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SPECIAL SERVICE CALL ROUTING

Technical Field

This invention relates to facsimile service and other specialized types of telecommunications calls.

Problem

Facsimile service is becoming increasingly popular because of the wide availability of relatively inexpensive facsimile machines. Facsimile (fax) service however still presents some problems. One common problem is attempting to send a facsimile message to a customer whose telephone number is known but whose facsimile number is not known. Under these circumstances, a separate call is typically required to identify the customer's facsimile number. This is wasteful of the calling and called customer time and is also expensive since an extra call is required.

International facsimile calls ideally should be transmitted over selected circuits with low distortion since conventional facsimile signals may be excessively distorted over many other international voice transmission facilities. Getting access to such selected circuits presents a problem.

Advances in fax service now enable a customer encountering a busy or ring-no-answer condition on a fax call to send a facsimile message to a store and forward facility for subsequent transmission to the destination facsimile machine when that facsimile machine is available. However, such service reorigination involves a time consuming process in order to call a store and forward facility and to redial the called number into that facility for subsequent fax delivery. In view of the foregoing, needs exist in the art to process fax calls to a fax machine without the caller dialing the fax number, to process international fax calls over special low distortion circuits, and to simplify the process of sending calls to a store and forward facility. Similar needs are encountered in other types of specialized telecommunication calls such as calls to a recipient voice messaging system and electronic mail system.

Solution

The foregoing needs are met and an advance is made over the prior art in accordance with the principles of this invention wherein in an illustrative embodiment, facsimile calls are processed to a fax destination by class of service marks for special treatment in their processing through a common carrier network. Advantageously, such a class mark permits a number of special fax features to be

implemented, including automatic transfer of fax calls from the number of a called voice station to an associated fax number, automatic routing of international calls over selected facilities, and semi-automatic conversion of a conventional fax call to a store and forward call on busy.

It is a feature of this invention that a fax caller may dialup a conventional (voice) telephone station line and have that call connected automatically to a fax machine serving that station line instead of its telephone. That action is achieved by recognizing a fax traveling class mark at a destination switching office controller or processor, having that processor consult a memory to derive a fax destination number serving the called party, and then controlling a routing of the fax call to that fax destination instead of the telephone identified by the dialed number.

On international fax calls, the invention provides facilities in an international gateway switch to ascertain that the call is a facsimile call and automatically to route the call over selected low distortion transmission facilities for quality communication.

It is a feature of the invention that facsimile calls are identified in a local switch from either the line equipment appearance number of the calling line or the directory number of the calling customer, and in an interexchange carrier switch on the basis of the calling customer directory number as forwarded through automatic number identification facilities. In the latter embodiment, a memory table maintained in an interexchange carrier (IXC) egress switch translates a called voice station number into a destination facsimile number to provide data so that call completion to a facsimile line is automatically effected.

In this embodiment some lines, such as those connecting a private branch exchange (PBX) to a switching office, may carry either facsimile or other traffic. Customers on those lines are asked to key a signal, illustratively, either 3 (= F for FAX) or 8 (= V for Voice). to identify whether a particular call is fax.

In an alternative embodiment, calls are illustratively recognized as being fax calls by a prefix comprising a special alternative common carrier code such as 10XXX or a non-numeric indicator such as the # sign or a # sign plus one or more digits keyed on a dual tone multi-frequency (DTMF) customer station dialed by the customer and recognized in the network as designating a fax call, or by a fax mark, data sent along with a message to set up a connection, from an integrated services digital network (ISDN) line. Advantageously, such a class mark permits a number of special fax features to be implemented, including automatic transfer of fax calls

from the number of a called voice station to an associated fax number, automatic routing of international fax calls over selected facilities, and automatic conversion of a conventional fax call to a store and forward call on busy or on ring-no-answer condition.

If a call is recognized as being a fax call, the fax caller may dial a conventional (voice) telephone station line and have that call connected automatically to a fax machine serving that station line instead of its telephone. That action is achieved by recognizing a fax traveling class mark at a destination switching office controller or processor or network control point processor, having that processor consult a memory to derive a fax destination number serving the called party, and then controlling the routing of the fax call to that fax destination instead of the telephone identified by the dialed number. When this happens, a fax message waiting indication may be activated on the called voice phone.

Another feature of the invention is that when a facsimile call is recognized, a receiver is attached to the call to detect if the calling customer dials additional digits for requesting a store and forward connection. The customer may dial such additional digits in response to hearing that the called facsimile number is busy or detecting that the called facsimile number does not answer. When the additional digits are detected, the call is routed to a store and forward facsimile facility and the previously dialed called number and the originating customer's number are automatically forwarded to that store and forward facility for delivery of the call, delivery of a confirmation, and for billing. Alternatively, the network can automatically forward calls from that calling customer to a store and forward facility on busy or ring-no-answer condition.

Another feature of this invention is that the called customer may specify that fax calls to busy or ring-no-answer condition be automatically rerouted to a fax store and forward facility. On international fax calls, the invention provides facilities in an international gateway switch to ascertain that the call is a facsimile call and automatically to route the call over selected low distortion transmission facilities for quality communication. Further, a translation from the voice number to an associated fax number is made at the gateway switch, either directly or by accessing a shared database, to provide automatic routing to an associated fax machine for countries which have not implemented automatic rerouting of calls from voice to fax machines. For Direct Services Dialing Capability (DSDC) calls, such as "800" or "Freephone" calls, a DSD Network Control Point, a database shared by a plurality of Interexchange Carrier (IXC) switches, provides the necessary data for

processing calls in accordance with the principles of this invention.

More generally, a large number of calls, consisting of several broad classes of specialized calls, can be handled advantageously by permitting a routing to a destination other than the nominal destination based upon the type of the call. Examples of types of calls are facsimile calls, calls directly to the voice messaging system serving the intended recipient, and calls to the electronic mail system serving the intended recipient. The type of the call can be established automatically, illustratively, in the local switch from either the line equipment appearance number of the calling line or the directory number of the calling customer (and communicated from a local switch to an IXC switch via information digits), and in an IXC switch on the basis of the calling customer directory number as forwarded through automatic number identification facilities or through additional digits collected from the originator of a call in response to a network provided prompt.

Accordingly, this invention is an arrangement for recognizing fax calls, and responsive to such recognition, to automatically transfer a call to a voice destination to the fax machine associated with that voice destination. A fax call indicator, such as a traveling class of service mark in CCS messages for the call, is used to communicate that the call is a fax call to switching offices for that call.

Brief Description of the Drawing

FIG. 1 is an overall block diagram of an interexchange carrier system for implementing applicants' invention;

FIGS. 2 and 3 are memory layouts of databases of interexchange carrier switches used for processing calls; and

FIGS. 4 and 5 are flow charts of programs for controlling actions required to implement applicants' invention in an interexchange carrier ingress and egress switch, respectively.

Detailed Description

FIG. 1 is a block diagram showing major elements required to implement applicants' invention. Three facsimile machines are shown, originating facsimile machine 102, originating facsimile machine 101, connected to an ISDN termination 105, and terminating facsimile (fax) machine 104. In accordance with one specific embodiment, each such machine is "registered" with the carriers serving the customer, and, as indicated below, data is recorded in the appropriate switches that the customer's line is, in fact, connected to a fax machine. Each of these machines has an associated telephone number. Originating facsimile machine 102 is connected to serving local exchange switch 106, and originating fax machine 101 is

connected to local exchange switch 107 equipped to support ISDN. The number of the originating facsimile machine 102 is referred to hereinafter as the calling number and is the number identified by Automatic Number Identification (ANI) at the connected local exchange carrier (LEC) switch 106. ANI is also provided for fax machine 101 in order to verify that the associated customer has subscribed to the service.

The terminating facsimile telephone number will be referred to hereinafter as the associated facsimile number; in this example, the caller at facsimile machine 102 or 101 does not know the telephone number of facsimile machine 104 but instead knows only the voice telephone number of a customer who is served by facsimile machine 104. However, as discussed infra, the interexchange carrier network has information stored in a table to translate from that voice telephone number to the number of fax machine 104.

When originating facsimile machine 102 places a call to a called number (the number of the voice telephone of the customer to whom a facsimile message is to be sent), the called number and the number of facsimile machine 102, identified by ANI facilities in local exchange carrier switch 106 and hereinafter referred to simply as the ANI number, are sent to ingress interexchange carrier (IXC) switch 110. In this specific embodiment, the IXC switches are 4 ESS™ switches, described in The Bell System Technical Journal, Vol. 56, No. 7, September 1977, pages 1015-1320. Signaling between LEC switch 106 and IXC switch 110 is carried out using Feature Group D signaling which permits the signaling of ANI data. Feature Group D signaling is specified in Bellcore document: Notes on the BOC Intra-LATA Networks - 1986, Technical Reference TR-NPL-00275, Issue 1, April 1986, Section 6. The IXC switch 110 comprises a switching network 112 for interconnecting communications ports, a processor 114 for controlling the operations of the switch, dual tone multi-frequency (DTMF) receivers 117 for receiving DTMF signals from fax machine 102, MF receivers 116 for receiving signals from local exchange carrier switch 106, a common channel signaling (CCS) transceiver 118 for transmitting messages to other IXC switches, and a database 120, shown in FIG. 2, for storing, among other items, a table 122. The table 122 stores ANI numbers associated with facsimile machines served by switch 110 and, for each such facsimile machine, an indicator of whether store and forward service is offered to that machine, an indicator of mixed use service, and an indicator of automatic connection to store and forward on busy or on ring-no-answer condition.

More generally, a number of methods can be used for identifying that a call is a fax call. The customer at machine 102 may also signal a fax call by dialing a special prefix, illustratively a special common carrier identification prefix, which is recognized at local exchange 106 or ingress switch 110 as designating a fax call. The ingress switch responds to this prefix, either received from the customer via local exchange switch 106, or transmitted in the form of a special signal from switch 106, by treating the call as a fax call as described hereinafter. The customer at fax machine 101, connected to local exchange switch 107 by an integrated services digital network (ISDN) connection, automatically signals a fax call via a fax indicator 109 in a call setup message 111 to switch 107. Switch 107 passes on a fax indicator 115 in a signaling message 113 to ingress switch 110. The presence of fax indicator 115 is a signal to switch 110 that the associated call is a fax call.

Other methods of recognizing a fax call include a class of service translation performed at an originating office to recognize that the call is from a fax machine. This class of service is then transmitted to an ingress switch by information digits as described hereinafter; alternatively, the information can be transmitted in a CCS message.

Another method of recognizing a fax call is by a prefix such as #, # plus one or more digits (for example, #3 = #F), or an alternative common carrier code such as 10XXX. The local office recognizes this prefix and signals the prefix to a toll carrier in one of the ways described above, or simply passes the prefix as well as the rest of the digits to the ingress switch.

When an incoming call from LEC switch 106 is detected in switch 110, the call is connected through network 112 to an MF receiver 116 to receive the called number and the ANI number transmitted from switch 106. Processor 114, operative under the control of program 119, records these digits as they are received and checks in database 120 to see if the ANI number corresponds to a facsimile machine, or whether the ANI number corresponds to a mixed use line. The treatment of mixed use lines is discussed hereinafter with reference to FIG. 4, blocks 230 and 232. In this case, the ANI number corresponds to facsimile machine 102 which, it is assumed for the purposes of this description, also has a store and forward indicator indicating that this machine has subscribed for store and forward service. The database 120 also includes screening data to prevent a particular ANI from making toll calls outside a particular range, or from making international calls. If the call is destined for a Direct Services Dialing Capability (DSDC) subscriber service such as "800" or Freephone service, then processor 114

queries the appropriate DSD Network Control Point (DSD/NCP) 121 as in the prior art to obtain the correct processing information and in addition will also do the additional processing and information retrieval for called party initiated features, such as voice to fax translation and redirect to store and forward for example. This information must be passed to the egress IXC via fields in message 140. Calls that are screened are simply not accepted and the caller receives a disconnect.

After the call has been received in switch 110, the call is routed toward an egress IXC switch 150 which can access the LEC switch 170 which serves the called number. It is assumed in this case that the connection must go through an intermediate IXC switch 182 in order to reach egress IXC switch 150. A CCS message 140 is sent to intermediate IXC switch 182 using CCS transceiver 118 and controlled by processor 114. The message 140 comprises segment 142, containing the ANI number, segment 144 containing a fax flag indicating that this is a call originated from a fax machine, segment 146 comprises the called number, and segment 148 comprising an identifier for identifying the call. Such a message is sent for any call recognized as being a fax call, regardless of whether the originating customer has subscribed to a fax specific feature. Alternatively, two or more flags may be used, a fax flag indicating that this is a fax call, and one or more additional flags specifying calling customer fax features, such as routing over preferred facilities or automatic rerouting. The preferred facilities flag can be set in response to a class of service indicator, specifying that the caller is willing to pay a premium to have fax calls routed over preferred international facilities.

Intermediate IXC switch 182 receives the message over CCS facility and the associated call over a transmission facility, and sets up an additional connection to egress IXC switch 150 and transmits the message 140 to that switch. Intermediate IXC switch 182 and egress IXC switch 150 are similar to ingress IXC switch 110. The call is connected to network 154 of egress IXC switch 150. The message 140 is received in CCS transceiver 152 of switch 150. Processor 156 of switch 150, operative under the control of program 157, examines message 140 and recognizes fax flag 144. Processor 156 then queries database 250, shown in detail in FIG. 3, of switch 150 to access voice to fax (V-T-FAX) translation table 252. This table translates from the called number such as 253 to the associated fax number such as 263 for LEC switches served by the egress IXC switch. The entries 253, 254, 255 may be either voice or fax numbers. Fax numbers are recognized because the corresponding fax entry, 263, 264, 265 matches the voice or fax number. In the example, a match is found between entries 255 and 265, indicating that the directory

number 255 is a number of a fax machine. Customers with fax machines who do not need translation from a voice to a fax number need not have an entry in table 252 since the call can be completed normally whether or not a fax flag is present. If these customers require special fax features, an entry such as 255 is used. For voice numbers, a message waiting lamp indicator, such as 278, associated with voice number 253, is available which, if set, causes a fax message waiting lamp on the voice station to be lit when a fax call is received. The message waiting lamp is lit via a data message sent from the egress switch to a local switch connected to the voice line; this is particularly straightforward if the voice line is an ISDN line.

The translation table also has an indicator 273 to specify whether the call should be automatically routed to a store and forward facility such as 180, so that all overflow fax traffic can be recorded for subsequent transmission to the desired fax terminal. In the case of a call whose dialed number is a voice number, such as 253, egress IXC switch 150 then forwards the associated fax number, not the called number, to store and forward (S/F) facility 180. The call is then subsequently completed from S/F facility 180 via IXC switch 150 to LEC switch 170 which serves terminating fax machine 104. If fax machine 104 is available, the call is set up. If the call is to a fax number such as 255, and the fax number is busy, if the store and forward indicator 275 is set, the call is forwarded. In an international gateway switching system, the V-T-FAX translation is made for countries which have not implemented the features of this invention. The translation may be stored either in the switching system or in a remote database (not shown).

Database 250 can make a number of other translations besides voice to fax. If completion to one of several fax numbers according to the time of day or day of week is desired, or other more complex routing is desired, a translation is made from a called number such as 254 to a pointer such as 264 which points to a block of memory 280. This block includes a number of alternative destinations 281, 282, according to the time and/or day of week 284, 285. In this case, one of the destinations, destination 282, is a store and forward facility 180 for automatically storing the facsimile message for subsequent delivery. The block also contains screening data 286 to block calls from certain numbers or to only permit calls from certain numbers to be completed; this is useful, for example, for shielding fax machines from receiving excessive "junk fax" messages.

Database 250 also comprises a block 290 for translations for international calls to countries that have not implemented the voice to fax translation. Entries 291, 292, 293 have corresponding translation results 296, 297,

298. Entries 291 and 292 represent voice numbers whose corresponding fax numbers are 296 and 297. Entry 293 is a fax number as indicated because corresponding entry 298 is the same. If the called number is not found in block 290, it is assumed that the called number is a fax number and that the call can be completed normally.

There exists a requirement that enhanced services (which includes store and forward fax) must be capable of being provided by anyone. If fax machine 104 is either busy as indicated to the caller via busy message 172 sent from egress IXC 150, or if fax machine 104 does not answer, then the customer at fax machine 102 may key a group of DTMF signals for requesting a store and forward connection. Because of the requirement, it is necessary for the customer to key information for specifying a desired store and forward carrier. For greater clarity, it is assumed in this case that the store and forward carrier is one associated with the interexchange carrier and therefore connected using switches of that interexchange carrier. For further simplicity, it is assumed that the store and forward facility 180 accessible from ingress IXC switch 110 is also connected via intermediate IXC switch 182 and egress IXC switch 150 to facsimile machine 104. If the customer hears a busy tone or recognizes that facsimile machine 104 is not answering, then the customer at facsimile machine 102 keys data for specifying use of store and forward facility 180 on this call. The connection from IXC switch 110 to fax machine 104 is removed and instead facsimile machine 102 is connected via IXC switch 110 to store and forward facility 180. Common channel signaling message 190 is sent to store and forward facility 180. This message 190 includes segments 192 comprising the ANI number, 194 comprising the called number, and optionally segment 196 for additional billing data such as a subaccount billing number. Both the ANI number and the called number have been retained in the memory of processor 114 and do not need to be redialed or retransmitted to IXC carrier switch 110. The store and forward facility 180 sends a fax flag along with fax call set-up messages. For customers who prefer an automatic connection to a store and forward facility on busy, the busy indicator 174 on CCS message 172 is used to set up the connection to the store and forward facility automatically.

In case the recognized fax call is further recognized in ingress IXC switch 110 as being a Direct Services Dialing Capability (DSDC) call, a request message similar to message 140 is sent to Direct Services Dialing/Network Control Point (DSD/NCP) 121 with a fax flag 144 marked. The DSD/NCP 121 translates this request message using a database, comprising data similar to that in

database 250 for translating voice to fax numbers, and returns a translated-to-fax number in a response message to switch 110. Thereafter, the call is processed as if the translated-to-fax number had been called by the calling station. If the called customer has any terminating features such as redirect to another station or to store and forward, the data describing these features is supplied in the response message from the DSD/NCP 121 and is forwarded to egress IXC switch 150 in message 140. In the case of screening, if the call is screened so that completion is denied, the call need not be forwarded from the ingress IXC 140 to the egress IXC 150, but can be blocked in IXC 140 on the basis of data returned in the response message.

FIG. 4 is a flow chart of actions performed in the ingress switch under the control of program 119. The ANI number and the called number for a call are received in the ingress switch (action block 202). This block is performed as in the prior art. In addition, special billing information such as a subaccount billing number may also be received along with the call (action block 204). Subaccount billing procedures are described in Bauer et al.: U.S. Patent 4,776,004. Next, the ANI number is checked to see whether it is associated with a fax machine (test 206), or a mixed use line. If not, then routine call processing in accordance with the principles of the prior art is performed for that call (action block 208). If the ANI number is associated with a fax machine, then a fax flag, and, alternatively, a preferred facilities routing flag, is inserted in the CCS message to be sent to the next switch to which this call is to be routed. Next, test 212 checks whether the store and forward indicator for that ANI number is 1. If not, then the call is processed routinely from that point with the exception of the retention of the fax flag in the CCS message being generated (action block 214). If the store and forward indicator is 1, then a dual tone multifrequency (DTMF) receiver is attached to the call (action block 216) and thereafter the call is processed routinely as previously described with respect to action block 214. If subsequently dialed DTMF digits are detected, representing a store and forward request (action block 218), then the outgoing call from the ingress IXC switch is disconnected (action block 220) and a connection to the customer selected store and forward facility identified by the store and forward request dialed by the customer is established (action block 222). The ingress IXC switch then sends to the store and forward facility the ANI number, the called number, and any special billing information generated in action block 204 (action block 224). Thereafter, the call is processed as a routine facsimile store and forward call wherein the CCS call set up message includes a fax flag. It is, of course, necessary to make sure that a S/F call is not terminated to another S/F system, since

such a case could lead to a large number of S/F message deliveries for one call (action block 226). If the called terminal is busy, and message 172 including busy indicator 174 is detected (action block 240), then if the calling fax number has automatic store and forward on busy (positive result of test 242), the actions starting with action block 220 are performed; if the result of test 242 is negative, the system continues to wait for a customer dialed store and forward request.

If the ANI number is associated with a mixed use line, a DTMF receiver is attached and the caller is prompted to key a 3 (for "F") for fax use or 8 (for "V" representing voice) for non-fax use (action block 230). If a 3 is detected, indicating a fax call, then the actions previously described starting with action block 210 are performed. If an 8 is detected, indicating a non-fax call, then routine call processing as indicated in action block 208 is performed. Any pair of different keys may be used to indicate fax or non-fax.

There are a number of other methods for recognizing a fax call. A fax call from an ISDN line can be recognized by the fax identifier in a signaling message received at the ingress switch (action block 203). In response to reception of a call with this identifier, the actions previously described, starting at action block 210, are executed.

A call from a station 102 can also be recognized at the ingress switch as being a fax call by a prefix such as a special alternative common carrier code taken from those numbers of the series 10XXX which have not been used to identify a common carrier and which have not otherwise been assigned or a prefix code whose initial character is non-numeric such as # or #9 (action block 201). The special alternative common carrier code should probably also specify a common carrier, since otherwise customers could not specify an alternative common carrier on a fax message sent in accordance with the principles of this invention. In response to reception of a call with this special code, the actions previously described, starting at action block 210, are performed.

Another alternative method of recognizing that a call is a fax call is the following: Feature Group B and Feature Group D of Equal Access Signaling, as described in the Bellcore document Notes on the BOC Intra-LATA Networks - 1986, Technical Reference TR-NPL-000275, Issue 1, April 1986, Section 6, provides for the transmission of two digits, called Information Digits ("II" digits), between network switches to classify a call. II digits have traditionally been used to identify coin phones, hotels, etc. and have been more recently used to identify services such as virtual private networks and wide-area telephone services. An II digit pair, can be

used to identify a fax call. These II digits can be transmitted by a local exchange 106 and received in an IXC switch 110 as a method of identifying the call as a fax call (action block 205). Once the call classification is communicated to the IXC network, the classification can be communicated to other switches in the IXC network via an indicator 144 in a CCS message 140. Alternatively, the II digits can be transmitted in an additional segment as part of the CCS message 140 and can be interpreted in IXC switch 150 to recognize a fax call or to recognize the indication of another special service type of call.

FIG. 5 is a flow chart of actions performed in the egress IXC switch. The CCS message for an incoming call is received in action block 302 in accordance with the prior art. This message is checked to see if the facsimile flag is present (test 304). If not, then the call is processed conventionally as in the prior art (action block 314). If the facsimile flag is present in the CCS call message, test 306 is used to determine whether this is an international call. If so, then the special handling for international calls is performed. First, a check is made to see if there is a V-T-FAX translation for the international called number (test 307). If so, the translated number is substituted for the called number (action block 308). The call is then routed over low distortion facilities satisfactory for transmitting facsimile signals (action block 309). If this is not an international call, then the voice-to-fax translation table is checked to see if the called number is in the "voice" portion of that table (test 310). If so, then the associated fax number is substituted for the called number (action block 311). The fax number, either as directly received, or as translated, is then further translated to find whether an automatic route to store and forward on busy or no answer within a predetermined time indicator is set (test 312). If the fax number is busy or does not answer within a predetermined time and that indicator is set (test 313), the call is routed to a store and forward facility (action block 314). If the call is not forwarded to a store and forward facility, then if the voice number has an associated indicator such as 278 marked, then the fax message waiting indicator for that voice number is set (action block 316). Thereafter, the call is processed conventionally (action block 315). The translation, as discussed earlier with respect to database 160, is flexible and can be different for different times of the day and/or days of the week, can include automatic redirection of calls for one fax number to another, and can include automatic routing to a store and forward facility 180, either on busy, or at the appropriate times of the day/days of the week. If calls are forwarded from the egress switch to an alternate destination, the terminating party may have to be separately billed for a portion of the call. If a

combined voice/fax instrument is associated with the called number, then the presence of the fax flag permits the egress IXC switch to recognize that this is a fax call and to initiate any terminating action necessary to assure that the call is treated as a fax call.

While this description has been in terms of facsimile calls and identification of the call via ANI, arrangements can be used for other classes of specialized calls and for the identification of those classes of calls by other means. All that is needed is a means to identify the class of the call, a means of transmitting the class of the call to an egress or local destination switching office controller or processor, and a means of translating the dialed number into the appropriate number associated with the dialed number based on the class of the call.

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Claims:

1. A fax call method comprising the steps of:

receiving a terminating number of a first destination on a call from a facsimile station; and

translating the terminating number to a code of a facsimile facility for serving said first destination.

2. A fax call method comprising the steps of:

in response to reception of a call from a facsimile station, determining whether the specified call destination is another facsimile station; and

in response to determining that the call destination is not another facsimile station, completing the call to a facsimile destination associated with the specified call destination.

3. A method of setting up a facsimile call comprising the steps of:

recognizing that the call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in a common channel signaling (CCS) message to a switching system; and

processing the call as a facsimile call in the switching system.

4. The method of claim 3 wherein said recognizing comprises the step of:

performing a class of service translation in a local office to determine that a line is connected to a facsimile station.

5. The method of claim 3 wherein said recognizing comprises the steps of:

receiving an automatic number identification (ANI) number of a calling customer; and

translating said ANI number to determine whether a line associated with said ANI number is connected to a facsimile station.

6. The method of claim 3 wherein said recognizing step comprises the step of:

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recognizing that the call is from a line which originates facsimile calls and other calls;

connecting a receiver to said call; and

detecting a signal identifying a facsimile call in said receiver for said call.

7. The method of claim 6 wherein said receiver is a dual tone multifrequency (DTMF) receiver, and wherein said signal is a DTMF signal keyed at a customer station.

8. The method of claim 3 wherein said processing step comprises the steps of:

detecting that said call is an international call; and

if said call is a facsimile call, routing said call over special transmission facilities for transmitting facsimile calls.

9. The method of claim 3 wherein said processing step comprises the steps of:

determining that the call destination is not another facsimile station;

translating from the identity of the destination to the identity of an associated facsimile station; and

completing the call to the associated facsimile station.

10. The method of claim 3 further comprising the steps of:

detecting that a destination of said call is busy;

automatically reconnecting said call to a store and forward facility for subsequent delivery.

11. The method of claim 3 further comprising the step of:

following said processing step, responsive to reception of dialed information from a caller of said call, connecting said call to a store and forward facility for storing a facsimile message for subsequent delivery without requiring said caller to reoriginate.

12. A switching system, comprising:

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a translation table for storing voice to fax number translations; and

processor means, operative under the control of a program, and responsive to receipt of a call with a fax indicator and a voice destination number, for detecting said fax indicator, and for translating said voice number to a fax number if said fax indicator is detected, and for completing said call to said fax number.

13. A switching system comprising:

a table for storing telephone numbers of facsimile machines originating calls served by said system; and

processor means, operative under the control of a program, for inserting a fax indicator in common channel signaling (CCS) messages for calls from one of said telephone numbers of facsimile machines.

14. The system of claim 13 further comprising:

means for receiving said telephone number as an Automatic Number Identification (ANI) number from another switching system.

15. A switching system comprising:

class of service indications of lines connected to facsimile machines; and

processor means, operative under the control of a program, for recognizing said class of service indications and, responsive to said recognition on a call for inserting a fax indicator in common channel signaling (CCS) messages for said call.

16. A switching system comprising:

a dual tone multifrequency (DTMF) receiver;

a table for storing telephone numbers of facsimile machines originating calls served by said system; and

processor means, operative under the control of a program, for recognizing a fax call from one of said telephone numbers to another number, for connecting said DTMF receiver to said call, and responsive to signals received by said DTMF receiver, for extending said call to a fax store and forward facility, and for forwarding said one of said telephone numbers and said another number to said fax store and forward facility.

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17. A method of setting up a facsimile call comprising the steps of:

recognizing that said call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in a common channel signaling (CCS) message to a switching system;

processing the call as a facsimile call in the switching system; and

responsive to reception of dialed information from a caller of said call, connecting said call to a store and forward facility for storing a facsimile message for subsequent delivery without requiring said caller to reoriginate;

wherein said recognizing comprises the steps of:

receiving an automatic number identification (ANI) number of a calling customer; and

translating said ANI number to determine whether a line associated with said ANI number is connected to a facsimile station;

wherein said processing step comprises the steps of:

determining that a call destination for said call is not another facsimile station;

translating from an identity of said destination to an identity of an associated facsimile station; and

completing the call to said identified associated facsimile station.

18. The method of claim 3 wherein the recognizing step comprises:

detecting at a local switch that a class of service of a caller of the call is facsimile; and

transmitting an indication that the call is a facsimile call to another switching system for setting the facsimile indicator.

19. The method of claim 18 wherein the indication is carried in information digits from a local exchange carrier to an interexchange carrier.

20. A call establishment method for a specialized call type comprising:

recognizing the specialized call type at an ingress switching system to a communications network;

transmitting data identifying a nominal destination of the call and data identifying the specialized call type to an egress switching system of the network; and

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translating the combination of the specialized call type and the nominal destination to determine an alternate destination for the specialized call type and extending the call from the egress switching system toward the alternate destination.

21. The method of claim 20 wherein the transmitting comprises transmitting an indication identifying the specialized call type within a common channel signaling message from the ingress switching system to the egress switching system.

22. The method of claim 20 wherein the translating comprises searching a table for an entry, comprising an indication of the alternate destination, the entry identified by the nominal destination and the specialized call type.

23. The method of claim 20 wherein the recognizing comprises:

receiving an automatic number identification (ANI) number from a switching system connected to the ingress switching system; and

testing whether the ANI number is listed as one for a telecommunications station that generates the specialized call type of call.

24. The method of claim 20 wherein the specialized call type is a facsimile call.

25. The method of claim 20 wherein the recognizing comprises:

detecting at a local switch that a call is a specialized type of call; and

signaling to said ingress switching system an indication of said specialized type of call.

26. The method of claim 25 wherein the data identifying the specialized call type comprises said indication.

27. A method of processing a fax call comprising:

receiving a call from a fax station to a number of other than a fax facility; and

in response to said receiving, automatically sending each said call to a fax facility.

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28. The method of claim 27 further comprising:
responsive to said receiving, detecting a fax signal of said call;
wherein said sending is performed responsive to said detecting.

29. The method of claim 27, wherein said receiving comprises:
recognizing at an ingress switch of a communications network for establishing said call that said call is from a fax station;
transmitting a fax signal for said call to an egress switch of said network; and
recognizing at said egress switch that said call, having said fax signal, is directed to said number of other than a fax facility.

30. The method of claim 29, wherein said first recognizing comprises:
translating from an identity of said fax station to a fax class of service.

31. The method of claim 30 wherein said identity is a number identified by automatic number identification at a local switching system and transmitted to said ingress switch.

32. The method of claim 29 wherein said transmitting comprises:
transmitting said fax signal as part of a common channel signaling message from said ingress switch to said egress switch.

33. The method of claim 29 wherein said second recognizing comprises:
translating said number to an indication of whether said number is for a fax facility.

34. The method of claim 33 wherein said sending comprises:
translating said number to a number of said fax facility.

35. A method of setting up a facsimile call comprising the steps of:
recognizing a special dialed prefix of the call indicating that the call is from a facsimile station;
responsive to said recognizing, setting a facsimile indicator in data of a common channel signaling (CCS) message to a switching system; and

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processing the call as a facsimile call in the switching system.

36. The method of claim 35 wherein said special dialed prefix comprises a special common carrier code.

37. The method of claim 35 wherein said special dialed prefix comprises a non-numeric dialed indicator.

38. A method of setting up a facsimile call comprising the steps of:

recognizing a facsimile call identifier in a signaling message from customer equipment;

responsive to said recognizing, setting a facsimile indicator in data of a common channel signaling (CCS) message to a switching system; and

processing the call as a facsimile call in the switching system.

39. The method of claim 38 further comprising:

sending said signaling message over an integrated signaling line.

40. The method of claim 39 wherein said sending comprises:

sending said message over an integrated services digital network (ISDN) line.

41. The method of claims 35 or 38 wherein said processing step comprises the steps of:

determining that the call destination is other than a facsimile station;

responsive to said determining, translating the identity of the call destination to the identity of an associated facsimile station; and

responsive to said translating, completing the call to the associated facsimile station.

42. The method of claim 41 further comprising:

responsive to said translating, sending an indication of a received facsimile message to said call destination.

43. The method of claim 41 wherein said translating comprises:

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translating the identity of the call destination to the identity of a plurality of associated facsimile stations; and

selecting one of said plurality according to time of day or day of week.

44. The method of claim 41 wherein said translating comprises:

translating the identify of the call destination to the identity of a plurality of associated facsimile stations; and

selecting one of said plurality that is available.

45. The method of claims 35 or 38 further comprising the steps of:

detecting that a destination of said call is busy;

automatically connecting said call to a store and forward facility for subsequent delivery.

46. The method of claims 35 or 38 further comprising the step of:

following said processing step, responsive to reception of dialed information from a caller of said call, automatically connecting said call to a store and forward facility for storing a facsimile message for subsequent delivery without requiring said caller to reoriginate.

47. The method of claims 35 or 38 wherein said processing step comprises the steps of:

detecting that said call is an international call; and

responsive to said detecting, routing said call over special transmission facilities for transmitting facsimile calls.

48. The method of claims 35 or 38 further comprising the step of:

responsive to said recognizing, setting a preferred facilities indicator in data of said common channel signaling message; and

wherein said processing step comprises the steps of:

detecting that said call is an international call; and

responsive to said detecting, if said preferred facilities indicator is set, routing said call over selected special transmission facilities.

49. The method of claim 48 wherein said setting a preferred facilities indicator comprises:

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testing whether said facsimile station has a class of service for requesting use of preferred facilities on international calls.

50. A method of setting up a facsimile call comprising the steps of:

recognizing that the call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in a common channel signaling (CCS) message to a switching system; and

responsive to receiving said message in said switching system, checking whether the call is to be forwarded to a store and forward system; and

responsive to the check, forwarding the call from said switching system to a store and forward system.

51. The method of claim 50 wherein said checking comprises:

checking a status of a destination of said call to determine whether the call is to a busy destination.

52. The method of claim 50 wherein said checking comprises:

checking data for a destination of said call to determine whether the call is to be forwarded for the time of day and day of week.

53. A method of setting up a facsimile call comprising the steps of:

recognizing that the call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in data of a common channel signaling (CCS) message to a switching system; and

processing the call as a facsimile call in the switching system;

wherein said processing comprises:

responsive to receiving said message, checking whether the call is to be forwarded to another facsimile line; and

responsive to the check, forwarding the call to said another facsimile line.

54. A method of sending a facsimile message from a first facsimile station to a second facsimile station comprising:

extending a connection from the first facsimile station to an egress switch of a telecommunications network;

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in said egress switch, checking a store and forward indicator in data of the second facsimile station;

if the second facsimile station is busy and the indicator is set, extending the connection to a facsimile store and forward facility; and

subsequently, delivering the message from the store and forward facility to the second facsimile station.

55. The method of claim 54 wherein the second facsimile station is a group of stations, and wherein the connection is extended to the store and forward facility if all the members of the group are busy.

56. A method of setting up a facsimile call comprising the steps of:

recognizing that the call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in a common channel signaling (CCS) message to a switching system, said message comprising a first number identifying said facsimile station and a second number identifying a destination;

responsive to receiving said message in said switching system, translating from said second number to derive screening data; and

responsive to said translating, comparing that said screening data with said first number to determine whether the call should be extended from said switching system toward another switching system for completing said call.

57. A method of setting up a facsimile call comprising the steps of:

recognizing that the call is from a facsimile station;

responsive to said recognizing, setting a facsimile indicator in data of a common channel signaling (CCS) message to a switching system;

responsive to receipt of said CCS message, detecting that said call is an international call; and

translating from a destination number received in said CCS message to an associated facsimile destination number for extending said call from said switching system toward a facsimile station associated with said destination number.

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SPECIAL SERVICE CALL ROUTING

Abstract

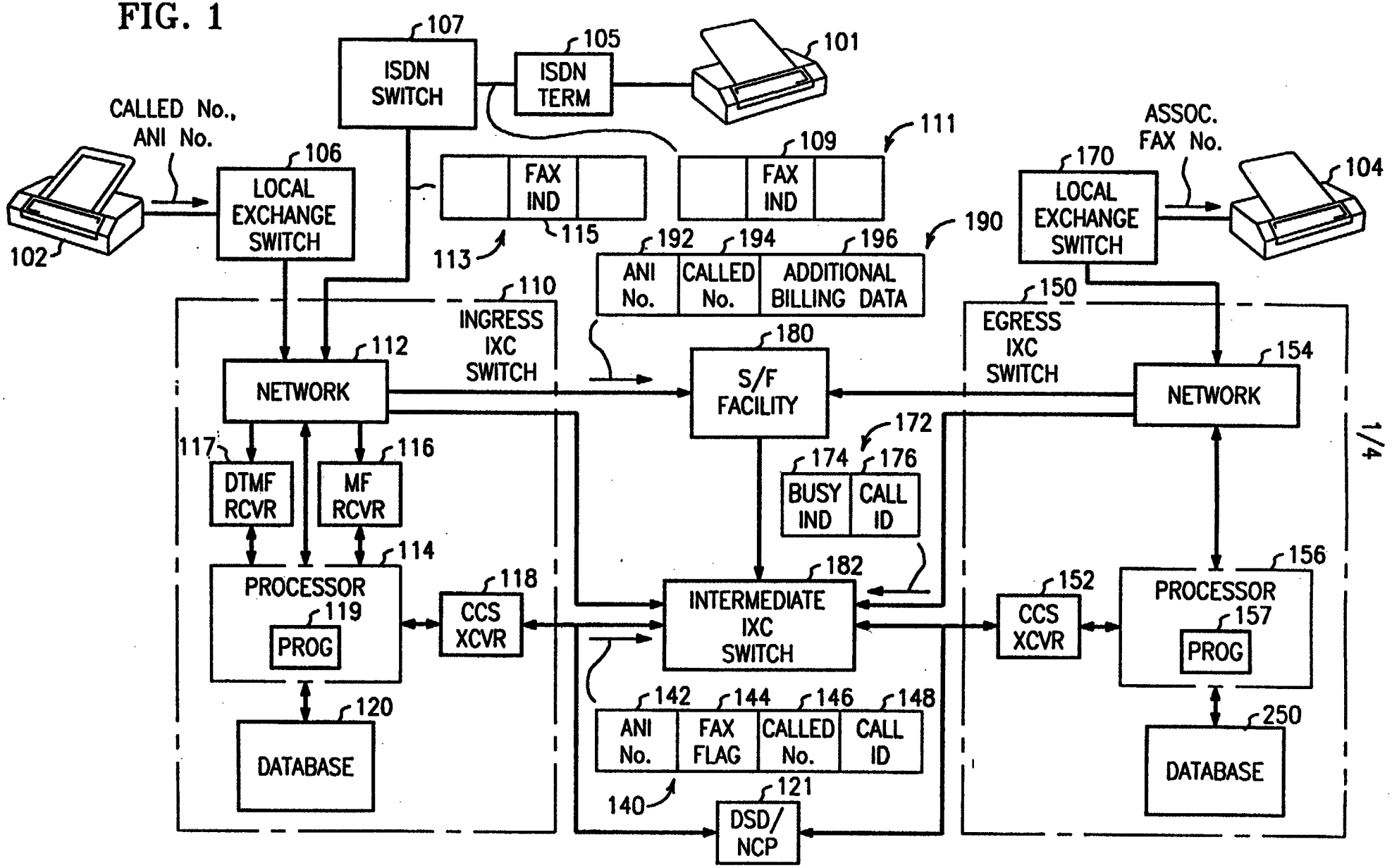
This invention relates to methods of establishing facsimile (fax) connections. If a call is originated from a fax source and the destination is a voice station, then the call will be automatically redirected to a fax machine designated to receive fax messages for the voice station. A fax call is detected by a class of service indication in a local switching office, or by having a number forwarded to a toll office from a local office by Automatic Number Identification (ANI) of the caller that is one of a list of fax numbers. When it is determined that a call is a fax call, a fax indicator is sent with Common Channel Signaling (CCS) messages for that call. If a call with a fax indicator is received in a destination switching office, then the destination office checks to see if the called number is a fax number; if not, translation is made to find the number of a fax station for serving fax calls to the called number, and the call is completed to that fax station. Advantageously, customers need not know a fax number to transmit a fax message to an intended recipient.

Three types of problems arise in treating such calls: recognition that the call is a fax call, transmitting that recognition to a far end switch, and redirecting the call at the fax end switch. Among the other techniques used for recognition are a fax class mark in an originating message from an Integrated Services Digital Network (ISDN) line or a dialed prefix such as #, #3, or an alternative common carrier code (10XXX) from an ordinary line. The redirection includes automatic redirection to a store and forward system on busy or no answer, routing to one of a plurality of alternative destinations based on the day and time, screening junk fax, and lighting a fax message waiting lamp on the called (voice) destination. For international calls, a translation from voice to fax may be made at an egress gateway switch; the fax calls may also be automatically routed over low distortion international transmission facilities.

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FIG. 1


107
ISDN SWITCH
105
ISDN TERM
101
CALLED No., ANI No.
102
106
LOCAL EXCHANGE SWITCH
FAX IND
109
111
113
115
ASSOC. FAX No.
104
170
LOCAL EXCHANGE SWITCH
190
192
194
196
ANI No.
CALLED No.
ADDITIONAL BILLING DATA
110
INGRESS IXC SWITCH
150
EGRESS IXC SWITCH
112
NETWORK
180
S/F FACILITY
154
NETWORK
172
174
176
BUSY IND
CALL ID
117
DTMF RCVR
116
MF RCVR
114
PROCESSOR
119
PROG
118
CCS XCVR
182
INTERMEDIATE IXC SWITCH
152
CCS XCVR
156
PROCESSOR
157
PROG
120
DATABASE
142
144
146
148
ANI No.
FAX FLAG
CALLED No.
CALL ID
250
DATABASE
140
121
DSD/ NCP
1/4

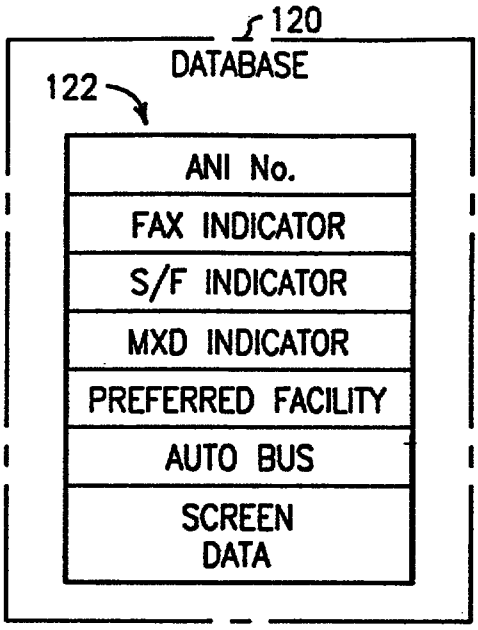

120
DATABASE
122
ANI No.
FAX INDICATOR
S/F INDICATOR
MXD INDICATOR
PREFERRED FACILITY
AUTO BUS
SCREEN DATA

FIG. 2

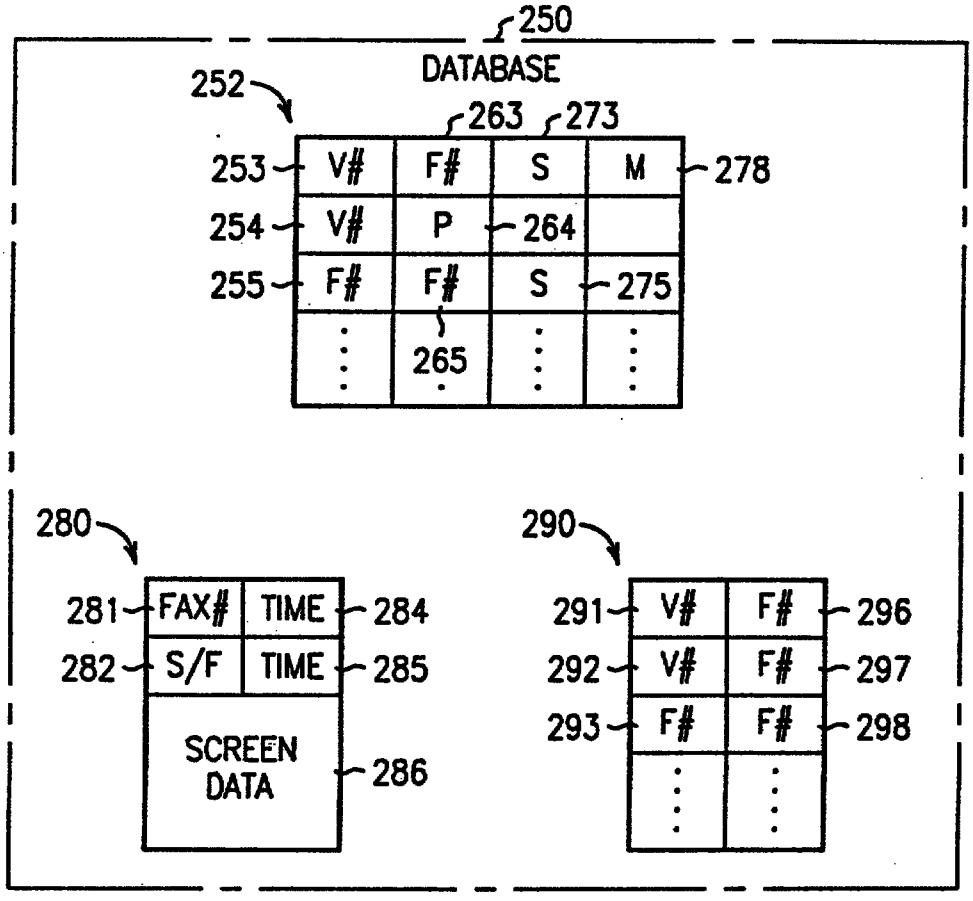

250
DATABASE
252
263
273
253
V#
F#
S
M
278
254
V#
P
264
255
F#
F#
S
275
265
280
281
FAX#
TIME
284
282
S/F
TIME
285
SCREEN DATA
286
290
291
V#
F#
296
292
V#
F#
297
293
F#
F#
298

FIG. 3

FIG. 4

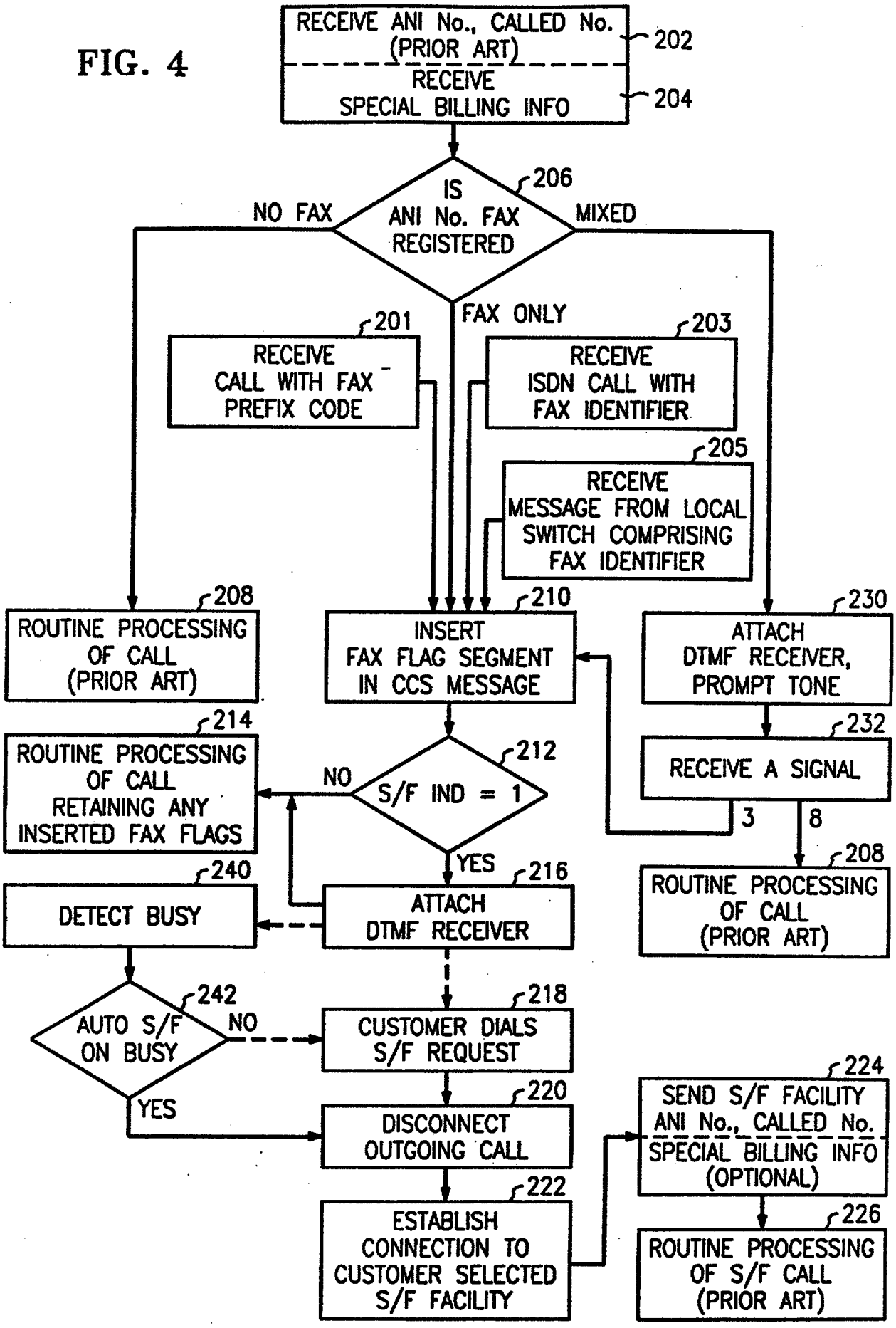
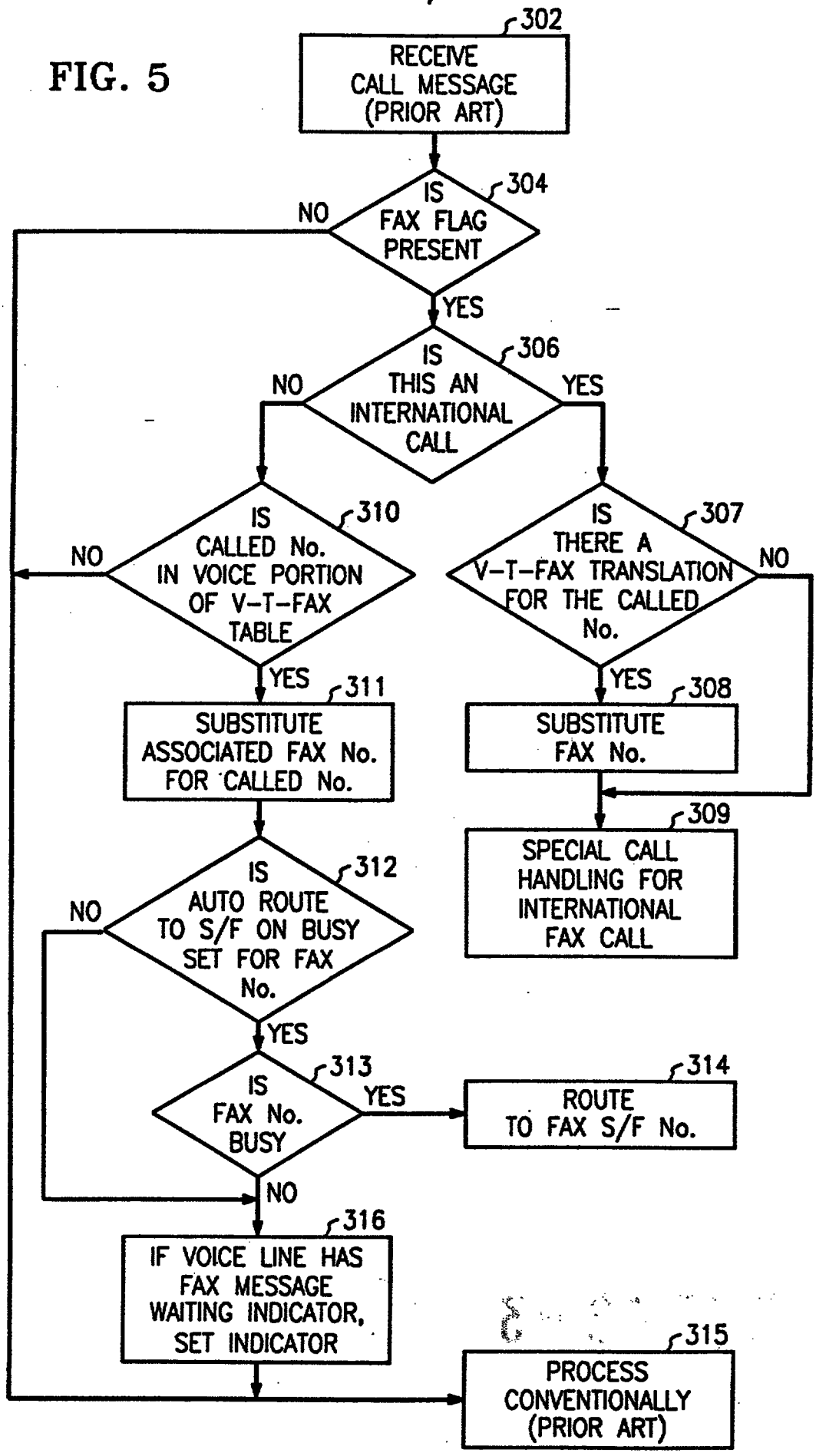

RECEIVE ANI No., CALLED No. (PRIOR ART)
202
RECEIVE SPECIAL BILLING INFO
204
IS ANI No. FAX REGISTERED
206
NO FAX
MIXED
FAX ONLY
201
RECEIVE CALL WITH FAX PREFIX CODE
203
RECEIVE ISDN CALL WITH FAX IDENTIFIER
205
RECEIVE MESSAGE FROM LOCAL SWITCH COMPRISING FAX IDENTIFIER
208
ROUTINE PROCESSING OF CALL (PRIOR ART)
210
INSERT FAX FLAG SEGMENT IN CCS MESSAGE
230
ATTACH DTMF RECEIVER, PROMPT TONE
214
ROUTINE PROCESSING OF CALL RETAINING ANY INSERTED FAX FLAGS
212
NO
S/F IND = 1
YES
232
RECEIVE A SIGNAL
3
8
208
ROUTINE PROCESSING OF CALL (PRIOR ART)
240
DETECT BUSY
216
ATTACH DTMF RECEIVER
242
AUTO S/F ON BUSY
NO
YES
218
CUSTOMER DIALS S/F REQUEST
220
DISCONNECT OUTGOING CALL
222
ESTABLISH CONNECTION TO CUSTOMER SELECTED S/F FACILITY
224
SEND S/F FACILITY ANI No., CALLED No. SPECIAL BILLING INFO (OPTIONAL)
226
ROUTINE PROCESSING OF S/F CALL (PRIOR ART)

FIG. 5


302
RECEIVE CALL MESSAGE (PRIOR ART)
304
IS FAX FLAG PRESENT
NO
YES
306
IS THIS AN INTERNATIONAL CALL
NO
YES
310
IS CALLED No. IN VOICE PORTION OF V-T-FAX TABLE
NO
YES
311
SUBSTITUTE ASSOCIATED FAX No. FOR CALLED No.
307
IS THERE A V-T-FAX TRANSLATION FOR THE CALLED No.
NO
YES
308
SUBSTITUTE FAX No.
309
SPECIAL CALL HANDLING FOR INTERNATIONAL FAX CALL
312
IS AUTO ROUTE TO S/F ON BUSY SET FOR FAX No.
NO
YES
313
IS FAX No. BUSY
YES
314
ROUTE TO FAX S/F No.
NO
316
IF VOICE LINE HAS FAX MESSAGE WAITING INDICATOR, SET INDICATOR
315
PROCESS CONVENTIONALLY (PRIOR ART)

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REPLACEMENT SHEET
22 JUN 1996

SPECIAL SERVICE CALL ROUTING

ABSTRACT

This invention relates to methods of establishing facsimile (fax) connections. If a call is originated from a fax source and the destination is a voice station, then the call will be automatically redirected to a fax machine designated to receive fax messages for the voice station. A fax call is detected by a class of service indication in a local switching office, or by having a number forwarded to a toll office from a local office by Automatic Nnumber Identification (ANI) of the caller that is one of a list of fax numbers. When it is determined that a call is a fax call, a fax indicator is sent with Common Channel Signaling (CCS) messages for that call. If a call with a fax indicator is received in a destination switching office, then the destination office checks to see if the called number is a fax number, if not, translation is made to find the number of a fax station for serving fax calls to the called number, and the call is completed to that fax station. Advantageously, customers need not know a fax number to transmit a fax message to an intended recipient.

FIGURE 4.

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REPLACEMENT SHEET
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Claims

1. A fax call method comprising the steps of:

receiving in a terminating switching system (170) a fax call identified by a voice terminating number (146);

translating in said switching system said voice terminating number to data for deriving an equipment location connected to a fax station (104) for serving fax calls for a voice station identified by said voice terminating number; and

if said fax station is available, completing said fax call to said fax station in a terminating switching system (170) connected to said fax station;

characterized in that the method further comprises the steps of:

translating (206) an originating directory number (146) of said call to determine whether said originating directory number is for a fax station;

responsive to a determination that said originating directory number is for a fax station, inserting a fax indicator (144) into a common channel signaling message (140) for said call;

receiving a signaling message for said call in a toll or a tandem switching system (150) switchably connectable to a terminating switch (170) for serving said voice terminating number, said signaling message comprising a fax indicator;

determining in said toll or tandem switching system whether said voice directory number is a fax terminating number (310);

if said toll or tandem switching system determines that said voice terminating number is not a fax terminating number, translating (311) said voice terminating number to a fax terminating number of a fax station for serving fax calls to a voice station identified by said voice terminating number, and transmitting said fax terminating number to said terminating switching system to provide said data for deriving said equipment location;

in said terminating switching system, translating from said fax terminating number received from said toll or tandem switching system to derive said equipment location of said fax station.

2. The method of claim 1 further comprising the step of:

receiving said terminating number from an analog caller station.

3. The method of claim 1 or 2 further comprising the step of:

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if said fax station is busy, automatically reconnecting (240, 242, 220, 222) said call to a store and forward facility for subsequent delivery.

4. The method of claim 1 wherein the step of translating an originating number comprises the step of receiving a telephone number of an originating station of said fax call and translating said telephone number into an indication that said telephone number is for a fax station.

5. The method of claim 1 wherein the step of translating an originating number comprises the steps of:

determining that the call is from the line which originates fax calls and other calls;

connecting a receiver to said call; and

detecting a signal identifying a facsimile call in said receiver for said call.

6. The method of claim 1 wherein the step of translating said voice terminating number comprises translating said terminating number to an identity of a plurality of associated facsimile stations; and

selecting one of said plurality according to time of day or week.

7. The method of claim 1 wherein the step of translating said fax terminating number comprises translating said fax terminating number to the identity of a plurality of associated facsimile stations; and

selecting one of said plurality that is available.

8. Telecommunications apparatus for establishing a fax call, comprising:

a toll or tandem switching system (150) for receiving a call, identified by a terminating number, and for forwarding said call toward a terminating switching system (170);

characterized in that said toll or tandem switching system further comprises:

processor means (156) operative under program control (150) for determining whether said call is a fax call by testing (304) for a fax indicator (144) in a common channel signaling message (140) for said call;

if it is determined that said call is a fax call, testing (310) via data in a database (250) of said toll or tandem switching system whether said terminating number is a number of a voice station;

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31 OCT 1997

if it is determined that said terminating number is the number of a voice station, translating (311) to determine a directory number of a fax station for serving calls for said voice station;and

providing (311) said directory number of said fax station as the directory number for said call to a terminating switching system (170) connected to said fax station.

SPECIAL SERVICE CALL ROUTING

ABSTRACT

This invention relates to methods of establishing facsimile (fax) connections. If a call is originated from a fax source and the destination is a voice station, then the call will be automatically redirected to a fax machine designated to receive fax messages for the voice station. A fax call is detected by a class of service indication in a local switching office, or by having a number forwarded to a toll office from a local office by Automatic Nnumber Identification (ANI) of the caller that is one of a list of fax numbers. When it is determined that a call is a fax call, a fax indicator is sent with Common Channel Signaling (CCS) messages for that call. If a call with a fax indicator is received in a destination switching office, then the destination office checks to see if the called number is a fax number, if not, translation is made to find the number of a fax station for serving fax calls to the called number, and the call is completed to that fax station. Advantageously, customers need not know a fax number to transmit a fax message to an intended recipient.

FIGURE 4.

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10 MAR 1998