

LOCAL AUTOMATIC MESSAGE ACCOUNTING FEATURES
GENERAL DESCRIPTIVE INFORMATION
NO. 5 CROSSBAR OFFICES
ARRANGED FOR PAPER OR MAGNETIC TAPE

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1. INTRODUCTION

1.01 This section describes the local automatic message accounting (LAMA) features of the No. 5 Crossbar System. Section 958-110-100 describes the switching features of this system.

1.02 Two arrangements for performing automatic message accounting (AMA) are described in this section. The one which uses punched paper tape for recording information will be referred to as LAMA paper tape and the one using magnetic tape for recording information will be referred to as LAMA magnetic tape.

1.03 LAMA features provide facilities for charging the customers local and toll dialed calls. It records the details of each call on tape in a form suitable for mechanically preparing a customer bill. LAMA equipment is self-checking to eliminate billing errors and allows the equipment associated with each customer line to be kept to a minimum. this

billing preparation equipment is located in centralized locations. LAMA equipment can be used to conduct traffic sampling studies and provides detailed information on service observed calls.

1.04 For the LAMA paper tape arrangement, the data recorded on tape is in a form which is referred to as entries (Fig. 1). This tape is arranged to allow six digits to be recorded in a line across the tape. An entry may be composed of one, two, four, or five lines depending upon the amount of information required within the entry. There are two basic types of entries. Initial entries contain all the information regarding the calling and called parties and the trunk involved. Timing entries contain the information to indicate when the call was answered and when it was disconnected. Each entry for a given call is associated with the other two entries by using the call identity index which is a 2-digit trunk number.

1.05 For the LAMA magnetic tape arrangement, data is recorded on magnetic tape. The magnetic tape recorder provides nine tracks on the tape for recording information. The nine tracks allow two AMA characters (Fig. 2) to be recorded at one time across the tape (called double packed format). There are no distinct lines of information as with the paper tape and the entries are not referred to as 1-, 2-, 4-, or 5-line entries. Instead, the entries contain one or more data groups. These associated data groups are the various entries (initial, answer, or disconnect). Each entry associated with a given call is identified by an entry identifier and a 2-digit entry index. Because a maximum of 2000 trunks are identified on each tape, the data group entries for a given call are associated by the 4-digit trunk number assigned each trunk.

2. EQUIPMENT ELEMENTS

LAMA PAPER TAPE

2.01 The following equipment elements are required when the office is equipped for paper tape:

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

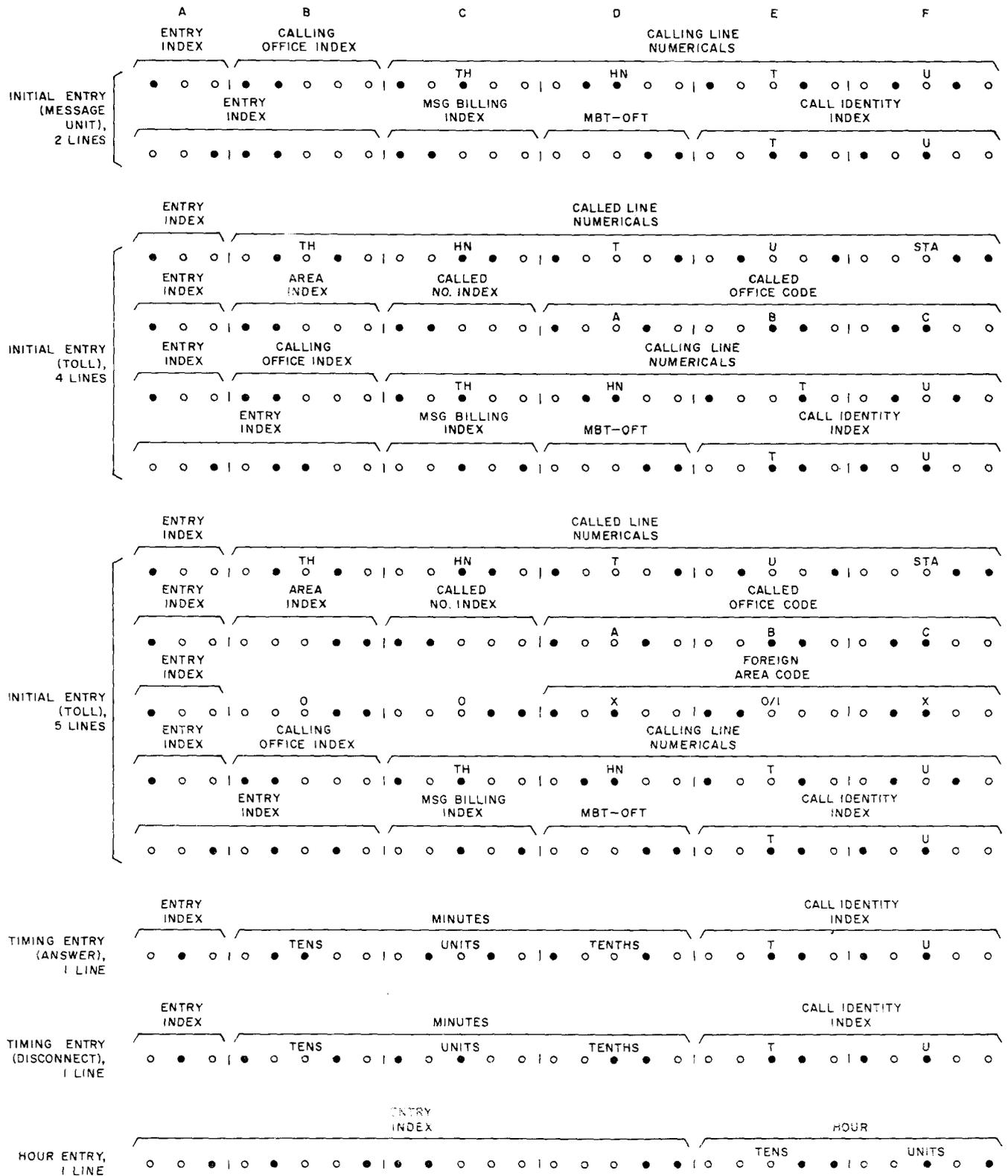
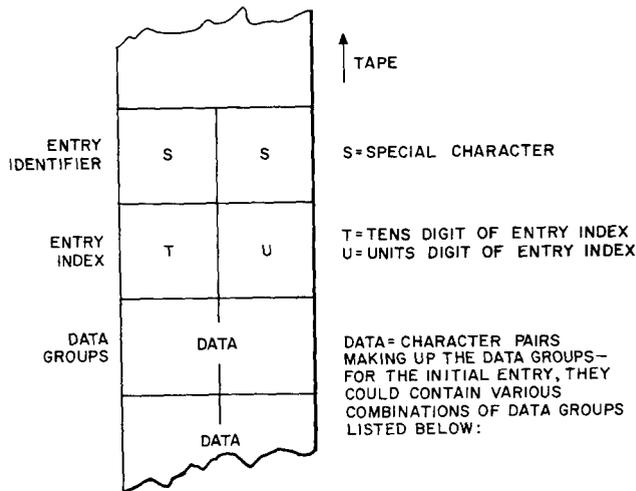


Fig. 1—Typical LAMA Paper Tape Entries



DATA GROUP	CONTENT	NUMBER OF DIGITS
A	CALL IDENTITY INDEX	3
B	SERVICE DATA	4
C	CALLING NPA	3
D	CALLING NUMBER	7
E	CALLED NUMBER	10
F	MESSAGE BILLING INDEX	2
G	CREDIT CARD NUMBER	10

Fig. 2—Examples of Data Groups for LAMA Magnetic Tape

- (e) Transverters and transverter connectors
- (f) Translators
- (g) Trunks and junctor circuits
- (h) Other equipment arranged for LAMA paper tape operation.

A. Recorders and Recorder Connectors

2.02 The recorder receives the charge data to be recorded on LAMA paper tape and directly controls the operation of an associated perforator which punches the holes in the tape.

2.03 Recorder control signals are provided by the transverter for the initial entry and control signals are provided by the call identity indexer for the answer and disconnect timing entries. The master timer provides the recorder

registers with time information in the form of minutes and tenths of minutes past the hour; at the start of every hour, the master timer provides a signal for the hour entry to be perforated on paper tape. The master timer also provides a signal for the recorder to place an end-of-tape pattern on the tape at 3:00 a.m. This pattern shows where the tape should be cut before it is sent to a centralized accounting center for processing.

2.04 A recorder group consists of one or more regular recorders as required by the central office traffic. Each recorder may serve a maximum of 100 trunks.

2.05 A maximum of 20 regular recorders and one emergency recorder may be used for LAMA in a No. 5 crossbar office. The emergency recorder serves as a substitute for any regular recorder taken out of service.

2.06 The LAMA paper tape recorder frame (Fig. 3) is a 2-bay unit which contains either three recorders and two call identity indexers or two recorders and four call identity indexers. Each recorder frame may serve from two to seven transverters.

2.07 The recorder connector provides the connecting paths between the recorder and transverters, master timers, and test frame facilities. It is mounted as part of the associated recorder. For installations where the total number of transverters exceeds seven, a supplementary recorder frame is required. This is a single-bay frame that contains the connector relays for a maximum of three additional transverters.

B. Perforators

2.08 The perforator is the unit which punches holes in the LAMA paper tape. It has an electromechanical unit consisting of perforator magnets and an associated perforating pin arrangement together with a cylindrical drum and 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 by the perforating pin has embossed edges which register with a corresponding hole in the drum. The embossed edges ensure the proper alignment of the tape with the perforating pins and provide the traction needed to move the tape through the perforator. After

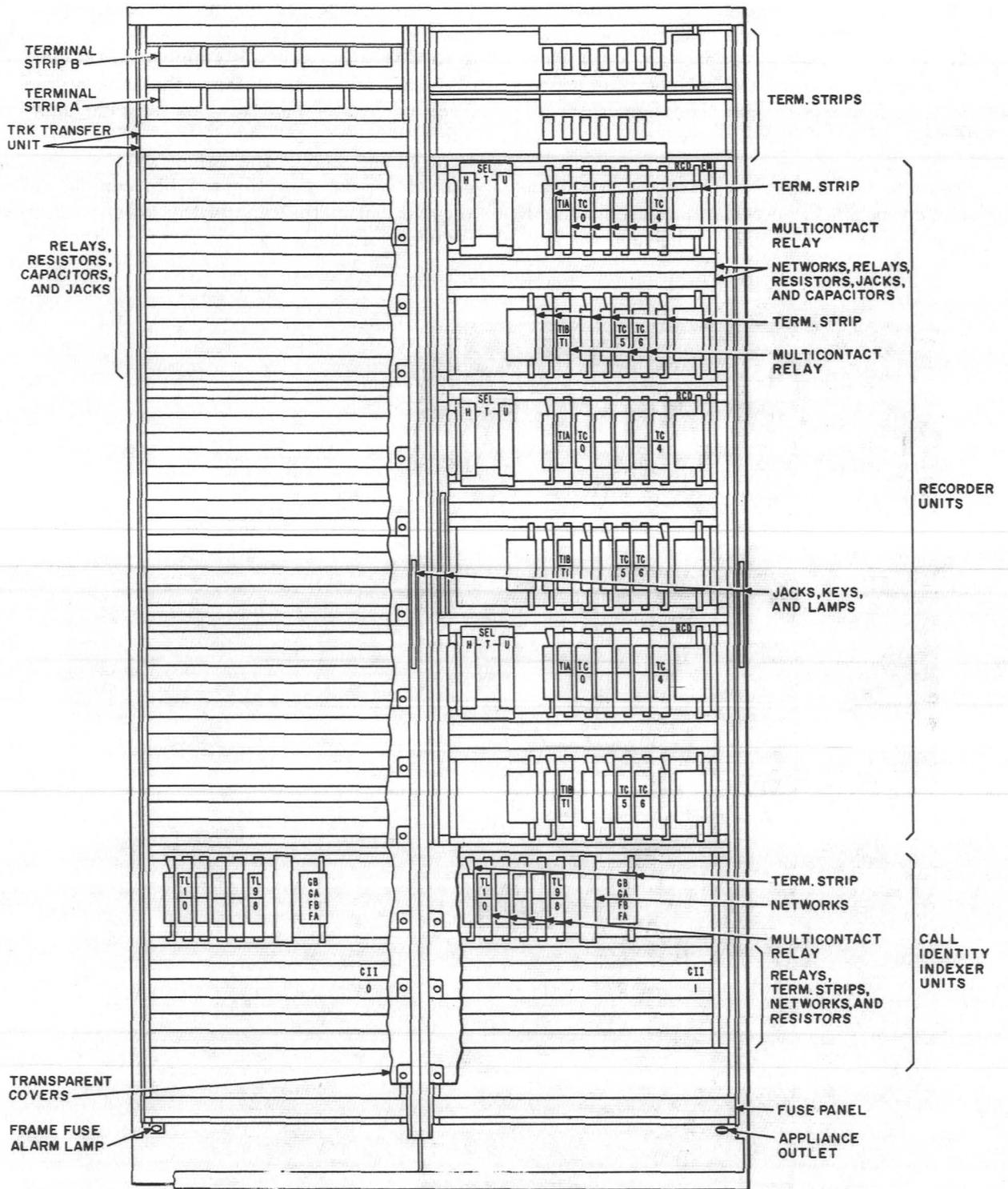


Fig. 3—LAMA Paper Tape Recorder Frame

the hole has been punched, the perforating pin is withdrawn as a result of de-energizing the perforating magnet. The stepping mechanism advances the tape and drum to the next position. During operation, a combination of these holes is punched simultaneously forming a line. The perforator is under direct control of its associated recorder.

2.09 The perforator cabinet (Fig. 4) is a single-sided steel enclosure. Two perforators are mounted in the upper part of the cabinet. The tape storage

bins and the motor-driven tape reels for the perforated tape are mounted in the bottom space.

2.10 The paper tape is supplied to the perforators in folded form from the tape storage bins. Each perforator has two tape storage bins holding about 3000 feet of folded tape. The two bins are located one above the other so that the bottom end of the tape in the top bin can be spliced to the top end of the tape in the lower bin, providing 6000 feet of tape to each perforator without renewing

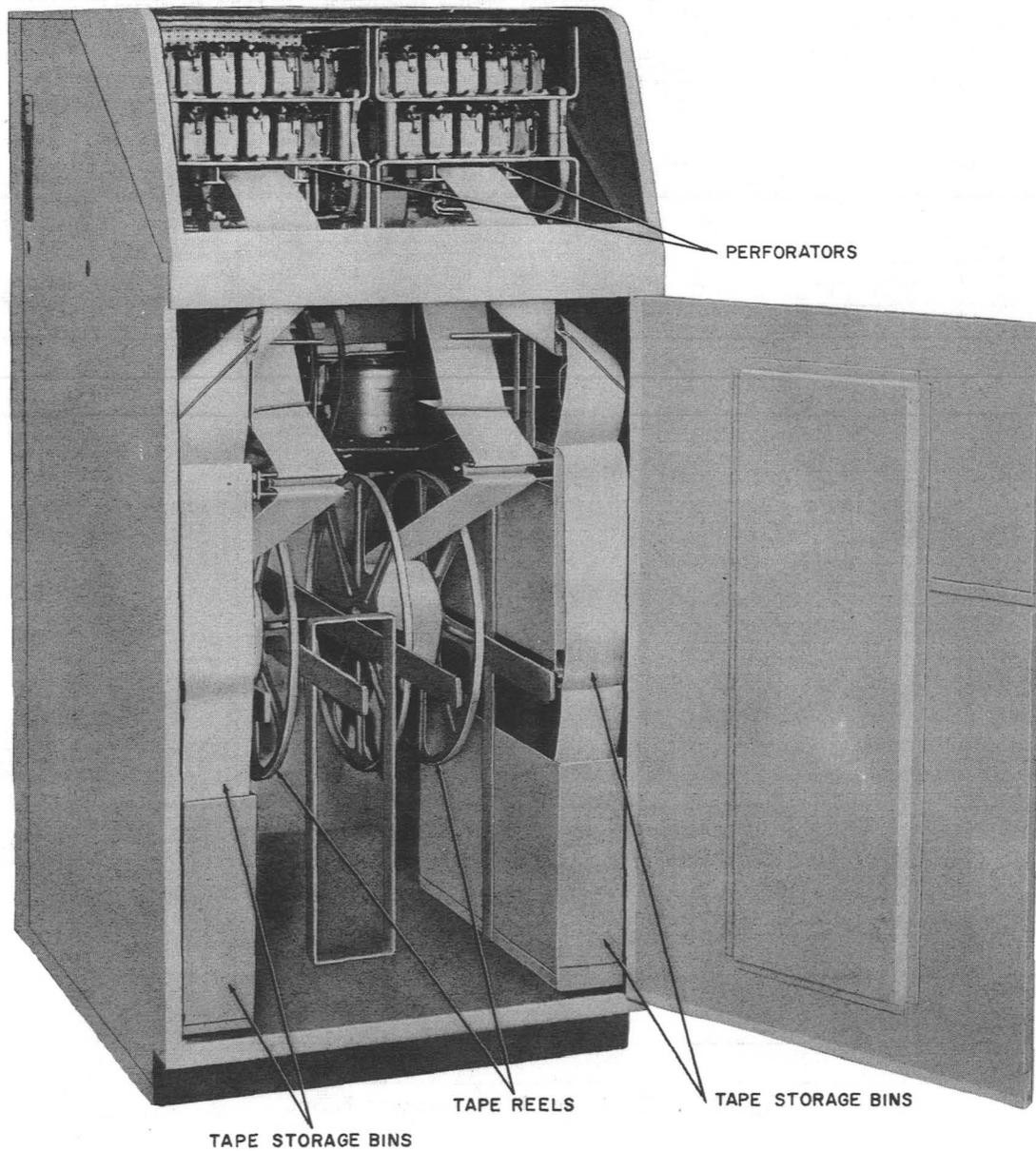


Fig. 4—Perforator Cabinet

the supply. When the supply in the top bin is exhausted, the lower bin is shifted to the upper position and a new supply of tape can be inserted in the second bin. This second bin is placed in the lower position and the two lengths of tape are spliced together.

2.11 Reels for taking up the perforated tape are motor-driven and are under the control of a switch which is activated by a movable arm in contact with the paper tape. When the output from the perforator produces sufficient slack in the tape, the movable arm switch activates the motor and the reel is rotated until the slack in the tape is taken up.

2.12 A maximum of 11 cabinets, that house one emergency perforator, and 20 regular perforators may be provided for LAMA in a No. 5 crossbar office.

C. Call Identity Indexers

2.13 The call identity indexer serves as a connector between recorders and trunks or recorders and junctor circuits. One indexer is provided for each regular recorder, and the equipment is mounted on the associated LAMA paper tape recorder frame (Fig. 3).

2.14 The 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 call entry on the AMA tape and serves to identify the entries for a particular call.

2.15 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 or disconnect timing entries, the trunk or junctor circuit signals the indexer to furnish the recorder with the number of the trunk or junctor for the required entry.

D. Master Timers

2.16 The recording equipment requires a source of time for timing calls. This timing is furnished by the master timer (Fig. 5). Two timers (even and odd) are provided for each office. Both timers maintain a continuous record of the time of day, date, and month and check each other every minute for synchronism. Time information is generated by synchronous motors, operating on

60-cycle commercial power. These motors produce pulses at 6-second intervals. This timing information is pulsed to the recorders to furnish timing information for LAMA paper tape calls.

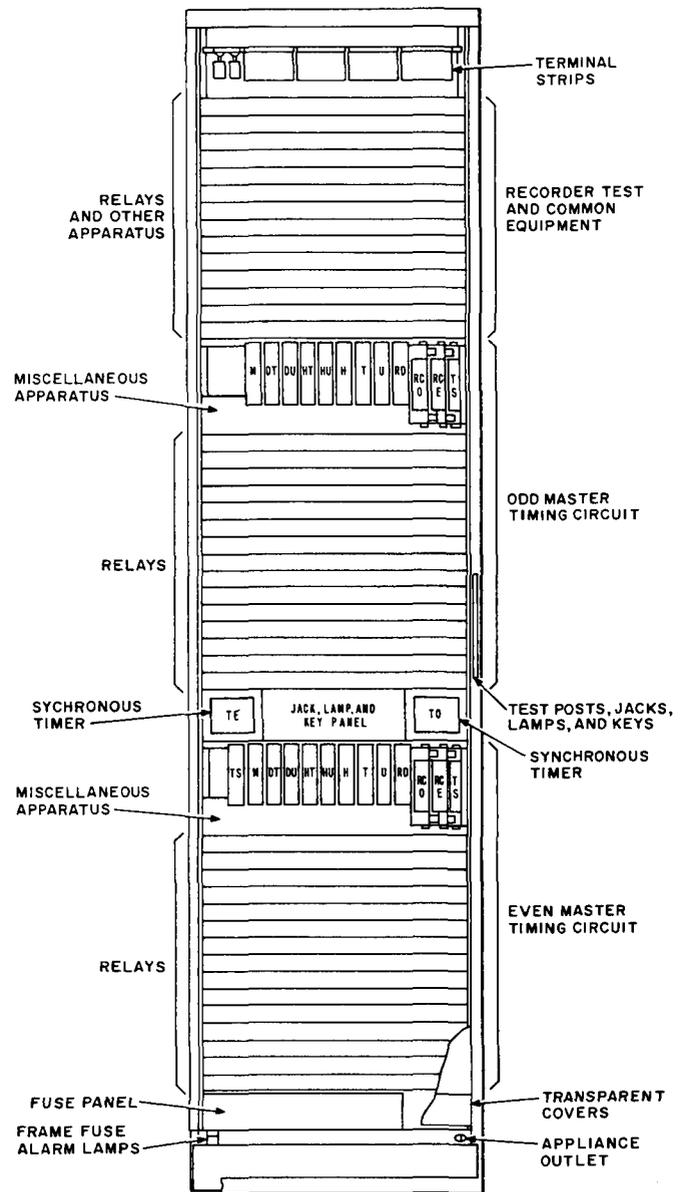


Fig. 5—LAMA Paper Tape Master Timing Frame

2.17 For the 3:00 a.m. end-of-tape pattern, both timer outputs are used. The odd timer functions with the odd-numbered recorders, and the even timer functions with the even-numbered recorders. The 3:00 a.m. entry includes a date

and time entry, a splice entry, and the date and time entry repeated. When the tape is cut, the leading and trailing ends of every complete tape contain a date and time entry. When the date and time entry is missing from either end, the central billing office knows the tape is incomplete.

E. Transverters and Transverter Connectors

2.18 The transverter provides a common circuit in the path between senders and recorders and is used to pass information to the recorder concerning initial entries on service and test calls. By way of the transverter connector, the transverter receives information registered in the sender, transmits part of the information in its original form, and converts the remainder of the information to a form suitable for controlling the perforating operations.

2.19 Information is transmitted forward to the recorders in line-by-line form, supplemented by an entry identification as required. In addition to controlling the transfer and recording the information on tape, the transverter uses a translator frame to obtain the directory number corresponding to line location of the calling customer and to the party assignment of a 2-party line. Another function performed by the transverter is the control of transfer of the trunk number from the call identity indexer to the recorder. The transverters are used in a group which is common to a marker group of equipment.

2.20 A transverter is designed to work with forty-eight 1000-line or twenty-four 2000-line translators.

2.21 A transverter frame (Fig. 6) is a single-bay frame that contains the equipment for one transverter circuit. In addition, if a full marker group of 60 line link frames is served, an auxiliary transverter unit is required to serve line link frames 40 through 59. This unit consists of four relay mounting plates and two terminal strip assemblies and must be located on a relay rack frame with frame covers.

2.22 Transverter connectors provide senders with access to transverters. The transverter connector frame is a single-bay frame that contains three transverter connectors. Through these connectors, a maximum of 15 senders can obtain access to any of the transverters and translators

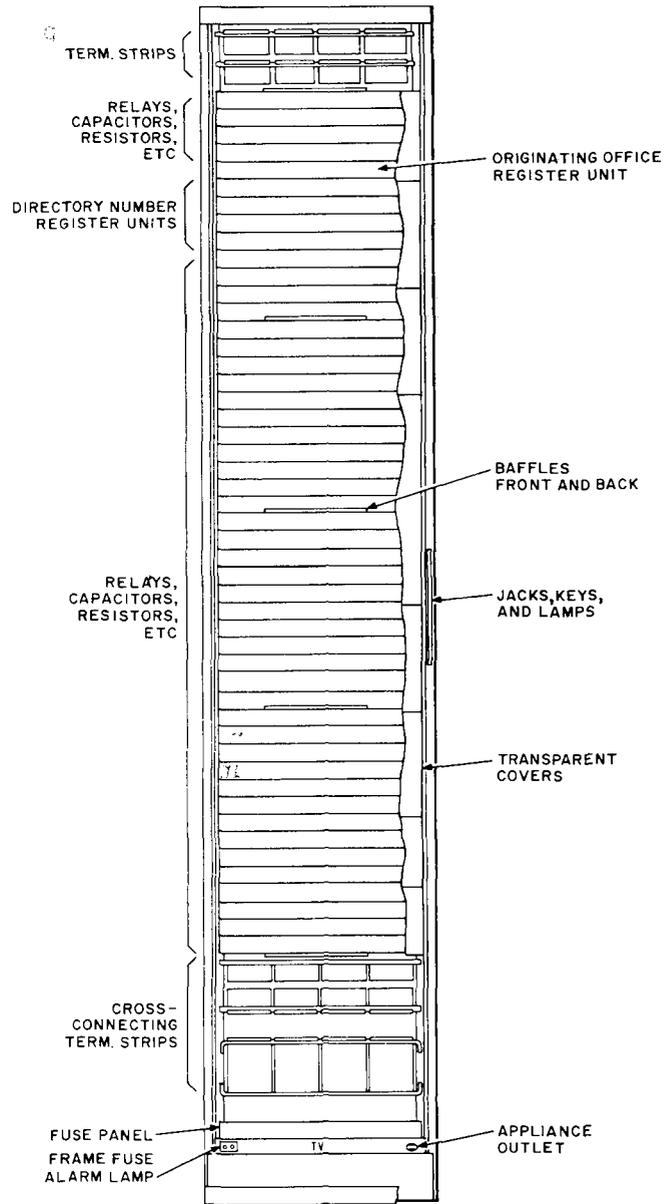


Fig. 6—LAMA Paper Tape Transverter Frame

in the office when it is necessary to record a call. There is also a double-bay transverter connector frame which provides 13 senders access to 10 transverters.

2.23 In addition to the transverters and the transverter connectors, an all-transverters-busy circuit is required. It is a single-plate unit which provides audible and visual alarms in the event all the transverters are busy for the time period measured by the timing control circuit.

F. Translators

2.24 The translator frame (Fig. 7) provides a means for translating a customer line equipment location (line link frame, horizontal group, vertical group, and vertical file numbers) to a directory number that is entered on a LAMA paper tape for billing purposes.

2.25 A translator frame may have a capacity of 1000 or 2000 customer line equipment numbers. For 2-party lines, each party must have a separate appearance. Tip parties normally appear on tip party translator frames, and ring parties together with individual lines appear on ring party translator frames. However, automatic identification for 4-, 8-, or 10-party lines is not possible and requires manual operator identification.

2.26 The directory numbers associated with the 1000 or 2000 lines of each translator frame may have a maximum of 30 office indexes. An office index consists of one or two digits assigned to represent a customer office code for billing purposes.

2.27 The translator frame is a single-bay frame that contains multicontact relays, preference chain relays, coil fields, and terminal strips.

G. Trunks and Junctor Circuits

2.28 The trunks and junctor circuits arranged for LAMA operation have appearances at the outgoing sender link frame for connection to outgoing senders, at the call identity indexer for trunk identification, at the line link frame, and at the trunk link frames as required.

2.29 *AMA Outgoing Trunks:* These trunks are used to handle outgoing traffic from a LAMA equipped office.

2.30 *AMA Junctors:* These junctors can be connected by switching equipment on a tandem basis to trunks which do not have AMA features to provide these trunks access to AMA equipment.

2.31 *Auxiliary Outgoing Trunks:* These trunks have AMA features and allow customers direct access to outgoing intertoll, 2-way intertoll, or 2-way CDO trunks.

2.32 *Outgoing Trunks or Junctors for Dial Coin Zone:* These circuits allow coin customers to dial direct beyond the local coin zone. AMA features are used for determining tax, commission payments, and division of revenue.

2.33 *Outgoing Trunks to Off-Net Access Line:* These circuits are used to provide customers of CCSA service access to the Bell System network on a subscriber outgoing basis. The AMA function is used for traffic sampling.

2.34 *Intraoffice Trunk Circuits:* These circuits provide AMA functions and connection between customers served by the same office and markers.

2.35 *Intraoffice Data AMA Trunks:* These trunks are used to provide data customers with access to other data customers served by the same office and markers where AMA records of such calls are required.

2.36 *AMA Intermarker Group Subscriber-to-Subscriber Trunks:* These trunks are used to provide connection between noncoin customers and other customers that are in the same building but served by different marker groups.

2.37 *AMA Intermarker Group Subscriber-to-Trunk Trunks:* These trunks are used as a connection from customers in one marker group to outgoing trunks in another marker group.

2.38 *Junctor Circuit for Use as Off-Net Access Line:* This circuit is used to provide customers of CCSA service access to the Bell System network on a subscriber outgoing basis. The AMA feature is used for traffic sampling.

2.39 *Junctor Circuit for Completion to Line Link Pulsing Circuits:* This circuit is used in completing intraoffice calls to line link pulsing circuits when an AMA record is required for traffic sampling.

H. Other Equipment

2.40 Several equipment units are modified to function with LAMA. The more important modifications are described below.

2.41 *Outgoing Sender:* This sender requires additional relays for registering AMA

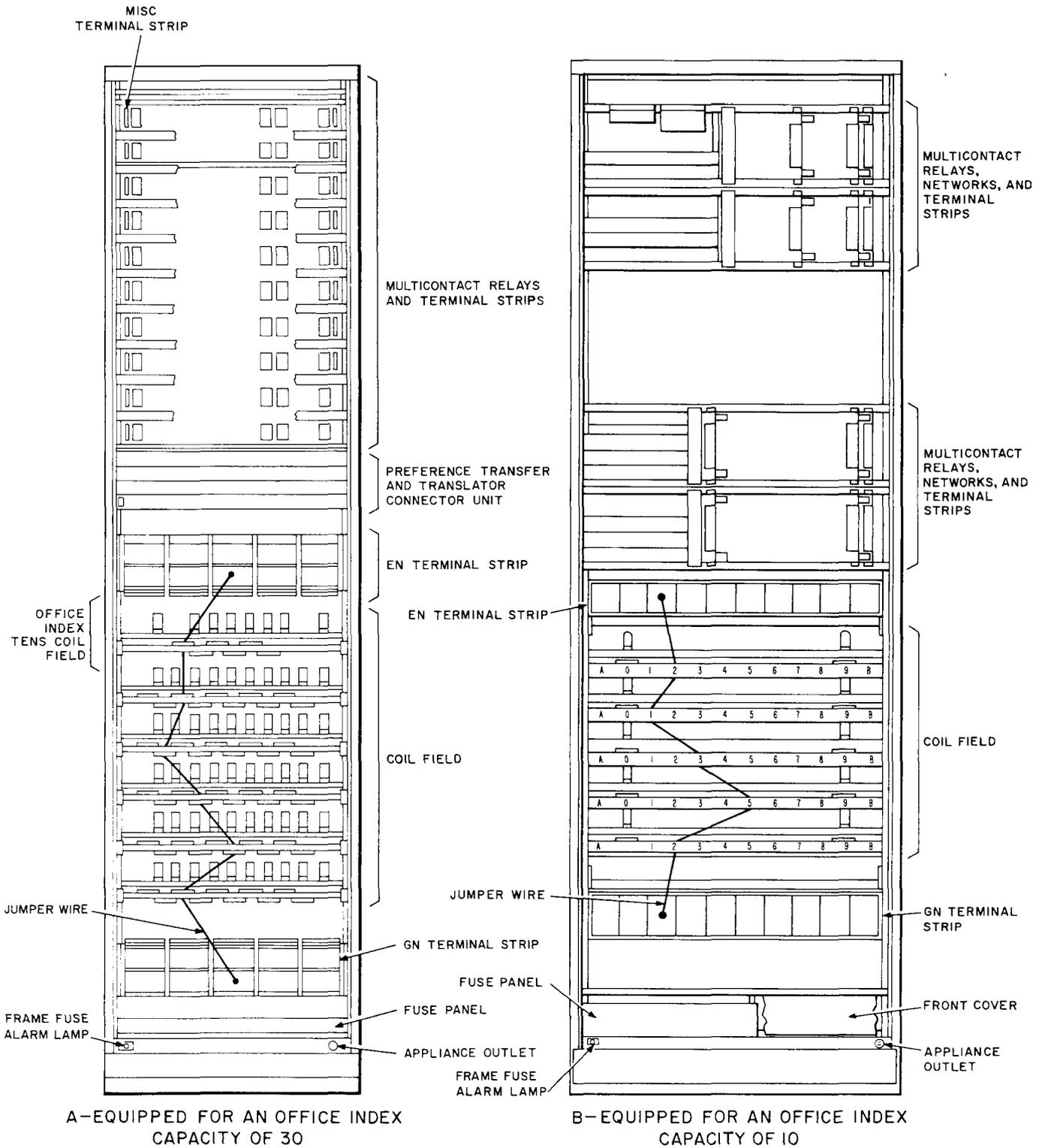


Fig. 7—LAMA Paper Tape Translator Frame—Typical

information. These relays are assembled in two units of two plates each, and these plates are mounted in each sender position on the sender frame.

2.42 Marker Frame: This frame requires several small units for setting up the message billing index and for transmitting the message billing index and other AMA information to the senders.

2.43 Originating Register: This register has an OBS relay added for storing an indication received from the marker via the line link frame. This indication shows whether or not the calling lines are connected to a service observing desk.

2.44 Trunk Link Frame: There is a cross-connection on the trunk link connector frame which indicates to the marker the number of the recorder serving each intraoffice and outgoing AMA trunk.

LAMA MAGNETIC TAPE

2.45 The following LAMA equipment elements are required when the office is equipped for magnetic tape:

- (a) Recorders and recorder control circuits
- (b) Call identity indexers
- (c) Master timers
- (d) Transverters and transverter connectors
- (e) Translators
- (f) Trunk control circuits
- (g) Trunks and junctor circuits
- (h) Other equipment.

A. Recorders and Recorder Control Circuits

2.46 The recorder and recorder control circuit receives charge data and records it on magnetic tape.

2.47 The recorder and recorder control circuit, in conjunction with the trunk control circuit, receive control signals from the transverter to make the initial entry for a call and control signals from the call identity indexer for answer

and disconnect entries. The master timer provides control signals and time information to the recorder and recorder control circuit to record the time each minute. This time entry consists of the hour and minute. The master timer also provides a control signal to cause the recorder and recorder control to record label entries on the tape at 3:00 a.m. These entries contain tape identification information as well as time data. The time data includes month, day, hour, and minute information. Since there are two tape recorders on this frame, one is used for recording and the other is on standby in case of a failure or change of tape. The label information is placed on the end of the tape of the active recorder and on the beginning of the tape for the standby recorder, since the standby recorder becomes the active recorder after the 3:00 a.m. transfer. Other types of label entries may be initiated by the system control portion or unit of the recorder and recorder control circuit when a transfer from one recorder to another is made at a time other than 3:00 a.m. This would be a trouble or manual transfer.

2.48 The recorder and recorder control circuit is composed of several units. These units include a multicontact relay connector (with two or three input channels to the recording units), two recording units (each containing a tape transport and control circuits), the system control (a control unit for both recorder units), a trouble buffer (for trouble recording), and a test circuit. Unlike the paper tape recorders for LAMA, one LAMA magnetic tape recorder and recorder control circuit can serve all trunks in a transverter group (2000 trunks or junctor circuits).

2.49 The recorders used for LAMA magnetic tape are incremental digital tape recorders. The recorders write information in digital form while the tape is not moving. The tape is stopped, a line of information (two AMA characters) is written, the tape is advanced and stopped, and another line of information is written, etc. This arrangement allows 200 lines of information to be written on each inch of tape (approximately 13 initial entries). The recorders have a feature which allows the written information to be read back from the tape while the tape is moving, thus allowing immediate verification of the AMA data.

2.50 The recorder and recorder control frame (Fig. 8) is a 2-bay unit. In larger offices (more than ten call identity indexers), a supplementary

relay rack unit which contains multicontact relay apparatus for additional transfer and trunk control circuits may be provided.

B. Call Identity Indexers

2.51 The call identity indexer (CII) used for LAMA magnetic tape is functionally identical with the CII described for LAMA paper tape, but was redesigned to realize a better equipment arrangement. The CII must also furnish a thousands digit of 0 or 1 to identify trunks since one recorder and recorder control circuit can handle up to 2000 trunks and junctor circuits.

2.52 The CII frame (Fig. 9) is a single-bay unit that provides mounting space for six CII units. When as many as 20 CII units are required, a supplementary frame is provided to mount the two extra CII units. This frame also provides space for one trunk control unit (Fig. 10).

C. Master Timers

2.53 The master timer provides the recording equipment with a source of time for timing calls. The circuit is divided into an even and an odd timer. Each timer is a duplicate of the other and arranged so that one circuit (even or odd) is supplying time (on-line unit) and the other serving as a check and back-up circuit (off-line unit). Time information is generated by a synchronous motor running at 30 revolutions per minute. The motor turns a cam which provides pulses to operate a relay counting circuit. The output timing information is updated once each second. The output of this counter is controlled by a gating circuit in the recorder and recorder control circuit so that timing information will not be updated while the recorder is recording it.

2.54 Timing for LAMA magnetic tape is recorded to the nearest second rather than to the nearest 6 seconds (1/10 of 1 minute) as in the LAMA paper tape system. Since the time entries on magnetic tape contain the hour and minute, the timing entries contain only seconds in units and tens.

2.55 When the 3:00 a.m. transfer label is initiated by the master timer (even or odd), the on-line circuit of the master timer controls this function. There is not an automatic transfer to the other

timing unit as is done in the LAMA paper tape master timer.

2.56 The master timer (Fig. 11) is a single-bay unit which contains both the even and odd circuits of the timer, a transfer and make-busy circuit, and a control and synchronizing unit.

D. Transverters and Transverter Connectors

2.57 Transverters and transverter connectors perform the same functions for LAMA magnetic tape as for LAMA paper tape. They must supply information faster for LAMA magnetic tape because the tape recorders operate faster than the perforators used for LAMA paper tape. One other difference is that an office index is not used for LAMA magnetic tape. Instead, the full office code (NXX) is used and the LAMA magnetic tape transverter does not have to convert the office code into an office index.

2.58 As many as eight transverters may be used with a recorder and recorder control circuit. The transverter frame is a single-bay unit (Fig. 12).

E. Translators

2.59 The translators used for LAMA magnetic tape are identical with those used with LAMA paper tape.

F. Trunk Control Circuits

2.60 The trunk control circuit transmits information to the recorder and recorder control for recording answer and disconnect entries. The trunk control circuit performs many of the functions performed by the LAMA paper tape recorder circuit. It does not contain any apparatus associated with the time of day; this information is supplied directly from the master timer to the recorder. In addition to functioning with the recorder and recorder control circuit to record answer and disconnect entries, it functions with the transverter to aid in identifying and controlling the trunks or junctor circuits on the initial entry.

2.61 Each trunk control circuit is associated with a CII. An additional trunk control circuit is provided as an emergency circuit and can substitute for any of the regular circuits which have been removed from service. One trunk control circuit is provided for each 100 AMA trunks plus one for

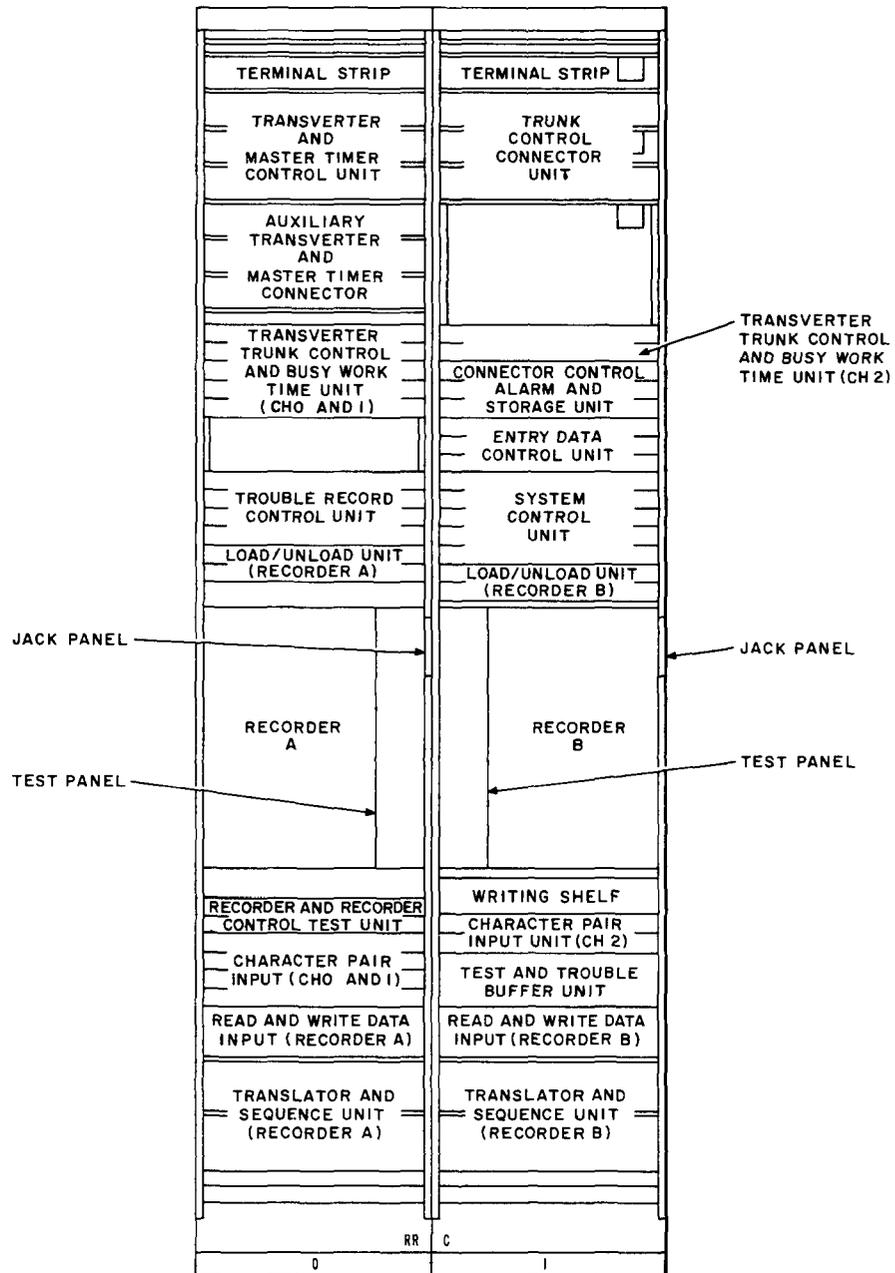


Fig. 8—LAMA Magnetic Tape Recorder and Recorder Control Frame

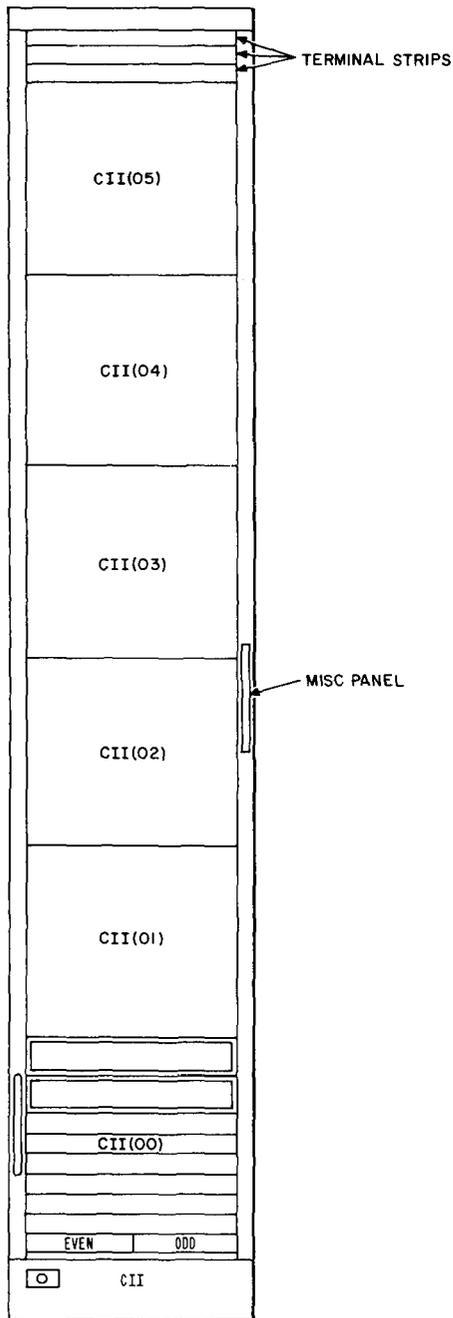


Fig. 9—LAMA Magnetic Tape Call Identity Indexer Frame

emergency. This allows a maximum of 21 trunk control circuits per recorder and recorder control circuit.

2.62 The trunk control frame (Fig. 13) is a single-bay unit which provides mounting space for

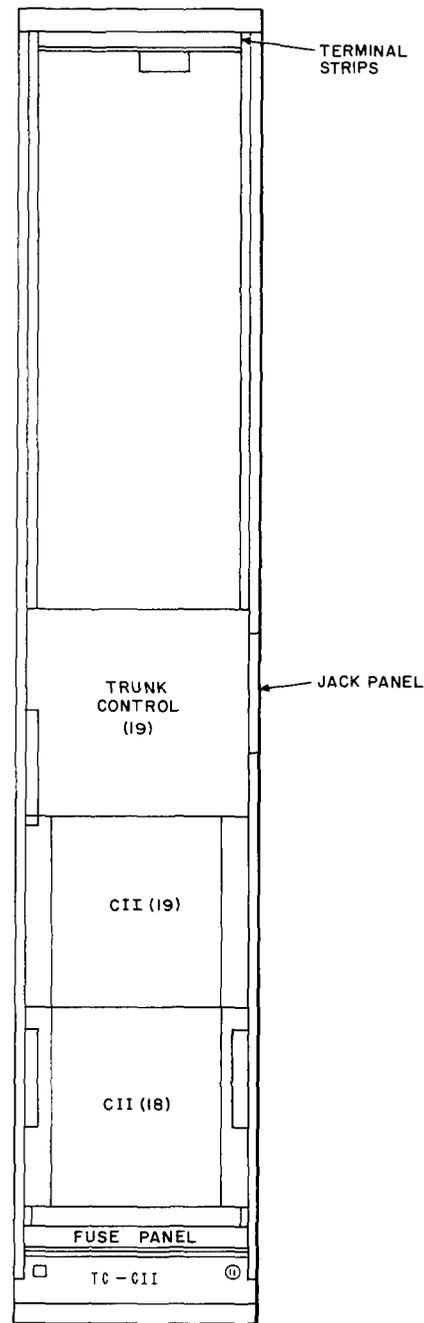


Fig. 10—LAMA Magnetic Tape Trunk Control, Call Identity Indexer—Supplementary Frame

four trunk control circuits and one emergency circuit or five trunk control circuits. In addition, when an office is fully equipped (21 trunk control circuits), a supplementary trunk control, call identity indexer frame (Fig. 10), can be added which provides space for two CIIs and one trunk control circuit.

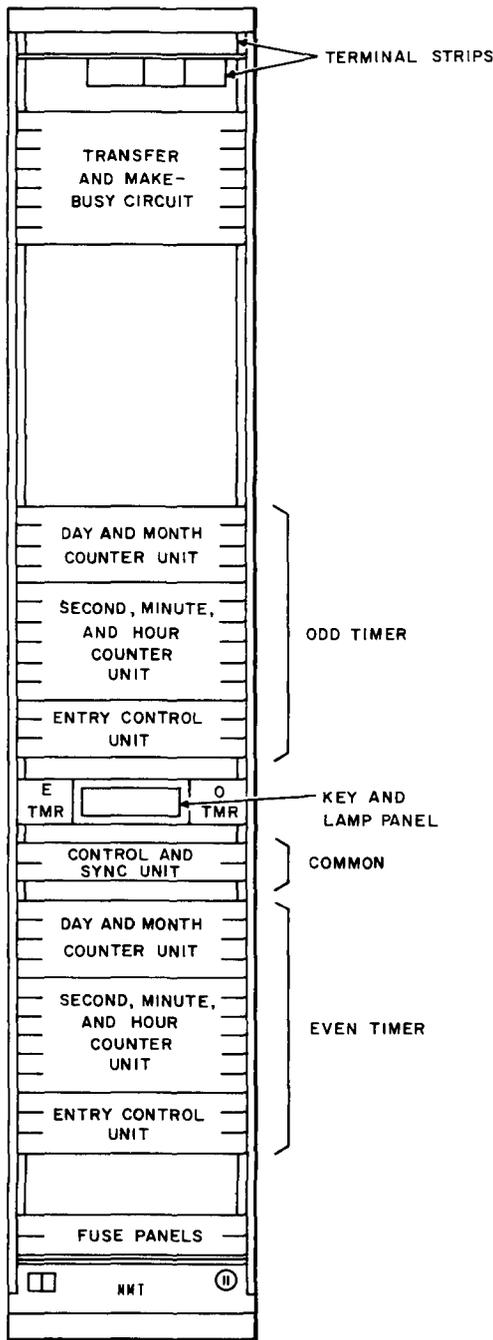


Fig. 11—LAMA Magnetic Tape Master Timing Frame

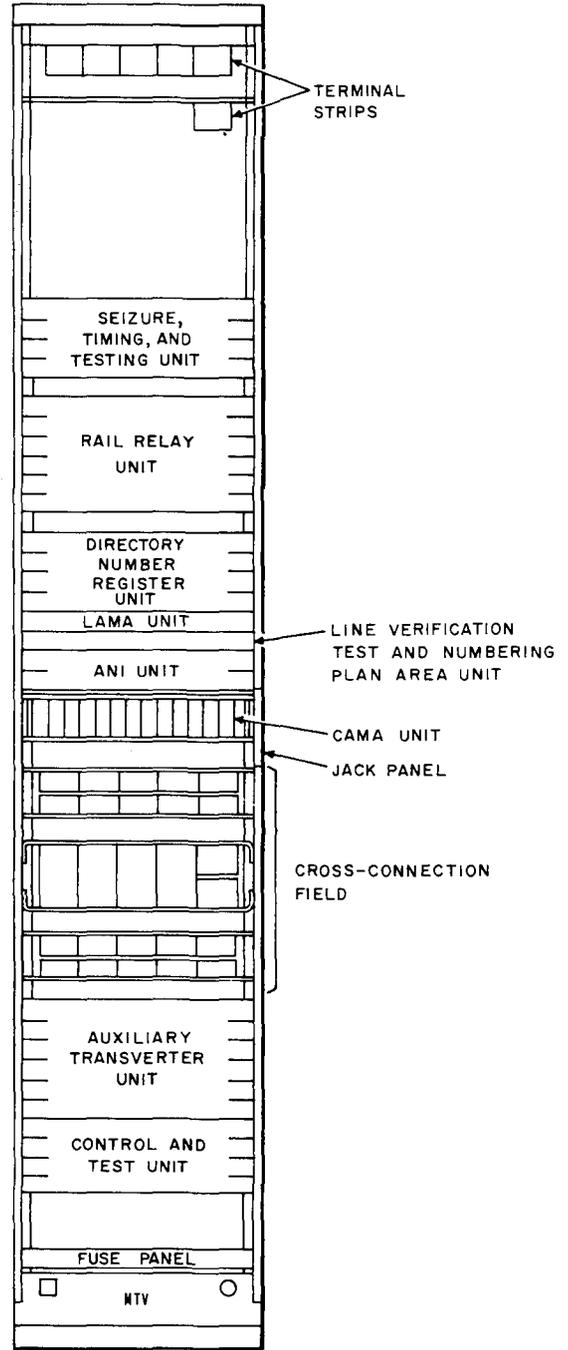


Fig. 12—LAMA Magnetic Tape Transverter Frame

G. Trunks and Junctor Circuits

2.63 The trunks and junctor circuits arranged for LAMA magnetic tape operation are the same as described for LAMA paper tape.

H. Other Equipment

2.64 In addition to the specific circuits for LAMA magnetic tape, additional circuits that require modification are described below.

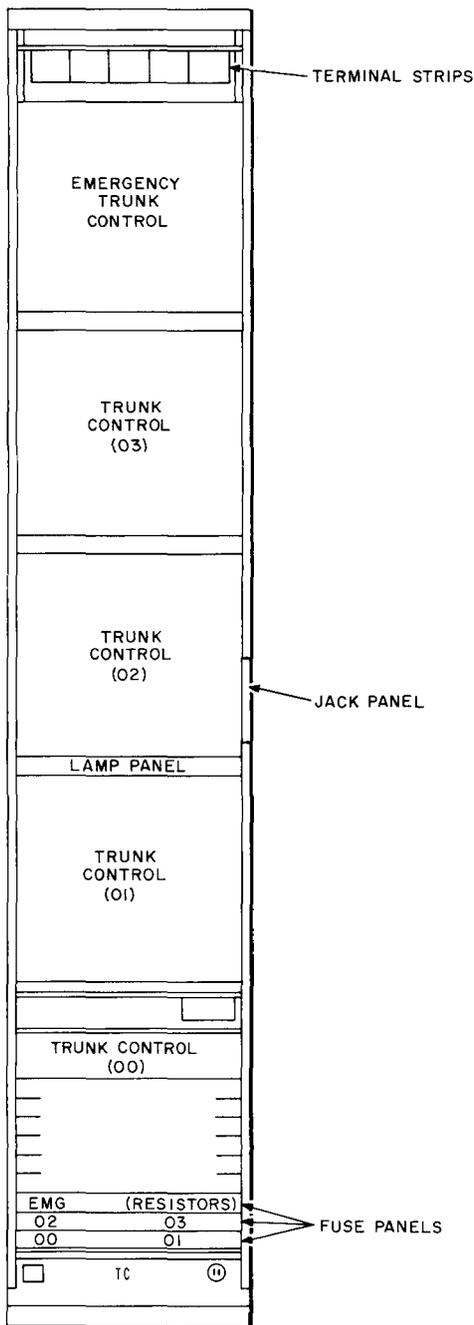


Fig. 13—LAMA Magnetic Tape Trunk Control Frame

2.65 Master Test Control Circuit: This circuit has features to permit testing the LAMA magnetic tape transverter trunk control circuits.

2.66 Master Test Connector: This circuit has features to permit the LAMA magnetic tape circuits to use the trouble recorder.

2.67 Other Miscellaneous: Alarm circuits and traffic registers have features to accommodate the LAMA magnetic tape arrangement.

3. METHOD OF OPERATION

A. General

3.01 The method of operation for LAMA paper tape and LAMA magnetic tape calls covers primarily those operations peculiar to LAMA paper tape and LAMA magnetic tape calls and describes briefly the marker, register, and sender jobs since these jobs are covered in Section 958-110-100.

3.02 Numbers in parentheses in Fig. 14, 15, 16, and 17 indicate the order of connections, and arrows on the connecting lines indicate the direction of connections.

B. LAMA Paper Tape Outgoing Call

3.03 Assume that the customer has completed dialing a call over the dialing connection (Fig. 14) which is to be completed over an outgoing trunk. The originating register connects to a marker through an originating register marker connector (connection 1). It also transmits the calling line location, class of service of the calling line, called office code and line number, called area code if dialed, and number of line link used in the dialing connection to the marker.

3.04 The marker determines that a call requires an AMA record from the area code, office code, and class of service. In addition, from the area or office code, it determines that an outgoing trunk connection is required and the type of sender to be used. The marker then connects to an outgoing sender through an outgoing sender connector (connection 2), notifies the sender that the call is to be handled by an outgoing trunk, and that the call requires an AMA record. The marker then transmits the calling line equipment location, message billing index, called line number, called area code, and office code to the outgoing sender.

3.05 The marker then selects an idle AMA trunk to the desired location, connects to the idle trunk through the trunk link connector (connection 3), and receives the recorder number from the outgoing trunk.

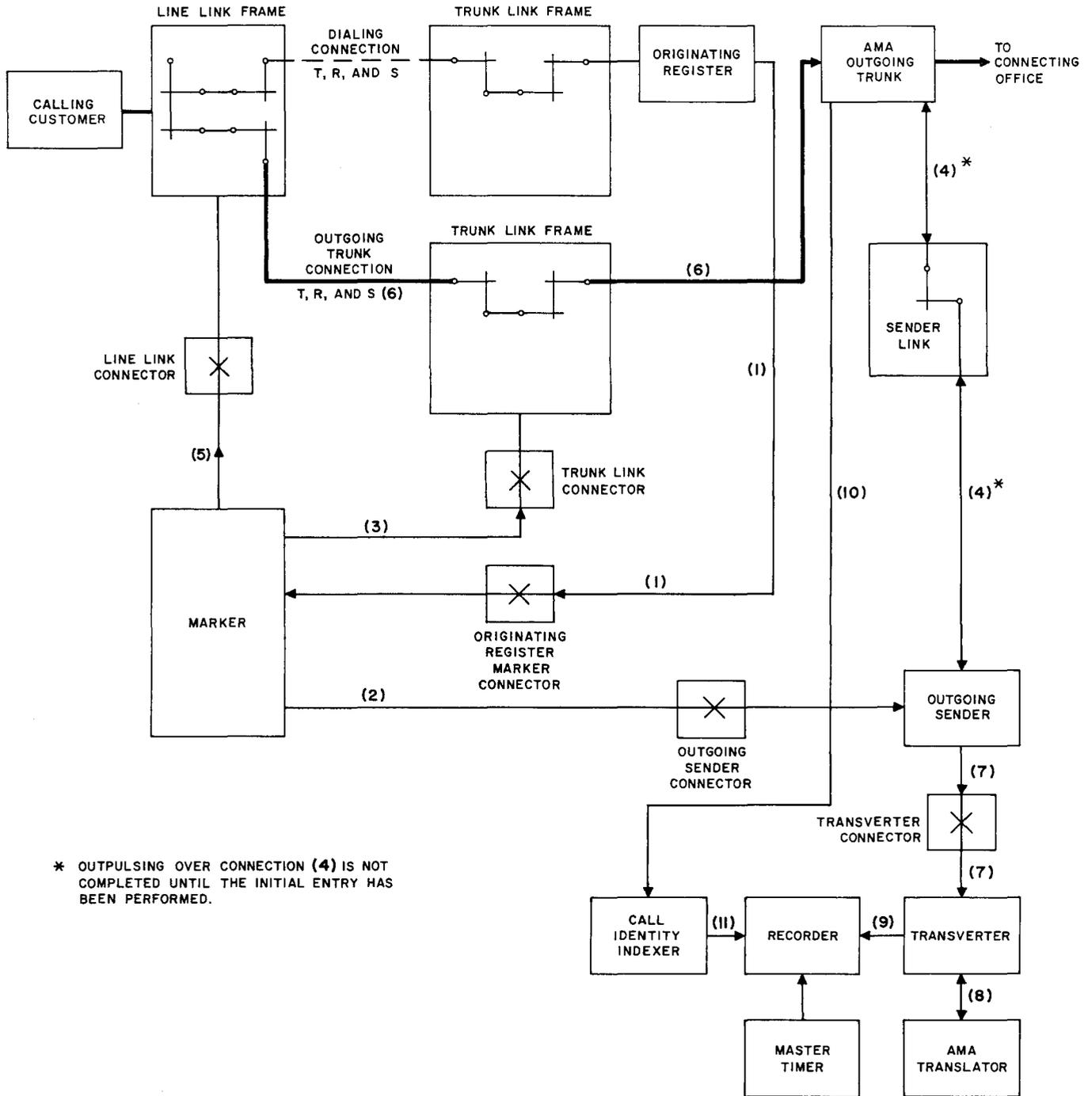


Fig. 14—Establishing LAMA Paper Tape Outgoing Trunk Connection

3.06 A connection between the sender and the AMA outgoing trunk (connection 4) is established by the marker through the outgoing sender link. It then connects to the calling customer line link (connection 5) and tests for an idle channel between the line link and trunk link frames.

3.07 A connection is established by the marker between the calling line and the outgoing trunk (connection 6). The marker releases itself, the outgoing sender connector, the line link connector, and the trunk link connector thereby leaving the call under control of the outgoing sender.

SECTION 958-308-100

3.08 After the outgoing sender selects a transverter (connection 7), it transmits the recorder number associated with the selected trunk and the equipment location of the calling line to the transverter.

3.09 The transverter selects an AMA translator (connection 8) associated with the equipment location of the calling line. The equipment location is then translated by the translator to the calling line number and calling office code. The translator transmits this information to the transverter and is then released from the connection by the transverter.

3.10 A connection is made by the transverter to the recorder associated with the selected AMA trunk (connection 9). The transverter signals the trunk through the transverter connector, sender, and sender link to identify itself. The trunk then signals the call identity indexer (connection 10) which transmits the trunk number to the recorder (connection 11).

3.11 The recorder, under control of the transverter, now starts perforating the initial entry which contains the following information.

- (a) Entry index—This index is a single digit. The digit is always 0 except in the last line of entry when it is a number to show that this is the last line of the entry.
- (b) Called line number—This number is thousands, hundreds, tens, and units digits of a called number.
- (c) Area index—This index is a compressed code of one digit representing an area code except in a 5-line entry when all three digits of an area code are used.
- (d) Called number index—This index is a single digit representing a number of numerals in the called number.
- (e) Called office code—This code is a 3-digit number giving the called office code.
- (f) Calling office index—This index is one digit representing a calling office code.

(g) Calling line number—This number is a thousands, hundreds, tens, and units digit representing the calling line number.

(h) Message billing index—This index is a single-digit number identifying the call as a message unit and/or a toll call.

(i) Message billing index tens/office tens information—This information is one digit representing a combination of these two numbers.

(j) Call identity index—This index is a 2-digit number used to identify the trunk used in a call (trunk number).

3.12 The outgoing sender outpulses the call to the distant office in the usual manner, except the last digit digit is delayed until the initial entry is perforated. The sender then completes outpulsing. After completion of the initial entry, the sender, recorder, and recorder connector are released. After the recorder is released, the transverter and transverter connector release. The call is then held under control of the AMA trunk.

3.13 After the called customer answers, the trunk calls in the recorder 2 to 5 seconds later (connections 10 and 11) through its associated call identity indexer. The recorder perforates the answer entry and releases.

3.14 When the calling customer disconnects, the trunk again calls in the recorder and the recorder perforates the disconnect entry. After the disconnect entry is perforated, the equipment releases in the same manner as a non-AMA call.

3.15 The answer and disconnect timing entries are one-line entries that contain the following information.

- (a) Entry index—This index is a digit 1 indicating an answer or a disconnect entry.
- (b) Minutes—Three digits indicate the time in tens, units, and tenths of minutes.
- (c) Call identity index—This index is two digits which represent the trunk number. It is used to associate the entries for a given call.

These entries cannot be identified as an answer or a disconnect entry by the information they

contain, but can be identified by their location on the tape.

C. LAMA Paper Tape Intraoffice Call

3.16 Assume that the customer has completed dialing a call over the dialing connection (Fig. 15) which is to be completed to another customer in the same marker group. The originating register connects to the completing marker through the originating register marker connector (connection 1) and transmits the calling line location, class of service of the calling line, called office code, called line number, and number of line link used in the dialing connection to the marker.

3.17 The marker determines from the office code that the call is to be an intraoffice call and from the class of service that an AMA trunk is to be used. All trunk link frames are checked by the marker for an idle intraoffice AMA trunk. It connects to the number group through the number group connector (connection 2). The number group performs translation functions, transfers the equipment location of the called number to the marker, and releases.

3.18 An idle intraoffice AMA trunk is selected by the marker on a previously selected trunk link frame. The marker also sets the ringing selection switch (connection 3).

3.19 The AMA intraoffice trunk transmits its associated recorder number to the marker. The marker then connects to the line link frame of the called line through the line link connector (connection 4). It establishes the terminating connection between the called line and B appearance of the intraoffice trunk (connection 5), connects to the line link frame of the calling line (connection 6), and establishes the originating connection between the calling line and the A appearance of the intraoffice trunk (connection 7).

3.20 A connection is made by the marker to an outgoing sender of any type with AMA features, since outpulsing is not required (connection 8). The marker notifies the outgoing sender that the call is to be handled by an intraoffice trunk and no outpulsing is to be required. The marker then transmits the recorder number associated with the selected trunk, calling line equipment location, message billing index, called line number, and called office code to the sender.

3.21 A connection between the sender and the intraoffice AMA trunk (connection 9) is established by the marker. The marker sets the trunk to start ringing and releases itself, the line link connector, and the outgoing sender connector.

3.22 The outgoing sender connects to a transverter through a transverter connector (connection 10) and transmits the recorder number associated with the selected trunk and the equipment location of the calling line to the transverter.

3.23 A translator associated with the equipment location of the calling line (connection 11) is selected by the transverter. The translator translates the equipment location of the calling line to the calling line number and calling office index, transmits that information to the transverter, and releases.

3.24 A connection is made by the transverter to the recorder associated with the selected AMA intraoffice trunk (connection 12). The transverter signals the trunk through the transverter connector, sender, and sender link to identify itself. The trunk then signals the call identity indexer (connection 13) which transmits the trunk number to the recorder (connection 14).

3.25 The recorder starts perforating the initial entry on tape under control of the transverter. This initial entry contains the entry index, calling line number and calling office index, message billing index, and call identity index.

3.26 After the initial entry is perforated, the outgoing sender, recorder connector, and recorder release. After the recorder releases, the transverter and transverter connector release.

3.27 The call is now under control of the trunk. After the called customer answers, the trunk calls in the recorder 2 to 5 seconds later through its associated call identity indexer (connections 13 and 14); the recorder perforates an answer entry and releases.

3.28 When the calling customer disconnects, the trunk again calls for a recorder; the recorder perforates a disconnect entry and releases. The other switching equipment releases in the same manner as a non-AMA call.

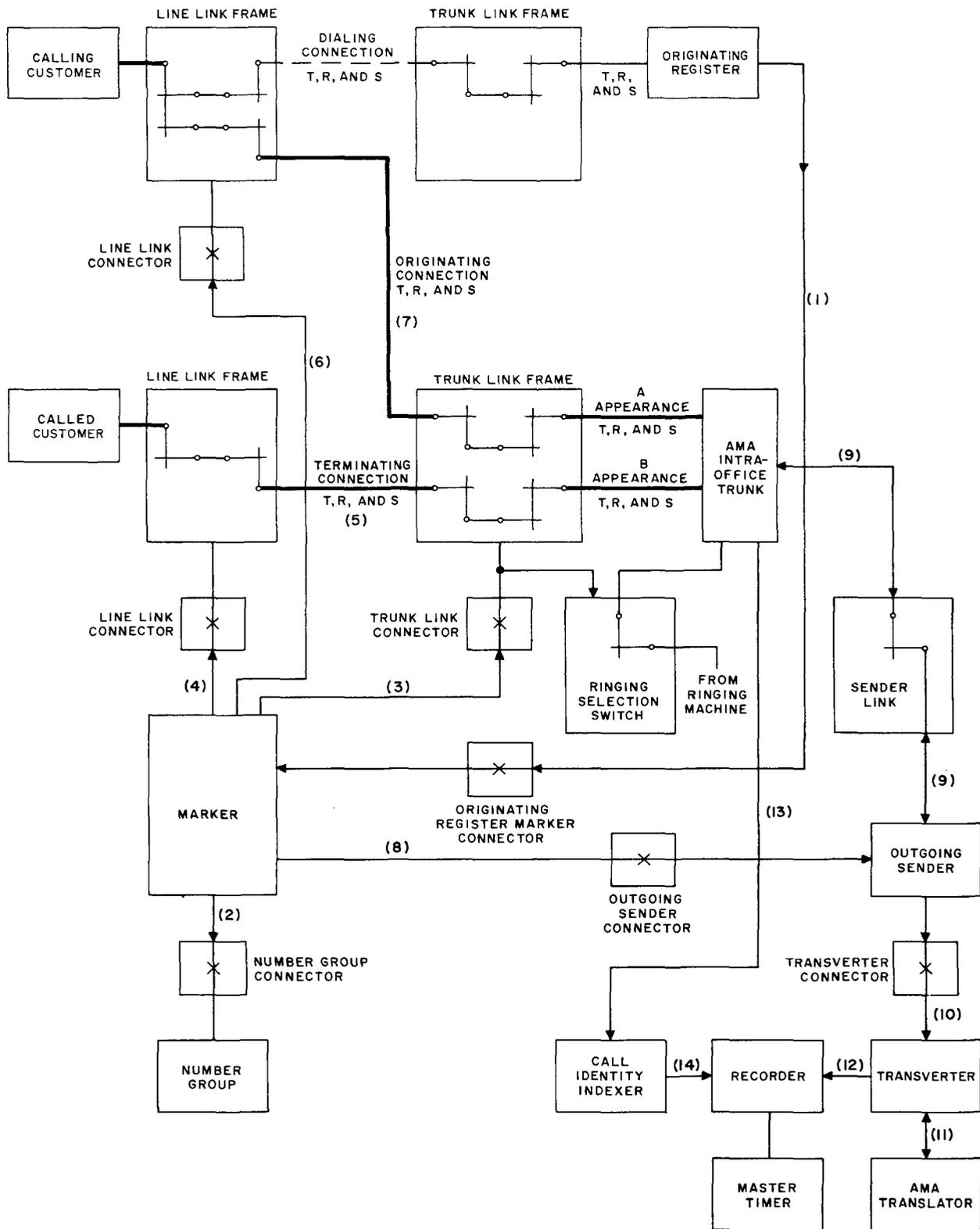


Fig. 15—Establishing LAMA Paper Tape Intraoffice Trunk Connection

D. LAMA Magnetic Tape Outgoing Call

3.29 Assume that the customer has completed dialing a call over the dialing connections shown in Fig. 16. In addition, the marker has established connections (1) and (2) in the same manner as a LAMA paper tape call and passed the calling line equipment location, message billing index, called line number, called area code, and called office code to the sender.

3.30 The marker then selects an idle AMA trunk to the desired location, connects to the idle trunk through the trunk link connector (connection 3), and receives the recorder number from the outgoing trunk.

3.31 A connection between the sender and the AMA outgoing trunk (connection 4) is established by the marker which then connects to the calling customer line location (connection 5) and tests for an idle channel between the line link and trunk link frames.

3.32 A connection between the calling line and the outgoing trunk (connection 6) is established by the marker. It releases itself, the outgoing sender connector, the line link connector, and the trunk link connector.

3.33 After the outgoing sender selects a transverter (connection 7), it transmits the recorder number associated with the selected trunk and the equipment location of the calling line to the transverter.

3.34 The transverter then selects a translator (connection 8) associated with the equipment location of the calling line. The equipment location is then translated to calling line number and calling office code. The translator transmits this information to the transverter and is released by the transverter.

3.35 A connection is made by the transverter to the trunk control circuit associated with the selected AMA trunk (connection 9). When the trunk control circuit has been seized, a signal via the transverter connector, sender, and sender link to the trunk causes the trunk to identify itself to the trunk control circuit by bidding for the call identity indexer (connection 10). When trunk identification is complete (connection 11), the transverter requests the recorder and recorder control circuit (connection 12), and upon being

connected, functions with the electronic circuitry to record the initial entry.

3.36 A typical initial entry contains fifteen 9-bit characters for AMA calls. Since each 9-bit character contains two AMA characters, this is a total of 30 AMA characters. This initial entry contains the following information:

- (a) Initial entry identifier—Two AMA characters which indicate trunk thousands, 0000 through 0999 or 1000 through 1999 (2000 trunks total)
- (b) Entry index—Two AMA characters which indicate that the call is station paid, noncoin, coin zone, etc
- (c) Fixed information digits—Two AMA characters which indicate that the call is traffic sampled, traffic sampled-charge, traffic service observed and operator identified, operator dialed, customer dialed, etc
- (d) Call identity index—Three AMA characters which in conjunction with the entry identifier indicate which trunk is used for the call
- (e) Calling number—Seven AMA characters which identify the calling number
- (f) Called number—Ten AMA characters which identify the numbering plan area plus the seven digit called number.

3.37 When recording is complete, the recorder and recorder control circuit is released and the transverter and trunk control circuits proceed to set charging relays in the trunk, and then release from the call.

3.38 After the called customer answers, the trunk bids for the trunk control via the call identity indexer. Upon being connected, the trunk control requests the recorder and recorder control (connection 13) which records three 9-bit characters on tape (six AMA characters) which comprise the answer entry. The recorder and recorder control circuit releases, and the trunk control circuit functions with the trunk to control charging relays and then releases.

3.39 When the calling customer disconnects, the trunk again calls in the trunk control circuit which requests the recorder and recorder control

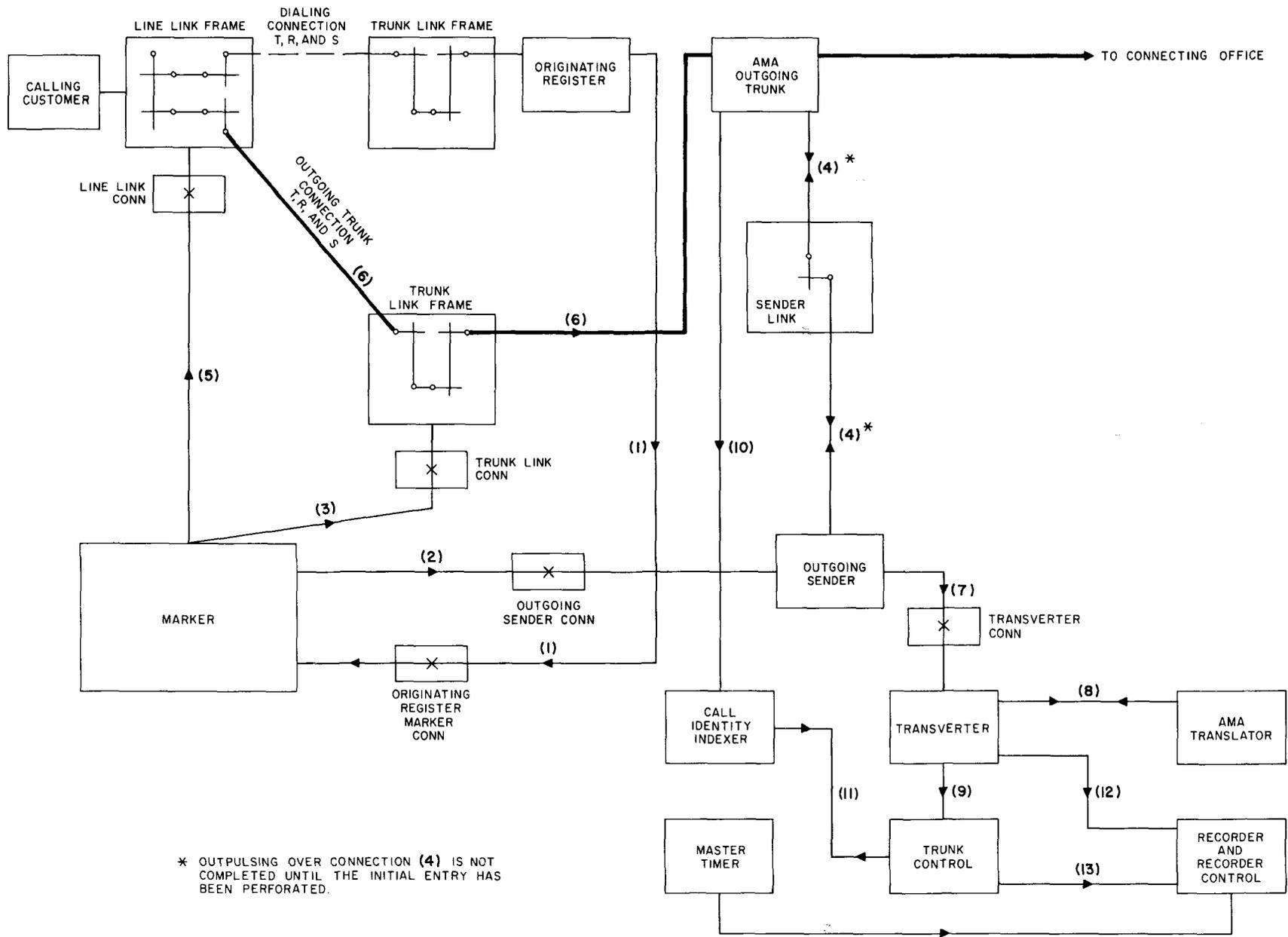


Fig. 16—Establishing LAMA Magnetic Tape Outgoing Trunk Connection

circuit to record a disconnect entry. After the disconnect entry is recorded, all the equipment is released.

3.40 The answer and disconnect entries as mentioned above contain six AMA characters as follows:

- (a) Timing entry identifier—One AMA character which identifies the entry as a timing entry and indicates trunks 0000 through 0999 or 1000 through 1999
- (b) Call identity index—Three AMA characters representing the trunk number
- (c) Timing—Two AMA characters giving seconds in tens and units.

E. LAMA Magnetic Tape Intraoffice Call

3.41 The LAMA magnetic tape equipment functions in the same manner for an intraoffice call as it does for an outgoing call. Fig. 17 shows a block diagram of this call and the above description of the outgoing call covers the functions of the LAMA magnetic tape equipment.

4. SERVICE OBSERVING

4.01 Service observing is used to ensure that customers are receiving the grade of service to which they are entitled and to observe customer lines on which customer complaints have been received. A trunk connected directly to a central observing bureau is used for connecting to the customer line. Only calls originated by the customer can be observed. The observing operator monitors on an originated call by means of an amplifier acting as a one-way repeater which prevents noise transfer from the observing trunk to the customer line.

4.02 Access to a customer line for service observing is obtained by plugging up an observing line to a service observing jack at the service observing patching panel.

4.03 When a call is originated by a customer on a line to be observed, a signal is passed to the combined or dial tone marker that the call is on service observing. The marker passes this information to the originating register. Then the

register stores the information and later forwards the information to the marker and to the transverter. This information ensures that an initial entry is made for a call on service observing and that one of the digits in the initial entry indicates to the accounting center that the call was observed.

5. MAINTENANCE FACILITIES

5.01 No additional test frames are required for LAMA paper tape or LAMA magnetic tape operation. The following existing test circuits may be modified to test AMA equipment.

- (a) Master test frame or office test frame
- (b) Automatic monitor, register and sender test circuit
- (c) Automatic progression trunk test circuit.

5.02 The master test frame or the office test frame is used to perform tests on the following AMA equipment:

- (a) Transverters
- (b) Outgoing senders
- (c) Trunk control circuits
- (d) Line circuits (overall line verification)
- (e) Trunks.

In addition, the master test frame can perform surge circuit tests of the translator.

5.03 The recorder test circuit located on the master timing frame is used to test LAMA paper tape recorders. In addition, provision is made to manually transfer the function of any recorder to an emergency recorder.

5.04 Provision is also made to manually transfer timing functions between the even and the odd timers.

5.05 Certain AMA troubles cause trouble cards to be produced by the trouble recorder in a master test frame office. These cards can be used to analyze LAMA troubles. In an office equipped with an office test frame, the troubles are indicated

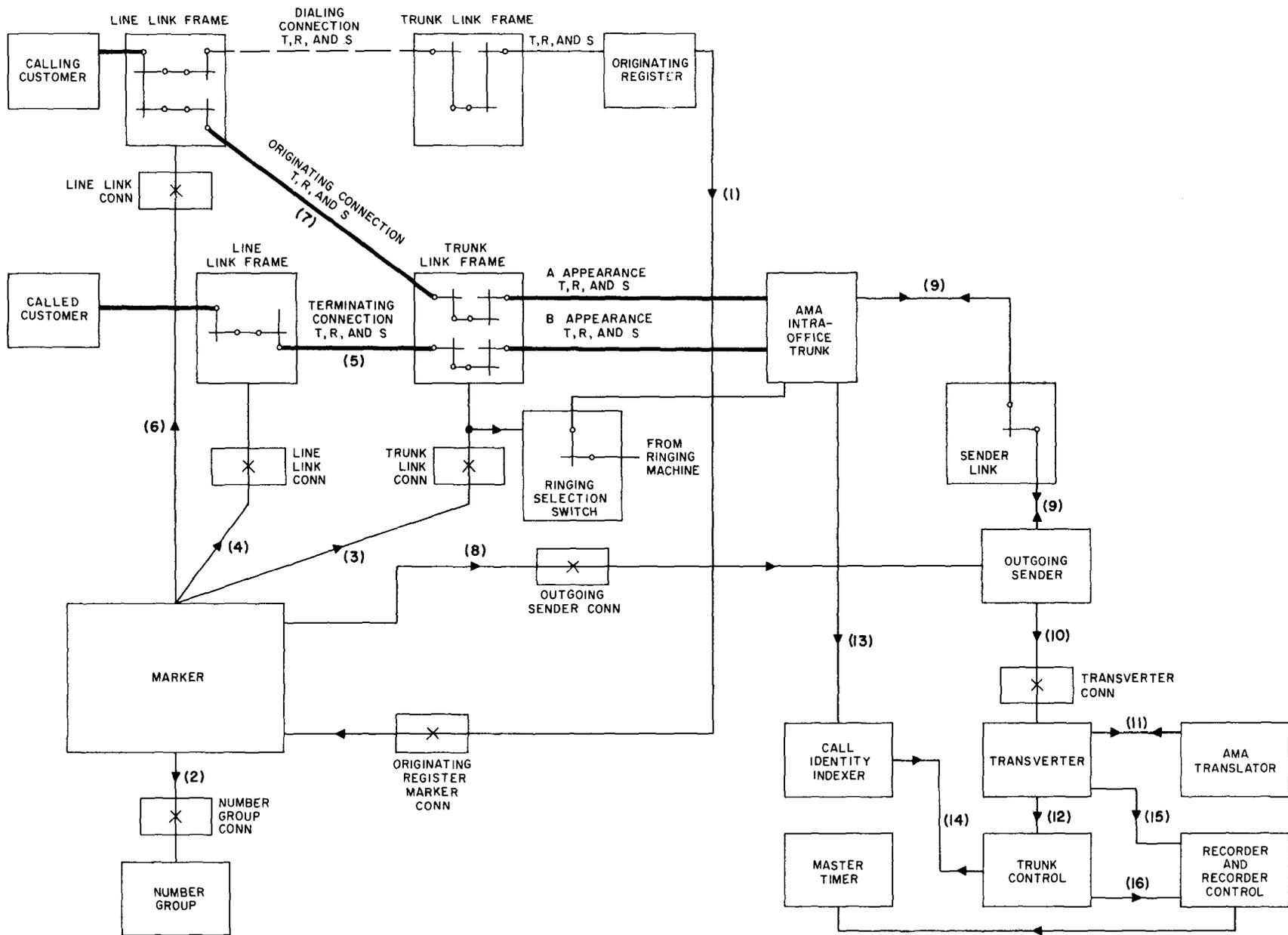


Fig. 17—Establishing LAMA Magnetic Tape Intraoffice Trunk Connection

by lighted lamps on the trouble indicator and connector circuit.

5.06 The LAMA magnetic tape recorder and recorder control frame has test facilities to

perform recorder tests. These tests are normal test (recording an entry), character pair test, character pair test with trouble simulation (with or without trouble recording), end of record test, and tape mark test.