

CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING
GENERAL DESCRIPTIVE INFORMATION
NO. 5 CROSSBAR SYSTEM

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NOTICE

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1. INTRODUCTION

1.01 This section describes the Centralized Automatic Message Accounting (CAMA) features of the No. 5 Crossbar System. Section 958-110-100 describes the switching features of the system.

1.02 This section is reissued for the reasons listed below. Since this reissue is a general revision, no revision arrows have been used to denote significant changes. This reissue does not affect Equipment Tests Lists.

- (a) To include information on the CAMA automatic progression trunk test frame (CAPTT)
- (b) To include information on the cancel automatic number identification timing key (CANIT)
- (c) To include changes in the calls-waiting lamps associated with the CAMA position
- (d) To include information on incoming trunk trouble reports
- (e) To make minor changes as required.

1.03 CAMA provides facilities for:

- (a) Serving local dial systems that do not have means for automatically charging station-to-station extra charge calls.
- (b) Charging calls from 4-party and rural line customers that cannot be charged by local facilities.
- (c) Serving offices in which local automatic charging facilities would be too expensive for the volume of traffic involved.

(d) Concentrating the expensive charging equipment where it can serve a number of offices.

1.04 Identification of the calling customer may be made:

- (a) By a CAMA operator (operator number identification—OI).
- (b) Automatically by receiving the information over the trunk from the calling office (automatic number identification—ANI).

1.05 There may be a need for both of these methods in the same CAMA installation. Though the originating offices may be arranged for ANI, OI will be required to serve the calls from 4-party and rural line customers. Means are not available to automatically identify calling stations on such lines.

1.06 With the No. 5 crossbar CAMA arrangements:

- (a) All offices served must be on a 205 numbering plan.
- (b) The calls served may consist of seven, eight or ten digits.
- (c) Calls from step-by-step offices must be prefixed by an access code. This is so the No. 5 equipment receives the full seven, eight, or ten digits of the called number.
- (d) The calls served may come from a maximum of 48 offices which may be distributed among three numbering plan areas.

1.07 No. 5 CAMA can serve the following basic types of traffic:

- (a) Calls from step-by-step offices and other No. 5 offices.
- (b) Calls from lines in the CAMA marker group.

In each case, the calls served may switch through or terminate on lines in the CAMA marker group.

2. AUTOMATIC MESSAGE ACCOUNTING

2.01 The Automatic Message Accounting System is an equipment arrangement designed to perform two functions:

- (a) To mechanically record on paper tapes the data required for computing charges on customer dialed calls.
- (b) The processing of these tapes in an accounting center to reduce the recorded information to a form from which customers' bills can be made.

2.02 Two equipment arrangements are available for recording the charge data:

- (a) Local automatic Message Accounting—LAMA—where the recording equipment is located in the originating office.
- (b) Centralized Automatic Message Accounting—CAMA—where the recording equipment is located at a tandem point to serve many local originating offices.

2.03 AMA facilities may be provided in the initial installation of a No. 5 office or may be provided later. When AMA is provided, a number of new frames are added and a number of the frames of the regular No. 5 office are modified by the addition of certain units.

2.04 With AMA, regardless of which type is involved, these equipment elements are required:

- (a) AMA recorders and recorder connectors
- (b) Perforators
- (c) Call identity indexers
- (d) Master timers

2.05 With LAMA, these additional elements are required:

- (a) AMA transverters and transverter connectors
- (b) AMA translators

- (c) Trunks and junctor circuits arranged for LAMA operation

2.06 With CAMA, these elements are required in addition to those of paragraph 2.04:

- (a) CAMA transverters and transverter connectors
- (b) Trunks and junctor circuits arranged for CAMA operation
- (c) CAMA billing indexers
- (d) CAMA senders
- (e) CAMA positions
- (f) CAMA position links

2.07 This section describes the equipment required for recording the charge data in a No. 5 CAMA installation. Descriptions of the accounting center equipment and of the AMA tape may be found in Division 968 of the Plant Series.

2.08 For convenient reference, Fig. 1 and 2 are attached to this section to illustrate the typical tape entries.

3. CAMA EQUIPMENT ELEMENTS

A. Trunks and Junctors

3.01 The trunks and junctors arranged for CAMA operation are as follows:

- (a) One-way CAMA incoming trunks arranged for either bylink or nonbylink operation.
- (b) CAMA junctor.
- (c) CAMA intermarker group (IMG) trunks (subscriber to trunk, S/T) and (subscriber to subscriber S/S).

3.02 These trunks and junctor have appearances at the outgoing sender link frame for connections to CAMA senders, and also at the line link and trunk link frames as required.

3.03 *The one-way CAMA incoming trunk arranged for bylink operation* handles incoming CAMA traffic from nonsenderized offices.

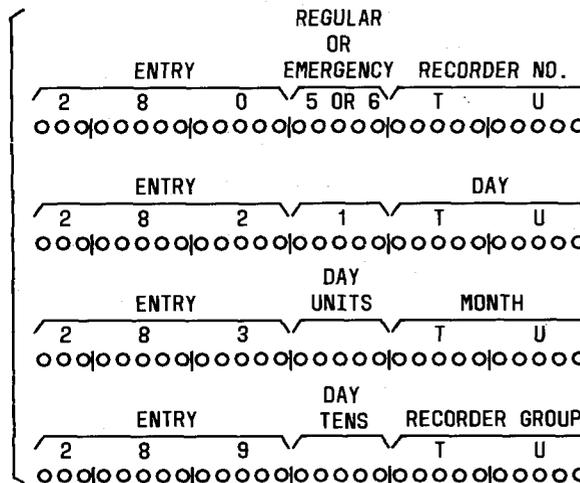
TAPE IDENTIFICATION
ENTRIES

Fig. 1—Method of Recording Information on the AMA Tape—Typical Entries Encountered—Sht. 2

B. CAMA Sender

3.08 The main functions of the CAMA sender are:

- (a) To receive and register from a combined or completing marker (first marker usage) all the information that is available at that time on a CAMA call.
- (b) To signal the originating office to pass forward the identity of the calling customer on an ANI call.
- (c) To convert an automatically identified (ANI) call, into an operator identified (OI) call if a 1-out-of-5 or 3-out-of-5 indication is received on the calling number.
- (d) To convert an automatically identified (ANI) call, into an operator identified (OI) call if a time-out occurs during the registration of the calling number.
- (e) To connect to an operator for calling customer-identification purposes on an OI call.
- (f) To register the calling customer number as keyed by the CAMA operator or MF outpulsed by ANI equipment.

(g) To seize a CAMA transverter and to supply it with information necessary for recording the initial entry.

(h) To request a combined or completing marker to establish the connections to complete the call (second marker usage).

3.09 A maximum of 40 CAMA senders are provided in groups, with a maximum of 10 in one group.

3.10 The CAMA senders and the MF receivers associated with them are mounted on separate frames. These frames are shown on Fig. 3, attached.

C. CAMA Position Links

3.11 The CAMA position links interconnect CAMA senders directly or via trunks to switchboard or TSPS No. 1 positions through the contacts of crossbar switches.

3.12 One link frame (see Fig. 4, attached) has the capacity for four 100-point crossbar switches to give 40 CAMA senders access to ten switchboard positions. The ten positions are multiplied to appear on the ten verticals of all the switches while the senders are distributed over the horizontals. Each CAMA sender group (maximum ten senders) is divided into two subgroups, A and

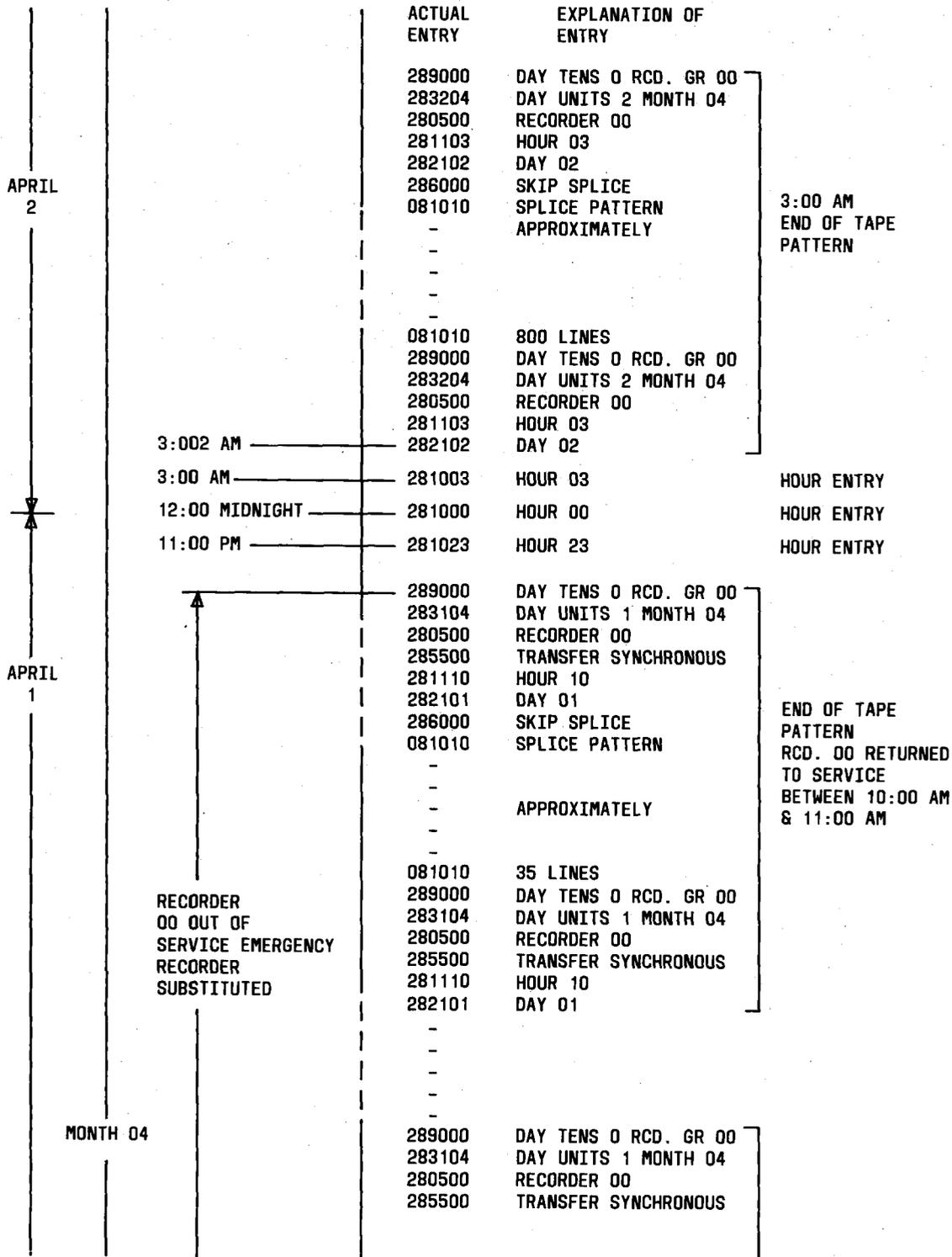
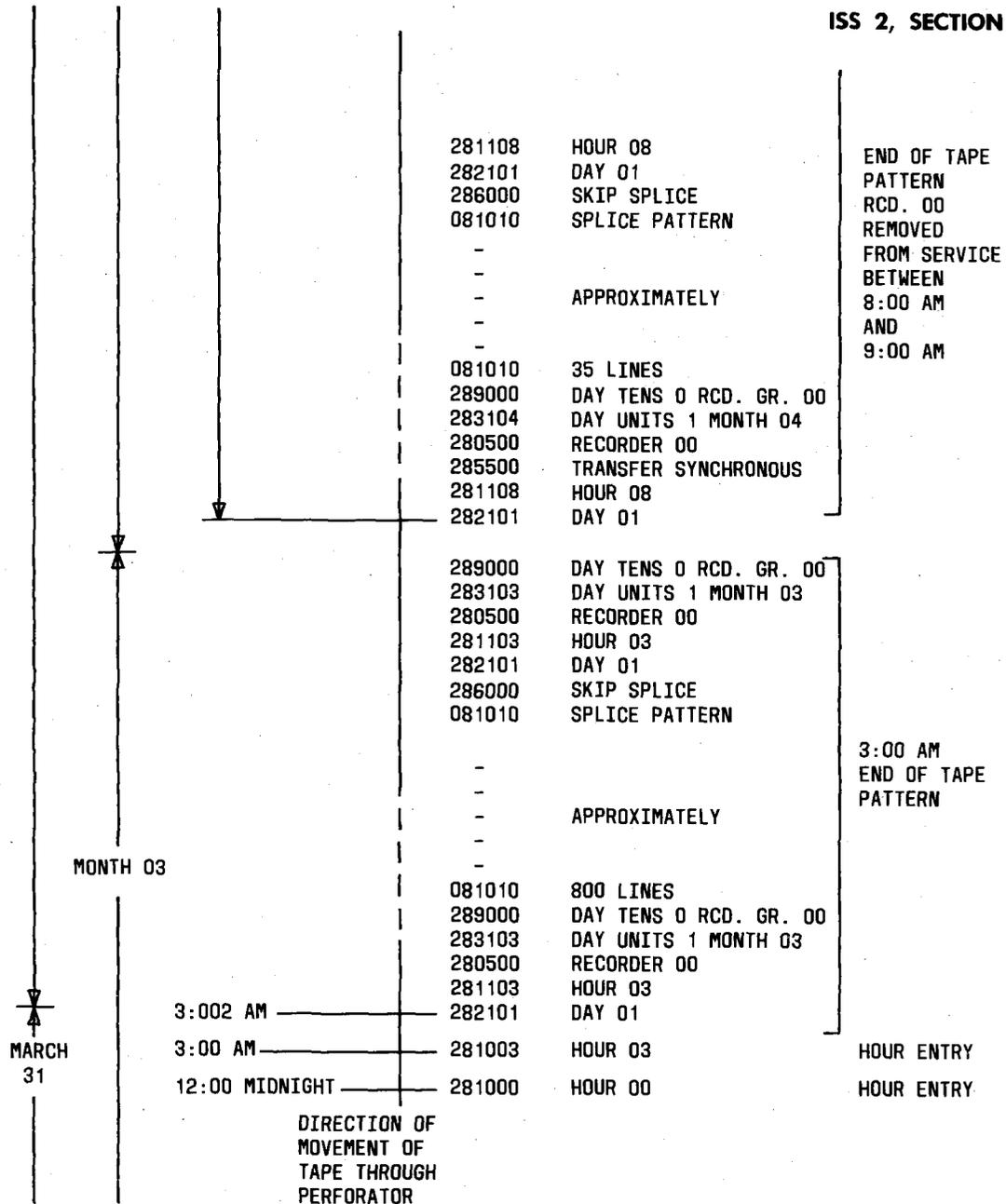


Fig. 2—Explanation of Some Special Entries-Sht. 1



NOTES

1. THE MONTH IS ADVANCED AFTER THE 3:00 AM END-OF-TAPE PATTERN. THE CALENDAR DAY IS ADVANCED AT MIDNIGHT.
2. THE TAPE IS READ BACKWARDS IN THE ACCOUNTING OFFICE.
3. DATA AND OTHER INFORMATION IS RECORDED BY NUMERALS AS FOLLOWS, PRECEDED BY A THREE OR FOUR DIGIT ENTRY NUMBER.

HOUR	00-23
DAY	01-31
MONTH	01-12
RECORDER	00-19
RECORDER GROUP	00-99

Fig. 2—Explanation of Some Special Entries-Sht. 2

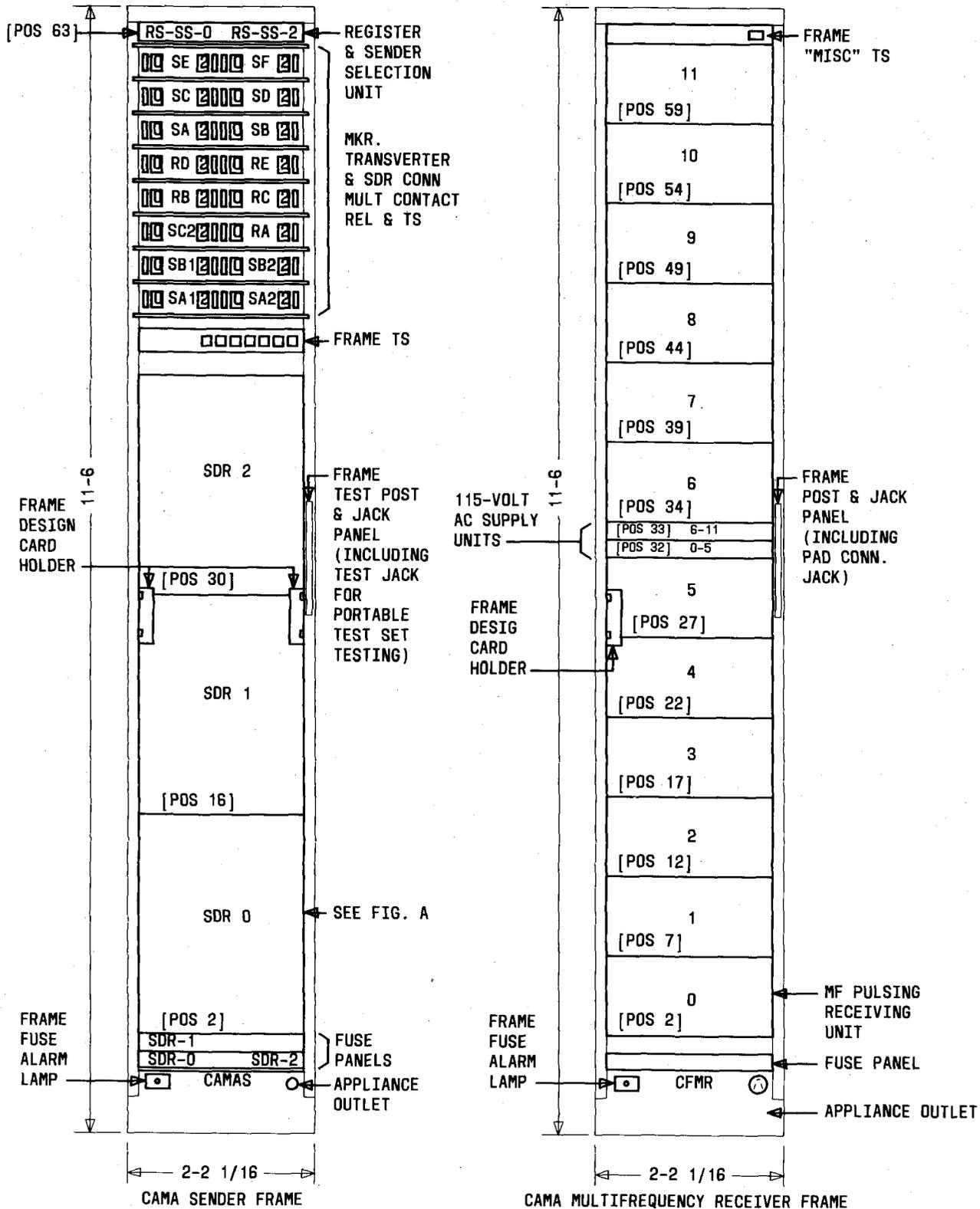


Fig. 3—CAMA Sender Frame and CAMA Multifrequency Receiver Frame

B. The subgroups appear on the horizontals of different switches.

3.13 The signaling circuit individual to the positions, and the preference and control relays are also mounted on this frame. This unit distributes the traffic evenly to all positions.

D. CAMA Switchboard Positions and Associated Equipment

3.14 The switchboard positions may be located in the same building with the switching equipment or they may be in a distant building. For a given CAMA installation, however, all positions are expected to be at the same location.

3.15 The positions may be of a type designed specifically for CAMA operation, or they may be No. 1, 3, 3C, or 3CL keypulsing toll switchboard positions modified to handle both CAMA and regular toll traffic. There may also be a combination of new CAMA positions and modified toll switchboard positions. This combination may appear where the daytime traffic is handled at CAMA positions, with transfer to modified toll positions during off-hour periods to improve operator efficiency or where it is desired to concentrate activities.

3.16 For switchboards in the same building with the position link, each of the ten appearances on the links is associated with a particular CAMA or toll position. Where toll positions are arranged to be used during off-hour periods, the number of positions for handling the daytime traffic will be limited to the difference between ten and the number of off-hour positions. With this arrangement, the off-hour positions can be manned at any time to relieve a traffic overload on the daytime positions.

3.17 When the switchboard is in a distant building, each of the position appearances on the link switches is extended by interbuilding cable to an incoming trunk circuit at the switchboard location. The trunk circuit is arranged so that it is normally associated with a particular CAMA-type switchboard position. The incoming traffic can be switched to a modified toll position during off-hours by a transfer circuit. With this arrangement the off-hour positions cannot be used to relieve an overload on the daytime positions.

3.18 When CAMA-type positions are not provided and modified toll positions are used at all hours, the incoming trunk units are connected to the positions under control of transfer circuits as in the case where CAMA-type positions are provided. However, with this arrangement, the normal paths through the incoming trunk units remain unconnected.

3.19 TSPS No. 1 offices may be associated with the No. 5 crossbar CAMA office for handling of CAMA traffic. Since TSPS No. 1 is a common system and its positions can only be accessed via a trunk, these trunks must have separate appearances on the position link whether they are in the same or distant building. The function of the TSP operator when serving a CAMA call is the same as that of a regular CAMA operator.

3.20 The CAMA switchboard is the same as that used in crossbar tandem CAMA installations. It consists of from one to five 2-position sections with a cable turning section which permits growth in either direction.

3.21 Each position is equipped with the following:

- (a) A 10-button keyset—operator uses this to key the calling customer identity into the CAMA sender.
- (b) A CAMA supervisory lamp (red)—this lamp steadily lighted indicates that a CAMA sender is attached to the position. A flashing lamp (120 ipm) indicates that the calling customer number has been rejected by the CAMA billing equipment as unsatisfactory.
- (c) A register reset key—this key permits the operator to wipe out the number keyed into the sender and then key again in the event that she receives a reorder signal (on the supervisory lamp) or she discovers an error before keying the last digit.
- (d) A position disconnect key—this key enables an operator to free a position from a call. Operation of this key signals the sender to release the position link and position and causes the calling customer to receive a reorder signal.
- (e) A calls-waiting lamp (white)—this lamp indicates that a least one sender has a call waiting to be served.

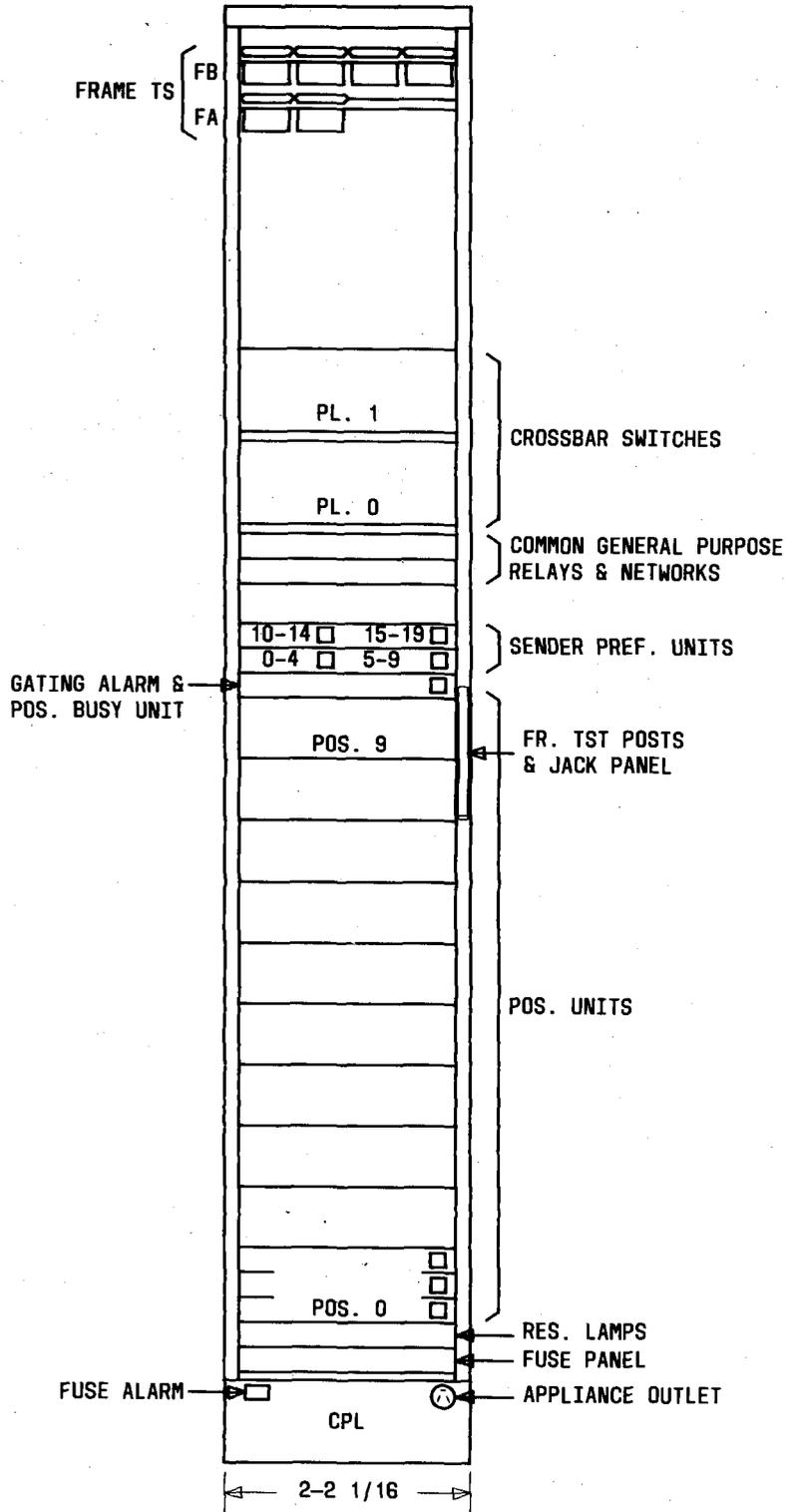


Fig. 4—CAMA Position Link Frame

(f) A service assistant call key and lamp—the operator uses these to signal need for assistance.

3.22 A single lamp standard per lineup is provided for mounting three calls-waiting lamps (white, green, red) and a service assistant call lamp. The white calls-waiting lamp and the service assistant lamp are multiples of those appearing at each position. The calls waiting lamps indicate the load on the lineup by indicating the number of CAMA senders waiting to be connected to positions. The lamp signals are:

white lamp—one or more senders waiting

green lamp—four or more senders waiting

red lamp—six or more senders waiting

3.23 At modified toll boards a single appearance of the green and red lamps is centrally located above the multiple of one position arranged for CAMA service. A white calls-waiting lamp is mounted in the piling rail at each position handling CAMA traffic.

Note: On Issue 3-D of SD-26046-01, calls waiting circuit, the lamp sequence of white, green, red was rated manufactured discontinued and the lamp sequence of green, white, red standard. If this change has been completed where reference is made to white lamp, change to read green, and where reference is made to green lamp, change to read white.

Calls Waiting Signal Circuit

3.24 The calls waiting signal circuit controls the lamp signals.

3.25 To avoid flashing of the lamps due to fluctuations in the traffic, the green or red lamps do not light until the calls waiting load has persisted for 3 to 5 seconds.

CAMA Suspension

3.26 This feature permits the CAMA operators to abandon their positions in case of an emergency without interrupting traffic. When this feature is activated, all calls offered to the No. 5

equipment for CAMA service which require OI operation are completed free of charge.

3.27 The CAMA suspension control key may be located in the operating room or in the maintenance center. Because of the nature of this feature, electrical and mechanical safeguards are provided to lessen the hazard of false operation.

E. CAMA Billing Indexer

3.28 In LAMA offices, the message billing index is relatively easy to obtain since it is only a function of the terminating office and the calling customer rate class. In a No. 5 CAMA office which is equipped for bulk billing, the derivation of this index is complicated by the number of originating offices, by varying customer rate classes in these offices, and in some instances by terminating office code duplication. Because of these factors, it is necessary to determine the index by the relationship between an arbitrary originating rate treatment assigned to the calling customer, and an arbitrary terminating rate treatment assigned to the specific called office.

3.29 An originating rate treatment is a pattern of charging for calls from the customers of a particular office directed through the CAMA point to all possible destinations. If the customers in two or more offices are charged alike for identical calls, they are assigned the same originating rate treatment. On the other hand, if two classes of customers associated with the same originating office designation are charged differently for identical calls, each class must be assigned a different originating rate treatment.

3.30 Terminating rate treatments are patterns of charging for calls to bulk billed areas reached through the CAMA point. A specific treatment may be assigned to a particular terminating office. If the same charge pattern applies to two or more terminating offices, they are assigned the same terminating rate treatment.

3.31 Consider, for example, the rate treatments applied to the offices identified as A, B, C, D, and E in the following table. The numbers 1 through 5 represent message unit charges, 0 and —represent misdirected calls to be rejected, and 9 represents a call to be detail billed.

SECTION 958-310-100

CALLS FROM	CHARGES FOR CALLS TO OFFICE				E
	A	B	C	D	
A	—	1	2	2	9
B	1	—	3	3	5
C	2	3	—	0	0
D	4	5	0	—	0
E	4	5	0	0	—

For originating traffic, offices D and E have similar charges for like calls; therefore, they have the same originating rate treatment. For terminating traffic, offices C and D have similar charges for like call; therefore, they have the same terminating rate treatment. No. 5 CAMA provides for 20 originating rate treatments and 60 terminating rate treatments.

3.32 The CAMA billing indexer functions to determine the proper billing index from the combination of these treatments. The billing indexer (shown in Fig. 5) is consulted on all calls and is arranged so that calls to offices in any terminating area may be detail billed, and calls to a maximum of three terminating areas can be billed on a bulk basis.

3.33 In the billing indexer, the originating rate treatments may be applied to 48 originating offices. These offices may be located in one or distributed among three numbering plan areas. The terminating rate treatments may be applied to 640 offices per area for three numbering plan areas.

3.34 Furthermore, as previously mentioned, customers in the same originating office can be charged differently for like calls. This is done by assigning rate classes. A maximum of three rate classes per originating office may be used. However, separate trunk groups to CAMA and distinctive originating rate treatments are required for each rate class.

3.35 The billing indexer receives from a CAMA transverter some or all of the following information:

- (a) Originating office code.
- (b) Originating rate class.
- (c) Originating area number.

- (d) Terminating office code.
- (e) Terminating area number.

3.36 From this information the billing indexer determines:

- (a) The billing index.
- (b) The type of initial entry to be perforated.
- (c) The calling office index.

3.37 The billing indexer can furnish any one of 10 message billing indices (MBI 0-9). Billing indices 1-8 are used for bulk billed calls, billing index 9 is used for detail billed calls. MBI 0 is used for misdirected free calls to be rejected and for test calls.

3.38 The billing indexer also checks:

- (a) The originating office code to verify that it *is not* the same as the called office code on intra-area calls.
- (b) That the originating office code is associated with the proper recorder group.
- (c) That the originating code is not a vacant code.
- (d) That a 0 or 1 is not present in the fourth or fifth digits of an inter-area call.
- (e) That the rate class indicated is valid.

3.39 The billing indexer can also recognize calls to toll test lines and toll testboards.

3.40 Extended area service calls (free calls) should not be directed to a No. 5 CAMA. Such calls will reach CAMA if they are prefixed by the CAMA directing code. These calls can be detected by the billing indexer if they are to offices for which bulk billing facilities are provided. Such calls are directed to an intercept trunk group by means of a feature termed free call diversion.

3.41 Access from the CAMA transverter to the billing indexer is through multicontact relay facilities which are a part of the indexer circuit and which mount on the indexer frame.

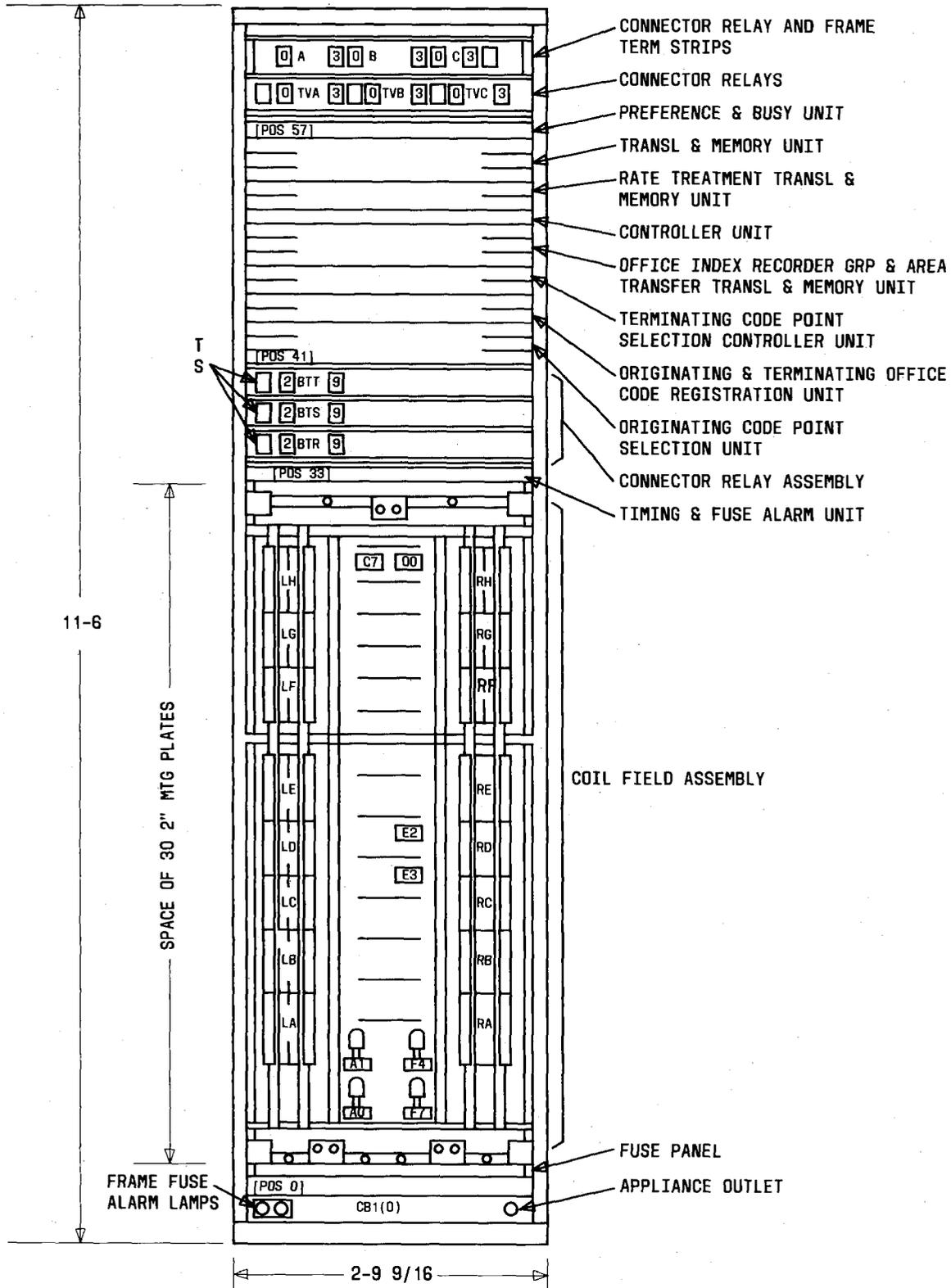


Fig. 5—CAMA Billing Indexes Frame

F. CAMA Transverters

3.42 The main functions of the CAMA transverter are to receive, register, and convert the information from the CAMA sender and billing indexer into a form satisfactory for recording, and then transmit to a recorder all the information necessary to perforate the initial entry. The initial entry is the only entry which the CAMA transverter controls. The answer and disconnect entries are made under control of the CAMA trunk or junctor, and a call identity indexer.

3.43 The CAMA transverter frame is shown on Fig. 6, attached. A maximum of four transverters may be provided for CAMA operation.

3.44 The CAMA transverter connector provides the CAMA senders with access to CAMA transverters. The CAMA transverter connector frame, designated CAMATVC, is a single bay frame which accommodates four connectors. Since one connector is provided per transverter, only one connector frame will be required on any job.

G. Recorders

3.45 As its name implies, this unit controls the recording of the charge data on the AMA tape. The recorder directly controls the operation of its associated perforator which punches the holes in the tape.

3.46 The recorder operates under control of the transverter for the initial entry, and the call identity indexer for the answer and disconnect time entries. Under control of the master timer, the recorder registers time in minutes, and tenths of minutes past the hour, and at the state of every hour causes a hour entry to be perforated on the tape. Also under control of the master timer, the recorder places an end-of-tape pattern on the tape at 3:00 A.M. This pattern shows where the tape should be cut when it is sent to the accounting center for processing. It contains all the information needed to identify the tape.

Note: In master timing circuits converted to 1-second timing, the time is recorded in minute units, second tens, and second units. The time in the recorder is updated every second by impulses from the master timer. The master timer also provides five ten-minute entries and one hour entry every hour which

the recorders call for under their own control. The master timer also informs the recorders which one is the hour entry so the recorders can provide a format change.

3.47 A recorder group consists of one or more recorders as required by the traffic. All CAMA trunks of a group must be served by the same recorder group. Each recorder group may serve a maximum of 100 trunks or the trunks from a maximum of 10 offices, whichever limit is reached first.

3.48 A maximum of ten regular recorders and one emergency recorder may be used for CAMA in a No. 5 CAMA installation. The emergency recorder serves as a substitute for any regular recorder taken out of service for maintenance reasons.

3.49 The record frame (shown on Fig. 7, attached) is a 2-bay unit which accommodates either three recorders and two call identity indexers, or two recorders and four call identity indexers. Each recorder frame may serve seven transverters.

3.50 The recorder connector provides the connecting paths between the recorder and the CAMA transverters, master timers, and master test frame. It is mounted as a part of the associated recorder. For installations where the total number of CAMA transverters and LAMA transverters exceed seven, a supplementary recorder frame is required. This is a single bay frame accommodating the connector relays for the maximum three additional transverters.

H. Perforator

3.51 The unit that punches the holes in the AMA tape is known as the perforator. It is an electromechanical equipment element consisting of perforator magnets and associated perforating pin arrangement, together with a cylindrical drum and a stepping mechanism. When a perforator magnet is energized, its associated perforating pin is forced through the paper tape which is located on the periphery of the drum. The hole produced has embossed edges which registers with a corresponding hole in the drum. The embossed edges insure proper alignment of the tape with reference to the perforating pins, and also provide the traction needed to move the tape through the perforator. After the hole has been punched, the perforating pin is withdrawn by means of the perforating

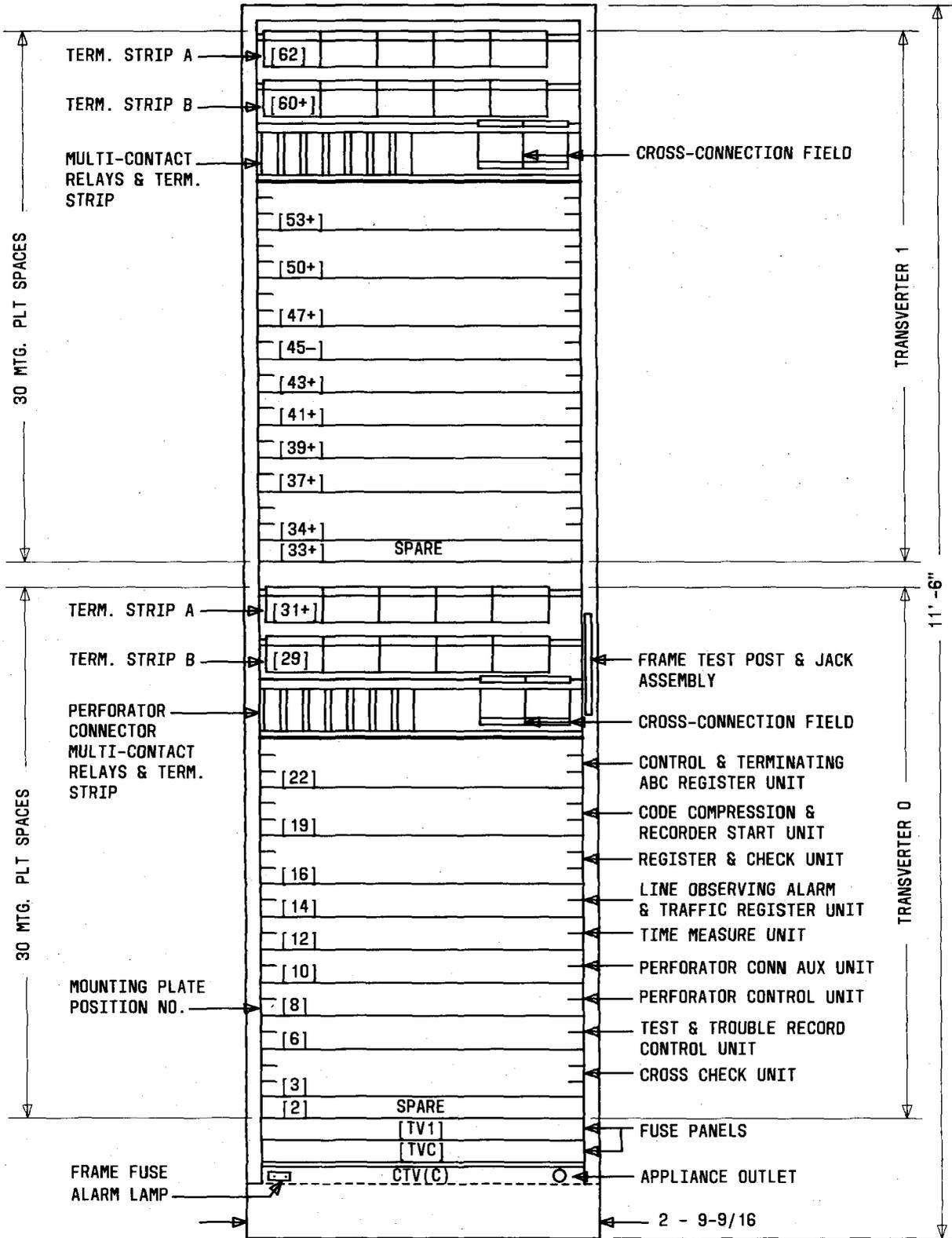


Fig. 6—CAMA Transverter Frame

magnet. The stepping mechanism advances the tape and drum to the next position. In practice, a combination of these holes is punched simultaneously with the resultant pattern of holes forming a line. The perforator is under direct control of its associated recorder.

3.52 The perforator cabinet is a singlesided 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.

3.53 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.

3.54 Reels for taking up the perforated tape are motor-driven and are under the control of a switch which is actuated by a removable 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, where upon the motor is stopped.

3.55 A maximum of six cabinets housing one emergency perforator and ten regular perforators may be provided for CAMA in a No. 5 CAMA installation.

I. Call Identity Indexers

3.56 The call identity indexer serves as a connector between recorders and trunks or junctor circuits. One indexer is provided for each recorder and the equipment is mounted on the associated recorder frame (see Fig. 7).

3.57 The call identity indexer supplies information in the form of a 2-digit number for identifying the trunk or junctor circuit used on a call. This

identification is part of each entry on the AMA tape and serves to associate the entries for a particular call.

3.58 For initial entries, the indexer is signaled by the transverter to furnish the recorder with the number of the trunk or junctor circuit being served. For answer and disconnect time entries, the trunk or junctor circuit signals the indexer to signal the recorder to make the required entry.

J. Master Timers

3.59 The recording equipment must have a dependable source of time for timing the calls. This is furnished by the master timer; and two of them, called the "even" and "odd" timers, are provided for each office. Both timers maintain a continuous record of the time of day, and check each other every minute for synchronism, but only one of them is "in control" at a time. Only one, that is, is supplying time information to the recorders, but each has certain checking functions to perform whether "in control" or not. Either timer may carry out all normal functions when the other is out of service.

3.60 The time information pulsed into each recorder consists of pulses at 6 second intervals generated by telechron type motors operating on 60 cycle commercial power.

Note: In master timing circuits converted to 1 second timing, the 1 second timing intervals are generated by the 4E electronic timer operating off the 22V-60 hertz power supply.

3.61 For the 3:00 A.M. end-of-tape pattern, both timers are in control. The odd timer functions with the odd numbered recorders, and the even timer functions with the even numbered recorders.

4. METHOD OF OPERATION

A. General

4.01 In this section the descriptions of the methods of operation for the various CAMA calls will be focused mostly on those steps peculiar to CAMA service. The marker, register, and sender jobs not peculiar to CAMA will be touched on lightly since these jobs are covered in Section 958-110-100. It will be pointed out, however, that on every

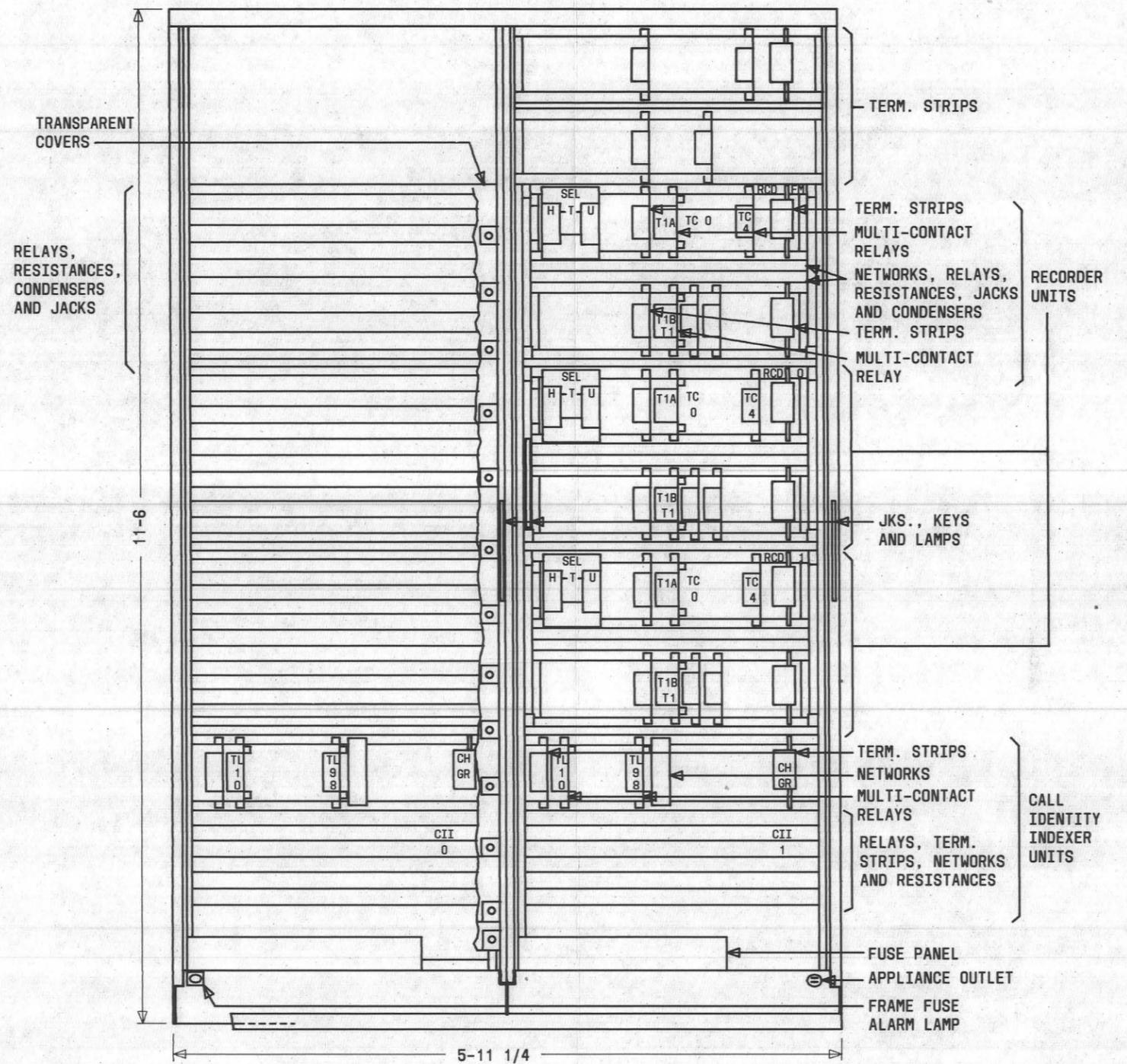


Fig. 7—Recorder Frame

CAMA call a combined or completing marker in the CAMA marker group is used at least twice. The first use is to connect the call to the CAMA equipment. The second use is to route the call toward its destination.

4.02 Furthermore, it is assumed that a customer in a step-by-step office originating a CAMA call will dial a prefix code to reach the CAMA point. Thus, the No. 5 equipment will always receive the full seven, eight, or ten digits of the called customer number.

4.03 A customer in a No. 5 originating office will not be required to dial a directing (prefix) code except where such a practice is considered desirable in the interest of providing a uniform customer dialing plan.

B. Incoming CAMA Traffic to be Switched Through or Terminate in the No. 5 CAMA Marker Group

4.04 When an incoming CAMA trunk is seized, it is connected to an incoming register through an incoming register link (connection 1, Fig. 8, attached). The incoming registers handling CAMA traffic will be either the dial pulse or the multifrequency pulse circuits. No provisions have been made for receiving revertive pulsing or panel call indicator pulsing at the No. 5 CAMA point. The called number is recorded in the incoming register as on a non-CAMA call. When the last digit has been recorded, the incoming register seizes a combined or completing marker (connection 2), and passes to it:

- (a) Called number
- (b) Trunk link frame number
- (c) Trunk class
- (d) Trunk number

4.05 The marker translates the first three digits of the called number to determine whether an irregular code is involved. If a working code is indicated, the marker connects the incoming trunk to a idle CAMA sender through the standard outgoing sender link (connection 3). This operation by the marker is similar to that performed on pulse conversion calls and is known as the CAMA function.

4.06 In the process of setting up the trunk-to-CAMA sender connection, the marker receives a signal from the trunk as to which method of customer identification is used—OI or ANI. This signal is received via the trunk link frame and trunk link frame connector associated with that trunk.

4.07 When the CAMA sender is selected, the marker transmits the following information to it:

- (a) Called number.
- (b) The incoming trunk number.
- (c) The originating rate class.
- (d) Type of calling party identification to be used—OI or ANI.
- (e) The number of the trunk link frame on which the trunk appears.
- (f) The number of the recorder to which the trunk is assigned.
- (g) Whether or not the call is being observed.

4.08 After the marker has established the trunk to CAMA sender connection, and has released, the CAMA sender takes control of the call. If the call is from an office equipped for ANI, the sender signals that office to outpulse the calling customer number. Otherwise, the sender will bid for a CAMA operator position through the position link (connection 4).

4.09 Even though the calling office is arranged for ANI, OI operation may be required. This will occur when:

- (a) The calling customer cannot be identified due to an ANI equipment failure.
- (b) The calling customer cannot be identified because he is on a multiparty line.

In either case, the ANI equipment will signal the CAMA sender to revert to OI operation.

4.10 When a position has been seized (connection 5), a talking path is established between the calling customer and the CAMA operator. The

operator requests the calling customer number and MF keypulses this number into the CAMA sender.

4.11 At this point the CAMA sender has registered all of the information that it is required to contribute for the perforation of the initial entry, and bids for a CAMA transverter through a CAMA transverter connector (connection 6). On an OI call, the CAMA sender will retain possession of the position used for identifying the calling customer until the calling office code has been verified by the billing indexer.

4.12 The transverter in turn bids for a billing indexer, and upon being connected with one (connection 7), passes to the indexer:

- (a) The originating office code.
- (b) The originating area.
- (c) The originating rate class.
- (d) The terminating office code.
- (e) The terminating area (on 10-digit calls).
- (f) A signal as to whether seven or ten digits had been dialed.

4.13 The billing indexer processes this information and advises the transverter as to:

- (a) the office index
- (b) message billing index
- (c) type of initial entry to be made for the bulk billed call—four line detail or two line entry
- (d) whether or not the calling office code and recorder number check satisfactorily.

This last piece of information is used by the transverter to signal the CAMA sender to release the CAMA position used on the OI call when the indexer accepts the calling office code as satisfactory, or to signal the sender to flash the operator's CAMA supervisory lamp at the reorder rate (120 ipm) to indicate that the indexer rejected the calling office code. Having registered this information, the transverter releases the billing indexer.

4.14 The transverter connects to the recorder associated with the CAMA trunk through the recorder connector (connection 8). Then the transverter transmits the initial entry, one line at a time, to the recorder. Before transmitting the last line, the transverter signals the CAMA trunk to identify itself to the recorder through its associated call identity indexer. The recorder signals the transverter that the trunk number was transmitted, and the transverter then transmits the information for the last line of the entry. (The trunk number appears in the last line.) As soon as the initial entry has been perforated, the transverter and recorder release and the CAMA sender prepares to advance the call.

4.15 The CAMA sender seizes a combined or completing marker through the incoming register marker connector (connections 9 and 10), and passes to it the information required by the marker to complete the call. Such information includes the called number, trunk number, and trunk link frame number. This is the second usage of a marker by the one CAMA call, and this marker job is known as the completing function.

4.16 From this point on, the call is handled in the same manner as a non-CAMA call. The combined or completing marker examines the first three dialed digits and the trunk class to determine the routing.

4.17 If the code and trunk class indicate a switched-through call, the marker will connect to a number group frame to learn the line link frame location of the incoming CAMA trunk (connection 13S). Meanwhile, the marker will have selected an outgoing sender of the type required for the routing and will have connected this sender to an outgoing trunk (connections 11S and 12S). After the marker has completed its function of connecting the CAMA trunk to an outgoing trunk, and a sender to that outgoing trunk, the marker will release. The sender takes control of the call.

4.18 After the sender has completed its functions, it releases from the connection, and the outgoing trunk is cut-through for talking. The CAMA trunk now has control of the call.

4.19 If the office code dialed indicates that the call is to be completed locally, the marker will perform the usual terminating function of connecting the CAMA trunk to the customer line

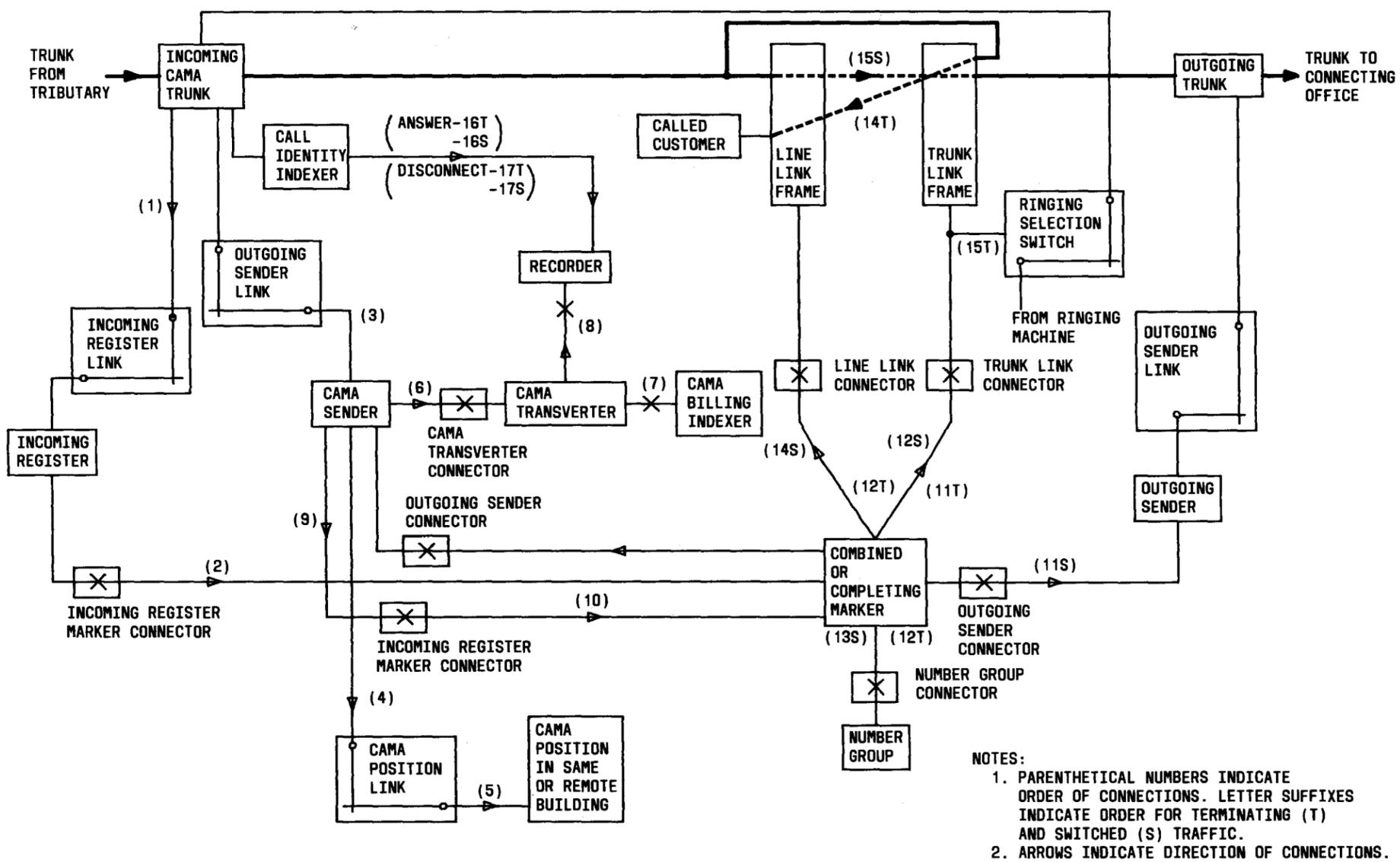


Fig. 8—Establishing Connections for Incoming CMA Traffic to be Terminated In or Switched Through the No. 5 CMA Marker Group

or to the proper intermarker group (trunk to subscriber) type trunk (connections 11T through 15T).

4.20 After the called customer answers, the CAMA trunk engages the recorder through the call identity indexer to have the one line answer time entry recorded (connection 16T or 16S). However, the CAMA trunk does not repeat the answer signal back to the calling office. When disconnection occurs, the CAMA trunk engages the recorder through the call identity indexer to have the disconnect time entry recorded (connection 17T or 17S). At this time, the on-hook signal is returned to the calling office equipment to restore all circuits to normal.

C. Calls Originated By Local Customers

4.21 Calls in this class fall into one of the following subdivisions:

(a) The calling customer is associated with the marker group of which the CAMA equipment is a part, and the called customer is located:

- (1) in a distant office
- (2) in another local marker group
- (3) in the same marker group

(b) The calling customer is not associated with the marker group of which the CAMA equipment is a part, and the called customer is located:

- (1) in a distant office
- (2) in the marker group of which the CAMA equipment is a part
- (3) in another local marker group
- (4) in the same marker group as the calling customer

4.22 In each of the call subdivisions listed, the calling customer dials the called number in the same manner as on a non-CAMA call. From the combination of called code and the calling customer class of service, the combined or completing marker in the originating marker group recognizes

the call as one requiring CAMA routing, and disposes of it as described in the following paragraphs.

4.23 For the case listed as a-1 above, where the calling customer is associated with the marker group of which the CAMA equipment is a part and the called customer is in a distant office, the marker sets up a connection from the calling customer to a CAMA junctor and attaches a CAMA sender as indicated in Fig. 9, attached. Beyond this stage the action by the No. 5 crossbar equipment is the same as on incoming CAMA call described above.

4.24 For the case listed as a-2 above, where the calling customer is associated with the marker group of which the CAMA equipment is a part and the called customer is in another local marker group, the marker sets up a connection from the calling customer to a CAMA junctor as described in paragraph 4.23. The call advances in the usual way and the line link appearance of the junctor is connected through the switches to the originating marker group trunk link appearance of a trunk to subscriber type intermarker group trunk. An intermarker group sender is then attached to the trunk, and the call is completed on a normal intermarker group basis.

4.25 The case where the calling and called customers are located in the same marker group a-3 above is expected to be encountered rarely, and will be cared for by the use of facilities primarily intended for other uses. Either of two arrangements may be employed. In the first arrangement, the calling customer may be connected to a flat rate outgoing trunk to which an MF outgoing sender would be connected. The main distributing frame terminals of this trunk would be cross-connected to a regular incoming CAMA trunk. The over-all operation is then the same as if the calling customer had been located in a remote No. 5 office.

4.26 The second arrangement for the case listed as a-3 above makes use of intermarker group facilities. This is a special use of the CAMA intermarker group subscriber-to-subscriber type trunk in which the established connection is made between customers in the same marker group by returning the call to the same group as that in which it originated. Although only one marker group is involved, it is possible to set up such connections.

4.27 In this second arrangement, the combined or completing marker recognizes from the information it received from the originating register (called number and calling customer class of service) that the call is to be handled on a CAMA basis. The marker connects the calling customer line to an intermarker group subscriber-to-subscriber type trunk arranged for CAMA service. Having attached an intermarker group sender to that trunk and having transferred to that sender the information required for completing the call, the marker releases from the connection.

4.28 Since the call is to be completed in the same marker group, the intermarker group sender will be arranged to seize a combined or completing marker in that group. The marker used performs its CAMA function to connect a CAMA sender to the intermarker group trunk. The CAMA sender in turn bids for an operator through the position link. All CAMA calls handled on an intermarker group basis, such as this one, require an operator to identify the calling customer.

4.29 After the CAMA record has been made, the CAMA sender seizes a combined or completing marker, through the incoming register marker connector, and passes to it the information required by the marker to complete the call. This information includes the trunk link frame number on which the terminating end of the intermarker group trunk appears. In performing its completing function the marker connects this end of the trunk to the called customer line.

4.30 For the case listed as b-1 above, where the calling customer is not associated with the marker group of which the CAMA equipment is a part and the called customer is in a distant office, the connection is set up through an intermarker group subscriber to trunk type of trunk arranged for CAMA. In the originating (non-CAMA) marker group the marker establishes a connection between the customer and the intermarker group trunk and attaches an intermarker group sender, see Fig. 9, attached. In the CAMA marker group the call passes from the intermarker group sender to the CAMA sender. The trunk is closed through to the CAMA sender by way of a sender link in the CAMA marker group. Eventually a talking path is established between customer and CAMA operator. The call next progresses to the second marker use (in the CAMA group) and the second marker group line link appearance of the intermarker

group trunk is connected through the switches to an outgoing trunk. An outgoing sender of the proper type is connected to the outgoing trunk, and when the outgoing sender is released the customer talking path is extended to the distant point. Supervision is cut through the outgoing trunk or is repeated by it to the intermarker group trunk. Answer time and disconnect time entries are made on the AMA tape under control of the CAMA intermarker group trunk.

4.31 The case listed as b-2 above, where the calling customer is not associated with the marker group of which the CAMA equipment is a part, and the called customer is in the CAMA marker group, employs the intermarker group subscriber-to-subscriber CAMA trunk for which a special application was described in paragraph 4.26. Fig. 9, shows the normal use of this trunk. Regular intermarker group operation is required in this case since the marker in the originating marker group cannot reach directly into the CAMA marker group to set up the trunk to CAMA sender connection.

4.32 In the originating marker group the marker establishes a connection between the calling customer and the CAMA intermarker group trunk and attaches an intermarker group sender. In the CAMA marker group the call passes from the intermarker group sender to the combined or completing marker, then to the CAMA sender. The trunk is closed through to the CAMA sender by way of a sender link in the CAMA marker group, thus establishing a talking path between customer and operator. The call next progresses to the second marker use in the CAMA marker group, and the CAMA marker group trunk link appearance of the CAMA intermarker group trunk is connected through the switches to the called customer. Answer time and disconnect time entries are made on the tape under control of the CAMA intermarker group trunk.

4.33 The cases listed as b-3 and b-4 above are substantially alike. A form of double intermarker group operation is involved in both cases with the CAMA marker group equipment in the center link of the connection. In one case the call returns to the group in which it originated; in the other case it is completed to another non-CAMA group.

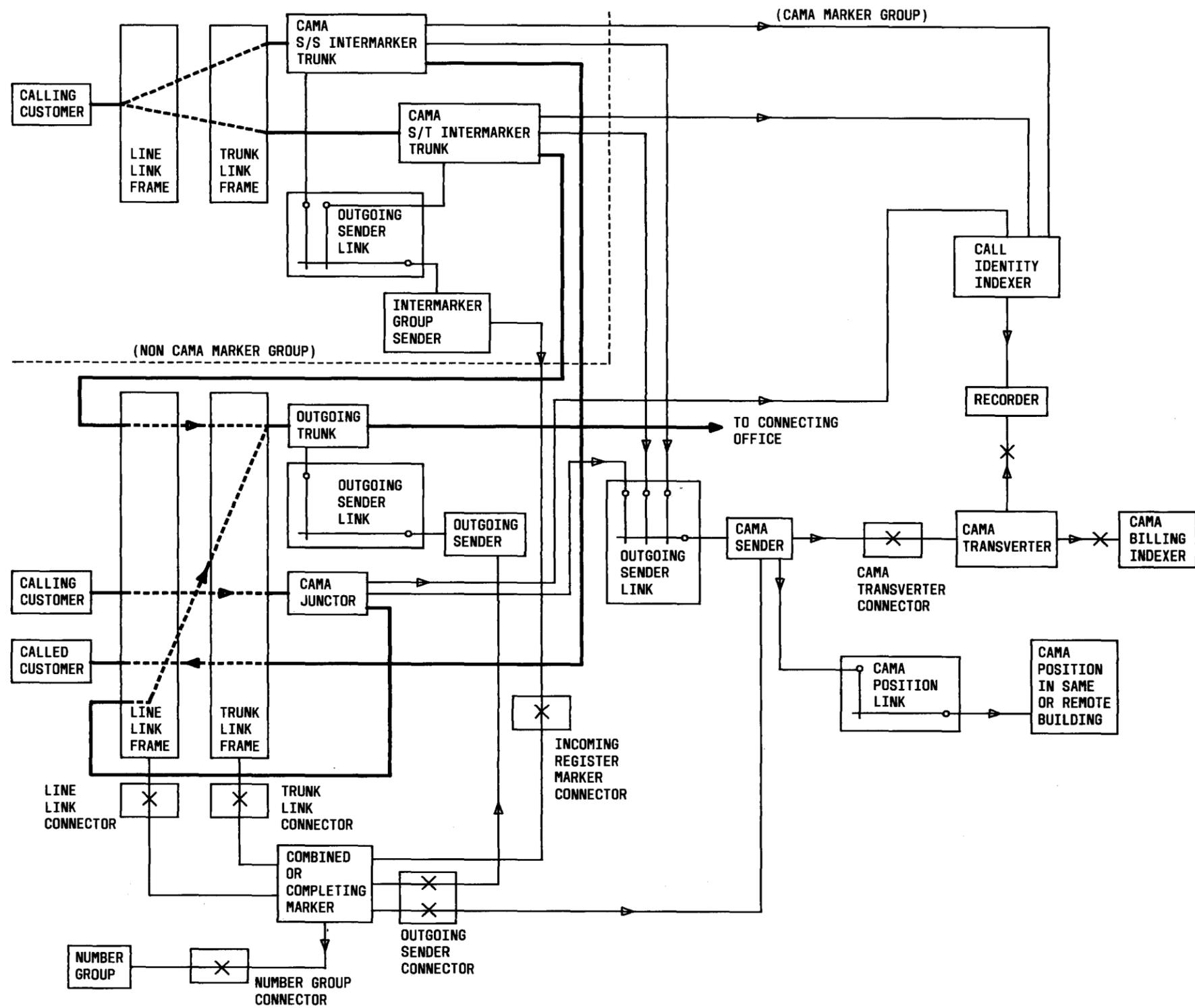


Fig. 9—Establishing Connections for Three Typical Locally Originated CMA Calls

5. OBSERVING FACILITIES

A. General

5.01 Two types of observing facilities, service and complaint, may be provided in a No. 5 crossbar 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 observed call is made. Information received from such observations is used to rate the performance of a CAMA office. Complaint observing facilities provide a detailed tape entry on CAMA calls from a line under complaint observation in an originating office.

B. Service Observing

5.02 The service observing facilities provide means for observing the digits of the called number and the progress of the call. With operator identification of the calling number, the CAMA observing facilities also provide means for observing the keying by the CAMA operator.

5.03 The CAMA observations may be made on incoming CAMA trunks, CAMA junctors, and intermarker group CAMA trunks. One hundred CAMA circuits (maximum) can be observed.

5.04 In addition to the observations made at the observing desk, a detailed tape record of the call is made by the AMA equipment. In the case of OI operation, an observing mark is transferred to the CAMA sender by the CAMA trunk. With ANI, this signal is transmitted by the ANI equipment in the calling office. The CAMA sender transfers this signal to the transverter which forces detailed recording even on bulk-billed calls.

C. Complaint Observing

5.05 To serve request for observations on a customer line in an office served by a No. 5 CAMA office, a centralized complaint service observing circuit (line observing number matching circuit) at the No. 5 CAMA office causes an observing indication to be given to the transverter, which then controls the perforation of a detailed record with an observing initial entry.

5.06 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 number 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 (detailed) entry is required.

5.07 Equipment may be provided at the CAMA 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 number matching frame shown in Fig. 10, attached.

6. KEY MONITORING FACILITIES

A. General

6.01 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

6.02 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 CAMA traffic. When the key is normal, the position operates like a regular position.

6.03 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

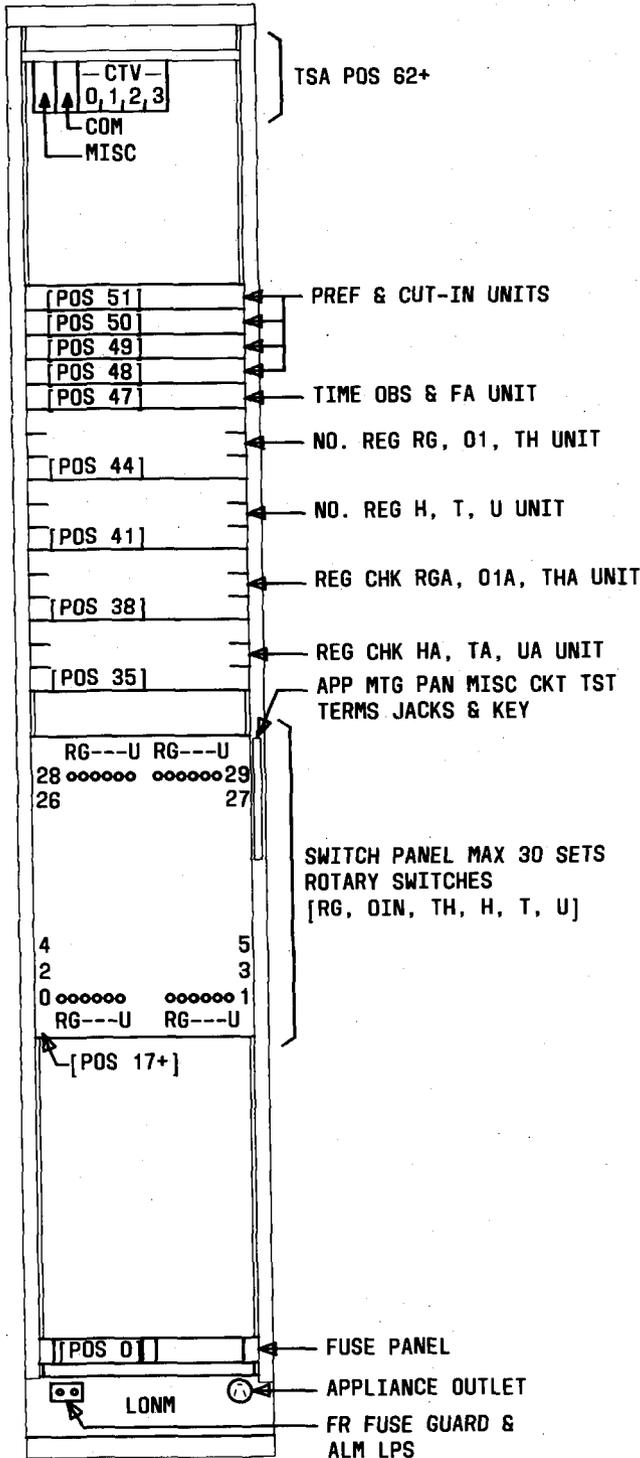


Fig. 10—Line Observing Number Matching Frame

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.

6.04 When a call is received in the CAMA position, the monitor receives an order tone. 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.

6.05 If the CAMA operator wishes to delete a registration and key again for any reason, the operation of the 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.

6.06 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 the position disconnect key, two lamps are lighted in the indicator display panel at the monitoring position.

6.07 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

6.08 The DSA or toll positions used for key monitoring must be modified to monitor on CAMA calls. 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.

7. MAINTENANCE

7.01 Existing test circuits may be modified to test CAMA equipment. Such circuits are:

- (a) the master test frame
- (b) automatic monitor, register, and sender test circuit
- (c) automatic progression trunk test circuit
- (d) test set facilities for incoming registers
- (e) the incoming register test circuit

CAMA Automatic Progression Trunk Test Frame (CAPTT)

7.02 One new test frame, the CAMA automatic progression trunk test frame (CAPTT) is required.

7.03 The function of the CAPTT frame is to enable the maintenance employee to test CAMA trunks and junctors automatically. This frame is used in conjunction with the automatic progression trunk test frame and is arranged to serve only one marker group.

7.04 Although the automatic progression trunk test frame serves a maximum of three marker groups for basic system operation it can be associated with only one CAPTT frame.

Cancel Automatic Number Identification Trouble Record Key (CANIT)

7.05 With automatic number identification (ANI), the originating office is arranged to transmit the telephone number of the calling customer to

the CAMA office. If the CAMA sender receives a 1-out-of-5 indication on the calling number or a 3-out-of-5 indication on the calling number or a time-out occurs during the registration of the calling number, the CAMA sender will convert the automatically identified call to an operator identified call, and a trouble record card will be printed.

7.06 The purpose of the trouble report is to provide documentation on the failure that occurred, where as the craftsperson can notify the originating office of the problem.

7.07 Operation of the CANIT key at the MTF grounds the CAIT lead to the CAMA transverters causing those circuits to cancel the trouble record request on automatic number identification failures. The amber guard lamp associated with the CANIT key remains lighted as long as the key is operated. Normally this key will *not* be operated.

Incoming Trunk Trouble Reports

7.08 With operator identification, the CAMA operator requests the calling subscribers number. If the CAMA operator experiences poor transmission on a trunk when requesting the calling number, a special office code followed by four arbitrary digits can be keyed into the CAMA sender in place of the actual calling number, and a trouble record card will be printed.

7.09 The reason for the trouble record card is to provide documentation identifying the defective trunk. With this, the craftsperson can remove the defective trunk from service by inserting a make-busy plug into the MB jack of the trunk at the MTF and resolve the problem.