

EXHIBIT B



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United States Patent [19] Martino

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[54] **TELEPHONE/TRANSACTION ENTRY DEVICE AND SYSTEM FOR ENTERING TRANSACTION DATA INTO DATABASES**

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[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **08/909,408**

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Related U.S. Application Data

[63] Continuation of application No. 08/446,546, May 19, 1995, Pat. No. 5,805,676.

[51] **Int. Cl.⁶** **H04M 11/00**

[52] **U.S. Cl.** **379/93.17; 379/93.25; 379/93.01**

[58] **Field of Search** 379/93.17, 93.25, 379/93.01, 88.18; 395/200.31, 200.33; 364/400; 348/13, 14; 381/110

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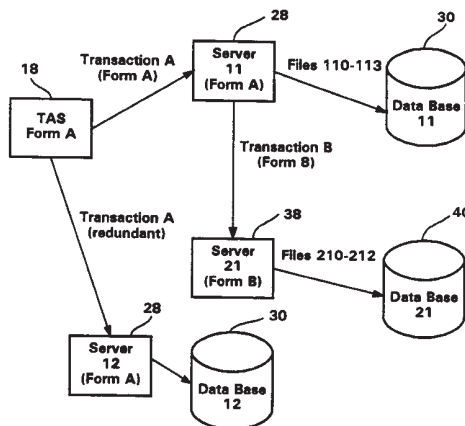
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Assistant Examiner—Melur Ramakrisnaah
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[57] ABSTRACT

A data transaction processing system in which transaction data is entered by the user in response to prompts in a template which is tailored to each user application. The template and entered data are accumulated into data transactions which are immediately transmitted upon completion to an external database server for processing and storage. The data transactions are not locally stored for processing, and no conventional operating system is necessary. No local processing needs to be provided, and the only local storage is a flash PROM which stored the control firmware, a flash memory which stores the data streams making up the forms and menus, and a small RAM which operates as an input/output transaction buffer for storing the data streams of the template and the user replies to the prompts during assembly of a data transaction. The data transaction is received via standard protocols at a database server which, depending upon the application, stores the entire data transaction, explodes the data transaction to produce ancillary records which are then stored, and/or forwards the data transaction or some or all of the ancillary records to other database servers for updating other databases associated with those database servers. Also, in response to requests from the transaction entry device, the database server may return data streams for use in completing the fields in the data transaction or in presenting a menu on the display which was read in from the database server or a remote phone mail system. The transaction entry device is integrated with a telephone and is accessed via a touch screen, an optional keyboard, a magnetic card reader, voice entry, a modem, and the like.

53 Claims, 12 Drawing Sheets



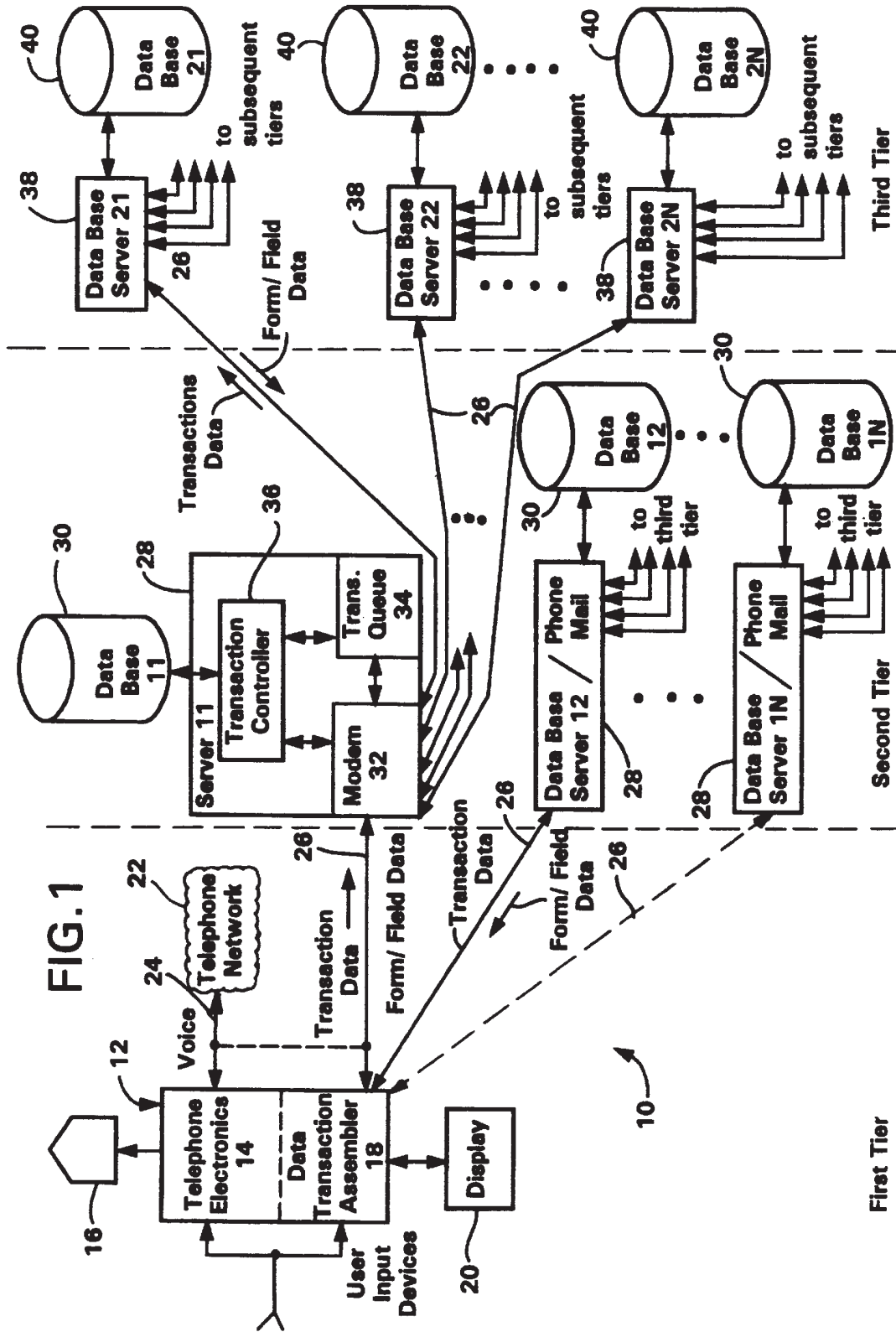


FIG. 2

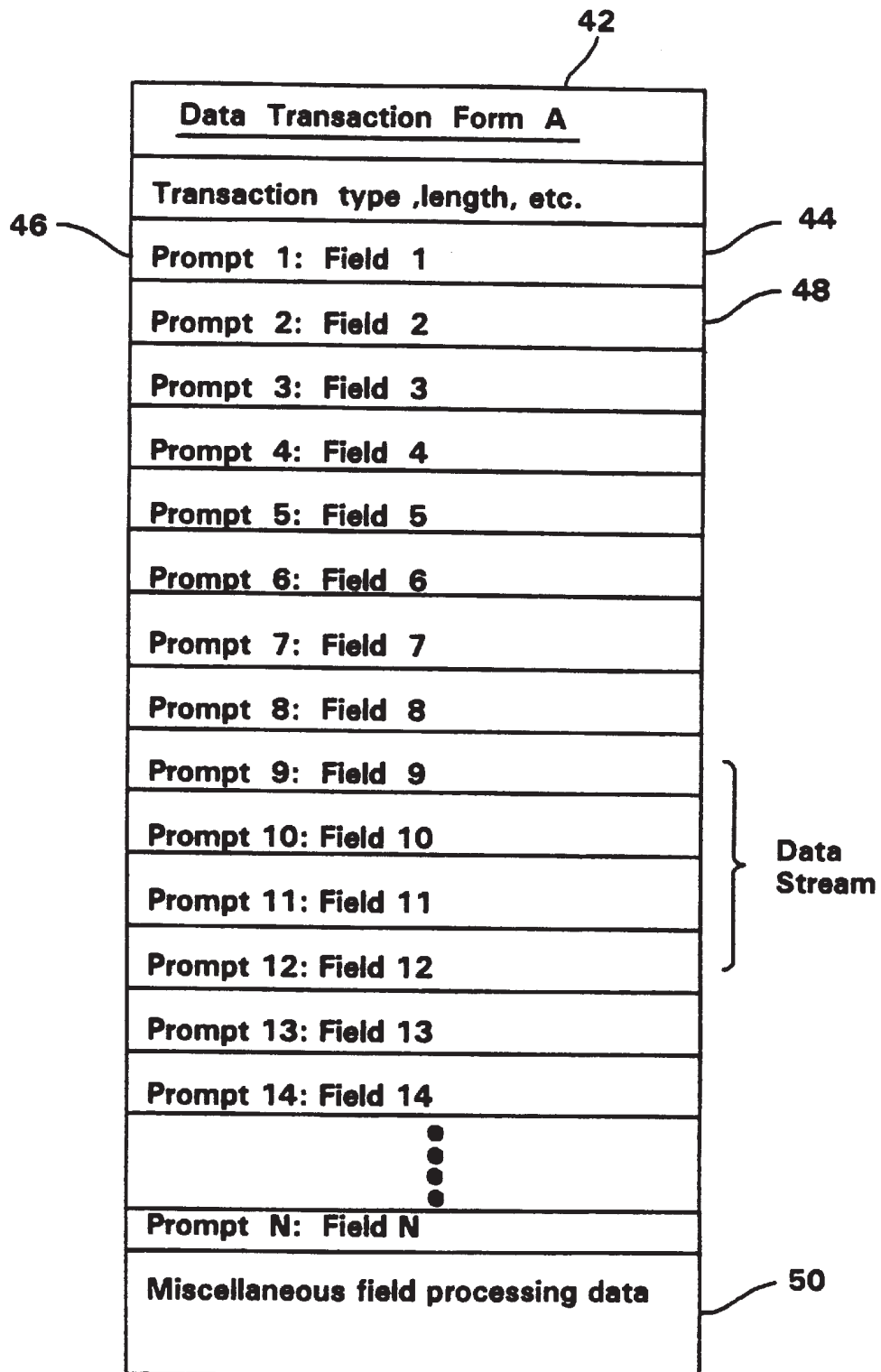


FIG. 3

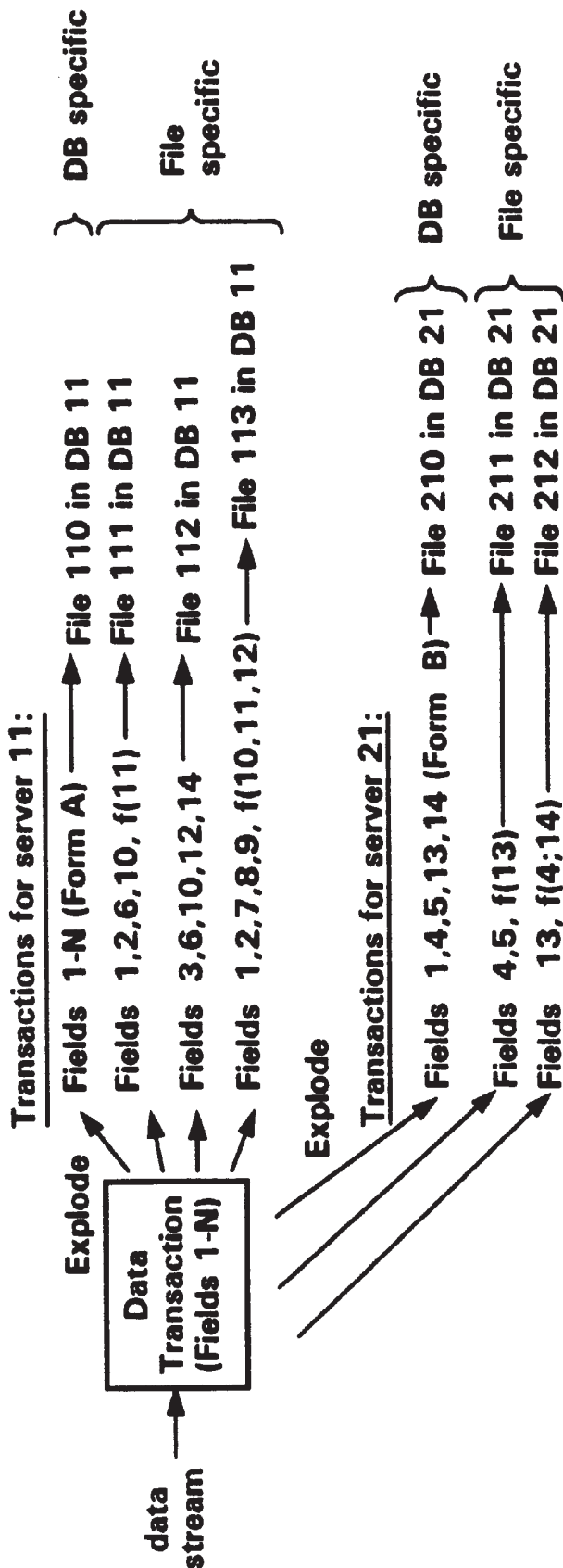
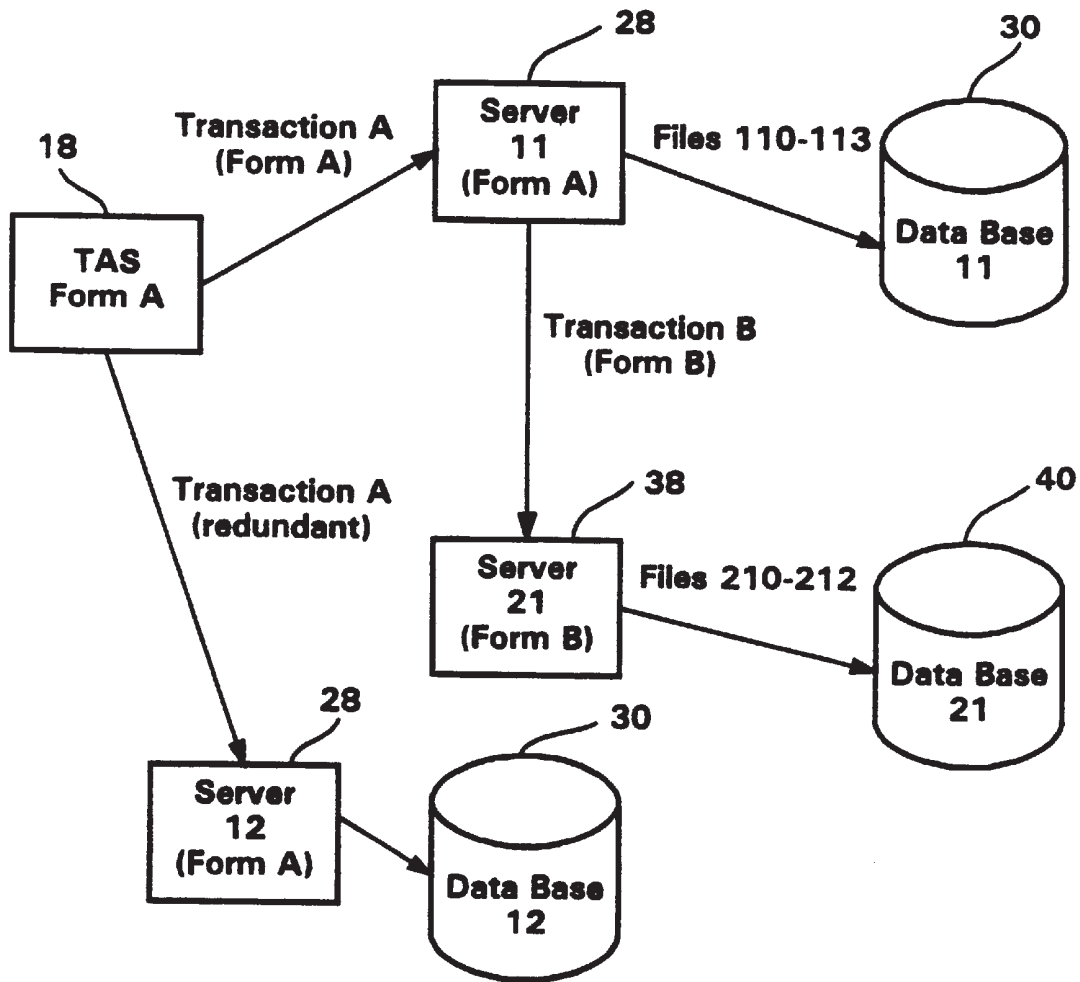


FIG. 4



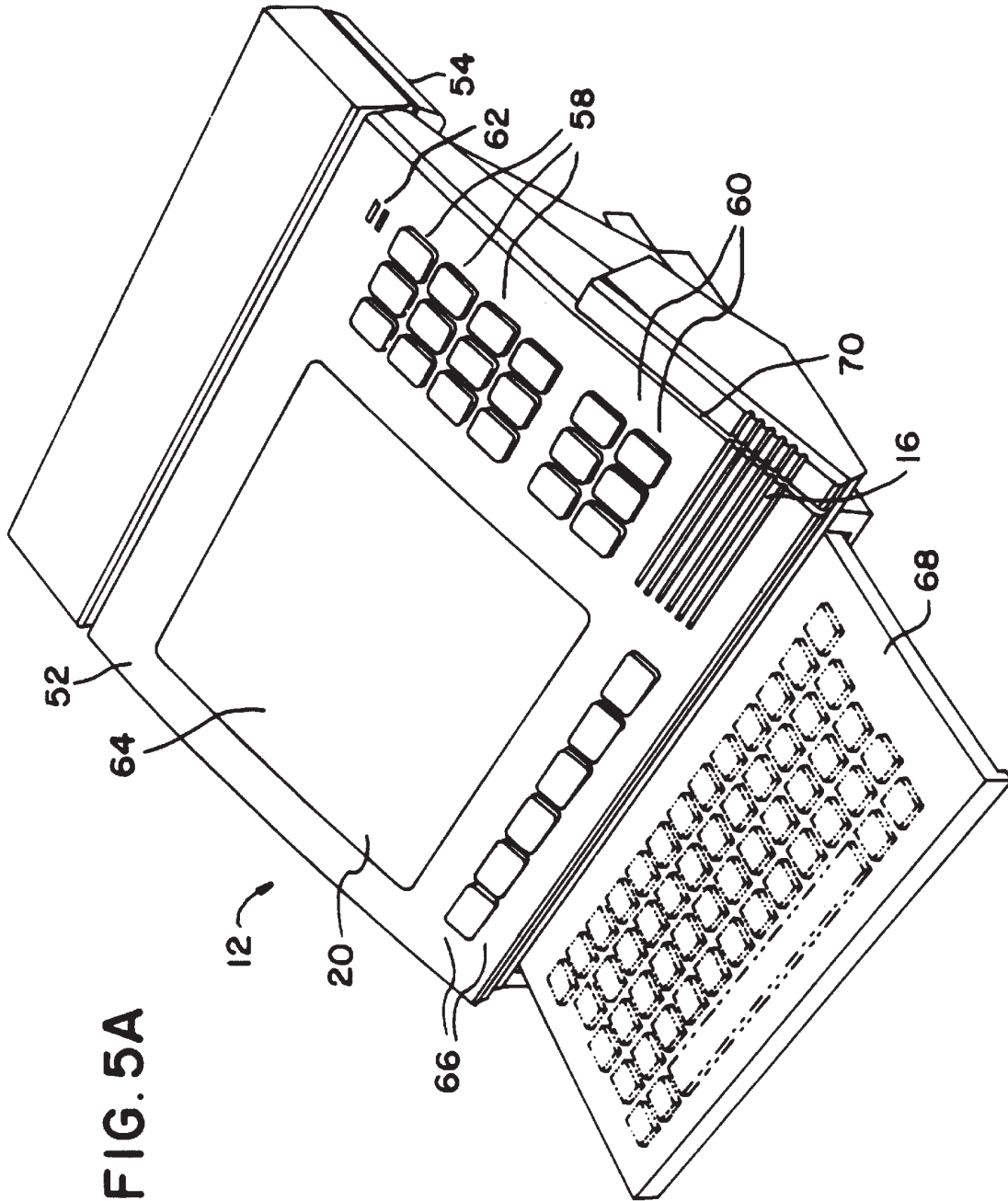


FIG. 5B

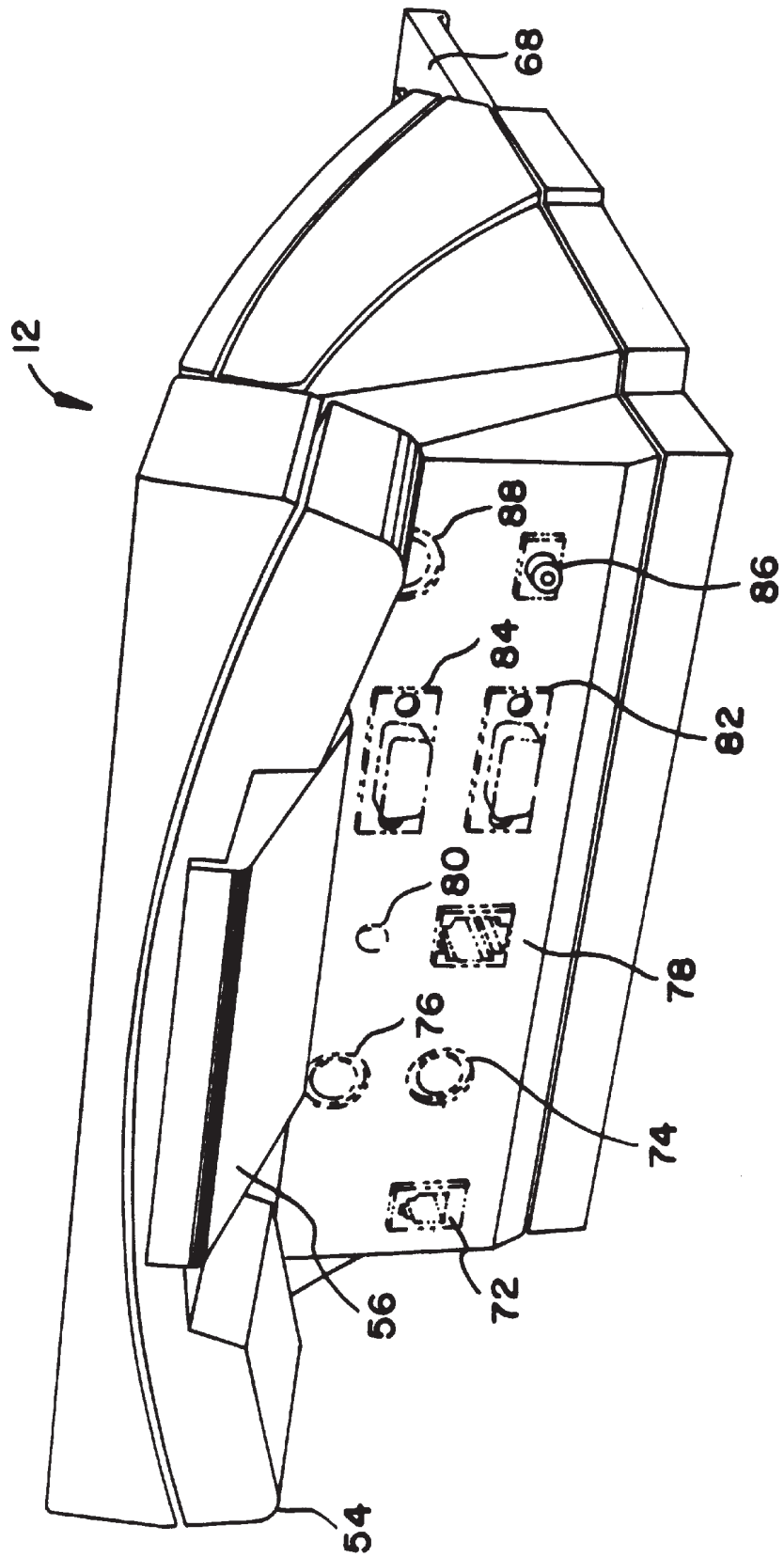


FIG. 6

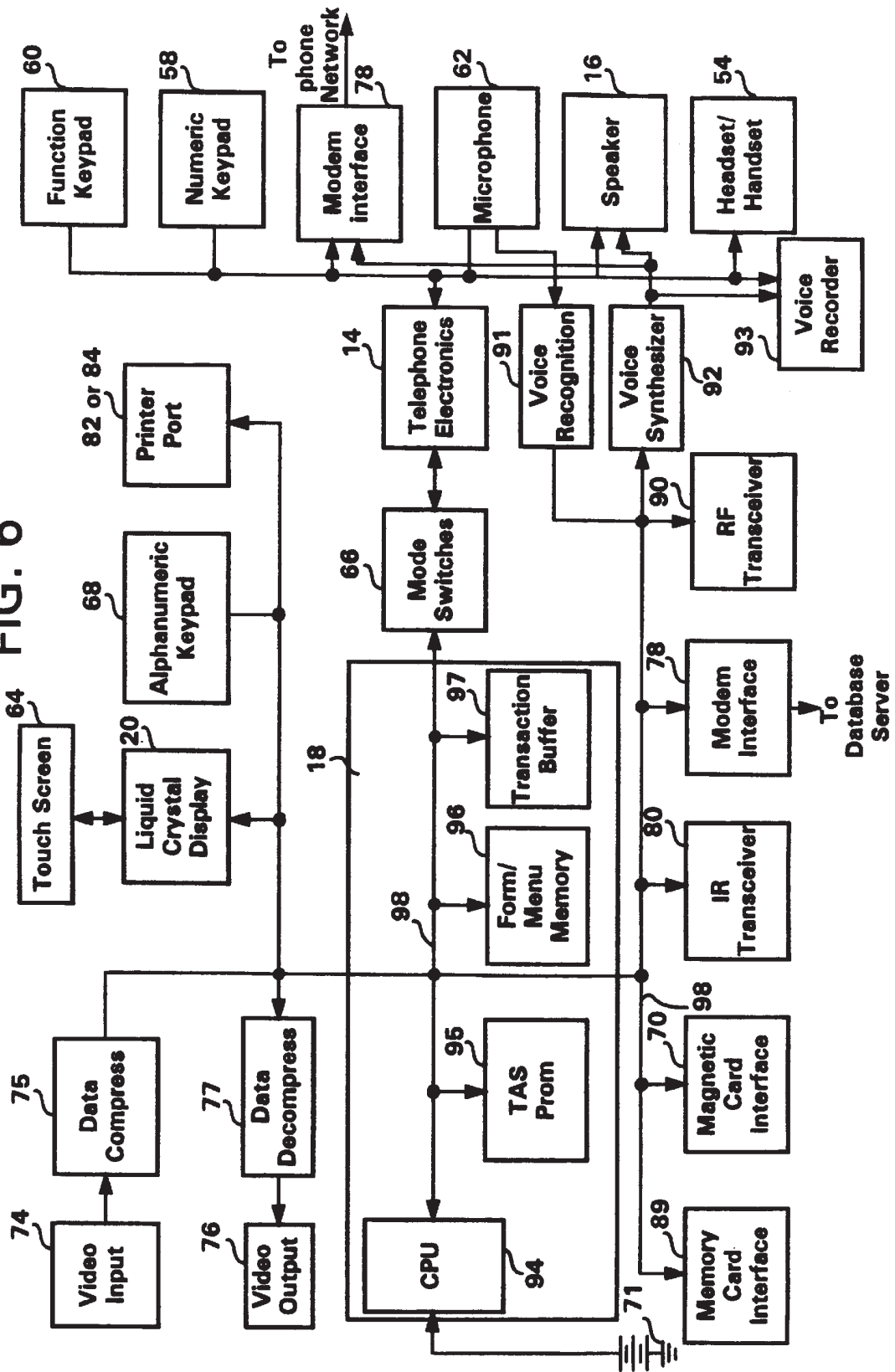


FIG. 7

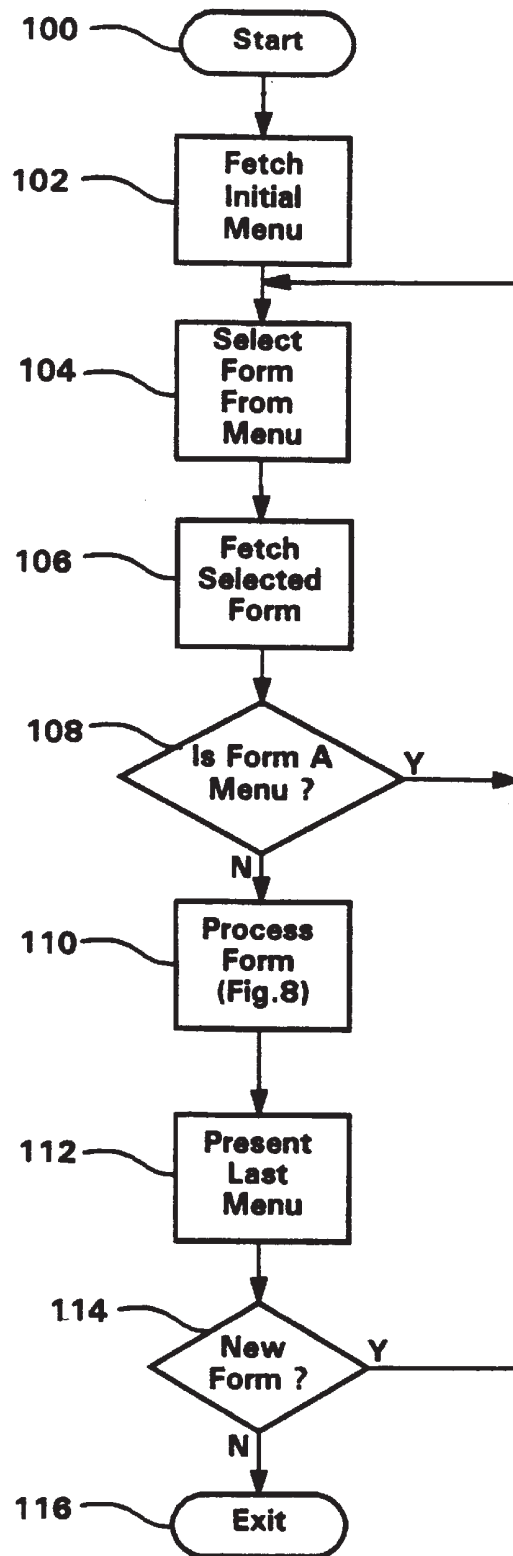


FIG. 8

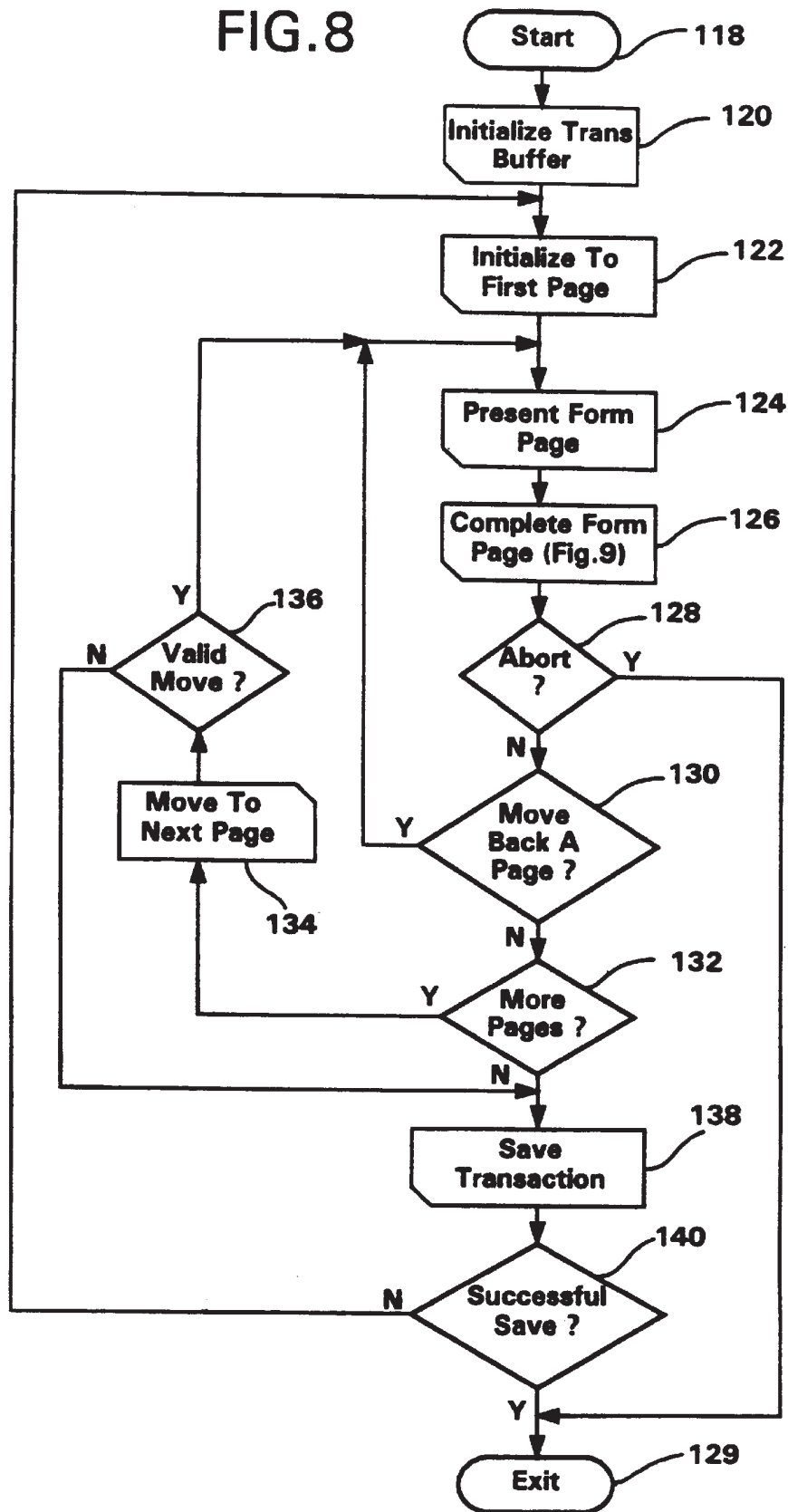


FIG. 9A

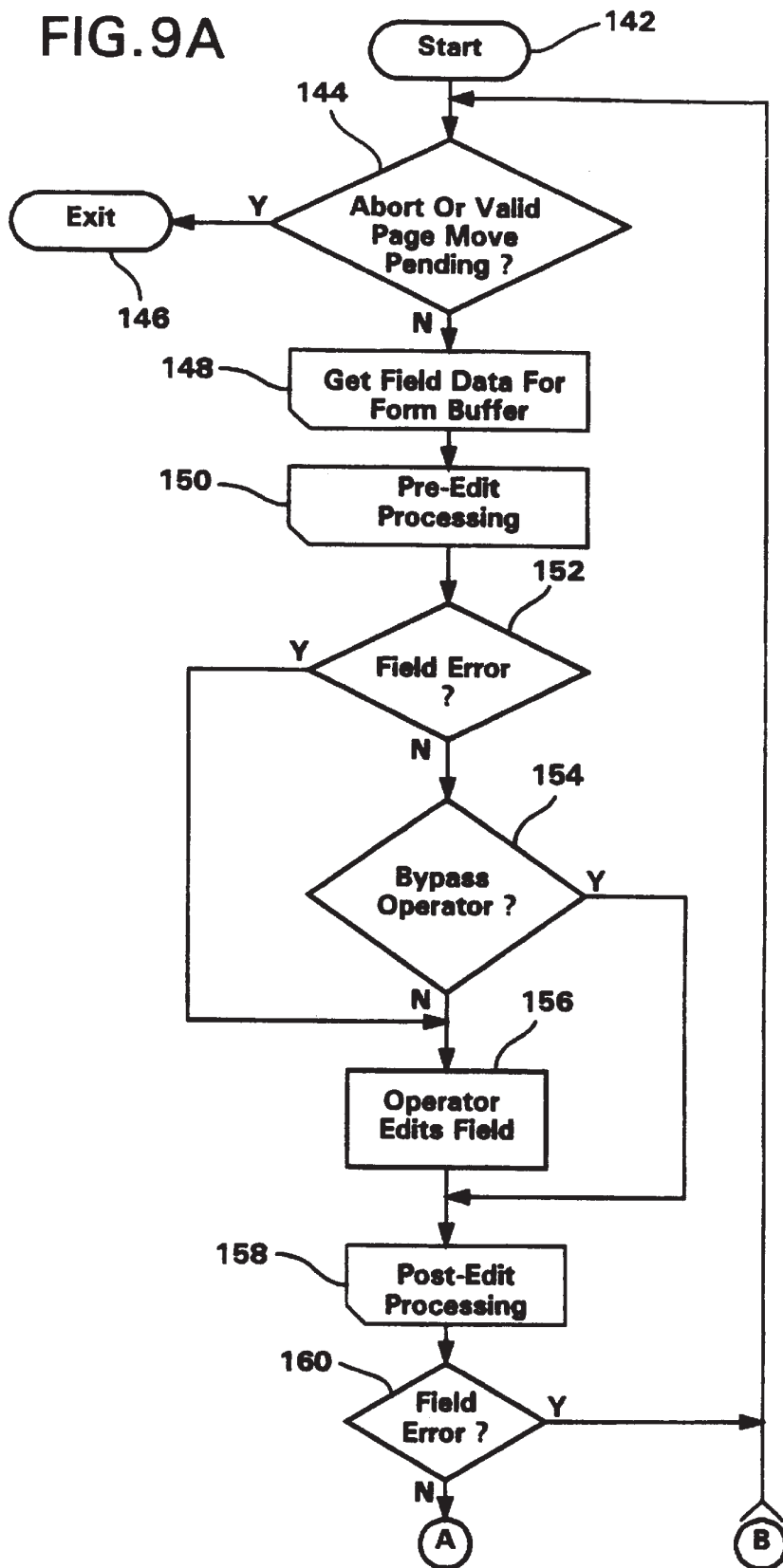


FIG. 9B

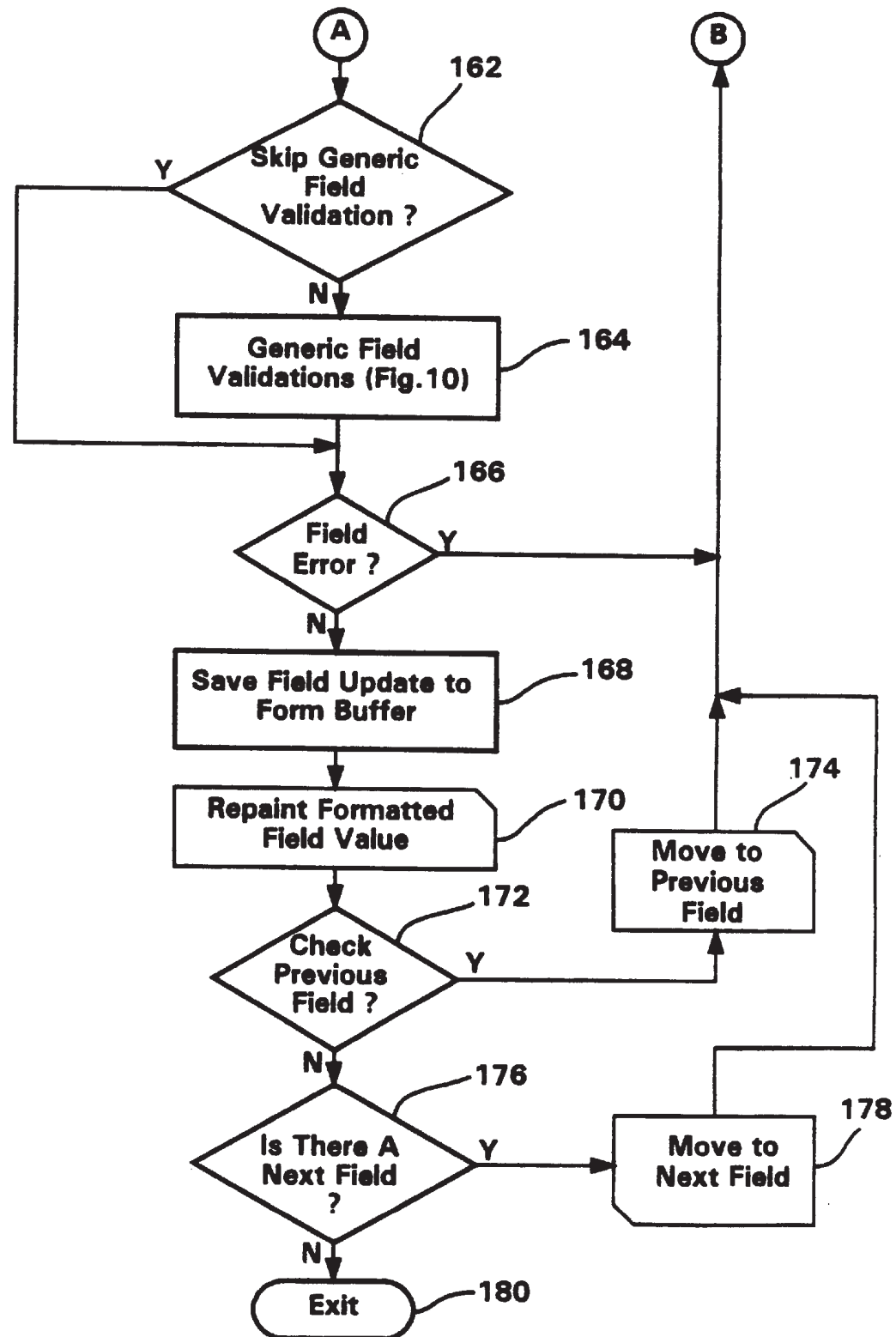
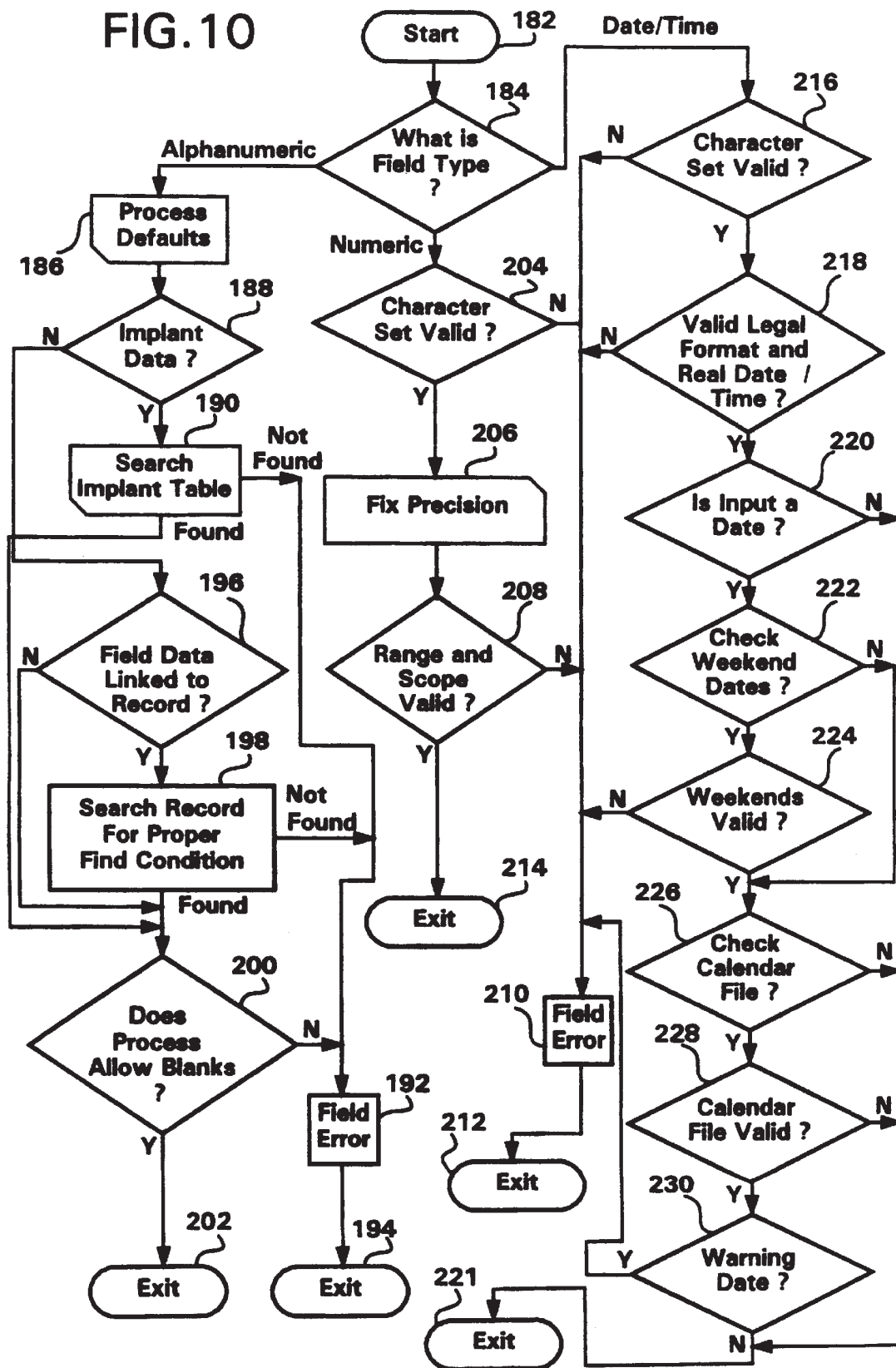


FIG. 10



**TELEPHONE/TRANSACTION ENTRY
DEVICE AND SYSTEM FOR ENTERING
TRANSACTION DATA INTO DATABASES**

This is a continuation, of application Ser. No. 08/446, 546, filed May 19, 1995, U.S. Pat. No. 5,805,676 the disclosure of which is herein incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a system for automatically capturing data at the point of transaction and storing that data in the appropriate database(s), and more particularly, to a data transaction processing system including a transaction entry device which can selectively operate in a telephone mode and a transaction entry mode. In the telephone mode, the transaction entry device operates as a conventional telephone. However, in the transaction entry mode, menus are used to navigate the user to forms which facilitate the entry of data. The entered data and forms together form data transactions which are transmitted to one or more databases for processing and storage. The database (s) also "explodes" the data transactions into their component parts and transmits those component parts to still other databases for processing and storage so that the data in the data transactions automatically updates all current database items affected by such data.

2. Description of the Prior Art

The telephone has become an increasingly versatile instrument. The functionality of telephones has been expanded by incorporating the functions of answering machines, facsimile machines, and the like. Point-of-entry systems have also been developed which incorporate computer processing capabilities into conventional telephones. For example, a computer/telephone apparatus is described in U.S. Pat. Nos. 5,195,130, 5,008,927, and 4,991,199 which configures a telephone as a programmable microcomputer which is operated through the standard telephone 12-key keypad. A programmable gate array is reconfigured to accommodate various types of software which require different hardware configurations but without actually reconfiguring the hardware. The reconfiguration data is received from a network host computer and is used by the programmable microcomputer to emulate the hardware of any of a plurality of service bureaus which communicate with the network host computer. In this manner, the telephone/computer is configured to communicate data to/from any of a number of different service bureaus via conventional telephone lines.

However, telephone/computer systems of the type described in the afore-mentioned patents are typically quite complicated and expensive and are limited by the types of operating software which can be downloaded from the network host computer. Also, such telephone/computer systems are relatively slow since the microcomputer must be reconfigured before it will permit communication with the requested service bureau. Because of these characteristic features, such telephone/computer systems are typically used in public locations and are not efficient for creating point-of-entry transactions in typical commercial or private settings. A point-of-entry transaction system is desired which does not have such limitations and which is operating system independent.

Elimination of the requirement of a conventional operating system and the associated application programs for the microcomputer of a data entry device would greatly

decrease the cost of such a device. However, to date, this has not been possible because the operating system is needed to run the application programs which control the data communications and together handle discrete parts of the system. Unfortunately, such application programs require substantial amounts of local memory and substantial processing power for performing the desired functions. Also, the operating systems themselves tend to be quite costly to purchase and maintain.

Accordingly, a data entry system is desired which does not have the inherent limitations of conventional point-of-entry systems such as the requirement of a standard operating system for communication with a remote service bureau or file server. A data entry device and associated system is desired which performs a minimal amount of processing at the data entry device so that the data entry device may be as simple and inexpensive as possible, thereby bringing the cost of such a device into a range suitable for most commercial and private uses. It is also preferable that such a data entry device provide a wide range of functionality without requiring a local operating system program and a plurality of applications programs for implementing each function. The present invention has been designed to meet these needs.

SUMMARY OF THE INVENTION

The system which meets the above-mentioned needs in the art includes a transaction entry device that permits the user to organize and control all aspects of his or her personal transactions as well as any transactions that may occur in an office setting. In its simplest terms, the transaction entry device formats input data into a data transaction having content which is dependent upon the type of application to which the associated data pertains. These data transactions are then transferred to a local or remote database server which "explodes" each data transaction into its component parts for updating all databases containing data to which the data in the component parts pertain. In this "transaction entry mode" the transaction entry device of the invention functions as a multi-purpose workstation. However, since the data transactions are created without the use of an operating system or application programs, the transaction entry device is quite simple and inexpensive and may be readily integrated with the customer's desktop telephone or portable telephone.

The present invention combines computer technology and telephone technology to allow transaction data to be captured at the point of initiation of the transaction. The transaction entry device is integrated into a conventional telephone which acts as either a normal telephone in a telephone mode or as a transaction entry device in a transaction entry mode. When in telephone mode, the telephone operates in a conventional manner. However, when in transaction entry mode, the transaction entry device is driven by a microprocessor which is, in turn, driven by an operating system independent transaction assembly (or application) server (TAS) comprised of data streams stored in a flash PROM. The TAS is absolutely self-contained in its relationship to the hardware of the transaction entry device and in general performs the two basic functions of (1) generating a template or form from a data stream and (2) developing a data transaction as the user inputs data in response to prompts in the template or form. The template is a series of data streams read from a local flash memory or transmitted directly from an external source such as a database file server.

During operation, the data entered by the user in response to prompts in the template are accumulated into data trans-

actions which are immediately transmitted to an external database server. Unlike typical prior art systems, the data transactions are not locally stored for processing by the local microprocessor once the data transaction has been completed. On the contrary, the only required storage in the transaction entry device is a flash PROM for storing the TAS firmware, a flash memory for storing the data streams used by the TAS firmware to complete a form and the modem numbers for the remote database servers, and a small RAM which operates as an input/output transaction buffer for storing the data streams of the template and the user replies to the prompts in the template during assembly of a data transaction. The transaction buffer(s) only needs to be as large as the largest data transaction since it only stores the form until the entire data transaction is completed. In this sense, the transaction entry device serves as an assembly point for specific transactions until they are ready for transmission to an external database server for processing and storage.

The data transaction formed by the transaction entry device is transmitted via modem to a local or remote database server for processing and storage. The data transaction is received via standard protocols at the database server which, depending upon the application, stores the entire data transaction, explodes the data transaction to produce ancillary records which are then stored, and/or forwards the data transaction or some or all of the ancillary records to other database servers for updating other databases associated with those database servers. Also, in response to requests from the transaction entry device, any of the database servers may send data streams back to the transaction entry device for use in completing the fields in the data transaction or in displaying new forms or menus for selection.

Thus, the data transaction system of the invention comprises at least three tiers: a first tier for capturing the data transaction from the user, where the data transaction has a one-to-many relationship to file structures; a second tier for exploding the data transaction into its component parts on a system-specific basis so that each component part has a one-to-one correspondence with a file; and a third tier for providing additional explosions of the data transactions on an application-specific basis so that each application has its own set of data transactions.

A preferred embodiment of the transaction entry device of the invention resembles a conventional telephone except that it includes a touch screen and an optional keyboard for data entry in addition to the conventional numeric and function keypad inputs. A telephone handset or headset is optional and may be replaced by a microphone and speaker. The transaction entry device of the invention also includes RS-232 and other input/output ports for accommodating other options such as a wireless (RF) receiver, a magnetic card and/or smart card reader, a video camera and video display, infrared controllers, and the like. The telephone preferably has normal touch-tone functions as well as mobile and cellular options.

Preferably, the transaction entry device contains a microprocessor such as an Intel 80386SX or higher, one megabyte of flash memory for dynamically storing the data streams for the templates, one megabyte of flash PROM for storing the TAS firmware, and a 128 kB RAM which functions as a transaction buffer for storing the data streams of the templates and the user responses until completion of the data transaction. A graphics display screen is also provided for displaying the templates to the user for the entry of the data which will form the data transactions. Preferably, the graph-

ics display screen is on the order of 24 lines by 40 characters for a desktop unit and 12 lines by 40 characters for a cellular unit.

The transaction assembly (application) server (TAS) guides the user to the desired template via menu selections, where the menus and templates are stored in flash memory as data streams and are called up by the TAS firmware when selected by the user. Generally, the menus are treated as a special type of template or form. The templates stored in the flash memory may be updated at any time to handle particular applications by reading in a new data set which has been created off-line and downloaded via modem or direct connection to the flash memory of the transaction entry device. Alternatively, the data may be downloaded to an RS-232 input. The same connections may be used to provide an automatic read from a remote database or an automatic write to a remote database. New applications may be added simply by adding additional flash memory elements containing the necessary templates for the new application.

The telephone/transaction entry device and the associated system for storing transaction data in accordance with the invention is unique in that it separates the user from the database and provides a simple, user friendly way to enter transaction data without requiring a local operating system to run various application programs. Since all data is entered as data transactions determined by templates tailored to particular applications, the user applications may be generalized so that no unique user application programs need to be written when a new application is added. However, if code is needed, or if a multimedia element is to be included in a data transaction, it can be appended to a data transaction as an additional parameter stream in the stream of data forming the data transaction. Also, since the nature of the data in the respective fields of the templates for particular applications is known in advance, the interface to a database server to permit storage of the data transactions and their component parts in the appropriate databases in the appropriate formats for each database becomes trivial.

In an alternative implementation of the invention, a process may be selected from the menu of the transaction entry device which creates a "visible" menu corresponding to a voice mail menu of a remote phone mail system. When such a process is selected, the telephone or modem interface makes a telephone connection to the remote phone mail system, and, once the connection is made, the data transaction assembler sends a data request for a visual representation of the phone mail menu of the remote phone mail system via the telephone connection to the remote phone mail system. A data stream containing the visual representation of the phone mail menu from the remote phone mail system is then returned via the telephone connection and stored in a memory of the transaction entry device for presentation to the display screen of the transaction entry device 12. When the desired phone mail menu option is selected from the "visible" voice mail menu, the data transaction assembler creates a data transaction indicating which menu item was selected and sends the data transaction to the remote phone mail system via the telephone connection. Based on the menu selection, the remote phone mail system then returns a data stream containing a visual representation of the next phone mail menu via the telephone connection for storage and display. This process is repeated until the calling party is required to leave a message or the called party is reached.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned characteristic features of the invention will become more apparent to those skilled in the art in view of the following detailed description of the invention, of which:

FIG. 1 is a schematic diagram of a system for entering data transactions into databases in accordance with the invention.

FIG. 2 illustrates a generic template for use in creating a data transaction in accordance with the invention.

FIG. 3 illustrates an “exploded” data transaction in which the component parts of a data transaction are stored in database-specific and file-specific locations.

FIG. 4 illustrates the “exploded” transaction of FIG. 3 in the context of the system illustrated in FIG. 1.

FIGS. 5(a) and 5(b) together illustrate a preferred embodiment of a transaction entry device in accordance with the invention.

FIG. 6 is a schematic diagram of the electronics of the transaction entry device illustrated in FIGS. 5(a) and 5(b).

FIG. 7 is a flow diagram of a menu driven transaction assembly (application) server (TAS) in accordance with the invention.

FIG. 8 is a flow diagram illustrating a technique for processing a form used to form a data transaction in accordance with the invention.

FIGS. 9(a) and 9(b) together illustrate a flow diagram of a technique for completing and editing a data transaction in accordance with the invention.

FIG. 10 is a flow diagram illustrating how the TAS validates the fields of each data transaction.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENT

A system and method which meets the above-mentioned objects and provides other beneficial features in accordance with the presently preferred exemplary embodiment of the invention will be described below with reference to FIGS. 1–10. Those skilled in the art will readily appreciate that the description given herein with respect to those figures is for explanatory purposes only and is not intended in any way to limit the scope of the invention. For example, those skilled in the art will appreciate that the telephone/transaction entry device and system for entering data transactions into remote databases in accordance with the invention may be used in numerous settings in numerous applications. Accordingly, all questions regarding the scope of the invention should be resolved by referring to the claims.

A. SYSTEM DESCRIPTION

1. Overview

The system of the invention provides for the automatic capture and computerization of data associated with data transactions as they occur. As used herein, a data transaction is the combination of a form or template or a series of forms or templates containing data entry prompts and the data entered in response to those prompts. Throughout the remainder of this specification, the words “form” and “template” will be used interchangeably.

The data transactions are generated by a transaction entry device through an interactive process between the user and the form. The data transaction is assembled in a transaction buffer in the data transaction entry device and then transmitted to an external database for storage. No local storage for data transactions is available. The data transaction is defined externally by the database in that all applications consist of a series of customized forms and prompts for soliciting entry of the data needed to update the databases containing data related to the particular application.

Generally, the data transaction will have a one-to-many relationship to the file structures of the database containing data for that application.

The data transactions are entered using the transaction entry device. Preferably, the transaction entry device is integrated with telephone electronics so that the resulting device may selectively operate as a conventional telephone or as a data transaction entry device. The resulting transaction entry device preferably includes a touch screen and/or keyboard which provides input to a transaction assembly (application) server (TAS) which, in turn, presents selection options via menus and forms for completion by the user. Menu and form selection and form completion is made by touch, by key selection from the keyboard, by moving a cursor to the appropriate selection point and depressing a key, or even by voice command. Whenever data entry (other than mere selection) is desired, it is accomplished via a menu-driven selection process and/or by direct entry of data using a keyboard, a keypad, a touch screen, and the like. In the menu-driven case, a set of options is presented to the display screen by the TAS firmware. If this set of options exceeds the capacity of the display screen, then the list is scrolled up or down through the use of scroll keys on the device, by voice command, or by touch at scroll command points. Once the selection is made, the data associated with that selection is automatically entered into the form from a local or remote database, or the data is input by the user. In the event of keyboard entry, the TAS firmware may present a keyboard at the bottom of the display screen for touch entry; alternately, an optional keyboard located at the base of the transaction entry device may be used.

When the data is entered independently of a selection process, such data also may be entered using a swipe card if the data resides on the swipe card or the data may be transferred into the data transaction via modem from an external source. The data read from the swipe card can be used to fill out a form or may be transmitted to an external database or computer. Data returned from the external database or computer via modem may also be used to fill out the fields in the form. As desired, the data in a data transaction may also be written to a swipe card or memory card and the like.

The TAS firmware of the invention stores the options as well as control programs (microcode) for the processor for use with the templates in creating the data transactions. The TAS firmware also includes a program allowing connection via modem to one or more external computers and databases. Preferably, two modes of operation are available: transaction entry mode (with or without modem connection) and telephone mode. A selection of either the transaction entry mode or the telephone mode is made through a switch selection on the transaction entry device.

When the transaction entry device is placed in the transaction entry mode, the TAS firmware immediately presents a selection menu for all of the options the system is programmed to handle. In the telephone mode, on the other hand, a dial tone is provided and the telephone keypad is enabled. In telephone mode, one or more lines may be connected so as to allow simultaneous use of the transaction entry device without interfering with the modem connection. However, if a single telephone line is used, the telephone capability is available at all times or intermittently via modem as specified by the particular application. In the intermittent mode, upon a “save” the transaction entry device will control a dial up and transfer of data to a remote database server. On the other hand, if the telephone is used with an automatic dialer mechanism utilizing a phone list,

the transaction entry device may automatically change from the telephone mode to the transaction entry mode. In this case, a display on the telephone may be used to present a name and telephone list from which a selection can be made in accordance with the menu selection techniques described below.

2. Data Transaction System (FIGS. 1-4)

FIG. 1 is a schematic diagram of a system 10 for entering data transactions into databases in accordance with the invention. As illustrated, system 10 comprises a first tier for capturing a data transaction having a one-to-many relationship to file structures, a second tier for exploding the data transaction into component parts having a one-to-one relationship to file structures, and a third tier for providing additional explosion of the data transactions for specific applications.

The first tier comprises a transaction entry device 12 which captures the data transaction from the user in response to any of a plurality of inputs from the user. Transaction entry device 12 includes conventional telephone electronics 14 and speaker 16 and a data transaction assembler 18 for creating a data transaction in accordance with the invention. A display screen 20 is preferably associated with data transaction assembler 18 so that the user may monitor creation of each data transaction. Telephone electronics 14 are connected to a telephone switching network 22 via a conventional voice connection 24 over the telephone lines, while data transaction assembler 18 is connected via telephone lines 26 to one or more database servers 28. As illustrated in FIG. 1, telephone lines 24 and 26 may be separate lines, thereby permitting simultaneous use of the telephone and data entry functions, or the telephone electronics 14 and data transaction assembler 18 may be connected to a single line as illustrated in phantom in FIG. 1. Of course, when the telephone electronics 14 and data transaction assembler 18 are connected to a single line, a mode switch will enable their mutually exclusive operation, or alternatively, any of a number of conventional transmission schemes may be used to permit simultaneous transmission of the voice from the telephone electronics 14 and the data from the data transaction assembler 18 over the same line.

During operation in the transaction entry mode, transaction entry device 12 is responsive to user input devices such as a touch screen, a telephone keypad, a keyboard, a microphone, a swipe card, a memory card, video input, and the like, to form data transactions using data transaction assembler 18. Alternatively, the transaction entry device 12 operates in a telephone mode as a conventional telephone and receives inputs from a microphone and/or a handset, a touch tone keypad, and the like. More details of the transaction entry device 12 and data transaction assembler 18 will be provided in the next section with respect to FIGS. 5-10.

The second tier comprises one or more database servers 28 and their associated databases 30. In general, each database server 28 receives data transactions from one or more transaction entry devices 12 and "explodes" the received data transactions into their component parts for storage in the appropriate files of the associated database 30. In other words, the one-to-many file structure of the data transactions from one or more transaction entry devices 12 is converted into many one-to-one data transactions for storage in individual files of database 30.

Each database server 28 includes a modem 32 for transmitting/receiving data from the telephone lines 26, particularly the data transactions from one or more transac-

tion entry devices 12. Preferably, the data transactions are transmitted over the telephone lines 26 as data packets having, for example, 128 bytes, where 120 bytes contain information and 8 bytes contain control data. A transaction queue 34 acts as an input buffer for the received data transactions and controls the rate of presentation of the data transactions to transaction controller 36. Transaction controller 36 processes the received data transactions to extract the physical file relationships of the component parts of the data transactions and stores the components parts and different combinations thereof in the appropriate files of associated database 30. Alternatively, transaction controller 36 may process a data request from data transaction assembler 18 requesting information from database 30 for completing certain fields of a data transaction being processed by the transaction entry device 12. Database 30 then provides the requested information to database server 28 which, via modem 32, provides a data stream back to data transaction assembler 18 for use in completing the data transactions or presenting additional menus and forms in accordance with the invention. Typically, a user ID and password are transmitted to the transaction controller 36 to permit a connection to be made by data transaction assembler 18. Thus, transaction controller 36 also checks and stores startup and logoff information in addition to storing data transactions and directing reconstituted data transactions to other database servers as described herein. In addition, database server 28 may include a conventional phone mail system with an associated database for storing voice mail messages. In this case, the data transaction may include voice data for storage in the remote voice mail system.

As shown in FIG. 1, several database servers 28 may be provided. Preferably, each transaction entry device 12 has an associated database server 28 for performing any desired processing of its data transactions, although it is preferred that the data transactions be copied to at least one other database server 28 as shown in FIG. 1. This redundancy minimizes the possibility of losing data in the event of a power outage and the like. Preferably, each database server 28 contains essentially the same hardware, although modem 32, transaction queue 34, and transaction controller 36 have not been shown for all database servers 28 for ease of illustration.

In transaction entry mode, the data transaction assembler 18 of transaction entry device 12 creates a data transaction that is transmitted to an associated transaction controller 36 of an associated database server 28. By "associated" it is meant that the database server 28 functions to perform any processing requested or necessary in conjunction with the storage of a data transaction from a particular transaction entry device 12. Of course, a particular database server 28 may have several transaction entry devices 12 associated with it. So that no data will be lost, a particular database server 28 may also serve as a backup for another database server 28 in the event of the failure of any database server 28.

As will be explained in more detail below with respect to FIGS. 2-4, database server 28 "explodes" data transactions received from data transaction assembler 18 and provides the component parts of the "exploded" file dependent data transactions via modem 32 to other database servers 28 as necessary to update other databases. Alternatively, as shown by dotted line in FIG. 1, the "explosion" of the data transactions may be performed by the data transaction assembler 18 at the transaction entry device 12 and the component parts transmitted to all appropriate databases 28 for updating the data therein. For this purpose, the data

transaction assembler **18** will also need to know the modem numbers for all database servers **28** to be updated by the exploded data transactions. However, those skilled in the art will appreciate that this latter alternative will require access to numerous phone lines by the transaction entry device and that such phone lines are not always available to the user.

Finally, the third tier of the system **10** includes additional database servers **38** and databases **40** which support file dependent data transactions for specific applications. This additional tier of database servers **38** and databases **40** permits the data in the data transactions to be routed to application specific databases for storage of application specific data and access by those transaction entry devices **12** requesting data related to that specific application.

The creation and storage of a data transaction in accordance with the invention will now be described with respect to FIGS. 2-4.

Data transactions are created by data transaction assembler **18** as a data stream of a known format. A generic data transaction is illustrated in FIG. 2. As defined herein, a data transaction is created using a form containing one or more of the following: instructions, prompts, menu selection options, and a template with fields for data entry. Generally, the menu form consists of prompts for selecting a form, another menu, or a process, and a single slot for entering a selection, while the data entry form consists of prompts and instructions together with fields for entering data as shown in FIG. 2. The data entry form can have either single or multiple fields for entering data.

In transaction entry mode, the user navigates through menus of data transaction assembler **18** until a form related to a particular type of data entry operation is selected. Once selected, data transaction form **42** is presented to the user on display device **20**. The data transaction form **42** is a collection of data defining the visual presentation on the display device **20** and a list of the fields through which linkages to external database files are defined.

As shown in FIG. 2, data transaction form **42** includes a format field **44** which identifies the type of data transaction this form pertains to, the length of the form, the number of pages in the form, the number of bytes in each field, storage keys, and the like. The body of the data transaction form **42** comprises a predetermined series of prompts **46** which are provided to the display screen **20** as a data stream. The prompts preferably include descriptive data which may be alphanumeric, an icon, or a list that scrolls, if necessary. Fields **48** are blank spaces of predetermined size provided for accepting user input in response to each prompt. Generally, the size of each field **48** is also stored in the stream of data defining the data transaction form **42**. Since the prompts are tailored to elicit the necessary data for the application for which the data transaction form **42** was created, the fields **48** will include the user data necessary for processing a data transaction for that particular type of application. The user responses become part of the data stream which forms the data transaction. Typically, the data transaction form **42** also includes a miscellaneous processing field **50** which permits processing data unique to that form to be appended to the data transaction for transmission. Such processing data may include, for example, equations which define the relationships of the data in certain fields of the data transaction or audio or video data attached to a multimedia data transaction. In addition, non-display data associated with the time of data entry, the date of data entry, the user ID, and the like may be stored in miscellaneous processing field **50**.

FIGS. 3 and 4 illustrate the "explosion" of the stream of data forming the data transaction created using the data transaction form **42** of FIG. 2. As shown in FIG. 3, each data transaction contains data which is specific to a particular database and/or specific to particular files in one or more databases. The data in the data transaction is "exploded" accordingly. For example, the complete data transaction from FIG. 2 (Form A) is stored in a particular file (file **110**) of the database associated with the transaction entry device **12** which created the data transaction (database **11** in FIG. 1). Storage of the entire data transaction is desired so that records may be maintained in the event of system error, power failure, and the like. The transaction controller **36** then extracts data from those fields of the data transaction which it knows to be related in forms of that particular type. For example, the data in fields **1, 2, 6, 10**, and a function of the data in field **11** may relate to a particular application stored in file **111** of database **11**. Similarly, the data in fields **3, 6, 10, 12**, and **14** may be related to an application stored in file **112** of database **11**, while the data in fields **1, 2, 7, 8, 9**, and a function of the data in fields **10, 11**, and **12** may be related to an application stored in file **113** of database **11**. These fields are extracted from the received data transaction by transaction controller **36**, reconstituted into a file entry of the appropriate format (as necessary), and stored in the associated database **30**.

All of the data in the received data transaction, or a subset thereof, may also be retransmitted to one or more additional application specific databases, such as database **21** of the databases **40** in tier **3**. As illustrated in FIG. 3, the database specific data of fields **1, 4, 5, 13**, and **14**, forming the subset (Form B) of the original transaction (Form A), is stored in file **210** of database **21** so that a complete record may be maintained. Subsets of the data in Form B are then stored in specific files of database **21** as indicated. In this manner, the data of the original data transaction (Form A) is automatically sent to all databases which contain files which must be updated by any or all of the data in Form A.

FIG. 4 illustrates the explosion of the data transaction in FIG. 3 for the system **10** illustrated in FIG. 1. As shown, the data in the data transaction (Form A) is extracted to update files **110-113** of database **11** as well as files **210-212** of database **21**. A redundant copy of Form A is also maintained in database **12**.

As will be explained more fully below, the system of FIGS. 1-4 is significant in that the data in a data transaction may update one or more databases serviced by file servers operating under control of numerous types of operating systems without the requirement of a terminal or operating system emulation by the transaction entry device **12**. On the contrary, the transaction entry device **12** of the invention permits data capture and storage with a minimum amount of processing at the transaction entry point (tier **1**), which, of course, minimizes system cost.

B. Transaction Entry Device **12** (FIGS. 5-10)

As noted above, the transaction entry device **12** is particularly characterized by the data transaction assembler **18**, which controls the various operations of the transaction entry device **12** in its transaction entry mode. Preferably, data transaction assembler **18** uses simple menu structures and predetermined forms stored as data streams in a flash memory for facilitating data entry. The menus are treated as a special type of form and are used to call other menus, forms, or processes. The forms, on the other hand, are used to create data transactions which are sent to one or more file

servers operating under different operating systems, where the data transaction is “exploded” into its component parts for storage in a unique file structure for updating all records affected by the data in that data transaction. In turn, the “exploded” data transactions may be transmitted to another application specific database (tier 3) for storage. Processes, on the other hand, are selected to perform limited processing of the values in the fields of the forms. Such processing may be performed locally but is preferably performed by the associated database server 28.

1. Hardware

A preferred embodiment of a transaction entry device 12 incorporated into a conventional telephone is illustrated in FIGS. 5 and 6. As shown in FIG. 5a, a preferred desktop embodiment of a transaction entry device 12 includes a housing 52 on the order of 8 inches wide by 12 inches long for housing telephone electronics 14 and the hardware of data transaction assembler 18. Transaction entry device 12 includes an optional handset (or headset) 54, cradle 56 (FIG. 5b), numeric keypad 58, telephone function/line keys 60, microphone 62, and speaker 16, which facilitate operation of the transaction entry device in the telephone mode. As known to those skilled in the art, telephone functions accessed by telephone function keys 60 may include mute, speaker, line select, conference, hold, transfer, volume control, and the like.

However, the transaction entry device 12 is further characterized by display 20 with touch screen 64, mode switch/computer function keys 66, optional retractable keyboard 68, and optional magnetic/smart card reader 70, which facilitate operation of the transaction entry device 12 in the transaction entry mode. A memory card reader may also be accessed via a door (not shown) as in a laptop computer. Preferably, display 20 is a super twisted, high contrast, reflective liquid crystal display (LCD) with a minimum of 20 characters per line and 16 lines (preferably, 40 columns by 24 lines), while touch screen 64 is preferably a clear pressure sensitive keyboard made up of 224 keys (16 rows of 14 keys) attached to the face of the LCD. Preferably, the LCD is also available as a backlit unit. Of course, touch screen 64 is not necessary if optional keyboard 68 is provided. In addition, a battery backup 71 (FIG. 6) may also be provided; alternatively, the battery 71 may be the primary power source for a portable (cellular) embodiment of the transaction entry device 12 in accordance with the invention.

FIG. 5b illustrates several of the connections to transaction entry device 12. Typically, transaction entry device 12 includes a handset (headset) jack 72 for connecting optional handset (headset) 54 to telephone electronics 14 when it is desired to communicate more privately than when only microphone 62 and speaker 16 are used. A video input port 74 is also provided for connecting conventional data compression circuitry 75 within the transaction entry device 12 (FIG. 6) to an optional video camera which provides picture phone type video or to a facsimile device or scanner. Such video data may be appended a frame at a time to the end of a data transaction in miscellaneous processing field 50 to create a multimedia data transaction as described above with respect to FIG. 2. A video output port 76 is also provided for providing decompressed video or facsimile data from data decompression circuit 77 (FIG. 6) to a video receiver, a high quality computer monitor, a facsimile device, and the like. Such data may also be provided to printer port 82 or 84 as desired. A multi-line phone jack (modem interface) 78 is also provided. Preferably, modem interface 78 provides separate modem connections for the telephone electronics

14 and the data transaction assembler 18, although only a single modem connection is necessary.

An optional infrared transceiver 80 is further provided for enabling remote control operation of television and stereo equipment and the like in response to data transactions transmitted/received by the transaction entry device 12. Infrared transceiver 80 includes an internal signal generator chip which reads parameters stored in data transaction assembler 18 for determining the appropriate transmission frequencies for the infrared signals. Control of the infrared devices is then provided through menus on the display 20. Additional infrared transceivers 80 may also be provided on each corner of the housing 52 so that the infrared signal will cover more area (each transmitter typically covers about 60° circumference). All such devices are known to those skilled in the art and thus will not be described in detail here.

A computer interface (RS-232) serial port 82 and parallel port 84 is also provided for transmitting/receiving data to/from another computer device and for providing output to a printer. A power input port 86 and a keyboard input 88 are also provided. Keyboard input 88 accepts a connection from a standard keyboard or a folding type keyboard (not shown) which may be used in addition to, or in place of, retractable keyboard 68. An optional removable PCMCIA memory card interface 89 (FIG. 6) for updating the operating instructions of the data transaction assembler 18 and an optional RF transceiver 90 (FIG. 6) for wireless networking to other electronic equipment may also be provided on the transaction entry device 12 as desired.

FIG. 6 is a schematic diagram of the electronics of the transaction entry device illustrated in FIGS. 5(a) and 5(b). Corresponding reference numerals for corresponding elements are used in FIGS. 5(a), 5(b) and 6. As shown in FIG. 6, in addition to the elements described above with respect to FIGS. 5(a) and 5(b), the transaction entry device 12 may include a simple voice recognition circuit 91 which permits voice selection of menu options and the like. In “voice selection” mode, the user would voice “1”, “2” or “3” depending on the desired menu selection, and the voice would be picked up by microphone 62 on the housing 52 of the transaction entry device 12 and recognized by voice recognition circuitry 91. The proper selection signal would then be sent to the data transaction assembler 18. Similarly, the data transaction assembler 18 may provide audible output using a conventional voice synthesizer 92, which provides the audio output to the user via speaker 16 and to a caller via modem interface/telephone line connection 78. The voice synthesizer 92 may, for example, allow certain data transactions to be audibilized for a blind person who cannot make selections from a conventional video display. In addition, a voice recorder 93 may also be provided to record portions of telephone calls, portions of voiced data transactions, or a caller’s message as when using a conventional digital answering machine. On the other hand, voice recorder 93 may be provided in database server 28 for use in storing/forwarding audible messages to the database 30.

As noted above, the transaction entry device 12 is characterized by data transaction assembler 18, which controls the creation of data transactions in the transaction entry mode. As shown in FIG. 6, data transaction assembler 18 is implemented in hardware using a conventional microprocessor 94, such as an Intel 80386SX (20 MHz or higher) or equivalent, a TAS PROM 95, a form/menu memory 96, and a transaction buffer (RAM) 97. In a preferred embodiment, TAS PROM 95 is a flash PROM which holds 1 MB of control data (firmware) for the microprocessor 94 (such as the microcode for the algorithms of FIGS. 7–10 below),

while form/menu memory **96** is a flash memory which holds 1 MB of data transaction menus and forms. Transaction buffer **97**, on the other hand, only needs to be as large as the largest data transaction, and may hold, for example, up to 128 kB of transaction data including application and operating system variables. Preferably, TAS PROM **95** and form/menu memory **96** are updated by downloading data streams containing new instructions and/or forms and menus over a conventional data bus **98** via modem **78**, magnetic card interface **70**, or via a removable memory card read by memory card interface **89** as necessary. Alternatively, additional flash memory elements may be added as additional applications are added to transaction entry device **12**. Transaction buffer **97** may also be expanded to handle transactions of any size or type, including multimedia applications in which video and/or audio data is appended to data transactions.

Those skilled in the art will appreciate that the transaction entry device **12** may be docked into a docking station of a network. RF transceiver **90** may be used for wireless communications in such an environment. In addition, those skilled in the art will appreciate that the transaction entry device **12** may be implemented as a battery operated portable device which is a cross between a laptop computer and a cellular telephone of the type illustrated by Paaanen et al. in U.S. Pat. No. 5,189,632, for example. In such an embodiment, an optional headpiece could be provided, as well as a microphone and speaker arrangement in the flip-top. Of course, the liquid crystal display screen would typically be reduced in size to, for example, 40 columns by 12 rows, and the touch screen **64** may be eliminated. However, most of the other options of the embodiment of FIGS. **5a** and **5b** would preferably remain so that the portable unit could also be used at a desk as desired. The electronics of the transaction entry device **12** would otherwise be as illustrated in FIG. **6** except for certain size and shape considerations well within the skill of those skilled in the art.

2. Software

As will be apparent from the following description, data transaction assembler **18** does not utilize a conventional operating system to control the operation of microprocessor **94**. On the contrary, TAS PROM **95** stores simple firmware algorithms (FIGS. **7-10**) operating in a kernel fashion for navigating a user through menus and forms provided from form/menu memory **96** for particular applications, and it is the resulting data streams which control the microprocessor **94** at any point in time. In other words, the data streams from the TAS PROM **95** and the data streams from the form/menu memory **96** together reconfigure microprocessor **94** into a special purpose processor for each application specified by the forms. The microcode of the TAS PROM **95** and the parameter streams from the form/menu memory **96** thus operate together as a simple form driven operating system for microprocessor **94** for all applications and is the sole code used to control microprocessor **94** (i.e., no conventional operating system or application programs are provided). As a result, the microprocessor **94** may be reconfigured into a new special purpose computer with each new form read from form/menu memory **96**, and such forms/menus may be added at any time by reading in the appropriate data streams from a memory card or from an external database server **28** or by adding an additional PROM. A specific implementation of the TAS firmware stored in TAS PROM **95** will be described below with respect to FIGS. **7-10**.

Thus, the TAS PROM **95** contains control data (firmware) for the microprocessor **94** and resides in each transaction

entry device **12** for generating a template for a data transaction from a data stream stored in form/menu memory **96** (or received directly from a memory card or external database server) and from data input by a user or retrieved from an external database or magnetic card, smart card, and the like. The TAS firmware and the selected template together control the behavior of the microprocessor **94** by logically defining a table of menu options and/or database interfaces which are navigated through by the user. As noted above, the user navigates through a series of menu selections by selecting another menu, a form, or a process. Once the data transaction for a desired application is completed, it is transmitted out for "explosion" into all of its component parts for storage. In this form, the TAS firmware from TAS PROM **95** and menus and forms from form/menu memory **96** of the invention together replace a conventional operating system and individual application programs. Indeed, the invention permits the transaction entry device **12** to be completely operating system independent.

The data transaction assembler **18** of the invention is connected via a predetermined protocol stored as instructions within TAS PROM **95** to a database server **28** and its associated database **30**. As noted above, the database server **28** associated with a particular transaction entry device **12** operates as a repository of the data transactions created by the transaction entry device **12** and as a supplier of data to the transaction entry device **12** for completing the forms and providing additional forms, menus, processes, and the like. Since the system of the invention is operating system independent, there are no hardware or software limitations on the characteristics of the database server **28**.

The parameter set making up the individual forms are typically provided by database server **28** as a stream of data via modem and stored in form/menu memory **96**, while any downloaded instructions are stored in TAS PROM **95**. Linkage between data transaction assembler **18** and its database server **28** is preferably provided via a dictionary program specific to each database server **28**. This dictionary program knows the characteristics of each field of each form for each data transaction and is used by the database server **28** to "explode" the received data transactions into their component parts.

Preferably, at power on, data transaction assembler **18** automatically prompts the user with a "Download Parameter Streams" command so that the user can load into form/menu memory (flash memory) **96** from an external source the desired streams of menu and form data for the desired application. The "download parameter" process will then be initiated by dialing the external database server **28** initiating the connection via the modem interface **78**. Once connected, the transaction controller **36** of database server **28** will transmit the requested parameter stream. The data transaction assembler **18** will load the received data stream into form/menu memory **96**, and, upon completion, the prompt "Executive Menu Ready" will be presented on the display screen **20**. The executive menu then will be automatically presented to the user for selection of the desired menu, form, or process.

Upon initiation of the transaction entry mode by the user, data transaction assembler **18** calls a set of panel parameters from form/menu memory **96** and paints a form onto display screen **20**. These forms are either menus for navigating to particular forms or a form into which data is entered by the user. As will be explained below, the menus provide functionality through simple menu selection. The form on the display screen **20** is completed by the user by entering the appropriate data using touch screen **64** or optional keyboard

68. Alternatively, the requested data may be read in from a memory card via memory card interface 90, from a magnetic strip on a swipe card or smart card via magnetic card interface 70 or memory card interface 89, or voice input via voice recognition circuit 91. In addition, a request may be sent to the database server 28 associated with the transaction entry device 12 for data needed to populate certain fields in the present form. The type of data entry is requested from a subset of options presented to the user upon pressing a “?” key or a “Request for More Information” button. This request will give the user several options to choose from, such as data entry using keyboard 68, touch screen 64, swipe card via magnetic card interface 70, memory card via memory card interface 89, by voice annunciation of the number of the item in the menu via voice recognition circuit 91, or via modem from a database 30. Hence, the data transaction created by the data transaction assembler 18 may or may not make use of stored data for reducing the amount of data entry required of the user.

When a data entry option is selected, data transaction assembler 18 does one of the following: another set of parameters is called up and another form is painted, the correctness of the selection is verified and a set of options for selections is presented based on interactions with stored data, the completed data transaction is transferred via modem to database server 28 for storage in database 30, or data values are requested from database 30 for incorporation within the transaction buffer 97. In a preferred embodiment, selections from the menu are made by touching the appropriate place on the menu using touch screen 64; by voice annunciation of the number of the menu item via microphone 62 and voice recognition circuit 91; by using one of the computer function keys 66 to run a cursor up the menu, another key to run the cursor down the menu, and a third key to make a selection in a conventional manner; or by using keyboard 68 as a selection device. When the keyboard 68 is used, the keyboard keys may be used to control a cursor, with the “enter” key being used for making a selection; alternatively, the number of the item selected may be entered and the “enter” key pressed to make the selection. Once the selection is made, the appropriate form is extracted from form/menu memory 96 as a stream of data.

Alternatively, in addition to presenting a menu for selection or completing a form, the data transaction assembler 18 can also present a menu selection for initiating a process such as calculation of an interest rate using one or more fields in the form, the finding of a mean, the finding of a name, or searching for entries for a particular date. These processes may be stored in TAS PROM 95, form/menu memory 96, in an off-line server where they are initiated, or any other place where they may be loaded down to the operating portion of the transaction entry device 12. In a preferred embodiment, processes are generally initiated in the database server 28 by sending a data request to the database server 28, processing the data in the database server 28, and then returning the answer as a data stream or report back to the transaction entry device 12.

A process typically initiates a data string which calls a process on an external machine. For example, the transaction entry device 12 may be used to download and store control signals for infrared control of various devices using infrared transceiver 80 (FIGS. 5 and 6). The form of the control signals will depend upon the signal storage in an optional infrared chip, which can be loaded by the data transaction assembler 18 or by an off-line device via modem or through the air using RF transceiver 90 for direct digital transfer in wireless form. In addition, in the case where the

transaction entry device 12 is used in a medical office, for example, the process may be used to transmit a prescription to a pharmacy or mail order house using prestored modem numbers or may enable the physician to call up a list of phone calls to make for the day or a list of the followup appointments for a particular date. In other words, the TAS firmware can also “explode” the data transaction into all of its ancillary parts for transmission to numerous records in one or more databases.

A preferred embodiment of the TAS firmware will now be described with respect to FIGS. 7–10.

As noted above, the transaction assembly (application) server (TAS) is a data stream stored in TAS PROM 95 which together with the forms from form/menu memory 96 create a simple form driven operating system which provides the necessary control data (firmware) to microprocessor 94 so that no conventional operating system is necessary. FIG. 7 is a flow diagram of a menu driven TAS in accordance with a preferred embodiment of the invention. As illustrated, the TAS firmware starts at step 100 and fetches an initial menu from form/menu memory 96 at step 102. The initial menu is prompted within a few seconds of booting the TAS firmware after the system logo. The initial menu typically presents the options of downloading a parameter stream from the database server 28 for enabling additional functions or printing an executive menu. If the executive menu is selected, the executive menu is retrieved from form/menu memory 96. The executive menu contains numerous application options to the user, namely, selection of a form, another menu, a process, or an automatic switch to telephone mode, one of which is selected at step 104. The data streams in form/menu memory 96 may be distinguished as to type (form, menu, or process) by appending a code such as “F” for form, “M” for menu, and “P” for process, and as to number by appending a form, menu, or process number at the beginning of the following data stream. These codes are recognized by the TAS firmware, and it acts accordingly.

If the option selected at step 104 is a form, the proper form (data stream for form F_{xy}) is fetched from form/menu memory 96 at step 106, a transaction buffer 97 equal in length to the size of the record associated with the form F_{xy} is formed in RAM, the form is stored in the transaction buffer 97, and a connection is made to the appropriate database server(s) 28. The data stream for the selected form will consist of prompts, print locations for the prompt, data entry points, print locations for the data entry start, data entry length, and a code as to the nature of the data entry. This code can be numeric, alphanumeric, a cross-reference to stored data or previously entered data, a formula for the creation internally to data transaction assembler 18 of the result from previously entered data, or an external request for data, help, or reformulated values. The data stream entered into the fields of the form will not only indicate the location for the printing of the prompt and the field for data entry, but also the size of the field and the storage, a start point within the transaction buffer for the stored element, and the type of data: alphanumeric, numeric (floating point or integer), date, and the like.

If it is determined at step 108 that the requested form is actually a menu (M_{xy}), a hidden set of codes pointing to the form F_{xy} that the selection will lead to is read, and control branches back to step 104 for selection of another menu or form. When a menu is chosen, each item has its sequential number, its descriptor, and a code for what it will “call” (another menu, form, or process). In other words, each choice has associated with it a series of item codes which branch out to another form, menu, or series of tests upon the