters are moved one full-size space to the right and the consonant selected in the screen shot 968 is inserted into the first full-size space in the region 904. The candidate consonant list in the screen shot 968 is automatically replaced by the candidate vowel list, and the cursor 916 automatically points to the first vowel in the candidate vowel list.

Screen Shot 972:

To select the thirteen vowel (a compound vowel) from the candidate vowel list, the user moves the cursor 916 to the third full-size component of the second display line in the region 906 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the vowel and display the compound vowel selected in the screen shot 972, together with the consonant selected in the screen shot 968, in the first full-size space in the region 904. The processor 804 then executes the application to display the candidate consonant list in the region 906.

Screen Shot 974:

In the screen shot 974, a character constructed from the consonant selected in the screen shot 968 and the compound vowel selected in the screen shot 972 is displayed in the first full-size space in the region 904. The candidate vowel list in the screen shot 972 is automatically replaced by the candidate consonant list, and the cursor 916 automatically points to the first consonant in the candidate consonant list.

Screen Shot 976:

To place an explicit delimiter for the Hangul character inserted, the user moves the cursor 916 to the right arrow "→" icon in the region 912 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to acknowledge completion of inserting the Hangul character and move the cursor 918 from the first full-size space to the second full-size space in the region 904.

Screen Shot 978:

In the screen shot 978, the cursor 918 is moved to the second full-size space in the region 904. To further move the

cursor 918 one full-size space to the right in the region 904, the user presses-in the jog dial wheel 708. In response, the processor 804 executes the application to move the cursor 918 one full-size space to the right in the region 904.

5 Screen Shot 980:

In the screen shot 980, the cursor 918 is moved from the second full-size space to the third full-size space in the region 904.

Screen Shot 982:

To insert an ASCII space, the user moves the cursor 916 to the "space" character in the region 912 and then presses-in the jog dial wheel 708. The application is able to recognize that the "space" character is an ASCII character. Thus, the processor 804 executes the application to move the third and fourth Hangul characters one half-size space to the right and insert a half-size space before the third Hangul character.

Screen Shot 984:

In the screen shot 984, a half-size space is inserted before the third Hangul character in the region 904.

Screen Shot 986:

In the screen shot 986, the cellular telephone 700 still remains in the editing mode. To save the data string shown in the screen shot 984, the user moves the cursor 916 to the region 908 and presses-in the jog dial. In response, the processor 804 executes the application to store the data string into the data memory 815 and ends a text entering session.

FIG. 10 shows a sequence of screen shots sequentially displayed on the display screen 702 to illustrate a process of constructing a compound vowel, in accordance with the present invention. In describing the process shown in FIG. 9, it is assumed that the cellular telephone 700 is set in an appending entering mode for enabling the processor 804 to execute the application stored in the application memory 820, thereby allowing the user to input a first component into the cellular telephone 700.

Screen Shot 1020:

The screen shot 1020 contains six display regions 1002, 1004, 1006, 1008, 1010, and 1012. The structures and functions of the regions 1002, 1004, 1006, 1008, 1010, and 1012 are the same as these of the regions 902, 904, 906, 908, 910, and 912 shown in FIG. 9. The screen shot 1020 further contains two cursors 1016 and 1018. The operations of the cursors 1016 and 1018 are the same as these of the cursors 916 and 918 shown in FIG. 9.

Since the cellular telephone 700 is set in an appending mode to enter a first component in a data string, the region 1006 displays the candidate consonant list, and the cursor 1016 points to the first consonant of the candidate consonant list.

To select a vowel from the candidate vowel list as a first component, the user presses-in and holds the jog dial wheel 804. In response, the processor 804 executes the application to replace the candidate consonant vowel with the candidate vowel list in the region 1006.

Screen Shot 1022:

In the screen shot 1022, the candidate consonant list is replaced by the candidate vowel list. The cursor 1016 points to the first vowel in the candidate vowel list.

Screen Shot 1024:

To select the ninth vowel from the candidate vowel list, the user moves the cursor 1016 to the ninth full-size component of the first display line in the region 1006 and presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the first vowel from the candidate vowel list and display the selected vowel in the region 1004. The processor 804 then executes the application to display the candidate consonant list in the region 1006.

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Screen Shot 1026:

In the screen shot 1026, the vowel selected in the screen shot 1024 is displayed in the region 1004. The candidate vowel list is automatically replaced by the candidate consonant list, and the cursor 1016 automatically points to the first consonant in the candidate consonant list.

To construct a compound vowel, the user presses-in and holds the jog dial wheel 708. The application is able to recognize this act as a request to switch the candidate list. Since the previously entered Hangul component is a vowel, the application recognizes that the user is requesting to construct a compound vowel. Thus, the processor 804 executes the application to re-display the candidate vowel list.

Screen Shot 1028:

In the screen shot 1028, the candidate vowel list is displayed in the region 1006.

Screen Shot 1030:

To select the tenth vowel from the candidate vowel list, the user moves the cursor 1016 to the tenth full-size component of the first display line in the region 1006 and then presses-in the jog dial wheel 708. It should be noted that, to the existing cellular telephones, two consecutively entered vowels are invalid as the first component of a character or as a whole character. However, the application stored in the application memory 820 is able to recognize that these two consecutively entered vowels here are meant to construct a compound vowel. Thus, the processor 804 executes the application to: (1) select the tenth vowel from the candidate vowel list, (2) combine the vowel selected in the screen shot 1024 with the vowel selected in the screen shot 1030 to construct a compound vowel, (3) display the constructed vowel in the region 1004, and (4) display the candidate consonant list in the region 1006.

Screen Shot 1032:

In the screen shot 1032, the compound vowel constructed from the vowels selected in the screen shots 1024 and 1030 is displayed in the region 1004. The candidate vowel list in the screen shot 1030 is automatically replaced by the candidate consonant list.

Screen Shot 1034:

To save the compound vowel, the user moves the cursor 1016 to the region 1008 and presses-in the jog dial wheel 708. In response, the processor 804 executes the application to save the compound vowel in the data memory 815.

FIG. 11 shows a sequence of screen shots sequentially displayed on the display screen 702 to illustrate a process of entering a data string containing both Hangul and ASCII characters into the cellular telephone 700, in accordance with the present invention.

In describing the process shown in FIG. 11, it is assumed that the cellular telephone 700 is set in an appending mode, enabling the processor 804 to execute the application stored in the application memory 820, thereby allowing a user to input a first component into the cellular telephone 700.

Screen Shot 1120:

The screen shot 1120 contains six display regions 1102, 1104, 1106, 1108, 1110, and 1112. The structures and functions of the regions 1102, 1104, 1106, 1108, 1110, and 1112 are the same as these of the regions 902, 904, 906, 908, 910, and 912 shown in FIG. 9. The screen shot 1120 further contains two cursors 1116 and 1118. The operations of the cursors 1116 and 1118 are the same as these of the cursors 916 and 918 shown in FIG. 9.

Since the cellular telephone 700 is set to enter the first component of a character string, the region 1106 displays the candidate consonant list, and the cursor 1116 points to the first consonant of the candidate consonant list.

To select the first consonant in the candidate consonant list, the user presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the first consonant from the candidate consonant list and display the selected consonant in the region 1104. The processor 804 then executes the application to display the candidate vowel list in the region 1106.

Screen Shot 1122:

In the screen shot 1122, the consonant selected in the screen shot 1020 is displayed in the region 1104. Since selected consonant is a Hangul component, the application displays it in full-size. In the region 1106, the candidate consonant list in the screen shot 1120 is automatically replaced by the candidate vowel list, and the cursor 1116 automatically points to the first vowel in the candidate vowel list. To select the first vowel from the candidate vowel list, the user presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the first vowel from the candidate vowel list and display the vowel selected in the screen shot 1122, together with the consonant selected in the screen shot 1120, in the region 1104. The processor 804 then executes the application to display the candidate consonant list in the region 1106.

Screen Shot 1124:

In the screen shot 1124, a character constructed from the two components selected in the screen shots 1120 and 1122 is displayed in the region 1104. In the region 1106, the candidate vowel list is automatically replaced by the candidate constant list.

Screen Shot 1126:

To select the eighth consonant from the candidate consonant list, the user moves the cursor 1116 to the eighth full-size component of the first display line in the region 1106 and presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the eighth consonant from the candidate consonant list and displays the consonant selected in the screen shot 1126, together with the two components selected in the screen shot 1120 and 1122, in the region 1104. The processor 804 then executes the application to display the candidate vowel list in the region 1106.

Screen Shot 1128:

In the screen shot 1128, a character constructed from the three components selected in the screen shots 1120, 1122 and 1126 is displayed in the region 1104. In the region 1106, the candidate consonant list in the screen shot 1126 is automatically replaced by the candidate vowel list, and the cursor 1116 automatically points to the first vowel in the candidate vowel list. To re-display the candidate consonant list, the user presses-in and holds the jog dial wheel 708. In response, the processor 804 executes the application to re-display the candidate consonant list in the region 1106 so that the user can select a consonant to start a trailing character.

Screen Shot 1130:

In the screen shot 1130, the candidate consonant list is displayed in the region 1106, and the cursor 1116 automatically points to the first consonant in the candidate consonant list.

Screen Shot 1132:

To select the eighth consonant from the candidate consonant list, the user moves the cursor 1116 to the eighth full-size component in the first display line in the region 1106 and presses-in the jog dial wheel 708. Since the previously selected component is also a Hangul consonant and the cellular telephone 700 is in an appending mode, the processor 804 executes the application to: (1) move the

cursor **1118** one full size to the right in the region **1104** to input a new character, (2) select the eighth consonant from the candidate consonant list, (3) display the selected consonant in the region **1104** in the position indicated by the cursor **1118**, and (4) display the candidate vowel list in the region **1106**.

Screen Shot **1134**:

In the screen shot **1134**, the consonant selected in the screen shot **1132** is displayed in the region **1104**. The candidate consonant list in the screen shot **1132** is automatically replaced by the candidate vowel list, and the cursor **1116** automatically points to the first vowel in the candidate vowel list.

Screen Shot **1136**:

To select the seventh vowel from the candidate vowel list, the user moves the cursor **1116** to the seventh full-size component of the first display line in the region **1106** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the seventh vowel from the candidate consonant list and display the vowel selected in the screen shot **1136**, together with the consonant selected in the screen shot **1132**, in the region **1104**. The processor **804** then executes the application to display the candidate consonant list in the region **1106**.

Screen Shot **1138**:

In the screen shot **1138**, a character constructed from the two components selected in the screen shots **1132** and **1136** are displayed in the region **1106**. The candidate vowel list in the screen shot **1136** is automatically replaced by the candidate consonant list, and the cursor **1116** automatically points to the first consonant in the candidate consonant list.

Screen Shot **1140**:

To append a half-size space, the user moves the cursor **1116** to the "space" character in the region **1112** and presses-in the jog dial wheel **708**. The application is able to recognize the "space" character in the region **1112** is an ASCII character. Thus, the processor **804** executes the application to move the cursor **1118** a half-size space to the right in the region **1104**.

Screen Shot **1142**:

In screen shot **1142**, the cursor **1118** is moved a half-size space to the right in the region **1104** since the "space" in the region **1112** is an ASCII character. At the screen shot **1142**, the process are led to two paths:

- (1) path one: the screen shots **1144** and **1146**, and
- (2) path two: the screen shots **1148** and **1150**.

Screen Shot **1144**:

As shown in the screen shot **1144**, from the key panel **710**, the user sequentially selects "S", "e", "o", "u", and "l". The application is able to recognize that each of the selections from the key panel **710** is an ASCII character input. Thus, the processor **804** executes the application to sequentially select the ASCII symbols "S", "e", "o", "u", and "l" in response to the selections on the key panel **710**, and display each of them in a half-size space in the region **1104**. Since the inputted components are ASCII characters, the candidate list displayed in the region **1106** will not be changed.

It should be noted that eight of the ten alpha/numeric keys on the key panel **710** are mapped to multiple ASCII characters. For example, the numeric key "2" is mapped to seven ASCII characters, including "A", "B", "C", "a", "b", "c", and "2". By continuously pressing the numeric key "2", the user can choose any one of the seven ASCII characters. In response to user's continuous presses on the numeric key "2", the application consecutively scrolls and selects among these seven letters. This principle also applies to the operations on the numeric keys "3-9".

Screen Shot **1146**:

To save the data string as shown in the screen shot **1144**, the user moves the cursor **1116** to the region **1108** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

Screen Shot **1148**:

As shown in the screen shot **1148**, from the key panel **710**, the user sequentially selects "L" and "A". Since the selection is from the key panel **710**, the processor **804** executes the application to sequentially select the ASCII symbols "L" and "A" in response to the selections on the key panel **710**, and display each of them in a half-size space in the region **1104**. Since the inputted components are ASCII characters, the candidate list displayed in the region **1106** will not be changed.

Screen Shot **1150**: To save the data string as shown in the screen shot **1148**, the user moves the cursor **1116** to the region **1108** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

It should be noted that in the example shown in FIG. **11**, the ASCII characters are appended at the end of the data string. However, using the principle shown in the present invention, an ASCII character can be entered before a Hangul character or between two Hangul characters.

FIG. **12** shows a sequence of screen shots is shown sequentially displayed on the display screen **702** to illustrate behavior of the cellular telephone **700** when there is no room in a character display region for further entering characters, in accordance with the present invention. In describing the process shown in FIG. **12**, it is assumed that the cellular telephone **700** is set in an appending mode.

Screen Shot **1220**:

The screen shot **1220** contains six display regions **1202**, **1204**, **1206**, **1208**, **1210**, and **1212**. The structures and functions of the regions **1202**, **1204**, **1206**, **1210**, **1208**, and **1212** are the same as these of the regions **902**, **904**, **906**, **908**, **910**, and **912** shown in FIG. **9**. The screen shot **1220** further contains two cursors **1216** and **1218**. The operations of the cursors **1216** and **1218** are the same as these of the cursors **916** and **918** shown in FIG. **9**.

The region **1204** contains a data string having six Hangul characters, and the cursor **1218** points the last Hangul character in the data string. Since the region **1204** contains six full-size spaces or twelve half-size spaces, there is no room for appending any further characters. After the sixth Hangul character was entered, the cellular telephone **700** remains in the appending mode. Thus, the application does not respond to the actions of: (1) pressing-in the jog dial wheel **708** to activate right arrow "→" icon in the region **1212**, (2) pressing-in the jog dial wheel **708** to select "space" character in the region **1212**, and (3) selecting any keys on the key panel **710**. However, the application still responds to the actions of: (1) pressing-in and holding the jog dial wheel **708**, and (2) pressing-in the jog dial wheel **708** to activating the left arrow "←" icon in the region **1212**.

To display the candidate consonant list, a user presses-in and holds the jog dial wheel **708**. In response, the processor **804** executes the application to display the candidate consonant list in the region **1206**.

Screen Shot **1222**:

In the screen shot **1222**, the candidate vowel list shown in the screen shot **1220** is replaced by the candidate consonant list. At the screen shot **1222**, the process is led to two paths:

- (1) path one, including screen shots **1226**, **1228**, and **1229**, to delete the last entered component in the region **1204** under an appending mode; and

(2) path two, including screen shots **1230**, **1232**, **1234**, and **1235**, to insert components in the data string in the region **1204** under an editing mode.

Screen Shot **1226**:

To delete the last entered component in the region **1204**, the user moves the cursor **1216** to the region **1210** and then presses-in the jog dial wheel **708**. Since the cellular telephone **700** is in the appending mode, the processor **804** executes the application to delete the one Hangul component last entered in the region **1204**.

Screen Shot **1228**:

As shown in the screen shot **1228**, the last entered component is deleted.

Screen Shot **1229**:

To save the data string as shown in the screen shot **1228**, the user moves the cursor **1216** to the region **1208** and presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data string into the data memory **815**.

Screen Shot **1230**:

To insert a character before the fifth character in the region **1204**, the user moves the cursor **1216** to the left arrow “←” icon in the region **1210** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the cursor **1218** one full-size space to the left in the region **1204**. Since the cursor **1218** is moved into the data string, the application recognizes the user wishes to insert or delete one or more characters. Thus, the processor **804** executes the application to switch the cellular telephone **700** from the appending mode to an editing mode.

Screen Shot **1232**:

In the screen shot **1232**, the cursor **1218** is moved pointing to the fifth character. To insert a “space” character, the user moves the cursor **1216** to the “space” character in the region **1212** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to move the fifth and sixth characters one half-size space (since the “space” character is an ASCII character) to the right and insert a “space” character before the fifth character. At the same time, the processor **804** executes the application to drop the last character (i.e. the sixth character) to keep the data string within the maximum length of the region **1204**.

Screen Shot **1234**:

In the screen shot **1234**, a half-size space is inserted before the fifth character in the region **1204**. At this point, the user can insert up to three more half-size characters, in any combinations of: (1) one half-size character, (2) two half-size characters, (3) one full-size character, (4) one half-size and one full-size characters, and (5) three half-sizes characters. The character at the end of the data string will be dropped as the insertion continues.

It should be noted that if a Hangul character is inserted into a middle position of the data string, the character at the end of the data string will also be dropped.

Screen Shot **1235**:

To save the data string as shown in the screen shot **1234**, the user moves the cursor **1216** to the region **1208** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to store the data stream in the data memory **815**.

FIG. **13** shows a sequence of screen shots sequentially displayed on the display screen **702** to illustrate a process of entering a data string containing unusual Hangul consonant combinations that are invalid to a conventional cellular telephone but valid to the cellular telephone **700**, in accordance with the present invention. In describing FIG. **13**, it is assumed that the cellular telephone **700** is set in an append-

ing mode, enabling the processor **804** to execute the application stored in the application memory **820**, thereby allowing a user to input a first component into the cellular telephone **700**.

Screen Shot **1320**:

The screen shot **1320** contains six display regions **1302**, **1304**, **1306**, **1308**, **1310**, and **1312**. The structures and functions of the regions **1302**, **1304**, **1306**, **1308**, **1310**, and **1312** are the same as these of the regions **902**, **904**, **906**, **908**, **910**, and **912** shown in FIG. **9**. The screen shot **1320** further contains two cursors **1316** and **1318**. The operations of the cursors **1316** and **1318** are the same as these of the cursors **916** and **918** shown in FIG. **9**.

Since the cellular telephone **700** is set in an appending mode, the region **1306** displays the candidate consonant list, and the cursor **1316** points to the first consonant in the candidate consonant list.

Screen Shot **1322**:

To select the twelfth consonant from the candidate consonant list, the user moves the cursor **1316** to the second full-size component of the second display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the twelfth consonant and display it in the region **1304**. The processor **804** then executes the application to display the candidate vowel list in the region **1306**.

Screen Shot **1324**:

In the screen shot **1324**, the consonant selected in the screen shot **1322** is displayed in the region **1304**. The candidate consonant list in the screen shot **1322** is automatically replaced by the candidate vowel list, and the cursor **1316** automatically points to the first vowel in the candidate vowel list.

Screen Shot **1326**:

To indicate that the selected consonant forms the first character, the user moves the cursor **1316** to the right arrow “→” icon in the region **1312** and then presses-in the jog dial wheel **708**. The right arrow “→” is an explicit delimiter for indicating the completion of a character. It should be noted that, to the existing cellular telephones, one consonant is an invalid Hangul character input. However, the application of the present invention is able to recognize a single consonant as a valid Hangul character. Thus, the processor **804** executes the application to move the cursor **1318** one full-size space to the right in the region **1304**. The processor **804** then executes the application to display the candidate consonant list in the region **1306**.

Screen Shot **1328**:

In the screen shot **1328**, the candidate vowel list in the screen shot **1326** is replaced by the candidate consonant list, and the cursor **1316** automatically points to the first consonant of the candidate consonant list. The cursor **1318** is moved to the second full-size space in the region **1304**.

Screen Shot **1330**:

To select the twelfth consonant from the candidate consonant list, the user moves the cursor **1316** to the second full-size component of the second display line in the region **1306** and then presses-in the jog dial wheel **708**. In response, the processor **804** executes the application to select the twelfth consonant and display it in the region **1304**. The processor **804** then executes the application to display the candidate vowel list in the region **1306**.

Screen Shot **1332**:

In the screen shot **1332**, the consonant selected in the screen shot **1330** is displayed in the region **1304**. The candidate consonant list in the screen shot **1330** is automatically replaced by the candidate vowel list, and the cursor **1316** automatically points to the first vowel in the candidate vowel list.

Screen Shot 1334:

To select the ninth vowel from the candidate vowel list, the user moves the cursor 1316 to the ninth full-size component of the first display line in the region 1306 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the ninth vowel and display the vowel selected in the screen shot 1334, together with the consonant selected in the screen shot 1330, in the region 1304. The processor 804 then executes the application to display the candidate consonant list in the region 1306.

Screen Shot 1336:

In the screen shot 1336, a character constructed from the two components selected in the screen shots 1330 and 1334 is displayed in the region 1304. The candidate vowel list in the screen shot 1334 is automatically replaced by the candidate consonant list, and the cursor 1316 automatically points to the first consonant in the candidate consonant list.

Screen Shot 1338:

To indicate the completion of entering the second character, the user moves the cursor 1316 to the right arrow "→" icon in the region 1312 and then presses-in the jog dial wheel 708. The right arrow "→" icon is an explicit delimiter to indicate the completion of the second character. In response, the processor 804 executes the application to move the cursor 1318 one full-size space to the right in the region 1304.

Screen Shot 1340:

In the screen shot 1340, the cursor 1318 is moved the third full-size space in the region 1304. To select the twelfth consonant from the candidate consonant list, the user moves the cursor 1316 to the second full-size component of the second display line in the region 1306 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the twelfth consonant and display it in the region 1304. The processor 804 then executes the application to display the candidate vowel list in the region 1306.

Screen Shot 1342:

In the screen shot 1342, the consonant selected in the screen shot 1340 is displayed in the region 1304. The candidate consonant list in the screen shot 1340 is automatically replaced by the candidate vowel list, and the cursor 1316 automatically points to the first vowel in the candidate vowel list. To select the ninth vowel from the candidate vowel list, the user moves the cursor 1316 to the ninth full-size component of the first display line in the region 1306 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the ninth vowel from the candidate vowel list and display the vowel selected in the screen shot 1342, together with the consonant selected in the screen shot 1340, in the region 1304. The processor 804 then executes the application to display the candidate consonant list in the region 1306.

Screen Shot 1344:

In the screen shot 1344, a character constructed from the two components selected in the screen shots 1340 and 1342 is displayed in the region 1304. The candidate vowel list in the screen shot 1342 is automatically replaced by the candidate consonant list, and the cursor 1316 automatically points to the first consonant in the candidate consonant list. To select the seventh consonant from the candidate consonant list, the user moves the cursor 1316 to the seventh full-size component of the first display line in the region 1306 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to select the seventh consonant from the candidate consonant list and

display the consonant selected in the screen shot 1344, together with the two components selected in the screen shots 1340 and 1342, in the region 1304. The processor 804 also executes the application to replace the candidate consonant list in the screen shot 1344 with the candidate vowel list.

Screen Shot 1346:

In the screen shot 1346, a character constructed from the three components selected in the screen shots 1340, 1342, and 1344 is displayed in the region 1304. To append a half-size space, the user moves the cursor 1316 to the "space" character in the region 1312 and then presses-in the jog dial wheel 708. In response, the processor 804 executes the application to insert a half-size space at the end of the data string in the region 1304. The processor 804 also executes the application to replace the candidate vowel list in the screen shot 1346 with the candidate consonant list.

Screen Shot 1348:

As shown in the screen shot 1348, a half-size space is appended at the end of the data string in the region 1304.

Screen Shot 1350:

As shown in the screen shot 1346, from the key panel 710, the user sequentially selects "G", "o", "o", and "d". The application is able to recognize that each of the selections, from the key panel 710 is an ASCII character input. Thus, the processor 804 sequentially selects the ASCII characters "G", "o", "o", and "d" in response to each of the user's selections, and display each of the selected ASCII characters in half-size in the region 1304.

Screen Shot 1352:

To save the data string formed in the region 1304, the user moves the cursor 1316 to the region 1308 and presses-in the jog dial wheel 708. In response, the processor 804 executes the application to store the data string into the data memory 815.

It should be noted that using the principle shown in FIG. 13, the cellular telephone 700 can enter one consonant, one vowel, two consonants, or two vowels as a Hangul character. Specifically, by entering a delimiter after one consonant, one vowel, two consonants, or two vowels that are inputted by a user, the application stored in the application memory 820 recognizes the one consonant, one vowel, two consonants, or two vowels that are inputted is a Hangul character. In response to the entering of the delimiter, the processor 804 executes the application to display the Hangul character in the region 1304.

In the present invention, the candidate consonant list, the candidate vowel list, and the ASCII characters can be stored in the component storage 813. The application for performing the steps shown in FIGS. 9-13 can be stored in the application memory 820. The processor 804 executes the application to perform the steps illustrated in the screen shots shown in FIGS. 9-13.

Although the present invention has been shown and described with respect to preferred embodiments, various changes and modifications are deemed to lie within the spirit and scope of the invention as claimed.

What is claimed is:

1. A method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel, the method comprising the steps of:

displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen;

inputting at least one Hangul character by selecting at least one Hangul component from the list displayed in the first region;

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inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and forming the data string using the inputted Hangul character and the inputted ASCII character.

2. The method of 1, further comprising the step of: displaying the string of inputs in a second display region located on the screen.

3. The method of 1, further comprising the step of: storing the string of inputs in a memory device.

4. The method of 1, further comprising the steps of: displaying the inputted Hangul character in a full-size space in the second display region; and displaying the inputted ASCII character in a half-size space in the second display region.

5. A method for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and a key panel, the method comprising the steps of:

- forming a consonant list containing a plurality of Hangul consonants;
- forming a vowel list containing a plurality of Hangul vowels;
- displaying the consonant list on a first display region located on the screen;
- selecting at least one consonant from the consonant list;
- displaying the vowel list on the first display region to replace the consonant list;
- selecting at least one vowel from the vowel list;
- forming a Hangul character by combining the selected consonant and vowel;
- forming at least one ASCII character by selecting the key panel; and
- forming the data string using the inputted Hangul character and inputted ASCII character.

6. The method of claim 5, comprising the step of: displaying the string on a second display region located on the screen.

7. The method of 5, further comprising the step of: storing the string of inputs in a memory device.

8. The method of 5, further comprising the steps of: displaying the inputted Hangul character in a full-size space in the second display region; and displaying the inputted ASCII character in a half-size space in the second display region.

9. An apparatus for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and key panel, the apparatus comprising:

- means for displaying at least one Hangul list containing a plurality of Hangul components on a first display region located on the screen;
- means for inputting at least one Hangul character by selecting at least one Hangul component from the list:displayed in the first region;
- means for inputting at least one ASCII character by selecting at least one ASCII character from the key panel; and
- means for forming the data string using the inputted Hangul character and the inputted ASCII character.

10. The apparatus of 9, further comprising: means for displaying the string of inputs in a second display region located on the screen.

11. The apparatus of 9, further comprising: means for storing the string of inputs in a memory device.

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12. The apparatus of 9, further comprising: means for displaying the inputted Hangul character in a full-size space in the second display region; and means for displaying the inputted ASCII character in a half-size space in the second display region.

13. An apparatus for entering a data string including both Hangul and ASCII characters into an electronic device having a screen and a key panel, the apparatus comprising:

- means for forming a consonant list containing a plurality of Hangul consonants;
- means for forming a vowel list containing a plurality of Hangul vowels;
- means for displaying the consonant list on a first display region located on the screen;
- means for selecting at least one consonant from the consonant list;
- means for displaying the vowel list on the first display region to replace the consonant list;
- means for selecting at least one vowel from the vowel list;
- means for forming a Hangul character by combining the selected consonant and vowel;
- means for forming at least one ASCII character by selecting the key panel; and
- means for forming the data string using the inputted Hangul character and inputted ASCII character.

14. The apparatus of claim 13, comprising: means for display the string on a second display region located on the screen.

15. The apparatus of claim 13, further comprising: means for storing the string of inputs in a memory device.

16. The apparatus of 13, further comprising: means for displaying the inputted Hangul character in a full-size space in the second display region; and means for displaying the inputted ASCII character in a half-size space in the second display region.

17. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of: displaying a plurality of Hangul consonants on a screen; selecting one of the consonants displayed on the screen; indicating a completion of the selection; and forming a Hangul character using the selected consonant.

18. The method of claim 17, further comprising the step of: displaying the Hangul consonants in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

19. The method of claim 17, further comprising the step of: storing the formed Hangul character into a memory device.

20. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of: displaying a list including a plurality of Hangul consonants on a screen;

- selecting a first consonant from the list;
- selecting a second consonant from the list;
- indicating a completion of the selections; and
- forming a Hangul character using the selected consonants.

21. The method of claim 20, further comprising the step of: displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

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22. The method of claim 20, further comprising the step of:

storing the formed, Hangul character into a memory device.

23. A method for entering a Hangul character into an electronic device having a screen comprising the steps of:

displaying a plurality of Hangul vowels on a screen;

selecting one of the vowels;

indicating a completion of the selection; and

forming a Hangul character using the selected vowel.

24. The method of claim 23, further comprising the step of:

displaying the Hangul vowels in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

25. The method of claim 23, further comprising the step of:

storing the formed Hangul character into a memory device.

26. The method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a list including a plurality of Hangul vowels on a screen;

selecting a first vowel from the list;

selecting a second vowel from the list;

indicating a completion of the selections; and

forming a Hangul character using the selected vowels.

27. The method of claim 26, further comprising the step of:

displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

28. The method of claim 26, further comprising the step of:

storing the formed Hangul character into a memory device.

29. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a plurality of basic consonants on a screen;

selecting a first basic consonant;

selecting a second basic consonant; and

forming a compound consonant by combining the selected two basic consonants.

30. The method of claim 29, further comprising the step of:

displaying the basic consonants in a first display region located on the screen, and displaying the formed compound consonant in a second display region on the screen.

31. The method of claim 29, further comprising the step of:

storing the formed compound consonant into a memory device.

32. A method for entering a Hangul character into an electronic device having a screen, comprising the steps of:

displaying a plurality of basic vowels on a screen;

selecting a first basic vowel;

selecting a second basic vowel; and

forming a compound vowel by combining the selected two basic vowels.

33. The method of claim 32, further comprising the step of:

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displaying the basic vowels in a first display region located on the screen, and displaying the formed compound vowel in a second display region on the screen.

34. The method of claim 32, further comprising the step of:

storing the formed compound vowel into a memory device.

35. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying a plurality of Hangul consonants on a screen;

means for selecting one of the consonants;

means for indicating a completion of the selection; and

means for forming a Hangul character using the selected consonant.

36. The apparatus of claim 35, further comprising:

means for displaying the Hangul consonants in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

37. The apparatus of claim 35, further comprising:

means for storing the formed Hangul character into a memory device.

38. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a list including a plurality of Hangul consonants;

means for selecting a first consonant from the list;

means for selecting a second consonant from the list;

means for indicating a completion of the selections; and

means for forming a Hangul character using the selected consonants.

39. The apparatus of claim 38, further comprising:

displaying the list in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

40. The apparatus of claim 38, further comprising:

apparatus for storing the formed Hangul character into a memory device.

41. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a plurality of Hangul vowels;

means for selecting one of the vowels;

means for indicating a completion of the selection; and

means for forming a Hangul character using the selected vowel.

42. The apparatus of claim 41, further comprising:

means for displaying the Hangul vowels in a first display region located on the screen, and displaying the formed Hangul character on a second display region located on the screen.

43. The apparatus of claim 41, further comprising:

means for storing the formed Hangul character into a memory device.

44. An apparatus for entering a Hangul character into an electronic device having a screen, comprising:

means for displaying on a screen a list including a plurality of Hangul vowels;

means for selecting a first vowel from the list;

means for selecting a second vowel from the list;

means for indicating a completion of the selections; and

means for forming a Hangul character using the selected vowels.

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45. The apparatus of claim 44, further comprising:
 means for displaying the list in a first display region
 located on the screen, and displaying the formed
 Hangul character on a second display region located on
 the screen. 5

46. The apparatus of claim 44, further comprising:
 means for storing the formed Hangul character into a
 memory device.

47. An apparatus for entering a Hangul character into an
 electronic device having a screen, comprising: 10

means for displaying on a screen a plurality of basic
 consonants;
 means for selecting a first basic consonant;
 means for selecting a second basic consonant; and 15
 means for forming a compound consonant by combining
 the selected two basic consonants.

48. The apparatus of claim 47, further comprising:
 means for displaying the basic consonants in a first
 display region located on the screen, and displaying the
 formed compound consonant in a second display region
 on the screen. 20

49. The apparatus of claim 47, further comprising:
 means for storing the formed compound consonant into a
 memory device. 25

50. An apparatus for entering a Hangul character into an
 electronic device having a screen, comprising:
 means for displaying on a screen a plurality of basic
 vowels; 30
 means for selecting a first basic vowel;
 means for selecting a second basic vowel; and
 means for forming a compound vowel by combining the
 selected two basic vowels. 35

51. The apparatus of claim 50, further comprising:
 means for displaying the basic vowels in a first display
 region located on the screen, and displaying the formed
 compound vowel in a second display region on the
 screen. 40

52. The apparatus of claim 50, further comprising:
 means for storing the formed compound vowel into a
 memory device.

53. A method for editing a data string inputted into a
 cellular telephone having a screen, comprising the steps of: 45

displaying a plurality of Hangul components in a first
 display region located on the screen;
 selecting a set of Hangul components from the first
 display region;
 forming a data string containing a plurality of Hangul
 characters using the selected Hangul components; 50
 displaying the formed data string in a second display
 region located on the screen;
 locating any one of Hangul characters in the data string
 displayed in the second display region; and 55
 editing the data string in a position of the located Hangul
 character without deleting the Hangul characters trail-
 ing that position.

54. The method of claim 53, wherein the editing includes 60
 insertion and deletion.

55. A method for editing a data string inputted into a
 cellular telephone having a screen, comprising the steps of:

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displaying a plurality of Hangul components in a first
 display region located on the screen;
 setting a plurality of ASCII components on a key panel;
 selecting a set of Hangul components from the first
 display region;
 selecting a set of ASCII components from the key panel;
 forming a data string containing a plurality of characters
 using the selected Hangul and ASCII components;
 displaying the formed data string in a second display
 region located on the screen;
 locating any one of characters in the data string displayed
 in the second display region; and
 editing the data sting in a position of the located character
 without deleting the characters trailing that position.

56. The method of claim 55, wherein the editing includes
 insertion and deletion.

57. An apparatus for editing a data string inputted into a
 cellular telephone having a screen, comprising:
 means for displaying a plurality of Hangul components in
 a first display region located on the screen;
 means for selecting a set of Hangul components from the
 first display region;
 means for forming a data string containing a plurality of
 Hangul characters using the selected Hangul compo-
 nents;
 means for displaying the formed data string in a second
 display region located on the screen;
 means for locating any one of Hangul characters in the
 data string displayed in the second display region; and
 means for editing the data string in a position of the
 located Hangul character without deleting the Hangul
 characters trailing that position.

58. The apparatus of claim 57, wherein the editing
 includes insertion and deletion.

59. An apparatus for editing a data string inputted into a
 cellular telephone having a screen, comprising: 40

means for displaying a plurality of Hangul components in
 a first display region located on the screen;
 means for setting a plurality of ASCII components on a
 key panel;
 means for selecting a set of Hangul components from the
 first display region;
 means for selecting a set of ASCII components from the
 key panel;
 means for forming a data string containing a plurality of
 characters using the selected Hangul and ASCII com-
 ponents; 50
 means for displaying the formed data string in a second
 display region located on the screen;
 means for locating any one of characters in the data string
 displayed in the second display region; and
 means for editing the data string in a position of the
 located character without deleting the characters trail-
 ing that position.

60. The apparatus of claim 59, wherein the editing
 includes insertion and deletion.

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,760,477 B2
DATED : July 6, 2004
INVENTOR(S) : Ko, Soon

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 21,

Lines 5, 8 and 10, after "of" and before "1" insert -- claim --.

Lines 41 and 43, after "of" and before "5" insert -- claim --.

Line 57, after "list" delete ":" (colon).

Lines 63 and 66, after "of" and before "9" insert -- claim --.

Column 22,

Line 1, after "of" and before "9" insert -- claim --.


Line 33, after "of" and before "13" insert -- claim --.

Column 26,

Line 15, change "sting" to -- string --.

Signed and Sealed this

Third Day of January, 2006

A handwritten signature in black ink on a light gray dotted background. The signature reads "Jon W. Dudas" in a cursive style.

JON W. DUDAS

Director of the United States Patent and Trademark Office

Exhibit L



US007313647B2

(12) **United States Patent**
Iida

(10) **Patent No.:** **US 7,313,647 B2**
(45) **Date of Patent:** **Dec. 25, 2007**

- (54) **STORAGE AND REPRODUCTION APPARATUS**
- (75) Inventor: **Kenichi Iida, Saitama (JP)**
- (73) Assignee: **Sony Corporation, Tokyo (JP)**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 431 days.

- (21) Appl. No.: **10/870,195**
- (22) Filed: **Jun. 17, 2004**

JP	64-27061	1/1989
JP	3-29144	2/1991

- (65) **Prior Publication Data**
US 2004/0225828 A1 Nov. 11, 2004

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(Continued)

Related U.S. Application Data

- (62) Division of application No. 10/043,506, filed on Jan. 10, 2002, now Pat. No. 6,775,753, which is a division of application No. 09/703,885, filed on Nov. 1, 2001, now Pat. No. 6,339,814, which is a division of application No. 09/128,744, filed on Aug. 4, 1998, now Pat. No. 6,490,235.

Primary Examiner—Tuan V. Thai
(74) Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

- (30) **Foreign Application Priority Data**

Aug. 7, 1997	(JP)	P9-213656
Aug. 8, 1997	(JP)	P9-215209

(57) **ABSTRACT**

A portable reproducing apparatus includes a storage medium, a reproduction unit, an operation unit, and a controller. The storage medium stores a digital input signal and auxiliary associated with the digital input data. The reproduction unit converts a digital signal read out from the storage medium into a hearable sound for the reproduction output. The operation unit is provided on a main body of the portable reproduction apparatus. The controller selects auxiliary data according to an input from the operation unit and reads out the input data associated with the selected auxiliary data from the storage medium and transmits it to the reproduction unit. The controller selects forward auxiliary data when an operation of the operation unit corresponds to a rotation in one direction around an imaginary axis perpendicular to the portable reproduction apparatus and selects backward auxiliary data when the operation of the operation unit corresponds to a rotation in another direction around the imaginary axis.

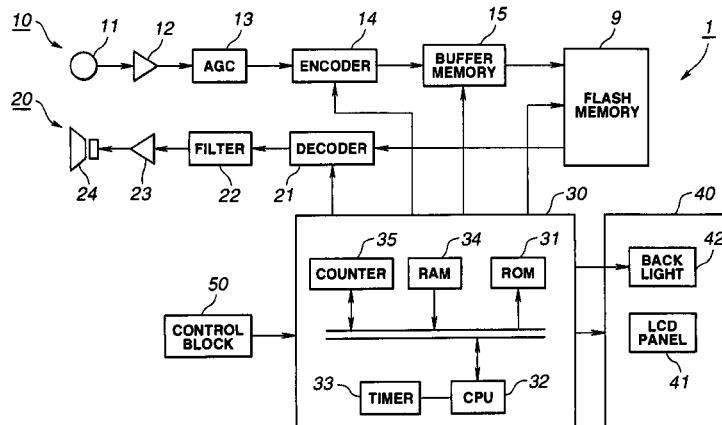
- (51) **Int. Cl.**
G06F 12/00 (2006.01)
G06F 13/00 (2006.01)
- (52) **U.S. Cl.** 711/103; 711/105; 711/115; 711/154
- (58) **Field of Classification Search** 711/100, 711/103, 154, 161, 162, 115; 369/47.1
See application file for complete search history.

- (56) **References Cited**

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11 Claims, 15 Drawing Sheets



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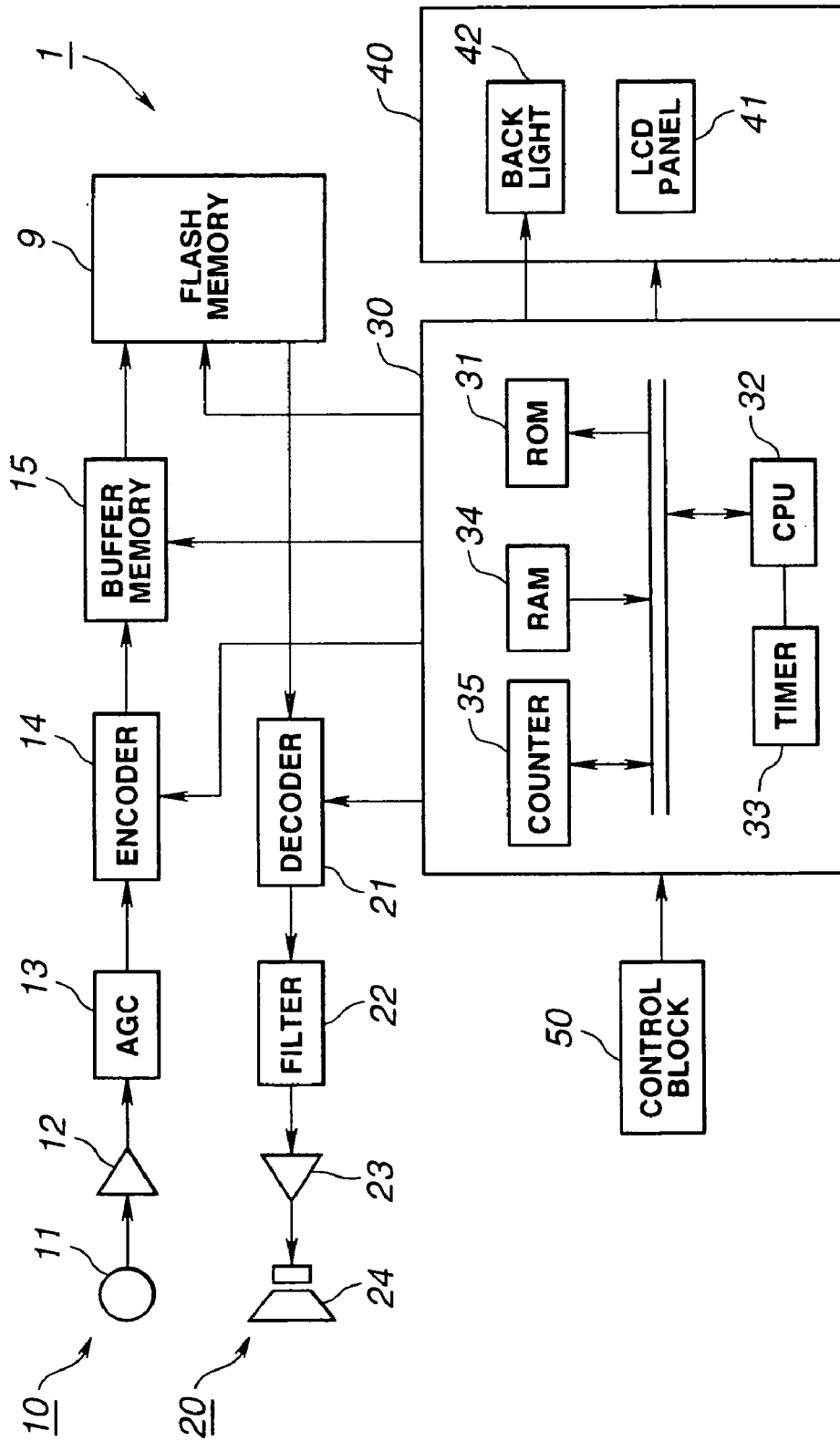


FIG.1

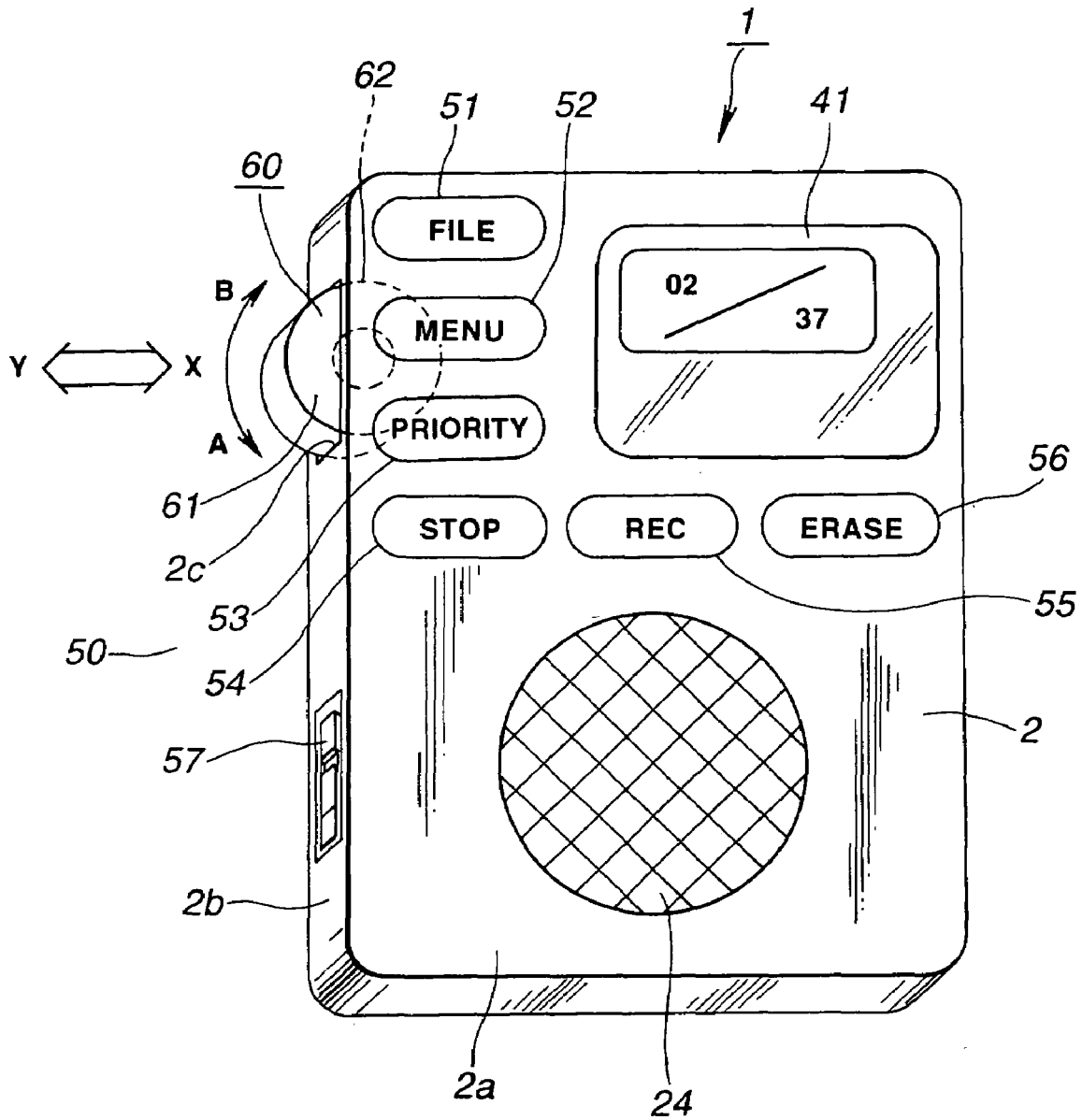


FIG.2

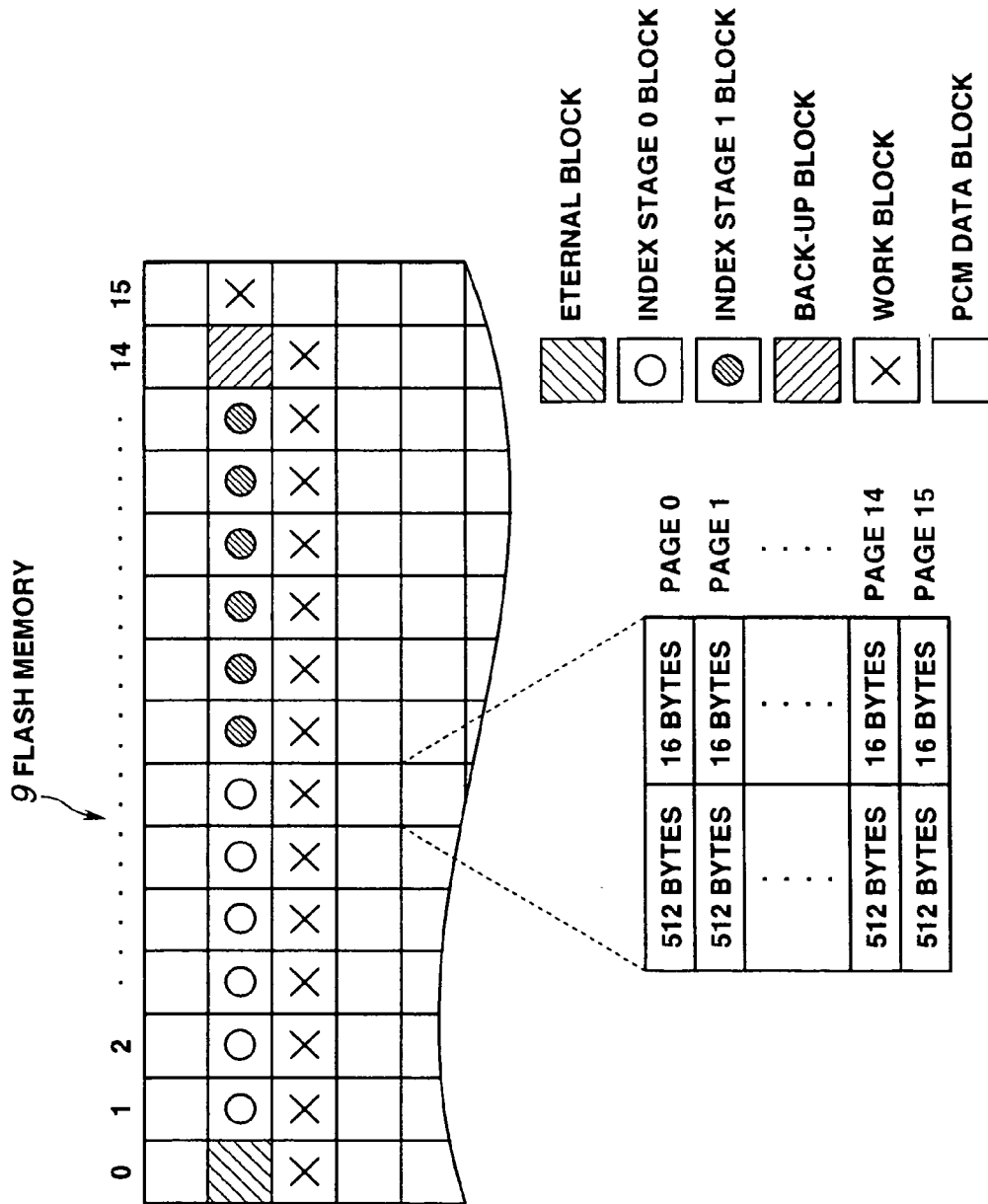


FIG.3

ADDRESS	CONTENTS
0 Byte	FOR ETERNAL BLOCK RECOGNITION
1 Byte	FOR ETERNAL BLOCK RECOGNITION
2 Byte	FOR ETERNAL BLOCK RECOGNITION
3 Byte	FOR ETERNAL BLOCK RECOGNITION
4, 5 Byte	ETERNAL BLOCK ADDRESS
6, 7 Byte	INDEX STAGE 0 ADDRESS
8, 9 Byte	INDEX STAGE 1 ADDRESS
10, 11 Byte	WORK AREA BLOCK START ADDRESS (UPPER)
12 Byte	DUMMY DATA
↓	↓
15 Byte	DUMMY DATA
16 Byte	BLANK MAP
↓	BLANK MAP
143 Byte	BLANK MAP
	NO DATA (0 × FF)

FIG.4

PAGE	CONTENTS
Page 0	ADR DATA BLOCK
Page 1	(PCM DATA START AND END ADDRESS, SP/LP)
Page 2	6 Byte \times (469 \times 2 block) = 5628 byte
Page 3	5628 byte = 10.99 page
Page 4	
Page 5	
Page 6	
Page 7	
Page 8	
Page 9	
Page 10	
Page 11	
Page 12	HDR DATA BLOCK
Page 13	(PRIORITY, ALARM DATA)
Page 14	8 byte \times 99 PIECES = 792 byte
Page 15	792 byte = 1.55 page

FIG.5

01	SP	STH	STM	ENH	ENM	01	SP	STH	STM	ENH	ENM	02	SP	STH	STM	ENH	ENM
03	SP	STH	STM	ENH	ENM	03	SP	STH	STM	ENH	ENM	03	SP	STH	STM	ENH	ENM
03	SP	STH	STM	ENH	ENM	04	SP	STH	STM	ENH	ENM	05	SP	STH	STM	ENH	ENM
06	SP	STH	STM	ENH	ENM	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

SP : SP OR LP
 STH : START ADDRESS (UPPER)
 STM : START ADDRESS (LOWER)
 ENH : END ADDRESS (UPPER)
 ENM : END ADDRESS (LOWER)

FIG.6

01	PRI	ALM	AMO	ADA	AHO	AMI	AOW	02	PRI	ALM	AMO	ADA	AHO	AMI	AOW
03	PRI	ALM	AMO	ADA	AHO	AMI	AOW	04	PRI	ALM	AMO	ADA	AHO	AMI	AOW
05	PRI	ALM	AMO	ADA	AHO	AMI	AOW	06	PRI	ALM	AMO	ADA	AHO	AMI	AOW
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

PRI : PRIORITY
 ALM : ALARM SET
 AMO : ALARM MONTH
 ADA : ALARM DAY
 AHO : ALARM HOUR
 AMI : ALARM MINUTE
 AOW : ALARM DAY OF WEEK

FIG.7

PAGE	CONTENTS
Page 0	VALID MARK (0 Byte)
Page 1	MODE INTERRUPT MARK (1 Byte)
Page 2	Blank Map (0 ~ 127 Byte)
Page 3	Eternal block Blank Map (0 ~ 127 Byte)
Page 4	
Page 5	
Page 6	
Page 7	
Page 8	
Page 9	
Page 10	
Page 11	
Page 12	
Page 13	
Page 14	
Page 15	

FIG.8

ADDRESS	CONTENTS
0 Byte	ID No.
1 Byte	SP/LP INFORMATION
2 Byte	PCM DATA STORAGE START ADDRESS (UPPER)
3 Byte	PCM DATA STORAGE START ADDRESS (LOWER)
4 Byte	PCM DATA STORAGE END ADDRESS (UPPER)
5 Byte	PCM DATA STORAGE END ADDRESS (LOWER)

FIG.9

ADDRESS	CONTENTS
0 Byte	PCM DATA
1 Byte	PCM DATA
↓	PCM DATA
510 Byte	PCM DATA
511 Byte	PCM DATA
512 Byte	YEAR DATA
513 Byte	MONTH DATA
514 Byte	DAY DATA
515 Byte	HOUR DATA
516 Byte	MINUTE DATA
517 Byte	SECOND DATA
518 Byte	DAY OF WEEK
519 Byte	CLOCK SET FLAG
520 Byte	NO DATA (0 × FF)
↓	
527 Byte	

FIG.10

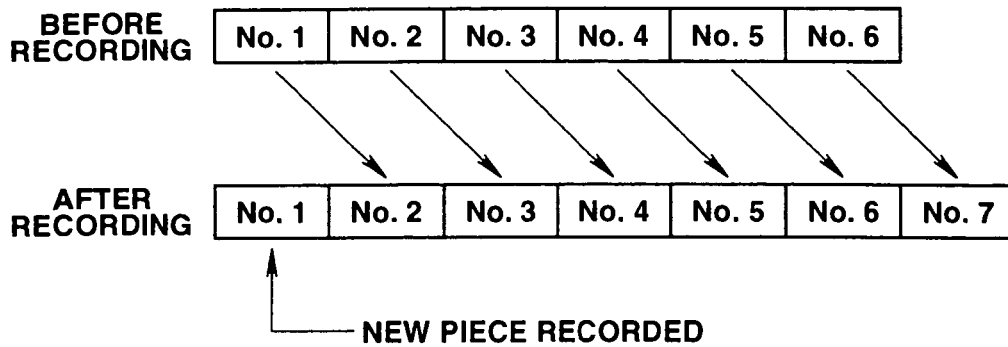


FIG.11

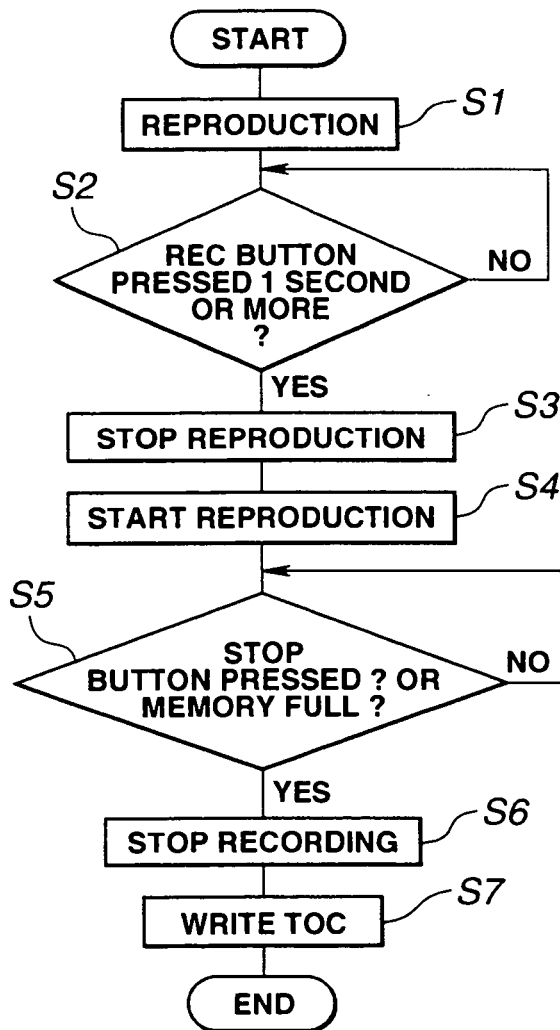


FIG.12

01	SP	STH	STM	ENH	ENM	01	SP	STH	STM	ENH	ENM	02	SP	STH	STM	ENH	ENM
02	SP	STH	STM	ENH	ENM	03	SP	STH	STM	ENH	ENM	03	SP	STH	STM	ENH	ENM
03	SP	STH	STM	ENH	ENM	03	SP	STH	STM	ENH	ENM	04	SP	STH	STM	ENH	ENM
05	SP	STH	STM	ENH	ENM	06	SP	STH	STM	ENH	ENM	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

SP : SP or LP
 STH : START ADDRESS (UPPER)
 STM : START ADDRESS (LOWER)
 ENH : END ADDRESS (UPPER)
 ENM : END ADDRESS (LOWER)

FIG.13

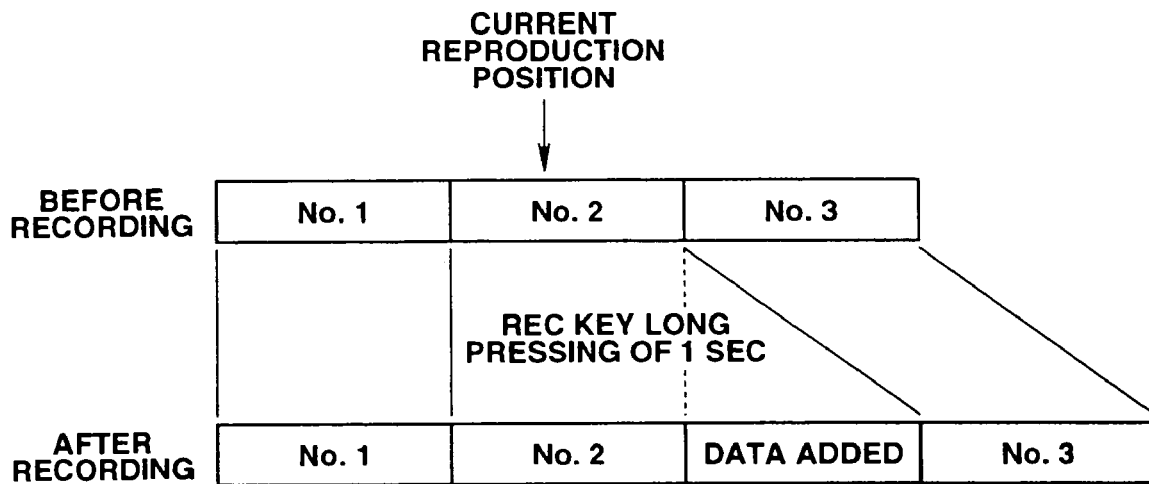


FIG.14

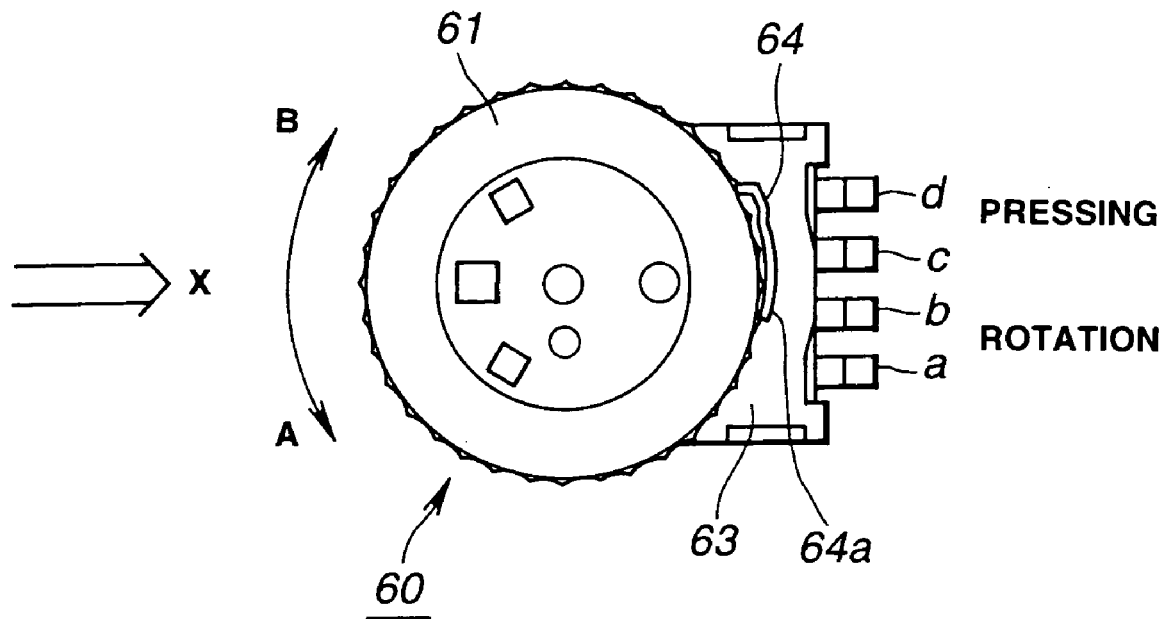


FIG.15A

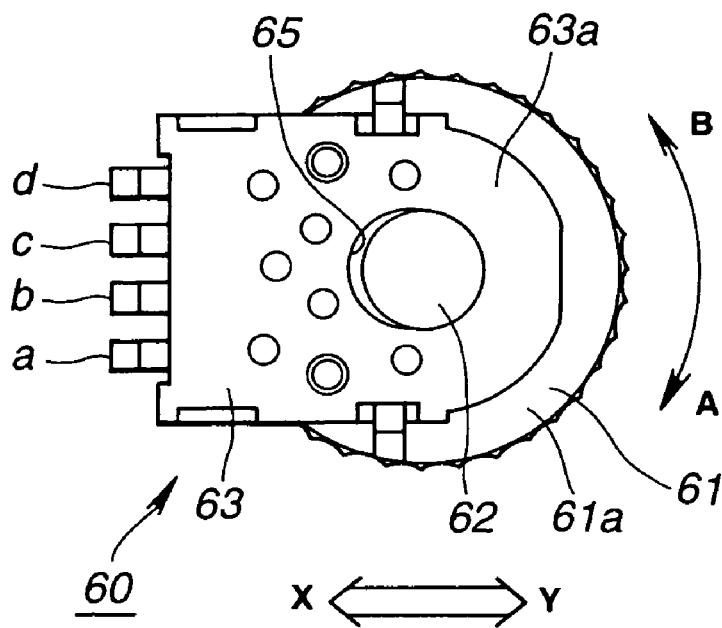


FIG.15B

SHAFT ROTATION	SIGNAL	OUTPUT WAVEFORM
CW (B DIRECTION)	α (BETWEEN TERMINATS a-c)	ON OFF
	β (BETWEEN TERMINATS b-c)	ON OFF
CCW (A DIRECTION)	α (BETWEEN TERMINATS a-c)	ON OFF
	β (BETWEEN TERMINATS b-c)	ON OFF

EACH PAIR 15 PULSES 360°

FIG.16

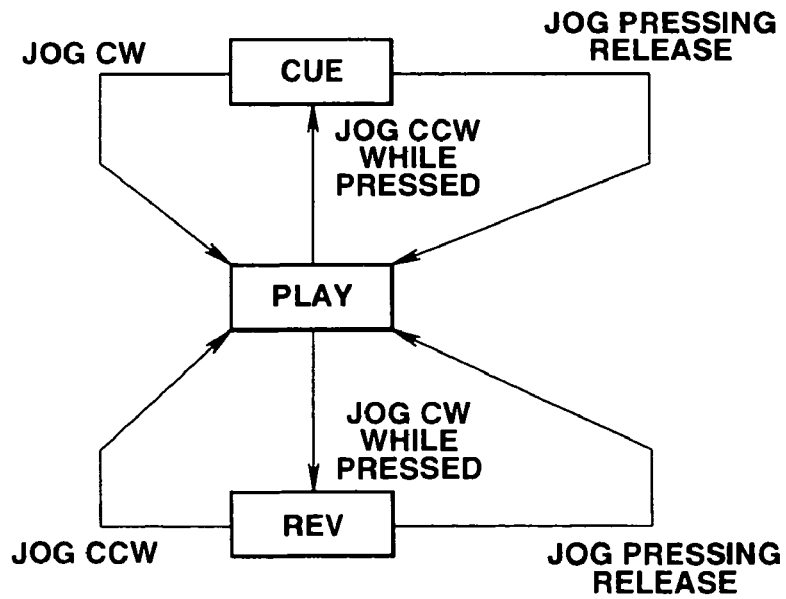


FIG.17

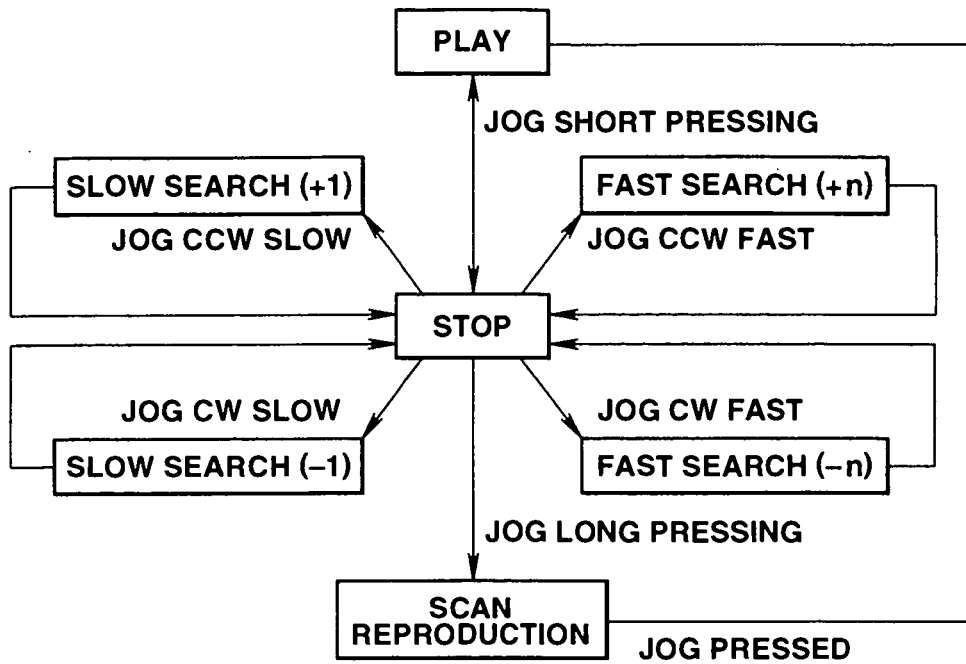


FIG.18

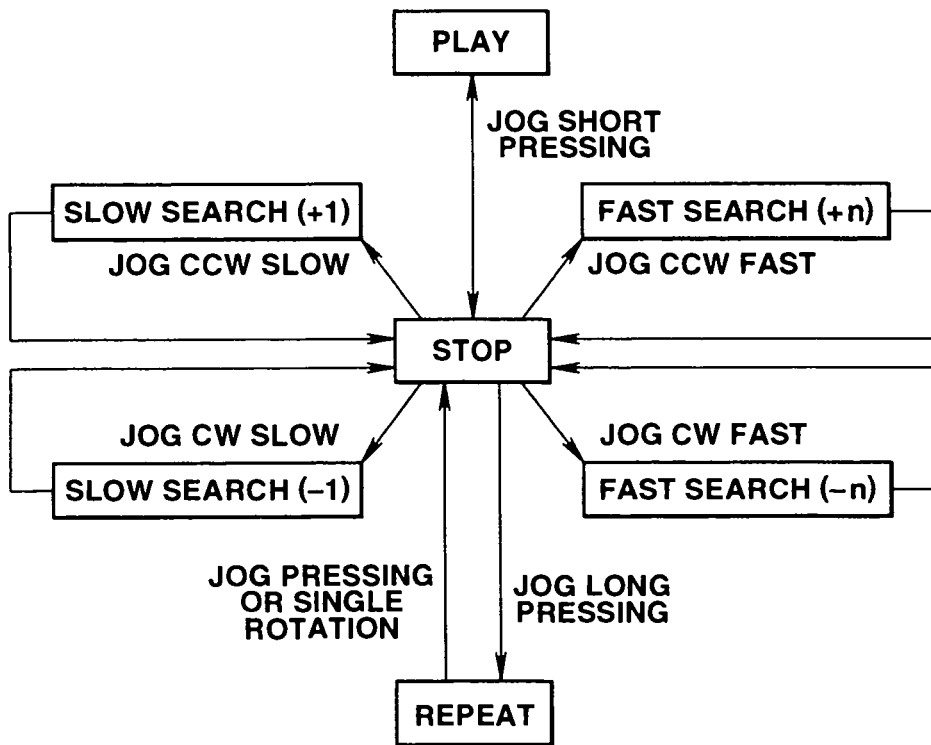


FIG.19

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STORAGE AND REPRODUCTION APPARATUS

This is a division of prior application Ser. No. 10/043,506 filed Jan. 10, 2002 now U.S. Pat. No. 6,775,753 which is a division of application Ser. No. 09/703,885 filed Nov. 1, 2001, now U.S. Pat. No. 6,339,814, which is a division of application Ser. No. 09/128,744 filed Aug. 4, 1998, now U.S. Pat. No. 6,490,235.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a storage and reproduction apparatus, and in particular to a storage and reproduction apparatus using a semiconductor memory.

2. Description of the Prior Art

Nowadays, there are recording/reproduction apparatus which can easily be used for recording/reproducing a sound just like writing down contents of a lecture or discussion on a memo paper. Such a recording/reproduction apparatus uses a semiconductor memory as a recording medium for storing a sound signals as a predetermined number of files and the sound signal is reproduced to output a sound. More specifically, the recording/reproduction apparatus stores a sound data consisting of a plurality of files in a semiconductor memory and upon reproduction, successively reproduces the sound data, starting with an older file.

When writing down contents of a discussion on a memo notebook, the latest content is written on a later page of the memo notebook. Accordingly, when reading the contents afterward, it is necessary to turn pages to read the latest contents.

This inconvenience is also met in a recording/reproduction apparatus which stores a latest sound as a last file in a semiconductor memory, which requires search of the file containing the latest sound prior to reproducing the latest sound.

Those files stored in memory can be erased when they have become unnecessary. However, when there is a necessity to reproduce a file or when new files are successively stored without any time to erase them, more important files tend to be recorded at the last write-in address or read-out address of memory. Accordingly, as more and more files are recorded, there will be contained more files which are scarcely to be accessed. Those files which are not so important are first to be read out from memory to be reproduced and the latest file which has been just recorded tends to be the last to be reproduced.

That is, when a user wants to reproduce a sound data of the latest important file, he/she needs to carry out an operation for search the target latest file from a plurality of files stored in memory. This requires a complicated operation procedure to read out a necessary file from memory and reproduce it.

In order to read out from memory and reproduce a target sound data in the aforementioned recording/reproduction apparatus using a semiconductor memory, a user needs to operate a plurality of operation buttons such as a reproduction button, forward direction search button, and reverse direction search button. More specifically, when a plurality of data pieces are recorded in a semiconductor memory, prior to reproduction, it is necessary to press a forward direction search button and a reverse direction search button to select a target data piece to be reproduced so that an index number of the target data piece is displayed in a display block of the apparatus. After this, a reproduction button is

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pressed so as to reproduce the target sound data. Here, if a plenty of index numbers are involved, the user needs to continuously press the search button so as to display the target index number.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a storage and reproducing apparatus which resolves the above-mentioned problem.

According to the present invention, there is provided a storage and reproducing apparatus including a memory, a reproduction block, an operation block, and a control block. The memory stores a data entered and an auxiliary data for the entered data. The reproduction block reproduces a data which has been read out from the memory. The operation block is provided on an apparatus main body. The operation block includes a rotary operation block provided on the apparatus main body in such a manner that the rotary operation block can be rotated around a rotation center and shifted along a plane which almost orthogonally intersects the rotation center. The control block, according to an input from the operation block, carries out writing of a data and an auxiliary data into the memory and read-out of a data stored in the memory. The control block, according to the rotation direction of the rotary operation block, reads out an auxiliary data from the memory, and when the rotary operation block is moved in the direction of the plane, reads out a data from the memory so as to be reproduced by the reproduction block according to an auxiliary data read out from the memory.

According to another aspect of the present invention, there is provided a storage and reproducing apparatus including a memory, a reproduction block, an operation block, and a control block. The memory stores a data entered and a management data for the entered data. The reproduction block reproduces a data which has been read out from the memory. The operation block is provided on an apparatus main body. The control block, according to an input from the operation block, carries out writing of a data and a management data into the memory and read-out of a data stored in the memory. The control block rewrites a management data so that a new data written into the memory is read out prior to the data already stored in the memory.

According to still another aspect of the present invention, there is provided a storage and reproducing apparatus including a memory, a reproduction block, an operation block, and a control block. The memory stores a data entered and a management data for the entered data. The reproduction block reproduces a data which has been read out from the memory. The operation block is provided on an apparatus main body. The control block, according to an input from the operation block, carries out writing of a data and a management data into the memory and read-out of a data stored in the memory. The control block operates as follows. If an instruction of a data write is issued from the operation block during a reproduction operation by the reproduction block, the control block interrupts the reproduction operation by the reproduction block and starts a data write into the memory.

According to yet still another aspect of the present invention, there is provided a storage and reproducing apparatus including a signal processing block, a memory, a reproduction block, an operation block, and a control block. The signal processing block converts a sound signal entered, into a digital signal. The memory stores a digital signal outputted from the signal processing block and a management data for

the digital signal. The reproduction block reproduces a digital signal which has been read out from the memory. The operation block is provided on an apparatus main body and includes a rotary operation block provided on the apparatus main body in such a manner that the rotary operation block can be rotated around a rotation center and shifted along a plane which almost orthogonally intersects the rotation center. The control block, according to an input from the operation block, carries out writing of a digital signal and a management data into the memory and read-out of a digital signal and a management data stored in the memory. Th control block operates as follows. According to the rotation direction of the rotary operation block, the control block reads out a management data, and when the rotary operation block is moved along the aforementioned plane, the control block reads out a digital data from the memory according to a management data read out from the memory.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a block diagram showing a specific configuration of an IC recorder according to the present invention.

FIG. 2 is an external front view of the IC recorder.

FIG. 3 shows a configuration of a semiconductor memory of the IC recorder.

FIG. 4 shows a configuration of an eternal block of the semiconductor memory.

FIG. 5 shows a configuration of an index stage block constituted by a file data of the semiconductor memory.

FIG. 6 shows a configuration of an ADR data block of the index stage block.

FIG. 7 shows a configuration of an HDR data block of the index stage block.

FIG. 8 shows a configuration of an index stage block constituted by a file data of the semiconductor memory.

FIG. 9 shows a configuration of a work area block of the semiconductor memory.

FIG. 10 shows a configuration of a PCM data block of the semiconductor memory.

FIG. 11 explains a recording position of a new sound data stored.

FIG. 12 is a flowchart explaining a CPU operation when additionally recording a new sound data as of ID number 02.

FIG. 13 shows a configuration of an ADR data of the index stage block when a new sound data is additionally recorded as of ID number 02.

FIG. 14 explains a storage position of a new sound data additionally recorded as of ID number 02.

FIG. 15A and FIG. 15B explain a configuration of a jog dial: FIG. 15A is an external front view of the jog dial and FIG. 15B is an external rear view of the jog dial.

FIG. 16 shows rotation directions of a rotation operation member in connection with signals outputted as a result of a jog dial rotation operation together with corresponding output waveforms.

FIG. 17 explains an operation of a rotary operation member associated with a cue/review reproduction and a reproduction state transition corresponding to the operation of the rotary operation member.

FIG. 18 a processing carried out when the rotary operation member is rotated or pressed in a stop state.

FIG. 19 shows a processing carried out when the rotary operation member s rotated or pressed in a sound data reproduction state.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Hereinafter, description will be directed to a storage and reproducing apparatus according to embodiments of the present invention with reference to the attached drawings. In the embodiments described below, explanation will be given on a recording/reproduction apparatus (hereinafter, referred to simply as an IC recorder) using a semiconductor memory for recording or reproducing a sound signal.

Referring to FIG. 1, this IC recorder 1 includes: a recording block 10 for converting an analog sound signal from a microphone 11, into a digital sound data and storing the digital sound data in a semiconductor memory 9; a reproduction block 20 for reading out the sound data stored in the semiconductor memory 9 and converting the read out sound data into an analog sound signal for reproduction output from a speaker 24; a control block 30 for controlling apparatus components including the recording block 10; a display block 40 for displaying an operation state and an operation procedure; and an operation block 50 through which a user enters various operations.

The recording block 10 has: an amplifier 12 for amplifying an analog sound signal outputted from the microphone 11; an automatic gain controller (hereinafter, referred to as AGC) circuit for adjusting a level of the sound signal amplified by the amplifier 12; an encoder 14 for converting the sound signal from the AGC 13, into a sound data; and a buffer memory 15 for temporarily accumulating the sound data from the encoder 14.

In the recording block 10, the microphone 11 converts a speaker's voice into an analog signal for supply to the amplifier 12. The amplifier 12 amplifies the analog sound signal for supply to the AGC 13. The AGC 13 amplifies the signal from the amplifier 12 so that the analog sound signal is at a proper level for supply to the encoder 14.

Because the analog sound signal supplied via the AGC 13 has a strong temporal correlation, the encoder 14 employs, for example, the adaptive differential pulse code modulation (hereinafter, referred to ADPCM) to encode an analog sound signal with a small data amount, to create a digital sound data and supplies the created sound data to the buffer memory 15. The encoder 14 can adjust a sound data coding amount according to two modes. For example, in an SP mode, a sound signal is sampled with an 8 kHz sampling frequency if in an SP mode and with a 4 kHz sampling frequency if in an LP mode so as to adjust a sound signal coding amount in the temporal axis direction.

The buffer memory 15 temporarily accumulates a sound data supplied from the encoder and supplies the accumulated data to the semiconductor memory 9.

The semiconductor memory 19 is constituted, for example, by an electrical erasable/programmable read only memory (hereinafter, referred to as an EEPROM), i.e., a non-volatile semiconductor memory which maintains a storage content of a storage element even if a memory drive power is turned off. This semiconductor memory 9 stores a sound data supplied from the buffer memory 15 and a management information (hereinafter, referred to as a TOC information) for carrying out a management, for example, which sound data is stored in which area. More specifically, the semiconductor memory 9 is, for example, a NAND type flash memory having a storage capacity of 4M×8 bits or 8×16 M bits, enabling to store a sound data corresponding to a sound signal of a predetermined frequency band for 30 minutes. For example, when the memory 9 has a storage capacity of 8×16 M bits, it is possible to store a sound data

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corresponding to a sound signal of 200 to 3400 Hz for 16 minutes in the aforementioned SP mode and to store a sound data corresponding to a sound signal of 200 to 1700 Hz for 24 minutes in the aforementioned LP mode.

On the other hand, the reproduction block 20, as shown in FIG. 1, has a decoder 21 for converting a sound signal read from the semiconductor memory 9, into a sound signal, a filter 22, and an amplifier 23 for amplifying the sound data from the filter 22 for supply to a loud speaker 24.

The decoder 21 corresponds to the encoder 14 of the recording block 10, and decodes a sound data which has been encoded by the ADPCM method, so as to create a so-called PAM signal. The filter 22 removes a high frequency component exceeding a voice frequency band from the PAM signal and outputs an analog sound signal. The amplifier 23 amplifies the analog sound signal supplied from the filter 22. The loud speaker 24 is driven according to a signal from the amplifier 23. Thus, a sound recorded in the memory 9 is outputted from the loud speaker 24.

The control block 30 includes: a ROM 31 containing a program for controlling the IC recorder; a microcomputer (hereinafter, referred to as a CPU) 32 for executing the program stored in the ROM 31 to control respective blocks; a random access memory (hereinafter, referred to as a RAM) 34 for temporarily storing the time of a timer 33 for creating a clock information, a program execution result, and the like; and a counter 35 for counting pulses supplied from a jog dial which will be detailed later. The control block 30, according to an operation setting of the operation block 50, carries out operation control of respective components of the apparatus 1.

The display block 40 displays an operation state of the IC recorder 1 and a sound data storage state according to a control signal from the control block 30 and includes a liquid crystal display panel 41 and a back light 42 for illuminating this liquid crystal display panel 41.

The operation block 50 supplies various input signals to the control block 30 when carrying out a sound recording/reproduction. The operation block 50 has various operation buttons, operation switches, and a jog dial to be operated by a user as will be detailed later. In the IC recorder 1, various output signals from these operation buttons/switches and the jog dial are supplied to the control block 30.

The CPU 32 of the control block 30, according to a signal supplied from the operation block 50, reads out from the ROM 31 and executes a corresponding program and controls the respective blocks according to the program which has been read out. For example, if a recording start button which will be detailed later is pressed, the CPU 32 reads out from the ROM 31 and executes a program corresponding to a recording operation and controls to operate the amplifier 12, the AGC 13, the encoder 14, the display block 40, and the like according to the program which has been read out, so that a sound data temporarily accumulated in the buffer memory 15 is written in an empty area of the semiconductor memory, for example. For reproduction of a sound data, the CPU 32 reads out from the ROM 31 and executes a program corresponding to a reproduction operation and according to the program which has been read out, control to operate the decoder 21, the filter 22, the amplifier 23, the display block 40, and the like, so that a sound data stored in a predetermined area of the semiconductor memory 9 is read out and converted into an analog sound signal so as to be outputted from the loud speaker 24.

Thus, the control block 30 controls a sound data writing and reading out into/from the semiconductor memory 9 and write up to 99 sound data pieces, for example, into the

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semiconductor memory 9 by adding an index number to identify each of the sound data pieces. According to the index number added to each of the sound data pieces, the control block 30 controls to read out a target sound data piece from the semiconductor memory 9.

Next, explanation will be given on the operation block 50 of the IC recorder 1 with reference to FIGS. 1 and 2. FIG. 2 is an external view briefly showing an external configuration of the IC recorder 1. The IC recorder shown in FIG. 2 is a portable type has an external casing 2 of a size to be grasped by one hand. In this external casing 2 is arranged a printed circuit board (not depicted) where the aforementioned electric circuits such as recording block 10 and the reproduction block 20 are mounted. On a main surface 2a of this external casing 2 are arranged the aforementioned liquid crystal display panel 41 and the loud speaker 24.

This IC recorder 1 has on the main surface 2a and side surfaces of the external casing 2, various operation buttons/switches 51 to 57 constituting the operation block 50 and the jog dial 60. The buttons and switches of the operation block 50 are arranged on the main surface 2a and the side surfaces of the casing 2 and can be operated with left hand fingers while the entire IC recorder 1 is held on the left hand palm so that a the user can continue a work such as writing with his/her right hand.

The operation buttons involved here are, as shown in FIG. 2, FILE button 51, MENU button 52, PRIORITY button 53, STOP button 54 for stopping a recording or the like, REC button 55 for starting a recording, and ERASE button for erasing a sound data stored in the semiconductor memory 9. These operation buttons are arranged on the main surface 2a for the external casing 2. A HOLD switch 57 of slide type is provided at a lower half of a left side surface 2b of the external casing 2. The operation block 50 also includes, although not depicted, a button for turning on the back light 42 of the liquid crystal display panel 41, a volume switch for adjusting loudness of a reproduced sound, an earphone jack, and the like which are arranged on a side surface of the external casing 2.

Here, the FILE button 51 is used to switch between a plurality of files set in the IC recorder 1. The term file corresponds to a directory or folder used in a personal computer. In this embodiment, five types of files are set beforehand. That is, in this IC recorder 1, each of the files can store up to 99 sound data pieces. The file types can be identified by displaying different icons on the liquid crystal display panel 41.

The MENU button 52 is used to operate during a stop state of recording/reproduction so as to modify the initial setting of the IC recorder 1 such as modification of a data and time, modification of a frequency band of a sound data to be recorded, modification of output of a beep sound and alarm sound given upon pressing of the operation buttons, modification of sensitivity of the microphone, and the like.

The PRIORITY button 53 is pressed during a reproduction operation or a stop state of the apparatus 1 so as to determine the reproduction priority for a sound stored in the memory 9. When this PRIORITY button 53 is pressed, an index number of a target sound data such as a data which is being reproduced is modified to a smaller number. In that file, a sound data having an index number modified by the PRIORITY button 53 is reproduced with a higher priority.

The HOLD switch 57 is used to maintain an operation state or a stop state of the IC recorder 1. When this HOLD switch 57 is in ON state, the IC recorder 1 is in a state not to accept operation of the operation buttons 51 to 56 and the

jog dial **60**. The configuration of the jog dial **60** and a reproduction operation using the jog dial **60** will be detailed later.

Here, as shown in FIG. 3, when a sound data and other data are stored in the semiconductor memory **9**, the data is divided into 512 blocks which are erase units. These blocks are grouped into six types as follows: an eternal block (1 block), index stage **0** blocks (6 blocks), index stage **1** blocks (6 blocks), a back-up block (1 block), work area blocks (15 blocks), and PCM data blocks (469 blocks).

The aforementioned TOC information consists of the eternal block, index stage **0** block, index stage **1** block, back-up block, and work area block. A sound data is written into PCM data blocks.

As shown in FIG. 3, each of the blocks consists of 16 pages (each page consisting of 528 bytes): page **0**, page **1**, . . . , page **14**, page **15**. Each one page consists of a 512-byte data area and a 16-byte redundant area. Ten blocks at maximum exist as blocks disabled for data recording and/or reproduction (hereinafter, referred to as invalid blocks).

The eternal block is provided other than at the first and the last blocks of the memory **9**, .e., other than at the memory write-in or read-out start and end addresses. The eternal block contains a management information which is first to be read out from the memory **9**. According to the data of the eternal block, the index stage **0** blocks and the index stage **1** blocks are read out. Thus, the eternal block is indispensable for reading out a data stored in the other blocks and accordingly located at a position other than the head and end addresses of the memory **9** which have the highest possibility of destruction upon an abnormal operation such as static electricity and an abnormal voltage. For example, if a block containing a sound data is destroyed, the data in the broken block can be erased so that a new sound data can be recorded without any problem. However, if the eternal block is destroyed, no data can be read out from the other blocks. To avoid such a situation, the eternal block is located, as has been described above, at other than the blocks of the memory **9** start and end addresses.

In the eternal block, only page **0** contains a data, and pages **1** to **15** contain no data. More specifically, as shown in FIG. 4, page **0** of the eternal block includes a 4-byte eternal block recognition data, 2-byte eternal block address, 2-byte index stage **0** address, 2-byte index stage **1** address, 2-byte work area block start address, 4-byte dummy data, and 128-byte blank map. The blank map indicates locations of the aforementioned invalid blocks.

The index stage **0** blocks and the index stage **1** blocks have an identical data configuration and these blocks are alternately rewritten for each sound data rewriting. That is, when a sound data is written in the memory **9**, for example, a data in an index stage **0** block is rewritten, and when another sound data is written in the memory **9**, a data in an index stage **1** block is rewritten. Hereinafter, these blocks will be referred to as index stage blocks in general.

As has been described, there are 6 index stage blocks for stage **0** and stage **1**, respectively: five blocks containing a file data and one block containing a stage data.

FIG. 5 shows a configuration of an index stage block having a file data which consists of an ADR data block of page **0** to page **11** and an HDR block of page **12** to page **15**.

FIG. 6 shows a configuration of the ADR data block, which has, for example, ID numbers **01** to **06**; SP which indicates the recording mode SP or LP corresponding to a coding amount by the aforementioned encoder **14** for each of the files containing a sound data; STH indicating an upper

start address and STM indicating a lower start address of the file; ENH indicating an upper end address and ENM indicating a lower end address of the file.

For example, when 6 sound data pieces are recorded, as shown in FIG. 7, in the ADR data block, index numbers **01** to **06** are recorded corresponding to the six sound data pieces. This index number is a data indicating a reproduction sequence of the six sound data pieces recorded. For each of the index numbers, recording mode (SP) together with a start address (STH, STM) and an end address (ENH, ENM) of the area containing the sound data are recorded. Because the sound of the index number **01** and the sound data of the index number **03** have a large capacity, as shown in FIG. 6, the index number **01** consists of two files and the index number **03** consists of four files, for example. In this case, for each of the files, a recording mode and a start address and an end address are recorded.

FIG. 7 shows a configuration of the HDR block. The following are recorded for each file; PRI indicating a file priority set by operation of the PRIORITY button **53** of the operation block **50**; ALM indicating ON/OFF of the alarm setting by the operation of the MENU button **52**; AMO, ADA, AHO, AMI, and AOW indicating the month, day, hour, minute, day of the week when the alarm is to be actuated. Here, as has been described above, the priority indicates a reproduction priority of a sound data when the sound data is reproduced. The HDR data block is updated when the priority or alarm setting is modified by operation of the PRIORITY button **53** and the MENU button **52** even if no sound data is updated.

On the other hand, the index stage block containing a stage data, as shown in FIG. 8, has a valid mark on page **0**, a mode interruption mode on page **1**, a blank map on page **2**, an eternal block blank map on page **3**.

The back-up block is a back-up for the aforementioned eternal block and is a copy of the eternal block. Consequently, when the eternal block is rewritten, the back-up block is also rewritten. There may be more than one back-up blocks.

The work area block is an area for temporarily recording an index data during a sound data recording. As shown in FIG. 9, the work area block has an almost identical data configuration as the index stage block. The work area block contains an index number, SP/LP information indicating the recording mode, a sound data upper start address, a sound data lower start address, a sound data upper end address, a sound data lower end address, each of which consists of 1 byte. In this work area block, while reading data from the work area block, the index stage block is rewritten and the data such as the start address is directly written as it is.

The PCM data block is an area where a sound data is mainly recorded. As shown in FIG. 10, in the PCM data block, each one page contains besides a sound data, the year, month, day, hour, minute, second, and day of the week created by the timer **33** are also recorded. More specifically, a 512-byte sound data, 1-byte data of year, 1-byte data of month, 1-byte data of day, 1-byte data of hour, 1-byte data of minute, 1-byte data of second, and 1-byte clock set flag are recorded on one page.

In the IC recorder **1** having the aforementioned configuration, if the REC button **56** is pressed when no recording or reproduction is carried out, the CPU **32** controls to write a sound data in the semiconductor memory **9**. It is assumed that in the semiconductor memory **9**, already six sound data pieces have been recorded as shown in FIG. 6.

More specifically, when the REC button **56** is pressed, the CPU **32** reads out from the ROM **31** and executes a program

corresponding to the recording operation so that the amplifier **12**, the AGC **13**, and the encoder **14** are actuated and a sound data delayed with a predetermined time via the buffer memory **15** is stored in the PCM data block of the semiconductor memory **9**.

For each of the data blocks, the CPU **32** stores a 512-byte sound data and creates a data of the recording year, month, day, hour, and minute to be recorded together with the sound data in the PCM data block. The CPU **32** controls to write a sound data as one sound data piece in the PCM data blocks of the semiconductor memory **9** until the STOP button is pressed.

When the STOP button is pressed, the CPU **32** terminates to control to record the sound data in the PCM data blocks and rewrites the TOC information of the memory **9**. More specifically, the index stage block is rewritten.

In the ADR data block of the index stage block containing a file data, the CPU **32** assigns an index number **01** to the 7-th sound data piece and writes in a data of mode setting, start address, and end address. The CPU **32** changes the previous index numbers **01** to **06** respectively to the index numbers **02** to **07** and writes in a data of the mode setting, start address, and end address of the respective index numbers.

This processing is illustrated in FIG. **11**. The CPU **32** assigns the index number **01** to the latest 7-th sound data piece recorded and shift by **1** the previous index numbers **01** to **06** respectively to index numbers **02** to **07** and rewrites the TOC information. That is, the latest sound data piece is recorded in the memory **9** with the index number **1**.

Next, explanation will be given on reproduction of a sound data.

If a user presses the jog dial shown in FIG. **2** in the direction of the arrow X when the apparatus **1** is in the stop state, the CPU **32** resumes a reproduction. That is, according to an eternal block recognition data of the eternal block from the memory **9**, the CPU **32** recognizes the eternal block and reads out a data from this eternal block. It should be noted that if the CPU **32** fails to recognize the eternal block shown in FIG. **3**, the CPU **32** recognizes the back-up block and reads out a data from this back-up block.

According to an index stage **0** address or index stage **1** address in the eternal block or in the back-up block, the CPU **32** reads out a data of the index stage block.

The CPU **32** uses the ADR data block of the index stage block containing a file data to control read-out of a sound data from PCM data blocks. Here, the CPU **32** reads out a sound data in the order of index number **01**, index number **02**, index number **03**, More specifically, firstly, according to the start address (STH, STM) and end address (ENH, ENM) of the index number **01** in the ADR data block, the CPU **32** reads out a sound data of index number **01**. The sound data which has been read out is converted into a sound signal via the decoder **21** and the filter **22** for supply to the loud speaker **24**. Thus, the sound of index number **01** is outputted from the loud speaker **24**.

The CPU **32** continues read-out of the sound data from the memory **9** until the STOP button **55** shown in FIG. **2** is pressed. That is, after the sound of index number **01** is outputted from the loud speaker **24**, the CPU **32** reads out a sound data of index number **02**, a sound data of index number **03**, . . . in this order.

As has been described above, in the IC recorder **1**, as shown in FIG. **11**, when a new sound data is recorded, it is stored in the semiconductor memory **9** as the latest sound data of index number **01** so that reproduction is carried out in the order of index number **01**, index number **02**, index

number **03**, This is because a sound data of a smaller index number tends to be more important than a sound data of a greater index number. The aforementioned control enables to set an important sound data piece with an earlier index number. Thus, there is no need of searching an important latest sound piece, which enhances operability.

In the IC recorder **1**, it is also possible to add another sound data to a sound data which has been recorded as an additional recording. Here, the CPU **32** executes a processing of step **1** and after shown in FIG. **12**.

For example, if a user presses the REC button **56** while the IC recorder is reproducing a sound data of index number **02** (step S1), the CPU **32** actuates the timer **3** and determines whether the REC button **56** is pressed for 1 second or more (step S2). If it is determined that the REC button **56** has been pressed for 1 second or more, the CPU **32** interrupts the reproduction of the sound data of index number **02** (step S3), and if it is determined that the REC button **56** has not been pressed for 1 second or more, the CPU **32** continues the reproduction.

After the reproduction is interrupted, the CPU **32** controls to start recording of a sound inputted from the microphone **11** (step 4) and write the sound data in a PCM data block of the memory **9**. The CPU **32** continues the recording until the STOP button **55** is pressed or the storage capacity of the semiconductor memory **9** becomes full (step S5). When the STOP button **55** is pressed or the storage capacity of the semiconductor memory **9** has become full, i.e., there is no more area for writing a sound data, the CPU terminates the recording (step S6).

After the reproduction is terminated, the CPU **32** executes rewriting of the TOC information of the sound data (step S7). More specifically, as shown in FIG. **13**, in the ADR data block of the index stage block containing a file data, the CPU **32** firstly writes a start address (STH, STM) and end address (ENH, ENM) of the index number **01** and index number **02** which were present prior to the recording. Next, the CPU **32** controls to write a start address and end address indicating the recording position of a new sound data which has been recorded additionally as index number **02** and to write again the start address and the like of the sound data of index number **03** and after which were present prior to the recording. Thus, the CPU **32** assigns an index number **02** for a new sound data to be additionally recorded and writes its start address (STH, STM) and end address (ENH, ENM).

Consequently, in the C recorder **1**, when the jog dial **60** is operated and reproduction is started, sound data reproduction is carried out in the order of index number **01**, index number **02**, Here, as shown in FIG. **14**, the sound data piece additionally recorded is outputted as index number **02** immediately after the sound data portion of index number **02** which has been recorded in advance.

That is, in the IC recorder **1**, it is possible to select one piece from a plurality of pieces already recorded and additionally record a new piece to be added to the selected piece. Thus, the user can record a new data piece with a desired index number to be added to the selected one of the pieces already recorded. This enables to significantly enhance the operability, eliminating time required for searching a desired piece. This additional recording can be carried out without changing the operation block **50** and accordingly without increasing production costs.

In the aforementioned embodiment, explanation has been given on a case an additional recording mode is set in when the REC button **56** is pressed for 1 second or more while a

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predetermined file is read out from the memory 9 and reproduced, but the additional recording mode is not to be limited to this case.

For example, the additional recording mode can be set by the CPU 32 if the REC button 56 is pressed for predetermined period of time (for example, 2 seconds) after the reproduction of file of index number 02 is interrupted by a user. When the additional recording mode is set in, the CPU 32 executes the processing of step S4 and after so as to record a new sound data as of index number 02 in the semiconductor memory 9.

Next, explanation will be given on the reproduction operation using the jog dial 60 and the configuration of the jog dial 60. In the IC recorder 1, a portion of the jog dial 60, i.e., a portion of the rotational operation member which will be detailed later, is exposed from a cut-off portion 2c formed on the upper half of the left side surface 2b of the external casing 2. This jog dial 60 includes a disc-shaped rotation operation member 61 having a rotation center shaft 62 and other members which will be detailed later and most of the members of the jog dial are contained in the external casing 2 and only a portion of the rotary operation member 61 is exposed outside from the cut-off portion 2c. The rotation operation member 61 of the jog dial 60 can be rotated around the rotation center shaft 62 in the directions of A and B indicated in FIG. 2.

Furthermore, the rotary operation member 61 of the jog dial 60 is provided in such a manner that the rotary center shaft 62 can be moved in side the external casing 2 in the directions of X and Y indicated in FIG. 2. In a normal state, i.e, when the jog dial 60 is in a non-operation state, the member 61 is urged by a spring (not depicted) in the direction of arrow Y so that a portion of the member 61 protrudes from the cut-off portion 2c. Accordingly, the rotary operation member 61 of the jog dial 60 can be operated by a user so as to rotate in the directions of arrow A and arrow B indicated in FIG. 2 as well as to move by pressing along plane which almost orthogonally intersects the rotation center shaft 62, i.e., in the direction indicated by arrow X in FIG. 2, which brings the rotary operation member 61 inside the external casing 2.

When this rotary operation member 61 is rotated in the direction of arrow A or B indicated in FIG. 2, the jog dial 60 supplies an output signal according to the rotation angle and rotation speed to the control block 30. When this rotary operation member 61 is pressed in the direction of arrow X indicated in FIG. 2, an output signal corresponding to the pressing time of the member 61 is supplied to the control block 30. More specifically, in the IC recorder 1, the control block 30 detects the rotation direction, rotation angle, and rotation speed of the rotary operation member 61, or detects whether the rotary operation member 61 is pressed and whether the pressing of the rotary operation member 61 exceeds a predetermined period of time. The control block 30 reads out a program from the ROM 31 corresponding to a detection result and executes the program so as to control the operation of the respective components of the apparatus 1. It should be noted that the control operation by this control block 30 will be detailed later.

This jog dial 60 is operated by a user in various cases including a case to carry out various operations in reproduction or a case to modify the initial setting of the aforementioned date and time. That is, this jog dial 60 is used with a high frequency. For this, the jog dial 60 is provided at the side surface of the external casing 2 as shown in FIG. 2 so that the user can hold the external casing 2 with his/her left hand and rotate and press the rotary operation member 61

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which partially protrudes from the cut-off portion 2c with his/her left hand thumb alone.

Referring to FIG. 15A, FIG. 15B, and FIG. 16, configuration of this jog dial 60 will be detailed below. FIG. 15A is a front view of the jog dial 60, i.e., an external view from the main surface 2a of the external casing 2. FIG. 15B is an external view from the rear face. As shown in FIG. 15A and FIG. 15B, the jog dial 60 includes the aforementioned rotary operation member 61, a base member on which this rotary operation member 61 is attached, a leaf-spring-shaped electrode 64, and four terminals a, b, c, and d which are mounted on the base member 63.

The base member 63 is made from an insulating material and has a main surface portion 63a attached inside the external casing 2 so that the entire jog dial 60 is fixed to the external casing 2. As shown in FIG. 15B, the base member 63 has a cut-off portion 65 of an elliptic shape having a longer axis in the direction of arrows X and Y. In the cut-off portion 65 is fitted the rotation center shaft 62 of a circular shape provided at the center of one main surface 61a of the rotary operation member 61 in such a manner that the shaft 62 can be rotated and shifted in the directions indicated by the arrows X and Y in FIG. 15B along a plane which almost orthogonally intersects the rotation center shaft 62.

The electrode 64, as shown in FIG. 15A, is made from a leaf spring which has been bent. The electrode 64 has a base end fixed to the base member 63. The plurality of terminals a, b, c, and d attached to the base member 63 are respectively connected to the control block 30 shown in FIG. 1. Here, the terminals a and b function to output an output signal based on the rotation of the rotary operation member 61. The terminal d functions to supply an input signal based on the pressing of the rotary operation member 61 in the direction of arrow X. The terminal c serves as a common grounding for the terminals a, b, and d.

When the rotary operation member 61 is pressed in the direction of arrow X, a tip end 64a of the electrode 64 is moved in the direction indicated by arrow X and brought into contact with the other electrode (not depicted). When the electrode 64 is brought into contact with this other electrode (not depicted), the jog dial 60 supplies an output signal from terminal d to the control block 30 which signal indicating that the rotary operation member 61 is pressed by the user. When the pressing of the rotary operation member 61 is stopped, the contact between the electrode 64 and the other electrode (not depicted) is released and supply of the output signal from terminal d to the control block 30 is terminated. The control block 30 detects the output signal supplied from terminal d indicating that the rotary operation member 61 is pressed and detects whether supply of this signal from terminal d has continued for a predetermined period of time. According to a result of the detection, the control block 30 reads out from the ROM 31 a program corresponding to the detection result and executes operation or control according to the program which has been read out.

As shown in FIG. 16, when the rotary operation member 61 is rotated in the direction of arrow A or B, the jog dial 60 outputs a 2-phase pulse signal. That is, if the rotary operation member 61 is rotated clockwise, i.e., in the direction of arrow B, a signal α is outputted from between the terminals a-c and a signal β , from between the terminals b-c with different phases from each other. Similarly, if the rotary operation member 61 is rotated counterclockwise, i.e., in the direction of arrow A, a signal α is outputted from between terminals a-c and a signal β , from between the terminals b-c with different phases from each other. As shown in FIG. 16, a pulse signal is outputted in such a manner that when the

rotary operation member **61** is rotated clockwise, the signal β is slightly delayed from the signal α , and when the rotary operation member **61** is rotated counterclockwise, the signal α is slightly delayed from signal β . Consequently, the control block **30** can identify the rotation direction of the rotary operation member **61** by detecting which of the signals α and β has a delayed phase.

While the jog dial **60** is rotated by 360 degrees clockwise or counterclockwise, a pulse is generated 15 times by the signal α and signal β , respectively. That is, when the rotary operation member **61** is rotated by $\frac{1}{15}$ turn (24 degrees), a pulse is generated by once by the signal α and signal β , respectively. Consequently, the control block **30** can detect the rotation angle of the rotary operation member **61** by counting the number of pulses by using the counter **35**. Furthermore, by counting the number of pulses for a predetermined period of time by using the counter **35**, the control block **30** can detect a rotation speed of the rotary operation member **61**.

In the IC recorder **1** having the aforementioned configuration, for example, if the FILE button **51** is pressed prior to carrying out a recording, the control block **30** controls to read out a data from the ROM **31** and icons corresponding to various files appear on the liquid crystal panel **41**. One of the icons on the display panel **41** can be selected by rotating the rotary operation member **61** of the jog dial **60** in the direction of arrow A or B in FIG. 2 and the selected icon can be specified by pressing the rotary operation member **61** in the direction of arrow X so that a new sound data will be stored in the specified file. If the MENU button **52** is pressed prior to carrying out a recording, the control block **30** reads out from the ROM **31** a data on the initial setting and a initial setting state appears on the liquid crystal display panel **41**. In order to modify a current initial setting, the rotary operation member **61** is rotated in the direction of arrow A or B so as to select a target item. When this selection is complete, the rotary operation member **61** is pressed in the direction of arrow X so that the selected item can be modified. In this state, the rotary operation member **61** is rotated and pressed to modify the initial setting.

When the REC start button **55** of the IC recorder **1** is pressed, the IC recorder **1** enters a recording start state. When the user speaks something toward the microphone **11**, a sound data is written in a PCM data block of the semiconductor memory **9** specified by the aforementioned operation of the jog dial **60**. When the STOP button is pressed, the recording state is released. When the sound data is recorded in the semiconductor memory **9**, the aforementioned TOC information and a data on the file number and index number are created as an auxiliary data or a management data by the control block **30** and written into the memory **9**.

Next, explanation will be given on reproduction of a sound data recorded or stored in the IC recorder **1**. In the same way as in recording, for example, the FILE button **51** is pressed so that a data is read out from the ROM **31** by the control block **30** and icons corresponding to various files appear on the liquid crystal panel **41**. The rotary operation member **61** of the jog dial **60** is rotated in the direction of arrow A or B to select one of the icons on the liquid crystal panel **41**. When the selection is complete, the rotary operation member **61** is pressed in the direction of arrow X so as to specify the selected icon so that a sound data stored in PCM data blocks of the specified file will be reproduced. On the liquid crystal panel **41** of FIG. 2, only **02/37** associated with the index number is displayed for convenience of explanation, but actually, various icons and time appear on the liquid crystal panel **41**. In the example of FIG. 2, the

denominator **37** represents the number of sound data pieces stored in the memory **9**, and the numerator **02** represents the index number which is currently reproduced or which can be reproduced immediately. In this case, a file contains 37 sound data pieces stored in the memory **9** and a sound data of index number **02** is being reproduced or in a state to be reproduced immediately.

Here, when the IC recorder **1** is in the state to be reproduced immediately, reproduction of the sound data of the selected index number is started by operating the rotary operation member **61** of the jog dial **60** as follows.

When the rotary operation member **61** is rotated counterclockwise, i.e., in the direction of arrow A, the control block **30** executes a forward search. More specifically, according to the number of pulses based on the signals α and β shown in FIG. 16, the control block **30** reads out later index numbers from the semiconductor memory **9** so as to be successively displayed on the liquid crystal panel **41** (in this case, **03/37**, **04/37**, **05/37** . . .). On the other hand, if the jog dial **60** is rotated clockwise, i.e., in the direction of arrow B, the control block executes a backward search. More specifically, according to the number of pulses based on the signals α and β , the control block **30** reads out earlier index numbers from the semiconductor memory **9** (in this case, **01**, **37**, **36** . . .) so as to be successively displayed on the liquid crystal panel **41**.

When the user has found the index number of the sound data to be reproduced and presses the rotary operation member **61**, the control block **30** detects an output signal supplied from the terminal d of the jog dial **60** and controls to read out from the memory **9** the sound data corresponding to the index number selected by operation of the jog dial **60** and start reproduction of the sound data. In this reproduction state, if the rotary operation member **61** is pressed in the direction of arrow X for a short period of time (hereinafter, this operation will be referred to as a short pressing), the control block **30** controls to terminate the sound data reproduction. If the rotary operation member **61** is pressed in the direction of arrow X in this reproduction state for a period of time longer than a predetermined period of time (hereinafter, this operation will be referred to as a long pressing), the control block **30** executes a repeat reproduction which will be detailed later.

Next, explanation will be given on various functions upon reproduction in the IC recorder **1**. The IC recorder **1** has, during a reproduction, a function of cue/review reproduction, a function of repeat reproduction, and a function of scan reproduction. These functions can be selected and executed by operating the rotary operation member **61** of the jog dial **60** alone.

FIG. 17 shows operations of the rotary operation member **61** associated with the cue/review reproduction in relation to the reproduction state transition. Note that in FIG. 17, the rotary operation member **61** is indicated simply as JOG. In order to carry out the cue/review, when or after starting a reproduction, this rotary operation member **61** is continuously pressed in the direction of arrow X while rotated in the direction of arrow A or B by a predetermined angle. As shown in FIG. 7, in this embodiment, if the rotary operation member **61** is continuously pressed in the direction of arrow X while rotated counterclockwise, i.e., in the direction of arrow A, the control block **30** controls to execute a cue reproduction, and if the rotary operation member is continuously pressed in the direction of arrow X while rotated clockwise, i.e., in the direction of arrow B, control is made to carry out a review reproduction. This cue/review reproduction operation is continuously carried out while the rotary

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operation member 61 is maintained in the pressed state in the direction of arrow X, assuming that, for example, a sound data is reproduced with a speed 10 times faster than a normal reproduction speed. On the other hand, if the pressing of the rotary operation member 61 in the direction of arrow X is released and supply of the output signal from the terminal d of the job dial 60 terminates, the control block 30 terminates this cue/review reproduction operation and switches the mode to the normal speed reproduction. As shown in FIG. 17, the control block 30 also controls to switch the mode to the normal speed reproduction if the rotary operation member 61 is rotated clockwise, i.e., in the direction of arrow B during a cue reproduction, or if the rotary operation member 61 is rotated counterclockwise, i.e., in the direction of arrow A during a review reproduction.

In the embodiment of the present invention, when the cue reproduction reaches the end of the sound data stored in the memory 9, control is made to interrupt the cue reproduction and set the mode to the head of the last sound data stored in the memory 9. On the other hand, when the review reproduction reaches the first sound data stored in the memory 9, control is made to interrupt the review reproduction and set mode to the head of the sound data stored in the memory 9. Thus, in the IC recorder 1, control is made in such a manner that a cue reproduction or a review reproduction will not be terminated other than at the first and the last positions of the sound data stored in the memory 9. For example, a cue reproduction or a review reproduction will not be terminated at a sound data of index number 03 when a sound data of index numbers 01 to 10 is stored.

If a long pressing of the rotary operation member 61 is carried out during a sound data reproduction, the control block 30 executes a repeat reproduction of the sound data piece which is being reproduced. In the embodiment of the present invention, the sound data piece which has been reproduced is repeatedly reproduced by the repeat reproduction. During this repeat reproduction, if the rotary operation member 61 is pressed again in the direction of arrow X or rotated in the direction of arrow A or B, the repeat reproduction is released and mode is switched to the normal reproduction. Also, if the STOP button 54 or ERASE button 56 is pressed during a repeat reproduction, the repeat reproduction is released and the normal reproduction mode is set in.

As shown in FIG. 18, if a long pressing of the rotary operation member 61 is carried out in the state to be reproduced immediately or in the stop state, the control block 30 executes a scan reproduction. That is, if the rotary operation member 61 is continuously pressed in the direction of arrow X for a predetermined period of time in the state to be reproduced immediately, the control block 30, according to an output signal from the terminal d, detects the period of time during which the rotary operation member 61 is pressed and controls to start a scan reproduction. Here, the scan reproduction is a reproduction method as follows. When a plurality of sound data pieces are stored in a file of the memory 9, starting portions of the respective sound data pieces stored in the file are reproduced intermittently and successively for a predetermined period of time (5 seconds for example) for each of the data pieces. Note that in FIG. 18, the rotary operation member 61 is indicated simply as JOG.

Here, the control block 30 determines whether to execute a scan reproduction by detecting, for example, whether an output signal from terminal d of the jog dial 60 based on the pressing of the rotary operation member 61 in the direction of arrow X is detected for 3 seconds or more continuously.

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That is, if the output signal from the terminal d is detected for 3 seconds or more from a start of pressing of the rotary operation member 61, the control block 30 controls to execute a scan reproduction, and if less than 3 seconds from the start of pressing, the control block 30 executes a normal mode reproduction.

After a scan reproduction is started, the scan reproduction continues even if the pressing of the rotary operation member 61 in the direction of arrow X is released. When the scan reproduction of the last sound data piece of the file which is being scan-reproduced is complete, the control block 30 stops the IC recorder 1 at the head of the first sound data piece of the file which has been scan-reproduced.

During a scan reproduction, if the rotary operation member 61 is rotated in the direction of arrow A or B, the control block 30 controls to switch to a scan reproduction of a sound data of an index number earlier or later by a count value of the counter 35 determined by the number of pulse signals generated by the rotation of the rotary operation member 61. During this scan reproduction, if a target voice is heard from the loud speaker 24, the user presses the rotary operation member 61 in the direction of arrow X while the target sound data is being reproduced. When the rotary operation member 61 is pressed, as shown in FIG. 18, the control block 30 controls to switch to a normal mode reproduction. Thus, by pressing the member 61 while a scan reproduction is in progress, it is possible to hear the target sound data from the beginning to the end. If the STOP button 54 is pressed during a scan reproduction, the control block 30, according to an input signal from the operation block 50, releases the scan reproduction and enters a stop state.

In this example, if the ERASE button 56, the FILE button 51, or the PRIORITY button 53 is pressed during a scan reproduction, the control block 30 invalidates the input signal issued by pressing these button regardless of the ON/OFF state of the HOLD switch.

In the IC recorder 1, when the rotary operation member 61 is rotated in the direction of arrow A or B, as has been described above, the control block 30 detects the signals α and β based on the output from the terminals a, b, and c of the jog dial 60 to determine the rotation speed of the rotary operation member 61 and executes a processing corresponding to the detected speed.

FIG. 18 also shows a processing carried out when the rotary operation member 61 is rotated from the STOP state. As shown in FIG. 18, when the rotary operation member 61 is rotated counterclockwise, i.e., in the direction of arrow A from the STOP state, if the rotation speed of the rotary operation member 61 is slow, the control block 30 controls to execute a forward direction search piece by piece and to increment the index number on the liquid crystal panel 41 one by one as the search proceeds. On the other hand, if the rotation speed of the rotary operation member 61 in the direction of arrow A is fast, the control block 30 controls to execute a forward direction search while skipping a number of pieces and to increment the index number of the liquid crystal display panel 41 by more than one at once.

Similarly, when the rotary operation member 61 is rotated clockwise, i.e., in the direction of arrow B from the STOP state at a slow rotation speed, the control block 30 controls to execute a backward direction search piece by piece and decrement the index number on the liquid crystal display panel 41 one by one. On the other hand, if the rotation speed of the rotary operation member 61 in the direction of arrow B is fast, the control block 30 executes a backward direction

search while skipping a number of pieces and decrement the index number on the liquid crystal display panel 41 by more than one at once.

Thus, in the IC recorder 1, even if a plenty of sound data pieces are stored in the semiconductor memory 9 with the corresponding index numbers, it is possible to carry out a fast rotation of the rotary operation member 61 so that a number of index numbers are skipped so as to quickly find a target index number, i.e., to display the target index number on the liquid crystal display panel 41. Accordingly, in this IC recorder 1, an index number search prior to a reproduction is significantly improved, enabling to quickly reproduce a target sound data with a simple operation.

FIG. 19 shows a processing carried out when the rotary operation member 61 is rotated in the direction of arrow A or B from a sound data reproduction state. As shown in FIG. 19, in the IC recorder 1, when the rotary operation member 61 is rotated counterclockwise, i.e., in the direction of arrow A from a reproduction state with a slow rotation speed, the control block 30 controls to execute a forward direction search piece by piece. More specifically, the control block 30 controls to increase the index number on the liquid crystal panel 41 one by one and start reproduction at the head of a sound data of the displayed index number. On the other hand, if the rotary operation member 61 is rotated with a fast rotation speed, the control block controls to execute a forward direction search while skipping a number of pieces. More specifically, the control block 30 controls to increment the index number on the liquid crystal panel 41 by more than one at once and start a reproduction at the head of a sound data corresponding to the displayed index number.

Similarly, when the rotary operation member 61 is rotated clockwise, i.e., in the direction of B from a reproduction state, if the rotation speed of the rotary operation member 61 is slow, the control block 30 controls to execute a backward direction search piece by piece. More specifically, the control block 30 controls to decrement the index number on the liquid crystal display panel 41 one by one and start reproduction at the head of a sound data corresponding to the displayed index number. On the other hand, if the rotation speed of the rotary operation member 61 is fast, the control block 30 controls to execute a backward direction search while skipping a number of pieces. More specifically, the control block 30 controls to decrement the index number of the liquid crystal display panel 41 by more than one at once and start reproduction at the head of a sound data corresponding to the displayed index number.

Thus, in the IC recorder 1, even if there are a number of sound data pieces stored in the semiconductor memory 9, a simple operation of fast rotation of the rotary operation member 61 enables to quickly find and reproduce the head portion of a target sound data by skipping a number of sound data pieces. This significantly enhances the sound data search efficiency during a reproduction.

As has been described above, in the IC recorder 1, various functions are assigned to the jog dial 60. This enables to improve the operability as well as to reduce the size and weight of the entire apparatus. More specifically, a user can carry out all the basic operations during a reproduction with his/her left hand thumb alone to rotate and press the rotary operation member 61 without moving his/her fingers here and there. Because a number of functions are assigned to the jog dial 60, it is possible to reduce the number of operation buttons and switches as a whole, which facilitates operation of the IC recorder 1 in the visual way as well as realizes reduction of the size and weight of the entire apparatus.

The aforementioned storage and reproduction apparatus according to the present invention uses a semiconductor memory. The present invention is not to be limited to the aforementioned embodiment but can be applied to recording apparatuses in general, especially portable type apparatuses which can easily be carried. In the aforementioned embodiment, a sound data recording and reproduction apparatus was detailed, but the present invention may be a recording and reproduction apparatus for recording/reproducing other than a sound data such as a video data.

What is claimed is:

1. A portable reproducing apparatus, comprising:

a storage medium configured to store input data and auxiliary data associated with said input data;

a reproduction unit configured to reproduce said input data read out from said storage medium;

an operation unit provided on a main body of said apparatus; and

a controller configured to select said auxiliary data according to an input from said operation unit and, upon receiving the input, reading out said input data associated with the selected auxiliary data from said storage medium, and transmit said input data to said reproduction unit,

wherein said controller is configured to select forward auxiliary data upon receiving a manual rotational input to the operation unit in a first direction of a circular path around an imaginary rotational axis, the imaginary rotational axis being perpendicular to a main surface of said portable reproducing apparatus, and said controller selecting backward auxiliary data upon receiving a manual rotational input to the operation unit in a second direction, opposite to the first direction, of the circular path around the imaginary rotational axis.

2. The portable reproducing apparatus as claimed in claim 1, further comprising:

an integral display configured to display at least said auxiliary data selected by said controller.

3. The portable reproducing apparatus as claimed in claim 1, wherein said auxiliary data includes a start address and an end address of said input data and includes data indicating a reproduction order.

4. The portable reproducing apparatus as claimed in claim 1, wherein said storage medium includes a semiconductor memory.

5. The portable reproducing apparatus as claimed in claim 1, wherein said input data is digital audio data.

6. The portable reproducing apparatus as claimed in claim 1, wherein said input data is digital video data.

7. The portable reproducing apparatus according to claim 1, comprising:

a menu control located at a position of the circular path and coplanar with respect to the main surface of the portable apparatus.

8. The portable reproducing device according to claim 7, wherein the menu control is actuated by receiving a depression force along an axis perpendicular to the main surface.

9. A portable device, comprising:

a storage medium configured to store input data and auxiliary data associated with said input data;

a reproduction unit configured to reproduce said input data read out from said storage medium;

a signal providing unit accessible from an external surface of said apparatus and configured to provide a signal in response to a manual rotational input with respect to an imaginary rotational axis perpendicular to the external surface; and

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a controller configured to select said auxiliary data according to the signal produced by the signal providing unit, upon receiving the signal, reading out said input data associated with the selected auxiliary data from said storage medium, and transmit said input data to said reproduction unit, wherein
said controller is configured to select forward auxiliary data according to the signal produced by the signal providing unit in response to application of the manual rotational input in a first direction of a circular path around the imaginary rotational axis, and said controller selecting backward auxiliary data according to the signal produced by the signal providing unit in response to application of the manual rotational input in

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a second direction, opposite to the first direction, of the circular path around the imaginary rotational axis.
10. The portable device as claimed in claim **9**, further comprising:
a menu control located at a position of the circular path and coplanar with respect to the external surface of the portable device.
11. The portable reproducing device according to claim **10**, wherein the menu control is actuated by receiving a depression force along an axis perpendicular to the external surface.

* * * * *

Exhibit M



US007349012B2

(12) **United States Patent**
Takezawa et al.

(10) **Patent No.:** **US 7,349,012 B2**
(45) **Date of Patent:** ***Mar. 25, 2008**

(54) **IMAGING APPARATUS WITH HIGHER AND LOWER RESOLUTION CONVERTERS AND A COMPRESSION UNIT TO COMPRESS DECREASED RESOLUTION IMAGE DATA**

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(73) Assignee: **Sony Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 763 days.

This patent is subject to a terminal disclaimer.

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(22) Filed: **Aug. 26, 2003**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation of application No. 09/353,287, filed on Jul. 14, 1999, now Pat. No. 6,639,627.

(30) **Foreign Application Priority Data**

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Nov. 20, 1998 (JP) 10-331614

(51) **Int. Cl.**
H04N 5/228 (2006.01)

(52) **U.S. Cl.** 348/222.1; 348/333.01

(58) **Field of Classification Search** 348/222.1, 348/333.01, 231.99

See application file for complete search history.

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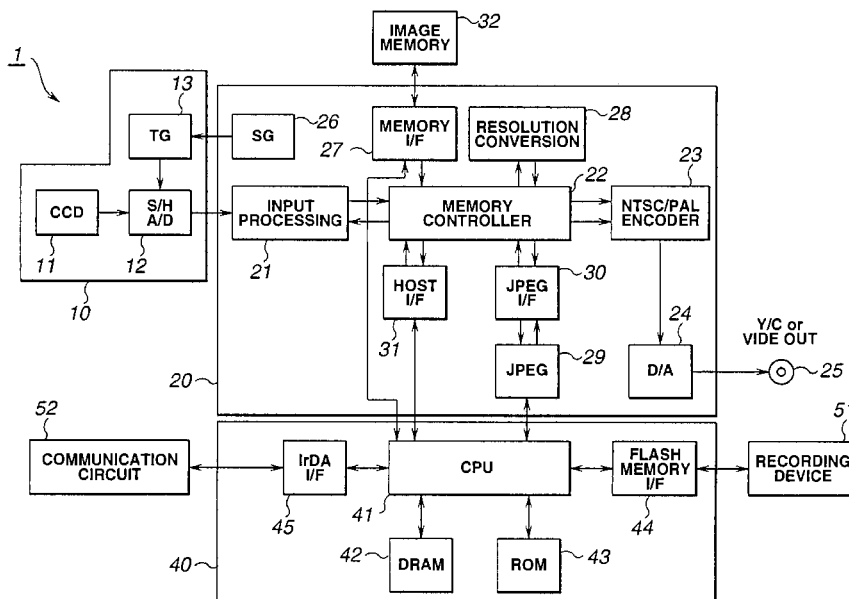
Primary Examiner—Tuan Ho

(74) *Attorney, Agent, or Firm*—Frommer Lawrence & Haug LLP; William S. Frommer

(57) **ABSTRACT**

In an imaging apparatus, an image is to be displayed in real-time on a finder. In the finder mode, a CCD interface 21a thins out horizontal components of image data supplied from an image generating unit 10 to one-third and also effects gamma correction etc to send the resulting image data to a camera DSP 21c. The camera DSP 21c effects data conversion and resolution conversion on the image data resulting from the thinning to convert the data into Y, Cb and Cr image data which is routed to a memory controller 22. The memory controller 22 writes the image data in the image memory 32 and reads out the data from the memory controller 22 to route the read-out data over an image data bus 33 to an NTSC/PAL encoder 23. The NTSC/PAL encoder 23 converts the image data in resolution and further converts the image data into data of the NTSC or PAL system to route the resulting data to a finder.

5 Claims, 13 Drawing Sheets



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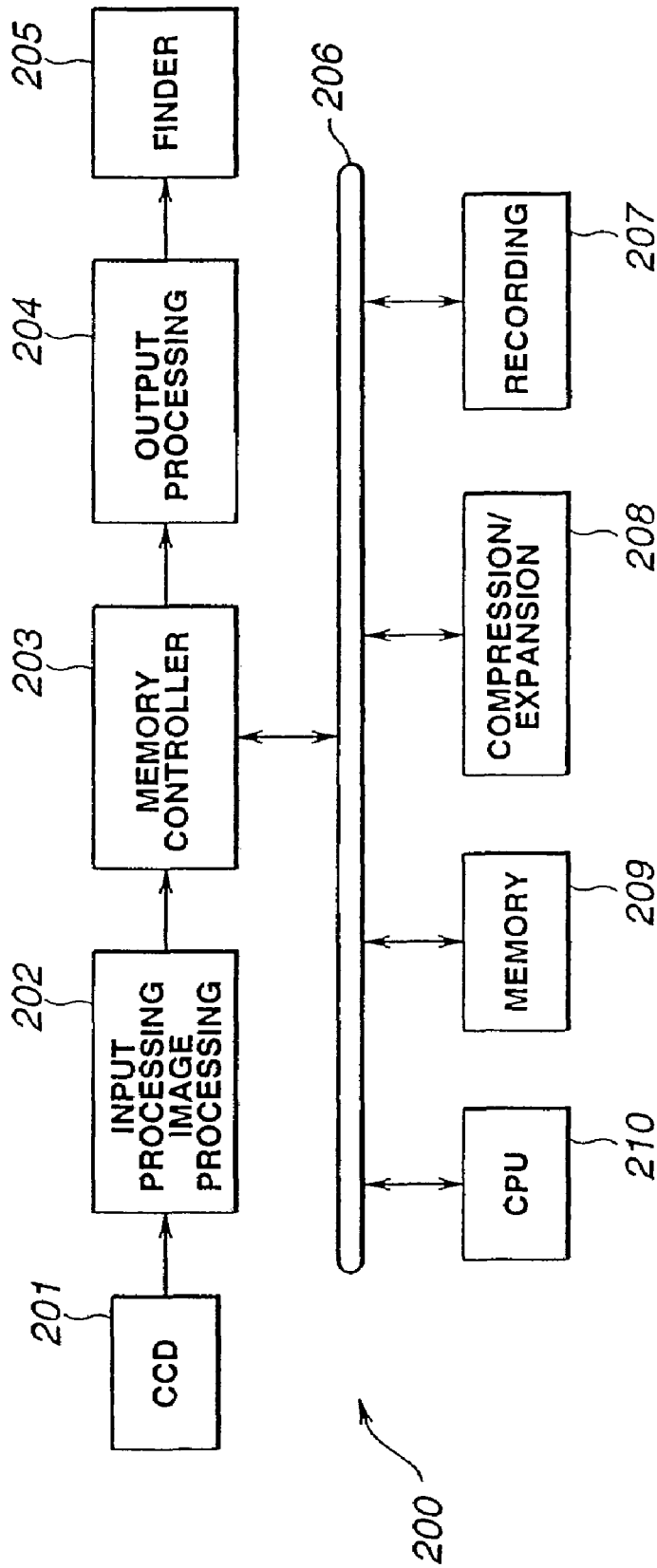


FIG.1

(PRIOR ART)

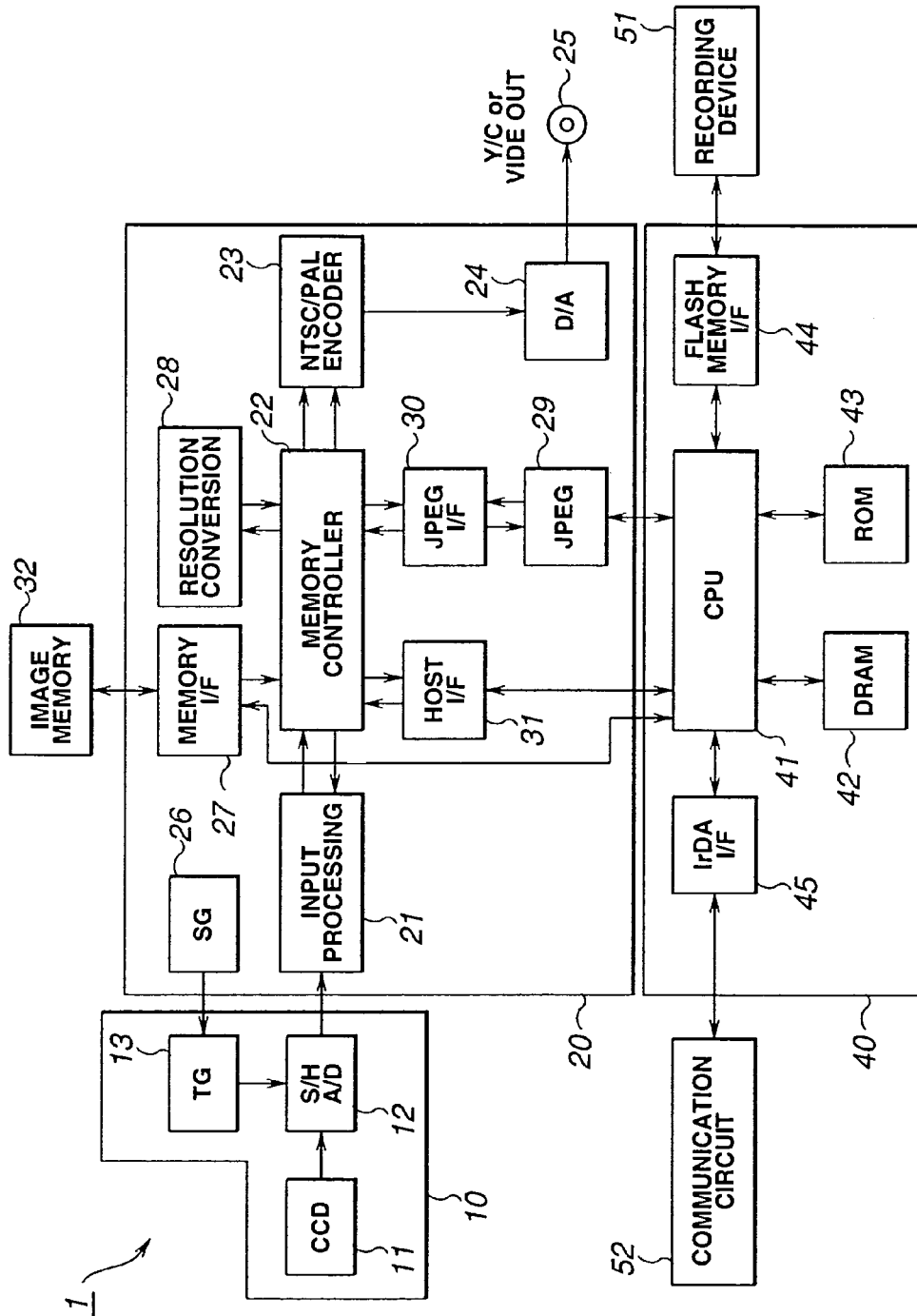


FIG. 2

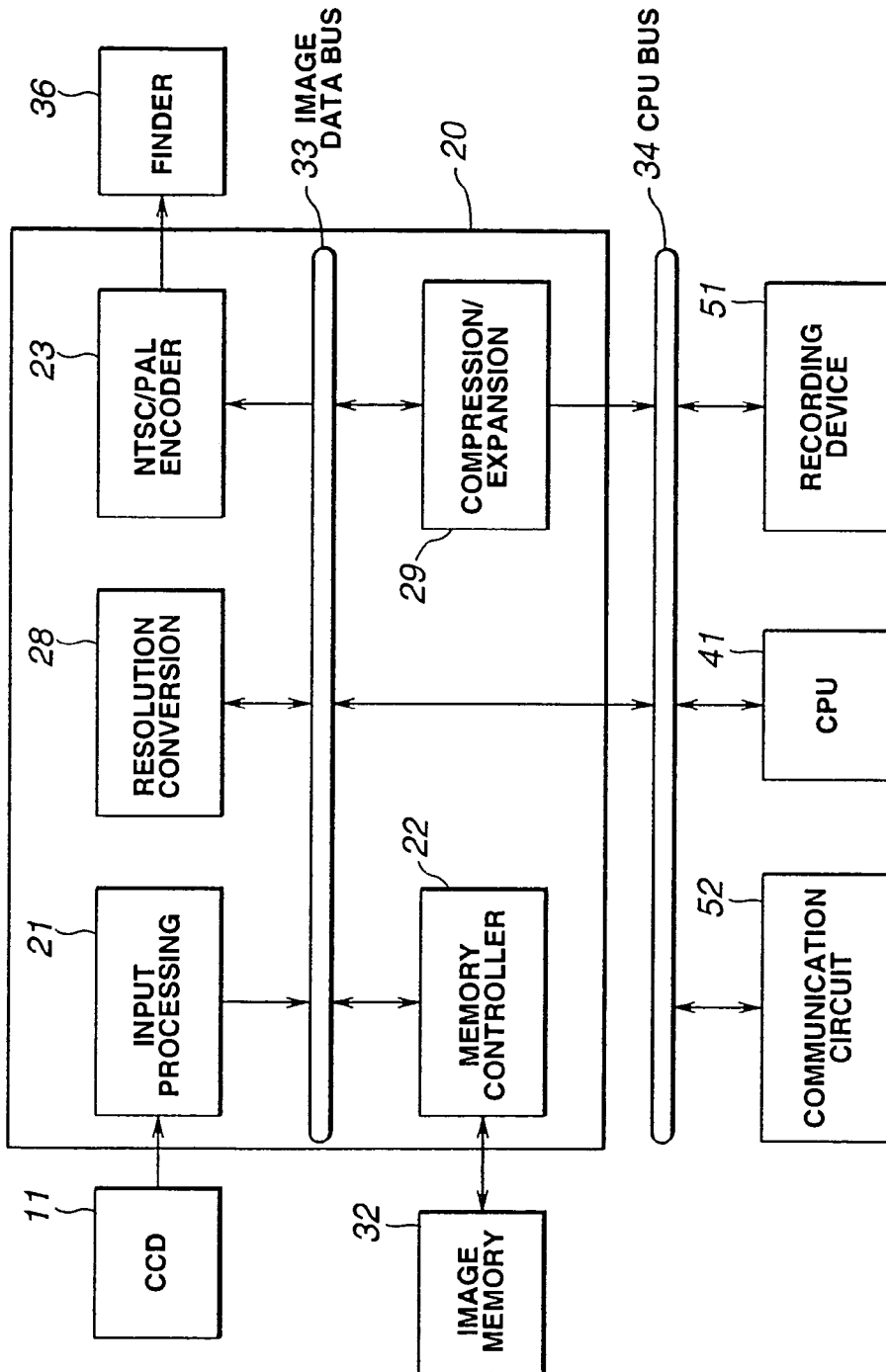


FIG. 3

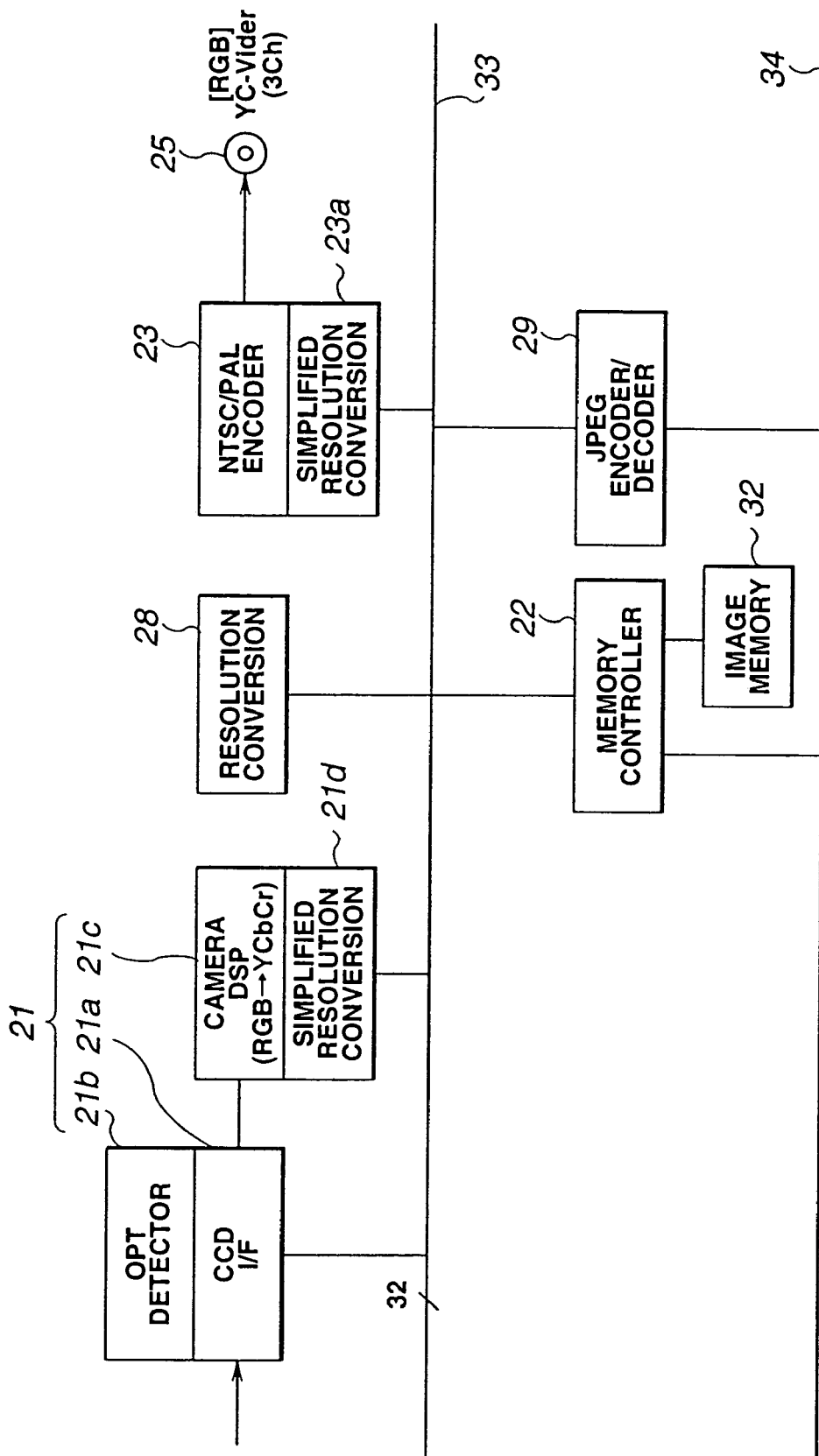


FIG. 4

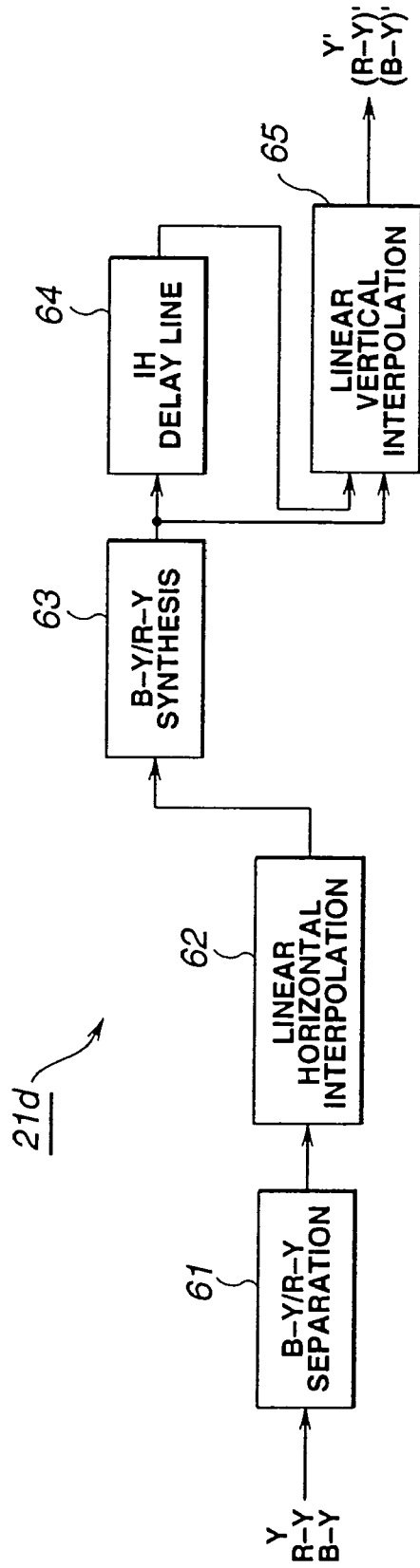


FIG. 5

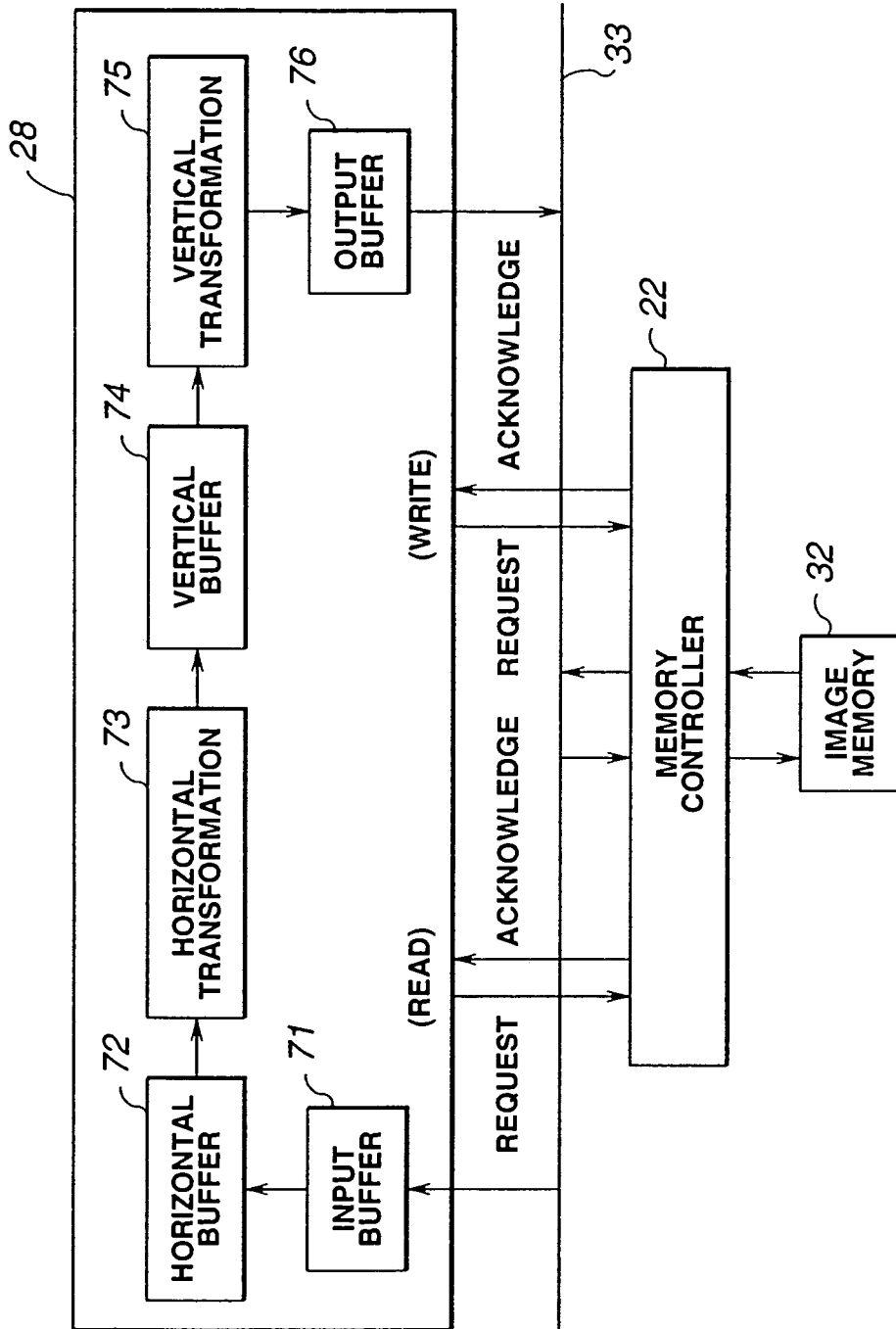


FIG. 6

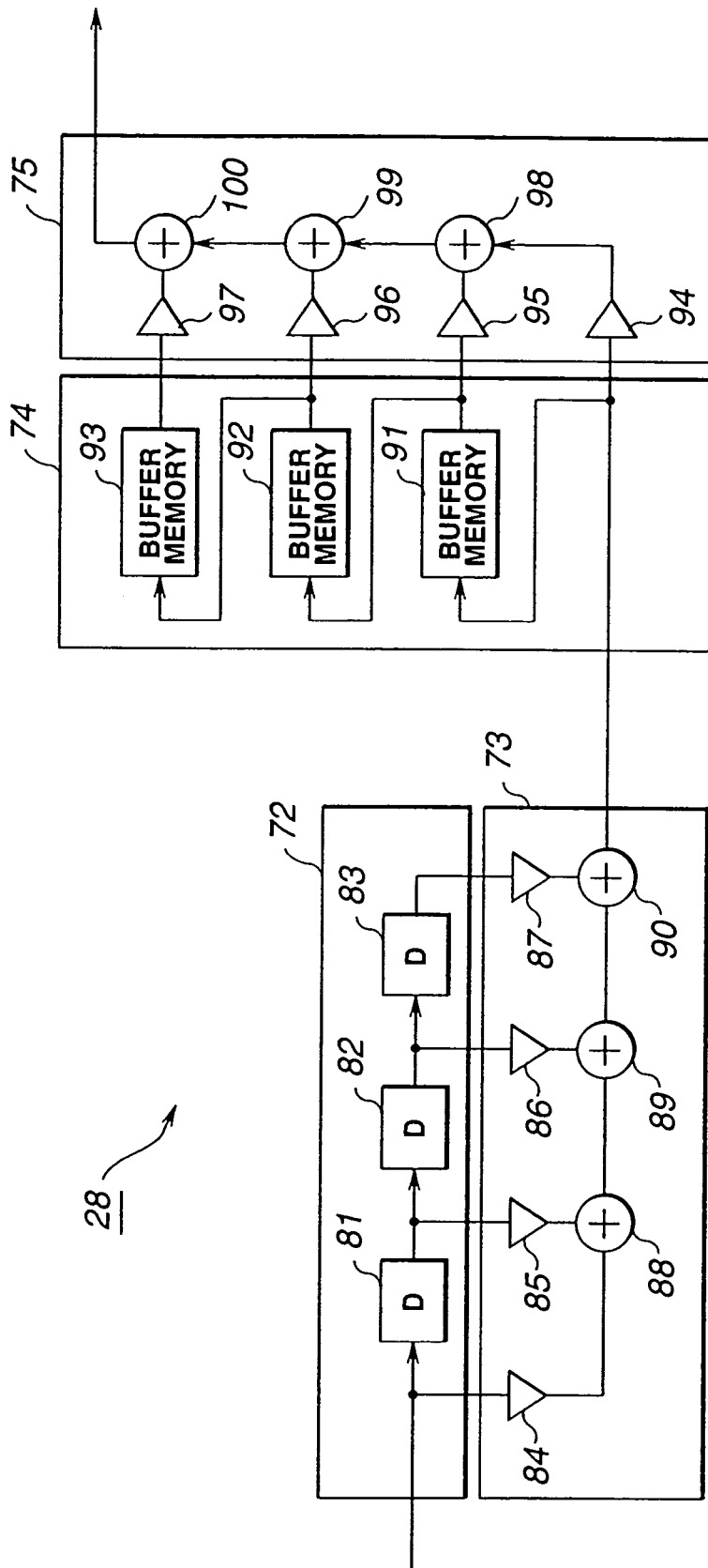


FIG.7

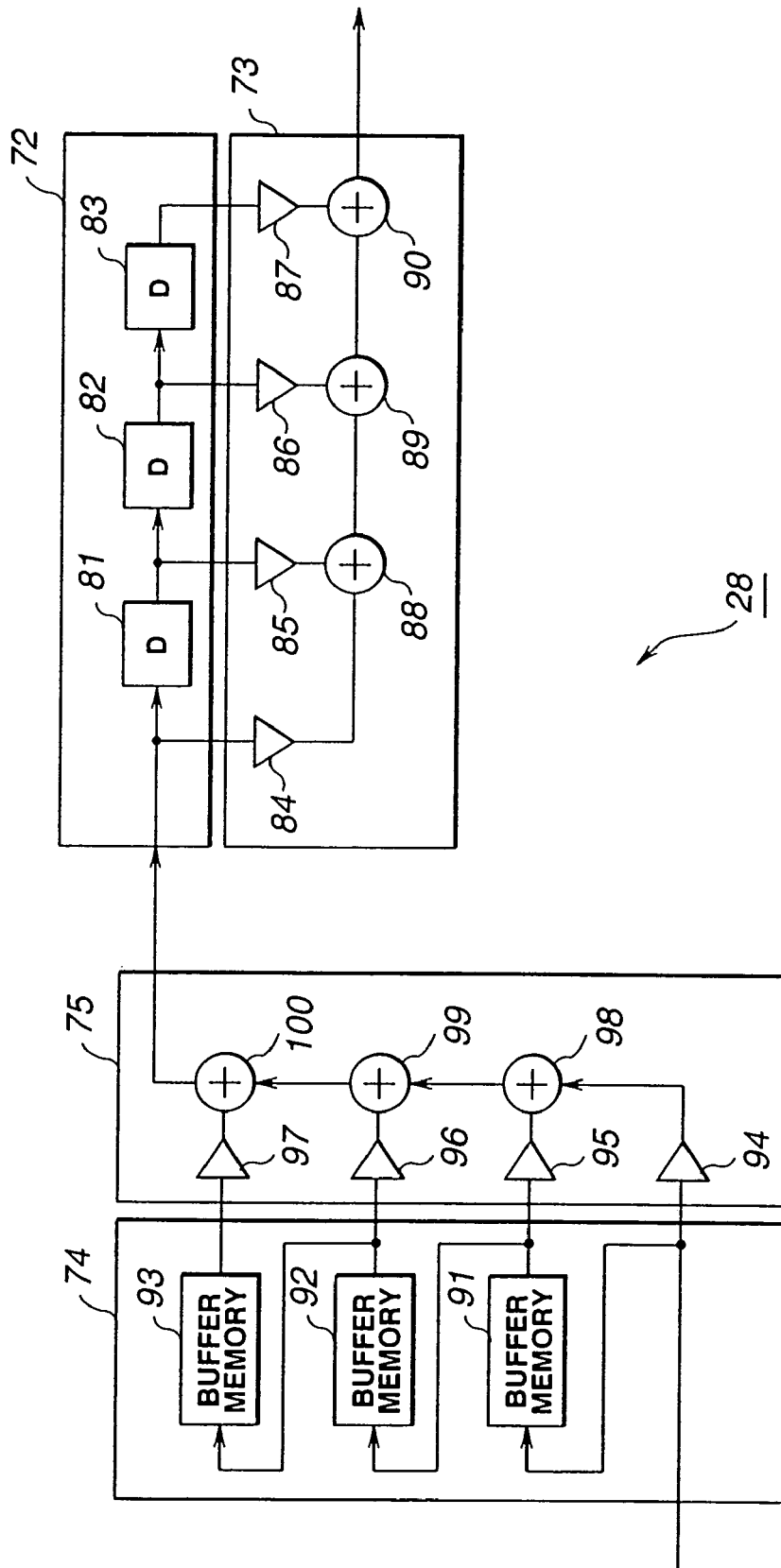


FIG.8

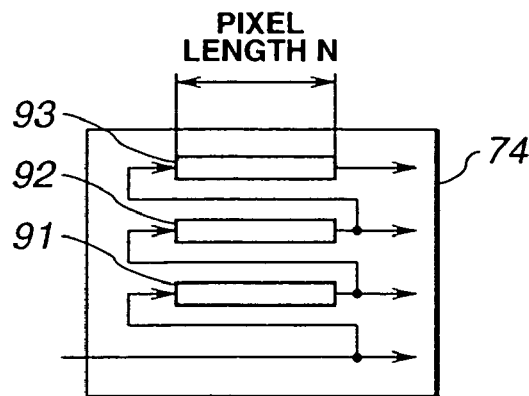


FIG.9

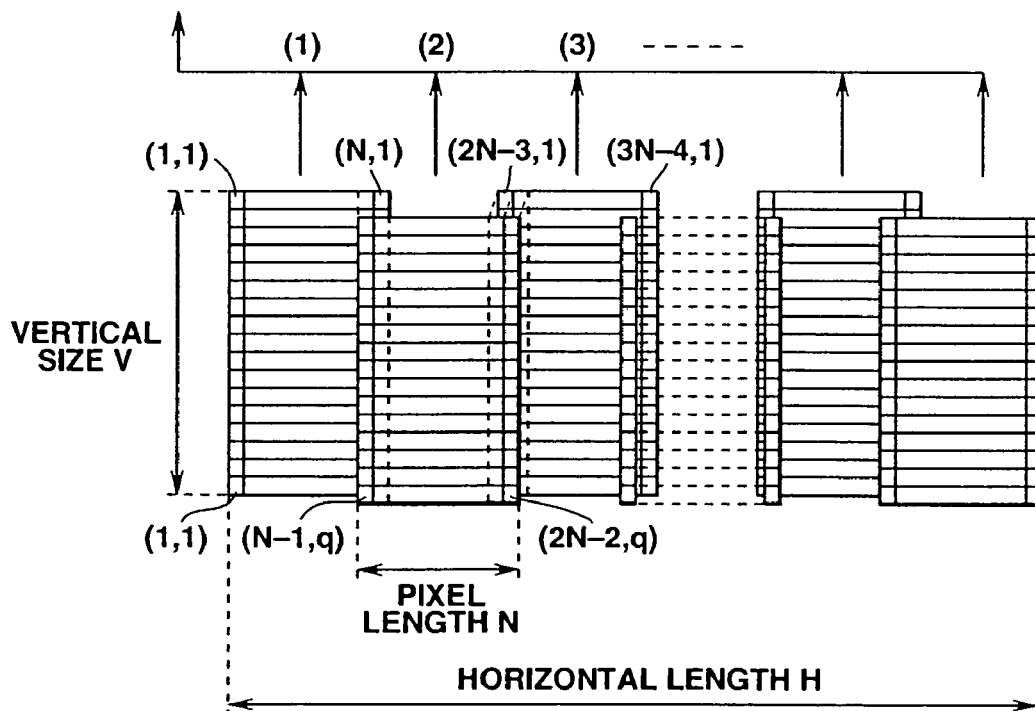


FIG.10

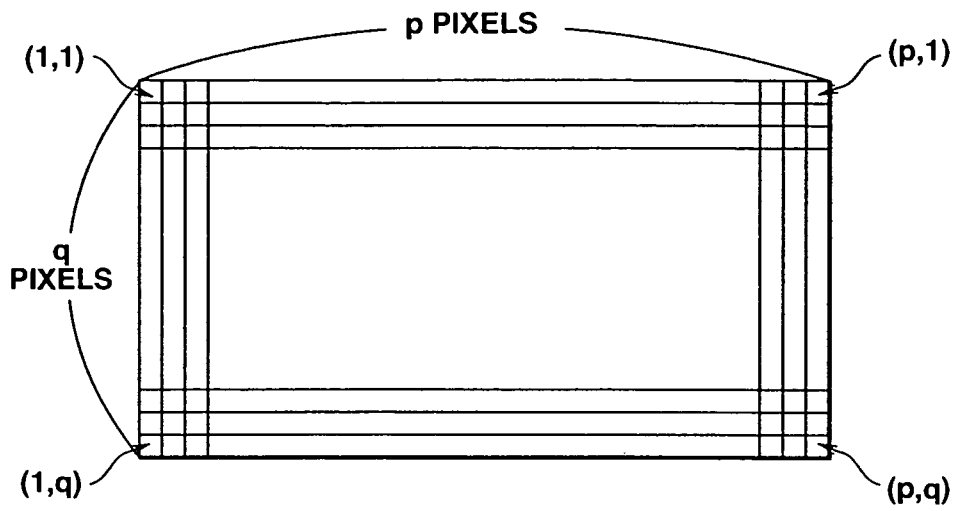


FIG.11

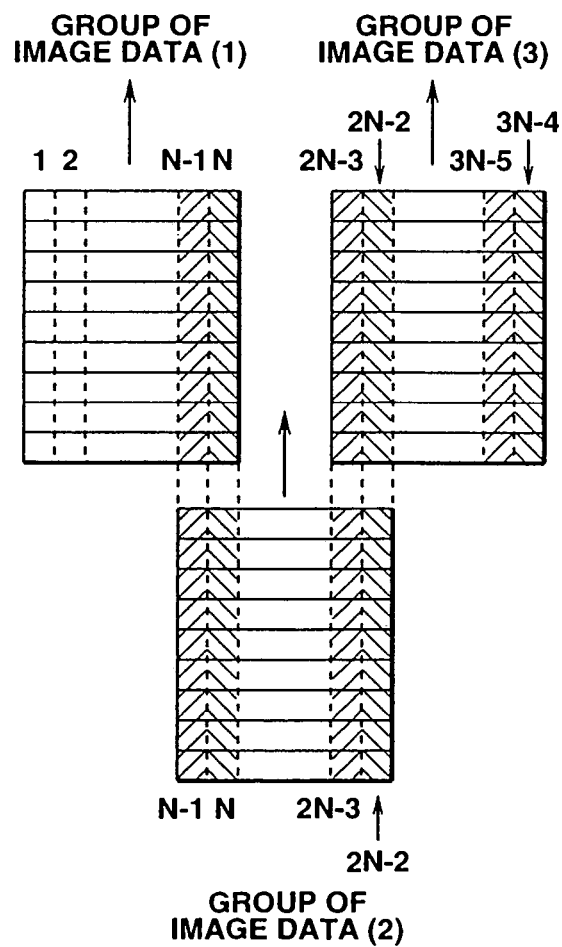


FIG.12

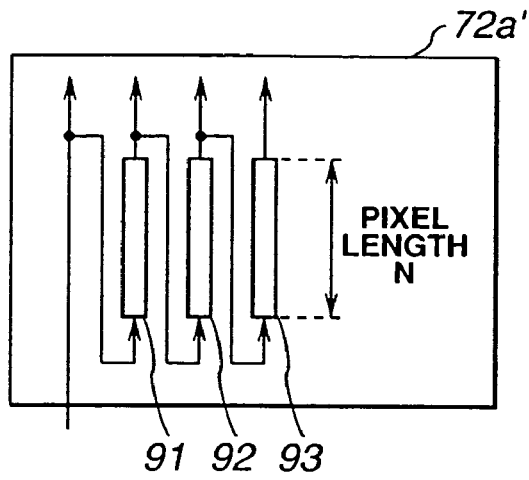


FIG.13

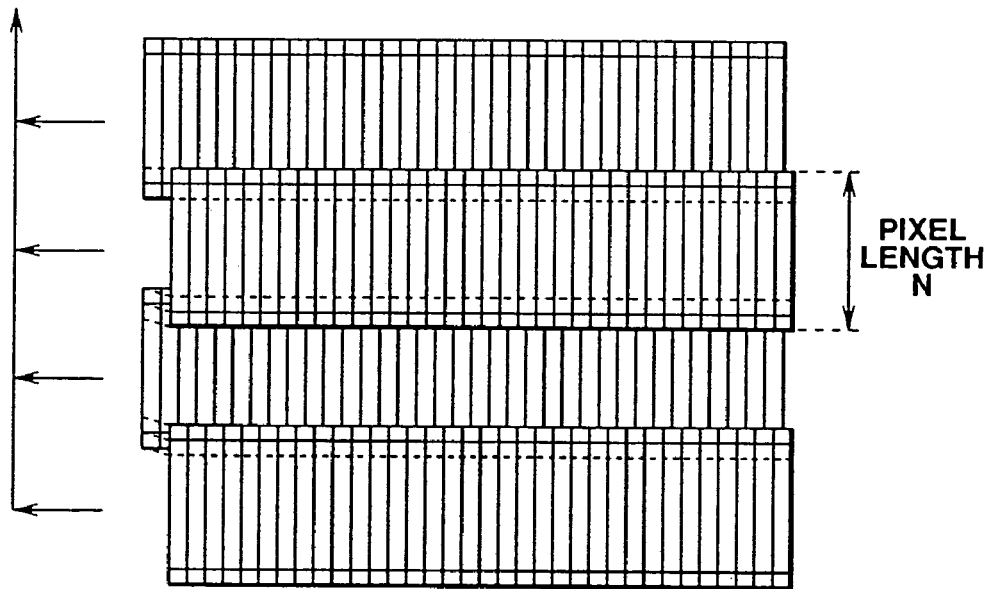


FIG.14

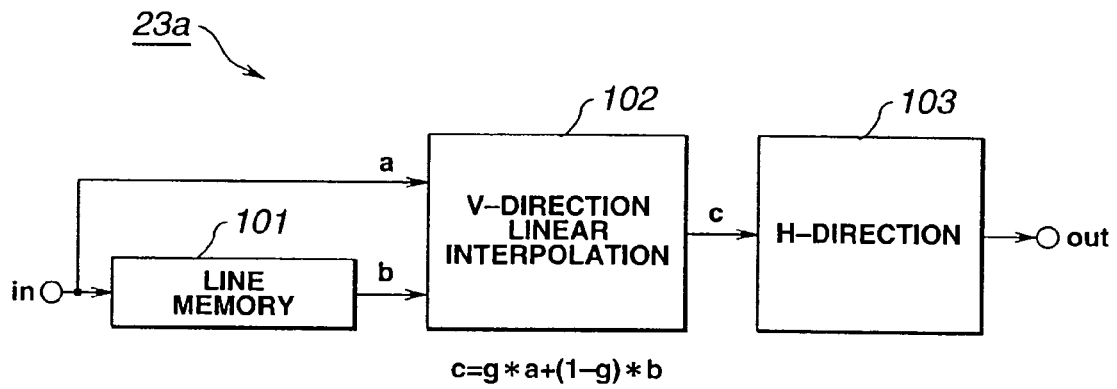
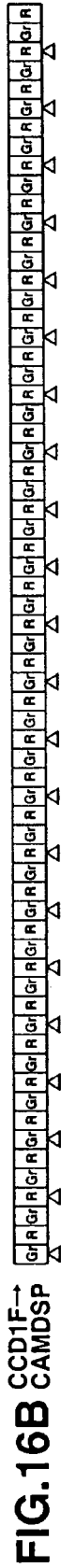
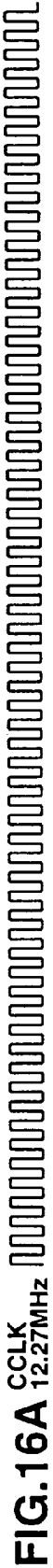
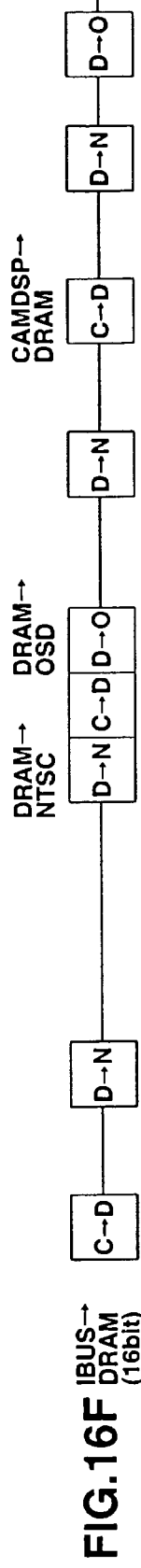
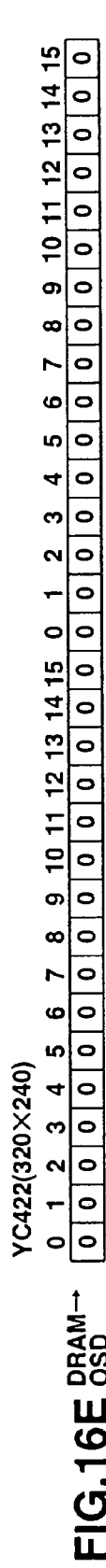
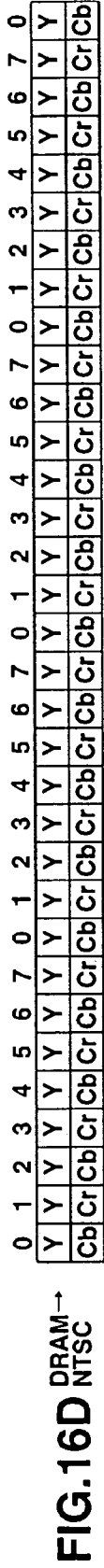
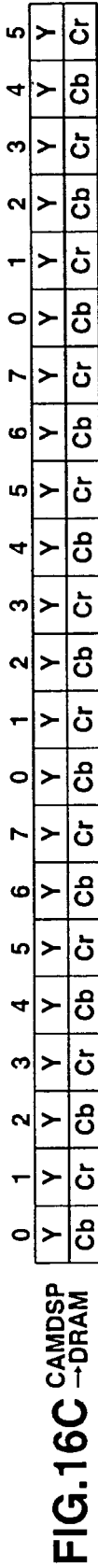


FIG.15



1/3 THINNING



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**IMAGING APPARATUS WITH HIGHER AND
LOWER RESOLUTION CONVERTERS AND
A COMPRESSION UNIT TO COMPRESS
DECREASED RESOLUTION IMAGE DATA**

CROSS-REFERENCE TO RELATED
APPLICATIONS

This application is a continuation application of U.S. patent application Ser. No. 09/353,287, filed Jul. 14, 1999 now U.S. Pat. No. 6,639,627.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an imaging apparatus having the function of displaying an image of an object on a finder in real-time.

2. Description of the Related Art

A digital still camera retrieves image data obtained by a CCD image sensor into a DRAM or a flash memory and subsequently transfers the image data to a so-called personal computer or the like. A major proportion of this type of the digital still camera has hitherto been of the type coping with the video graphics array (VGA) system.

Referring to FIG. 1, this digital still camera **200** includes a CCD image sensor **201** for generating image signals, an input processing/image processing circuit **202**, a memory controller **203** for reading and writing image data, an output processing circuit **204** for conversion to an output image of a pre-set system, a finder **205** for displaying the state of an object at the time of image shooting, a recording unit **207** for recording compressed image data over a CPU bus **206** and a compression/expansion circuit **208** for compressing/expanding image data. The digital still camera **200** also includes a memory **209**, formed by, for example, a DRAM, and a CPU **210** for controlling the overall device.

Before starting the image shooting of an object, the user has to confirm an object image displayed on the finder **205**. This state is termed a finder mode. At this time, the CCD image sensor **201** sends image signals obtained on photoelectric conversion of the imaging light from an object to the input processing/image processing circuit **202**. The input processing/image processing circuit **202** performs the correlated dual sampling processing on the image signals to digitize the image signals. The input processing/image processing circuit **202** then performs pre-set signal processing, such as gamma correction, knee processing or camera processing and routes the processed image signals to the memory controller **203**, which then is responsive to the control by the CPU **210** to send the image data from the input processing/image processing circuit **202** to the output processing circuit **204**. The output processing circuit **204** encodes image data in accordance with, for example, the National Television System Committee (NTSC) system, and analogizes the encoded image data to route the resulting analog data to the finder **205**. This allows the object as an object of image shooting to be indicated on the finder **205**.

On the other hand, if the user pushes a shutter button, not shown, to shift to the recording mode, the memory controller **203** causes the image data furnished from the input processing/image processing circuit **202** to be written in the memory **209**. The CPU **210** causes the image data to be read out from the memory **209** and compresses the image data from the recording unit **207** in the compression/expansion circuit **208** in accordance with, for example, the Joint

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photographic Experts Group (JPEG) system to record the compressed image data in the recording unit **207**.

If the user performs pre-set processing to shift to the reproducing mode, the CPU **210** causes image data to be read out from the recording unit **207** to cause the image data to be expanded in JPEG system in the compression/expansion circuit **208** to route the resulting data via memory controller **203** and output processing circuit **204** to the finder **205**. This causes the as-shot image to be displayed on the finder **205**.

In keeping up with recent outstanding technical progress in the CCD image sensor, the resolution of image data is approximately surpassing 1,000,000 pixels. On the other hand, it may be feared that the digital still camera of the above-described structure cannot sufficiently cope with the image data exceeding 1,000,000 pixels.

If, for example, the CCD image sensor **201** outputs image signals of high resolution in the finder mode, the input processing/image processing circuit **202** has to perform resolution conversion of image data in real-time in meeting with the resolution of the finder **205**. Simultaneously, the memory controller **203** has to access the memory **209**. The output processing circuit **204** also has to perform pre-set processing.

The result is stagnancy on the CPU bus **106**, such that each circuit cannot execute pre-set processing in real-time and hence an image of an object is displayed in a frame-decimated fashion on the finder **205**. If, in this case, an object has made movements, there is produced deviation between the actual object and the movement of the object displayed on the finder **105**, thus producing an inconvenience in the imaging operation.

On the other hand, if image data is not of high resolution, the resolution of the image data has to be converted into that of, for example, the NTSC system or the PAL system, taking into account the system of the finder **205**. In this case, it is similarly required to display an image on a finder in real-time.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an imaging apparatus in which, even of image data of an image are of high resolution, the image can be displayed in real-time on the finder.

In one aspect, the present invention provides an imaging apparatus including imaging means for generating image data corresponding to the imaging light from an object, first resolution converting means for lowering the resolution of the image data from the imaging means by way of resolution conversion, second resolution conversion means for raising the resolution of the image data supplied from the first resolution conversion means over an image data bus by way of resolution conversion, and outputting means for outputting the image data from the second resolution conversion means on display means.

In another aspect, the present invention provides a recording/reproducing apparatus including imaging means for generating image data corresponding to the imaging light from an object, recording/reproducing means for recording the image data on a recording medium and for reproducing the image data recorded on the recording medium, first resolution conversion means for effecting resolution conversion of lowering the resolution of the image data from the imaging means, second resolution conversion means for effecting resolution conversion of raising the resolution of the image data supplied from the first resolution conversion means

over an image data bus, storage means for storing the image data, third resolution conversion means for performing resolution conversion of the image data supplied from the storage means, and display means for displaying an image corresponding to the image data from the second or third resolution conversion means.

According to the imaging apparatus of the present invention, in which, by way of performing resolution conversion, the first resolution conversion means lowers the resolution of the image data from the imaging means, and the second resolution conversion means raises the resolution of the image data supplied from the first resolution conversion means over the image data bus to reduce the proportion of occupation of the image data on the image data bus to enable real-time display of the object image on the display means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram for illustrating the structure of a conventional digital still camera.

FIG. 2 is a block diagram showing a schematic structure of a digital still camera embodying the present invention.

FIG. 3 is a block diagram showing the schematic structure of the digital still camera shown in FIG. 2.

FIG. 4 is a block diagram for illustrating flow of image data in a signal processing unit of the digital still camera shown in FIG. 2.

FIG. 5 is a block diagram for illustrating the structure of a simplified resolution conversion circuit in an input processing circuit of the signal processing unit.

FIG. 6 is a block diagram showing the structure of the resolution conversion circuit of the signal processing unit.

FIG. 7 is a block diagram showing a specified structure of a horizontal direction buffer, a horizontal direction conversion processing circuit, a vertical direction buffer and a vertical direction conversion processing circuit of the resolution conversion circuit.

FIG. 8 is a block diagram showing an alternative structure of the resolution conversion circuit.

FIG. 9 is a block diagram showing the structure of the vertical direction buffer of the resolution conversion circuit.

FIG. 10 illustrates a technique for reading out image data from the image memory by the memory controller.

FIG. 11 illustrates the coordinate position of pixels making up an image.

FIG. 12 illustrates another technique for reading out image data from the image memory by the memory controller.

FIG. 13 is a block diagram showing the structure of the horizontal direction buffer of the resolution conversion circuit constituted by a line buffer.

FIG. 14 illustrates the technique when the memory controller reads out image data from the image memory.

FIG. 15 is a block diagram showing the structure of the simplified resolution conversion circuit in the NTSC/PAL encoder of the signal processing unit.

FIGS. 16A to 16F show a timing chart for illustrating the contents of the signal processing in the respective circuits in the finder mode.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, preferred embodiments of the present invention will be explained in detail.

The present invention is applied to digital still camera 1, configured as shown for example in FIG. 2.

The digital still camera 1 includes an image generating unit 10 for generating image signals, an input signal processor 20 for processing image data in a pre-set fashion, an image memory 32, comprised of an SDRAM, and a controller 40 for controlling the input signal processor 20.

The image generating unit 10 includes a solid-state imaging device for generating image signals, such as a CCD image sensor 11, a sample holding-analog/digital circuit (S/H-A/D circuit 12) for sample-holding and digitizing the image signals to output image data, and a timing generator 13 for generating timing signals. This timing generator 13 generates horizontal synchronization signals and vertical synchronization signals for controlling respective circuits of the image generating unit 10 based on synchronization signals supplied from the signal processor input.

The CCD image sensor 11 generates image data corresponding to XGA (extended graphic array: 1024×768) pixel data made up of, for example, 800,000 pixels. The CCD image sensor 11 is driven based on the synchronization signals from the timing generator 13 to output image signals at a rate of 30 frames per second. Meanwhile, the CCD image sensor 11 has the function of thinning out image signals and is able to thin out vertical components of the image signals to 1/2, 1/3, 1/4, . . . to output the resulting thinned-out signals.

The S/H-A/D circuit 12 is also adapted to perform sample-holding and A/D conversion at a pre-set sampling interval based on the synchronization signals from the timing generator 13 to send the resulting image data to the signal processor 20.

The signal processor 20 includes a sole LSI (large scale integrated circuit). The signal processor 20 includes an input signal processor 21 for input processing and camera processing on image data from the image generating unit 10, a memory controller 22 for controlling the readout/write of image data for the image memory 32, an NTSC/PAL (phase alternation by line) encoder 23, a D/A converter 24 for analogizing image data and outputting the resulting analog signals to outside, and a sync generator 26 for generating synchronization signals and supplying the resulting synchronization signals to the timing generator 13.

The signal processor 20 also includes a memory interface 27, as an interface for the image memory 32, a resolution conversion circuit 28 for converting the resolution of the image data, a JPEG (Joint Photographic Experts Group) encoder/decoder 29, for compressing/expanding image data, a JPEG interface 30, as an interface of the JPEG encoder/decoder 29, and a host interface 31, as an interface for having data transmission/reception with the CPU of the controller 40.

The input signal processor 21 processes the image data from the S/H-A/D circuit 12 with digital clamp, shading correction, aperture correction, gamma correction or color processing and routes the resulting processed signals to the memory controller 22. The input signal processor 21 has the function of processing input data to convert the input data into Y, Cb and Cr. If the resolution of the image data is larger than that of the VGA (Video Graphics Array), the input signal processor 21 is able to perform the processing of lowering the resolution. The input signal processor 21 also performs the auto-focussing and auto-iris detection to route the data to the controller 40 to effect automatic adjustment of the focussing mechanism and the iris mechanism. The input signal processor 21 also detects the signal level of the three prime colors making up the image data to adjust automatic white balance.

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The memory controller 22 also performs control to cause image data supplied from the input signal processor 21 or other circuitry to be written in the image memory 32 via a memory interface 27 and to read out image data of the image memory 32 via the memory interface 27. At this time, the memory controller 22 detects whether or not there is any defective pixel in the CCD image sensor 11 based on the image data stored in the image memory 32.

The memory controller 22 routes the image data read out from the image memory 32 to, for example, the NTSC/PAL encoder 23. When fed with the image data from the memory controller 22, the NTSC/PAL encoder 23 encodes the image data in accordance with the NTSC system or the PAL system to send the encoded data to the D/A converter 24. The D/A converter 24 analogizes the image data to output the resulting analog signals via output terminal 25.

The memory controller 22 routes the image data, read out from the memory controller 22, to the resolution conversion circuit 28 to cause the image data to be converted in resolution, while causing the image data outputted by the resolution conversion circuit 28 to be written in the image memory 32.

The memory controller 22 routes the image data via the JPEG interface 30 to the JPEG encoder/decoder 29 to effect compression of the still image, while causing the image data expanded by the JPEG encoder/decoder 29 to be written in the image memory 32.

The image memory 32 not only stores the image data as described above but also stores OSD data (on-screen-display data) as the so-called character generator data. The OSD data is made up of bit map data. The controller 22 controls the readout/write of the OSD data. The image data and the OSD data are synthesized by the NTSC/PAL encoder 23.

The controller 40 includes a CPU (central processing unit) 41 for controlling the respective circuits of the signal processor 20, a DRAM (dynamic random access memory) 42, a ROM (read-only memory) 43, having the control program for the CPU 41 stored therein, a flash memory interface 44, as an interface for exchanging image data with a storage device 51, such as a flash memory, and an IrDA interface 45, as an interface of the communication circuit 52 constituted such as by IrLED.

For example, the CPU 41 causes image data compressed by the JPEG encoder/decoder 29 to be written via a flash memory/interface 44 in a storage device 51, made up of a flash memory, while causing image data to be read out from the storage device 51 to route the image data read out from the JPEG encoder/decoder 29. The CPU 41 also causes the image data read out from the storage device 51 to be outputted via the IrDA interface 45 and the communication circuit 52 as infrared light to outside.

The schematic structure of the digital still camera 1 is shown in FIG. 3.

The input signal processor 21 routes the image data from the CCD image sensor 11 via an image data bus 33 to the image memory 32. The NTSC/PAL encoder 23 encodes the image data from the image memory 32 in a pre-set fashion to send the resulting encoded data to the finder 36. This causes an image of an object to be displayed on the finder 36 which is adapted to display the image in association with the image data up to the VGA format.

The memory controller 22 performs data transfer between the image memory 32 and the signal processing circuits connecting to the image data bus 33. The resolution conversion circuit 28 performs resolution conversion of the image data from the image memory 32 to route the results to the image memory 32. The JPEG encoder/decoder 29

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compresses the image data from the image memory 32 in accordance with the JPEG system to route the compressed image data via CPU bus 34 to the CPU 41, which then causes the compressed image data to be written in the storage device 51. The CPU 41 is also able to output the compressed image data via the CPU bus 34 and the communication circuit 52 to outside.

Thus, in FIG. 3, the respective circuits of the signal processor 20 are interconnected over the image data bus 33. The image data bus 33 is a virtual bus and indicates that there is placed a limit to the transfer band for image data exchanged between the respective circuits.

In the signal processor 20, the respective circuits, such as NTSC/PAL encoder 23 or the resolution conversion circuit 28, send to the memory controller 22 a request signal indicating that image data are demanded. These circuits also transmit a request signal to the memory controller 22 when outputting the image data after the end of the processing of the image data.

On reception of the request signals from the respective circuits, the memory controller 22 selects those circuits having the high priority sequence, and transmits an acknowledge signal to the selected circuit. The acknowledge signal indicates that image data can be routed to a circuit receiving the signal or that image data outputted by a circuit which has received the acknowledge signal is ready to be received. The memory controller 22 reads out image data from the image memory 32 to route the read-out image data via image data bus 33 to the circuit corresponding to the destination of the acknowledge signal. The memory controller 22 receives the image data outputted by the circuit which has sent the acknowledge signal to write the image data in the image memory 32.

On reception of the request signals from plural circuits, the memory controller 22 is able to select preferentially the circuit which has to perform the processing in real-time. For example, if an image of an object is to be displayed on the finder 36, the memory controller 22 preferentially selects the input signal processor 21 and the NTSC/PAL encoder 23. It is also possible for the memory controller 22 to decipher the bus occupation ratio of the image data on the image data bus 33 to determine the priority sequence of the respective circuits depending on the occupation ratio.

If image data can be routed to the respective circuits within the transfer band limitation of the image data bus 33, it is possible for the memory controller 22 to perform control to send the acknowledge signal to the respective circuits time-divisionally to permit the respective circuits to perform pre-set processing. This enables the memory controller 22 to have access in real-time to data in the respective circuits to cause the image data from the respective circuits to be written in the image memory 32 or to cause the image data in the image memory 32 to be read out and sent to the respective circuits.

If, when the memory controller 22 has access to external circuitry, not shown, over the image data bus 33, the external circuitry can send the above-mentioned request signal or receive the transmitted acknowledge signal, the memory controller 22 can have access simultaneously and time-divisionally to the respective circuits within the signal processor 20 within the transfer band limitation range of the image data bus 33. That is, if within the range of the band of the image data bus 33, the memory controller 22 can have simultaneous access to the circuits in the signal processor 20 or to the external circuits within the signal processor 20 time-divisionally without regard to the number of the circuits within the signal processor 20 or the external circuit.

As mentioned above, the memory controller **22** performs arbitration of the image data bus **33**, write/readout control of image data between the image memory **32** and the respective circuits and data transfer to the CPU bus **34**.

The specified flow of image data in the signal processor **20** is explained with reference to FIG. 4.

The input signal processor **21** includes a CCD interface **21a** for performing pre-set signal processing on the image data from the image generating unit **10**, a detection circuit **21b** for processing the CCD interface **21a**, and a camera digital signal processor **21c** (camera DSP **21c**) for doing conversion processing of the image data.

The CCD interface **21a** performs the processing, such as the digital clamp, white balance adjustment or gamma correction, on the image data made up of R, G and B from the S/H-A/D circuit **12** shown information FIG. 2, or decimates the components in the horizontal direction of image data in case of necessity. After such processing, the CCD interface **21a** routes image data to the camera DSP **21c** or to the memory controller **22** via the image data bus **33**.

From the image data of the CCD interface **21a**, the detection circuit **21b** performs detection for auto-focussing, auto-iris or white balance adjustment.

The camera DSP **21c** converts the image data of R, G and B from the CCD interface **21a** into image data made up of luminance signal Y and chrominance signals Cb, Cr. The camera DSP **21c** also has a simplified resolution conversion circuit **21** which not only performs the above processing but also converts the resolution of the image data in a simplified fashion.

The simplified resolution conversion circuit **21d** operates for converting the resolution of the image data to lower values if the resolution of the image data generated by the CCD image sensor **11** is larger than, for example, the VGA format.

Specifically, the simplified resolution conversion circuit **21d** includes a B—Y/R—Y separation circuit **61**, for separating chrominance signals, a horizontal direction linear interpolation circuit **62** for interpolation in the horizontal direction, a B—Y/R—Y synthesis circuit **63** for synthesizing the chrominance signals, a 1H delay circuit **64** for delaying the respective signals by a horizontal scanning period (1H period), and a vertical direction linear interpolation circuit **65**.

The B—Y/R—Y separation circuit **61** separates the chrominance signals B—Y and R—Y, as chroma signals Cb, Cr, from the image data from the camera DSP **21c**, to route the separated chroma signals to the horizontal direction linear interpolation circuit **62**. The horizontal direction linear interpolation circuit **62** interpolates the luminance signals Y and the chrominance signals B—Y, R—Y in the horizontal direction to lower the luminance in the horizontal direction to route the interpolated luminance signals Y and the chrominance signals B—Y, R—Y to the B—Y/R—Y synthesis circuit **63**.

The B—Y/R—Y synthesis circuit **63** synthesizes the chrominance signals B—Y, R—Y, to route the luminance signals Y from the horizontal direction linear interpolation circuit **62** and the synthesized chrominance signals B—Y, R—Y to the 1H delay circuit **64** and to the vertical direction linear interpolation circuit **65**. The 1H delay circuit **64** delays the luminance signals Y and the chrominance signals by 1H to route the delayed signals to the vertical direction linear interpolation circuit **65**. The vertical direction linear interpolation circuit **65** performs linear interpolation processing in the vertical direction, based on the luminance signals Y and the chrominance B—Y, R—Y from the

B—Y/R—Y synthesis circuit **63** and the 1H delay circuit **64**, to output image data made up of luminance signals Y' and chrominance signals (B—Y)', (R—Y)' lowered in resolution in both the horizontal and vertical directions.

The resolution conversion circuit **28** performs resolution conversion processing of converting [p×q] image data into [m×n] image data. The resolution conversion circuit **28** performs processing for suppressing the resolution to a pre-set value if the image data produced in the CCD image sensor **11** are of high resolution. It is however possible to process the image data of low resolution into data of high resolution.

Referring to FIG. 6, the resolution conversion circuit **28** includes an input buffer **71** for storing image data, inputted from the image data bus **33**, a horizontal direction buffer **72**, for buffering the image data from the an input buffer **71** in the horizontal direction, a horizontal direction transform processing circuit **73** for converting the resolution of the image data from the horizontal direction buffer **72** in the horizontal direction, a vertical direction buffer **74** for buffering the image data from the horizontal direction transform processing circuit **73** in the vertical direction, a vertical direction transform processing circuit **75** for converting the resolution of the image data in the vertical direction, and an output buffer **76** for buffering at the time of outputting.

When ready for converting the resolution of the image data, the resolution conversion circuit **28** outputs a read request signal requesting the memory controller **22** to read out image data from the image memory **32**, while outputting a write request signal requesting the memory controller **22** to write the image data in the image memory **32** after the conversion processing of the image data. The resolution conversion circuit **28** also receives an acknowledge signal indicating that the memory controller **22** has responded to the request signal.

Referring to FIG. 7, the horizontal direction buffer **72** is made up of a first delay circuit **81**, a second delay circuit **82** and a third delay circuit **83** each for producing the delay of one pixel. Thus, the first delay circuit **81** outputs image data delayed by one pixel, while the second and third delay circuits **81**, **82** output image data delayed by two pixels and image data delayed by three pixels, respectively.

Referring to FIG. 7, the horizontal direction transform processing circuit **73** includes first to fourth multipliers **84**, **85**, **86**, **87**, and first to third adders **88**, **89**, **90**. A circuit for normalizing data is incidentally annexed at back of the adder **90**.

The first multiplier **84** multiplies the image data supplied from the an input buffer **71** with a pre-set coefficient to route the resulting data to the adder **88**. The second multiplier **85** multiplies the image data supplied from the first delay circuit **81** with a pre-set coefficient to route the resulting data to the adder **88**. The third multiplier **86** multiplies the image data supplied from the second delay circuit **82** with a pre-set coefficient to route the resulting data to the adder **89**. The fourth multiplier **87** multiplies the image data supplied from the third delay circuit **83** with a pre-set coefficient to route the resulting data to the adder **90**. The first adder **88** synthesizes the image data to send the resulting data to the second adder **89**. The second adder **89** synthesizes the image data to send the resulting data to the third adder **90**. The third adder **90** synthesizes the respective image data to send the resulting data as image data converted in resolution in the horizontal direction to the vertical direction buffer **74**.

Thus, the horizontal direction transform processing circuit **73** weights plural image data each having one pixel delay in a pre-set fashion with pre-set weights and synthesizes the

weighted image data to interpolate or decimate the pixels in the horizontal direction to convert the resolution in the horizontal direction.

The vertical direction buffer 74 is constituted by a serial connection of first to third buffers 91, 92, 93, each adapted to produce a one-line delay. Thus, the first bufer memory 91 outputs image data delayed by one line, while the second and third buffer memories 92, 93 output the image data delayed by two and three lines, respectively.

Referring to FIG. 7, the vertical direction transform processing circuit 75 includes fifth to eighth multipliers 94 to 97 and fourth to sixth adders 98 to 100. The vertical direction transform processing circuit 75 occasionally includes a circuit for normalizing data on the downstream side of the adder 90.

The fifth multiplier 94 multiplies the image data supplied from the horizontal direction conversion circuit 73 with a pre-set coefficient to route the resulting data to the fourth adder 98. The sixth multiplier 95 multiplies the image data supplied from the first line memory 91 with a pre-set coefficient to route the resulting data to the fourth adder 98. The seventh multiplier 96 multiplies the image data supplied from the second line memory 92 with a pre-set coefficient to route the resulting data to the fifth adder 99. The eighth multiplier 97 multiplies the image data supplied from the third line memory 93 with a pre-set coefficient to route the resulting data to the sixth adder 100. The fourth adder 98 synthesizes the image data to send the resulting data to the fifth adder 99. The fifth adder 99 synthesizes the image data to send the resulting data to the sixth adder 100. The sixth adder 100 synthesizes the respective image data to output the resulting data as image data converted in resolution in the horizontal direction.

Thus, the vertical direction transform processing circuit 75 weights plural image data each having one line delay in a pre-set fashion with pre-set weights and synthesizes the weighted image data to interpolate or decimate the pixels in the horizontal direction to convert the resolution in the vertical direction.

In FIG. 7, the resolution conversion circuit 28 first performs resolution conversion in the horizontal direction followed by resolution conversion in the vertical direction. It is however possible for the resolution conversion circuit 28 to perform resolution conversion in the vertical direction followed by conversion in the horizontal direction. That is, the resolution conversion circuit 28 may be configured to supply the image data from the input buffer 71 to the vertical direction buffer 74 and to effect the processing in the vertical direction buffer 74, vertical direction transform processing circuit 75, horizontal direction buffer 72 and in the horizontal direction transform processing circuit 73, in this order.

In the above-described embodiment, the first to third buffer memories 91 to 93 in the vertical direction buffer 74 are configured to store one-line (1H) image data. Alternatively, the first to third buffer memories 91 to 93 may be configured for storing image data lesser than one line, as shown in FIG. 9. It is then necessary for the memory controller 22 to read out the image data stored in the image memory 32 every N pixels, as shown in FIG. 10.

Specifically, the memory controller 22 reads out pixel data corresponding to a viewing screen stored in the image memory 32 every N pixels on the line basis in the vertical direction. Referring to FIG. 11, each viewing screen is made up of $p \times q$ pixels, with the coordinate of the upper left pixel being (1,1), that of the upper right pixel being (p,1), that of the lower left pixel being (1,q) and with the lower right pixel being (p,q).

Referring to FIG. 12, the memory controller 22 causes the image data of N pixels to be read out on the line basis in the horizontal direction in the sequence of the rows 1, 2, . . . , q. This causes the memory controller 22 to read out image data corresponding to N pixels from the left end, or $N \times q$ pixels, that is pixel data in an area defined by (1,1), (1,q), (N,q) and (N,1). This image data is referred to below as image data set (1).

The memory controller 22 then reads out image data in a range defined by (N-1, 1) (N-1, q), (2N-2, q), (2N-2, 1), referred to below as the image data set (2). If the memory controller 22 reads out the image data set (1) and the image data set (2), it is tantamount to reading out the image data of the (N-1)st column and the Nth column twice.

The reason is that, since the vertical direction transform processing circuit 75 performs interpolation beginning from the surrounding pixel, the pixels stored in the beginning end and the trailing end of the first to third buffer memories 91 to 93 are not the object of processing. For example, if the image data set (1) is read out, the pixel (N, 1) is not the object of the interpolation processing in the vertical direction. However, this pixel (N, 1) is read out when the pixel data set (2) is read out, and becomes the object of interpolation processing.

In similar manner, the memory controller 22 reads out image data of N pixels in the horizontal direction every line so that image data of the last two columns of the directly previous image data set will be included. This routes the image data set to the resolution conversion circuit 28.

The vertical direction buffer 74 is fed with image data, in an amount corresponding to the capacity of the first to third buffers 91 to 93, on the line basis. Thus, image data offset one line is stored in each of the first to third buffer memories 91 to 93. The vertical direction transform processing circuit 75 is able to perform the resolution conversion processing in the vertical direction based on the image data from the first to third buffers 91 to 93 of the vertical direction buffer 74.

With the memory controller 22, the memory controller 22 can cause the resolution conversion circuit 28 to execute the resolution conversion in the vertical direction, by readout in meeting with the capacity of the buffer memory, even if the capacity of the buffer memory required for resolution conversion in the vertical direction is not up to one line.

Although the read-out overlap between the image data sets is two columns, it is probable that the overlap exceeds two columns or there is no overlap. It is noted that the present invention is applicable to image signal processing, such as camera signal processing, without limitation to resolution conversion.

Although the foregoing description is directed to the embodiment in which the buffer memory is being used for interpolation for the vertical direction, the present invention is also applicable to an embodiment in which the buffer memory is being used for interpolation for the horizontal direction.

That is, the resolution conversion circuit 28 may perform resolution conversion in the horizontal direction using a horizontal direction buffer 72a comprised of a buffer memory 72a having a capacity of N pixels, as shown in FIG. 13. The memory controller 22 can read out image data of N pixels on the column basis in the sequence of the rows 1, 2, . . . , p in the vertical direction, as shown in FIG. 14. Meanwhile, it is necessary for the memory controller 22 to read out the image data stored at the leading and trailing ends of the buffer memory twice, as in the above-described vertical interpolation processing, so that these image data will be the object of the horizontal interpolation processing.

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Thus, the memory controller 22 is able to read out image data from the image memory 32 so that resolution conversion processing in the horizontal and vertical directions will be effected for the first to third buffer memories 91 to 93 each having a capacity of N pixels. This enables the circuit scale of the horizontal direction buffer 72 and the vertical direction buffer 74 to be reduced to lower the production cost.

The NTSC/PAL encoder 23, executing the encoding as described above, also has a simplified resolution conversion circuit 23a for increasing the resolution of the image data, if need be, before proceeding to encoding.

The simplified resolution conversion circuit 23a performs resolution conversion for matching to the display standard of the finder 36 if the image data on the image memory 32 is lower than the resolution required for display.

Referring to FIG. 15, the simplified resolution conversion circuit 23a includes a line memory 101 for storing image data from the image data bus 33, a vertical direction linear interpolation circuit (V-direction linear interpolation circuit 102) for interpolating image data in the vertical direction, and a horizontal direction interpolation circuit 103.

The line memory 101 stores image data from an input terminal in an amount corresponding to one line to send the image data to the V-direction linear interpolation circuit 102 in the order it is stored. The V-direction linear interpolation circuit 102 weights the image data from the input terminal in and the image data from the V-direction linear interpolation circuit 102 with a pre-set weighting to perform linear interpolation in the vertical direction. The horizontal direction interpolation circuit 103 interpolates Y with an order-seven filter, while interpolating Cb and Cr with an order-three filter. This is simply the interpolation for increasing the resolution by a factor of two. The horizontal direction interpolation circuit 103 outputs the image data at an output terminal out.

For example, if image data inputted from the input terminal in is denoted a, image data read out from the line memory 101 is b, a coefficient for weighting is g, where $0 \leq g \leq 1$, and image data outputted by the V-direction linear interpolation circuit 102 is c, the V-direction linear interpolation circuit 102 effectuates the following processing:

$$c = g * a + (1 - g) * b$$

The image data outputted by the output terminal out is encoded by the NTSC/PAL encoder 23, as mentioned previously.

In the signal processing system, the digital still camera 1 is made up of so-called two chips, namely a signal processor 20 and a CPU 41. Therefore, the respective signal processing circuits are each of the chip configuration, so that the substrate surface area and further the power consumption can be made smaller than if the respective signal processing circuits are of separate chip configurations.

Also, since the signal processor 20 is not of the chip configuration inclusive of the CPU, signal processing can be adaptively effectuated even if the application in connection with the CPU 41 is changed. That is, if the signal processor 20 is of the chip configuration inclusive of the CPU, it is impossible to reconstruct the chip in case the application of the CPU is changed. However, the signal processor 20 can perform the pre-set signal processing using a CPU of an optimum structure on the application basis.

The digital still camera 1 of the above-described structure has a finder mode for confirming the status or the position of an object prior to image shooting, a recording mode for shooting the image of the object as confirmed, and a

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reproducing mode for confirming the shot state of the object image, and effects the processing depending on the prevailing mode.

In the finder mode, the user has to observe the state of the object indicated on the finder 36 before thrusting a shutter button, not shown, to shoot the object. In this finder mode, the memory controller 22 and other circuits are controlled in the following manner. For illustrating the respective modes, reference is had mainly to FIG. 4 and occasionally to FIG. 16.

In the finder mode, the CCD image sensor 11 generates image signals, thinned out to one-third from the vertical components, and furnishes the digitized image data via the S/H-A/D circuit 12 to the CCD interface 21a.

The CCD interface 21a performs signal processing in synchronism with clocks shown in FIG. 16A. Specifically, the CCD interface 21a decimates the horizontal components of the image data supplied by the image generating unit 10 to one-third and corrects the decimated image data for gamma to send the gamma-corrected data to the camera DSP 21c. The CCD interface 21a furnishes the image data converted to 340×256 from the $1/3$ decimation process to the camera DSP 21c.

The camera DSP 21c performs data conversion processing on the decimated image data into YCrCb image data. The camera DSP 21c converts the resolution of the image data in the simplified resolution conversion circuit 21d ($340 \times 256 \rightarrow 320 \times 240$) for lowering the resolution of the image data to route the converted image data via image data bus 33 to the memory controller 22.

It is noted that the simplified resolution conversion circuit 21d lowers the resolution in a simplified fashion to an extent necessary for subsequent processing. In this manner, if image data generated by the CCD image sensor 11 is of high resolution, the transfer range taken up by the image data generated by the CCD image sensor 11 can be decreased to evade the stagnancy on the image data bus 33 to maintain the real-time characteristics of the finder mode.

The memory controller 22 writes the image data in the image memory 32, while reading out the image data from the image memory 32 as shown in FIG. 16D to send the read-out image data via the image data bus 33 to the NTSC/PAL encoder 23. Simultaneously, the memory controller 22 reads out the OSD data stored in the image memory 32, as shown in FIG. 16E, to send the OSD data stored in the image memory 32, as shown in FIG. 16E. FIG. 16F shows the state of transfer on the image data bus 33 which enables the above-described real-time processing.

The NTSC/PAL encoder 23 performs resolution conversion of $320 \times 240 \rightarrow 640 \times 240$ or $320 \times 240 \rightarrow 640 \times 288$ in the case of the NTSC system or the PAL system, respectively, to send the converted image data to the NTSC/PAL encoder 23. The NTSC/PAL encoder 23 also converts the image data into data of the NTSC system or the PAL system into OSD data which is routed to the finder 36 shown in FIG. 3. This allows the image of the object and the title information etc to be displayed in-real time on the finder 36.

Meanwhile, the NTSC/PAL encoder 23 converts the resolution so that data with low resolution will be increased in resolution, such that, if 320×200 image data is furnished, it is converted into 640×240 image data and into 640×288 image data for the NTSC system and for the PAL system, respectively.

In the digital still camera 1, the resolution of the image data generated by the CCD image sensor 11 is lowered in a simplified fashion in the finder mode to reduce the data volume, so that the image data will be within the bandwidth

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limitation of the image data bus 33 and so that the resolution will be increased at an output stage to the extent that is necessary for display, at a timing shown in FIG. 16F.

Thus, with the digital still camera 1, the image data is held in the bandwidth limitation of the image data bus 33 to permit the image of the object to be displayed on the finder 36, even if the image data is of high resolution, without the necessity of performing the time-consuming decimation processing.

If the circuitry for preferential processing, namely the CCD interface 21a, camera DSP 21c or the NTSC/PAL encoder 23, is previously set in the CPU 41, and signal processing is carried out time-divisionally in other circuits as in the above circuits, the processing of the respective circuits with high priority may be preferentially performed depending on the data volume of the image data.

In the event of the large data volume of the image data in the simplified resolution conversion circuit 21d, data processing may be performed at a high processing speed, in order to give priority to real-time processing, even though the picture quality is degraded to a certain extent, under control by the CPU 41. In this manner, high-speed processing can be effected in the finder mode even in case of the large data volume of the image data generated in the image generating unit 10.

In the case of the digital still camera 1, having an electronic zooming function, the CPU 41 can control the respective circuits in the following manner.

The memory controller 22 causes the image data, supplied via the CCD interface 21a and camera DSP 21c, to be written in the image memory 32, while causing the image data to be read out from the image memory 32 and routed to the resolution conversion circuit 28. The resolution conversion circuit 28 formulates image data enlarged from a portion of the input image, by an electronic zooming function, to output the resulting image data to the image memory 32. This image data is read out from the image memory 32 and outputted to the finder 36 via the NTSC/PAL encoder 23. This generates electronically zoomed image data.

Since the finder mode gives utmost priority to the real-time characteristics, time-consuming processing is not executed by the respective circuits. However, the CPU 41 can be configured to cause the memory controller 22 and other circuits to perform various processing operations if within the range allowed by the transfer area of the image data bus 33.

For example, the memory controller 22 may be configured to read out image data from the image memory 32, in which is stored the image data furnished from the CCD interface 21a, and to furnish the read-out image data to the NTSC/PAL encoder 23 over the image data bus 33 and to the JPEG encoder/decoder 29. The finder 36 displays the image of the object in real-time, while the JPEG encoder/decoder 29 compresses the image data in accordance with the JPEG system.

The JPEG encoder/decoder 29 compresses/expands the still image, while it cannot process high-pixel image in real-time. It is thus possible for the JPEG encoder/decoder 29 to decimate a pre-set number of frames of the image data supplied from the image data bus 33 (number of frames or fields) by way of compression or to slice a portion of the image to lower the resolution by way of compression. This enables shooting of a frame-decimated still image continuously or shooting of a low-resolution image continuously.

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The user observes the state of the object displayed on the finder 36 in the above-mentioned finder mode. If the object is decided to be shot, the user pushes a shutter button, not shown.

If the shutter button is pushed, the digital still camera 1 proceeds to the recording mode. In the recording mode, the CPU 41 controls the memory controller 22 or the respective circuits in the following manner to record the image of the as-shot object on a recording device 51.

The CCD image sensor 11 halts the decimation operation in synchronism with the thrusting the shutter button to generate image signals of the XGA format to route the digitized image data via the S/H-A/D circuit 12 to the CCD interface 21a.

The CCD interface 21a routes the image data furnished from the S/H-A/D circuit 12 not to the camera DSP 21c, but to the memory controller 22 via the image data bus 33. The memory controller 22 first writes the image data in the image memory 32 and subsequently reads out the image data to route the read-out image data via the image data bus 33 to the camera DSP 21c. The camera DSP 21c converts the image data made up of RGB into image data made up of Y, Cb and Cr.

The camera DSP 21c is fed with image data once written in the image memory 32. That is, the camera DSP 21c effects data conversion on the image data from the image memory 32 instead of on the image data directly supplied from the CCD interface 21a. Thus, it is unnecessary for the camera DSP 21c to perform high-speed data conversion, but it is only sufficient if the camera DSP 21c executes such processing when the image data bus 33 is not busy. Stated differently, it is unnecessary for the camera DSP 21c to perform the processing in real-time, so that data conversion processing can be executed with priority given to the high picture quality rather than to the high processing speed and the resulting converted image data may be routed to the memory controller 22 via the image data bus 33. The memory controller 22 causes the image data to be written in the image memory 32.

The memory controller 22 causes the image data to be read out from the image memory 32 to route the read-out image data to the JPEG encoder/decoder 29. The JPEG encoder/decoder 29 compresses the image data in accordance with the JPEG system to write the compressed image data in the recording device 51 shown in FIG. 3.

If real-time processing is not unnecessary, as during recording, the CPU 41 permits the pre-set processing to be executed after writing the image data transiently in the image memory 32 to exploit the transfer band of the image data bus 33 to process the high-pixel image.

The CPU 41 records the image data of the XGA format directly in the recording device 51 in the recording mode. It is however possible for the resolution conversion circuit 28 to convert the resolution of the image data before recording the image data on the recording device 51. Specifically, it is possible to cause the resolution conversion circuit 28 to convert the resolution of the image data read out from the image memory 32 via the memory controller 22 in meeting with the VGA (1024×768→640×480) to permit the JPEG encoder/decoder 29 to compress the image data to record the compressed data in the recording device 51.

If desirous to confirm the as-shot image after image shooting, the operator thrusts the playback button, not shown, for reproducing the as-shot image.

If the reproducing button is thrust, the digital still camera 1 moves to the reproducing mode. In the reproducing mode,

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the CPU 41 controls the respective circuits in the following manner to read out the image data of the object.

That is, on detecting the thrusting the reproducing button, the CPU 41 reads out the image data from the recording device 51 and transiently stores the read-out image data in the DRAM 42 before routing the data via CPU bus 34 to the JPEG encoder/decoder 29. The JPEG encoder/decoder 29 expands the image data read out from the recording device 51 in accordance with the JPEG system to produce image data of the XGA format to route the resulting image data via the image data bus 33 to the memory controller 22.

The memory controller 22 writes the image data on the image memory 32 and reads out the image data from the image memory 32 to send the read-out image data via the image data bus 33 to the resolution conversion circuit 28.

The resolution conversion circuit 28 effects resolution conversion so that the image data will be in meeting with the VGA format (1024x768→640x480 in the NTSC system and 1024x768→640x576 in the PAL system) to route the converted image data over the image data bus 33 to the memory controller 22. The image data then is read from the image memory 32 and routed via the NTSC/PAL encoder 23 to the finder 36. This displays an image corresponding to the image data recorded in the recording device 51 on the finder 36.

That is, since the image data recorded in the recording device 51 has high resolution, the CPU 41 first lowers the resolution and subsequently routes the image data to the finder 36.

It is also possible for the CPU 41 to set, for each of the finder mode, recording mode and the reproducing mode, the order of priority of the circuits to be processed in preference and to cause the pertinent circuit to execute the processing in accordance with the order of priority on movement to one of the modes. This enables the signal processing of image data to be executed efficiently depending on the processing contents in each mode.

In the above-described embodiment, it is assumed that the data being processed is the image data equivalent to XGA. It is to be noted that the present invention is not limited to this embodiment and can be applied to, for example, the processing of image data comprised of one million or more pixels.

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What is claimed is:

- 1. Imaging apparatus having an imaging unit for generating image data in response to image light received from an object and an output unit for outputting image data to a display, the imaging apparatus comprising:
 - a first resolution converter for decreasing a resolution of image data generated by the imaging unit,
 - a second resolution converter for increasing a resolution of image data that is to be outputted to the display via the output unit, and
 - a compression unit for compressing image data with a resolution that is decreased by the first resolution converter.
- 2. The imaging apparatus according to claim 1, further comprising:
 - a display unit for displaying an image based on the image data from the output unit, and
 - an image data recording unit for writing on a recording medium the image data compressed by the compression unit.
- 3. The imaging apparatus according to claim 1, further comprising:
 - an image data output unit for outputting to outside the image data compressed by the compression unit.
- 4. Imaging apparatus having an imaging unit for generating image data in response to image light received from an object and an output unit for outputting image data to a display, the imaging apparatus comprising:
 - a first resolution converter for decreasing a resolution of image data generated by the imaging unit, and
 - a second resolution converter for increasing a resolution of image data that is to be outputted to the display via the output unit, wherein
 - the second resolution converter performs a resolution conversion to increase the resolution of the image data if the resolution of that image data before resolution conversion thereof is less than a resolution that matches a resolution standard of the display.
- 5. The imaging apparatus according to claim 4, further comprising:
 - a display unit for displaying an image based on the image data from the output unit.

* * * * *

Exhibit N



US005915239A

United States Patent [19]
Haavisto et al.

[11] **Patent Number:** **5,915,239**
[45] **Date of Patent:** **Jun. 22, 1999**

[54] **VOICE-CONTROLLED TELECOMMUNICATION TERMINAL**
[75] Inventors: **Petri Haavisto; Kari Laurila; Markku Majaniemi**, all of Tampere, Finland

4,853,953	8/1989	Fujisaki	379/88
4,928,302	5/1990	Kaneuchi et al.	379/88
4,945,557	7/1990	Kaneuchi et al.	379/67
5,182,765	1/1993	Ishii et al.	379/88
5,222,121	6/1993	Shimada	379/88
5,640,485	6/1997	Ranta	395/2.6

[73] Assignee: **Nokia Mobile Phones Ltd.**, Espoo, Finland

Primary Examiner—David R. Hudspeth
Assistant Examiner—Susan Wieland
Attorney, Agent, or Firm—Perman & Green, LLP

[21] Appl. No.: **08/918,386**

[57] **ABSTRACT**

[22] Filed: **Aug. 26, 1997**

[30] **Foreign Application Priority Data**

Sep. 2, 1996 [FI] Finland 963417

A method for selecting a telephone number by means of voice control, the telephone numbers which can be selected are stored, and for each telephone number which can be selected at least one identifier, such as a name is stored. In the storing phase, the identifier is pronounced and divided into one or several sub-identifiers, which are stored, and to which information on the telephone number is linked, wherein the telephone number mentioned in the selecting phase can be dialed either by pronouncing said sub-identifiers in any order according to a combination or partial combination of the sub-identifiers.

[51] **Int. Cl.⁶** **G10L 9/00; H04M 1/27**

[52] **U.S. Cl.** **704/275; 704/270**

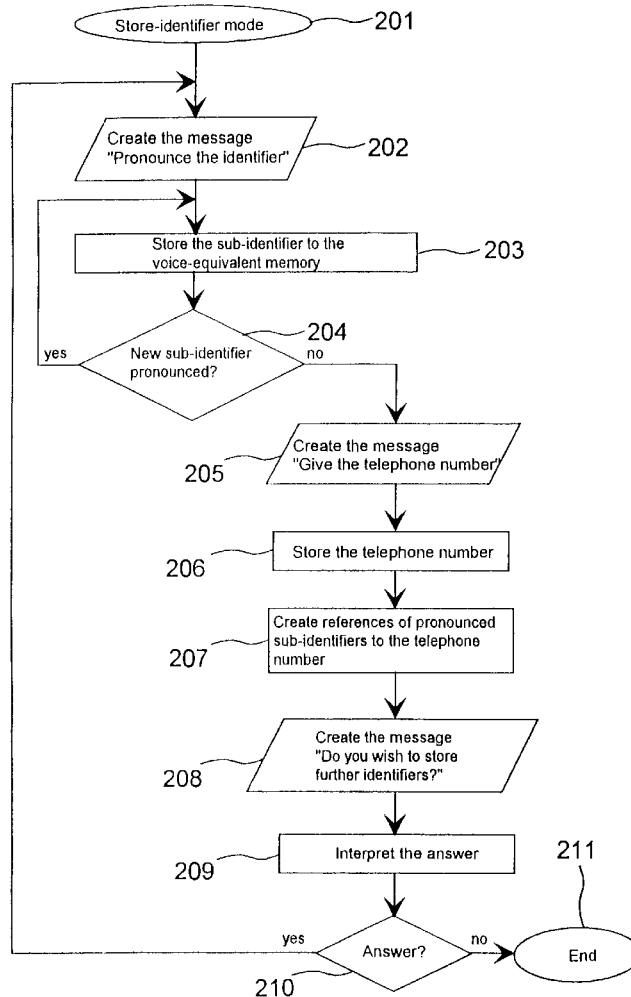
[58] **Field of Search** **704/270, 275; 379/67, 354, 355, 88, 216**

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,644,107 2/1987 Clowes et al. 379/354

13 Claims, 3 Drawing Sheets



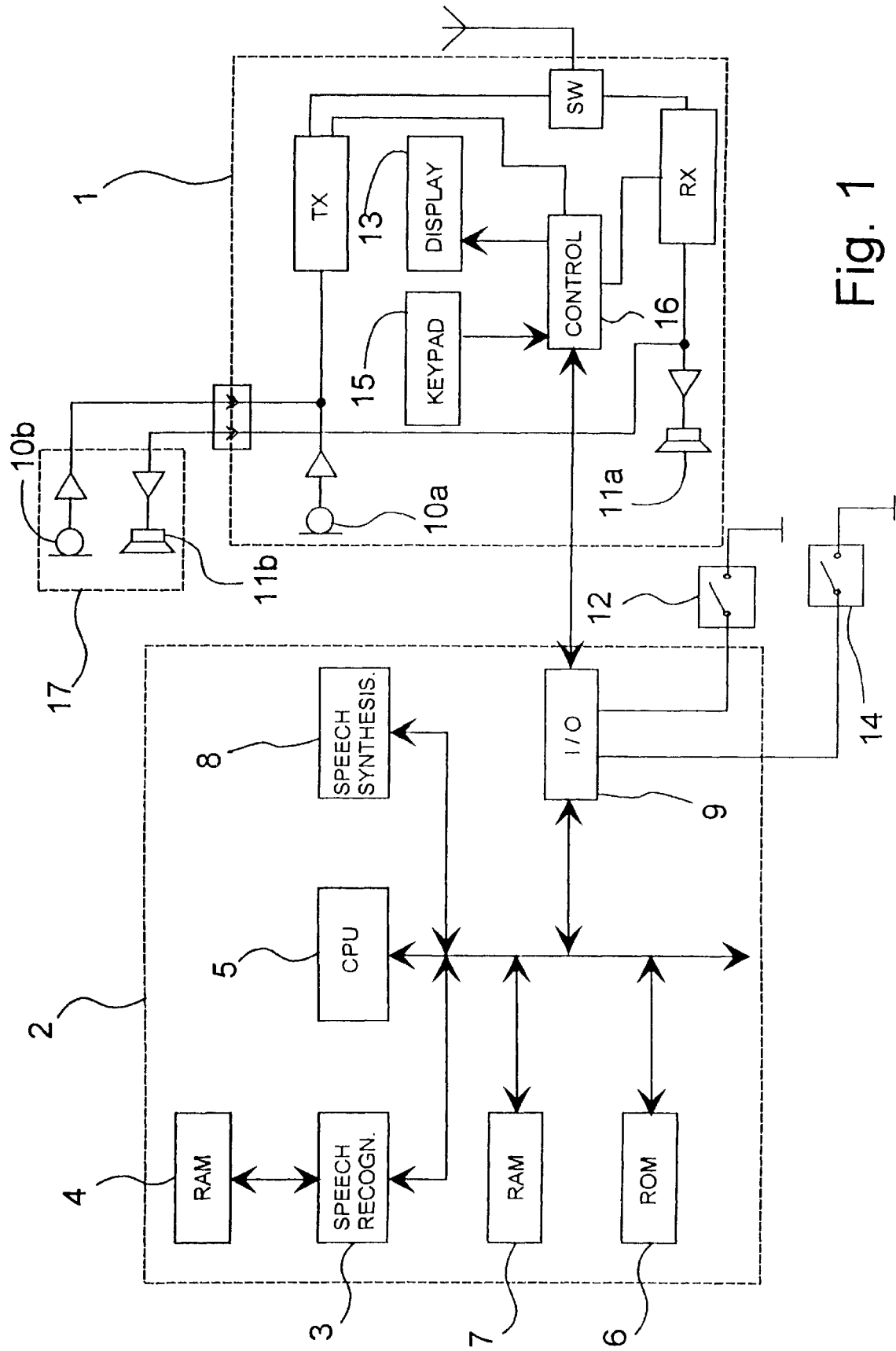
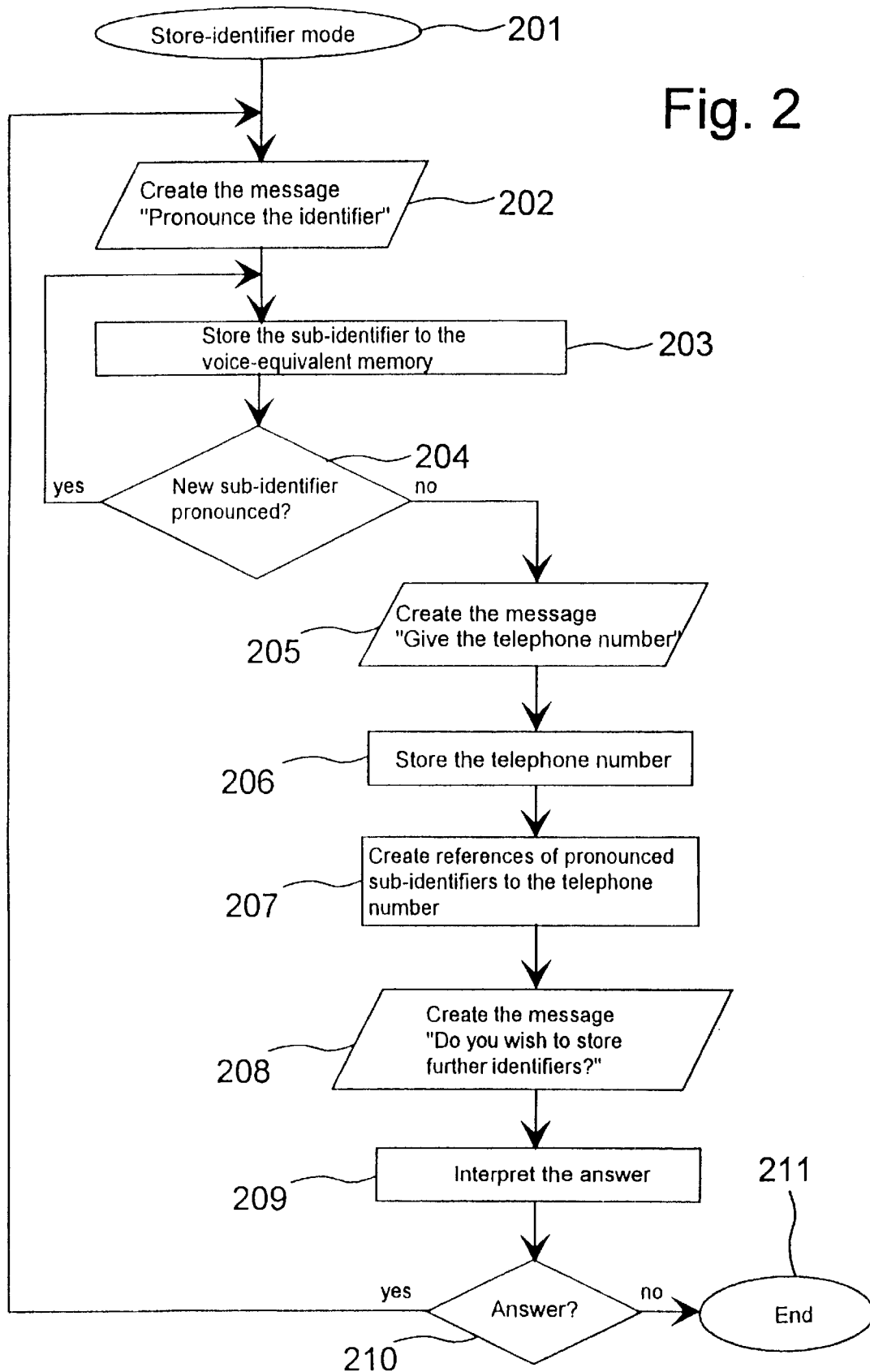


Fig. 1

Fig. 2



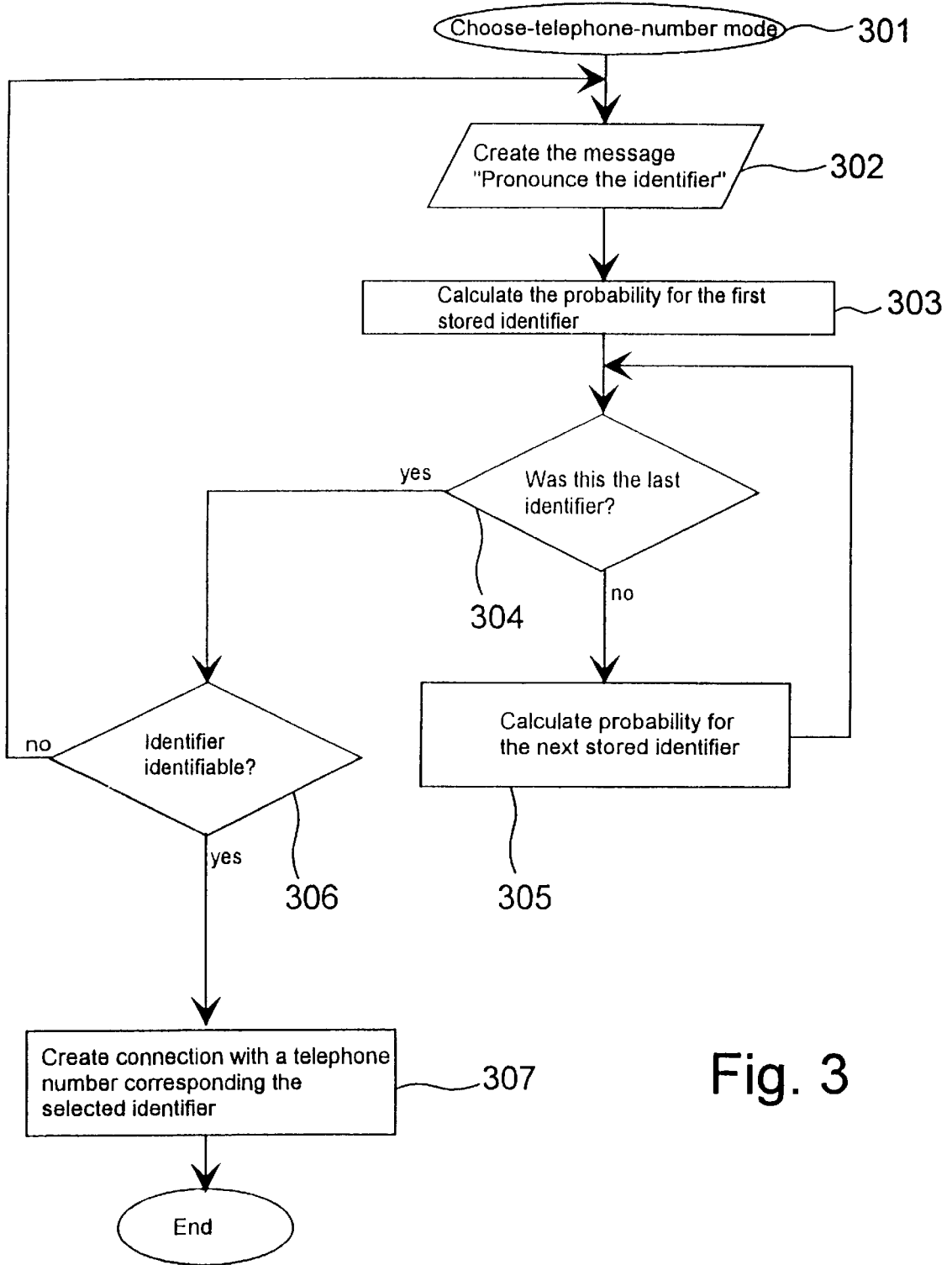


Fig. 3

VOICE-CONTROLLED TELECOMMUNICATION TERMINAL

BACKGROUND OF THE INVENTION

The present invention relates to a method for controlling a telecommunication terminal by means of voice, as presented in the preamble of the claim 1, and a voice-controlled telecommunication terminal according to the method.

When a mobile phone is used in a car, a hands-free mode is often required, wherein the car has a hands-free equipment for the mobile phone, comprising a separate loudspeaker and a microphone. Thus, the speaker can use both hands for driving during the call. The advantages of the hands-free mode are comfort in use and improved safety. To increase comfort in use, the hands-free mode is used also in offices as a desktop hands-free installation.

The convenience of hands-free mode is decreased by the fact that for making a call the driver has to dial the telephone number by pressing the keys of the phone. This impairs traffic safety, because the look of the driver is attached to the phone. To facilitate the dialing of numbers, shortcut functions have been designed to phones, wherein names and numbers of persons have been stored into the memory of the phone. The shortcut memory can be scrolled through, wherein it is advantageous to show on the display device of the phone an identifier corresponding to each telephone number, such as the name of the respective person. If needed, it is also possible to show the phone number corresponding to the identifier. The memory can be scrolled forwards and backwards, and when the desired identifier appears on the display device, the dialing the phone number can be started, for example by pressing a call key. However, the shortcut function does not entirely eliminate the need to press the keys when calling.

Various methods based on voice recognition for telecommunication terminals, such as mobile phones and wireline telephones, have been developed, particularly for dialling a phone number without pressing the keys. In such methods, the desired phone number can be dialed usually in a manner that the caller pronounces the phone number or an identifier related to the phone number, such as the name of the person. The phone number corresponding to the identifier has been stored advantageously to the shortcut memory.

Some known telecommunication terminals and methods based on voice recognition have been described in the patent publications U.S. Pat. No. 4,644,107, U.S. Pat. No. 4,853,953, U.S. Pat. No. 4,928,302, U.S. Pat. No. 5,182,765 and U.S. Pat. No. 5,222,121.

Prior art control and calling methods of a telecommunication terminal using voice recognition are mainly based on the fact that a distinguishing voice pattern has been stored for each command and phone number. Thus, the command or identifier has to be given in a form as identical with the stored form as possible. Thus, the caller has to remember in which form e.g. the name "Matthew Herbert Williams" was stored; was it stored exactly in this form, or in form "Matthew Williams", "Williams Matthew", or "Williams Matthew Herbert".

U.S. Pat. No. 5,222,121 discloses a voice-recognition dialing device arranged in connection with a telephone mounted on a vehicle or the like. Into the memory of the dialing device, voice patterns corresponding to the commands and telephone numbers, such as words "RECALL MEMORY", "SEND" and "VERIFY", are stored. Voice patterns are preferably stored already when the dialing device is manufactured. The dialing unit can also be imple-

mented in a manner that the user teaches the unit also the commands and numbers. The dialing device includes a loudspeaker and/or a display device, wherein the user is given instructions in form of voice signals and/or text. The call is initiated by pronouncing the command "RECALL MEMORY", wherein the dialing device requests the user to pronounce the identifier of the desired telephone number. After the identifier has been pronounced, the device compares the identifiers stored into the memory and after finding an identifier that most resembles the pronounced identifier, it gives a voice signal. The user may then give the device a call command "SEND", or a command "VERIFY" if the user wishes to check that the number is correct. In this case, the dialing device informs the chosen identifier, for example in a sound signal. If the chosen identifier is correct, a connection is created by using a call command. If the chosen identifier is incorrect, the user can scroll through the other alternatives by using a command "NEXT ONE". However, the identifiers have to be given in the same form as they have been stored, which increases the possibility of false choices.

U.S. Pat. No. 4,928,302 presents another dialing device for calling a desired telephone number by using voice commands. In this device, the telephone numbers can be classified for example according to the initial part of the name. The search can thus be implemented by pronouncing for example the surname "Williams", wherein the device searches all the names having "Will" in their initial part, such as "Williams", "Williamson" and "Willis". In the next phase the desired name can be chosen from the list formed by the device, which is thus in this phase briefer than the list of all the names stored in the memory. Even this device has the disadvantage that the user has to remember the form the name was stored, that is, "Williams Matthew", "Matthew Williams", "Williams Matthew Herbert" or "Matthew Herbert Williams".

SUMMARY OF THE INVENTION

The purpose of the present invention is to eliminate the above mentioned disadvantages to a great extent and to provide a device and method for controlling a telecommunication terminal by means of voice command, particularly for choosing a telephone number from a group of stored telephone numbers. The invention is based on the idea that the identifier can comprise more than one sub-identifier, i.e. word, wherein in the search phase the identifier can be dictated according to combination of any sub-identifiers. The method of the invention is characterized in what is said in the characterizing portion of the appended claim 1. The voice-controlled unit of the invention is characterized in what is said in the characterizing portion of the appended claim 3.

The present invention provides significant advantages over prior art voice-control methods and voice-controlled devices.

In the method according to the invention the identifier related to a telephone number can be composed of one or several sub-identifiers stored into the memory of the device. However, it is not required in the calling phase to pronounce the sub-identifiers in the exact order as they were stored, but any combination or partial combination of sub-identifiers can be used. It is not even necessary to pronounce all the sub-identifiers provided that the telephone number to be chosen is identified by the group of the pronounced sub-identifiers. In some cases the identifier can be identified by pronouncing just one sub-identifier.

A method in accordance with a second advantageous embodiment of the invention provides the option to pro-

nounce sub-identifiers not present in the group of sub-identifiers stored in the memory, that is the word list, when the telephone number is chosen. The voice-recognition advantageously ignores these sub-identifiers and performs the selection based on sub-identifiers present in the word list.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention is described in more detail with reference to the accompanying drawing, where

FIG. 1 shows a reduced block diagram of one advantageous dialling device according to the invention,

FIG. 2 shows a reduced flow chart of storing of an identifier into the memory of the device, and

FIG. 3 shows a reduced flow chart of a situation in which a telephone number is dialled in accordance with one advantageous embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

A voice-controlled telecommunication terminal **1** according to an advantageous embodiment of the invention as shown in FIG. 1 is for example a mobile station, such as a GSM mobile phone, or a fixed wireline telephone. FIG. 1 shows only those blocks which are the most essential for understanding the invention. A voice-control unit **2** comprises advantageously a voice-recognition means **3**, a voice pattern memory **4**, a controller unit **5**, read-only memory **6**, random access memory **7**, speech synthesiser **8** and an interface **9**. Voice control can be given e.g. by means of a microphone **10a** of the telecommunication terminal **1** or by means of a microphone **10b** of a hands-free equipment **17**. The instructions and notices to the user can be given e.g. by means of sound signals created by a speech synthesizer **8** either through a loud-speaker **11a** belonging to the telecommunication terminal **1** or through a loudspeaker **11b** of the hands-free equipment. The voice-control unit **2** of the invention can also be implemented without the voice-synthesizer **8**, wherein instructions and notices are transmitted to the user preferably in text form on the display means **13** of the telecommunication terminal. Another option is to transmit instructions and notices to the user both as sound and as text messages.

In the following, the operation of the method and the telecommunication device **1** in accordance with the invention is described. Before the voice-control operates, the device has to be taught usually all the voice commands and identifiers to be used. It is preferable that the voice commands have been taught in the manufacturing phase of the device, wherein the user teaches only those identifiers he or she will need. This can be implemented e.g. by setting the voice-control unit **2** to a teach mode, for example by keying the voice-storing key **A** of the keyboard **15** of the telecommunication terminal **1**, by keying the supplementary voice-storing key **12** or through the menu facility of the telecommunication terminal **1**. The manner how the changing over to the teach mode of the voice commands is implemented depends e.g. on the telecommunication terminal **1** used and on the implementation of the voice control and its technology known by an expert in the field as such. Subsequently, the user pronounces the command taught at a time and advantageously by pressing the keys informs which command was pronounced. If required, the command is repeated several times to ensure reliable storing as to the voice recognition. According to the pronounced command, the voice-recognition means **3** forms an identifier, which is stored to the voice pattern memory **4**. Prior art includes

several alternative implementations for voice-recognition means **3** and voice-equivalent memory **4** and they are known by an expert in the field. Thus, a more detailed description of these implementations is unnecessary in this context; instead reference is made for example to the publications mentioned in connection with the description of prior art.

Also the numerals from zero to nine are advantageously stored into the voice-equivalent memory, wherein the user can store also the telephone number by pronouncing it, wherein the voice-control unit **2** transforms the pronounced telephone number preferably to signals corresponding to the numeral keys and stores the information on the telephone number to the telephone number memory, wherefrom it can be collected when calling. The user can give the telephone number also by keying in the corresponding numerals. The teach mode of the voice commands is terminated advantageously by keying again the voice-store key **A** or through the menu function of the telecommunication terminal.

In the phase when the user wishes to store the identifier of the telephone number, the voice-control unit **2** is set to a mode in which the voice-control unit can expect to receive identifiers, which can be composed of one or several sub-identifiers. This function mode is described in the following with reference to the flow chart of FIG. 2. Changing over to the store-identifier mode (block **201**) is implemented advantageously by keying the voice-store key **A** or through the menu facility, as presented earlier in connection with command storing. The voice-recognition unit **2** creates advantageously a message "Pronounce the identifier" (block **202**), wherein the user starts pronouncing the sub-identifiers of the identifier. Thus, the identifier can comprise one or several sub-identifiers, for example "Williams", "Matthew", "Herbert". A short pause is kept between each sub-identifier, wherein the voice-recognition unit **2** is able to separate the sub-identifiers from each other. Each pronounced sub-identifier is stored into the voice-equivalent memory **4** (block **203**). The voice-control unit **2** can additionally create a short sound signal (e.g. a bleep) after each pronounced sub-identifier as a sign that the sub-identifier is stored. Subsequently, after all the sub-identifiers have been pronounced (block **204**), the user is requested to give the telephone number related to the identifier (block **205**), e.g. by pronouncing the numbers or by keying. After the number has been given, the voice-control unit **2** stores the telephone number e.g. to the random access memory **7** (block **206**) and creates references of the sub-identifiers to the telephone number (block **207**). Subsequently, the user is asked whether any other identifiers and telephone numbers are to be stored (blocks **209**, **210**). In case the user wishes to continue the storing, the function moves back to the block **202** until identifiers are no longer given (block **211**).

Division into sub-identifiers can also be implemented in a manner that the user divides the identifier into sub-identifiers and separates the sub-identifiers e.g. by pressing a key.

In the calling phase the voice-control unit **2** has to be set to a choose-name mode, e.g. by a voice command "phone call" or by using the keys of the telecommunication terminal **1**. When mounted on a car, it is also possible to bring a supplementary control option, external from the telecommunication terminal **1**, e.g. close to the steering wheel of the car, wherein the activation of the choose-name mode is easy to implement, e.g. by an activation switch **14**. In the following, the voice-controlled dialling of telephone number in accordance with a preferred embodiment of the invention is described with reference to the flow chart of FIG. 3.

After the voice-control unit **2** has recognised the given command as the activation command of the choose-name

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mode, the voice-control unit **2** moves to a choose-telephone-number mode (block **301**). The voice-control unit **2** creates advantageously a sound signal to the loud-speaker **11** and/or a text message on a display means **13**, which signal or message informs the user to pronounce the identifier (block **302**). The user can pronounce the sub-identifiers of the identifier in any order, preferably by keeping a short pause between sub-identifiers to separate the sub-identifiers from each other. The voice-control unit **2** calculates the probability between the first stored identifier and the pronounced identifier (block **303**). Subsequently, it is examined whether any other identifiers are stored into the memory (block **304**). In case there remains any non-examined identifiers, probability is created for the next identifier (block **305**). When probability has been created for every stored identifier, the highest calculated probability is searched. In case the probability calculated to one stored identifier is distinctively higher than that calculated to the rest of the identifiers, it can be assumed that the said identifier is the correct one (block **306**), wherein choose-telephone-number mode can be started (block **307**). In case the identifying of the identifier did not succeed, it is possible e.g. to move back to the block **302** and ask the user to repeat the identifier until the selection can be identified.

A complete identification is not always reached, wherein the voice-control unit **2** can inform the user and to ask the user to pronounce the identifier again, e.g. by moving back to block **302** in the flow chart of FIG. 3. The voice control unit **2** can also create e.g. a sound signal of those identifiers that according to the comparison made by the voice-recognition means **3** most resemble the pronounced identifier, wherein the user can select the correct identifier. In case none of the proposed identifiers is correct, the user can repeat the identifier. Even if the voice-control unit **2** could recognize the given identifier, it is preferable to verify from the user that the selected identifier is correct. This can be performed for example in a manner that the user gives a dial command if the identifier is correct, or a re-recognition command if the identifier is incorrect. The verifying can be advantageously performed also by an activation switch key **14**. Yet another alternative for verifying is that the telecommunication terminal **1** will wait a predetermined time for the command of the user, and in case no command is coming, it presumes the selected telephone number to be correct and starts the dialling.

The telephone number is dialled according to the information stored to the telephone number memory in a manner known as such. The used memory can be memory of the telecommunication terminal **1** (not shown) or the random access memory **7** of the voice-control unit **2**. Also non-volatile random access memory (NVRAM) can be partially used as the random access memory **7** of the voice-control unit **2**, wherein the information stored in the memory is preserved also without operating voltage.

The method according to the invention can be implemented e.g. in a manner that in the storing phase a separate model is formed of each pronounced identifier. In the following, it is assumed that N number of names, that is sub-identifiers: n_1, n_2, \dots, n_N , is related to the telephone number. For the recognition phase, a model structure is formed to the telephone number, the structure including every possible sub-identifier composition, that is, 1 to N sub-identifiers in every possible order.

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These sub-identifier compositions include

$$\sum_{i=1}^N i! \cdot \binom{N}{i} \text{ pcs.}$$

The voice-control unit **2** defines probability to all the sub-identifier compositions, and the sub-identifier composition which is given the highest probability is the final result of the recognition.

For example in the case n_1 =Williams, n_2 =Matthew and n_3 =Herbert, the possible sub-identifier compositions are:

Williams, Matthew, Herbert, Williams Matthew, Matthew Williams, Williams Herbert, Herbert Williams, Matthew Herbert, Herbert Matthew, Williams Matthew Herbert, Williams Herbert Matthew, Matthew Williams Herbert, Matthew Herbert Williams, Herbert Williams Matthew, and Herbert Matthew Williams

Thus, there are altogether 15 possible sub-identifier compositions when the number of the sub-identifiers is three. Sub-identifier combinations are thus full combinations of sub-identifiers (consisting all the sub-identifiers) or partial combinations of sub-identifiers (consisting only a part of the sub-identifiers). Also partial combinations having only one sub-identifier are possible when adapting the voice control according to the invention.

The following Table 1 shows the number of sub-identifier combinations as the function of sub-identifiers.

Number of sub-identifiers	Number of sub-identifier combinations
1	1
2	4
3	15

As it can be seen in the Table 1, the number of sub-identifier combinations rises very quickly, it being as high as **64** when the number of the sub-identifiers is four. The quantity of the memory and the calculation time required for storing the model structure can be diminished by means of the implementation alternative according to the preferred embodiment of the invention. In this alternative, separate sub-identifiers are recognised, these being independent from each other, from the group of all the pronounced words (word spotting). In this method, it looks as if the voice-control unit **2** is constantly waiting for a certain sub-identifier and it recognizes whether it is pronounced or not. In this case, the voice-control unit **2** produces several possible alternative names and a probability rank for them. According to these alternatives, the telephone number meant by the user can be concluded.

In this method, it does not make a difference how many words not included in the word list (the group of all the stored sub-identifiers) are used, which makes this method highly flexible in use.

In the teaching phase, the voice-control unit **2** transforms the pronounced sub-identifiers to a form appropriate for storing and compares each pronounced sub-identifier to ready-stored sub-identifiers. In case the pronounced sub-identifier had already been stored; e.g. the user has already stored the name "Matthew Taylor", the voice-control unit **2** detects, when "Matthew" is being pronounced, that this had already been stored. In this case, the voice-control unit **2** forms a reference from the sub-identifier "Matthew" to the telephone number of Taylor and the telephone number of

Williams. In this situation, in the recognition phase, after the sub-identifier "Matthew", the voice-control unit 2 has formed e.g. a list which includes both Matthew Taylor and Matthew Williams. Thus, the voice-control unit 2 knows to expect either Taylor or Williams, and after the user has pronounced the next sub-identifier, the voice-control unit 2 judges whether the identifier can be identified on basis of the given sub-identifiers or whether it should wait for a possible sub-identifier to come. This could be possible in such cases when the two sub-identifiers are identical and the third sub-identifier is different. Although the above mentioned sub-identifiers comprise only the surnames and forenames of persons, the sub-identifiers can denote e.g. to the name of the company or group where the person in question is working, or possibly also to the department or filial name ("Matthew", "Williams", "Nokia", "Mobile Phones"). Further, the person may have several telephone numbers, even in different countries, wherein one used sub-identifier can be a country ("Matthew", "Williams", "Nokia", "Finland"). Also the home number can be distinguished by using e.g. a sub-identifier "Home".

The voice-control unit 2 according to the invention is preferably formed to constitute a part of the telecommunication terminal 1, wherein the functions of the voice-control unit are included advantageously in the functional software and apparatus of the telecommunication terminal 1. Thus, the used controller unit 5, read-only memory 6 and random access memory 7 are the corresponding parts of the telecommunication terminal. In order to simplify this in FIG. 1, these parts are shown in a control block 16.

Another alternative to implement the telecommunication terminal 1 according to the invention is to form a part of the blocks in the voice-control unit 2 in connection with the telecommunication terminal 1 and in a manner that a part of the blocks is e.g. a separate device.

Most mobile stations include an access gate for the possibility of connecting external auxiliary devices, wherein the voice-control unit 2 can be implemented as a separate auxiliary device connected to the access gate. Thus, the dialling signals of the control and telephone number can be transmitted via the connectors of the access gate, which is known technology as such.

Yet another alternative to implement the voice-control unit is to form a voice-control service in a telecommunication network, such as mobile communication network, in which voice-control service the functions of the voice-control unit are situated. Thus, the voice recognition is selected e.g. through the menu functions of the mobile station, wherein a voice connection is formed from the mobile station to the voice-control service. Subsequently, the recognition is advantageously performed, as described above. After the identifier has been identified, the voice-control service is capable of creating a connection to the telephone number corresponding to the identifier.

The invention is not restricted solely to the examples presented above but it can be modified within the scope of the accompanying claims.

What is claims is:

1. A method for selecting a telephone number by means of voice control, in which method the telephone numbers which can be selected are stored, and an identifier is stored for each telephone number which can be selected, wherein in the storing phase the identifier is pronounced and divided into several sub-identifiers, which are stored and to which information of the telephone number is linked, wherein the method comprises selecting the telephone number from all combinations of sub-identifiers in response to a voice command comprising the sub-identifier.

2. A method for selecting a telephone number by means of voice control, in which method the telephone numbers which can be selected are stored, and an identifier is stored for each telephone number which can be selected, wherein, in the storing phase the identifier is pronounced and divided into several sub-identifiers, which are stored and to which information of the telephone number is linked, wherein the method comprises selecting the telephone number in response to a voice command comprising a combination of several sub-identifiers.

3. A method as set forth in claim 1, characterized in that the identifier is a name of a person, wherein the used sub-identifiers are preferably the surname of the person and one or several forenames of the person.

4. A voice controlled device comprising:
 means for storing the telephone numbers to be selected,
 means for storing at least one identifier for each telephone number to be selected,
 means for receiving an identifier given in a voice form,
 means for interpreting the received voice commands,
 means for selecting a telephone number in response to a voice command,
 wherein the identifier comprises a plurality of sub-identifiers, and the voice controlled device comprises means for storing the sub-identifiers, and means for selecting a telephone number in response to a voice command comprising at least two of the plurality of sub-identifiers including the sub-identifier.

5. A voice controlled device as set forth in claim 4 wherein the voice controlled device is formed to constitute a separate device.

6. A voice controlled device as set forth in claim 4 wherein the voice controlled device is arranged to be used in connection with a telecommunication terminal.

7. A voice controlled device as set forth in claim 4 intended to be used in call formation in a telecommunication network, such as a mobile communication network, wherein the voice controlled device is located in the telecommunication network.

8. A voice controlled device as set forth in claim 4 wherein the voice controlled device is formed to constitute a part of a telecommunication terminal.

9. A voice controlled device as set forth in claim 8 wherein the telecommunication terminal is a mobile station, such as a Global System for Mobile Communications (GSM) mobile-station.

10. A voice controlled device comprising:
 means for storing telephone numbers to be selected,
 means for storing at least one identifier for each telephone number to be selected,
 means for receiving an identifier given in a voice form,
 means for interpreting received voice commands,
 means for selecting a telephone number in response to a voice command,
 wherein the identifier comprises several sub-identifiers, and the voice controlled device comprises means for storing the sub-identifiers, and means for selecting a telephone number in response to a voice command comprising a combination of several sub-identifiers.

11. A voice controlled device comprising:
 means for storing telephone numbers to be selected,
 means for storing at least one identifier for each telephone number to be selected,
 means for receiving an identifier given in a voice form,

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means for interpreting received voice commands,
 means for selecting a telephone number in response to a
 voice command,
 wherein the identifier comprises at least one sub-
 identifier, and the voice controlled device comprises
 means for storing the sub-identifier, and means for
 selecting a telephone number in response to a voice
 command comprising the sub-identifier, and
 the identifier is arranged to be divided into sub-identifiers
 in the voice controlled device automatically, preferably
 on the basis of pauses kept between the sub-identifiers
 when pronouncing the sub-identifiers.

12. A voice controlled device comprising:

means for storing telephone numbers to be selected,
 means for storing at least one identifier for each telephone
 number to be selected,
 means for receiving an identifier given in a voice form,
 means for interpreting received voice commands,
 means for selecting a telephone number in response to a
 voice command, wherein the identifier comprises at

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least one sub-identifier, and the voice controlled device
 comprises means for storing the sub-identifier,
 means for selecting a telephone number in response to a
 voice command comprising the sub-identifier, and
 means for giving commands to the voice controlled
 device, wherein, the identifier is arranged to be divided
 into sub-identifiers by using means for giving com-
 mands to the voice controlled device.

13. A method for selecting a telephone number by means
 of voice control, in which method the telephone numbers
 which can be selected are stored, and an identifier is stored
 for each telephone number which can be selected, wherein
 at the storing phase the identifier is pronounced and divided
 into several sub-identifiers, which are stored and to which
 information of the telephone number is linked, wherein the
 method comprises selecting the telephone number from a
 plurality of sub-identifiers uttered in any order by a voice
 command, the plurality of sub-identifiers including said
 sub-identifier.

* * * * *