CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING
OPERATOR IDENTIFIED
GENERAL DESCRIPTIVE INFORMATION
CROSSBAR TANDEM OFFICES

CONTENTS PAGE

FIGURES

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1. INTRODUCTION

1.01 This section describes the application of operator identified CAMA (centralized automatic message accounting) to crossbar tandem offices in panel, crossbar, and step-by-step areas.

1.02 This section is reissued to include crossbar tandem CAMA operation in step-by-step areas. The new circuits designed for this type of operation use the new wire-spring relays and reed diodes. The use of operating centers which are not in the same building as the CAMA tandem office is also described. Since this section covers a general revision, arrows used to indicate changes have been omitted.

1.03 Operator identified CAMA is a means of recording charge data at a centralized point, whereby a customer can dial certain charge calls which were formerly placed through an operator. After completion of dialing by the customer, a CAMA operator comes in on the connection, requests the calling number, and keys it into the sender which has already registered the called number. Both the calling and called numbers are passed from the sender to the AMA equipment which uses them and other information to produce a perforated tape containing the charge data. This tape is then processed at an AMA accounting center.

1.04 Operator identified CAMA provides AMA service for all customers in offices which cannot economically justify local central office AMA and for 4-party and multiparty line customers in offices equipped with local AMA. In accordance with the general plan for full automatic customer dialing, the areas in which CAMA calls originate and terminate must operate on a 2-5 numbering plan.

1.05 Two senders (one which receives PCI pulses and one which receives dial pulses) have been developed to handle AMA traffic at crossbar tandem offices. The PCI sender can receive a maximum of eight digits and outpulse a maximum of eight digits on a multifrequency or dial pulse basis, four digits on a revertive basis, or five digits on a PCI basis. The DP sender can receive a maximum of eleven digits and outpulse a maximum of eleven digits on a multifrequency or dial pulse basis, four digits on a revertive basis, or five digits on a PCI basis. These same senders may also be used for non-AMA calls. The DP sender can be used for operator dialed calls and can complete these calls either by outpulsing or on a straightforward basis.

1.06 Customers in a step-by-step area dial a directing code to reach the tandem office and the remaining digits are dialed without pause. An incoming register and a fast register link have been developed to store the first three digits after the directing code.

1.07 In panel and crossbar areas, the digits are dialed into an originating sender and are forwarded to the tandem office when the tandem sender is attached. The markers and decoders in the originating offices must be arranged for routing to tandem on codes which were formerly treated as vacant or restricted.

1.08 For traffic originating in panel or crossbar areas, a choice between revertive and PCI pulsing to crossbar tandem was available. PCI was chosen because of the greater code coverage. With revertive pulsing, a maximum of 300 office codes can be transmitted, and three trunk groups are required to obtain this maximum. With PCI pulsing, a maximum of 800 office codes can be transmitted, and separate trunk groups are not required.

1.09 This section is primarily concerned with a general description of centralized automatic message accounting - operator identified, as used in panel, crossbar, and step-by-step areas. Because an understanding of both crossbar tandem and AMA operation provides a helpful background to this general description, brief summaries of them are given in this section.

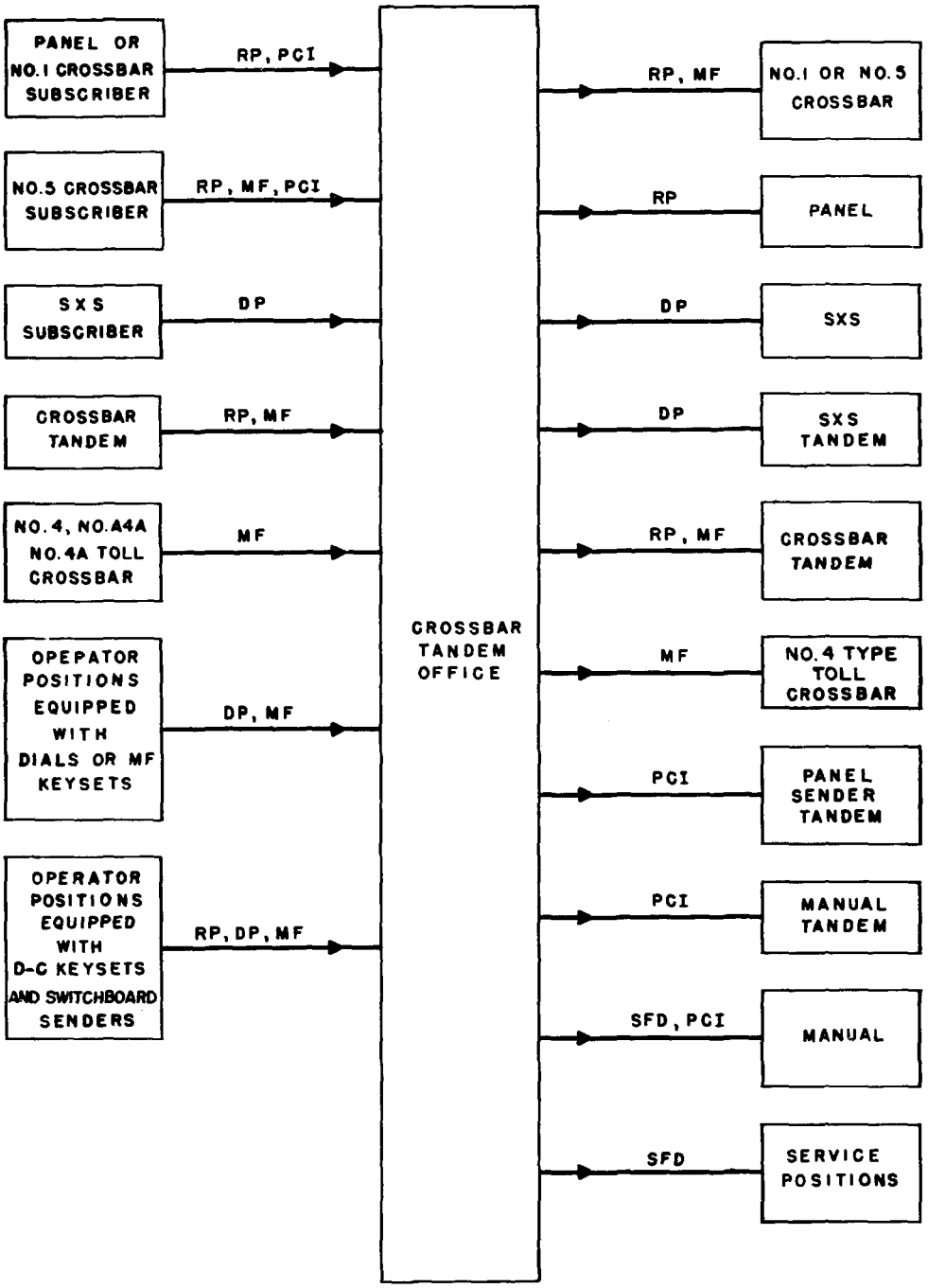
2. CROSSBAR TANDEM

A. General

2.01 Crossbar tandem is a marker-type common control switching system which can be used for local tandem operation and limited inward and outward toll operation in panel, crossbar, and step-by-step areas. A block diagram of the sources and destinations of traffic routed by a crossbar tandem system is shown in Fig. 1.

2.02 This system routes both customer and operator dialed calls and can be used in a 2- or 3-digit area or a combination 2- and 3-digit area. Until recently, toll operation has been limited to handling inward and outward calls requiring a maximum of eight digits. An 11-digit feature added to an incoming multifrequency sender and a new 11-digit dial pulse incoming sender are now available. These permit through switching (intertoll to intertoll) at points where transmission arrangements for such switching are provided.

2.03 Traffic from other dial offices can be received on a revertive, PCI, dial, or multifrequency pulsing basis. Traffic is also received on a dial or multifrequency basis from operators at positions equipped with dials or keysets. Crossbar tandem sends traffic to other dial offices on a revertive, dial, PCI, or multifrequency pulsing basis, or to manual offices on a PCI or straightforward basis. However, all senders cannot be equipped for all types of outpulsing.



NOTE: ALL SENDERS CANNOT BE EQUIPPED FOR ALL TYPES OF OUTPULSING SHOWN ABOVE.

Fig. 1 - Block Diagram of Sources and Destinations of Traffic Routed Through Crossbar Tandem Systems

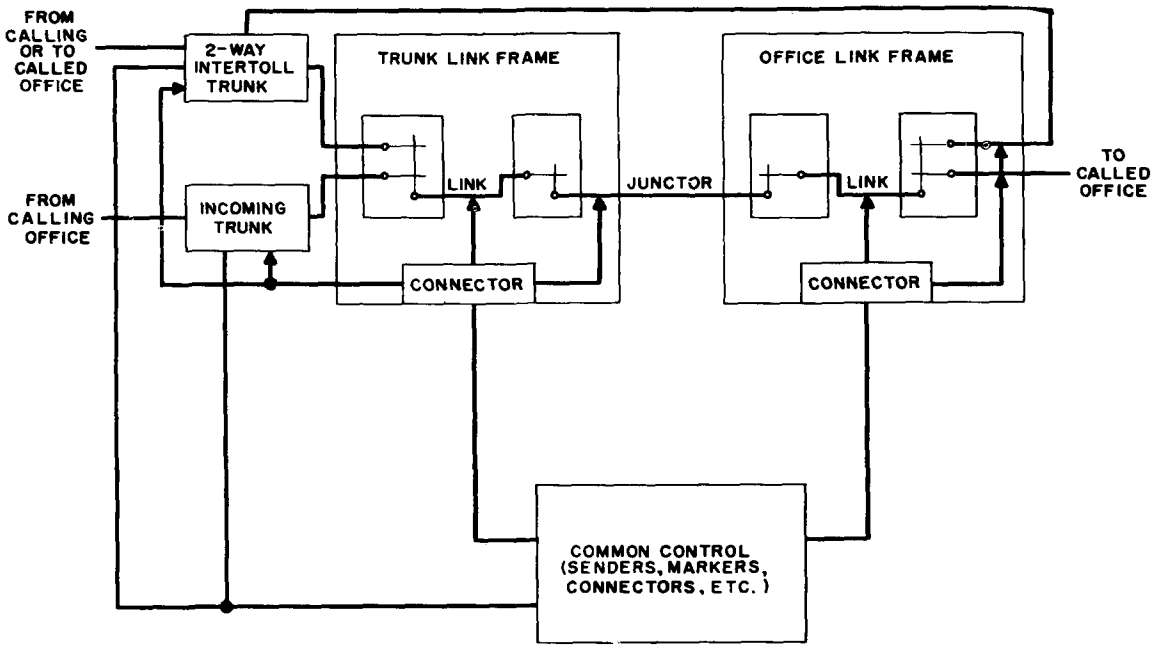


Fig. 2 - Basic Switching Plan of Crossbar Tandem Systems

B. Switching Plan

2.04 Fig. 2 shows the basic switching plan of a crossbar tandem system. Incoming trunks appear on trunk link frames and outgoing trunks on office link frames. Two-way trunks appear on both the trunk link and office link frames. Through a system of links and junctors, which interconnect the crossbar switches on these frames, any incoming trunk can be connected to any outgoing trunk. For each connection there are several possible paths (or channels) through these frames, and on a call, one of these paths is selected by the common control equipment.

2.05 To establish a path, the incoming trunk calls for the services of the common control equipment. This equipment consists of a small number of elements (senders, markers, etc.) each of which is called into service for a relatively short time, performs its functions, releases, and is free to serve another call. These functions are listed below:

(a) Store the digits as they are received.

(b) Translate these digits.

(c) Test for and select an idle outgoing trunk.

(d) Test for and select an idle channel.

(e) Outpulse, if required.

C. Equipment Elements

2.06 A crossbar tandem office can be equipped with terminations for a maximum of 3200 incoming trunks (2000 AMA trunks, maximum) and 4000 outgoing trunks, although traffic carrying capacity will limit these numbers to something less. The incoming trunk capacity is based on 160 trunks on each of 20 trunk link frames. In the past, 130 trunks was about the highest realizable, but 2-way intertoll trunks are being introduced which, with their lighter incoming load, will permit the use of more of the trunk link terminations. The outgoing trunk capacity is based on 200 trunks on each of 20 office link frames equipped with extension frames.

2.07 Incoming trunks are connected to senders through sender link frames. These frames may be arranged to provide access to one or two types of senders. When all the trunks are of the same type (with respect to pulsing), the frame provides a maximum of 100 trunks with access to a maximum of 40 senders all of the same type. When there are two types of trunks, the frame gives the first type of trunk access to 40 senders of one tvpe and the second type access to 40 senders of another type. Two controllers, mounted on each sender link frame, test for idle senders and operate crossbar switches to set up connections between the trunks and senders.

2.08 Four types of senders (MF, DP, RP, and PCI) are available for crossbar tandem offices. Each multifrequency sender has an associated multifrequency receiving unit which detects combinations of two incoming frequencies and registers the corresponding digits in the sender.

2.09 Marker connectors connect senders to markers. Each connector gives a maximum of five senders access to all the markers (maximum of eight) in an office.

2.10 A marker performs the following operations:

(a) Receives information from a sender.

(b) Analyzes this information.

(c) Returns to the sender whatever information the sender needs to complete its functions.

(d) Tests for and selects an idle outgoing trunk.

(e) Tests for and selects an idle channel.

2.11 A maximum of 800 office codes can be used with dial, multifrequency, and PCI senders, and a maximum of 300 office codes can be used with revertive senders. In addition, a maximum of 300 TX codes and 190 miscellaneous codes, which are assignable to trunk groups outgoing to operators, service desks, intertoll trunks, etc., can be used with dial and multifrequency senders.

2.12 The marker frame is a multibay frame consisting of two common equipment unit bays and several types of supplementary bays. The two common unit bays have space for a maximum of 120 route relays and may be used alone if the office is equipped with revertive senders only. One type of supplementary bay is added when dial, multifrequency, or PCI senders are used or when more than 120 route relays are required for revertive pulse operation. A second type of supplementary bay is provided when additional route relays are required for any type of sender operation. A third type of supplementary bay, one per marker, has been used in existing jobs when two to ten classes of service are used with dial, multifrequency, or PCI operation. A newer class-of-service bay which serves two markers is now standard.

2.13 The facilities provided for maintaining crossbar tandem equipment are similar to those used in local crossbar offices, and include automatic sender and trunk test frames, test line circuits, a marker trouble indicator frame, etc.

3. AMA FEATURES OF CROSSBAR TANDEM

A. General

3.01 This description of automatic message accounting is limited to that operation and equipment which applies to CAMA. Although an operator is used in CAMA, her only function is to obtain the calling number and key it into the equipment. The charge data entries are perforated on tapes in a coded form. These tapes are periodically taken to an accounting center where they are processed into a form from which customer bills are prepared.

B. Tape Entries

Call Entries

3.02 Three tape entries are perforated for each call.

(a) An initial entry (two, four, or five lines) when the call is received at the tandem office and before the talking path is cut through.

(b) An answer time entry (one line) when the called party answers.

(c) A disconnect time entry (one line) when the calling party disconnects.

3.03 The entries for a large number of calls, many of which may be going on at the same time, are recorded on a single continuous tape (one per recorder) and there are usually entries for other calls interspersed between the three entries for one call. However, each entry for a given call carries the number (call identity index) of the incoming trunk used for the call. This number is used by the accounting center equipment to assemble the initial, answer, and disconnect entries of the call for further processing.

Initial Entries

3.04 A message unit (MU) initial entry, consisting of two lines, is made for message unit calls which are billed on a bulk basis. A message unit detail (MUD) initial entry, consisting of four lines, is made when it is desired to obtain a complete record of the details of a message unit call. This is for operating company information only; the customer still receives bulk billing. A toll statement (TS) initial entry, consisting of four or five lines, is made on all calls for which the customer receives a detail record in the form of a toll statement. The 4-line entry may be used when it is desired to identify the called area by a single digit on the perforated tape. The 5-line entry must be used when all three digits of the called area are perforated on the tape.

3.05 The 2-, 4-, and 5-line initial entries all contain the following information:

(a) An entry index for each line which controls the accounting center equipment during the processing of the tape.

(b) The calling office index - a single-digit number arbitrarily assigned to identify a central office within a recorder group.

(c) The calling line numerals - these, together with the calling office index, establish the calling subscriber's directory number.

(d) The message billing index - a single-digit number which identifies the call as message unit or toll and indicates to the accounting center equipment how to compute

the charges for the call. The digits 1 to 8 are used for message unit calls, the digit 9 for toll calls, and the digit 0 for test calls.

(e) The call identity index - a 2-digit number assigned to each trunk associated with a recorder.

3.06 The 4- and 5-line initial entries used for detail record calls contain the following information in addition to that covered in 3.05:

(a) The called office code.

(b) The called line numerals.

(c) The called number index - a single-digit number which indicates whether the called number has four numerals (with or without a party letter) or five numerals.

(d) The area index - a single-digit number (ten maximum) which identifies the numbering plan area in which the called office is located. This is used on 4-line entries only.

(e) The area code - the three digits which identify the called area. This is used on 5-line entries only.

Answer and Disconnect Entries

3.07 The answer and disconnect entries are single-line entries which are identical except for the time indicated. They contain the following information:

(a) An entry index.

(b) The time in minutes and tenths of a minute.

(c) The same call identity index which appears on the associated initial entry. The accounting center equipment distinguishes between the answer and disconnect entries for a particular call by their relative positions on the tape.

3.08 A timed release entry is made when the called customer disconnects and the calling customer delays disconnecting for a given interval. This entry is identified by a distinctive entry index which instructs the accounting center equipment to subtract a time allowance before computing the elapsed time.

Miscellaneous Entries

3.09 In addition to the call entries, other entries, such as those which identify the tape for processing, and splice entries which indicate a section where the tape can be cut, are recorded on the tape by the central office equipment either automatically or as a result of maintenance force operations. Time is also perforated in the form of hour entries, starting at midnight as 00 and ending at 11:00 P.M. the next night as 23. These entries facilitate compiling and billing at the accounting center.

C. Handling of the Tapes

3.10 At 3:00 A.M. each day, a series of identification entries are recorded automatically on the tape. Then a splice pattern, which provides a visually identifiable cutting area, and another set of identification entries are perforated. Thus, when the tape is cut in the splice pattern area, both the end of the old tape and the beginning of the new tape are left with identification entries. The tapes are cut, collected, and sent to the accounting center at regular intervals.

D. Tandem Office AMA Equipment

3.11 The principal equipment elements in the tandem office which produce the tape records are:

(a) Transverters which connect to AMA recorders and control the recording of the initial entry.

(b) Billing indexers which determine the message billing index, the calling office index, and type of initial entry.

(c) Call identity indexers which supply a 2-digit number to the recorders with each of the three entries (initial, answer, and disconnect) of a call to identify the trunk handling the call.

(d) Recorders which receive the information to be recorded on the tape and control their associated perforators.

(e) A master timer which transmits time pulses to all AMA recorders every 6 seconds and controls the perforating of the hour entries, splice entries, 3:00 A.M. entries, etc.

4. METHOD OF OPERATION

A. General

4.01 The equipment elements used on an AMA call are shown in Fig. 3, Page 31. An over-all description of the method of operation on a call basis is given below to indicate the interrelationship of these elements. In a subsequent part, these elements are discussed in detail.

B. AMA Call From a Panel or Crossbar Office

4.02 An AMA call from a panel or crossbar office comes into a crossbar tandem office over a PCI AMA incoming trunk. This trunk has two main appearances in the office: a trunk link frame appearance used in the talking connection and a sender link frame appearance used for passing information to the common control equipment.

4.03 As soon as the incoming trunk receives a seizure signal from the originating office, it signals a sender link and controller circuit to obtain a PCI sender (connections 1a and 1b shown in Fig. 3). Information concerning the incoming trunk (AMA call, trunk link frame number, recorder number, etc.) is passed to the sender by the sender link and controller. The controller also sets up the connection between the sender and trunk through the link. After the sender has registered the above information, it signals the originating office that it is ready to receive the called number.

4.04 After it has registered the first three digits, the sender signals its marker connector to seize an idle marker (connections 2a and 2b). The sender then gives the marker the information necessary to select an outgoing trunk and establish a transmission path through the office. The marker selects an idle outgoing trunk (connection 3) and an idle channel (connections 3 and 4) and sets up the connection between the incoming trunk and the outgoing trunk. The marker gives the sender outpulsing instructions and releases, leaving the sender in control of the transmission path.

4.05 During the registration of the incoming digits, the sender signals a position link to obtain an idle position (connections 5a and 5b). After the sender registers the complete called number (code plus numerals), order tone is given to the operator, the supervisory lamp lights, and a talking path is established between the operator and the customer. The operator then requests the calling customer's number. She sets up this number on her keyset and it is registered in the sender.

4.06 Now the sender signals a transverter connector to seize an idle transverter (connections 6a and 6b). To this transverter the sender transmits the called and calling numbers and other information necessary for perforating the initial entry on the tape.

4.07 The transverter signals its billing indexer connector to obtain a billing indexer (connections 7a and 7b). From information supplied by the transverter, the billing indexer determines the message billing index, the calling office index, and the type of initial entry that must be perforated. The billing indexer transmits the above information to the transverter. The transverter then releases the billing indexer and signals the sender to release the CAMA position.

4.08 The transverter connects to the recorder associated with the incoming trunk through the recorder connector (connections 8a and 8b). Then the transverter transmits the initial entry, one line at a time,to the recorder. Before transmitting the last line, the transverter signals the incoming trunk to identify itself to the recorder through the call identity indexer (connections 9 and 10). As the last line is being perforated, the transverter signals the recorder to use the information supplied by the call identity indexer. As soon as the complete initial entry has been perforated, the transverter and recorder release.

4.09 On some calls, the sender can start outpulsing upon release of the marker or upon the keying of the first digit of the calling number; however, on other calls it must wait for completion of transverter functions as described above. The type of distant office is controlling, and more detailed information is given later in the part describing the sender.

4.10 At the completion of outpulsing, the sender releases. The incoming trunk maintains the connection through the trunk and office link frames.

4.11 When the called party answers, the trunk recalls its recorder through the call identity indexer. The recorder perforates a one-line answer entry and releases. When the calling party disconnects, the recorder is called in again by the trunk to perforate a one-line disconnect entry. At the same time, the connection through the trunk and office link frames is released.

C. AMA Call From a Step-by-Step Office

4.12 An AMA call from a step-by-step office comes into the tandem office over a DP AMA incoming trunk. This trunk has three main appearances in the office: a trunk link frame appearance, an incoming register link frame appearance, and a sender link frame appearance. The first is used in the talking connection, while the other two are used for passing information to the common control equipment.

4.13 As soon as the DP trunk receives a seizure signal from the originating office, it signals the incoming register link to obtain an incoming register (connections 1c and 1d) and the sender link and controller to obtain a DP sender (connections 1a and 1b).

4.14 The register link normally obtains a register in time to receive the first digit following the directing code. During the registration of the first three digits in the register, a sender is attached and has received information concerning the incoming trunk (AMA call, trunk link frame number, class of service, etc.). The fourth and succeeding digits are registered in the sender via the sender link. The incoming register transfers the first three digits to the sender via the sender-register connector (connections 1e and 1f) and releases. After the sender has registered the digits, the operation is similar to that described for panel and crossbar areas in 4.04 through 4.11.

D. Non-AMA Call

4.15 A non-AMA call is switched through a crossbar tandem office in much the same way as the PCI AMA call described above. The non-AMA call does not use any of the AMA equipment and any necessary charge data are recorded at the originating office. A non-AMA PCI trunk is available for this type of traffic. DP trunks, previously available for use with older DP senders, will work with the new 11-digit DP sender on a non-AMA basis.

4.16 Referring to Fig. 3, this call involves connections 1a, 1b, 2a, 2b, 3, and 4. The call comes in over a PCI trunk, for example, and is connected to a PCI sender through a sender link (connections 1a and 1b). Information concerning the trunk, including a non-AMA indication, is given to the sender. Then the sender registers the called code and requests a marker (connections 2a and 2b). From information supplied by the sender, the marker first selects an idle outgoing trunk, then an idle channel, and sets up a connection between the incoming and outgoing trunks (connections 3 and 4). Then the marker transmits outpulsing instructions to the sender and releases.

4.17 The sender outpulses the necessary digits and releases. The incoming trunk maintains the connection and releases it upon receipt of a disconnect signal.

5. FUNCTIONS OF PRINCIPAL EQUIPMENT ELEMENTS

A. Incoming Trunk

General

5.01 An AMA incoming trunk is similar in its switching functions to other crossbar tandem trunks. It assists in setting up a talking connection by identifying itself to a marker and maintains the path established by the marker through the trunk and office link frames for the duration of the call. The DP trunks which are used with the incoming register return a reorder tone to the customer if a register is not attached in time to receive the first digit

5.02 An AMA trunk also has charging functions. It identifies itself to an associated recorder through a call identity indexer, it times to distinguish called party answer supervision from flashes, and it controls the recording of answer and disconnect time entries.

5.03 The various types of trunks which may be used are as follows:

(a) A PCI trunk for traffic incoming from panel and crossbar offices.

(b) A 2-wire DP trunk with reverse battery supervision for traffic from a step-by-step office in a distant building.

(c) A 3-wire DP trunk with sleeve supervision for traffic from a step-by-step office in the same building (under development).

The above trunks have a trunk link frame appearance and a sender link frame appearance. In addition, trunks in (b) and (c) above also have appearances on the incoming register link frame.

Charging Functions

Initial Entry

5.04 The 100 (or fewer) trunks associated with one recorder are also associated with one call identity indexer. When the last line of an initial entry is to be perforated, the incoming trunk gets a signal from the transverter to identify itself to the recorder through the call identity indexer. After the initial entry is completed, the trunk is set in the "ready-to-charge" condition in preparation for initiating the answer and disconnect entries.

Answer Entry

5.05 After outpulsing has been completed to the called office by the sender, the control of the call is given to the incoming trunk. The called party answer supervision is timed by the trunk to distinguish between busy-back or overflow signals and a true called party answer. This is termed the "charge delay interval." When it has been determined that the call was answered, the trunk calls in the AMA recorder through the call identity indexer and indicates that a timing entry should be perforated. If the recorder is busy, the trunk waits its turn. Such delays are usually less than a one-second interval. Upon completion of the perforation of the answer entry, the recorder signals the trunk, which then releases the recorder. For the PCI trunk, return of supervision to the originating office is optional so that it can be withheld if the originating office cannot be arranged for "talking - no charge." DP supervision is described in 5.07.

Disconnect Entry

5.06 As soon as the calling party disconnects, the trunk partially restores to normal and releases the connection through the trunk link and office link frames. Simultaneously, the trunk puts in a bid for the recorder to perforate the disconnect entry. When the disconnect entry has been perforated, the trunk circuit restores to normal. If the originating panel or crossbar office recognizes the disconnect and immediately reseizes the PCI trunk for another call, the call will be accepted, but a sender will not be requested until the disconnect entry has been perforated.

5.07 As mentioned earlier, on DP calls the digits are dialed without pause. For this reason the DP trunk, unlike the PCI trunk, cannot hold a call while waiting for the final perforation on the previous call. It must call for a register immediately and have it attached in time to receive the first digit after the directing code. To prevent premature reseizure of the trunk to tandem, answer and disconnect supervision is not returned to the originating office. Instead, a reversal is sent to the originating office as soon as the trunk is seized and is not removed until the disconnect entry has been perforated.

Timed Release Entry

5.08 Although the calling customer is normally in control of his call, he is not permitted to maintain indefinitely a connection through the switches of a tandem office after the called customer has hung up. The trunk starts timing if the called customer disconnects and the calling customer does not. If the calling customer has not disconnected by the end of the timing period, the connection to the outgoing trunk is released and a timed release entry on the AMA tape is called for. The timed release entry causes the AMA center equipment to deduct a time allowance from the elapsed time of the call.

5.09 At the end of the timing period, the PCI trunk sends the called party's disconnect signal to the originating office, which times again. At the end of timing, the trunk to tandem is released and dial tone is returned to the customer.

5.10 The DP trunk waits until the disconnect entry has been made and then removes the reversal which was returned when the trunk was seized. The originating office immediately releases the trunk to tandem and returns dial tone to the customer.

5.11 If a trunk calls for a disconnect entry and the recorder cannot be reached for any reason, the trunk times out in an interval equal to the charge delay interval. It then withdraws its request for the perforation of a disconnect entry and restores to normal. In this case, the call has only one timing entry and the accounting center equipment enters a charge only for the initial period.

Abandoned Call

5.12 A customer may abandon a call after the initial entry is perforated and before the called party answer is recognized by the trunk. Upon abandonment, the trunk restores to normal without causing any further tape perforation. The AMA accounting center equipment disregards the initial entry and no charge is made.

Decade Arrangements

5.13 AMA trunks, like other tandem trunks, are grouped in decades on the sender link frame to permit the sender to obtain information common to ten trunks on the same switch. The decade arrangement persists at all trunk appearances, namely:

(a) On the MDF or IDF.

(b) On the trunk frame.

(c) On the sender link frame.

(d) On the trunk link frame.

(e) On the call identity indexer frame.

(f) On the trunk test connector frame.

(g) On the incoming register link frame.

5.14 All the trunks in a decade must meet the following requirements:

(a) Be served by the same recorder.

(b) Have the same class of service. (For PCI CAMA, class of service may be used to indicate the called area. This is discussed in more detail under Transverter.)

(c) Have the same rate class. (For CAMA, rate class is used to distinguish divisions of customers within an office to which different charge treatments are applied. This is described in more detail under Billing Indexer.)

(d) Be connected to the primary switches of the same trunk link frame.

(e) Be connected to the same switch on a register link frame when used.

(f) Be connected to the same primary switch on a sender link frame.

(g) Be associated with the same tens group relay in the call identity indexer.

(h) Be associated with the same vertical of a trunk test connector switch.

Reserve Trunks

5.15 A reserve trunk is a substitute trunk to which the cable conductors are transferred while the regular trunk is being tested. They are used for PCI operation to avoid the need for calling the originating office to take the regular trunk out of service. Reserve trunks are not required for DP operation since the regular trunk can be made busy at the originating end by sending a reversal from the tandem office.

5.16 One reserve trunk is required for all PCI trunks served by the same recorder. The trunk automatic test circuit controls the replacement of a service trunk with its associated reserve trunk before the test of the service trunk is begun. The same feature allows the reserve trunks to be associated with the test circuit for testing.

5.17 Reserve trunks are also arranged in decades and the decade association persists on the trunk frame, the trunk link frame, and on the sender link frame.

5.18 A decade of reserve trunks has fewer requirements than a decade of service trunks, since some of the information normally pertaining to a service trunk is supplied by the trunk test frame. All the trunks in a decade of reserve trunks must meet the following requirements:

(a) Be connected to the primary switches of the same trunk link frame.

(b) Be connected to the same primary switch on the sender link frame.

5.19 A reserve trunk must be associated with the same recorder as the service trunks it replaces. A reserve trunk may serve several different types of service trunk decades; for example, a reserve trunk may serve one decade of service trunks with rate class 0 and another decade of trunks with rate class 1.

5.20 When a decade of service trunks is not filled, it may be desirable to mount the reserve trunks in the vacant spaces on the service trunk frame rather than on a separate reserve trunk frame. However, if this is done, it will be necessary for both the service and reserve trunks to meet their own decade requirements as stated above, and nonstandard cabling will be used.

B. Incoming Register and Link Frame

5.21 This is a new 2-bay frame arranged to give incoming DP AMA trunks access to registers. The registers are associated with horizontals of a 6-wire, 200-point crossbar switch and the trunks with the verticals, as shown in Fig. 4. The basic frame is equipped with two switches and three registers and may be expanded in increments of one switch or one register to a capacity of ten switches and ten registers.

5.22 Upon seizure by the incoming DP trunk, the link selects a register and returns a register attached signal to the trunk. It uses bylink operation over a temporary fast relay path to prevent loss of digits. When the switch crosspoint paths are closed, the switch is held under control of the selected register and the temporary path is paralleled by a path through the crossbar switch.

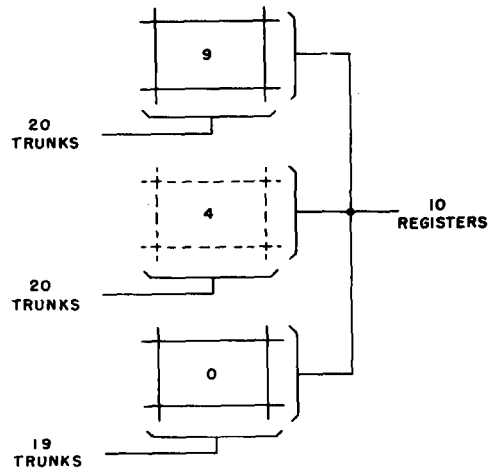


Fig. 4 - Incoming Register Link

5.23 The DP incoming register receives the first three digits from the incoming trunk. It receives a sender attached signal, and the three digits are passed to the sender via the sender-register connector. If a sender is not available by the time the third digit is registered, the register instructs the trunk to return a reorder signal to the customer.

C. Sender-Register Connector

5.24 The sender-register connector connects DP senders to incoming registers. Each office has four connectors and all connectors have access to the full register group, a maximum of 130 registers. Each connector serves one quarter of the senders and each sender appears in only one connector.

5.25 Within any one connector only one connection can be made at a time. However, all four connectors can be used simultaneously.

5.26 In case of simultaneous demands on a connector by two or more senders, the senders take their turn, as determined by a lockout preference chain.

5.27 When the sender receives a signal from the register indicating that the three digits have been received, it seizes the connector associated with it. The sender signals the register via the trunk and gives it the identity of the connector. The register transfers the three digits to the sender via the connector.

5.28 The connector signals the register when the transfer of digits is complete. It recognizes the register release and signals the sender to release itself from the connector.

D. Sender Link

5.29 For AMA operation, the regular crossbar tandem sender link is used with 5-wire instead of 4-wire crossbar switches. It is

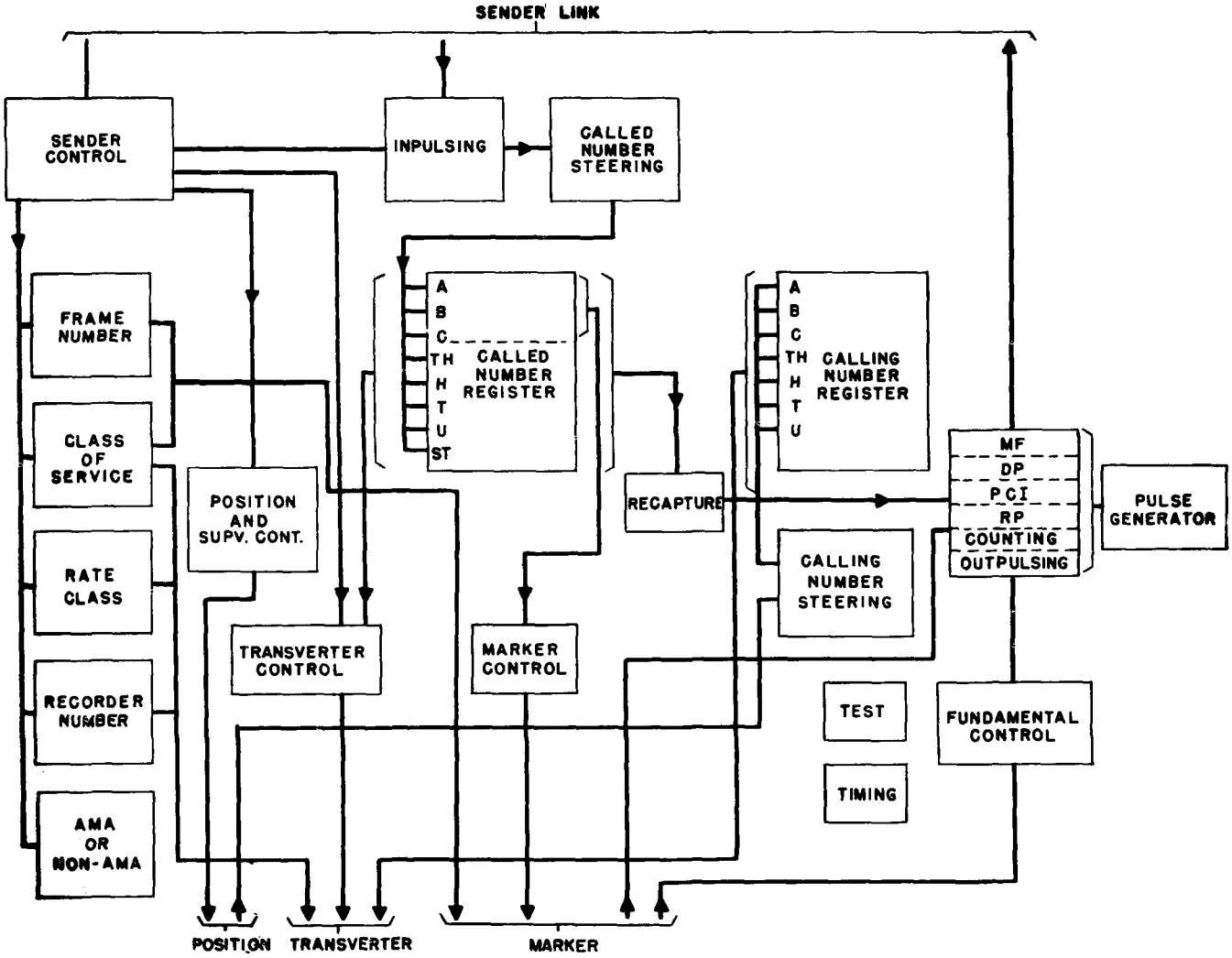


Fig. 5 - Functional Schematic of the PCI Sender Unit

a primary-secondary link frame and provides 100 incoming trunks with access to a maximum of 40 senders. Sender subgroups, multiples between frames, etc., are the same as for the non-AMA sender link frame.

5.30 For AMA operation, two additional leads are required for connection to the transverter and the sender. Over one lead, at the end of the initial entry, the transverter requests the trunk to identify itself through its call identity indexer. Over the other lead, the trunk indicates to the sender that a trunk test call is being made or that this is a call under service observing.

5.31 Several of the sender link controller relays need more contacts for AMA operation, and new relays will be provided on all new link frames whether used for AMA or non-AMA.

E. PCI and DP Senders

General

5.32 The main functions of the sender are to register the called and calling numbers, request a marker to establish a connection to an outgoing trunk, supply a transverter with information for the initial entry, and outpulse the called number. Fig. 5 is a functional schematic of the PCI sender. The DP sender is similar to it, except that the called number register has a capacity of eleven digits. On bylink calls, the first three digits are received via the sender-register connector rather than the sender link.

5.33 The PCI sender can register and outpulse a maximum of eight digits, while the DP sender can register and outpulse a maximum of eleven digits. Each sender can outpulse the called number as received, code convert, or delete the code, as instructed by the marker. Four

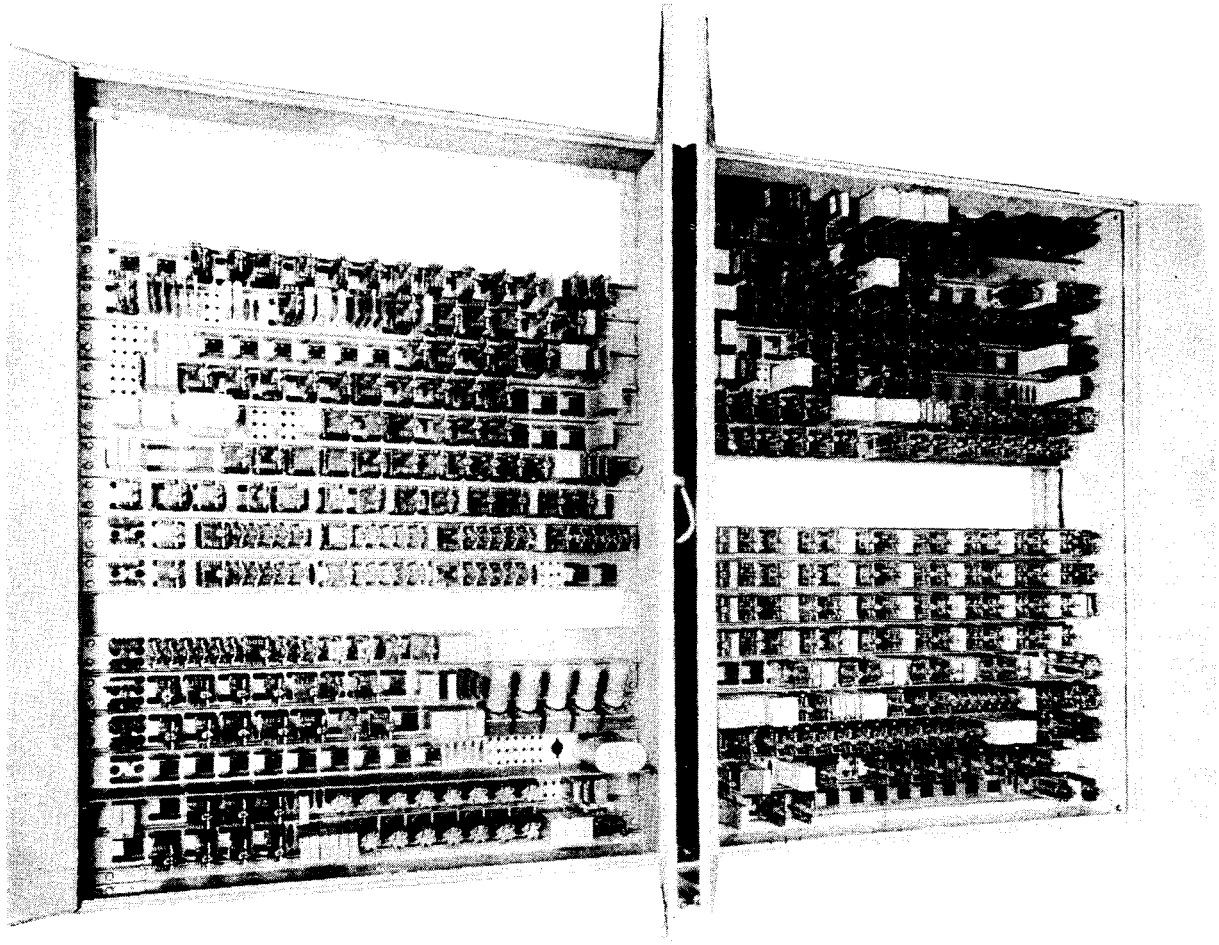


Fig. 6 - PCI Sender Unit

types of outpulsing are available, DP, MF, PCI, or RP. The senders can be arranged for non-AMA operation or combined AMA and non-AMA operation.

5.34 The DP sender, when used on non-AMA calls, can handle operator dialed or automatic ticketing traffic and can complete these calls either by outpulsing or on a straightforward basis. It can complete to either 2-digit TX operators (11XX) or to 3-digit TX operators (11XXX). When the sender is arranged for 3-digit TX codes, it can also complete to 2-digit TX codes of the form 115X.

5.35 The DP sender is arranged to complete customer dialed calls such as time of day (for example, MEridian 7-1212) on a straightforward basis, suppressing the four numerical digits. The PCI sender completes these calls by PCI outpulsing into an inert digit absorber called the "run down" circuit.

5.36 Three PCI or four DP senders are mounted on a single-bay frame. Fig. 6 is a photograph of a PCI sender, Figs. 7 and 8 are equipment sketches showing the location of the various components of the PCI and DP senders, respectively.

5.37 By means of leads from the sender link and controller, the sender gets the following information about the incoming trunk:

(a) The number of the trunk link frame on which the trunk appears.

(b) The number of the recorder which serves this trunk.

(c) Class of service; one of ten, if needed. (This may be used to indicate terminating area.)

(d) AMA or non-AMA indication if the sender is used for both.

(e) Rate class; one of three, if needed.

(f) Bylink or non-bylink - DP sender only.

5.38 The sender uses items (d) and (f) to determine its operation; it passes items (a) and (c) to the marker and items (b), (c),

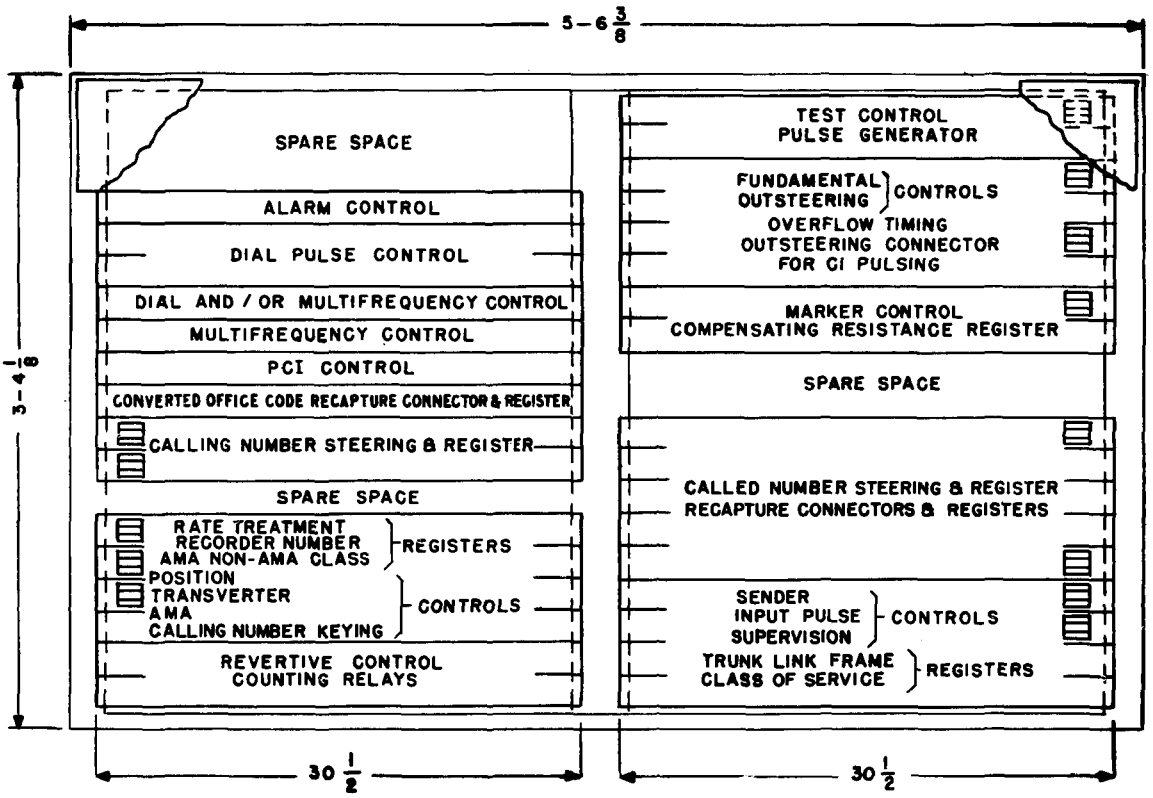


Fig. 7 - Unit Layout of the PCI Sender

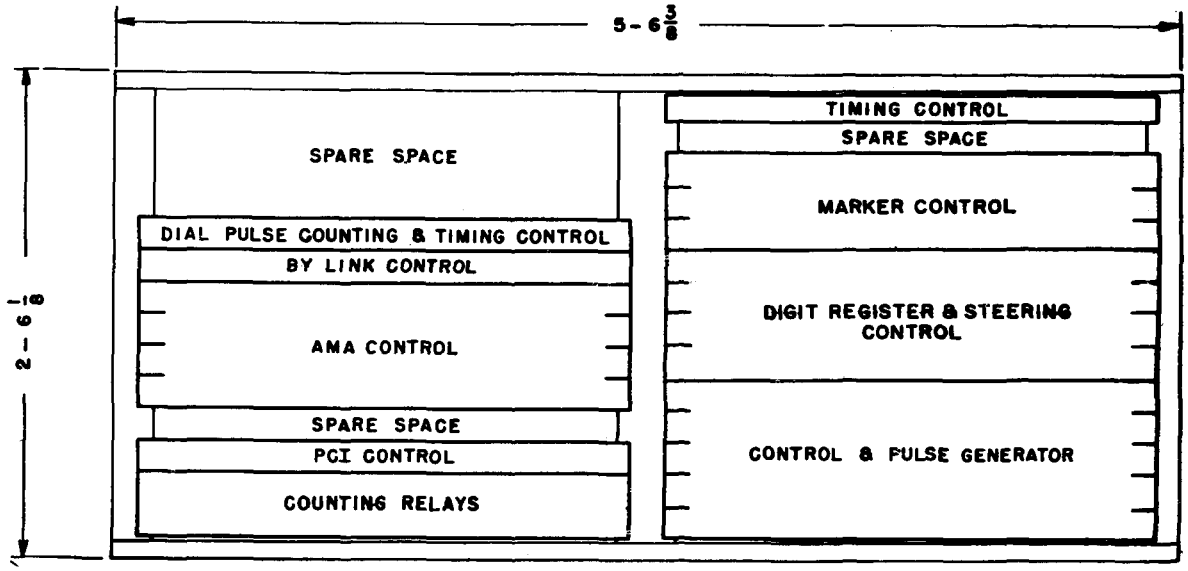


Fig. 8 - Unit Layout of the DP Sender

and (e) to the transverter. Leads are brought from the trunk to the sender through the sender link crosspoints to pass signaling and control information and to indicate whether a call is being service observed or under trunk test.

Receiving the Called Number

5.39 The originating panel or crossbar office sender always sends eight digits to the PCI sender. They are sent in the following order: A, B, C, stations, thousands, hundreds, tens, and units. The stations digit will be 1 if the called number is over 9,999. (Numbers higher than 10,499 can not be routed through CAMA.) The stations digit will be 0 if the called number is under 10,000 and has no party letter. The stations digit will be sent as 2, 3, 4, and 5 for party letters W, R, J, and M, respectively, although the calling customer dials 9, 7, 5, and 6 for these letters. Translation to the proper numerals is made in the tandem sender.

5.40 In the DP sender, the digits are registered in the order that they are dialed.

Information To and From Marker

5.41 As soon as it registers the first three digits, the sender requests a marker through a marker connector and gives it the following information:

(a) The first three digits.

(b) Class of service, if used.

(c) Trunk link frame number.

5.42 The marker selects an outgoing trunk and gives the sender outpulsing instructions, such as:

(a) Type of outpulsing - DP, RP, MF, or PCI.

(b) Number of digits to be outpulsed.

(c) Code conversion - none or one, two, or three converted office code digits.

The DP sender can operate with 2-way intertoll trunks, MF outpulsing to senderized offices or DP outpulsing to step-by-step selectors. For MF outpulsing, two marker seizures are required. On the first, the marker identifies the trunk to the sender, but it does not set up the connection. When the operator keys the first digit of the calling number, the marker is called in a second time, the trunk is seized, and a connect signal is sent to the distant office.

Operation With Position

5.43 An optional sender cross connection permits arranging the PCI sender to request the position link for a position at any specific point between the first (or A) digit and the last (or units) digit. The DP sender may be arranged to request a position at a specific point, namely, after the hundreds, tens or units digit or when registration is complete. After all the called digits have been registered in the sender and a position is attached, the operator is given order tone and the talking path between the calling customer and operator is closed. If there is a delay in seizing the position, audible ringing tone is sent back to the calling customer.

5.44 The operator obtains the calling number and keys it into the sender on a 2-out-of-5 dc basis. In the case of remote operation of the CAMA switchboard, the digits are keyed into a multifrequency receiver which then passes them into the sender. This type of operation is covered in 5.72. The sender now has enough information to connect to a transverter.

Information To Transverter

5.45 The sender requests a transverter through a transverter connector and transmits the following information to it:

(a) Calling number.

(b) Called number - including the area code on a DP call if one was dialed.

(c) Recorder number.

(d) Class of service, if used.

(e) Rate class, if used.

(f) Service observed, sender test, or trunk test indication, if required.

(g) Called number is over or under 10,000.

5.46 After the transverter has registered this information and other information supplied by the billing indexer, it signals the sender to release the position.

Outpulsing

5.47 As mentioned earlier, the procedure for outpulsing varies with the type of distant office. On calls to panel and crossbar offices (including toll crossbar), outpulsing does not start until the CAMA operator keys the first digit of the calling number. This is done to prevent time-out of a distant sender or register if the CAMA operator has difficulty in obtaining the calling number. On calls to step-by-step offices (including intertoll), since no distant sender or register is involved, outpulsing can start earlier and does so as soon as the marker releases. In all the above cases, outpulsing proceeds up to the units digit. This digit is not outpulsed until the transverter releases, which indicates that all AMA functions are complete. This is done to prevent ringing the called station prematurely.

5.48 On calls to PCI manual offices, outpulsing does not start until all AMA functions are complete. After the transverter releases, the sender awaits assignment of an operator at the manual office and then outpulses all digits without pause. The operator at the manual office then completes the call.

5.49 DP outpulsing to senders is not recommended. It is done in some offices, but only under unsatisfactory conditions. If it cannot be avoided, interdigital and over-all timing should be investigated.

Abandoned Calls

5.50 When a call is abandoned before a marker is seized, the sender releases the sender link and the position link, if this was seized, and returns to normal. If a call is abandoned while a marker is engaged, the sender waits for marker release before returning to normal.

5.51 When a call is abandoned after a marker has been released, the sender can return to normal at any stage on MF or DP outpulsed and straightforward calls. On abandoned RP calls, the sender drives the distant selector or sender to tell-tale, makes trunk closure, and then returns to normal. On PCI calls to KDCI (key display call indicator) positions, the sender releases immediately if assignment has not been made; otherwise, it sends out the remaining digits as zeros, makes trunk closure, and then releases. On PCI calls to ADCI (automatic display call indicator) positions, the sender waits for assignment, sends out all digits as zeros, makes trunk closure, and releases.

Second and Third Trials

5.52 The sender may go to second or third trial operation for various reasons:

(a) If the marker encounters trouble or times out.

(b) If all channels are busy.

(c) If the outgoing trunk is open.

(d) If the outgoing trunk polarity is reversed.

PCI Sender Time-outs

5.53 Certain sender operations are timed in order to free the sender when trouble conditions occur in the sender or in connecting circuits. The following intervals are timed:

(a) From sender seizure to registration of first called digit - 3 to 6 seconds.

(b) From sender seizure to registration of complete called number - 6 to 9 seconds.

(c) Incoming trunk closure (transfer of supervision to sender) to position order tone - 20 to 40 seconds.

(d) Position release to sender release - 20 to 40 seconds on all but ADCI and KDCI calls for which the timing is 60 to 80 seconds.

5.54 If the sender times out under any of the above conditions, a marker is requested to break down any established connection and set the call to a reorder trunk.

5.55 The over-all interval from sender seizure to sender release is also timed. If an over-all time-out occurs (112 to 232 seconds), the sender causes a stuck sender lamp to light at the sender make-busy frame and a minor audible alarm to sound.

5.56 No other action is taken by the sender on an over-all time-out. If the customer is still talking to the CAMA operator, the connection between them is maintained.

DP Sender Time-outs

5.57 The following intervals are timed for the DP sender:

(a) From sender seizure to registration of the third digit in the register for bylink operation or for registration of the third digit in the sender for non-bylink operation - 20 to 40 seconds.

(b) From registration of the third digit to registration of the fourth digit - 20 to 40 seconds.

(c) From registration of the fourth digit until all digits have been received - 20 to 40 seconds.

(d) Interdigital time after the fourth digit - 5 to 6.5 seconds.

(e) Stations delay timing - 3.5 to 4.5 seconds.

(f) For non-CAMA calls from completion of registration to sender release - 20 to 40 seconds.

(g) For CAMA calls from completion of registration to attachment of position - 20 to 40 seconds.

(h) From attachment to release of position - 120 to 225 seconds.

(i) From release of position to sender release - 20 to 40 seconds.

Note: Slight differences between PCI and DP for similar functions are due to the use of newer techniques in the DP sender.

5.58 If the sender times out under any of the above conditions except (d), (e), or (h), reorder is returned to the customer or operator. A time-out under condition (d) results in a reorder on customer dialed calls or indicates that all digits have been received on operator dialed calls. A time-out under condition (e) indicates that there is no stations digit. Under condition (h), a time-out will cause a stuck sender lamp to light and an alarm to sound. However, the connection between the customer and the operator is maintained.

F. Marker and Marker Connector

5.59 The marker and marker connector circuits have been revised to operate with the new DP sender. Information exchanged between this sender and the marker is on a 2-out-of-5 basis, whereas the older senders (including the PCI) exchange information on a 2-out-of-7 basis. Due to the modification, two separate coded marker connectors will be provided and assignment of senders to marker connectors of the correct type is required.

5.60 In addition, the marker and marker connector arrangements have been modified to increase the connector capacity of an office to 39, thus the sender capacity, which is 5 senders per connector, is increased from 170 to 195.

G. Position Link

5.61 The position link provides a maximum of 40 senders with access through a primary-secondary link arrangement to a maximum of 100 positions. Traffic is distributed on a call distribution basis by two controllers per frame, each of which can simultaneously set up one call at a time. Each link frame serves a different group of 40 senders, but all link frames have access to the same 100 positions. The 40 senders associated with a frame are divided into four groups, with two groups preferring one controller and the other two groups preferring the second controller. However, both controllers can serve all four groups, and if one controller attempts but fails to handle a call, the call is given to the mate controller.

5.62 The position link frame is a 2-bay frame equipped with sixteen 200-point, 5-wire crossbar switches and two controllers. Senders are connected to the horizontals of four switches associated with controller A and of four other switches associated with controller B. Positions (or trunks to remote positions) are also connected to the horizontals of four switches associated with controller A and four switches associated with controller B. The horizontals of the position switches are split so that each group of four switches can accommodate five position groups. Eighty 10-wire links connect the verticals of the sender switches to the verticals of the position switches.

5.63 To insure equitable distribution of traffic over the switchboard, positions are divided into groups and adjacent positions assigned to different groups. With this arrangement, a controller, in distributing calls over a group, distributes them over separated positions along the switchboard. The division into groups is determined by the ultimate number of positions, with five groups as a minimum and ten groups as a maximum. Each controller of a link frame has access to five position groups.

5.64 Fig. 9 illustrates an arrangement for an office that has 12 positions equipped and will not exceed 50 positions in the ultimate. For this case, the positions are divided into five position groups (A to E). Position 0 is assigned to appearance 0 in group A, position 1 is assigned to appearance 0 in group B, etc., up to position 4 which is assigned to appearance 0 in group E. The next five positions (5 to 9) are assigned to appearance 1 in groups A to E, respectively. This arrangement continues through all equipped positions and is maintained for all added positions.

5.65 Fig. 9 also illustrates the sequence with which a controller distributes calls over the switchboard. Assuming the previous call was given to appearance D0 (position 3), the next call is given to appearance C1 (position 7), the next to C0 (position 2), the next to B2 (position 11), and so on in descending order.

5.66 The above distribution assumes that all positions are idle and that only one controller is hunting for a position. If more than one controller is hunting for a position, the controller with first preference for a group will be the one that hunts over the positions in that group. The other controllers hunt over other groups as determined by a preference chain.

5.67 When hunting over a group, a controller assigns a call to the preferred position if idle, and if not, assigns the call to the first idle position in the descending chain. A call is not assigned to a position within the preferred group if the preferred position and all lower-numbered positions are busy, even though a position above the preferred position is idle. The controller advances to the next preferred group and starts hunting over the group starting with the highest-numbered position. It then continues assigning calls in descending order.

5.68 When the number of position groups exceeds five, both controllers of a frame cannot reach all positions. For example, Fig. 10 shows the arrangements for six position groups with 22 positions equipped. Position groups B to F can be reached by controller B of frame 0; position groups A to E can be reached by controller A of frame 0. However, no impairment of service is expected. Controller preference arrangements are such that during light as well as heavy load periods the calls will be distributed without noticeable inequality.

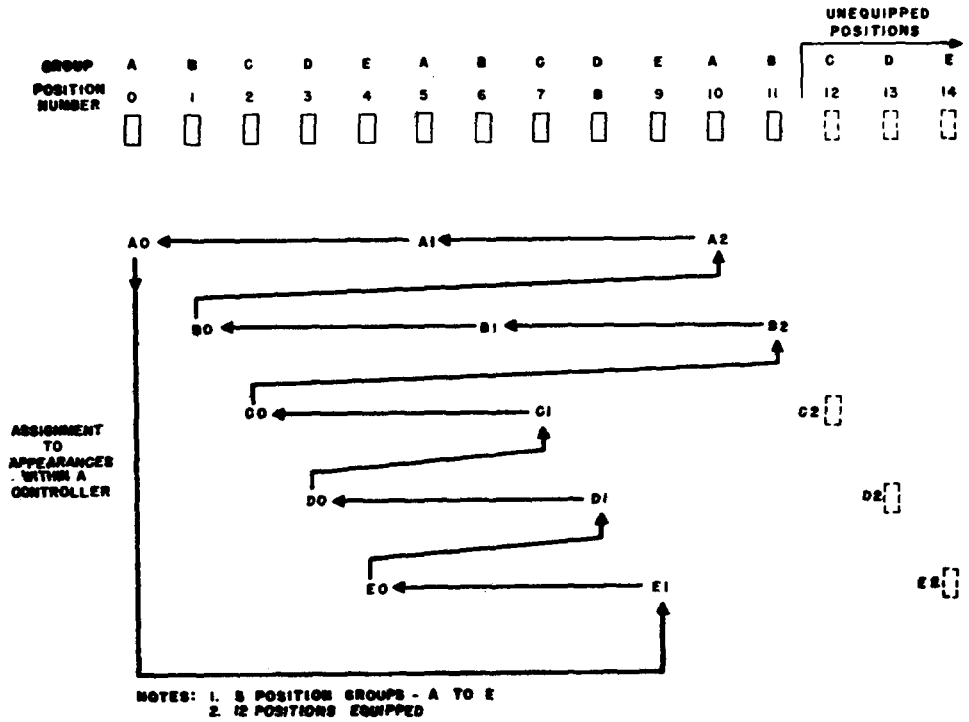


Fig. 9 - Distribution of Calls to Positions - Five Position Groups

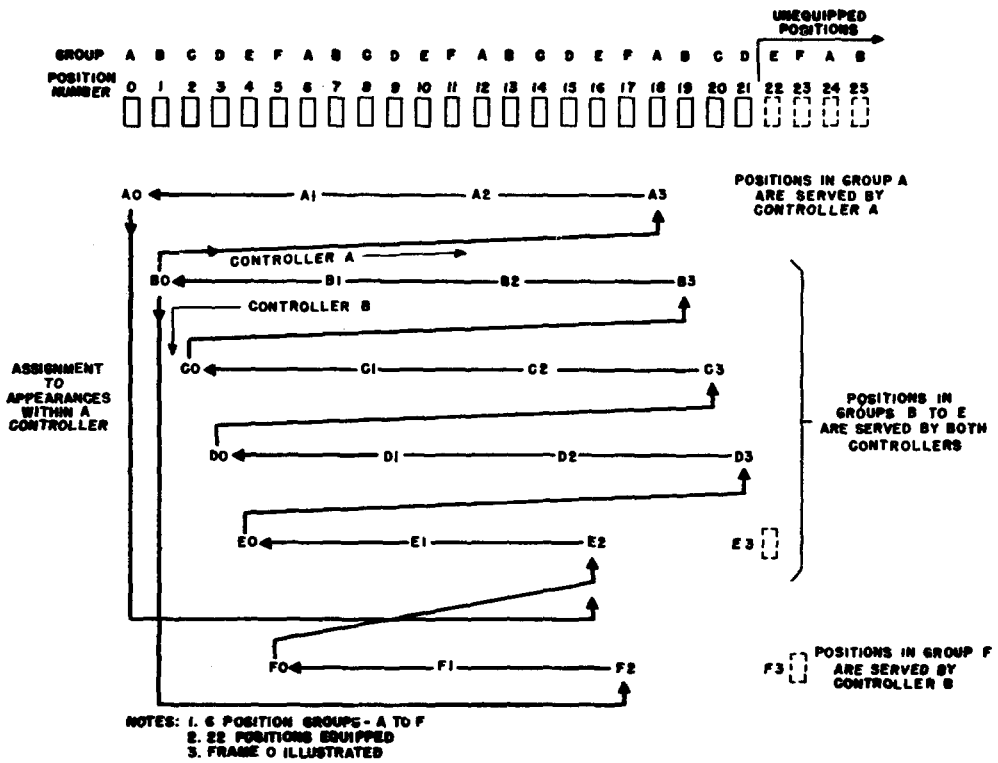


Fig. 10 - Distribution of Calls to Positions - Six Position Groups

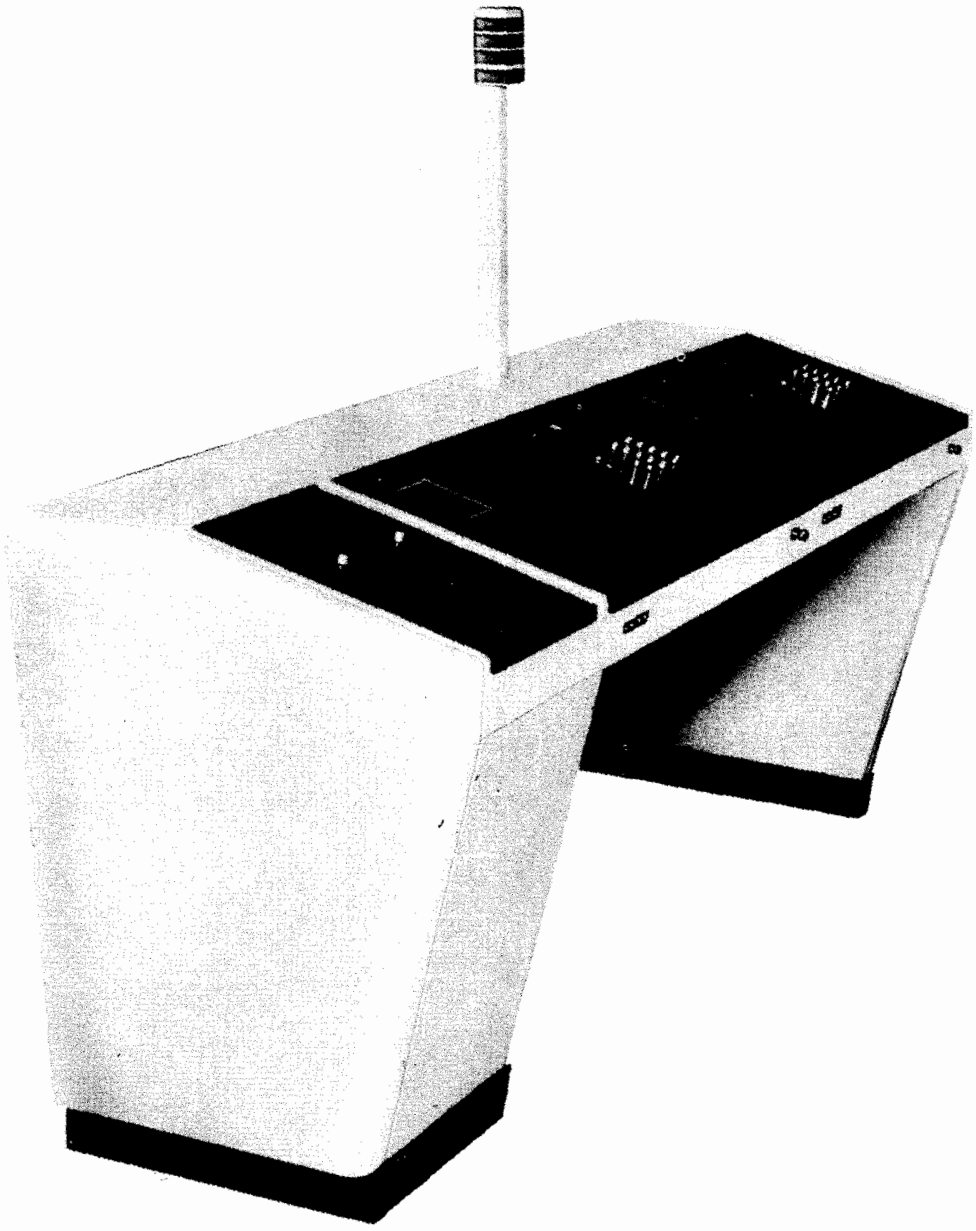


Fig. 11 - CAMA Switchboard

M. CAMA Switchboard

5.69 This switchboard is of the cordless type consisting of one or more line-ups of 2-position sections and a cable-turning section. The framework is of sheet-metal construction. Fig. 11 is a photograph of a switchboard section and the cable-turning section. The cable-turning section is in the foreground. A maximum of 100 positions may be provided. The CAMA positions may be located at the tandem switching point and at remote operating centers, as shown in Figs. 12 and 13. When the positions are located at the tandem switching point, the calling number is given to the sender on a 5-wire dc key-pulsing basis. When the positions are located at a remote center, the calling number is sent to tandem on an MF basis and then converted to a dc basis.

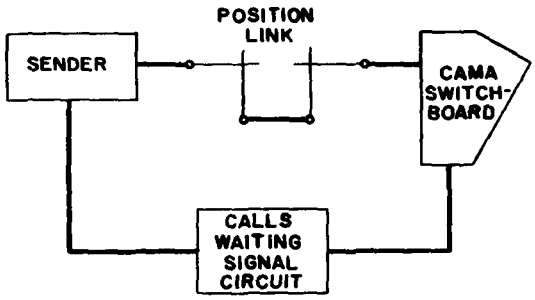


Fig. 12 - CAMA Switchboard at the Tandem Switching Point

5.70 Each position is equipped with the following:

(a) A 10-button keyset.

(b) A CAMA supervisory lamp (red).

(c) A KP key and KP lamp (green) - remote positions only.

(d) A register reset key.

(e) A position disconnect key.

(f) A calls waiting lamp (white).

(g) A service assistant call key and lamp.

5.71 The CAMA supervisory lamp lights when the operator is connected to a sender and remains lighted until the sender releases the position. This lamp is flashed at reorder rate if the number keyed by the operator is not accepted as satisfactory by the sender, the transverter, or the billing indexer.

5.72 The KP key is provided at remote positions only. After the operator obtains the calling number, she operates the KP key which sends a dc signal to the distant end and causes the transmission path to be opened between the customer and the operator. It also causes the MF receiver to be conditioned to receive MF pulses. The KP lamp lights as an indication to the operator that she may start keying the calling number.

5.73 The register reset key permits the operator to wipe out the number she keyed into the sender and then key again in the event that she receives a reorder signal or discovers an error before the last digit is keyed. At a remote location, the operation of the reset key also reestablishes the talking path to the customer.

5.74 The position disconnect key enables the operator to free her position, if necessary. The operation of this key signals the sender to release the position link and position, and the call is routed to a reorder trunk.

5.75 A lamp standard that contains a service assistant call lamp and three calls waiting lamps (green, white, and red) is furnished for each division of ten positions. The calls waiting lamps indicate the unserved load per occupied position, with increasing load indicated by the lighting of the green, white, and red lamps in that order. A multiple of the white calls waiting lamp also appears at each position.

5.76 The calls waiting lamps are under control of two keys: a calls waiting key, which puts the circuit into operation, and a team size key. The keys are located on the cable-turning section. The team size key has three positions (A, B, and C) and is set to the desired team size, depending upon the traf-

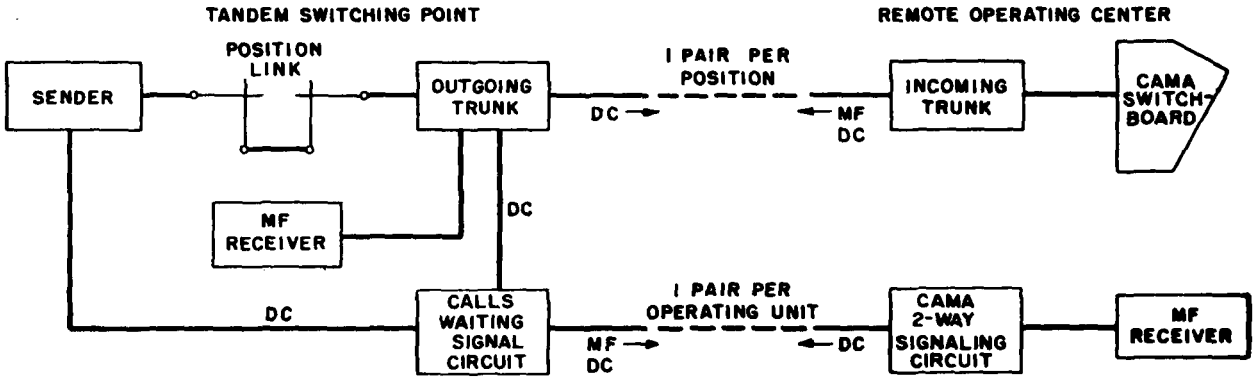


Fig. 13 - CAMA Switchboard at a Remote Location

fic conditions during the day. Representative team sizes are 1 to 4 for A, 5 to 10 for B, and over 10 for C. Lighting of a calls waiting lamp may be preset so that it indicates a different number of calls waiting for each team size. For example, after adjustment, the green lamp may indicate one call per occupied position for team size A, 0.5 of a call for team size B, and 0.25 of a call for team size C.

5.77 When the CAMA position is located at the tandem switching point, all information to and from the calls waiting circuit is on a dc basis. When the position is at a remote location, the calls waiting circuit is connected to an MF supply. A new circuit, the CAMA 2-way signaling circuit which is located at the position end, is associated with an MF receiver. The calls waiting circuit receives dc signals from the outgoing trunks to indicate the number of occupied positions and from the senders to indicate the number of calls waiting. To determine the team size, it sends an MF signal to the signal circuit for each of the three team sizes until a dc signal is returned, indicating that the correct team size has been identified. It then sends an MF signal to indicate whether a red, white, green, or no lamp should be lighted.

5.78 When there are positions at two or more locations in the same or different buildings, each operating unit is associated with a separate group of senders, position links, and calls waiting circuits. This does not mean that the senders are split into groups as far as the incoming trunks are concerned, but only that they are assigned to different operating teams.

5.79 The service assistant call lamp is provided to enable a CAMA operator to obtain instructions or relief. No service assistant jacks are provided. Multiple telephone set jacks are provided at the CAMA positions for relief exchanges.

5.80 In an emergency, the CAMA switchboard might have to be abandoned. To permit AMA traffic to be handled in this event, an abandon switchboard key may be provided. The operation of this key causes the sender links to send a non-AMA signal to the senders. The calls are then completed without calling in the operator or AMA equipment. When there is an operating unit at the tandem office, the key will generally be located on the CAMA, toll, or DSA switchboard. When there is no operating unit at the tandem office, the key will be located in the maintenance center.

5.81 Inasmuch as operation of this key will result in a substantial loss of revenue, it is threaded by a wire loop with a lead seal to disclose unauthorized operation and covered by a guard to prevent inadvertent operation. A guard lamp is lighted and an alarm sounded in the operating room as long as the key is operated. An alarm is also sounded in the maintenance center, but this may be retired and replaced by a guard lamp.

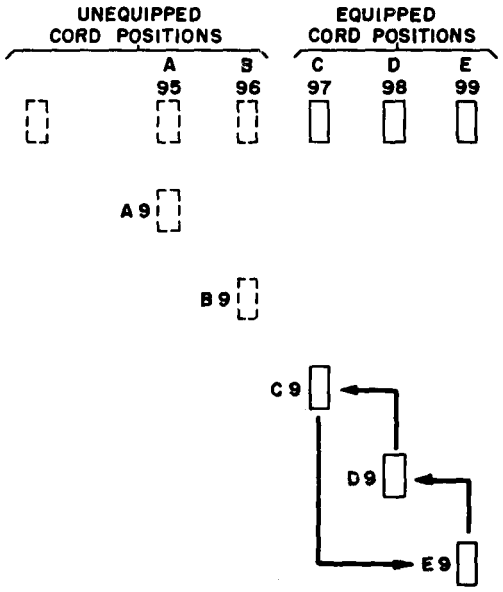


Fig. 14 - Distribution of Calls to Cordboard Positions at the Tandem Switching Point

I. DSA and Toll Switchboards

General

5.82 It may be necessary to transfer AMA calls to a cord-type switchboard during light load periods when the cordless switchboard is closed down. At the tandem switching point, connections are available for Nos. 3C and 3CL toll boards and for Nos. 13C, 15C, and 15D DSA boards. Similar arrangements will be made for No. 3 toll boards, No. 1 toll boards with type A cords, and No. 14 DSA boards, when necessary. At a remote operating center, connections are available only for Nos. 3C and 3CL, but arrangements will be made for the boards listed above, when necessary.

DSA or Toll Switchboards at the Tandem Switching Point

5.83 Cordboard positions are assigned to the link in the reverse order and start with the last position group and the last position within the group. This facilitates additions in both cordless and cordboard positions.

5.84 Fig. 14 shows the assignment of three cordboard positions in an office with an ultimate of five position groups (A to E). The cordboard positions are assigned to ap-

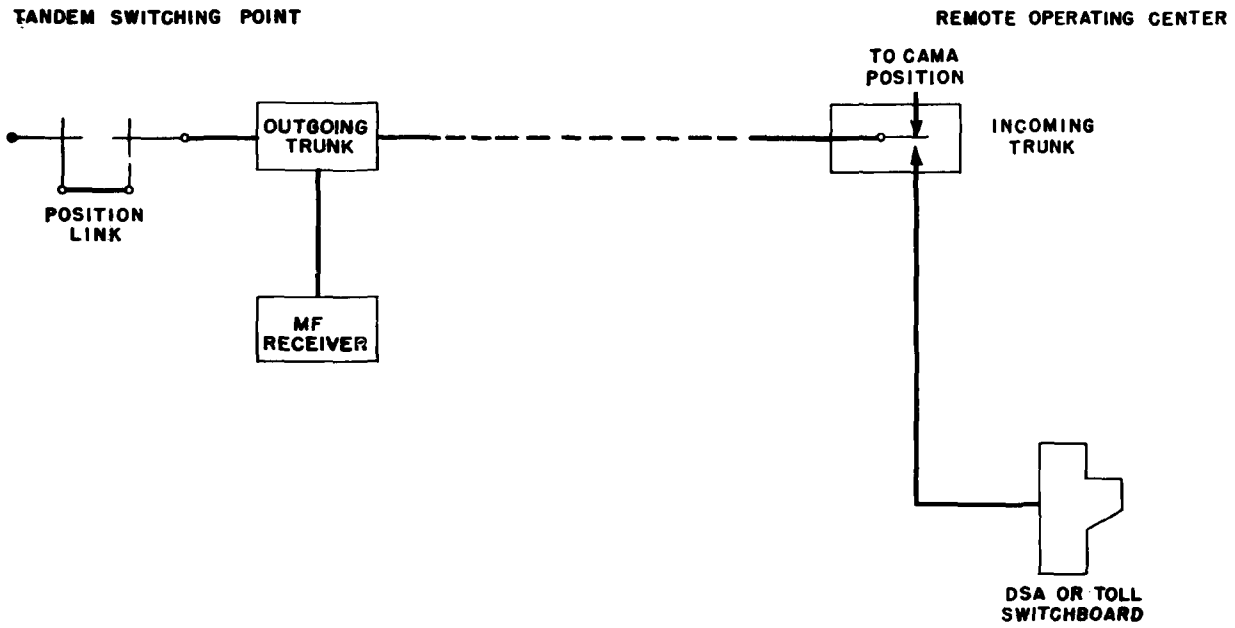


Fig. 15 - DSA or Toll Switchboard at a Remote Location

pearances E9, D9, and C9, respectively. If the number of cordboard positions increases, the additional positions are assigned to appearances B9, A9, E8, etc.

5.85 Each switchboard position arranged for dual operation is equipped with a transfer key which, when operated, allows selection by the CAMA position link just as any of the regular CAMA cordless positions are selected. The DSA or toll operator then handles the AMA traffic in the same manner as a CAMA operator at a cordless position; the cordboard is provided with similar keys and lamps for this purpose. However, a multiple of the calls waiting lamp in terms of team size is not provided at the DSA or toll switchboard. Instead, a simple call waiting lamp is provided. This lamp lights whenever one or more senders are waiting for positions and no position is available.

5.86 The DSA or toll operator may also handle non-AMA traffic in the regular manner while handling AMA traffic. If a non-AMA call comes in while the transfer key is operated, the operation of a talk or monitor key makes the position busy to the position link.

5.87 DSA or toll positions that handle AMA calls should not be arranged for DSB operation, nor should the positions be grouped to DSB or combined DSA-DSB positions. Although regular DSA or toll positions may be arranged for grouping under normal operating conditions, the grouping keys should not be operated when the positions are handling AMA calls.

5.88 The position circuit provided for a combined CAMA and DSA or toll switchboard is not the same as that provided for the CAMA cordless switchboard, as the keys and lamps have been added to the regular circuit associated with the switchboard. The position circuit units are relay rack mounted.

DSA or Toll Switchboard at Remote Operating Center

5.89 When located at a remote operating center, each cordboard position which is to be used for CAMA operation must be associated with a particular CAMA position. As shown in Fig. 15, an option is provided so that the incoming trunk circuit can be transferred from the regular CAMA position to the cordboard. The cordboard is provided with a call waiting lamp which lights whenever one or more senders are waiting for positions and no position is available. However, this signal is furnished by the calls waiting circuit and is available only when the calls waiting signals are not being used at the CAMA positions, since it is planned that the transfer keys will not be operated while the cordless switchboard is in operation.

5.90 The cordboard at a remote location is similar in operation to the CAMA switchboard at a remote location, except that the existing keyset circuit sender lamp rather than the KP lamp indicates readiness of the MF receiver to receive pulses. To conform with standard toll practice, the existing KP lamp lights when the KP key is depressed, and the existing ST key is made ineffective so that it may be operated after the operator keys the calling number.

J. Transverter Connector

5.91 A transverter connector connects senders to transverters so that information can be exchanged between these circuits. There are two types of connectors: one for use with PCI senders and one for use with DP senders. All connectors have access to the full transverter group, a maximum of twelve transverters. Each connector can serve a maximum of five senders and each sender appears in only one connector.

5.92 Within any one connector, only one connection can be made at a time. However, as many simultaneous connections as there are transverters can be made through different connectors.

5.93 In case of simultaneous demands on a connector by two or more senders, the senders take their turn, as determined by their relative positions in a sender preference circuit.

5.94 The transverters are arranged in a definite order by a chain circuit in each connector. If the first choice transverter is busy, then the first idle transverter in the order of preference is selected. If all transverters are busy, the connectors take their turn depending upon the relative position which each connector has in the transverter preference chain.

5.95 If a transverter fails to complete its functions and times out, it gives a trouble release signal to the connector. The connector releases the transverter and makes a second trial by seizing another transverter or the same transverter if all others are busy. If this second transverter encounters trouble, the call is handled free if it can be identified as a message unit call. If it is a toll statement call or one that cannot be identified, it is routed to reorder.

5.96 The transverter connector frame is a single-bay frame and has capacity for two connectors serving a maximum of ten senders. A maximum of 20 such frames may be associated with a transverter group.

5.97 Another function of the transverter connector is to seize the line observing number matching circuit. This circuit, as explained later, signals the transverter to make detailed tape records of AMA calls originated from particular subscriber lines when detailed records are desired for various reasons, such as customer charge complaints. The connector seizes the line observing circuits at the time the transverter is connected to the sender. Information between the two circuits is passed directly and not through the connector.

K. Transverter

General

5.98 The major functions of a transverter are to register, translate, and convert the information received from the sender and billing indexer to a form or pattern satisfactory for recording, and then transmit to a recorder all the information necessary for the initial entry of a call. This is the only entry for which the services of the transverter are required; the answer and disconnect entries are made under control of the trunk and call identity indexer.

5.99 The transverter can be equipped to handle intra-area traffic only, or both intra-area and interarea traffic. Under some conditions, the transverter can handle interarea traffic as intra-area traffic and serve called offices outside of the home area. In these cases, the called offices are for all practical purposes within the home area and are reached by dialing only the called directory number, since the called office code will not conflict with any office in the home area.

5.100 The transverter receives 3-digit area codes from the DP sender to indicate called foreign numbering areas. The PCI sender makes use of class-of-service indications derived from trunk decades on the sender link to indicate foreign terminating areas and one trunk group per terminating area is required from the originating office.

5.101 Although ten classes of service are possible at tandem, selection at the originating panel or crossbar office of a second trunk group, to indicate to the tandem equipment a terminating area other than the home area, requires the dialing of a directing code before the called office code. Panel and Nos. 1 and 5 crossbar offices may now be arranged to handle the "11" directing code. They are limited to indicating one foreign area by this method.

5.102 Regardless of the number of terminating areas, the transverter can refer only three (home area and two foreign areas) to the billing indexer as areas for which the billing indexer must determine information for bulk-billing purposes. The remaining areas must be areas for which all calls receive toll statement billing.

Operation With Sender and Billing Indexer

5.103 After connection to the sender, the transverter receives the following information:

(a) Calling number.

(b) Called area code, if necessary.

(c) Called number.

(d) Rate class, if required.

(e) Recorder number.

(f) Class of service, if required.

(g) Trunk test, sender test, or service observing indication, if required.

(h) Called number is over or under 10,000.

5.104 The transverter uses all but the rate class in performing its functions. The rate class plus the calling office code and the called office code are passed to the billing indexer. The transverter also determines the terminating area when interarea traffic is served and passes the terminating area indication to the billing indexer. Although the transverter controls the recording and uses the recorder number to select the proper recorder, the recorder number is required by the billing indexer for other purposes and it is passed on by the transverter.

5.105 The billing indexer performs its functions and passes to the transverter the calling office index, the type of initial entry to be made (MU, MUD, or toll), and the message billing index. After the complete information is received and is checked as satisfactory, the transverter sends a position release signal to the sender and a release signal to the billing indexer.

Operation With Recorder and Call Identity Indexer

5.106 The recorder is called for and the initial entry information is perforated on the tape one line at a time in the proper sequence. Message unit calls are perforated in two lines, message unit detail and toll statement calls in four or five lines. Four lines are used in panel and crossbar areas since the terminating area is given by class-of-service indication. Five lines may be used in step-by-step areas where 3-digit codes indicate the terminating area, except as discussed below.

5.107 The transverter may be arranged to perforate a maximum of ten 3-digit area codes as single digits on 4-line entries. If more than ten areas are reached, then the remaining area codes are perforated as three digits on 5-line entries. However, the three areas to which either bulk-billed or toll statement calls can be made must be areas for which the area codes are perforated as single digits on 4-line entries. For accounting center purposes, it is necessary that 5-line entries be restricted to areas for which all calls receive toll statement billing.

5.108 At about the time the recorder is seized, the transverter signals the call identity indexer to get ready to identify the incoming trunk. As the last line of the initial entry is being perforated, the call identity indexer furnishes this trunk number to the recorder. With the initial entry completed, the transverter signals the recorder that the initial entry is complete. This signal is relayed from the recorder to the trunk and tells the trunk that the call should be charged for if answered.

5.109 If the transverter is unable to complete the initial entry after two attempts, a bulk-billed (MU or MUD) call is switched through without charge and a detail-billed (toll) call is routed to reorder. If the call cannot be identified by the billing indexer as a message unit call, it is treated as a toll call and routed to reorder.

5.110 In rare instances, a recorder may be plugged busy and the emergency recorder may not be available. The transverter recognizes this condition as soon as the recorder number is given by the sender. Disposition of the call awaits completion of billing indexer functions. Second trial by the transverter connector is made on a bulk-billed call. If on this second attempt a recorder cannot be obtained, the call is handled free. A routing to reorder is made on toll calls without making second trial.

5.111 If a recorder is associated with the master timer for the 3:00 A.M. entry during the early stages of perforating this entry, or if the recorder is perforating a splice pattern, the transverter recognizes this condition and the call is handled as described in 5.110. If the recorder is requested during the later stages of the 3:00 A.M. entry, a signal is given to the transverter, which then temporarily extends the timing to wait for the recorder.

Equipment Arrangements

5.112 The transverter frame is a single-bay frame and accommodates the equipment of one transverter. It can be arranged to operate with a maximum of 20 recorders, 40 transverter connectors, and three billing indexers. A billing indexer connector is part of each transverter and provides access to all three billing indexers.

L. Billing Indexer

5.113 The billing indexer has functions other than that indicated by its name and must be supplied even when every call is billed by toll statement. In addition to determining the billing index, its other major duties are the determination of an office index and of the type of initial entry. It also checks the originating office code against the recorder number to determine

that the code given is assigned to the recorder, and it checks the originating office code against the called office code to determine whether the customer gave the operator the called rather than the calling number.

5.114 The billing indexer deals only with a transverter, and depending upon the call, receives all or some of the following:

(a) Originating office code

(b) Rate class, if required.

(c) Recorder number.

(d) Terminating area number.

(e) Terminating office code.

Determination of Billing Index

5.115 In local AMA offices, the message billing index is relatively easy to obtain as it is practically a function of the terminating office. At crossbar tandem, the complexity of obtaining this index is multiplied by the number of originating offices, by their varying rate classes, and in some cases, by office codes duplicated in two or more originating areas. In information released earlier (CDs, SDs, etc.), these codes are referred to as conflicting codes, although this is not so since they appear in different areas. However, to simplify reference between this BSP and earlier information, the same terminology is retained.

5.116 Because calls from different originating offices to the same called office may receive different charge treatment, the tandem billing indexer must first determine which one of the originating offices is making the call and then apply an originating rate treatment. Similarly, since many called offices may be reached and the charges for calls to these offices may not be the same, the billing indexer must determine which office is being called and then apply a terminating rate treatment. A combination of an originating rate treatment and a terminating rate treatment determines the message billing index for the call.

Originating Rate Treatment

5.117 All originating offices, for which identical charges can be applied on like calls, form an originating rate treatment group and receive the same originating rate treatment at tandem. The originating rate treatment will be the same for all calling customers in an office, provided they are all charged the same for like calls.

5.118 If there are subdivisions of customers within an originating office who are not charged the same for like calls, they are assigned to one of three rate classes and their calls are routed to tandem over different trunk groups. A maximum of 80 originating offices may have two or three subdivisions of customers who receive different originating rate treatment at tandem.

5.119 Identical originating rate treatment may be given to customers in several different offices regardless of their rate class, providing they are charged the same for like calls. For example, customers in rate class 0 in office A and customers in rate class 1 in office B can receive the same originating rate treatment at tandem.

5.120 Referring to Fig. 16, Page 32, the billing indexer is provided with two originating office code fields, each of which has a maximum of 800 code points available and which may represent originating offices in a maximum of three numbering plan areas. One originating code field is used to determine the message billing index and the other to determine the office index and type of initial entry. The originating office code is cross-connected to one of several points, as discussed below.

5.121 The calling office code is cross-connected (A) to one of 50 originating rate treatment group terminals, provided that all customers within the calling office receive the same charge for all like calls through this tandem office, and provided that the code is not duplicated in any other originating areas served by this CAMA.

5.122 If there are subdivisions of customers who are not charged alike and whose calls to tandem are routed over separate trunk groups, then cross connection (B) is made. At this point, a maximum of three rate classes may be differentiated and cross connection (C) is made to the proper originating rate treatment terminals.

5.123 Three (C) cross connections are made for an office with three rate classes and two (C) cross connections are made for an office with only two rate classes. A third cross connection (D) to the wrong office code field is made for those offices with only two rate classes.

5.124 This latter cross connection provides a means whereby the billing indexer can determine that the calling subscriber did not give his own office code, although the code given was one acceptable by the billing indexer for another originating office. In this instance, the customer gave the code of an office which had two rate classes, but neither rate class was the same as the rate class indication given by the transverter. If the code given is one not acceptable by the billing indexer for any call, this is determined through cross connection (E) which directs all such calls to the vacant originating code terminal. For these calls, the CAMA operator is given reorder.

5.125 If this CAMA office serves originating offices in more than one originating area (a maximum of three areas is possible), there may be several originating offices with the same code in more than one area. The billing indexer can resolve a maximum of ten

such code conflicts. To resolve these codes, the originating office code is cross-connected (F) to the code conflict fields where separation by originating area is made. The arbitrary area number (0, 1, or 2) is obtained from the recorder group number cross connection (G) which, in turn, is obtained from the recorder number cross connection (H).

5.126 Cross connection (G) is always made when there is more than one originating area, whether there are code conflicts or not, since it is necessary to establish the arbitrary originating area number in order to determine whether to make or skip a match check of calling and called office codes. When only intra-area traffic is handled, the match check is always made. If the calling and called office codes match, it indicates that the customer gave the called office code instead of the calling office code when his number was requested by the CAMA operator. In such cases, a reorder signal is returned to the sender via the transverter. The sender in turn sends reorder to the operator and releases the transverter connector. In an earlier version, the match check was made by the transverter, and when interarea traffic was handled, the billing indexer determined whether the check was to be made.

5.127 From the originating area identification fields, cross connection (J) is run directly to the originating rate treatment terminals if no rate class differentiation is necessary; otherwise, cross connection (K) is necessary.

5.128 Cross connection (L) provides a means of determining that the office code keyed by the operator was not one assigned to the area indicated by the recorder group. The operator is given reorder under this condition.

Terminating Rate Treatment

5.129 As mentioned earlier, the message billing index is based on both an originating and a terminating rate treatment. The terminating rate treatment is obtained more simply.

5.130 The billing indexer is provided with three terminating office code fields, each containing a maximum of 800 code points representing called offices in different terminating areas. Calls to these offices may be either bulk-billed or detail-billed, and the billing indexer must determine which applies for each call.

5.131 A terminating office code point is cross-connected (M) to one of the 75 terminating rate treatment terminals. Here, in association with an originating rate treatment, a combined rate treatment is obtained.

5.132 Cross connection (N) is run from a combination rate treatment terminal to the message billing index terminal. Billing indexes 1 through 9 are used for service calls. Billing index 0, used for test calls, is obtained directly from the terminating office code field by means of cross connection (P).

5.133 If all calls to an area are toll statement calls, the transverter recognizes the area as not being one of the three areas for which the billing indexer determines bulk-billing information. For these calls, the transverter signals the billing indexer that the terminating area is completely toll and the billing indexer furnishes MBI 9.

Determination of Office Index and Type of Initial Entry

5.134 The second of the two originating office code fields is used in the determination of the calling office index and the type of initial entry. The originating office code alone determines the office index which is the same for all calls from an office. Both the originating office code and the message billing index for the call being handled are needed to determine the type of initial entry. A particular message billing index does not necessarily mean that the same type of entry is made for different originating offices; flexibility is provided as described below.

5.135 When there are no code conflicts involved, cross connection (R) is made from the code point to a recorder group terminal. Here the billing indexer makes a check of the calling office code, as keyed by the CAMA operator, against the recorder group number. If the office code is one that is not assigned to the recorder group, the operator is given reorder. If the code is assigned to the recorder group, the office index (1 to 9) and type of initial entry are determined through cross connection (S) to the office index-initial entry combination terminals.

5.136 Since it is desirable to allow flexibility in the type of initial entry perforated for like billing indices for various calling offices, ten patterns are provided. These patterns (A to J) are controlled by cross connection (T) which allows the assigning of a billing index to one of three types of initial entries. Within a pattern, each office has the same type of initial entry perforated for like billing indices; between patterns, like billing indices may indicate different initial entries. For example, the offices using tape entry pattern A may have billing indices 1 to 9 indicate MU, MU, MU, MUD, MUD, MU, MUD, MU, and TS entries. Offices using tape entry pattern J may have billing indices 1 to 9 indicate MU, MUD, MU, MUD, MU, MU, MU, MU, and TS entries. (The terminals representing toll statement are designated as TL.)

5.137 As mentioned earlier, cross connection (R) is made only when the originating office code is not in conflict with originating office codes in other areas. If interarea originating office code conflicts exist, cross connection (U) is made. At this point, the billing indexer can place the code in the proper area after the originating area is determined from the recorder group number, cross connections (G) and (H).

5.138 After placing the code in the correct area, the billing indexer checks the code against the recorder group number, cross connection (V). If the code is one assigned to the recorder group, the office index indication is obtained. If the code is one not assigned to the recorder group, a wrong office indication is obtained and the CAMA operator is given reorder.

5.139 In some instances, several originating offices may be assigned to unfilled recorders that are primarily associated with originating offices in another area. This may be done when most of the originating offices are in one area and it is desired to serve a few offices in one or two other areas without increasing the number of recorder groups. Since the recorder group number provides the billing indexer with the area number, and area numbers are compared in order to determine whether to make or skip match check, the correct area numbers must be determined. An area transfer feature, through cross connections (W) and (X), permits transferring area numbers to the correct area. A maximum of 12 offices may be put in the recorder groups assigned to area 0 or 2 and be transferred to area 1 by the billing indexer. A maximum of six others may be put in the recorder groups assigned to area 0 or 1 and be transferred to area 2.

Equipment Arrangements

5.140 The billing indexer consists of a 2-bay originating frame and a single-bay supplementary frame. The originating frame is sufficient when all the bulk-billed traffic terminates in one area. The originating frame is also sufficient when the required number of originating rate treatments does not exceed 33 or the number of terminating rate treatments does not exceed 58.

5.141 The supplementary frame is provided when bulk-billing information for a terminating area, other than the home area, is required. A maximum of two such terminating areas may be handled. The supplementary frame also provides for an additional 17 originating and 17 terminating rate treatments.

5.142 Three billing indexers are required for each office.

M. Call Identity Indexer

5.143 The call identity indexer performs connecting functions between a recorder and the 100 trunks (maximum) assigned to a recorder and supplies the 2-digit call identity index (trunk number) for the initial, answer, and disconnect entries.

5.144 For initial entries, the call identity indexer is signaled by the transverter (through the transverter connector, sender link, and trunk) when to identify the trunk to the recorder.

5.145 For answer and disconnect entries, since the transverter has released, the incoming trunk requests the services of the recorder by closing a path between the recorder and the call identity indexer.

5.146 For answer and disconnect entries, the call identity indexer has lockout features which permit the serving of a trunk while locking out other trunks requesting the recorder for answer and disconnect entries. This feature is not necessary for initial entries, since only the transverter that has seized the associated recorder can signal the particular trunk and call identity indexer and request identification.

5.147 The call identity indexer uses the same circuit as the indexers for Nos. 1 and 5 local AMA, but equipment-wise, the arrangements are different. The call identity indexer frame for tandem is a single-bay frame with a capacity for four call identity indexer units. Thus, five indexer frames are required for an office with 20 recorders.

N. Recorder

5.148 The recorder, in conjunction with an associated perforator, transfers the information needed for billing purposes to the paper tape. The recorder operates in response to a transverter in making initial entries on the tape and in response to the call identity indexer in making answer and disconnect entries. Certain other entries are made under the control of the master timer. The master timer has first preference, the transverter second, and the call identity indexer third.

5.149 Upon being engaged by a transverter, call identity indexer, or the master timer, the recorder operates perforator magnets as directed by the circuit in control, operates the perforator stepping magnet as each line is perforated, and checks the operation of the perforator magnets.

5.150 The recorder registers (on rotary selectors) the time in minutes and tenths of minutes past the hour, under the control of the master timer, and causes a record of the time in minutes and tenths to be placed on the tape at the beginning and at the end of the conversation period as directed by the trunk and call identity indexer.

5.151 At the start of each hour, the recorder places an hour entry on the tape, and at 3:00 A.M., an end-of-tape pattern. These are made under the control of the master timer.

5.152 An emergency recorder is provided which may be substituted for any of the regular recorders (20 maximum). The substitution is made by inserting a make-busy plug into the transfer jack of the regular recorder. Prior to the transfer being effected, the master timer causes the end-of-tape pattern to be placed on the tapes of both the regular and emergency recorders. This procedure is repeated when the regular recorder is returned to service. A record of the transfer thus appears on both tapes. The record on the emergency tape includes the number of the regular recorder for which it is substituted.

5.153 A recorder may be associated with a maximum of 100 AMA trunks. For PCI, this includes the reserve. All of these trunks must be associated with the same call identity indexer. As mentioned earlier, all service trunks in a decade must be assigned to the same recorder.

5.154 No more than ten office designations may be assigned to the same recorder. For accounting reasons, these ten names appear in a recorder group. One recorder may constitute a recorder group. However, the trunks may be divided over two recorders assigned to the same recorder group, if required.

5.155 The recorder frame used for tandem AMA is a single-bay frame with capacity for four recorder units, each of which operates with the full transverter group. Even-numbered recorders are associated with the even master timer; odd-numbered recorders and the emergency recorder are associated with the odd timer.

O. Perforator

5.156 The perforator cabinet is a single-sided steel enclosure. Two perforators are mounted in the upper part; in the space below are the paper supply bins and the motor-driven take-up reels for the perforated tape.

5.157 The paper tape is supplied to the perforators in folded form from the supply bins. There are two such bins per perforator, each holding about 3000 feet of folded paper. The two bins are located one above the other so that the bottom end of the paper tape in the top bin can be spliced to the top end of the paper in the lower bin. In this way, a total of 6000 feet of tape is available to each perforator without renewing the supply. In practice, a second carton of paper is introduced after the top one is exhausted. At that time, the lower bin is shifted to the upper position, a fresh carton inserted in the second bin which is placed in the lower position, and the two lengths of tape spliced together.

5.158 Reels for taking up the perforated tape are motor-driven and are under the control of a switch which is actuated by a movable arm in contact with the paper tape. When the output from the perforator reaches a certain amount, the motor is started and the reel rotated until the slack in the tape is taken up, whereupon the motor is stopped.

5.159 A maximum of 11 perforator cabinets housing 20 regular and one emergency perforators may be furnished for an office.

P. Master Timing

5.160 The master timing circuit is composed of an odd and even master timer of the synchronous motor type. The master timer frame is a single-bay frame on which both timers are mounted.

5.161 One of the functions of a timer is to supply a pulse every 6 seconds to all recorders. This operation can be performed by either timer, and the one selected for this function becomes the control timer. Transfer arrangements allow this and other functions to be assumed by the other timer in the event of trouble.

5.162 The answer and disconnect time entries entered on the tapes by the recorders and associated perforators are determined by the setting of three selectors provided in each recorder. One of these selectors is advanced every 6 seconds by the pulse from the control master timer, and it in turn controls the others. At one-minute intervals, the control timer makes a check of the other timer and of all recorders for synchronism. An alarm sounds if any timer is out of synchronism, and it is brought into synchronism by maintenance force operation.

5.163 At the start of each hour, the master timing frame supplies the recorders with hour information for entry on the tapes. At 3:00 A.M., an end-of-tape pattern is placed on each recorder tape under the control of the master timing frame; the odd master timer controlling the odd recorders, and the even master timer the even recorders. The end-of-tape pattern includes the month, day, hour, recorder number, and recorder group number. It also contains a special pattern defining where the tape shall be cut for removal to the accounting center for processing.

5.164 In addition to the above functions, the master timing frame is arranged to test certain features of recorders and perforators. These tests are under the control of the odd master timer.

6. OBSERVING FACILITIES

A. General

6.01 Two types of observing facilities, service and complaint, may be provided at a CAMA office. The service observing facilities are used for observing on a sample of all traffic offered to the office and are made by an observer at a centralized

service observing desk. In addition, a detailed tape entry of each call is made. Information received from such observations is used to rate the performance of a CAMA office. Complaint observing facilities at a CAMA office provide a detailed tape entry on CAMA calls from a line under complaint observing in an originating office.

B. Service Observing

6.02 The service observing facilities for crossbar tandem CAMA are described briefly below. A detailed description will be given in the BSP covering the No. 12 service observing desk.

6.03 Loops from incoming AMA trunks, on which service observing is desired, are wired to jack appearances at a patching panel where they may be patched to the loop connectors (50 maximum) associated with a trunk to the service observing desk. This trunk handles only one call at a time, and at the desk end of the trunk, the call is assigned by a call distribution circuit to a position arranged for CAMA service observing. Generally, a maximum of 10 per cent of the AMA trunks are arranged for service observing.

6.04 The equipment arrangements for the desk and the CAMA service observing trunk are for inclusion in a No. 12 service observing desk and in a No. 7 service observing desk modified for No. 12 operation. These arrangements include circuits for converting the called and calling number to the multifrequency pulses for transmission to the No. 7 or 12 desk. Equipment arrangements for other standard service observing desks will be developed if the need arises.

6.05 As explained previously, the CAMA operators may be divided into a maximum of three teams, each group associated with a particular group of senders. An indication at the service observing desk enables the service observer to identify the team handling the call.

6.06 In addition to the observations made at the observing desk, a detailed tape record of the call is made by the AMA equipment. When connection to the observing position is established, the AMA incoming trunk gives an observing mark to the sender. This is passed on to the transverter which forces detail recording even on bulk-billed calls.

C. Complaint Observing

6.07 When a request is received for observations on a subscriber line in a non-AMA local office, a connection is made at the local dial office from the subscriber line to a No. 10 service observing desk. At the No. 10 desk, all numbers dialed by the customer are recorded on a tape by a pen register. A time stamp also prints the time of the start and the conclusion of a call, and if the office is equipped with message registers, the time that message register current is applied.

6.08 Calls routed through CAMA offices will, of course, not be scored on message registers where provided in the originating office, and therefore, on these calls no method is available for registering the charge information on the No. 10 service observing tape at the local office. Instead, a centralized complaint service observing circuit (line observing number matching circuit) at tandem causes an observing indication to be given to the transverter, which then controls the perforation of a detailed record with an observing initial entry.

6.09 The calling office code and numericals of the lines set up for complaint observing are manually set up on rotary switches of individual line observing number matching units. On all calls through the CAMA office, the transverters pass the calling numbers to the line observing matching circuit. If any calling number is the same as one set up on a matching unit, the transverter serving the call is signaled that an observing entry is required.

6.10 The line observing number matching circuit can serve requests from two transverters at the same time. In periods of heavy traffic, the observing circuit may not be able to handle all of the traffic and no matching test will be made on a very small percentage of the calls. These calls are not delayed, since the transverters are arranged to complete calls with or without an answer from the line observing number matching circuit.

6.11 Equipment may be provided at the tandem office so that a maximum of 30 lines can be placed under observation. Any line in any served office may be put under observation. The individual matching units and the preference and control units are mounted on a line observing frame.

7. KEY MONITORING FACILITIES

A. General

7.01 Two arrangements of key monitoring facilities for use in monitoring on and observing the keying performance of an operator in a CAMA office are discussed below.

(a) Key monitoring facilities at a CAMA cordless position may be used to monitor CAMA cordless positions only.

(b) Key monitoring facilities at a DSA or toll switchboard may be used to monitor on CAMA cordless positions, on combined CAMA and DSA (or toll) switchboards, and on regular DSA or toll positions.

B. Combined CAMA and Key Monitoring Position

7.02 In order to use a CAMA position for key monitoring, the CAMA position must be modified by the addition of a key and a display panel. This panel displays the keyed number and the number of the connected operating position. The operation of a key prepares a combination CAMA monitoring position for monitoring operations and makes the position appear busy to incoming AMA traffic. When the key is normal, the position operates like a regular position.

7.03 Means are provided whereby a monitor is connected to the desired CAMA position by keying the number of the position. For keying the CAMA position number, the regular position keyset is used. When an operating position is connected to a monitoring position, the number of the operating position is displayed before the monitor. The operating position is released by the operation of the position disconnect key in the monitoring position.

7.04 When a call is received in the CAMA position, the monitor receives an order tone. For 2-out-of-5 dc operation, a lamp is lighted in the indicator display panel, but for MF operation, the lamp is not lighted until the KP key is operated. The monitor is able to hear all conversation between the calling customer and the CAMA operator. A display of the number keyed by the CAMA operator appears before the monitor. The display of the keyed number may be deleted by the monitor operating the register reset key.

7.05 If the CAMA operator wishes to delete a registration and key again for any reason, the operation of her register reset key extinguishes the display before the monitoring operator and lights a reset lamp in the indicator display panel at the monitoring position. This lamp is locked in until the CAMA operator begins to key again and is extinguished by the subsequent keying of the first digit.

7.06 If a CAMA operator receives a reorder signal from a sender, the monitoring operator receives a flashing lamp at the time of reorder. If the CAMA operator operates her position disconnect key, two lamps are lighted in the indicator display panel at the monitoring position.

7.07 There is no partial registration of a call at the monitoring position, because the monitoring operator cannot be connected when a CAMA operator is in the process of handling a call. This also applies if a CAMA operator begins keying before the monitor is ready to begin monitoring. For example, a CAMA operator may key a call before the monitor has recorded the number and wiped out the display of a preceding call. If this happens, the keying of the succeeding number does not disturb the record of the previous number.

C. Key Monitoring at a Toll or DSA Switchboard

7.08 The DSA or toll positions used for key monitoring must be modified to monitor on CAMA calls. For 2-out-of-5 dc pulsing, the modification consists of the addition of a unit which receives the 2-out-of-5 pulsing and transfers the information to the display panel. For MF pulsing, this unit is not necessary since the monitoring circuit is already arranged to receive MF pulsing. However, provision must be made to receive the new CAMA dc KP and ST signals.

7.09 A jack is furnished at the monitoring position for each position to be observed. When a monitoring cord is inserted into this jack, a connection is established with the position to be monitored. The operation of a key at the combined DSA-CAMA or Toll-CAMA position to take up a CAMA call automatically arranges the monitoring circuit for monitoring on the CAMA call and no action is required by the monitoring operator.

8. TRAFFIC AND COMMERCIAL MEASURING FACILITIES

8.01 In addition to the measuring facilities provided for regular non-AMA crossbar tandem offices, connections to the following facilities are available:

(a) All incoming registers busy - one per group of ten incoming registers.

(b) No sender attached - one per group of ten incoming registers.

(c) Permanent signal - one per group of ten incoming registers.

(d) Partial digits - one per incoming register group.

(e) Incoming register peg count - one per group of ten incoming registers.

(f) Sender group busy - one per sender group.

(g) Partial digits register - one per sender group.

(h) Sender load register - one per group of 20, 40, or 80 PCI or DP senders.

(i) No position attached - one per office.

(j) Position peg count - one per position.

(k) Transverter peg count - one per transverter group.

(l) Free call peg count - one per transverter group.

(m) Wrong calling code peg count - one per transverter group.

(n) Call count process control - two per recorder.

(o) Answering time recorder - one per office.

(p) Holding time recorder - as required.

8.02 The free call peg count register is scored by a transverter if the transverter cannot complete the initial entry for a bulk-billed call and the call is allowed to advance.

8.03 The wrong calling code peg count register is scored under several conditions, namely:

(a) If a billing indexer determines that a vacant calling office code was given by the customer.

(b) If a billing indexer determines that a nonvacant but wrong calling office code was given by the calling customer.

(c) If a billing indexer determines by match check that the called office code was given in error by the calling customer.

8.04 Call count process control is a means of keeping an account of the calls or messages at various stages, beginning at the CAMA tandem office and extending through the AMA center. For this purpose, two registers per recorder are provided at the CAMA office. Each is to be used on alternate days with the transfer from one register to the other being made at 3:00 A.M. The register is scored for each completed initial entry and test call perforated on the recorder tapes.

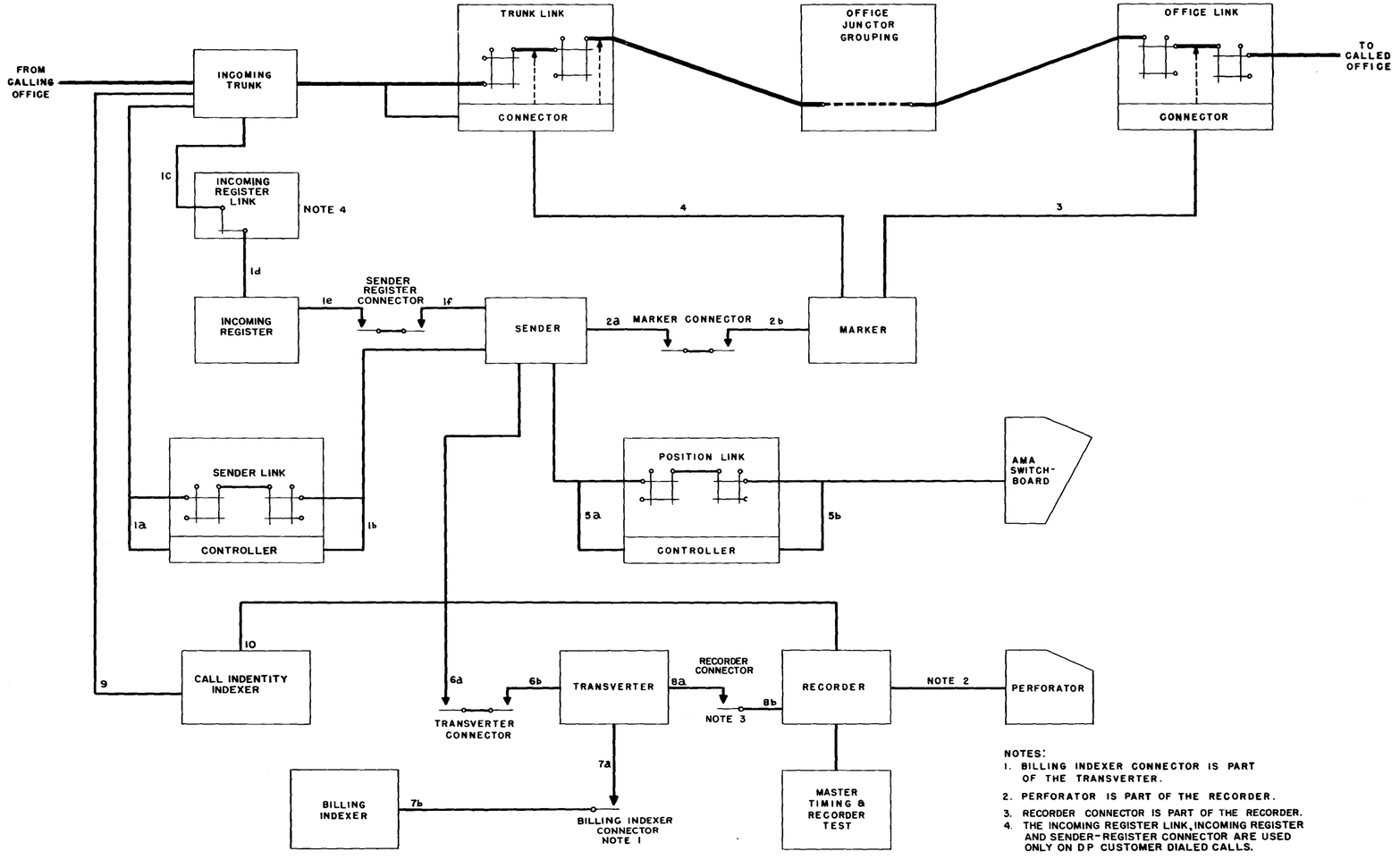
8.05 Use of traffic usage equipment has been anticipated and this equipment may be added when available. The change of some connecting information only will be required; some changes have already been made.

9. POWER

9.01 Crossbar tandem CAMA offices will require sources of 24-, 48-, and 130-volts dc and 22- and 115-volts ac audible ringing and reorder tones.

10. MAINTENANCE

10.01 In addition to the usual facilities for the maintenance of crossbar tandem offices, three new maintenance frames are provided for offices with CAMA features. An automatic trunk test frame is provided for testing incoming PCI and DP AMA trunks. A sender test frame is provided for testing PCI and DP senders, and can also be used for testing positions, transverters, and incoming registers. A transverter trouble indicator frame, similar to other trouble indicator frames except that it cannot be used for testing, is also provided. More complete descriptions of the various maintenance facilities will be made available at a later date.



NOTES:
1. BILLING INDEXER CONNECTOR IS PART OF THE TRANSVERTER.
2. PERFORATOR IS PART OF THE RECORDER.
3. RECORDER CONNECTOR IS PART OF THE RECORDER.
4. THE INCOMING REGISTER LINK, INCOMING REGISTER AND SENDER-REGISTER CONNECTOR ARE USED ONLY ON DP CUSTOMER DIALED CALLS.

FIG. 3 – CIRCUITS ASSOCIATED WITH A CROSSBAR TANDEM AMA CALL

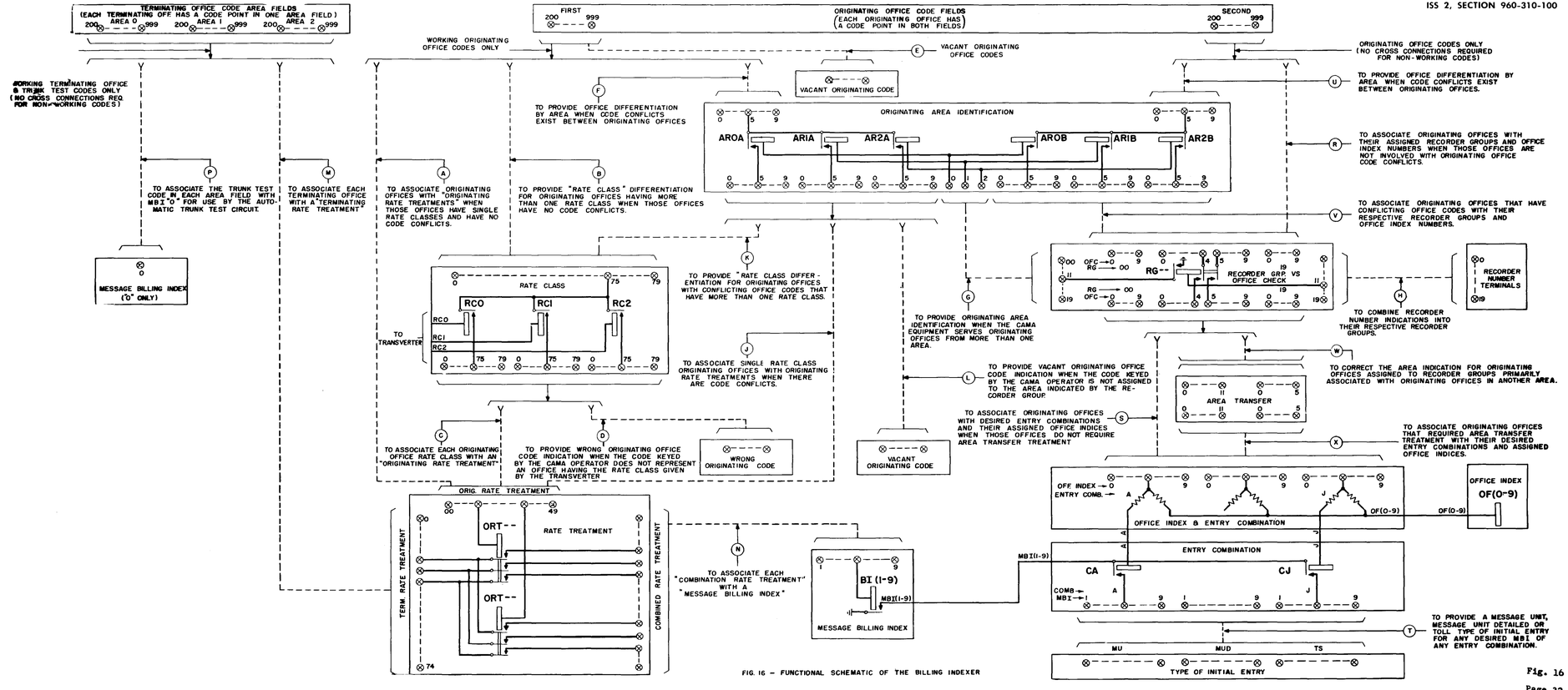


FIG. 16 – FUNCTIONAL SCHEMATIC OF THE BILLING INDEXER

Fig. 16