(12) UK Patent Application (19) GB (11) 2 310 102 (13) A

(43) Date of A Publication 13.08.1997

(21) Application No 9702571.2

(22) Date of Filing 07.02.1997

(30) Priority Data
(31) 117071 (32) 07.02.1996 (33) IL

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(51) INT CL[6]
H04N 1/21

(52) UK CL (Edition O)
H4F FFS FS25C FS25R FS30K FS33

(56) Documents Cited
GB 2282725 A US 5237430 A

(58) Field of Search
UK CL (Edition O) H4F FFC FFS FFX
INT CL[6] H04N 1/00 1/21 1/32
Online:WPI

(54) Facsimile long term storage and retrieval system

(57) A passive long term facsimile transmission storage and retrieval system, includes a facsimile logger 11 passively coupled to at least one telephone line connected to a facsimile machine 14. The facsimile logger 11 acquires and stores the facsimile transmissions that occur on the telephone line, on long term archive media 48. The system also includes a database 40 coupled to the facsimile logger 11 and at least one workstation coupled to the facsimile logger. The database 40 holds relevant data associated with the stored facsimile transmission. The workstation is able to search for and retrieve the facsimile transmissions previously stored by the facsimile logger on the long term archive media 48.

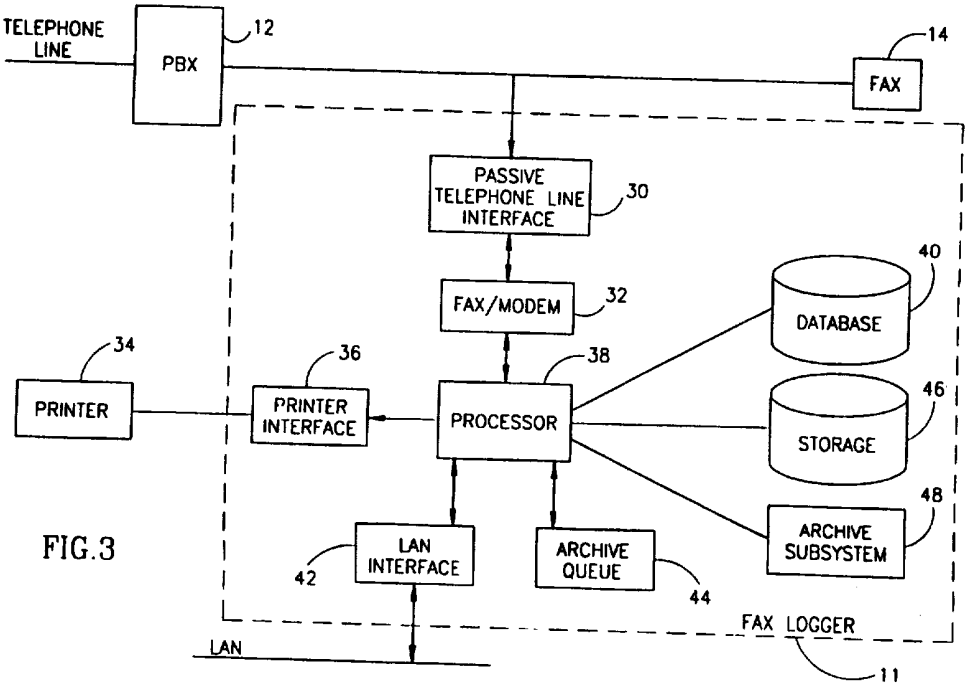


FIG.3

GB 2 310 102 A

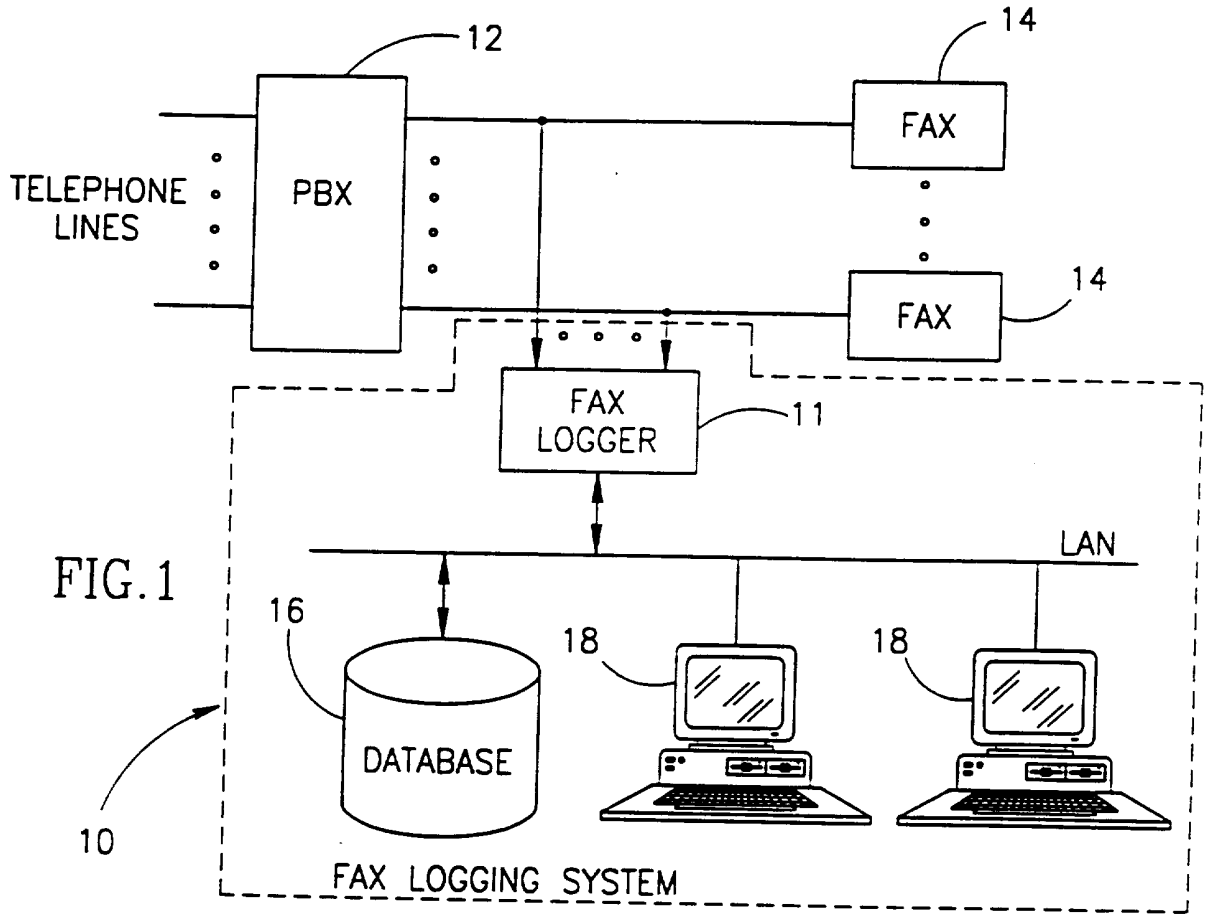

12
14
TELEPHONE LINES
PBX
FAX
FAX
14
FAX LOGGER
11
LAN
16
18
18
DATABASE
10
FAX LOGGING SYSTEM

FIG.1

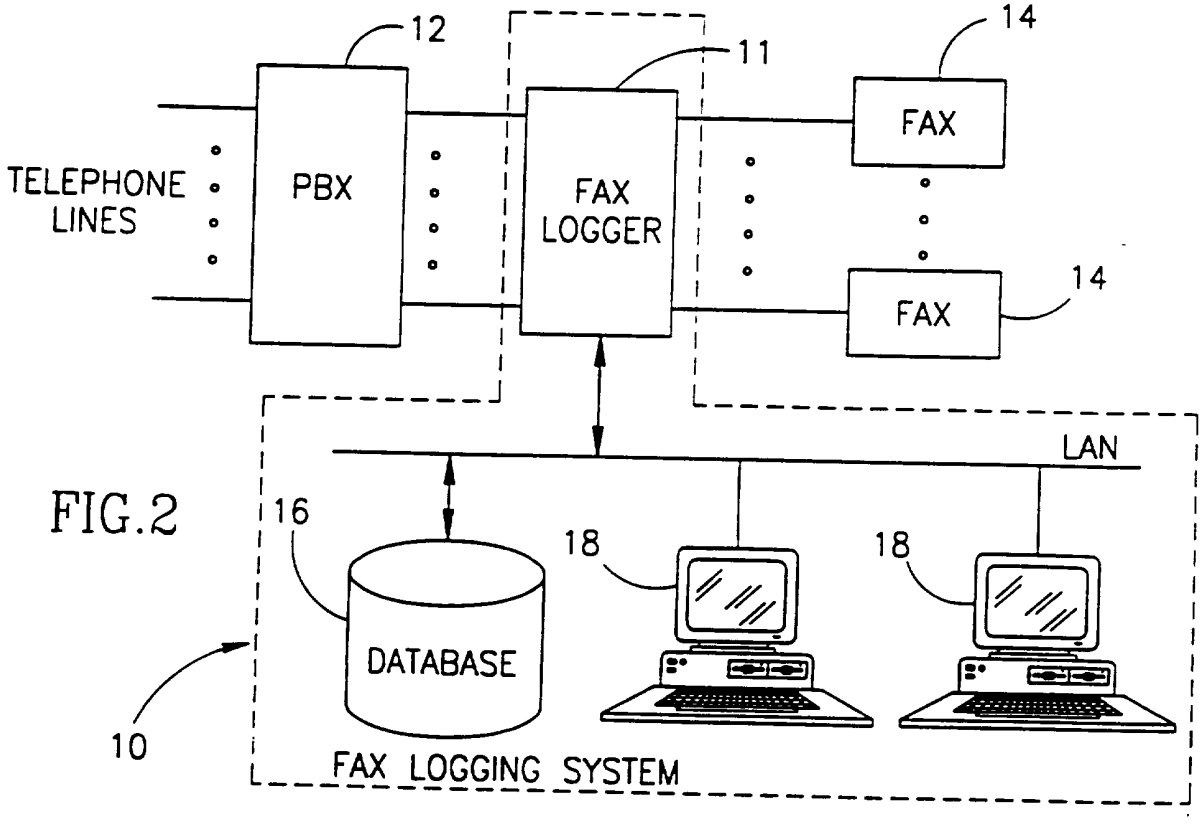

12
11
14
TELEPHONE LINES
PBX
FAX LOGGER
FAX
FAX
14
LAN
16
18
18
DATABASE
10
FAX LOGGING SYSTEM

FIG.2

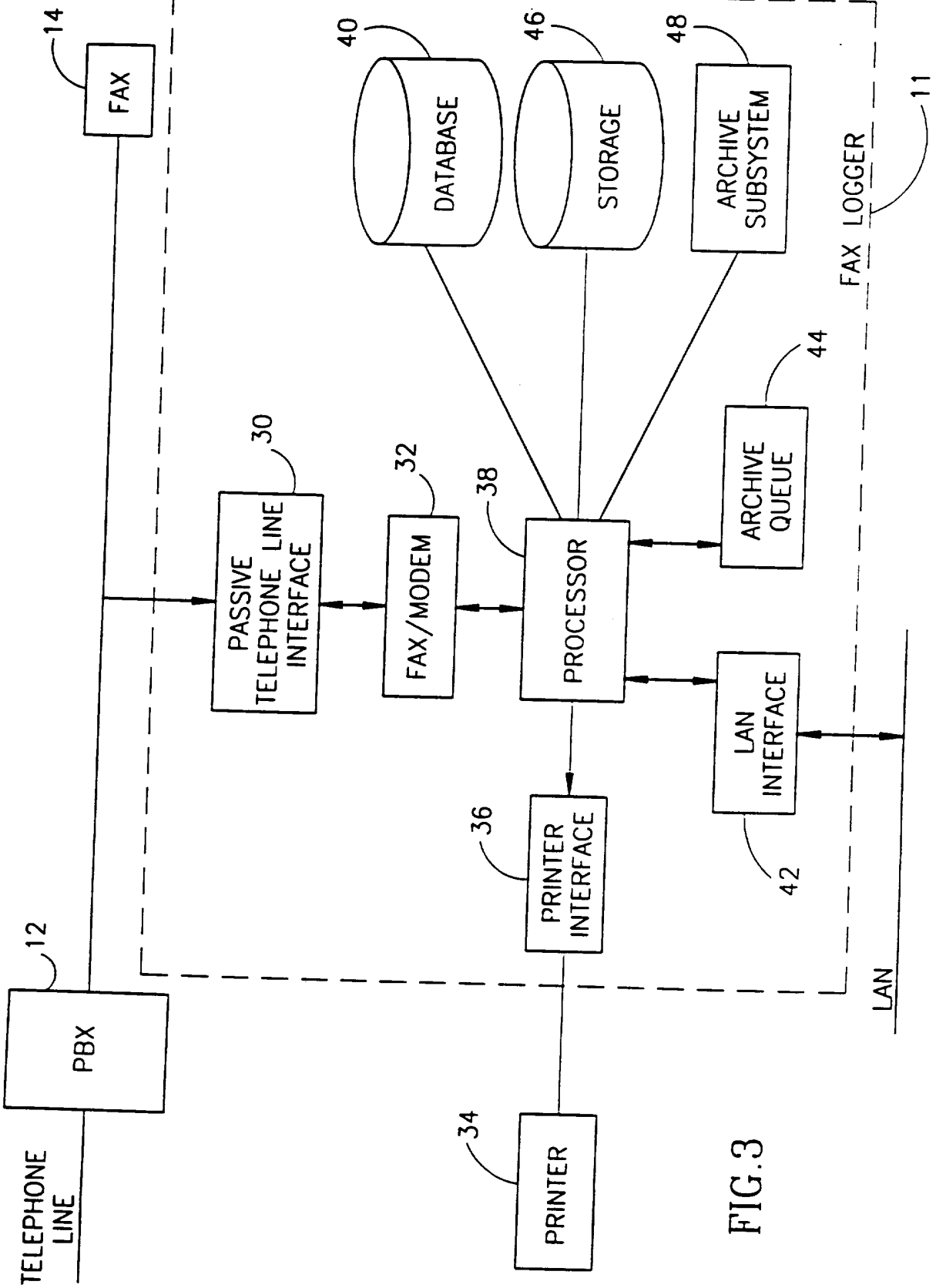

14
FAX
40
DATABASE
46
STORAGE
48
ARCHIVE SUBSYSTEM
11
FAX LOGGER
44
ARCHIVE QUEUE
30
PASSIVE TELEPHONE LINE INTERFACE
32
FAX/MODEM
38
PROCESSOR
LAN INTERFACE
42
36
PRINTER INTERFACE
12
PBX
34
PRINTER
TELEPHONE LINE
LAN

FIG.3

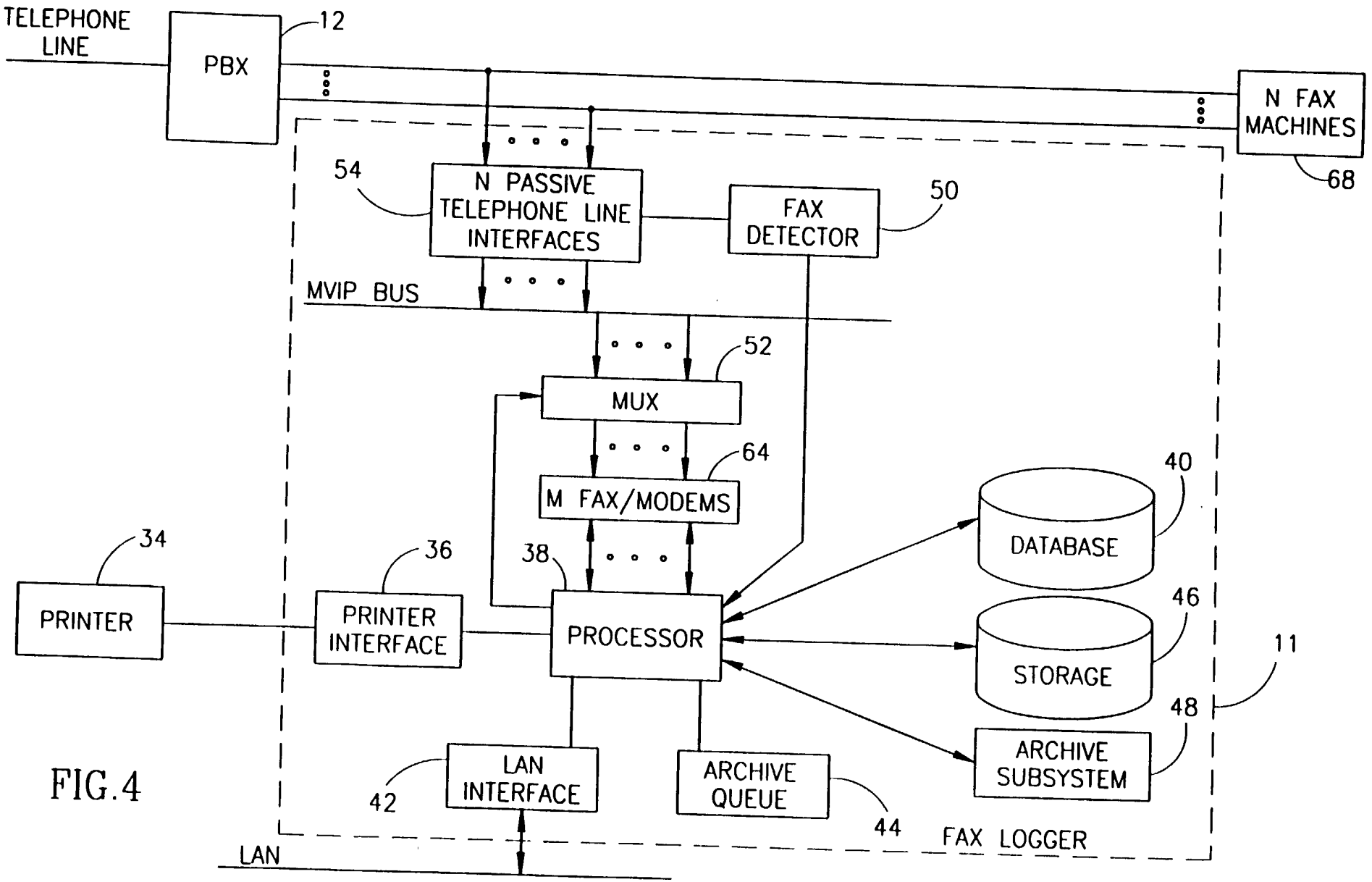

TELEPHONE LINE
PBX
12
N FAX MACHINES
68
54
N PASSIVE TELEPHONE LINE INTERFACES
FAX DETECTOR
50
MVIP BUS
52
MUX
64
M FAX/MODEMS
40
DATABASE
34
36
38
PRINTER
PRINTER INTERFACE
PROCESSOR
46
STORAGE
11
48
ARCHIVE SUBSYSTEM
LAN INTERFACE
42
ARCHIVE QUEUE
44
FAX LOGGER
LAN

FIG.4

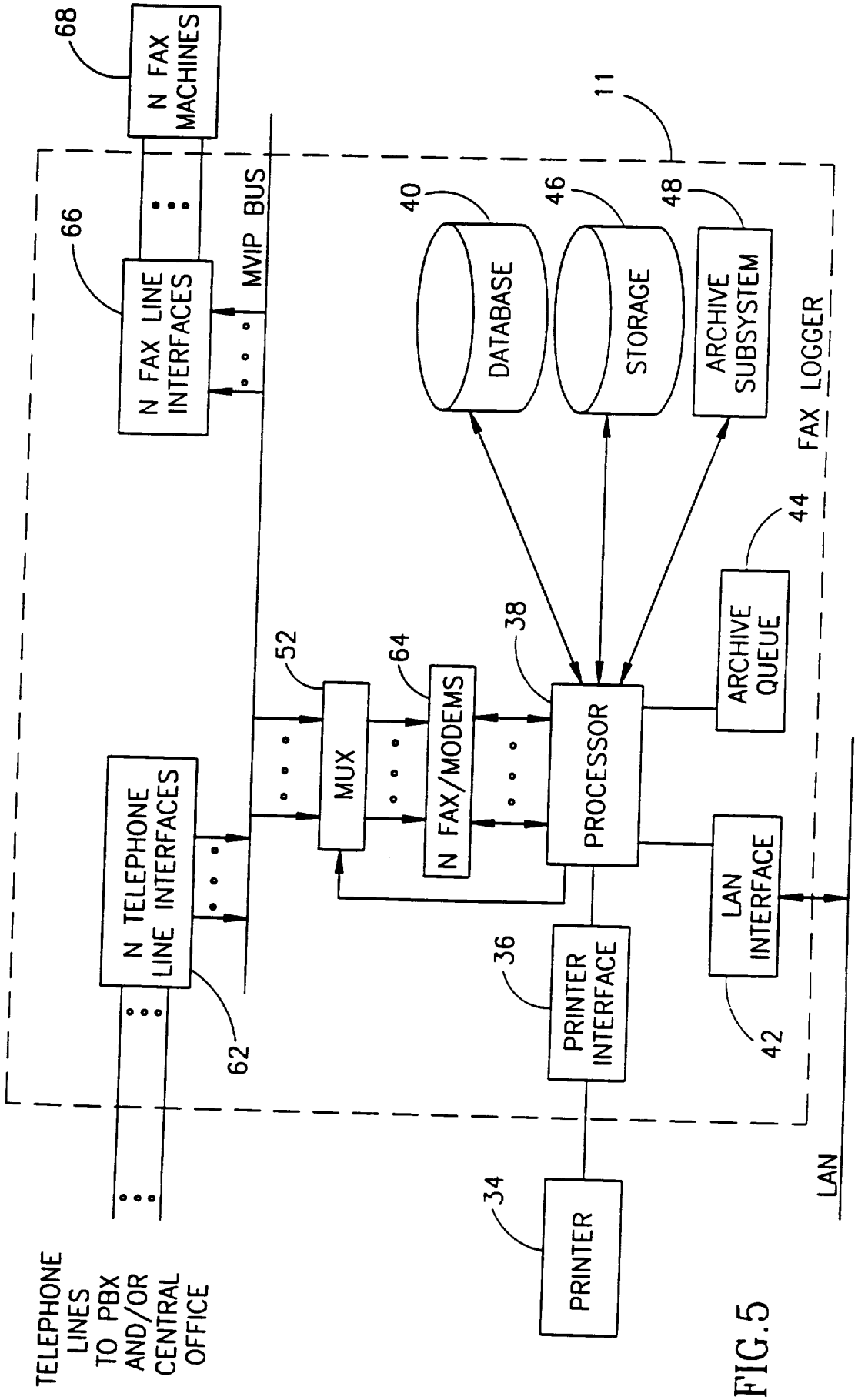

68
N FAX MACHINES
66
N FAX LINE INTERFACES
MVIP BUS
11
40
DATABASE
46
STORAGE
48
ARCHIVE SUBSYSTEM
FAX LOGGER
44
ARCHIVE QUEUE
52
64
38
MUX
N FAX/MODEMS
PROCESSOR
N TELEPHONE LINE INTERFACES
62
36
PRINTER INTERFACE
LAN INTERFACE
42
34
PRINTER
LAN
TELEPHONE LINES TO PBX AND/OR CENTRAL OFFICE

FIG.5

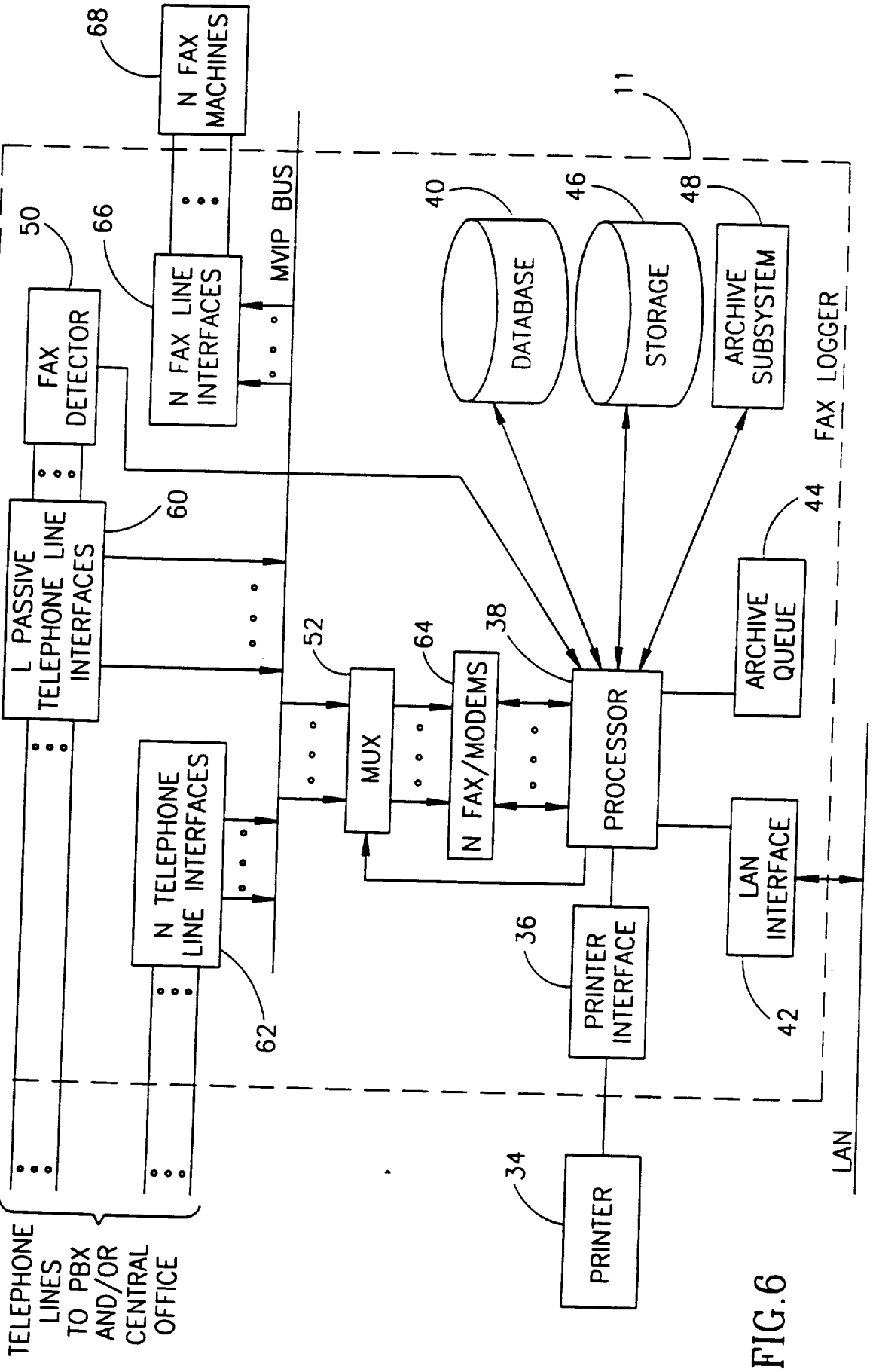

68
N FAX MACHINES
11
50
66
FAX DETECTOR
N FAX LINE INTERFACES
MVIP BUS
40
DATABASE
46
STORAGE
48
ARCHIVE SUBSYSTEM
FAX LOGGER
60
L PASSIVE TELEPHONE LINE INTERFACES
52
64
38
MUX
N FAX/MODEMS
PROCESSOR
44
ARCHIVE QUEUE
N TELEPHONE LINE INTERFACES
62
36
PRINTER INTERFACE
LAN INTERFACE
42
34
PRINTER
LAN
TELEPHONE LINES TO PBX AND/OR CENTRAL OFFICE

FIG.6

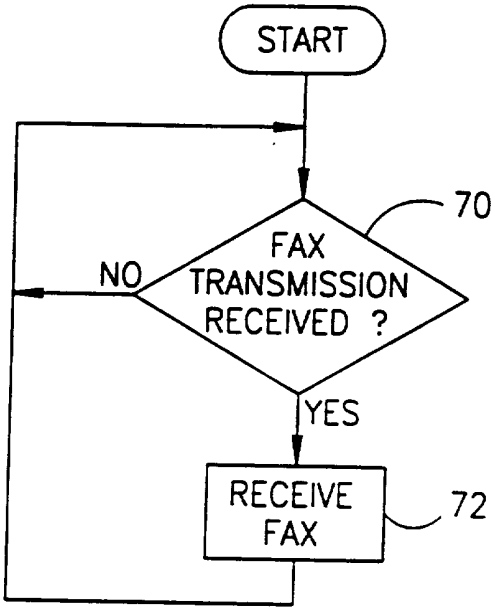

START
70
FAX TRANSMISSION RECEIVED ?
NO
YES
RECEIVE FAX
72

FIG.7

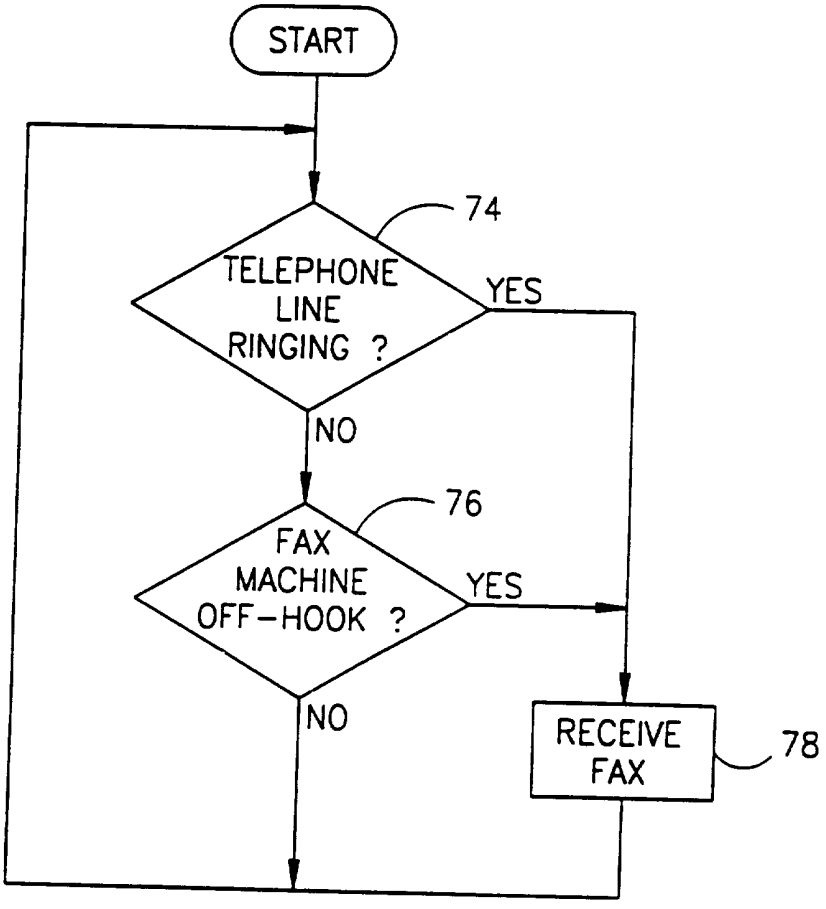

START
74
TELEPHONE LINE RINGING ?
YES
NO
76
FAX MACHINE OFF-HOOK ?
YES
NO
RECEIVE FAX
78

FIG.8

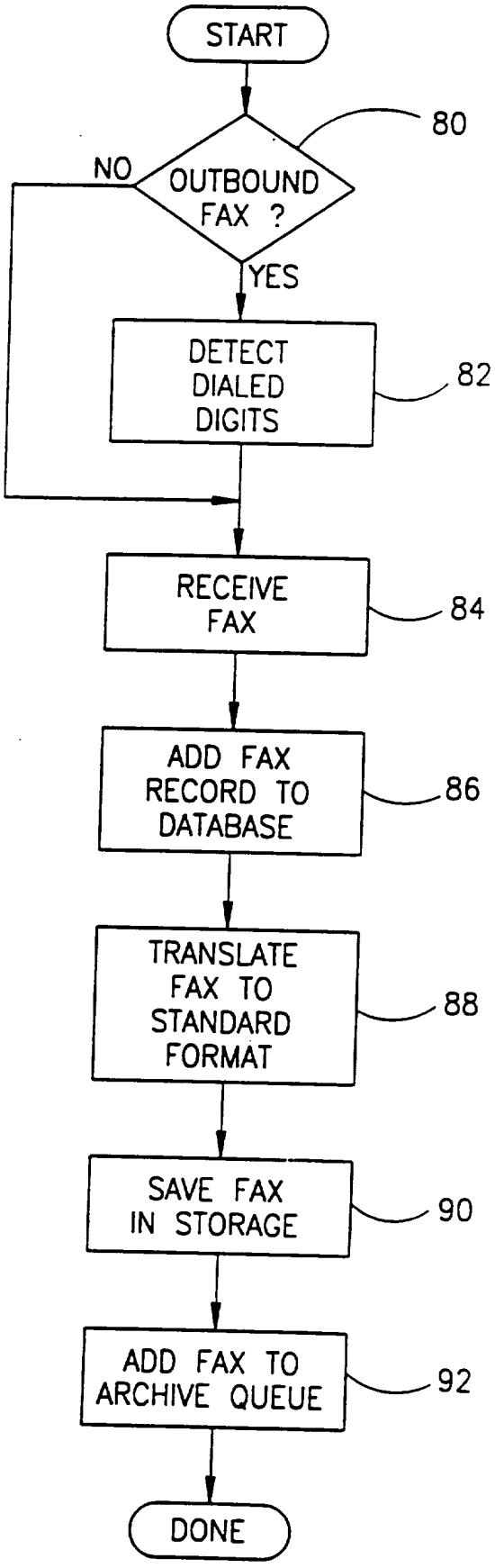

START
80
NO
OUTBOUND FAX ?
YES
DETECT DIALED DIGITS
82
RECEIVE FAX
84
ADD FAX RECORD TO DATABASE
86
TRANSLATE FAX TO STANDARD FORMAT
88
SAVE FAX IN STORAGE
90
ADD FAX TO ARCHIVE QUEUE
92
DONE

FIG.9

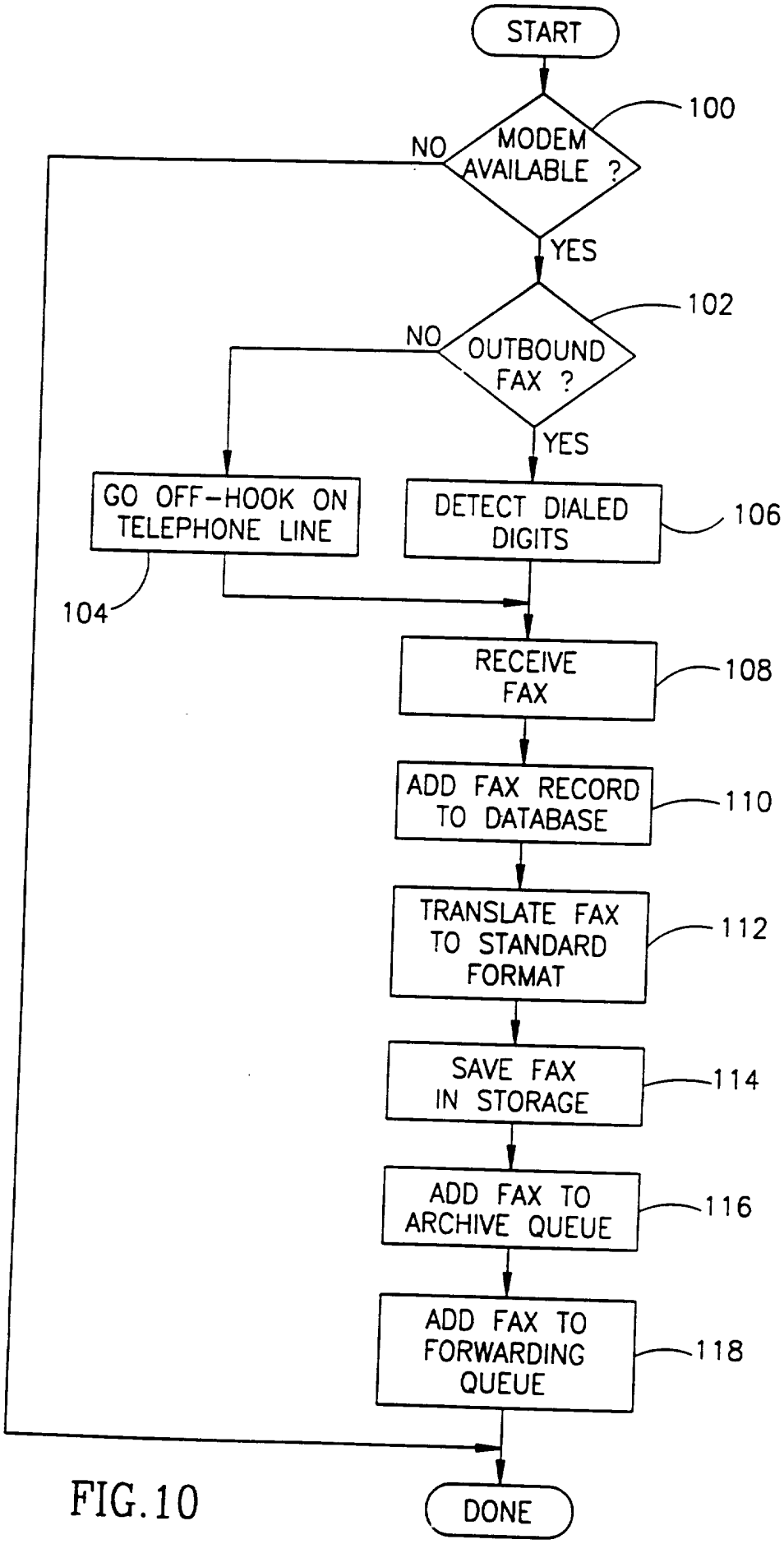

START
MODEM AVAILABLE ?
100
NO
YES
OUTBOUND FAX ?
102
NO
YES
GO OFF-HOOK ON TELEPHONE LINE
104
DETECT DIALED DIGITS
106
RECEIVE FAX
108
ADD FAX RECORD TO DATABASE
110
TRANSLATE FAX TO STANDARD FORMAT
112
SAVE FAX IN STORAGE
114
ADD FAX TO ARCHIVE QUEUE
116
ADD FAX TO FORWARDING QUEUE
118
DONE

FIG.10

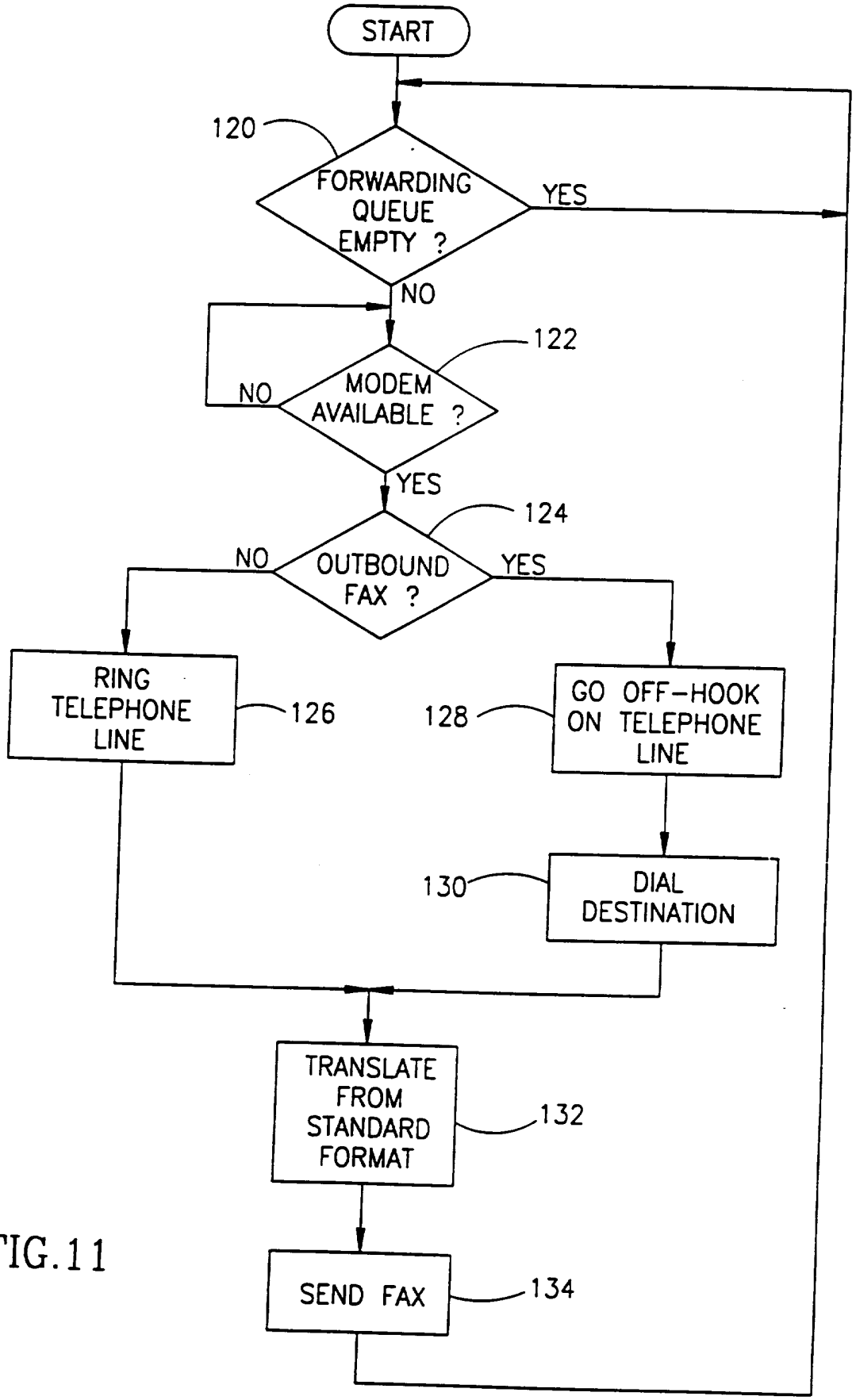

START
120
FORWARDING QUEUE EMPTY ?
YES
NO
122
MODEM AVAILABLE ?
NO
YES
124
OUTBOUND FAX ?
NO
YES
RING TELEPHONE LINE
126
128
GO OFF-HOOK ON TELEPHONE LINE
130
DIAL DESTINATION
TRANSLATE FROM STANDARD FORMAT
132
SEND FAX
134

FIG.11

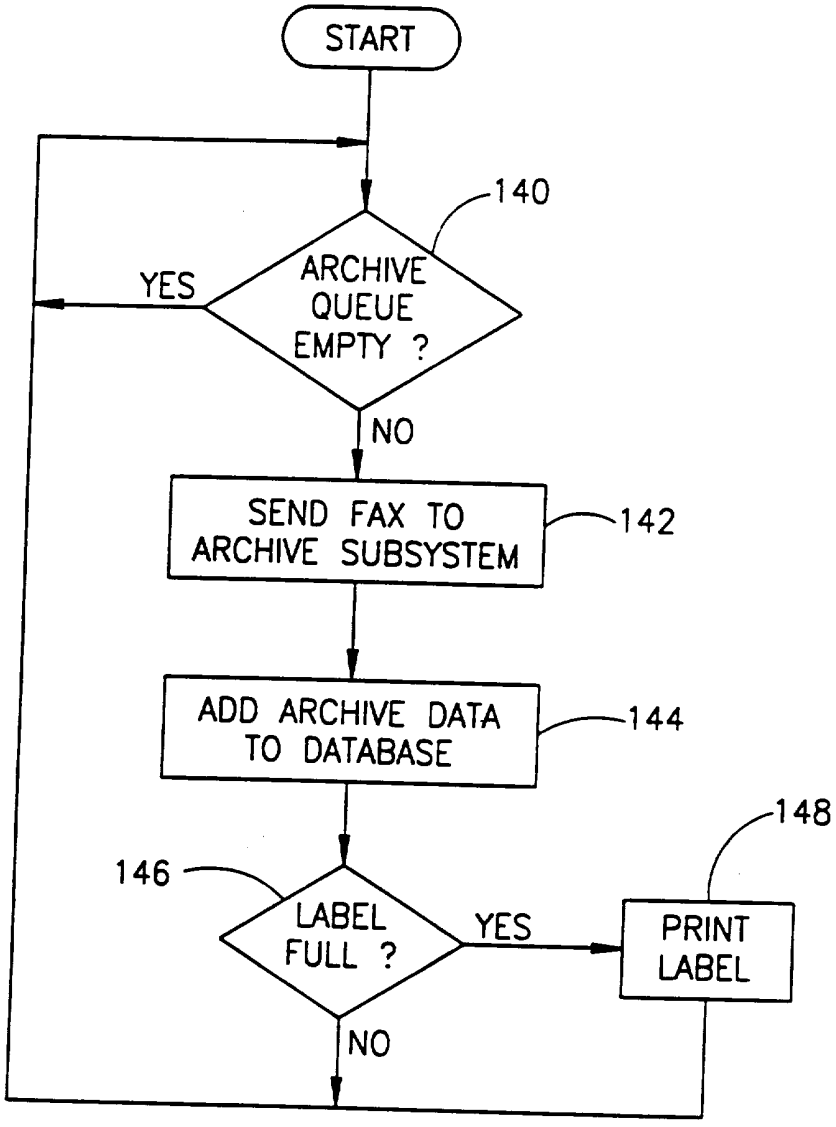

START
140
ARCHIVE QUEUE EMPTY ?
YES
NO
SEND FAX TO ARCHIVE SUBSYSTEM
142
ADD ARCHIVE DATA TO DATABASE
144
146
LABEL FULL ?
YES
148
PRINT LABEL
NO

FIG.12

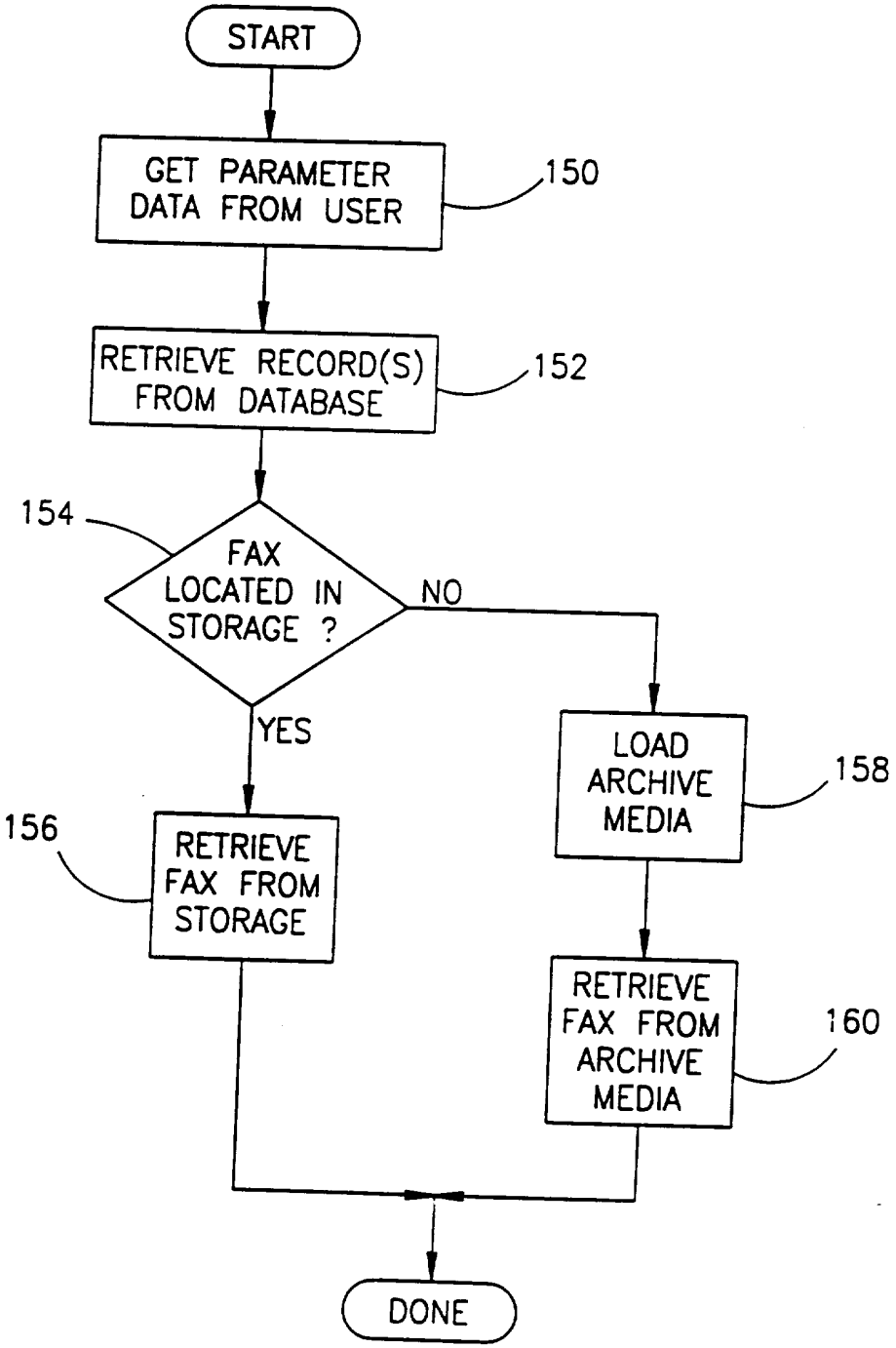

START
GET PARAMETER DATA FROM USER
150
RETRIEVE RECORD(S) FROM DATABASE
152
154
FAX LOCATED IN STORAGE ?
NO
YES
LOAD ARCHIVE MEDIA
158
156
RETRIEVE FAX FROM STORAGE
RETRIEVE FAX FROM ARCHIVE MEDIA
160
DONE

FIG.13

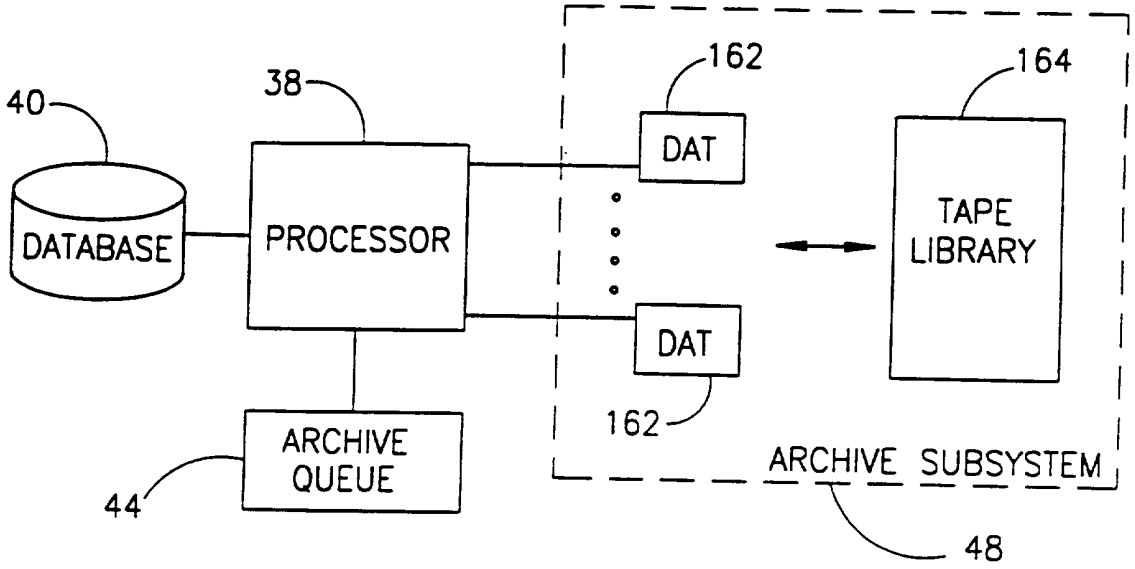

40
38
162
164
DAT
DATABASE
PROCESSOR
TAPE
LIBRARY
DAT
162
ARCHIVE
QUEUE
44
ARCHIVE SUBSYSTEM
48

FIG.14

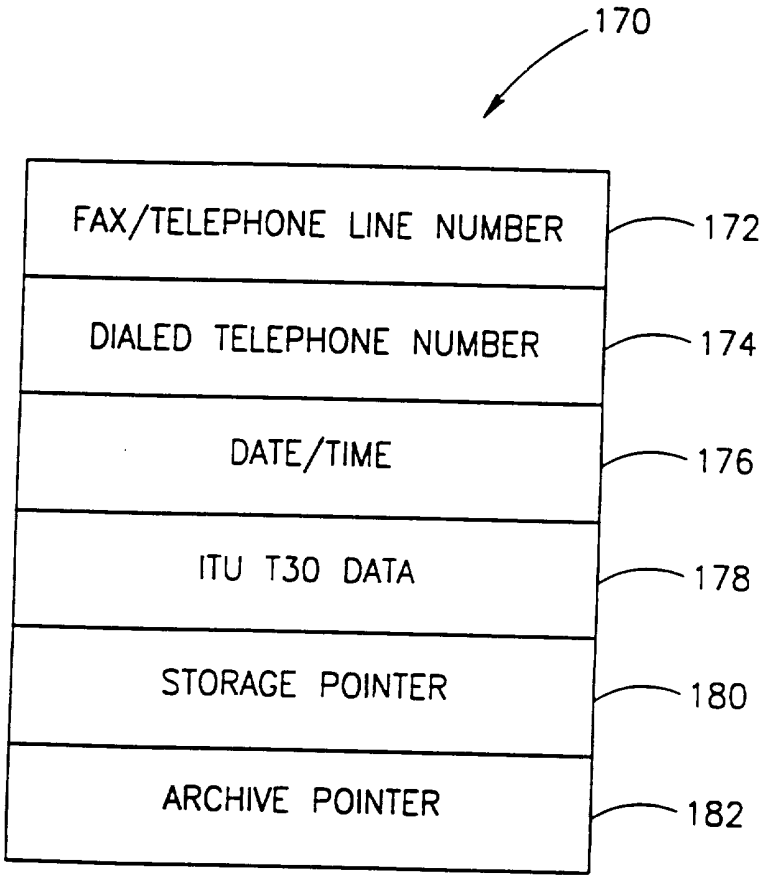

170
FAX/TELEPHONE LINE NUMBER
172
DIALED TELEPHONE NUMBER
174
DATE/TIME
176
ITU T30 DATA
178
STORAGE POINTER
180
ARCHIVE POINTER
182

FIG.15

FASCIMILE LONG TERM STORAGE AND RETRIEVAL SYSTEM

FIELD OF THE INVENTION

The present invention relates to facsimile logging devices and in particular to an active and passive facsimile storage and retrieval system.

BACKGROUND OF THE INVENTION

The use of facsimile transmission equipment has been steadily increasing over recent years. Facsimile transmission is a very convenient mechanism of transmitting documents and images from one location to another in near real time. The almost instantaneous transmission speed of facsimile transmission equipment is a huge advantage over regular conventional mail delivery and accounts for the immense popularity of facsimile as the transmission mechanism of choice in many business.

With the exploding use of facsimile equipment today, there are many businesses that conduct a substantial amount of their business through facsimile transmissions. In addition, many businesses and government agencies use facsimile equipment to send and receive data on a daily basis. These same companies typically also employ sophisticated telephone systems for handling their high volume of inbound and outbound telephone calls. Many businesses such as banking institutions, insurance companies and government entities have an additional requirement of recording and archiving telephone conversations occurring on company telephones. The necessity of recording telephone calls might be required for any number of reasons such as security,

liability, eavesdropping, etc. Telephone archiving systems exist today and are employed by many businesses to record, on a long term basis, all internal and external telephone calls.

As with voice telephone call long term storage and retrieval, there is a long felt need by many businesses to be able to store on a long term basis, both inbound and outbound facsimile transmissions. Facsimile storage systems exist in the prior art however none disclose the long term storage, archival and retrieval of facsimile transmissions.

U.S. Patent No. 4,935,955, issued to Neudorfer, discloses a system for interfacing central office telephone lines with internal facsimile machines. Incoming facsimile transmission data is placed in a memory temporary storage area after being received and before being transmitted. Facsimile transmissions are deleted from the storage after they are transmitted.

U.S. Patent No. 5,235,433, issued to Clarkson et al., discloses a system and method for automatically indexing facsimile transmissions into an image management system by applying telephony data accompanying the facsimile transmission to index the transmission by use of a substitution table.

U.S. Patent No. 5,357,562, issued to Metser et al., discloses an automated facsimile/voice memory managing system which includes a facsimile board, a voice response board, a storage device and central processing unit (CPU). The storage means disclosed, however, is used to store facsimile transmission on a temporary basis.

U.S. Patent No. 5,014,300, issued to Harvath et al., discloses a facsimile store and forward network that includes a network access device and an

address processing unit that cooperates to interface an originating facsimile machine with a store and forward inbound node. Facsimile transmission, however, are stored on a temporary basis only.

Another potential problem that exists in present facsimile transmission storage devices is that if the facsimile transmission equipment is using a proprietary non-standard facsimile protocol, it becomes impossible to receive and store it without knowledge of the protocol. One solution to this problem is to have the facsimile transmission recording equipment determine the facsimile protocol to use and subsequently instruct the two facsimile machines accordingly.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a long term facsimile transmission storage system whereby facsimile transmissions are archived on suitable archive media and are able to be stored for relatively long periods of time.

It is another object of the present invention to provide a facsimile search and retrieval system able to search for, locate and retrieve any facsimile transmission previously archived.

Yet another object of the present invention is to provide a long term storage and retrieval system that utilizes industry standard archive devices and media.

Another object of the present invention is to provide a long term facsimile storage and retrieval system that is able to record facsimile transmissions in a passive manner without interfering with the transmissions.

It is another object of the present invention to provide a long term facsimile storage and retrieval system that can be configured to actively store and forward facsimile transmissions and to also select the facsimile transmission protocol used by the facsimile transmission equipment on both sides of the transmission.

There is thus provided in accordance with a preferred embodiment of the present invention, a passive long term facsimile transmission storage and retrieval system which includes a facsimile logger passively coupled to at least one telephone line connected to a facsimile machine, the facsimile logger acquiring and storing facsimile transmissions that occur on the at least one

telephone line, the facsimile logger storing the facsimile transmissions on long term archive media, a database coupled to the facsimile logger, the database for holding relevant data associated with the stored facsimile transmission, and at least one workstation coupled to the facsimile logger, the at least one workstation able to search and retrieve the facsimile transmissions previously stored by the facsimile logger on the long term archive media.

There is also provided in accordance with a preferred embodiment of the present invention an active long term facsimile transmission storage and retrieval system which includes a facsimile logger coupled between at least one telephone line and at least one facsimile machine, the facsimile logger storing and forwarding facsimile transmissions that either arrive on the at least one telephone line or that are originated by the at least one facsimile machine, the facsimile logger storing the facsimile transmissions on long term archive media, a database coupled to the facsimile logger, the database for holding relevant data associated with the stored facsimile transmission, and at least one workstation coupled to the facsimile logger, the at least one workstation able to search and retrieve the facsimile transmissions previously stored by the facsimile logger on the long term archive media.

In addition, there is also provided in accordance with a preferred embodiment of the present invention a passive facsimile logger coupled passively to a telephone line connected to a facsimile machine which includes a passive telephone line interface coupled to the telephone line, the passive telephone line interface interfacing the telephone line to a fax/modem without interfering with facsimile transmissions occurring on the telephone line, the

fax/modem coupled to the passive telephone line interface, the fax/modem for translating the facsimile transmissions from a telephone line facsimile signal format into digital facsimile data, a processor coupled to the fax/modem for receiving and processing the digital facsimile data, the processor controlling the operation of the passive facsimile logger, a database coupled to the processor, the database holding relevant data associated with the facsimile transmissions, a storage coupled to the processor, the storage providing a temporary memory storage area for the facsimile transmissions as they are received from the telephone line, an archive subsystem coupled to the processor, the archive subsystem recording the facsimile transmissions on long term archive media, the archive subsystem retrieving the facsimile transmissions, previously archived, upon command from the processor, and an archive queue coupled to the processor, the archive queue holding the facsimile transmissions that have been received and are awaiting to be archived.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

Fig. 1 is a high level block diagram illustrating a preferred embodiment of the passive facsimile logging system of the present invention applied to a sample telephone system having multiple attached facsimile devices;

Fig. 2 is a high level block diagram illustrating an alternative embodiment of the active facsimile logging system of the present invention applied to a sample telephone system having multiple attached facsimile devices;

Fig. 3 is a detailed block diagram illustrating a single channel passive facsimile logging system applied to a sample telephone system;

Fig. 4 is a detailed block diagram illustrating a multichannel passive facsimile logging system applied to a sample telephone system;

Fig. 5 is a detailed block diagram illustrating a multichannel active facsimile logging system applied to a sample telephone system;

Fig. 6 is a detailed block diagram illustrating a multichannel active and passive facsimile logging system applied to a sample telephone system;

Fig. 7 a high level logic flow diagram illustrating the overall computer software process of the passive facsimile logging system;

Fig. 8 is a high level logic flow diagram illustrating the overall computer software process of the active facsimile logging system;

Fig. 9 is a high level logic flow diagram illustrating the receive facsimile process of the passive facsimile logging system;

Fig. 10 is a high level logic flow diagram illustrating the receive facsimile process of the active facsimile logging system;

Fig. 11 is a high level flow diagram illustrating the forwarding process of the active facsimile logging system;

Fig. 12 is a high level flow diagram illustrating the archive process of both the passive and active facsimile logging systems;

Fig. 13 is a high level flow diagram illustrating the facsimile retrieval process of both the passive and active facsimile logging systems;

Fig. 14 is a high level block diagram illustrating the archive subsystem of both the passive and active facsimile logging systems; and

Fig. 15 illustrates the data fields comprising a record of the database used in maintaining information about each facsimile archived in the system.

DETAILED DESCRIPTION OF THE INVENTION

A high level block diagram illustrating a preferred embodiment of a passive facsimile (fax) logging system **10** of the present invention applied to a sample telephone system having multiple attached facsimile devices is shown in Figure 1. One or more telephone or trunk lines from a central office (CO) are coupled to a private branch exchange (PBX) **12**. One or more extensions couple PBX **12** to one or more facsimile machines **14**. Fax logger **11** is coupled in a passive manner to each PBX extension connected to a facsimile machine. The passive connection does not interfere in the sending and receiving of facsimiles from and to the facsimile machines **14**. Fax logger **11** listens to the each extension it is coupled to and when it senses a facsimile transmission present on the line, it records related data in a database **16** and archives the transmission on suitable archive media such as magnetic tape, optical disk (i.e. write once read many (WORM), magneto-optical, etc.) or high capacity conventional hard disk drives. Database **16** can be either external to fax logger **11** or integrated internally within fax logger **11**. In the example illustrated in Figure 1, database **16** is shown coupled to fax logger **11** through a local area network (LAN).

Fax logging system **10** also includes retrieval capabilities whereby any facsimile previously stored and archived by the fax logging system can be searched for and retrieved. One or more workstations **18** are coupled to fax logger **11** through the LAN. Workstations **18** provide the software front end user interface to allow a user to construct search queries and browse through retrieved facsimile records. Included are other various software tools used in

connection with searching and viewing previously archived facsimile records. In an alternative embodiment, the user interface employed in workstations **18** can be integrated within fax logger **11** itself.

Illustrated in Figure 1 is an example of a preferred passive fax logging system. A passive fax logging system is preferred because it is desirable to not interfere at all in the process of sending and receiving facsimiles. No interference is possible if standard facsimile protocols are used in the transmission (i.e. International Telegraphic Union (ITU) facsimile protocols). However, preventing interference with facsimile transmissions is not always feasible because it is possible that two facsimile machines do not use a standard protocol but rather use a company proprietary or otherwise non-standard facsimile protocol. A solution to this problem is to become active in the facsimile acquisition process rather than remain passive. In the alternative active embodiment, the fax logging system determines what facsimile transmission protocols both sides will use. The fax logging system chooses a standard protocol for both sides of the transmission.

A high level block diagram illustrating an alternative embodiment of the active facsimile logging system of the present invention applied to a sample telephone system having multiple attached facsimile devices is shown in Figure 2. In this active embodiment, fax logging system comprises fax logger **11** coupled between PBX **12** and facsimile machines **14,** database **16** coupled to a LAN and one or more workstations **18**. As in Figure 1, one or more telephone or trunk lines from the CO are coupled to PBX **12**. One or more PBX extensions are coupled to fax logger **11**. Fax logger **11,** in turn, is coupled to one or more

facsimile machines **14**. All facsimile transmissions must pass through fax logger **11**. Using this scheme, fax logger **11** can determine the transmission protocol to use for both sides of the transmission. .

As in the passive embodiment discussed above, database **16** is illustrated external to fax logger **11** but can also be integrated internally with fax logger **11**. Similarly, workstations **18** provide the software tools comprising the user interface for retrieving and browsing or viewing previously archived facsimiles and can be located external to fax logger **11** or integrated internally with it.

With reference to Figure 3, fax logger **11** will now be described in more detail. Illustrated in Figure 3 is an embodiment of a single channel passive fax logger **11**. A telephone line or trunk from the CO is coupled to PBX **12**. An extension connects PBX **12** to facsimile machine **14**. Fax logger **11** comprises a passive line interface **30**, fax/modem **32**, processor **38**, database **40**, storage **46**, archive subsystem **48**, archive queue **44**, LAN interface **42** and printer interface **36**. Passive fax logger **11** constantly listens to the extension line and waits for a facsimile transmission. Once a facsimile transmission is detected, fax logger **11** stores it, records pertinent related data in a database and records the facsimile transmission on archive media.

Fax logger **11** listens to the PBX extension line through passive line interface **30**. Circuitry in passive line interface **30** functions to unobtrusively allow the fax logger to hear everything that occurs on the line but does not interfere in the sending or retrieving of facsimiles. Devices that perform this listening function are well known in the art, being used extensively in voice

recording systems, thus they will not be described in further detail. The signal received by passive line interface **30** is output to fax/modem **32**. Fax/modem **32** functions to receive the tapped signal and, using the appropriate facsimile transmission protocol, convert the facsimile transmission into a more practical and usable digital format. As with passive line interface **30**, fax/modem devices are also well known in the art and thus need not be described further. Standard fax/modems used today in many personal computer applications will work in the present invention with minor modification. Conventional fax/modems are designed to connect to a telephone line, typically through an RJ-11 connector. The signals present on a telephone line are similar but not identical to the signals output by passive line interface **30**. The modifications needed to be made pertain to the matching the electrical interface to the passive telephone line interface and would be apparent to one skilled in the art.

The digital data output from fax/modem **32** is input to processor **38**. Processor **38** can be a microprocessor, personal computer, or any other suitably programmed computing device. Processor **38** controls the internal operations of fax logger **11** and overseas the facsimile acquisition, archiving and retrieval processes. As facsimiles are being acquired, they are stored temporarily in storage **46**. Storage **46** is any suitable storage device such as a hard disk drive. It is important that storage device **46** be suitably large and fast enough to store incoming acquired facsimile transmissions. Facsimiles remain on storage device **46** until they can be archived at which time they are removed from storage **46**. As will be described in more detail below, after facsimiles are acquired, related facsimile data about the transmission is stored in database **40**.

In Figure 3, database **40** is illustrated as being internal and integral with fax logger **11**. An externally located database would also work as well. Once the relevant data has been stored in database **40**, the facsimile is placed onto archive queue **44** where it awaits archiving. Eventually, the facsimile transmissions are taken from archive queue **44** and sent to archive subsystem **48** for permanent recording onto suitable archive media. It is a high priority to record the incoming facsimile transmission in storage as quickly as possible, in order to avoid potential problems caused by, for example, a power failure, etc. Thus a large and fast hard disk drive should be used for the storage (e.g., fast and wide SCSI-2 hard disk drives).

Processor **38** is coupled to a LAN interface **42** which provides an interface to the LAN. In addition, printer interface **36** couples processor **38** to a printer **34**. Printer **43** functions to generate labels for the archive media to facilitate the handling of the actual disks, tape cassettes, etc.

A detailed block diagram illustrating a multiple channel fax logger applied in a passive configuration to a sample telephone system is shown in Figure 4. In this preferred embodiment, PBX 12 is coupled to N facsimile machines. Fax logger **11** is coupled to each of these N PBX extension lines through N passive telephone line interfaces **54**. The function of N passive telephone line interfaces **54** are similar to those described in connection with the single channel fax logger illustrated in Figure 3. Each individual interface listens for facsimile transmission on its extension. In this embodiment, however, each telephone interface is coupled to a multi-vendor interface protocol (MVIP) bus, commonly used to allow different telco equipment from different vendors to communicate

which each other. Also coupled to the MVIP bus is an N input/M output multiplexer (mux) **52**. Mux **52** can be any device that can switch any of N inputs to any of M outputs, such as a multiple input and output switch, etc. Coupled to mux **52** are M fax/modems **64**. Fax/modems **64** are identical to those described in connection with Figure 3. Fax detection circuitry **50** is coupled to each of N individual passive telephone line interfaces **54** and to processor **38**. Fax detector functions to listen to each of N PBX extension lines and informs processor **38** when a facsimile transmission is occurring on a line.

Processor **38**, database **40**, storage **46**, archive subsystem **48**, archive queue **44**, LAN interface **42** and printer interface **36** function similarly to the corresponding components described in connection with Figure 3. The switching or selection control of mux **52** is performed by processor **38** through a control signal line coupled from processor **38** to mux **52**. At any one time M fax/modems **64** are coupled to N telephone extension lines through the MVIP bus and the passive telephone line interfaces. Both N and M can be any positive integer. The system may have more telephone lines than fax/modems, an equal number of telephone lines and fax/modems or less telephone lines than fax/modems. Typically there will be more telephone lines than fax/modems, in which case it is possible that some facsimile transmissions will be archived. Fax detector **50** listens to all N telephone extensions. When a facsimile transmission is detected, a signal is transmitted to processor **38**, which, in turn, couples a fax/modem to the appropriate extension. The MVIP bus allows each passive telephone line interface to be connected to one of the inputs of mux **52**.

A detailed block diagram illustrating a multichannel active facsimile logging system applied to a sample telephone system is shown in Figure 5. In this embodiment, the PBX extensions or telephone lines are not connected directly to the fax machines. The connection between telephone lines and fax machines is broken and the fax logger is inserted between them. All facsimile transmissions sent from and to the local fax machine are intercepted by the fax logger. In this manner, the fax logger controls the protocols used in the transmissions.

The N PBX extensions or telephone lines are input to N telephone line interfaces **62**. The output of N telephone line interfaces **62** is coupled to an MVIP bus. Line interfaces **62** convert the signals present on the telephone line or PBX extension into signals suitable for placement onto the MVIP bus. N fax machines are coupled to N fax line interfaces **66**. The fax line interfaces provide an interface between the MVIP bus and the conventional facsimile signals used on regular telephone lines or extensions. Also coupled to the MVIP bus is an N input/M output multiplexer or switch **52**. Mux **52** is able to switch any of N inputs onto any of M outputs. The M output signals from mux **52** are fed to M fax/modems **64**. Each fax/modem handles the signal from a different output from mux **52**. The fax/modems convert the telephone line signals into a format processor **38** can understand. The processor **38** receives the output of each fax/modem and provides a control signal to mux **52** to select which inputs are to be switched to which outputs. Database **40**, storage **46**, archive subsystem **48**, archive queue **44**, LAN interface **42** and printer interface **36** function similarly to the corresponding components discussed in connection with Figure 3.

In operation, processor **38** listens for facsimile transmissions on M telephone lines or PBX extensions. When a facsimile transmission is detected, it is stored on storage device **46** and forwarded to one of N fax machines at a later time. In addition, facsimile transmissions originating from N fax machines **68** are also detected. The store and forward mechanism assures that the a standard facsimile transmission protocol will be used for both sending and receiving facsimiles. Once the facsimile is stored and placed onto the archive queue, as in the embodiments discussed previously, it is translated into a standard facsimile transmission protocol, regardless of the original transmission protocol used (i.e. PCS, TIFF, or any other compressed format). If the transmission originated on a telephone line or PBX extension it is sent out through the particular fax/modem **64** and mux **52**, onto the MVIP bus, to one of N fax line interfaces and finally to one of N fax machines. If it originated from one of N fax machines **68**, it is sent out through the particular fax/modem **64** and mux **52**, onto the MVIP bus, to one of N telephone line interfaces **62** and out to the telephone line or PBX extension. This process will be described in more detail below.

A high level block diagram of an embodiment of the fax logger combining both the passive and active embodiments is illustrated in Figure 6. In this embodiment, L telephone lines or PBX extensions are coupled to L passive telephone line interfaces **60**. The L passive telephone line interfaces are passively coupled to the lines that connect the telephone lines or PBX to fax equipment in such a way that the telephone line or PBX extension is not interfered with. L passive telephone line interfaces **60** are coupled to fax

detector **50** which functions to detect the start of a facsimile transmission on any of its connected lines. The fax detector is coupled to processor **38** through a control signal line. The output of L passive telephone line interfaces **60** is coupled to the MVIP bus. Mux **52** functions to connect any of L outputs of L passive telephone interfaces **60** to any of M fax/modems **64**. The numbers L, N and M are all positive integers.

In addition to the passive portion of the fax logger, the active portion of the fax logger comprises N telephone line interfaces **62** coupling N telephone lines or PBX extensions to the MVIP bus and N fax line interfaces **66** coupling N fax machines to the MVIP bus. Mux **52** functions to couple any of N telephone line interfaces **62** or N fax line interfaces **66** to any of M fax/modems **64**. The remaining portion of the fax logger operates similarly, for both passive and active portions, as previously described in connection with Figures 4 and 5, respectively.

A high level flow diagram of the software process used to control the passive fax logger is illustrated in Figure 7. Generally, the fax logger waits and continually listens for the a facsimile transmission (step 70). Once detected, the facsimile transmission is received (step 72). A high level flow diagram of the software process used to control the active fax logger is illustrated in Figure 8. Generally, the fax logger waits and listens for either the telephone line/PBX extension to ring (step 74) or for one of the fax machines to go off-hook (step 76). Once either of these events occur, the facsimile transmission is received (step 78).

The receipt of a facsimile transmission in the passive fax logger will now be described in more detail. A high level logic flow diagram illustrating the receive facsimile process of the passive facsimile logging system is shown in Figure 9. First, it is determined whether the facsimile is outbound or inbound (step 80). It is outbound if one of fax machines went off-hook and dual tone multiple frequency (DTMF) tones are detected. It is inbound if ringing is detected on the line. If the facsimile is outbound than the digits are detected as they are dialed (step 82). For both outbound and inbound facsimiles, the transmission is then received (step 84). A database record is then created in database **40** (Figures 3 and 4) for holding data related to the facsimile transmission (step 86). The facsimile transmission is then translated into a standard format regardless of the original format used (step 88). Standard formats include formats such as PCX, TIFF, or any other standard bit mapped graphic format. The data is also typically compressed before being saved to storage. The facsimile is then stored in storage **46** (Figures 3 and 4) in the standard format (step 90). The facsimile is then added to archive queue **44** (Figures 3 and 4) which is a queue holding facsimiles waiting to be archived (step 92).

The receipt of a facsimile transmission in the active fax logger will now be described in more detail. A high level logic flow diagram illustrating the receive facsimile process of the active facsimile logging system is shown in Figure 10. First, after the presence of a facsimile transmission is detected, it is determined whether a modem is available (step 100). If no modems are available, the facsimile cannot be archived and the process is exited. If a modem is available,

it is determined whether the facsimile is outbound or inbound (step 102). If it is inbound, the particular telephone line interface **62** (Figures 5 and 6) is made to go off-hook (i.e. the call is answered) (step 104). If the facsimile is outbound, the off-hook condition and the dialed DTMF digits can be detected (step 106). For both inbound and outbound facsimiles, the transmission is then received (step 108). Similar to the passive receive facsimile process, a database record is then created in database **40** (Figures 5 and 6) for holding data related to the facsimile transmission (step 110). Regardless of the original facsimile transmission protocol, it is translated into a standard format (i.e. PCX, TIFF, or any other compressed format) (step 112). Standard formats include formats such as PCX, TIFF, or any other standard bit mapped graphic format. The data is also typically compressed before being saved to storage. The facsimile is then stored in storage **46** (Figures 5 and 6) in the standard format (step 114). The facsimile is then added to archive queue **44** (Figures 5 and 6) which is a queue holding facsimiles waiting to be archived (step 116). Finally, the facsimile is added to the forwarding queue to complete the store and forward process (step 118).

The forwarding portion of the store and forward process will now be described in more detail. A high level flow diagram illustrating the forwarding process of the active facsimile logging system is shown in Figure 11. First, the forwarding queue is continually checked for facsimiles (step 120). Once the queue becomes not empty, it is determined whether there is an available modem (step 122). If there is an available modem, it is then determined whether the facsimile is inbound or outbound (step 124). If it is inbound, the line

connecting the particular fax line interface **66** to the destination fax machine **68** (Figures 5 and 6) is made to ring (step 126). If it is outbound, the line connecting the particular telephone line interface **62** to the telephone line or PBX extension is made to go off-hook (step 128) and the destination is dialed (step 130) using the digits collected previously (step 106, Figure 10). Then, the facsimile is translated and decompressed from the standard format, previously stored, into the ITU standard T4 format using the standard facsimile transmission protocol (step 132). After translation, the facsimile is then sent (step 134).

The archive process will now be described in more detail. A high level flow diagram illustrating the archive process of both the passive and active facsimile logging systems is shown in Figure 12. First, it is determined whether the archive queue is empty (step 140). If the queue is not empty, the facsimile is sent to the archive subsystem (Figures 3, 4, 5, 6) where it is recorded onto long term storage media such as, magnetic tape, optical disk storage, magneto-optical storage, etc. (step 142). Once the facsimile is recorded onto long term media, the corresponding record in database **40** (Figures 3, 4, 5, 6) is updated with the appropriate data (i.e. data pointers) related to the archive (step 144). In addition, to facilitate handling of the various tapes, disks or other media by system operators, labels are generated when the contents of the corresponding media (i.e. tape or disk) become full. Each facsimile recorded is tracked and an entry is added in a label list for that particular tape or disk. Once it is determined that the media is full (step 146), the label is printed (step 148).

The retrieval process of the fax logging system will now be described in more detail. A high level flow diagram illustrating the facsimile retrieval process of both the passive and active facsimile logging systems is shown in Figure 13. First, the user of the retrieval system enters the parameters comprising the search (step 150). A search engine searches and retrieves the records from the database matching the previously entered search criteria (step 152). If the facsimiles corresponding to the database records found in the search (step 154) are present in storage **46** (Figures 3, 4, 5, 6), then they are retrieved from there (step 156). If the they are not located in storage, the appropriate archive media is first loaded onto the system (step 158). For example, if the facsimile exists on a tape located in a tape library, the tape is either manually or automatically retrieved (i.e. through a jukebox). The facsimiles are then retrieved from the long term archive media for viewing and browsing by the user (step 160).

An example of an archive subsystem **48** used in both the passive and active facsimile logging systems is illustrated in Figure 14. Processor **38** is coupled to database **40** and archive queue **44**. Archive queue **48** comprises one or more archive units, such as DAT drives **162**. Alternatively, archive units **162** may be any suitable archive media such as tape, optical, etc. In the case of magnetic tape, a tape library **164** holds tape cassettes full of archived facsimile data. When facsimile search requests are made, the appropriate tape is pulled from tape library **164** and inserted in one of DAT recorders/players **162**. In addition, archive units **162** can be arranged in one of several configurations to increase archive reliability and/or performance. Such configurations include mirroring, autoswitching of a unit when its media becomes full, using one

archive unit for recording and one for retrieval and using autochangers to automate the retrieval process.

The data fields comprising a record **170** of the database used in maintaining information about each facsimile archived in the system is illustrated in Figure 15. The facsimile or telephone line number **172** is stored as a field. The dialed telephone number **174** and the data/time of the received facsimile **176** is recorded. ITU T30 data **178** includes information such as caller ID, receiver ID, facsimile resolution, page size, compression and other facsimile related data. In addition, a pointer to the storage area **180** where the facsimile is stored and a pointer to the location where the facsimile is archived **182** is stored as fields in record **170**.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made.

CLAIMS

1. A passive long term facsimile transmission storage and retrieval system, comprising:

   a. a facsimile logger passively coupled to at least one telephone line connected to a facsimile machine, said facsimile logger acquiring and storing facsimile transmissions that occur on said at least one telephone line, said facsimile logger storing said facsimile transmissions on long term archive media;

   b. a database coupled to said facsimile logger, said database for holding relevant data associated with said stored facsimile transmission; and

   c. at least one workstation coupled to said facsimile logger, said at least one workstation able to search and retrieve said facsimile transmissions previously stored by said facsimile logger on said long term archive media.

2. An active long term facsimile transmission storage and retrieval system, comprising:

   a. a facsimile logger coupled between at least one telephone line and at least one facsimile machine, said facsimile logger storing and forwarding facsimile transmissions that either arrive on said at least one telephone line or that are originated by said at least one facsimile machine, said facsimile logger storing said facsimile transmissions on long term archive media;

b. a database coupled to said facsimile logger, said database for holding relevant data associated with said stored facsimile transmission; and

c. at least one workstation coupled to said facsimile logger, said at least one workstation able to search and retrieve said facsimile transmissions previously stored by said facsimile logger on said long term archive media.

3. A passive facsimile logger coupled passively to a telephone line connected to a facsimile machine, comprising:

a. a passive telephone line interface coupled to said telephone line, said passive telephone line interface interfacing said telephone line to a fax/modem without interfering with facsimile transmissions occurring on said telephone line;

b. said fax/modem coupled to said passive telephone line interface, said fax/modem for translating said facsimile transmissions from a telephone line facsimile signal format into digital facsimile data;

c. a processor coupled to said fax/modem for receiving and processing said digital facsimile data, said processor controlling the operation of said passive facsimile logger;

d. a database coupled to said processor, said database holding relevant data associated with said facsimile transmissions;

e. a storage coupled to said processor, said storage providing a temporary memory storage area for said facsimile transmissions as they are received from said telephone line;

f. an archive subsystem coupled to said processor, said archive subsystem recording said facsimile transmissions on long term archive media, said archive subsystem retrieving said facsimile transmissions, previously archived, upon command from said processor; and

g. an archive queue coupled to said processor, said archive queue holding said facsimile transmissions that have been received and are awaiting to be archived.

4. A multi-channel passive facsimile logger coupled passively to N telephone lines connected to N facsimile machines, comprising:

a. N passive telephone line interfaces coupled to said N telephone lines, said N passive telephone line interfaces interfacing said N telephone lines to a switch having N input ports and M output ports, said N passive telephone interfaces operative to not interfere with facsimile transmissions occurring on said N telephone lines;

b. a facsimile detector coupled to said N passive telephone line interfaces, said facsimile detector detecting the presence of said facsimile transmissions on said N telephone lines;

c. said switch coupled to said N passive telephone line interfaces through said N input ports, said M output ports

coupled to M fax/modems, said switch able to coupled any one passive telephone line interface to any one fax/modem;

d. said M fax/modems coupled to said M output ports, said M fax/modems for translating said facsimile transmissions from a telephone line facsimile signal format into digital facsimile data;

e. a processor coupled to said M fax/modems for receiving and processing said digital facsimile data, said processor controlling the cperation of said passive facsimile logger, said processor for determining the input to output configuration of said switch;

f. a database coupled to said processor, said database holding relevant data associated with said facsimile transmissions;

g. a storage coupled to said processor, said storage providing a temporary memory storage area for said facsimile transmissions as they are received from said telephone line;

h. an archive subsystem coupled to said processor, said archive subsystem recording said facsimile transmissions on long term archive media, said archive subsystem retrieving said facsimile transmissions, previously archived, upon command from said processor; and

i. an archive queue coupled to said processor, said archive queue holding said facsimile transmissions that have been received and are awaiting to be archived.

5. The facsimile logger according to claim 4, wherein N and M are both positive integers.

6. A multi-channel active facsimile logger coupled to N telephone lines and to N facsimile machines, comprising:

a. N telephone line interfaces coupled to said N telephone lines, said N telephone line interfaces interfacing said N telephone lines to an internal data bus;

b. N facsimile line interfaces coupled to said N facsimile machines, said N facsimile line interfaces interfacing said N facsimile machines to said internal data bus;

c. a switch having N input ports and M output ports, said N input ports coupled to said internal data bus, said M output ports coupled to M fax/modems, said switch able to couple any one telephone line interface to any one fax/modem and any one facsimile machine to any one fax/modem;

d. said M fax/modems coupled to said M output ports, said M fax/modems for translating said facsimile transmissions between a telephone line facsimile signal format and digital facsimile data;

e. a processor coupled to said M fax/modems for receiving and processing said digital facsimile data, said processor controlling the operation of said active facsimile logger, said processor for determining the input to output configuration of said switch;

f. a database coupled to said processor, said database holding relevant data associated with said facsimile transmissions;

g. a storage coupled to said processor, said storage providing a temporary memory storage area for said facsimile transmissions as they are received from said telephone line;

h. an archive subsystem coupled to said processor, said archive subsystem recording said facsimile transmissions on long term archive media, said archive subsystem retrieving said facsimile transmissions, previously archived, upon command from said processor; and

i. an archive queue coupled to said processor, said archive queue holding said facsimile transmissions that have been received and are awaiting to be archived.

7. The facsimile logger according to claim 6, wherein N and M are both positive integers.

8. A multi-channel facsimile logger, comprising:

a. L passive telephone line interfaces coupled to L telephone lines, said L passive telephone line interfaces interfacing said L telephone lines to an internal data bus, said L passive telephone interfaces operative to not interfere with facsimile transmissions occurring on said L telephone lines;

b. a facsimile detector coupled to said L passive telephone line interfaces, said facsimile detector detecting the presence of said facsimile transmissions on said L telephone lines;

c. N telephone line interfaces coupled to N telephone lines, said N telephone line interfaces interfacing said N telephone lines to an internal data bus;

d. N facsimile line interfaces coupled to N facsimile machines, said N facsimile line interfaces interfacing said N facsimile machines to said internal data bus;

e. a switch having N input ports and M output ports, said N input ports coupled to said internal data bus, said M output ports coupled to M fax/modems, said switch able to couple any one of said N telephone line interfaces to any one of said M fax/modems, any one of said N facsimile machines to any one of said M fax/modems and any one of said L passive telephone line interfaces to any one of said M fax/modems;

f. said M fax/modems coupled to said M output ports, said M fax/modems for translating said facsimile transmissions between a telephone line facsimile signal format and digital facsimile data;

g. a processor coupled to said M fax/modems for receiving and processing said digital facsimile data, said processor controlling the operation of said active facsimile logger, said processor for determining the input to output configuration of said switch;

h. a database coupled to said processor, said database holding relevant data associated with said facsimile transmissions;

i. a storage coupled to said processor, said storage providing a temporary memory storage area for said facsimile transmissions as they are received from said telephone line;

j. an archive subsystem coupled to said processor, said archive subsystem recording said facsimile transmissions on long term archive media, said archive subsystem retrieving said facsimile transmissions, previously archived, upon command from said processor; and

k. an archive queue coupled to said processor, said archive queue holding said facsimile transmissions that have been received and are awaiting to be archived.

9. The facsimile logger according to claim 8, wherein L, M and M are all positive integers.

10. A method of processing a facsimile transmission received through a fax logger coupled passively to N telephone lines, comprising the steps of:

a. determining whether said facsimile transmission is inbound or outbound;

b. if said facsimile transmission is outbound, detecting digits dialed onto one of said N telephone lines;

c. receiving said facsimile transmission through said one of said N telephone lines;

d. adding a facsimile transmission record to a database;

e. translating said facsimile transmission into a standard format;

f. storing said facsimile transmission in a storage; and

g. adding said facsimile transmission to an archive queue.

11. A method of processing a facsimile transmission received through a fax logger coupled actively to N telephone lines, comprising the steps of:

a. determining whether a said facsimile transmission is inbound or outbound;

b. if said facsimile transmission is outbound, detecting digits dialed onto one of said N telephone lines;

c. if said facsimile transmission is inbound, causing said one of said N telephone lines to go off-hook;

d. receiving said facsimile transmission through said one of said N telephone lines;

e. adding a facsimile transmission record to a database;

f. translating said facsimile transmission into a standard format;

g. storing said facsimile transmission in a storage;

h. adding said facsimile transmission to an archive queue; and

i. adding said facsimile transmission to a forwarding queue.

The Patent Office

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Application No: GB 9702571.2
Claims searched: 1 to 11

Examiner: John Donaldson
Date of search: 3 April 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4F(FFC, FFS, FFX)

Int Cl (Ed.6): H04N 1/00, 1/21, 1/32

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2282725 A	(SNELL), see whole document	1, 2
X	US 5237430	(SAKURAI), see abstract, column 3, line 66 to column 7, line 37	1 to 11

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.