UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
07/347,629	05/05/89	LANG	R

EXAMINER
NGUYEN, H

ART UNIT	PAPER NUMBER
235	13

KENNETH E. LEEDS
SKJERVEN, MORRILL, MACPHERSON,
FRANKLIN & FRIEL
25 METRO DRIVE, STE 700
SAN JOSE, CA 95110

DATE MAILED: 04/23/91

NOTICE OF ALLOWABILITY

PART I.

1. ☑ This communication is responsive to Applicant's amendment Jan 4, 1991.
2. ☐ All the claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice Of Allowance And Issue Fee Due or other appropriate communication will be sent in due course.
3. ☑ The allowed claims are 26-30.
4. ☐ The drawings filed on _____ are acceptable.
5. ☐ Acknowledgment is made of the claim for priority under 35 U.S.C. 119. The certified copy has [_] been received. [_] not been received. [_] been filed in parent application Serial No. _____, filed on _____.
6. ☐ Note the attached Examiner's Amendment.
7. ☐ Note the attached Examiner Interview Summary Record, PTOL-413.
8. ☐ Note the attached Examiner's Statement of Reasons for Allowance.
9. ☐ Note the attached NOTICE OF REFERENCES CITED, PTO-892.
10. ☐ Note the attached INFORMATION DISCLOSURE CITATION, PTO-1449.

PART II.

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" indicated on this form. Failure to timely comply will result in the ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

1. ☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.
2. ☑ APPLICANT MUST MAKE THE DRAWING CHANGES INDICATED BELOW IN THE MANNER SET FORTH ON THE REVERSE SIDE OF THIS PAPER.
   a. ☐ Drawing informalities are indicated on the NOTICE RE PATENT DRAWINGS, PTO-948, attached hereto or to Paper No. _____. CORRECTION IS REQUIRED.
   b. ☑ The proposed drawing correction filed on May 7, 1990 has been approved by the examiner. CORRECTION IS REQUIRED.
   c. ☐ Approved drawing corrections are described by the examiner in the attached EXAMINER'S AMENDMENT. CORRECTION IS REQUIRED.
   d. ☑ Formal drawings are now REQUIRED.

Any response to this letter should include in the upper right hand corner, the following information from the NOTICE OF ALLOWANCE AND ISSUE FEE DUE: ISSUE BATCH NUMBER, DATE OF THE NOTICE OF ALLOWANCE, AND SERIAL NUMBER.

Attachments:

- _ Examiner's Amendment
- _ Examiner Interview Summary Record, PTOL-413
- _ Reasons for Allowance
- _ Notice of References Cited, PTO-892
- _ Information Disclosure Citation, PTO-1449
- _ Notice of Informal Application, PTO-152
- _ Notice re Patent Drawings, PTO-948
- _ Listing of Bonded Draftsmen
- _ Other

ROY N. ENVALL, JR.
PRIMARY EXAMINER
ART UNIT 235

PTOL-37 (REV. 4-89) *

USCOMM-DC 89-9789

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

Address: Box ISSUE FEE
COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

KENNETH E. LEEDS
SKJERVEN, MORRILL, MACPHERSON,
FRANKLIN & FRIEL
25 METRO DRIVE, STE 700
SAN JOSE, CA 95110

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

☐ Note attached communication from the Examiner
☐ This notice is issued in view of applicant's communication filed _____

SERIES CODE/SERIAL NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
07/347,629	05/05/89	005	NGUYEN, H	235	04/23/91

First Named Applicant: LANG, RICHARD A.

TITLE OF INVENTION: AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS, RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS (AS AMENDED)

	ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
2	M914US	358-335.000	097	UTILITY	YES	$525.00	07/23/91

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY Status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:
A. If the Status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
B. If the Status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:
A. Pay FEE DUE shown above, or
B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

II. Part B of this notice should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by a charge to deposit account, Part B should be completed and returned. If you are charging the ISSUE FEE to your deposit account, Part C of this notice should also be completed and returned.

III. All communications regarding this application must give series code (or filing date), serial number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees.

PTOL-85 (REV 12-88)(OMB Clearance is pending) PATENT AND TRADEMARK OFFICE COPY

#14

IN THE

UNITED STATES PATENT AND TRADEMARK OFFICE

ART UNIT 235

Examiner Huy Nguyen

"Express Mail" mailing label number RB188710278

Date of Deposit May 6, 1991

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

William E. Hein

(Typed or printed name of person mailing paper or fee)

(Signature of person mailing paper or fee)

Richard A. Lang

CASE 211

SERIAL NO. 07/347,629

FILED May 5, 1989

SUBJECT AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS, RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS

THE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, D.C. 20231

SIR:

INFORMATION DISCLOSURE STATEMENT

Pursuant to the provisions of 37 CFR 1.56, 1.97, and 1.98, as well as MPEP 609, applicant submits herewith a copy of U.S. Patent No. 4,506,387. Also enclosed is one sheet of Form PTO-1449 on which this reference is cited. This reference first came to applicant's attention on April 2, 1991, and was first discussed with applicant's undersigned attorney on April 9, 1991, following which applicant's attorney ordered the file history of this patent from the PTO and reviewed and discussed the subject matter thereof on several occasions with applicant and his technical associates before concluding on or about May 3, 1991, that the reference is material to the examination of the instant application. Therefore, applicant respectfully requests that the Examiner give consideration to this recently-discovered reference. A brief description of the relevance of the cited reference follows:

U.S. Patent No. 4,506,387 is directed to a programming-on-demand cable TV system in which a video program is divided into a number of segments and

stored in a segmented memory in compressed digital form. The stored video segments are then converted from electrical data to optical data and simultaneously tranmsitted over a plurality of parallel fiber optic transmission lines to a data receiving station, which then reconverts the optical data back to the original electrical data.

Respectfully submitted,

Richard A. Lang

By _____
William E. Hein
Patent Attorney #26,465

May 6, 1991
(303) 667-6741
Loveland, Colorado

Sheet 14 of

LIST OF PATENTS, PUBLICATIONS AND OTHER INFORMATION DISCLOSED BY APPLICANT (Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
211	07/347,629
APPLICANT: Richard A. Lang	
FILING DATE: May 5, 1989	GROUP: 235

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
HN	AA	4 5 0 6 3 8 7	3/1985	Walter	455	612	
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							
	AN							
	AO							
	AP							

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	AR	
	AS	
	AT	

EXAMINER	DATE CONSIDERED
HUY NGUYEN	6/4/1991

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
07/347,629	05/05/89	LANG	R M914US

EXAMINER
NGUYEN, H

ART UNIT	PAPER NUMBER
235	15

DATE MAILED: 06/05/91

KENNETH E. LEEDS
SKJERVEN, MORRILL, MACPHERSON,
FRANKLIN & FRIEL
25 METRO DRIVE, STE 700
SAN JOSE, CA 95110

NOTICE OF ALLOWABILITY

Supplemental

PART I.

1. [X] This communication is responsive to prior art statement 5-6-91.
2. [ ] All the claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice Of Allowance And Issue Fee Due or other appropriate communication will be sent in due course.
3. [X] The allowed claims are 26-30.
4. [ ] The drawings filed on _____ are acceptable.
5. [ ] Acknowledgment is made of the claim for priority under 35 U.S.C. 119. The certified copy has [_] been received. [_] not been received. [_] been filed in parent application Serial No. _____, filed on _____
6. [ ] Note the attached Examiner's Amendment.
7. [ ] Note the attached Examiner Interview Summary Record, PTOL-413.
8. [ ] Note the attached Examiner's Statement of Reasons for Allowance.
9. [ ] Note the attached NOTICE OF REFERENCES CITED, PTO-892.
10. [X] Note the attached INFORMATION DISCLOSURE CITATION, PTO-1449.

PART II.

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" indicated on this form. Failure to timely comply will result in the ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

1. [ ] Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.
2. [X] APPLICANT MUST MAKE THE DRAWING CHANGES INDICATED BELOW IN THE MANNER SET FORTH ON THE REVERSE SIDE OF THIS PAPER.
   a. [ ] Drawing informalities are indicated on the NOTICE RE PATENT DRAWINGS, PTO-948, attached hereto or to Paper No. _____. CORRECTION IS REQUIRED.
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   c. [ ] Approved drawing corrections are described by the examiner in the attached EXAMINER'S AMENDMENT. CORRECTION IS REQUIRED.
   d. [X] Formal drawings are now REQUIRED.

Any response to this letter should include in the upper right hand corner, the following information from the NOTICE OF ALLOWANCE AND ISSUE FEE DUE: ISSUE BATCH NUMBER, DATE OF THE NOTICE OF ALLOWANCE, AND SERIAL NUMBER.

Attachments:

- _ Examiner's Amendment
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- ✓ Information Disclosure Citation, PTO-1449
- _ Notice of Informal Application, PTO-152
- _ Notice re Patent Drawings, PTO-948
- _ Listing of Bonded Draftsmen
- _ Other

Roy N. Envall, Jr.
Supervisory
Patent Examiner
Art Unit 235

PTOL-37 (REV. 11-88) USCOMM-DC 89-3615

#16
8/4/91
EG

IN THE

UNITED STATES PATENT AND TRADEMARK OFFICE

ART UNIT 235

Examiner H. Nguyen

Richard A. Lang

CASE 211

SERIAL NO. 07/347,629

FILED May 5, 1989

SUBJECT AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS, RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS

THE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, D.C. 20231

SIR:

DRAWING TRANSMITTAL LETTER

In response to the drawing requirement set forth in form PTOL-37 mailed April 23, 1991, enclosed herewith for filing in the above-identified, allowed patent application (Issue Batch No. 097) are four (4) sheets of substitute formal drawings.

Respectfully submitted,

Richard A. Lang

By _____
William E. Hein
Patent Attorney #26,465

July 22, 1991
(303) 667-6741
Loveland, Colorado

"Express Mail" mailing label number RB188719399
Date of Deposit July 22, 1991

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

William E. Hein
(Typed or printed name of person mailing paper or fee)

_____
(Signature of person mailing paper or fee)

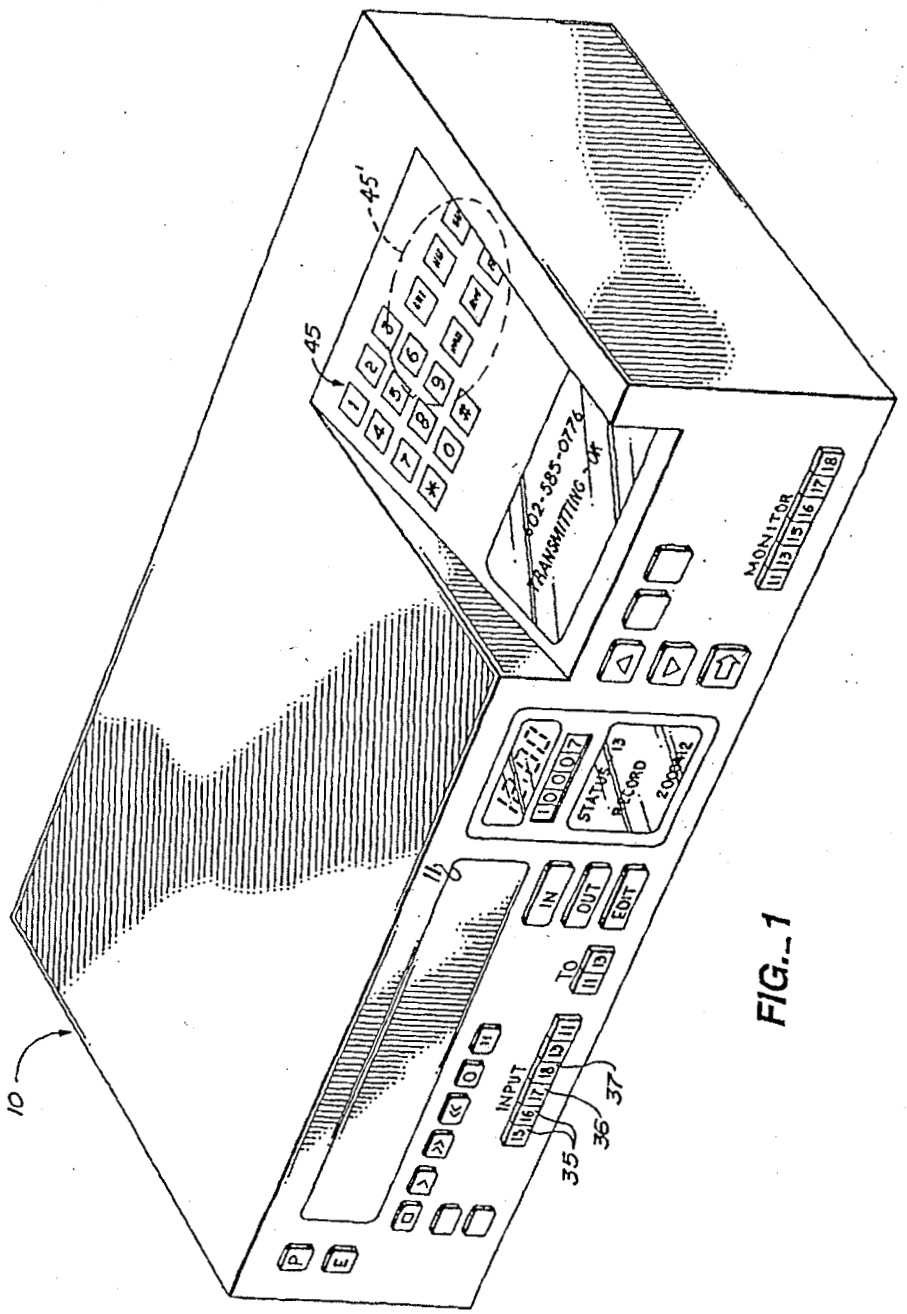


FIG._1

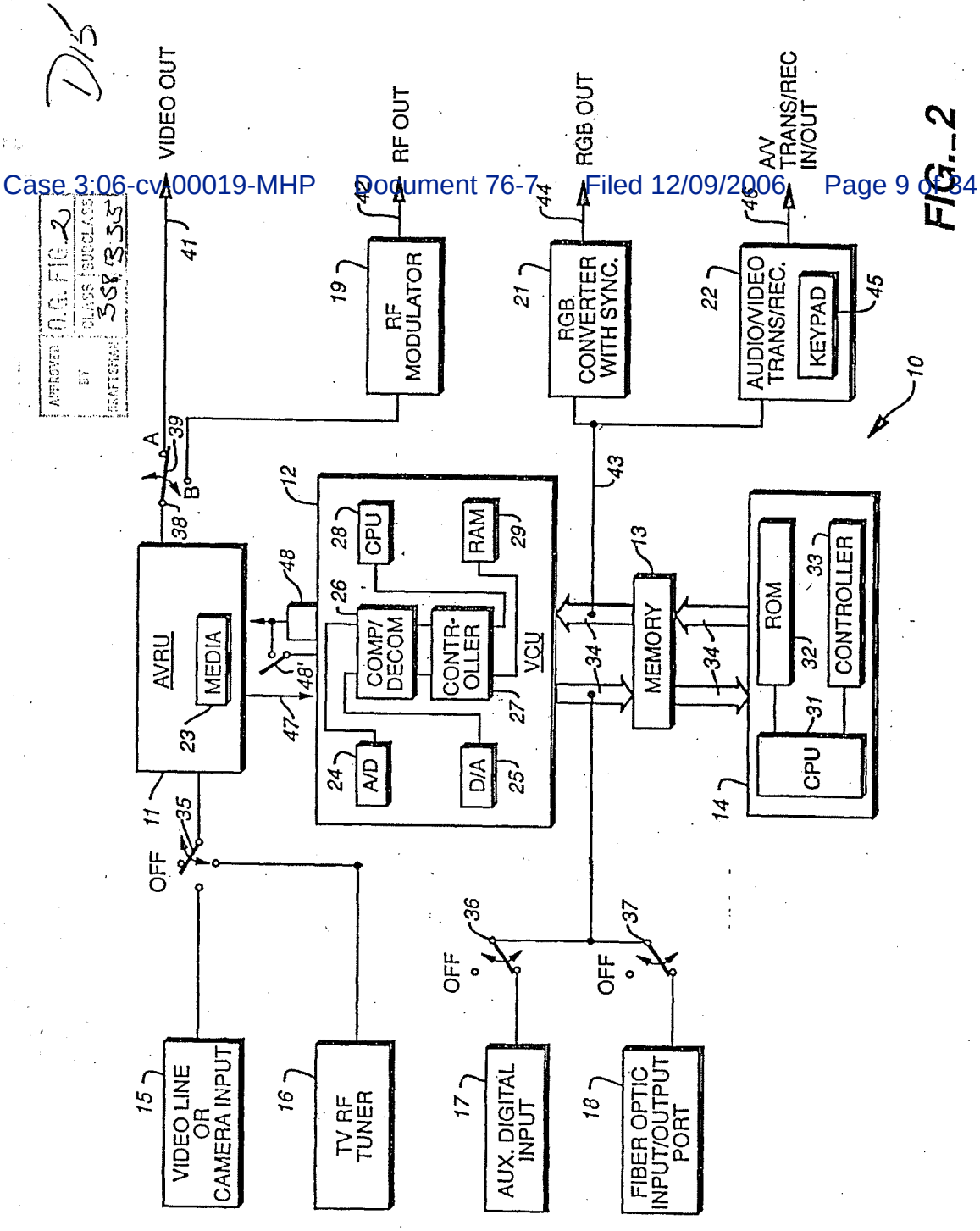

VIDEO OUT
RF OUT
RGB OUT
A/V TRANS/REC IN/OUT
RF MODULATOR
RGB CONVERTER WITH SYNC.
AUDIO/VIDEO TRANS/REC.
KEYPAD
AVRU
MEDIA
COMP/ DECOM
CONTR-OLLER
VCU
CPU
RAM
A/D
D/A
MEMORY
ROM
CONTROLLER
CPU
OFF
VIDEO LINE OR CAMERA INPUT
TV RF TUNER
AUX. DIGITAL INPUT
FIBER OPTIC INPUT/OUTPUT PORT

FIG._2

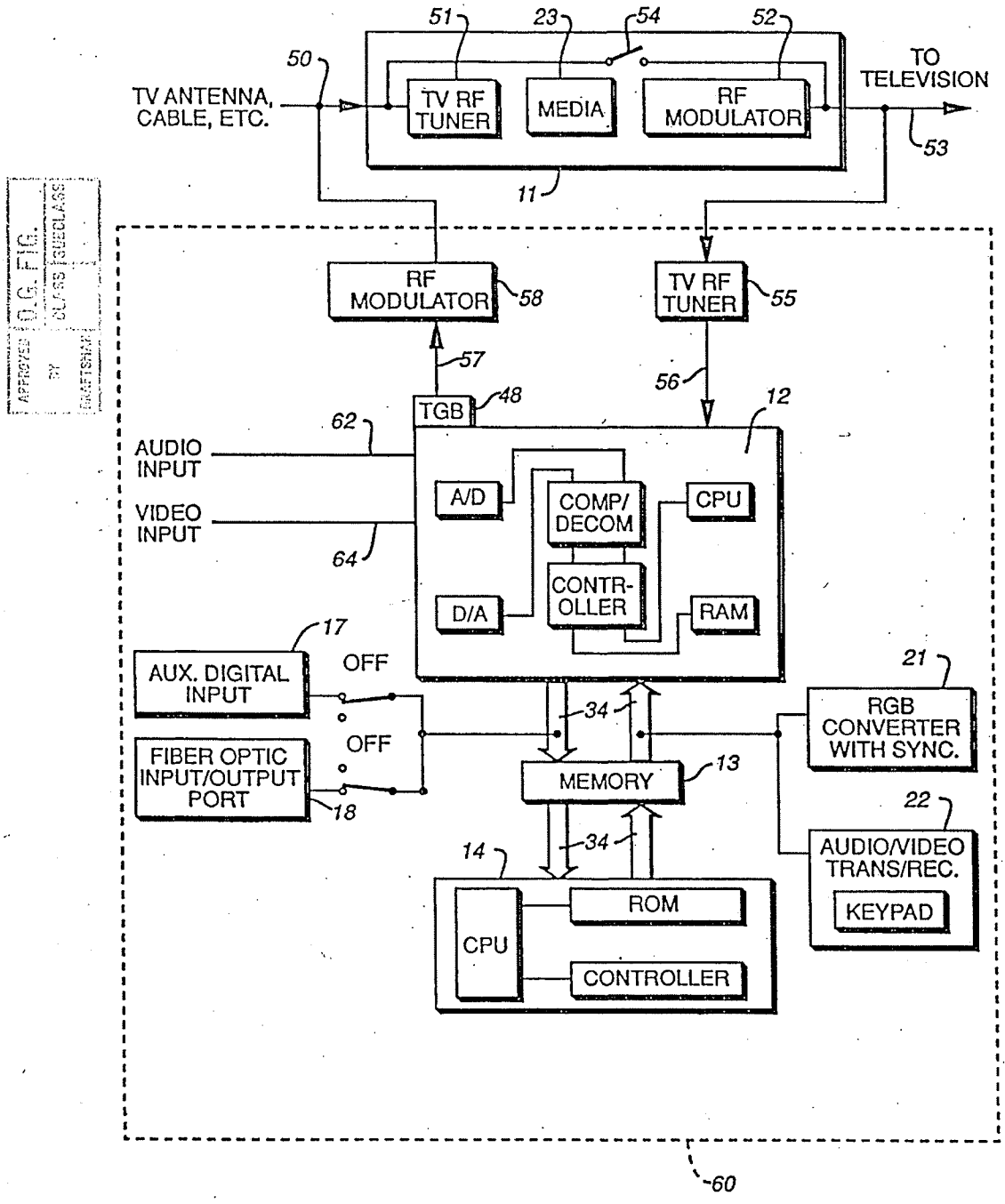

51
23
54
52
50
TV ANTENNA, CABLE, ETC.
TV RF TUNER
MEDIA
RF MODULATOR
TO TELEVISION
53
11
RF MODULATOR
58
TV RF TUNER
55
57
56
TGB
48
12
62
AUDIO INPUT
VIDEO INPUT
64
A/D
COMP/ DECOM
CPU
D/A
CONTR- OLLER
RAM
17
AUX. DIGITAL INPUT
OFF
FIBER OPTIC INPUT/OUTPUT PORT
OFF
18
34
MEMORY
13
21
RGB CONVERTER WITH SYNC.
22
AUDIO/VIDEO TRANS/REC.
KEYPAD
14
34
CPU
ROM
CONTROLLER
60

FIG._3

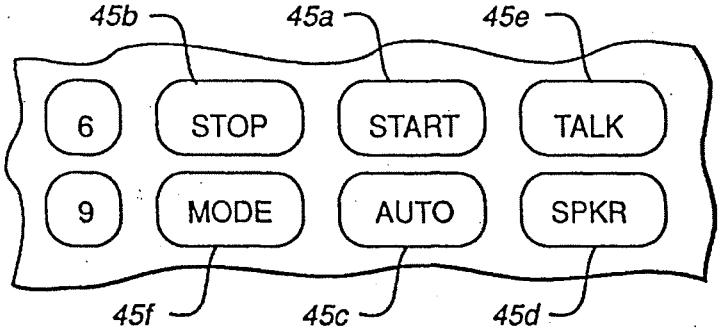

45b
45a
45e
6
STOP
START
TALK
9
MODE
AUTO
SPKR
45f
45c
45d

FIG._1A

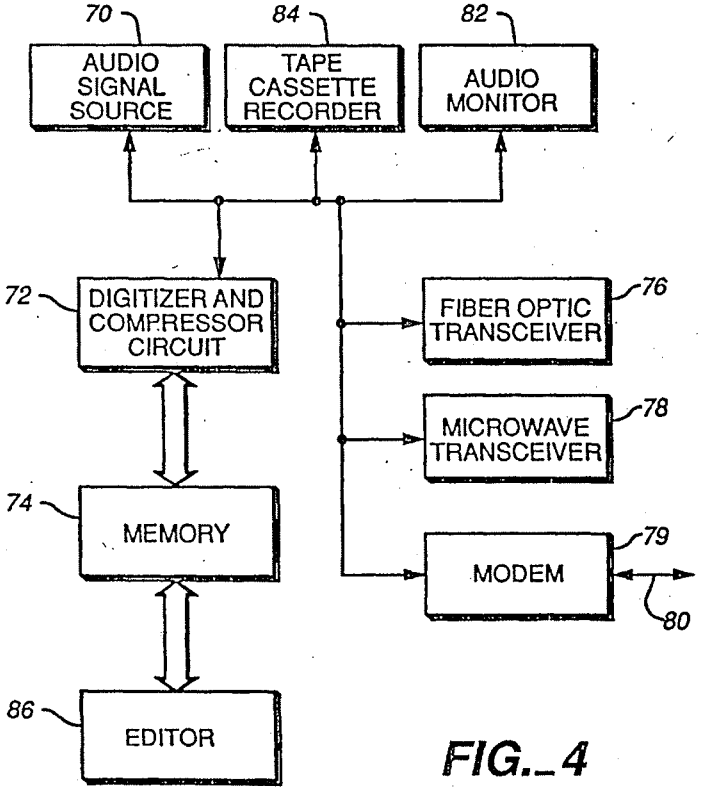

70
84
82
AUDIO SIGNAL SOURCE
TAPE CASSETTE RECORDER
AUDIO MONITOR
72
DIGITIZER AND COMPRESSOR CIRCUIT
76
FIBER OPTIC TRANSCEIVER
78
MICROWAVE TRANSCEIVER
74
MEMORY
79
MODEM
80
86
EDITOR

FIG._4

525-142
15-501

PART B - ISSUE FEE TRANSMITTAL

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 2 through 6 should be completed where appropriate. All further correspondence including the Issue Fee receipt, the Patent, advanced orders and notification of maintenance fees will be mailed to addressee entered in Block 1 unless you direct otherwise by: (a) specifying a new correspondence address in Block 3 below; or (b) providing the PTO with a separate "FEE ADDRESS" for maintenance fee notification with the payment of Issue Fee or thereafter. **See reverse for Certificate of Mailing.**

JUL 25 1991 PAT. & TRADEMARK

1. CORRESPONDENCE ADDRESS	2. INVENTOR(S) ADDRESS CHANGE (Complete only if there is a change)
KENNETH E. LEEDS SKJERVEN, MORRILL, MACPHERSON, FRANKLIN & FRIEL 25 METRO DRIVE, STE 700 SAN JOSE, CA 95110	INVENTOR'S NAME Street Address City, State and ZIP Code CO-INVENTOR'S NAME Street Address City, State and ZIP Code ☐ Check if additional changes are on reverse side

SERIES CODE/SERIAL NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
07/347,629	05/05/89	005	NGUYEN, H	235 04/23/91

First Named Applicant: LANG, RICHARD A.

TITLE OF INVENTION: AUDIO/VIDEO TRANSCEIVER APPARATUS INCLUDING COMPRESSION MEANS, RANDOM ACCESS STORAGE MEANS, AND MICROWAVE TRANSCEIVER MEANS (AS AMENDED)

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
M9141S	358-335.000	067	UTILITY	YES	525.00	07/23/91

3. Further correspondence to be mailed to the following:
William E. Hein
Attorney at Law
P.O. Box 335
Loveland, Colorado 80539

4. For printing on the patent front page, list the names of not more than 3 registered patent attorneys or agents OR alternatively, the name of a firm having as a member a registered attorney or agent. If no name is listed, no name will be printed.
1 William E. Hein
2
3

DO NOT USE THIS SPACE

160 HB 07/25/91 07347629 1 142 525.00 CK
160 HB 07/25/91 07347629 1 501 15.00 CK

5. ASSIGNMENT DATA TO BE PRINTED ON THE PATENT (print or type)
(1) NAME OF ASSIGNEE:
Explore Technology, Inc.
(2) ADDRESS: (City & State or Country)
Scottsdale, Arizona
(3) STATE OF INCORPORATION, IF ASSIGNEE IS A CORPORATION
Arizona

A. ☐ This application is NOT assigned.
☒ Assignment previously submitted to the Patent and Trademark Office.
☐ Assignment is being submitted under separate cover. Assignments should be directed to Box ASSIGNMENTS.

PLEASE NOTE: Unless an assignee is identified in Block 5, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

6a. The following fees are enclosed:
☒ Issue Fee ☒ Advanced Order - # of Copies 10 (Minimum of 10)

6b. The following fees should be charged to:
DEPOSIT ACCOUNT NUMBER
(Enclose Part C)
☐ Issue Fee ☐ Advanced Order - # of Copies
☒ Any Deficiencies in Enclosed Fees (Minimum of 10)

The COMMISSIONER OF PATENTS AND TRADEMARKS is requested to apply the Issue Fee to the application identified above.

(Signature of party in interest of record) (Date) 7/22/91

NOTE: The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

TRANSMIT THIS FORM WITH FEE-CERTIFICATE OF MAILING ON REVERSE.

PTOL-85B (REV 12-88)(OMB Clearance is pending)

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Box ISSUE FEE
Commissioner of Patents and Trademarks
Washington, D.C. 20231

on _____ (Date)

(Name of person making deposit)

(Signature)

(Date)

Note: If this certificate of mailing is used, it can only be used to transmit the Issue Fee. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawings, must have its own certificate of mailing.

"Express Mail" mailing label number RB188719399
Date of Deposit July 22, 1991

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

William E. Hein
(Typed or printed name of person mailing paper or fee)

(Signature of person mailing paper or fee)

This form is estimated to take 20 minutes to complete. Time will vary depending upon the needs of the individual applicant. Any comments on the amount of time you require to complete this form should be sent to the Office of Management and Organization, Patent and Trademark Office, Washington, D.C. 20231 and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, D.C. 20503.

REVERSE PTOL-85B (REV.12-88)(OMB Clearance is pending)

PTO UTILITY GRANT
Paper Number 17

The United States of America

The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person or persons having title to this patent the right to exclude others from making, using or selling the invention throughout the United States of America for the term of seventeen years from the date of this patent, subject to the payment of maintenance fees as provided by law.

Harry F. Manbeck, Jr

Commissioner of Patents and Trademarks

Priscilla A. Fuller

Attest

PTO-1584

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

P75M

WILLIAM E. HEIN
ATTORNEY AT LAW
P.O. BOX 335
LOVELAND CO 80539

DATE PRINTED
11/23/99

NOTICE OF PATENT EXPIRATION

According to the records of the Patent and Trademark Office, payment of the maintenance fee for the patents listed below has not been timely received prior to the end of the six-month grace period in accordance with 37 CFR 1.362(e). THE PATENT(S) LISTED BELOW HAS THEREFORE EXPIRED AS OF THE END OF THE GRACE PERIOD. 35 U.S.C. 41(b).

Expired patents may be reinstated in accordance with 37 CFR 1.378 if upon petition, the maintenance fee and the surcharge set forth in 37 CFR 1.20(m) are paid, AND THE DELAY IN PAYMENT OF THE MAINTENANCE FEE IS SHOWN TO THE SATISFACTION OF THE COMMISSIONER TO HAVE BEEN UNAVOIDABLE. 35 U.S.C. 41(c)(1).

IF THE COMMISSIONER ACCEPTS PAYMENT OF THE MAINTENANCE FEE UPON PETITION, THE PATENT SHALL BE CONSIDERED AS NOT HAVING EXPIRED, BUT WOULD BE SUBJECT TO THE INTERVENING RIGHTS AND CONDITIONS SET FORTH IN 35 U.S.C. 41(c)(2).

NOTICE OF THE EXPIRATION WILL BE PUBLISHED IN THE OFFICIAL GAZETTE.

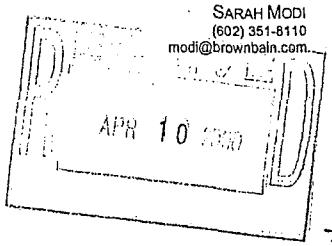
PATENT NUMBER	U.S. SERIAL NUMBER	PATENT DATE	APPLICATION FILING DATE	EXPIRATION DATE	ATTORNEY DOCKET NUMBER
5057932	07347629	10/15/91	5/ 5/89	10/15/99	M914US

PTOL-441
MB441A

PART B - FILE COPY

BROWN & BAIN, P.A.
Attorneys at Law

SARAH MODI
(602) 351-8110
modi@brownbain.com



#18

April 10, 2000

Burst.Com, Inc.

Dear Sir or Madam:

Enclosed for filing are the following documents:

1. **Recordation Form Cover Sheet for Patents**, with
   (i) a copy of the Name Change Certificate from the Secretary of State of Delaware;
   (ii) a check in the amount of $360.00 as filing fee for same; and
   (iii) a self-addressed, postage paid return postcard acknowledging receipt by the Patent and Trademark Office;
2. **Petition to Accept Unintentionally Delayed Payment of Maintenance Fee in an Expired Patent (37 CFR 1.378(c)) and Statement Under 37 CFR 3.73(b)**, with
   (i) a check in the amount of $2,590.00, and
   (ii) a self-addressed, postage paid return postcard acknowledging receipt by the Patent and Trademark Office.

Please direct all communications regarding this matter to the undersigned.

Sincerely,

Sarah Modi

Commissioner of Patents and Trademarks
Box Assignments
Washington, D.C. 20231

U.S. EXPRESS MAIL
EJ131450237US

SBM/rs
Enclosures

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PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378(c))

Docket Number (Optional)

Mail to: Assistant Commissioner for Patents
Box DAC
Washington, D.C. 20231

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (703) 305-9282.

Patent No. 5,057,932 Application Number 374,629

Issue Date October 15, 1991 Filing Date May 5, 1989

CAUTION: Mandatory Identifiers: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number (or reissue patent number, if a reissue) and (2) the application number of the actual U.S. application (or reissue application) leading to issuance of that patent. 37 CFR1.366(c) and (d).

Also complete the following information, if applicable

The above-identified patent:

☐ is a reissue of original Patent No._____,original issue date _____; original application number _____, original filing date _____.

☐ resulted from the entry into the U.S. under 35 U.S.C. 371 of international application _____filedon _____.

CERTIFICATE OF MAILING (37 CFR 1.8(a))

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the Assistant Commissioner for Patents, Box DAC, Washington, D.C. 20231.

4/10/2000
Date

Roberta G. Sealy
Signature

EJ131450237US

ROBERTA G. SEALY
Typed or printed name of person signing Certificate

05/02/2000 ACORAH1 00000005 5057932
01 FC:188 240.00 DP
02 FC:284 950.00 DP

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1. SMALL ENTITY

☐ Attached herewith is a statement establishing small entity status.

OR

☒ A statement establishing small entity status for this patent has been filed and it is confirmed that the current owner of this patent still qualifies for small entity status.

2. LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

NOTE: 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in...patent prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate pursuant to Section 1.19 of this part." From the wording of 37 CFR 1.28(a): notification of change of status (a) must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity. See also 37 CFR 1.366(f).

☐ The status of this patent has changed from that of small entity to other than that of small entity.

3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))

The appropriate maintenance fee must be submitted with this petition, unless it was paid earlier.

NOT Small Entity			Small Entity		
Amount	Fee	(Code)	Amount	Fee	(Code)
☐ $____	3 1/2 yr fee	(183)	☐ $____	3 1/2 yr fee	(283)
☐ $____	7 1/2 yr fee	(184)	☒ $950.00	7 1/2 yr fee	(284)
☐ $____	11 1/2 yr fee	(185)	☐ $____	11 1/2 yr fee	(285)

MAINTENANCE FEE BEING SUBMITTED $950.00

4. SURCHARGE

The surcharge required by 37 CFR 1.20(i)(2) of $1,640.00 (Fee Code 188) must be paid as a condition of accepting unavoidably delayed payment of the maintenance fee.

SURCHARGE BEING SUBMITTED $1,640.00

5. MANNER OF PAYMENT

☒ Enclosed is a check for the sum of $2,590.00.

☐ Please charge Deposit Account No.____ the sum of $____. A duplicate copy of this authorization is attached.

6. AUTHORIZATION TO CHARGE ANY FEE DEFICIENCY

☒ The Commissioner is hereby authorized to charge any maintenance fee, surcharge or petition deficiency to Deposit Account No. 501201. A duplicate copy of this authorization is attached.

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7. OVERPAYMENT

As to any overpayment made please

OR [X] Credit to Deposit Account No. 501201.

[ ] Send refund check.

8. STATEMENT

The delay in payment of the maintenance fee to this patent was unintentional.

9. PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED.

NOTE: 37 CFR 1.378(d) states: "Any petition under this section must be signed by an attorney or agent registered to practice before the Patent and Trademark Office, or by the patentee, the assignee, or other party in interest."

4/4/00
Date

Edward H Davis
Signature(s) of Petitioner(s)

(415) 391-4455
Telephone Number

Edward H. Davis
General Counsel &
Typed or printed name(s)
Vice President, Strategic Alliances
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Address
500 Sansome St., Suite 503
San Francisco, CA 94111

ENCLOSURES:

[X] Maintenance Fee payment

[ ] Small Entity Status Form

[X] Surcharge

[ ] _____

PTO/SB/96 (6-98)
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Explore Technology, Inc.

Application No./Patent No.: 5,057,932 Filed/Issue Date: October 15, 1991

Entitled: Audio/video transceiver apparatus including compression means, random access storage means, and microwave transceiver means

Instant Video Technologies, Inc., a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. [x] the assignee of the entire right, title, and interest; or
2. [ ] an assignee of an undivided part interest

in the patent application/patent identified above by virtue of either:

A. [X] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the Patent and Trademark Office at Reel 8321, Frame 0817, or for which a copy thereof is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as shown below:

1. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
3. From: _____ To: _____
   The document was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[ ] Copies of assignments or other documents in the chain of title are attached.
NOTE: A separate copy (i.e., the original assignment document or a true copy of the original document) must be submitted to Assignment Division in accordance with 37 CFR Part 3, if the assignment is to be recorded in the records of the PTO. See MPEP 302-302.8]

The undersigned (whose title is supplied below) is empowered to sign this statement on behalf of the assignee.

4/7/02
Date

Edward H. Davis
Signature

Edward H. Davis
Typed or printed name

General Counsel & Vice President, Strategic Alliances
Title

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

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SPECIAL PROGRAMS OFFICE
DAC FOR PATENTS

EDWARD H. DAVIS
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500 SANSOME ST., SUITE 503
SAN FRANCISCO, CA 94111

In re Patent No. 5,057,932
Issue Date: October 15, 1991
Application No. 07/347,629
Filed: May 5, 1989
Patentee(s) Richard A. Lang

ON PETITION

This is a decision on the petition under 37 CFR 1.378(c), filed April 10, 2000, to accept the delayed payment of a maintenance fee for the above-identified patent.

The petition is **GRANTED**.

The maintenance fee is hereby accepted and the above-identified patent is reinstated as of the mail date of this decision.

Petitioner will not receive future correspondence related to maintenance fees for the above-identified patent unless a "fee address" (see PTO/SB/47) is submitted for the above-identified patent.

Telephone inquiries concerning this decision should be directed to Wan Laymon at (703) 305-9282.

The patent file is being forwarded to Files Repository.

Wan Laymon
Petitions Examiner
Office of Petitions
Office of the Deputy Assistant Commissioner
for Patent Policy and Projects

Back to paper tape – digital paper

By David Owen
Development Executive,
Data Storage Products
ICI Imagedata
Wilmington, Del.

For applications demanding massive amounts of data, the storage found in 3½-inch, 100-Mbyte disk drives is no longer enough, and at 15 cents per megabyte, rigid optical WORM disks—a serious memory contender—are still too expensive. However, a technology that shows signs of approaching these storage needs inexpensively is digital paper.

Not really paper at all—but almost as inexpensive—digital paper is produced by sputtering a reflective layer onto a 25- to 75-micron Melinex polyester film substrate. The film is then coated with a dye polymer layer and topped with a protective coating.

The dye polymer is designed to be reactive to 830- or 780-nm wavelength laser light, and the dye can be tuned to suit the infrared wavelength of the writing laser.

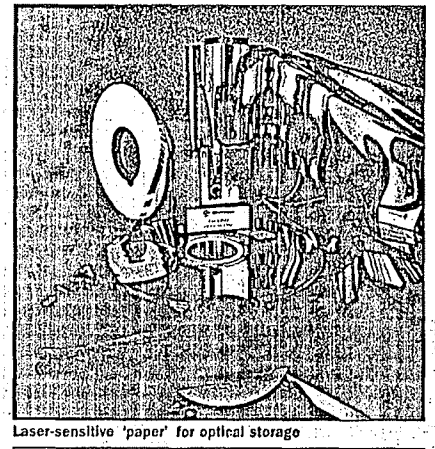
Thus, the same kinds of lasers used in conventional, rigid optical-storage media, can write data onto the surface of digital paper by burning in permanent minute indentations. The indentations, which reflect less light than surrounding unwritten areas, are read as digital bits.

This lightweight, robust and flexible material promises to offer an effective storage life of at least 15 years. While sharing the same recording characteristics and data density as conventional rigid optical disks, the medium is less than .025-mm thick, allowing it to be delivered in a variety of physical formats, including not only disks, but also cassettes, open-reel tapes and strips.

The data density of optical media is currently limited by the wavelength of the lasers that write the data. The infrared end of the spectrum used by lasers today allows data bits to be as close as 1-micron apart. This gap can be reduced to .5 micron by using laser with wavelengths closer to the blue end of the spectrum. Currently in development, low-cost lasers of this wavelength and suitable power show promise of quadrupling the data-packing density.

Currently, two optical disk drives employing the medium have already been announced, and several more drive manufacturers are working on practical implementations.

Boulder, Colo.-based Bernoulli Optical Systems Corp. (Bosco), a wholly owned subsidiary of Iomega Inc., was established to develop optical disk cartridge drives that would use the Bernoulli principle in conjunction with flexible optical disks from ICI Imagedata.



Laser-sensitive 'paper' for optical storage

Preformatted by embossing during production and cut into disks, the "cookies" are housed in 5¼-inch removable cartridges of a similar physical size and shape as the present Bosco 20-Mbyte magnetic cartridges. The cartridges slot into a half-height space in a standard personal computer storage console.

Bosco's drive works by spinning the flexible optical disk close to the reading head with an air pressure differential between the two sides of the disk. This approach offers access time and data rates that are directly comparable to a Winchester hard disk, and it offers removability—the principal advantage of the floppy disk—but with a vastly increased storage capacity and at a much lower cost.

> Lightweight, robust and flexible, digital paper promises to offer an effective storage life of 15 years.

More important, however, "head crashes" and their disastrous consequences, so much a part of rigid disks, are no longer a problem because dust particles on the Bosco disk simply cause a temporary separation of the head and the rotating medium until they are spun harmlessly out of the way.

The same thing applies to power interruptions. Unlike Winchester technology, the media drops away from the head, not the head onto the media.

The application of the Bernoulli principle to optical drives also offers dramatic improvements over conventional rigid optical disk technology because the head and the rotating medium are held in stable close proximity by aerodynamics. As a result, the bulky focusing device used in rigid optical disks can be replaced by a lightweight, fixed-focus read/write head. Being able to run with a closer disk-head gap allows the use of a wide-aperture, low-mass lens, through which the laser can deliver more power to the optical medium, boosting the data transfer rate.

Since the medium is very low in mass and is paper thin, it can be spun as a pair of disks in the same cartridge. Each disk is addressed by its own head, thus doubling the on-line capacity over an equivalent rigid optical device. With access times and transfer rates comparable to today's rigid magnetic disks, the Bernoulli-type cartridge demonstrates the very wide potential of flexible optical disk systems.

This technology, developed by ICI and Bosco and available for licensing, makes it possible to create a drive with access times of better than 40 ms, a transfer rate of 1.5 Mbytes/s and a capacity of 1.5 Gbytes formatted or 1.8 Gbytes unformatted. Most important, its media price is targeted at $50 for a cartridge that, in some circumstances, could provide enough data storage to see the user's hardware through to the end of its useful life.

While certainly not a must for every PC user, this kind of data retention could be critical for a system used to back up a LAN in a law firm or to store patient records—such as X-rays and CAT scans—in a hospital or medical clinic.

This optical material is also seen as ideal for reel-to-reel tape storage. A 2,400-foot reel of digital paper at half-inch tape size wound onto a 10½-inch spool—today's standard format for reel-to-reel magnetic tape—would store 600 Gbytes of data. This is more than 4,000 times the capacity of a magnetic reel of the same size, but with a cost of less than half a cent per megabyte.

And, there are many applications for such storage. This reel-to-reel optical tape material would be well-suited for a bank that must maintain an expert system or store customer transaction records, or for a government agency system.

An IBM 3400-compatible tape drive, announced by Creo Electronics Corp., of Burnaby, B.C., boasts an average access time of about 28 seconds for a given byte of information on this tape. A worst-case search would take approximately 1 minute. With a corrected error rate of 10^{-12}, the 2,400-foot tape would hold 1,000 Gbytes of data on a 12-inch reel.

SYSTEMS ARCHITECTURE

Peripheral Storage: Who's Got What

by Carl Warren, Contributing Editor

System platforms, regardless of architecture, have become powerful data processing engines. Like a racing car that gulps gallons of fuel by the second, these new systems gobble up and spit out data streams at unprecedented rates. To match the performance of these "data engines," storage devices such as Winchester disk drives, flexible disk drives, tape subsystems, semiconductors, and emerging optical storage units are offering equally impressive performance and capacity. Moreover, manufacturers of these storage devices can offer this capability at a fraction of the cost of devices available just five years ago.

The storage device has become the system core, and the latest crop of new storage announcements is stepping ahead in technology capability. For example, system designers can purchase Winchester disk technology in the 765-Mbyte-plus range with under 20-msec average access times, tape drives that match virtually any capacity demand, and even erasable optical storage drives. Further, interfacing technology, due to the increased popularity of the Small Computer Systems Interface (SCSI), is rapidly becoming a commodity business (see *Embedded SCSI Brings High Performance, Smarts to Smaller Drives*, p. 62).

System manufacturers, however, demand more than capacity and performance. Indeed, the real impetus behind the burgeoning storage market is cost/performance per cubic inch. The goal: to inexpensively pack more storage solution into the smallest amount of space. Even full-sized 5¼" Winchester disk drives are staying true to this axiom.

The major performance providers—Control Data Corp. (Minneapolis, MN), Maxtor Corp. (San Jose, CA), and Micropolis Corp. (Chatsworth, CA)—offer fast 380-Mbyte and 765-Mbyte drives with average access times below 20 msec. Workstation vendors and host CPU makers are snatching up these drives.

Demand for the drives is helping to push the price per megabyte into the $2 range; but so are innovative storage subsystem designs. One OEM array solution from Micropolis is the

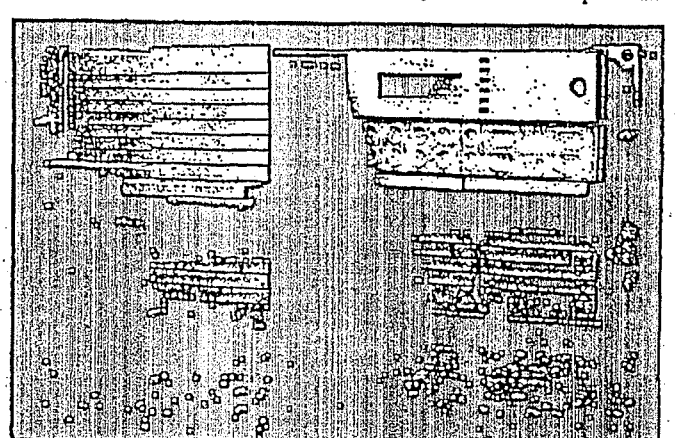


Figure 1: Though this 3-Gbyte data storage array from Micropolis did not prove an apt fit for the company's disk line, such arrays will be pursued by other vendors, especially those who find promise in SCSI-II.

1804 (Figure 1). This storage array used a combination of four data drives and a parity drive (4 + 1 array). In addition to enhancing channel performance and increasing overall capacity, this combo also improves the transfer rate. For example, an array using disk drives with 10-MHz transfer rates produces an aggregate bandwidth of 40 MHz (3 Mbytes/sec).

Besides the benefit of a higher bandwidth, arrays fit more storage into smaller footprints. Thus, the overall cost/megabyte/cubic inch is lessened. For example, a 3-Gbyte array built using the Micropolis 1580 series of 15-MHz ESDI drives would fit into less than half the space required for a 1.2-Gbyte IBM 3380 subsystem, and consume one-third the power.

Although arrays offer certain benefits, there is a price to pay. For example, the subsystem demands synchronized controllers, timing controls, and buffers to properly match the transfer rate to the host I/O controller.

Interestingly, designers have been using ESDI drives to achieve high bandwidths. For the best system match, the drives are coupled to SCSI controllers, which increases the overall cost. The

Packing more storage solution into a smaller space, at a lower cost, is the goal.

trend, however, is to move away from ESDI and instead go straight to SCSI. This is permissible since the emerging SCSI-II more than meets bandwidth requirements for high-performance systems. In addition, command overhead, once the bane of SCSI developers, has dropped from a 1-msec average to the nanosecond range.

Another company making use of the array concept, but as a fault-tolerant storage system, is Pacstor Inc. (Los Gatos, CA). The company's Integra series of subsystems uses Conner Peripherals' (San Jose, CA) 3½" 100-Mbyte Winchesters to create arrays up to 1.2 Gbytes.

Besides using 3½" Winchesters, the fault-tolerant aspects of the overall system make the Pacstor approach unique. The Integra system is an intelligent standalone unit that uses an Intel 80386 to control file access and data management. Pacstor uses SCSI to its fullest extent as a peripheral bus. Thus, drives can be easily removed or added without disturbing subsystem operation—a function of the disconnect/reconnect feature of SCSI.

Pacstor has also developed proprietary file and error correction management that makes it possible to fully reconstruct a file should a disk drive malfunction. Pacstor pricing is between $4000 and $9000, depending on the configuration.

WORMing Its Way In

Write Once Read Many (WORM) optical technology, although not an overwhelming market giant, is proving useful in some niche segments. Ian Turner, vice-president of engineering at Laserdrive Ltd. (Santa Clara, CA), sees the technology as well suited to the imaging business. "Images take up lots of space and usually need to be considered permanent," says Turner. To this

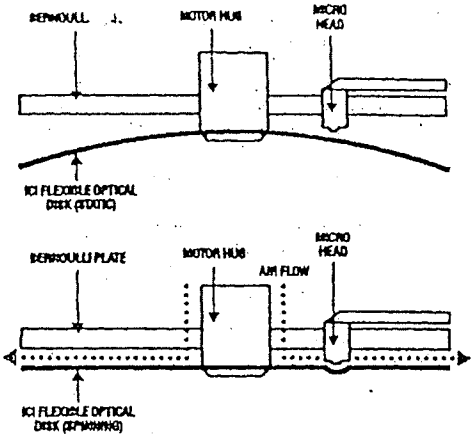


Figure 2: The Bernoulli Optical drive uses the ICI Digital Paper, mounted on a hub under a plate that guides the air flow, creating a lift effect. Thus, the media flies rather than the head. The head/media interface as shown creates a dimpling much like the prow of a boat plowing through water.

end, Laserdrive packages (in a 5¼" form factor) 405 Mbytes per side of storage; a three-interleave Reed-Solomon error correction code (ECC) is implemented with the Neal Glover chip set from Scientific Microsystems Inc. (Mountain View, CA).

Since the Laserdrive 810 series of optical drives are write once, the company has implemented the management of write once protocol in the drive firmware. The upshot is that the host operating system doesn't require any specialized software.

Although WORMs are early to market, 5¼" drives haven't really caught on. Moreover, they may be ignored in favor of emerging erasable optical.

Verbatim first introduced a magneto optical erasable drive over four years ago, but Maxtor stands as today's market leader, with drives developed both in-house and with Seiko/Epson. And by this month, Maxtor should have made early shipments of its Fiji and Tahiti optical drives.

The Fiji I is a 3½" drive with 160 Mbytes of removable storage and a 100-msec average access time. The Tahiti, on the other hand, is a 5¼" optical drive that stores 600 Mbytes to 1 Gbyte of data, depending on the format. Maxtor adheres to the ANSI standard that specs 600 Mbytes, and offers an extended format for higher capacity. OEM pricing for the Tahiti is $2500; $1000 for Fiji. Erasable media will add about $200 to the cost.

The technology used by Maxtor is called thermo magneto optical (TMO). This uses a medium, in this case built by Philips Dupont, that combines optical sensitivity with magnetic read/write characteristics. Here, a laser is used to heat a spot on the media until a bias field of about 250 Oe is achieved, causing a reorientation of the magnetic domain. The result is a written bit that can be sensed by the read/write head.

Although bits can be reoriented, there is no overwrite capability. Consequently, an erase pass must take place before a new bit is written. This might seem to slow operation. However, with careful integration, such as using buffers in combination with a fast Winchester, the system impact should be negligible.

An interesting write once optical technology is being pursued by Iomega Corp. (Roy, UT) in concert with the British firm ICI Electronics. ICI has developed an optical Digital Paper. The drive being developed by a subsidiary of Iomega, Bernoulli Optical Systems Corp. (BOSCO) (Boulder, CO), is based on Bernoulli

principles whereby the media floats in relationship to the read/write head (Figure 2). The company claims the ability to store 1 Gbyte of data, with a 40-msec access time and a SCSI transfer rate of 1.5 Mbytes/sec.

The ICI Digital Paper (Figure 3) is a dye polymer infrared sensitive coating on a polyester-based substrate. The media has the look and feel of a wrapping paper, and since it is flexible, it can be used in rotating media, or tape drives. Developed by Creo Products, Inc. (Vancouver, Canada), the Creo drive stores up to 1 Tbyte of data on a 12" reel.

Half-Inch Upgrades

The half-inch tape is the only standard for interchange. IBM's ½" cartridge tape drive, the 3480, has been carried over to an easily handled cartridge. But third-party versions are few, and only one firm has emerged with a viable alternative to the high-end 3480.

Working in a very open joint development effort with IBM, Cipher Data Products, Inc. (San Diego, CA) has fabricated the 3000i series of ½" drives. Designed for 8" and 5¼" form factors, the 3000i series drives store 320 Mbytes on a single ½" cartridge with 600' of tape.

This significant storage boost over IBM's 200-Mbyte capacity is achieved via the Multitrack Serpentine Recording (MSR) format. A variation of the proposed Half Inch Tape Cartridge (*Hi/TC*) standard, this format permits serpentine (continuous loop) recording on either two or four tracks on the 24 specified in MSR. This, too, denotes a significant step over IBM's 18-track format. However, IBM writes all 18 in a parallel fashion. The Cipher drive relies on a stepping mechanism to index over the track real estate.

The 3000i drives employ the standard ½" tape cartridge used in the IBM drive, which is a chromium dioxide tape that is priced in the $5 range in OEM quantities. Cipher reports 27,000 flux reversals/inch and ensures a 1 × 10-byte to 12-byte error rate.

The Many Lives of Magnetic Tape Technology

by Joe Phillips, 3M Data Storage Products Div., St. Paul, MN

Magnetic tape technology refuses to die, despite periodic predictions of its demise at the hands of competitive products—first from magnetic disk drives as a primary storage medium, and, more recently, from technologies such as optical disk in removable storage applications. Half-inch reel-to-reel tape has survived and flourished by its adaptability to a variety of applications where cost per megabyte and data interchange are the primary concerns.

The earliest data recording tape recorded information at 100 bits/inch. The technology has evolved to a 500-fold increase: The current generation of data storage tape products has boosted density beyond 50,000 bits/inch.

Today's mainstream magnetic tape technologies break down into four general categories: ½" reel-to-reel; ¼" data cartridge, both in standard-sized DC600 and the micro-sized DC2000 mini cartridges; ½" single-reel cartridges (e.g., IBM 3480 and DEC CompacTape media); and various helical scan formats, including 8-mm and Digital Audio Tape (DAT). A possible fifth category having minor applications has developed for digital data cassette systems using a Philips-type cassette and various nonstandard ½" cartridge designs.

Higher densities now being demonstrated with a helical scan format are the result of advanced tape formulations with greatly increased coercivities—up to 1450 oersted using metal particle tape on DAT cartridges. In comparison, ½" reel-to-reel tape has held the line at around 290 oersteds. A planned move to higher coercivity pigments for future ¼" data cartridge media will also offer higher areal recording densities; plans for a next-generation ¼" data cartridge product specify 40 tracks of data at a linear recording density of 40,000 bits/inch to achieve 1 Gbyte on a standard-size cartridge by 1990. These newer ¼" data cartridges have moved coercivities to 900 oersteds.

With both product segments (helical and linear recording), as track and bit densities increase, vendors are becoming more concerned with accurate head positioning on these ever-smaller data tracks. Various types of servo positioning systems will be incorporated into these products to ensure the required level of data integrity; sophisticated ECC will be included as well.

Although the venerable 9-track reel-to-reel systems have served as the dominant means of data interchange in mainframe and minicomputer applications for 25 years, most observers predict that within the next few years drives based on the IBM 3480 ½" cartridge will become the most popular in the ½" tape arena. Storage Tek, Hitachi, Fujitsu, NEC, Cipher, and Aspen have all announced 3480 drives, ensuring this technology's use in the major data centers of the world.

Data Cartridge	14,000	26	Ferric oxide	¼"	320 Mbytes	240 Kbits/sec	120
Reel-to-Reel	6250	9	Ferric oxide	½"	165 Mbytes	1.25 Mbits/sec	200
IBM 3480	38,000	18	Chromium dioxide	½" cartridge	200 Mbytes	3 Mbits/sec	120
Data DAT	61,000	1269 stripes/ inch	Metal particle	3.81 mm	1.3 Gbytes	183 Kbits/sec	122 (effective)

Currently, 3480 cartridges are rated at 200 Mbytes/transport using 18 parallel tracks having a linear recording density of 24,689 flux changes/inch for a bit density of 38,000 bits/inch. The media uses chromium dioxide based magnetic tape and thin-film read-write heads. Chrome tape has the potential to support much higher densities—over eight times the current level—and it is expected that IBM will soon upgrade the 3480 drive modules, at least doubling current capacity. In some proprietary drives based on the 3480 cartridge, storage capacities of up to 320 Mbytes are now being demonstrated.

The future of tape technology looks promising. Much of the research into magnetic tape coating and resulting developments can be shared both in commercial audio and video applications as well as data recording. The metal particle media used for DAT drives is the same as that used for consumer audio recording. Moreover, research into advanced videotape formulations may possibly provide the answer for the next generation of high-coercivity tape used in data cartridge applications. With this synergistic research, it's a safe bet that continued technical improvements will make magnetic tape products strong competitors in the data storage market well into the next decade.

EE Times
Feb 13 89
Issue 525 pg 122

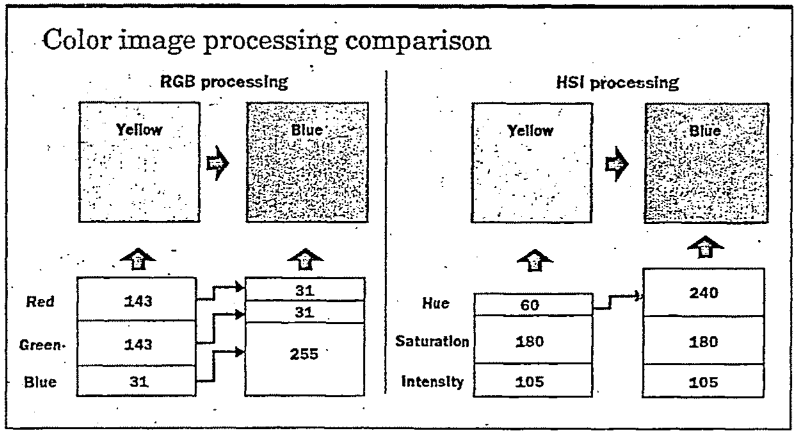
Solid State

Chips for real-time color comparisons

BY RICHARD DOHERTY

Marlboro, Mass. — Data Translation, developers of the first IBM PC peripheral board designed to handle RGB color video information in a streamlined look-up table fashion, is offering two proprietary chips that allow developers of color scanners, inspection systems, frame grabbers and video signal processors to engineer rapid analysis systems.

The DT7910 and DT7911 allow real-time video color comparisons by translating the RGB video signals produced by most color-image capture systems into easier-to-process hue-saturation-intensity (HSI) values. Using 8 bits for each primary light value, 24-bit color sources can be analyzed in the HSI domain.



HSI color processing allows engineers working with data from RGB video cameras to more easily process specific areas of chromatic interest. Once colors are changed to their equivalent HSI values, engineers have a greater latitude of data comparison opportunities (using HSI data lookup tables) than do traditional RGB intensity value comparisons.

Once either a full video image frame (or select portions of it) are converted from RGB into calculated HSI values, any further image manipulation becomes simpler and usually about three times faster. Still, over 16 million colors can be handled by the HSI technique.

The intensity portion of HSI represents the monochromatic light intensity of an image region. Simple edge enhancements, shape comparison and other image-alteration schemes are made simpler with one-step intensity comparison. Indeed, the color data that tags along with RGB technical approaches usually gets in the way of rapid image analysis.

Color image translations are far easier after HSI conversion. For example, a purple image can be made into an orange one with just a single value change. RGB would require three value translations. Si[illegible]y, intensity changes in color require a single modification (three are needed for RGB brightness changes). In order to achieve this real-time HSI conversion, one value must be divided by another at a 15-MHz rate.

The DT7910 (RGB to HSI) and DT7911 (HSI to RGB) chips handle video data at rates up to 768 × 512 pixels, at 30-Hz video rates. Using HCMOS fabrication, each 68-pin PLCC package draws under 140-mA from a 5-V supply.

Chips are $63 each in lots 1,000. Both chips can be used with an IBM PC-based RGB-to-HSI video board, the $3,995 DT7821, for prototyping. A $995 software subroutine library, Aurora, allows customization of the chip's operation.

Bill O'Brien *(508) 481-3700*

It's a new ball game in datacom controllers

Continued from page 121

ecutive officer and president Ed Sack is touting the IC as a candidate for semiconductor "product of the year."

Sack's point of view is hardly neutral, but the Z16C30 is undoubtedly a quantum leap beyond the competition. Most general-purpose datacom controllers run at around 2.5 Mbits/s, with some hitting 4 Mbits/s. The Z1630 also boasts 174,000 transistors,

The multiprotocol data peripheral can accommodate any conventional multiplexed or non-multiplexed bus, serving as a serial-to-parallel, parallel-to-serial converter/controller. And software takes care of configuring the chip for a range of serial communications applications.

The chip packs a fuller complement of functions than any of its ancestors: two baud-rate generators per channel, digital

com devices whose talents surpass anything yet seen. A cascade of products should follow this pioneer, based on a cell library three years in the making and on the design automation system that helped assemble that library. The toolset came from VLSI Technology Inc. in a technology swap that returns product developments to VLSI.

The evolution will continue at midyear, when a single-channel USC will be offered

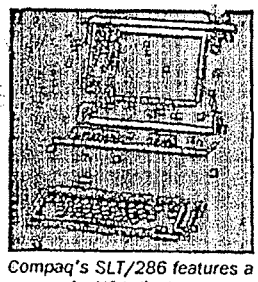
ing its own supply of proprietary circuit functions highlighted by the Z80 microprocessor and Z8 microcontroller, into application-specific combinations.

The company's traditionally strong position in datacom controllers also gives it a foundation of circuit functions and the applications experience needed to capitalize on its superintegration methodology.

"CPUs get the press," admitted Hulme,

APBU-00000262

386 VOLUME 10, ISSUE 42, $2.95



Compaq's SLT/286 features a supertwist VGA display.

AC outlet or an internal Enhanced Nicad Battery Pack. The battery life is over three hours, and it recharges when the laptop is connected to an AC outlet. Power packs weigh 1.8 pounds each and recharge in 1½ hours when the system is not in use and connected to a 110-, 220-, or 240-volt source.

The user conserves power by pressing a Standby button that powers down the display, microprocessor, drives, modem, and keyboard when the system is not in use. The SLT/286 automatically enters Standby mode when it has been inactive for a user-defined time period. Operation is restored by pressing the Standby button. An LED indicator and audible signal indicate low

See **Compaq, Page 5**

IBM's OS/2 Named-Pipe Support Quells LAN Incompatibility Fears

BY SHARON FISHER

IBM will support the named-pipes interface in OS/2, Version 1.1, an IBM executive confirmed last week, helping to dispel fears that IBM and Microsoft's OS/2 communications will not work with each other.

"Named pipes are in there," said Mike O'Dell, IBM product manager of distributed systems products. "It's not something we've announced." O'Dell also confirmed that named-pipe API calls would be documented for IBM's OS/2.

Because OS/2, Version 1.1 (due to ship this month) has no communications capability, the named-pipes API is so far supported only within a single machine, not on a LAN. O'Dell would not say whether named pipes would be supported in OS/2 Extended Edition, Version 1.1 or the LAN Server, which IBM uses to provide communications and LAN features to OS/2. IBM said previously, however, that all the features in OS/2 Standard Edition would be present in Extended Edition.

IBM provided further evidence of interoperability between its Extended Edition and Microsoft's LAN Manager last week by demonstrating an Extended Edition client running under a 3Com 3+Open server, which is LAN Manager-based.

In addition, 3Com said, but did not demonstrate, that DOS users running IBM's PC LAN 1.3 can communicate with a 3+Open server.

IBM has said that DOS users who want to communicate with IBM's OS/2 LAN Server should use PC LAN 1.3, which means

See **Pipes, Page 8**

Job's Next Machine Wins Praise, Poses Questions

BY THE INFOWORLD STAFF

SAN FRANCISCO — Steve Jobs' dream machine has finally arrived — sort of.

The wunderkind of Silicon Valley wowed the industry last week with the promise of a workstation that includes a 256-megabyte read/write optical drive, a minimum of 8 megabytes of memory, a 17-inch megapixel monitor, and a new user interface he vows will change the way people use computers.

But while the Next computer holds great promise, Jobs also said the $6,500 machine won't be available until the second quarter of 1989, and then will be marketed solely to the higher education market.

Many analysts, developers, and academic buyers, while generally impressed with the machine, are already looking for a lower-priced model. And many questioned when the company will provide a machine for the business market.

One explanation Jobs offered last week for targeting academia

See **Next, Page 93**

Steve Jobs introduced Next Inc.'s 68030 Unix workstation.

Users Would it Than Switch

"The majority of my larger clients find that the current release of 1-2-3 meets the majority of their spreadsheet needs," said Richard Creeth, a consultant in Norwalk, Connecticut.

But in organizations that haven't standardized with one product, competitive products are attractive.

"A lot of people buying new machines are taking a serious look at Excel," said Richard Silverston, senior systems support consultant with Arco, in Los Angeles. Especially with 80386 systems, many users are buying Excel rather than 1-2-3,

See **Lotus, Page 8**

Next Interface to Enhance IBM's Unix Environment

BY NICK ARNETT

IBM's licensing of the Next Step interface from Next Inc. represents a Unix strategy intended to complement, rather than threaten, its OS/2 Presentation Manager strategy, an IBM official said last week.

IBM and Next do not plan to develop the interface jointly, officials of each company said. IBM will, on its own, add color to its version, said William Filip, assistant general manager of

AT DEADLINE

IBM Says Presentation Manager Is on Schedule

IBM will announce the availability of its Presentation Manager for OS/2 Standard Edition on October 31, according to sources. The company will make the announcement in New York, where a handful of software developers, including Microsoft Corp., Aldus Corp., and Micrografx Inc., are expected to demonstrate applications running under Presentation Manager.

Several sources said Microsoft was planning to show a version of

Next

Continued From Page 1

was the opportunity he feels the machine has to broaden that market. "The key thing to note here is that although there are a lot of computers in higher education, they have not penetrated into the curriculum," Jobs said. "To develop courseware takes months and months, if not years. If we can allow people to write in two or three days what would have taken months, a lot more people will use computers. We want to be the first computer to contribute to the curriculum."

Other aspects of the academic market doubtlessly appealed to Jobs. A relatively small sales force can market new technology to universities, compared to the business market. Academic users are generally focused on developing their own applications, meaning they will be less concerned with the lack of applications software for the new machine.

POSITIVE REACTION. Reaction to the machine from universities was generally positive. "They had very aggressive goals, technologically, and I think they've reached them," said Kenneth King, a member of the Next advisory board and president of Educom, the higher education computing consortium in Princeton, New Jersey.

"It's unfortunate that the price is at the upper end of what universities generally spend for instructional technology," King said. "[Jobs has] been advised by his advisory board that he has to get it down to the $3,000 level before students will buy it in significant numbers. It's the hope of the advisory board that an entry-level machine emerges."

"It clearly is a price breakthrough for all that it offers in one package," said Ira Fuchs, vice president for computing and information technology at Princeton University. "But it's not going to be a machine that Princeton students are going to buy because students aren't prepared to spend more than $2,500 to $3,000. We sell a lot of Macs and IBM PS/2 Model 30s. Even with an impact printer and word processing software, they are under $2,500."

"We want to see a machine without the disk, where we cluster them all and run them off servers," Fuchs continued. "Come second quarter I expect him to offer a more naked machine." Fuchs estimated that Princeton would order about 50 Next machines in the 1988-89 academic year.

"What excites me is the object-oriented environment and the opportunity for sharing critical components among universities," said Ron Danielson, director of information services at Santa Clara University. "It takes 100 to 1,000 hours for each hour of student contact with the machine. If you want students to spend an hour in front of the machine, you have to spend at least 100 hours developing. The Interface Builder will cut down that time."

COSTLY MEDIA. Many developers, though impressed with the Next technology, are hoping for markets beyond higher education and expressed amazement that Next expects applications to be distributed on optical disks that cost $50 each.

"I wish they had said more about their distribution strategy," said Clinton Nagy, national sales manager for Adobe Systems' Systems Division. "Higher education is not enough; I hope we'll be buying the Next machine at Businessland next year."

According to Dan'l Lewin, Next's vice president for sales and marketing, the company is looking at several options for software distribution, including having Next act as a distribution center for programs.

Effect of the Next machine on the overall computer market is likely to be minimal in the near term, particularly in light of Job's own slow-growth business plan, which envisions the product in the hands of developers and universities for the next two years. "The impact will be nothing in the near term," said Michele Preston, an analyst with Salomon Brothers. "The only question right now is how it will affect Apple's position in the education market."

"When the first generation of students using the Next computer graduate, they will take their machines with them into business," predicted Peter Tiege of Infocorp.

"The technology is wonderful, but the deal with IBM is the smartest part," said Esther Dyson, editor of Release 1.0. "The Next machine will get applications because of IBM, and IBM will lead the way right into the business market."

Next Ups the Price/Performance Ante

Offers $2,000 Postscript Laser; I/O Chip Transfers DMA at 5 MBPS

BY MARTIN MARSHALL

The Next Inc. introductions produced few surprises in the hardware offered but dramatic confirmation that a new price/performance plateau would soon be reached.

Claiming that "people don't want impact printers anymore," Next unveiled its 400-dpi laser printer, which works only with the Next CPU. The $2,000 price for a Postscript-speaking laser printer seems phenomenal, cutting the present market price of such printers in half, until one considers that Postscript is not in the laser printer, it is in the CPU running Display Postscript.

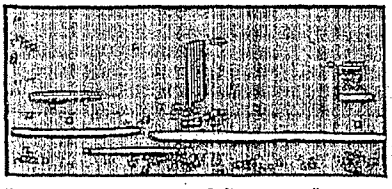
The image is created by the 68030 in a frame buffer in RAM, then an I/O processor effects the Direct Memory Access (DMA) transfer at a rate of 5 megabits per second without further burdening the CPU. The Postscript interpreter and associated RAM required in other Postscript printers do not exist in the Next laser printer. Only a single VLSI chip is required in the printer, which otherwise uses a Canon SX engine and downsized packaging that makes the printer 60 percent the size of other laser printers.

The same architecture that allows the low-cost laser printer transfers without burdening the CPU also works to speed up other parts of the overall system processing, the company said. This makes optimum use of the 5-MIPS processing power of the 68030 CPU.

Although Next is using Nubus protocols for the two expansion slots, its 25-MHz implementation will not be compatible with add-on products for Mac II Nubus boards. Next would not say what add-on boards are in preparation for the system, but it does plan to license its backplane technology that uses Nubus protocols to other companies.

The digital signal processor that is used for synthesizing sound someday also will be used to emulate a 9,600-bps modem, according to Next. The machine also has a 32-bit implementation of Ethernet.

Standard Configuration of the Next Machine



Hardware:
- Motorola 68030 microprocessor running at 25 MHz
- Motorola 68882 floating-point processor running at 25 MHz
- 10-MIPS Motorola 56001 Digital Signal Processor
- 12 DMA channels
- 25-MHz backplane using Nubus protocols
- Two proprietary VLSI chips (integrated Channel Processor and Optical Storage Processor)
- 256-megabyte read/write/erasable optical disc, 60- to 70-ms average access time, 4MB/sec burst transfer rate
- Built-in Ethernet adapter
- 17-inch monochrome gray-scale display, 1,120-by-832 resolution, 2 bits per pixel
- Keyboard
- 2-button mouse
- 8 megabytes of RAM
- Three available expansion slots that can hold up to 3 more CPU boards
- "Mac-compatible" SCSI controller
- Two "Mac-compatible" serial ports
- Speaker and headphone jack

Software:
- Display Postscript
- Mach System Software
- Sun's Network File System (NFS)
- Application development tools including Objective-C; GNU C compiler, debugger, and EMACS; and BSD 4.3 utilities
- Next Step software environment (includes Window Server, Workspace Manager, Application Kit, and Interface Builder)
- Digital Librarian searching and indexing tool
- Unix electronic mail
- Write Now word processor
- Mathematica
- Next SQL Database Server
- Allegro CL Common Lisp
- Jot personal database
- Digital Library

Options:
- 400-dpi Postscript-compatible laser printer
- 330MB or 660MB Winchester hard disk
- 16 megabytes of RAM

Developers Eye Next, But Microsoft Abstains

BY PEGGY WATT

A fistful of software packages — including an object-oriented development program — will ship with the Next machine, and a respectable number of software developers are eyeing the system for future development.

The new computer comes with Mach, a flavor of Unix developed at Carnegie-Mellon University and compatible with BSD 4.3; and Next Step, an object-oriented environment developed by Stepstone Corp.

BUNDLES. Also being bundled with Next are Adobe Postscript, as both display and printer driver; T/Maker Write Now word processor; Mathematica from Wolfram Research Inc.; Franz Inc.'s Allegro Common Lisp; and Sybase SQL Server database technology. It also comes with Next's Sound & Music generation software and a Unix-Mail compatible graphical Mail program.

Frame Technology Corp., Cricket Software, Mark of the Unicorn Inc., and Farallon Computing also endorsed Next and promise applications; others said they are considering development. More than 500 developers signed up for a Next conference held the day after the product's announcement, said John Ison, Next's director of applications product marketing.

Next is also bundling a Digital Library comprised of *Webster's Ninth New Collegiate Dictionary*, *Webster's Collegiate Thesaurus*, the *Oxford Dictionary of Quotations*, and the Oxford Press' *William Shakespeare: The Complete Works*, with Digital Librarian search and indexing tools. All Next documentation is also on-line.

ABSENT. Conspicuously absent from the supporters is Microsoft — first to endorse the new technology in Apple co-founder Steve Jobs' earlier innovation, the Macintosh. Microsoft Chairman Bill Gates declared the Next machine's higher education market too small and said he "decided not to put the energy into" development now.

"We'd have to get the impression that it would sell in very, very big numbers, like a corporation coming in and telling me they don't want to stick to a few standards any more," Gates said.

NEXT STEP. "We'd love to have Microsoft software on this machine," Jobs said. He expects applications will be speeded with the help of Next Step — also licensed by IBM for its RT and Intel-based systems.

Software developers face such new challenges as distributing programs on $50 CDs instead of floppy disks.

Ashton-Tate is evaluating the Next machine, which would probably require entirely new products, said Terry Garnett, an Ashton-Tate vice president. "The environment he's done is so different in terms of multimedia that we'll have to go back and ask, what do users want in that environment?"

In a prepared statement, Lotus president Jim Manzi congratulated Jobs and his team, but fell short of announcing a version of 1-2-3 for the new machine.

The ARRL Operating Manual

Edited by
Robert J. Halprin, K1XA

The American Radio Relay League
Newington, CT USA 06111

The Radio Amateur's Handbook

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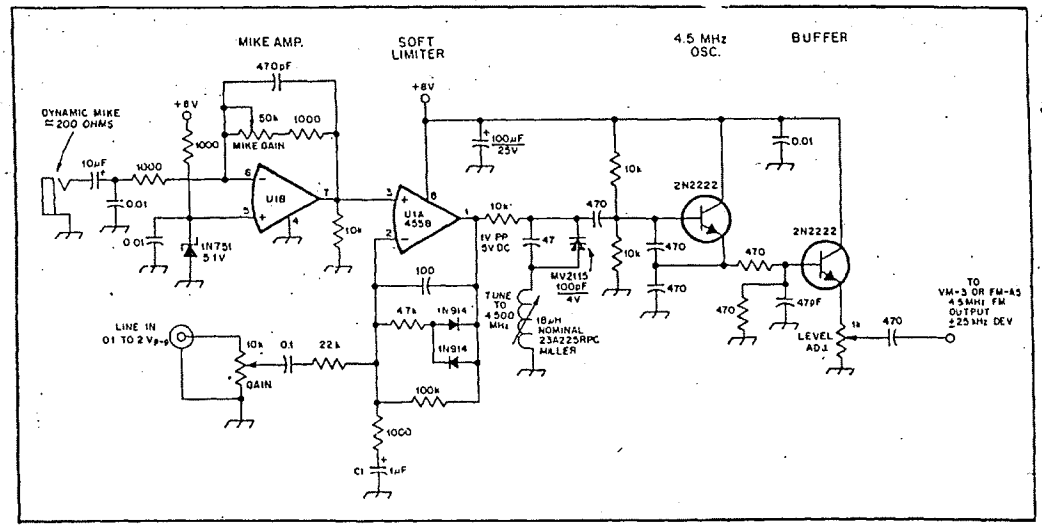

Fig. 48 — This ATV sound-subcarrier generator (FM-A5) permits both voice and video to be transmitted. U1 is either a Motorola MC1458 CP1 or Raytheon RC4558DN operational amplifier.

In the completed installation a coaxial relay can be used for antenna switching. A set of auxiliary contacts on that relay should be used to switch power to the various modules for transmit and receive.

FSTV Station Identification

As of June 15, 1983, the FCC discontinued the requirement for FSTV stations to identify by cw or voice, thus permitting FSTV stations to identify by video. Please note that this applies only to transmissions employing U.S. 525-line standards, legally "those which conform, at a minimum, to the monochrome transmission standards of Section 73.682(a)(6) through Section 73.682(a)(13), inclusive (with the exception of Section 73.682(a)(9)(iii) and Section 73.682(a)(9)(iv)." The FCC also requires that the characters be "readily legible." It follows that ATV operators should use an ordinary type style for identification and make their call signs cover enough of the screen to be readable even under weak-signal conditions.

SLOW-SCAN TELEVISION

Fast-scan TV signals take up more than 5 MHz of bandwidth. Since this is more kHz than in all the amateur bands below 6 meters, it is obvious that if we want to work TV-DX on the hf bands we will have to modify the TV signal a bit.

Slow-scan TV (SSTV) is, just as its name implies, a TV signal with a very slow scan rate. While a regular fast-scan TV signal produces 30 frames per second, it takes eight seconds to send once SSTV frame. Thus, motion pictures are impossible. (However, a form of image transmission called *medium-scan television* (MSTV) allows limited motion in a fairly narrow bandwidth. Don Miller, W9NTP, and others are experimenting with MSTV on the 10-meter band under special temporary authority from FCC). If FSTV is analogous to watching home movies by radio, then SSTV resembles a photographic slide shown on the air. In addition, SSTV picture definition is four times coarser than fast-scan TV. Table 14 summarizes the video SSTV format used by amateurs.

But these disadvantages are more than balanced by the fact that SSTV can be used in any amateur phone band above 3.5 MHz. Anyone you can work with a good signal on ssb can be worked via slow scan. Many DX stations are now equipped for picture transmission, and more than one amateur has worked over 100 countries on SSTV!

The signal that comes out of an SSTV camera is a variable-frequency audio tone — high tones for bright areas and low tones for dark. To send SSTV over the air, you just feed this tone into the microphone jack of any ssb transmitter. (SSTV on double sideband a-m or fm is illegal on the hf bands.) To receive, you tune in the signal on an ssb receiver and feed the audio into the SSTV monitor.

All you need to get started is an ssb station, a monitor (the slow-scan "TV" set") and a camera. You don't even need the camera if you already have a tape recorder.

Recent advances have led to the development of fast-scan converters. On receive,

Table 14
Amateur Slow-Scan Standards

	60-Hz Areas	*50-Hz Areas*
Sweep Rates:		
Horizontal	15 Hz (60 Hz/4)	16 2/3 Hz 50 Hz/3)
Vertical	8 sec.	7.2 sec.
No. of Scanning Lines	120	120
Aspect Ratio	1:1	1:1
Direction of Scan:		
Horizontal	Lt to Rt	Lt to Rt
Vertical	Top to Bot.	Top to Bot.
Sync Pulse Duration:		
Horizontal	5 millisec.	5 millisec.
Vertical	30 millisec.	30 millisec.
Subcarrier Freq.:		
Sync	1200 Hz	1200 Hz
Black	1500 Hz	1500 Hz
White	2300 Hz	2300 Hz
Req. Trans. Bandwidth	1.0-2.5 kHz	1.0-2.5 kHz

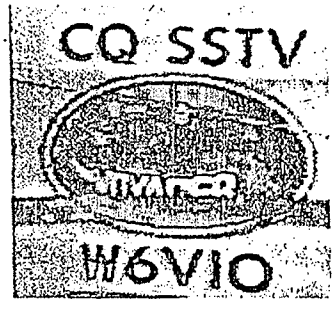

Fig. 49 — A typical slow-scan TV picture.

such a device converts the incoming audio to a signal that is usable by a conventional fast-scan video monitor. Similarly, on transmit the converter changes the output of a fast-scan camera to a standard slow-scan signal.

SSTV may be used by amateurs holding a General class license or above in their respective hf voice segments, and by Technician-class licensees or above in the voice bands above 50 MHz. The following SSTV operating frequencies have been recommended by *A5* magazine:

75 meters — 3.990- 4.000 MHz
40 meters — 7.290- 7.300 MHz
20 meters — 14.340-14.350 MHz
15 meters — 21.440-21.450 MHz
10 meters — 28.990-29.000 MHz

SSTV signals must be tuned in properly so the picture will come out with the proper brightness and the 1200-Hz synchronization pulses will be detected. If the signal is not "in sync," the picture will appear wildly skewed. The easiest way to tune SSTV is to wait for the transmitting operator to say something on voice and then tune him in while he is talking. With experience you may find you are able to zero in on an SSTV signal by listening to the sync pulses and by watching for proper synchronization on the screen. Many SSTV monitors are equipped with tuning aids of various kinds.

If you want to record slow-scan pictures off the air, there are two ways of doing it. One is to tape record the audio signal for playback later. The other is to take a picture of the image right from the SSTV screen. Polaroid cameras equipped with a close-up lens enable you to see the results shortly after the picture is taken. If you want to do this without darkening the room lights, you'll have to fabricate a light-tight hood to fit between the camera and the monitor screen.

On SSTV, FCC rules require that identification be made by voice or cw. Sending "This is WAØXYZ" on the screen is *not* sufficient. Most stations intersperse the pictures with comments anyway, so voice i-d is not much of a problem. Otherwise, SSTV operating procedures are quite similar to those used on ssb.

As with RTTY, the station transmitter must be tuned for 100-percent duty cycle, since the SSTV emission is a constant tone. Only the frequency is changing.

For more information about amateur TV, see *Amateur Television Magazine*, c/o Mike Stone, WBØQCD, P.O. Box H, Lowden, IA 52255. A *QST* television bibliography is available for an s.a.s.e. from ARRL.

SLOW-SCAN TELEVISION

Nestled among the CW, phone and RTTY operators in the Amateur Radio bands is a sizable following of hams who regularly exchange still pictures in a matter of seconds virtually anywhere on earth. They are using a system called slow-scan television (SSTV), which was originally designed by an amateur in the early 1960s. Over the years, the amateur community has been continually refining and improving the quality of SSTV. Amateur success with SSTV during the past two decades has led to its application by the military and commercial users as a reliable long-range, narrow-bandwidth transmission system. The worldwide appeal of SSTV is manifested by the many DX stations that are now equipped for this type of picture transmission. Several amateurs have even worked over 100 DXCC countries on SSTV!

Just as the name implies, SSTV is the transmission of a picture by very slowly transmitting the picture elements, while a television monitor at the receiving end reproduces it in step. An SSTV signal is a variable frequency audio tone from 1500 Hz for black to 2300 Hz for white, with 1200 Hz used for synchronization pulses. Unlike fast-scan television, which uses 30 frames per second, a single SSTV frame takes at least eight to fill the screen. Additionally, the vertical resolution of SSTV is only 120 lines (or 128 for some digital systems) compared with 525 lines for fast-scan. (Some high-resolution experimental designs are operating with 256 lines.) These disadvantages are offset by the fact that SSTV requires less than 1/2000 of a fast-scan TV's bandwidth. Thus, the FCC permits it in any amateur phone band.

The basic SSTV format represents a trade off among bandwidth, picture rate and resolution. To achieve practical HF long-distance communications, the SSTV spectrum was designed to fit into a standard 3-kHz voice bandwidth through a reduction in picture resolution and frame rate. Thus, SSTV resolution is lower than FSTV and is displayed in the form of still pictures. A sample SSTV picture is shown in Fig 16-6.

In recent years, amateurs have been actively experimenting with various forms of video-processing techniques to provide limited motion and increased resolution. The greatest advancements are currently being made in the realm of color SSTV. Unfortunately, most of this work has been done independently from each other, resulting in a multitude of different SSTV color standards. Although the 120-line/8-s format is standard for black and white, newcomers to SSTV should be cautioned that color SSTV standards are in a state of flux which may severely limit interoperability. In the coming years, it is expected that the amateur community will adopt a single color format.

License Requirements and Operating Frequencies

In the HF bands, a General- or higher-class license is required to operate SSTV. Operation is restricted to the phone portion of the bands. At UHF and above, a Technician-class amateur license or higher is needed, although the vast majority of SSTV activity occurs in the HF bands. In the US, slow-scan TV using double-sideband AM or FM on the HF bands is not permitted.

The common accepted SSTV calling frequencies are 3.845 MHz (Advanced), 7.171 MHz (Advanced), 14.230 MHz (General) and 28.680 MHz (General). Traditionally, 20 meters has been the most popular band for SSTV operations. A weekly international SSTV net is held each Saturday at 1800 UTC on 14.230 MHz. Many years ago, when SSTV was first authorized, the FCC recommended that

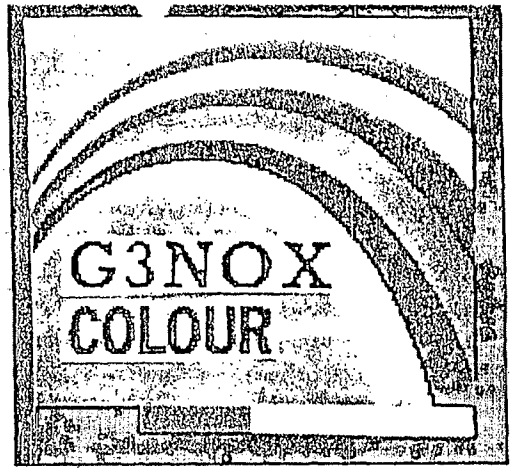

Fig 16-6—SSTV picture as seen on a standard TV set using a digital scan converter.

SSTVers not spread out across the band even though it was legal to do so. A "gentlemen's agreement" has remained to this day that SSTVers operate as close as possible to the above calling frequencies to maintain the problem-free operation that has existed for nearly 20 years.

Identifying

On SSTV, the legal identification must be made by voice or CW. Sending "This is W9NTP" on the screen is not sufficient. Most stations intersperse the picture with comments anyway, so voice ID is not much of a problem. Otherwise SSTV operating procedures are quite similar to those used on SSB.

Equipment

All you need to get started is an SSB station (or FM station for VHF/UHF), a monitor, scan converter and a video source. Like RTTY, SSTV is a 100%-duty-cycle transmission. Most sideband rigs will have to run considerably below their voice power ratings to avoid ruining the final amplifier or power supply. Early SSTV monitors used long-persistence CRTs much like classical radar displays. In a darkened environment, the image remained visible for a few seconds while the frame was completed. This type of reception is unusual today and has been replaced with digital scan converters which convert SSTV to FSTV to place a bright image on a conventional television monitor. Some of this older equipment is available almost for the asking and is a good way, on a temporary basis, to examine the SSTV mode without investing much money.

Motivated by the difficulty of observing SSTV pictures on the long-persistence CRTs, the scan converter is a result of recent advances in digital techniques. In receive mode, the device converts the incoming audio to a fast-scan video signal that is usable by a conventional fast-scan TV monitor. Similarly, on transmit the converter changes the fast-scan camera output to a standard slow-scan signal. A personal computer equipped with the proper software and interface makes a highly cost-effective slow-scan converter. Computers