

**GENERAL OUTLINE**  
**OPERATING AND EQUIPMENT FEATURES**  
**NO. 4A OFFICE**  
**EQUIPMENT DESIGN REQUIREMENTS**  
**NO. 4 TYPE TOLL SWITCHING SYSTEMS**

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#### 1. GENERAL

##### SCOPE

1.01 This specification outlines the operating and equipment features of the No. 4A Toll Switching System. Equipment design requirements are covered in the specifications listed in **8. SUPPLEMENTARY INFORMATION**.

1.02 This specification is reissued to reflect current standard equipment design. The added information expands the information previously furnished on the Electronic Translator System (ETS). Peripheral bus computer (PBC) CAMA-C and new trunk test frames and equipment for common channel interoffice signaling (CCIS) are added.

1.03 **8. SUPPLEMENTARY INFORMATION**, lists the specifications covering the engineering requirements for the various equipment required for No. 4A toll switching offices. **9. GENERAL DRAWINGS** lists general drawings not covered in specific specifications.

1.04 The following is a list of diagrams found at the end of this specification.

Fig. 1 — Equipment Schematic

Fig. 2 — Equipment Schematic (CAMA)

Fig. 3 — Typical Floor Plan—Switching Area—Separate Train Combined-Operation Office (Non-CAMA)—Electronic Translator Office

Fig. 4 — Typical Floor Plan—Separate Train Combined Operating Link Frame Area

Fig. 5 — Typical Floor Plan—Two Train Combined Operation—Non-CAMA Switching Machine Equipped With Small Switch Link Frame Area

Fig. 6 — Typical Floor Plan—CAMA Equipment

Fig. 7 — Frame Sizes

Fig. 8 through 93 — Frame Equipment Layouts

## 2. GENERAL DESCRIPTION

### Application

**2.01** The No. 4A Toll Switching System provides a means for completing connections:

- (a) Between various long-distance dial trunks (intertoll trunks)
- (b) Between these trunks and other trunks terminating (toll switching) or originating (incoming tandem, CAMA) within the toll center area
- (c) Between these latter trunks.

The switching equipment is controlled by dial or key-pulses originated by the subscribers or long-distance operators enabling the subscribers or the operators to establish the calls more quickly and accurately than is possible by manual means.

### Nationwide Dialing

**2.02** The No. 4A Toll Switching System provides all the necessary features for full Control Switching Point (CSP) operation, as required for the nationwide direct distance dialing plan. The entire United States, Bermuda and the Caribbean Islands, Canada, and a portion of Northwest Mexico have been divided geographically into 129 "Numbering Plan Areas," each of which is assigned a distinctive 3-digit desig-

nation called an "area code." Calls between numbering plan areas will, in general, require dialing the code of the area in which the called telephone is located, as well as the called customer 7-digit number. Home area calls, which originate and terminate within the same NPA, ordinarily require the dialing of only the called customer 7-digit local number.

**2.03** The code received by a switching system must contain sufficient information to advance the call to or toward its destination. In many instances, a 10-digit call for another NPA can be routed at a switching system on the basis of the NPA code alone; this involves "3-digit translation." In other instances involving calls to another NPA, the first 3 digits do not provide sufficient information. When this occurs, the switching system obtains the additional information it requires by also examining the 3-digit office code, thus using the first 6 digits to properly advance the call; this involves "6-digit translation." Other requirements of the switching system are:

- (a) Variable spilling — deletion of certain digits when not required for outpulsing
- (b) Prefixing of digits when required
- (c) Code conversion — a combination of digit deletion and prefixing
- (d) Automatic alternate routing.

### Types of Traffic Handled

**2.04** No. 4A Toll Switching System is a common control 4-wire dial system with operating, equipment, accounting, and maintenance features which fit it to handle inward, through, toll tandem, overseas, and CAMA traffic to and from dial lines, and through and tandem traffic from dial to ring-down. Ringdown toll lines remain in manual switchboards as at present, but calls from dial toll lines or toll tandem trunks can reach them through the switches. In general outward switchboards in the same building with the No. 4A system will reach ringdown lines in the manual multiple while decentralized outward boards will reach them through the dial equipment where transmission limitations permit. Ringdown to dial is trunked from the through switchboard through the switches. Calls may be completed to the usual service operators for delayed outward, inward, information, rate and route and call order traffic.

### General Methods of Operation for Electronic Translator Office

**2.05** A non-CAMA call through an office equipped with an ETS is similar to that for a card translator equipped office. In an ETS equipped office the translation is down in the Stored Program Control (SPC) via peripheral electronic and electromechanical units. The main part of the SPC is the processor-store complex. As shown in Fig. 1 an incoming call is connected from the trunk equipment through an incoming sender link to an incoming sender. After the sender has received sufficient digits it seizes a decoder channel through a decoder connector. The sender then passes input information into the SPC via the decoder channel and peripheral scanner (PSC) frame. The SPC now identifies the sender being used and the code requiring route translation and can now determine the trunk class information and proceed to translate this code into an outgoing trunk route. The SPC distributes the translation information through the peripheral function translator and distributor register to the output section of the decoder channel. The information transmitted is as follows:

- (a) Type of marker to be selected (IT or TC)
- (b) Outgoing trunk group location in trunk block connector
- (c) Class, code conversion, and variable spill information
- (d) Action to be taken by marker if all trunks are busy.

After registration of routing information, the decoder channel signals its marker connector to seize an idle marker. When the marker is connected, routing information from the distributor register is cut through the marker connector to the marker. The marker sends a registration check signal to the decoder channel which then requests the decoder connector to assume control of the marker, then releases itself and the marker connector. After testing for and seizing an idle outgoing trunk, the marker establishes connections on incoming and outgoing link frames between the selected outgoing and incoming trunks. The marker then passes outpulsing information to the sender and releases. The sender outpulses the necessary digits to the distant office in the case of multifrequency or dial pulse calls, or to an outgoing sender attached to the outgoing trunk for revertive pulsing or panel call indicator calls.

**2.06** The general method of operation remains the same for Centralized Automatic Message Accounting (CAMA) operation. The trunk class translator sends trunk class information to the transverter. Traffic separation is performed by the SPC. CAMA calls require CAMA trunk and CAMA sender groups and, for dial pulse traffic, incoming registers as shown in equipment schematic per Fig. 2. A CAMA call is otherwise completed through the toll switching equipment in the same manner as an incoming tandem or intertoll call except for the added message recording features. For this, the calling subscriber number as well as the called number must be registered in the sender either by automatic number identification pulses from the local dial offices or by operator keyed pulses from the CAMA switchboard. This information, together with rate class information from the trunk class translator, is passed on to a transverter which obtains the proper billing index and other information for the call from a billing indexer. This is then transmitted to a recorder for perforation on tape or recorded on magnetic tape when CAMA-C is provided with the trunk number obtained from a call identity indexer as the initial entry. If the call is satisfactorily completed, the answer and disconnect times are initiated by a signal from the trunk and perforated on the tape or recorded on magnetic tape as subsequent entries by the recorder operating in conjunction with the master timer.

### Train Arrangements

**2.07** Two arrangements of equipment are provided for the No. 4A Toll Switching System, one with a single train for small offices where the number of incoming or outgoing link frames will not exceed 40 and the other with two trains, each having this capacity. The single-train arrangement handles both intertoll and toll completing traffic with a maximum of ten markers and ten decoder channels and offices using it are called "combined train offices". This single-train arrangement can be initially engineered with provisions for ultimate expansion to the 2-train arrangement and, therefore, can be furnished in an area where the anticipated growth would ultimately require the larger 2-train arrangement. The 2-train arrangement and the expanded single-train offices operate with a maximum of ten markers for each train and ten decoder channels and are called "separate train-combined operation" to distinguish them from the 2-train offices used in the early toll switching systems. In the No. 4A 2-train arrangement, each train handles both intertoll and toll com-

pleting traffic with a multiple appearance of all incoming trunks on the incoming link frames of both trains. In order to retain existing nomenclature, the intertoll and toll completing designations are retained for these trains even though they have no such functional significance.

### Capacity

**2.08** In order to meet a variety of office sizes and conditions, the No. 4A Toll Switching System possesses considerable flexibility with regard to quantities and arrangements of equipment. The capacity of an office is based on the switching plan followed and is determined by the number and arrangement of the incoming and outgoing frames. Detailed information on this is covered in the description of the individual frames. In general, however, the largest installation for which standard arrangements are available will provide facilities for an office serving approximately 1,500,000 attempts a day. Engineered busy-hour marker capacity is approximately 135,000 attempts.

### Transmission

**2.09** The No. 4A Toll switching System is a 4-wire switching system with separate paths through the switching mechanism for talking in each direction. Any 2-wire circuits are made to appear as 4-wire circuits by the inclusion of hybrid coils in the toll connecting trunk equipments.

### Signaling

**2.10** In No. 4A as in all toll systems, it is necessary to provide a separate signaling channel whereby the supervisory signals (connect, disconnect, busy, reorder, etc) may be transmitted in both directions. This separate channel may be obtained either by compositing, which is not considered practical on trunks greater than about 300 miles in length, or by superimposing an ac tone signal on the talking path itself in each direction of transmission. In this latter system, known as single frequency, this tone is present during idle conditions and absent during busy conditions in order not to interfere while talking is in progress. The 4A Toll Switching System is arranged to operate with both CX and SF signaling systems.

### Pulsing

**2.11** In addition to the talking path and supervisory signaling facilities, the No. 4A system requires the transmission of the pulses which govern the switching selection. These pulses originate at subscriber dials, and dials or keysets at operators positions as dial or multifrequency pulsing, respectively. Inward pulsing, therefore, to the No. 4A equipment is either dial, converted to multifrequency via the incoming register, or DP sender for non-CAMA or multifrequency, the latter being received from either the keyset or another office. Outward pulsing may be multifrequency, dial, revertive, or PCI, depending on the destination of the call. Multifrequency pulsing is transmitted to another No. 4 office or to a crossbar office so arranged, dial pulsing to a step-by-step office, revertive pulsing to a panel office or a crossbar office not arranged for multifrequency pulsing, and PCI to a manual office equipped with panel call indicator. Revertive and PCI pulsing is used only over toll switching trunks to local offices. Multifrequency and dial pulsing is used over intertoll trunks to distant offices. In the case of dial pulsing over intertoll trunks to distant step-by-step offices, the dial signals are transmitted in the same way as the supervisory signals, that is, either by compositing or by the single-frequency signal system as described in paragraph 2.11.

### Assistance Facilities

**2.12** The handing of delayed through, special methods call, or any call requiring operator assistance may be done at manual 2-wire No. 3-type switchboards through hybrid equipped trunks. Operators at these positions are reached over special trunks called "121" trunks appearing on the outgoing link frames. The trunks necessary for the completion of these calls are reached over tandem trunks to the incoming link frames. The positions are equipped with 10-button keysets so that they may extend connections through the incoming and outgoing link frames on a full mechanical basis.

### Centralized Automatic Message Accounting Facilities

**2.13** The CAMA equipment for a No. 4A office is furnished on a transverter group basis contain-

ing 1800 CAMA trunks. These facilities provide the means for recording the data for billing calls. The billing data are recorded as perforations in paper or magnetic tape and consist of three main entries. The first or initial entry consists of the calling and called number, office index, and class-of-service or billing index; the second and third entries are the answering and disconnect time. The perforated tapes are processed in accounting centers on the same machines used in processing local AMA tapes. The magnetic tapes are processed in accounting data centers.

#### Maintenance Facilities

**2.14** The maintenance of the switching equipment for a No. 4A office is directed from a maintenance center located near the chief switchman desk. This center includes frames for testing the common control equipment, CAMA incoming trunks and the toll switching trunks, and facilities for removing them from service. The testing and operation of the toll line equipment is directed from the toll test room and includes a No. 17C toll testboard, assignment patching bay, and an automatic test frame for operational and transmission test of intertoll trunks. In an ETS equipped office the 7 foot high maintenance frames (control and display, program tape and teletypewriter frame, and the alarm and display frame) are located in the ETS area with the other 7-foot frames.

#### Distributing Frames

**2.15** These frames are required for the following purposes:

- (a) Trunk distributing (TDF) between trunk relay equipment and switch frames and testboard.
- (b) Assignment distributing (ADF) among trunk block connectors, CBA trunks, trunk relay equipments, and assignment patching jacks.
- (c) Traffic register distributing (TRDF) between traffic register rack and circuits requiring registrations.
- (d) Intermediate distributing (TDF) between trunk relay equipment and toll terminal equipment, and outside plant.
- (e) Toll distributing (MDF) among toll terminal equipment, toll line terminating equipment, and outside plant.

#### Power Plant

**2.16** Power and ringing plants for the No. 4A system involve supplies similar to those required for local crossbar offices plus positive and negative 130-volt supplies, +24 volt and -48 volt for the electronic equipment in the office.

#### Building Requirements

**2.17** This system is designed for use in standard buildings with a minimum clearance of 13 feet 6 inches under all obstructions. Frames are 11 feet 6 inches high and 10 inches between ladder guards, except the electronic frames which are 7 feet high and 12 inches between ladder guards. Fig. 7 lists the frame designations and lengths. Fig. 3 shows typical floor plan layouts for offices without CAMA equipment and Fig. 6 shows a typical floor plan for CAMA equipment.

#### Operation With Common Channel Signaling

**2.18** Common channel interoffice signaling (CCIS) is a system for exchanging information between processor-equipped switching systems over a network of signaling links. All signaling data, including the supervisory and address signals necessary to control call set up and take down, as well as network management signals, will be exchanged by these systems over the signaling links instead of being sent over the voice path as is done using present inband signaling techniques.

**2.19** With conventional inband signaling, a single frequency (SF) unit is required at each trunk end. In addition, a number of multifrequency (MF) transmitters and receivers switched to these trunks are required to pass address information. With CCIS, both the SF units and the MF equipment will be supplanted by a signaling link between the two processors and a number of continuity-checking transceivers.

**2.20** As shown in the figure, the signaling link will consist of two signaling terminals, two modems, and a voice-frequency link (VFL). The signaling terminals store both outgoing signaling messages awaiting transmission and incoming messages until ready to be processed. The terminals also perform error control through redundant coding and retransmission of signaling messages found to be in error. Each modem forms a digital-analog interface between the terminal and voice-frequency link. The VFL is a con-

ventional 4-wire message-grade transmission facility (type 3002 data channel). The terminal access circuit (TAC) enables the processor to access the various signaling links, provides an interface between processor and terminal, and performs certain maintenance operations.

**2.21** With the CCIS system, no signals are passed over the message trunks. Hence, trunk failures can no longer be detected by the loss of supervision as is done with SF/MF signaling. Instead, a number of 2010-Hz transceivers are provided which are connected to CCIS trunks during call set-up to check the continuity of the voice path.

**2.22** In most cases the signaling information will be routed through one or two signal transfer points (STPs). These STPs act as signaling message processors which concentrate the signaling for a large number of trunks onto a few signaling links.

**2.23** With CCIS, the signaling for many trunks will be sent over the same signaling links. Therefore, all portions of the signaling network will be sufficiently redundant and diversified so as to insure signaling availability. For floor plan information of the ETS area in an ETS/CCIS/SO office see 10.8 sheet 2.

#### **Signal Transfer Point (STP) Application To No. 4A/ETS**

**2.24** The signal transfer point (STP) acts as a signaling message processor which concentrates the signaling for a large number of trunks onto a few signaling links.

**2.25** The STP feature is for application in exhausted No. 4A/ETS toll switching offices which are not candidates for conversion to CCIS switching office operation. The STP feature is intended to utilize the spare processing capacity of the ETS system and is envisioned as a temporary solution which will allow early introduction of the signaling network.

**2.26** The No. 4A STP is designed to have a minimum interface, both software and hardware with the host ETS switching machine. There are no connections between the 4A crossbar frames and the STP equipment. The major interconnections are located in the ETS peripheral unit area. The PBC and ETS equipment is a prerequisite for STP operation. For floor plan information for the ETS area in an (ETS/CCIS/STP) office see section 10.8, sheet 14.

### **3. GENERAL EQUIPMENT ARRANGEMENTS**

#### **Framework**

**3.01** All the No. 4A and CAMA switching and trunk relay equipment, except the electronic equipment, is assembled on 11-foot 6-inch high bulb-angle 1- or 2-bay structures. The auxiliary framing is 11 feet 9-1/2 inches high. Most switching frames and certain of the trunks have their own fuse panels which are mounted at the top whereas the other trunks are fused at fuse-boards. Frames employing U-type relays have sender-type casings front and rear or have sender-type casings on the front and enclosures with removable covers on the rear. Frames employing wire-spring relays do not require frame covering. On the relay racks, where other than wire-spring relays are employed, strip-type covers are furnished for the individual mounting plates. The electronic equipment is assembled on 7 foot high sheet metal 1-, 2-, or 3-bay structures. The frames have their own fuse panels and are equipped mostly with electronic circuit packs, ferrod sensors and piggyback twistor memories.

#### **Wiring Arrangements**

**3.02** Two schemes of wiring the No. 4A frames have been used. Some of the frames are wired by means of frame local cables with all the interconnections except straps contained therein. On the other frames, a "functionalized unit" arrangement is used. In this scheme, the circuits are broken down into functional parts for which the intra-unit connections are made by surface wiring. The interunit connections are made by means of the frame or unit local cable. All the No. 4A, overseas, and CAMA trunk relay equipments are assembled on surface-wired units or plug in printed wiring boards.

### **4. DESCRIPTION OF FRAMES**

#### **General**

**4.01** The frames of the No. 4A Switching System mount the conventional crossbar switching system type apparatus, that is, crossbar switches for the link frames, multicontact relays for the connectors and relays, resistors, capacitors, etc, for the various control circuits. The physical dimensions of the frames are covered in Fig. 7. A description of all the frames used in the No. 4A Switching System is not included herein. Instead, only the major frames will

be discussed and then for the most part, only a brief description of the equipment and its primary function will be covered. For detailed equipment and functional descriptions, reference should be made to the specification covering the particular frame, listed in 8. **SUPPLEMENTARY INFORMATION.**

### 11-Foot 6-Inch Electromechanical Frames

#### Incoming and Outgoing Frames — Fig. 8 and 9

**4.02** The function of the incoming and outgoing frames is to establish connections from incoming tandem, CAMA, tributary, or intertoll trunks to outgoing intertoll, tributary, or toll completing trunks. These connections are set up through the switches by crosspoint closures which extend the incoming trunks through the A links of the incoming frame, the junctors (B links) between incoming and outgoing frames, and the C links of the outgoing frames to the outgoing trunks. As shown in Fig. 1 and 2, the trunks connect to the horizontal of the incoming primary and outgoing secondary switches; the links to the vertical of the incoming primary and outgoing secondary switches and to the horizontals of the incoming secondary and outgoing primary switches; and the junctors to the verticals of the incoming and outgoing primary switches. The basic incoming frames have a capacity of 360 trunks, 200 links and 200 junctors. The basic outgoing frames have a capacity of 240 incoming trunks and 200 junctors. The incoming trunk extension and outgoing trunk extension frame can each accommodate an additional 120 trunks using the same 200 link paths through the frame. This frame contains switches for even and odd frames and serves 240 trunks, 120 for odd and 120 for even frames. The incoming junctor extension and outgoing junctor extension bays provide an additional 200 junctor outlets for the 200 links. The 400 junctors are then used in common by the paired, even and odd link frames of a type which make up an incoming or outgoing link frame group. Incoming and outgoing groups are always furnished.

**4.03** A maximum of 480 incoming and 360 outgoing trunks can be connected to the incoming and outgoing link frames, respectively. The 460 trunk capacity is for use only in 2-train offices where all incoming trunks are multiplexed to both trains. The overall trunk capacity for a maximum size single-train office is 4,400 incoming and 14,400 outgoing trunks and, for a 2-train office, 19,200 incoming and 28,800 outgoing trunks.

#### Direct Cabling TC Junctor Distributing Plan

**4.04** The terminal strips shown at the top of the incoming frame junctor extension bays in Fig. 9 and the outgoing frame junctor extension bays in Fig. 10 permit direct cabling of the junctors. The terminals are connected to the switch verticals through a shop-connected local cable and to the junctors by switchboard cable. These arrangements provide a single junctor plan which permits orderly growth from a minimum of two incoming and two outgoing groups to a maximum of twenty incoming and outgoing groups.

#### Marker Frame — Fig. 10

**4.05** The principal function of the marker, with the information furnished by the decoder channel SPC, and trunk block relay, is to locate the calling trunk, select an idle trunk in the group to the called destination and mark an idle path between the two before setting up the connection from the incoming to the outgoing frame. The marker only provides routing instructions for calls requiring final reorder and circuit busy announcement trunks, and no circuit announcement in some cases. The marker together with a decoder channel is also used as a test circuit for senders under test by the sender test frame and is arranged to permit tests of its features by the decoder marker test and trouble recorder frame.

**4.06** In separate train offices with combined operation and in combined train offices, the markers in all trains are similarly equipped as combined markers to handle both intertoll and toll completing traffic. However, in the combined train offices, the combined marker is designated M and in the separate train offices with combined operation MIT or MTC with the last two designations indicating the train with which it is associated. A minimum of three markers per train is required.

**4.07** The various markers are arranged to function with the following maximum quantities of connecting equipment:

	SEPARATE TRAIN		SINGLE TRAIN
	MIT	MTC	M
Incoming Frames	40	40	40
Outgoing Frames	40	40	40
Trunk Block Connectors	30	30	30
Block Relay Frames	10	10	10

	SEPARATE TRAIN	SINGLE TRAIN
Decoder Channel Frames	2	2
Decoder Channels	10	5*
Decoder Connectors Frames	14	7*
Decoder Connectors	55	28*
Marker Connector Frames	4	2*
Marker Connectors	10	5
Trouble Recorder Frame	1	1
Incoming Sender and Register Test Frame	2	1

\* Recommended equipment limitation for single train office.

**Marker Connector and Supplementary Marker Connector Frame — Fig. 11**

**4.08** The marker connector frame has been designed in two sizes, one 2-bay frame for offices requiring both intertoll and toll completing trains, and a smaller single-bay frame for use as a basic or supplementary frame. The basic or smaller frame is furnished for combined train offices requiring only one group of markers at the time of installation. This same basic frame is furnished as a supplementary frame when an office is expanded to the separate train office size requiring the second group of markers. The equipment arrangement of the basic or supplementary frame is identical to that of the right bay of the larger frame shown in Fig 11.

**4.09** The function of the marker connectors and their associated supplementary marker connectors is to provide facilities for closing through the pulsing and control leads of an associated decoder channel to the marker selected for routing the call.

**4.10** The capacities of the marker connector frames are as follows:

**Marker Connector Frame for Use in Separate Train Offices**

Connectors per Frame	3
Decoder Channels per Connector	1

Decoder Channels per Frame	3
Markers Intertoll Train	10
Toll Completing Train	10
Marker Total	20

**Marker Connector or Supplementary Marker Connector Frame for Use in Combined Train Offices**

Connectors per Frame	3
Decoder Channels per Connector	1
Decoder Channels per Frame	3
Marker Total	10

**Decoder Connector Frame — Fig 12, Supplementary Decoder Connector Frame — Fig. 13**

**4.11** One basic decoder connector frame is available for initially engineered separate train offices or for initially engineered combined train offices.

**4.12** One supplementary decoder connector for each two basic decoder connector frames is required to provide connections for the full 2-train complement of 20 markers, or for expansion of combined train office to separate train operation.

**4.13** The function of the decoder connectors and their associated supplementary decoder connectors is to provide facilities for closing through the pulsing and control leads of the assigned overseas, MF, DP or CAMA incoming senders to any decoder channel, or marker in the office. MF and DP senders are connected to the decoder channels through a common decoder connector multiple. However, connectors serving CAMA and overseas senders cannot be connected to this multiple and must be mounted on separate frames with their own decoder channel multiple.

**4.14** The capacity of the decoder connector frame and the supplementary decoder connector frame is as follows.

**Decoder Connector Frame for Use in Separate Train Offices — Fig. 12**

Connectors per Frame	4	
Senders per Connector	9	
Senders per Frame	36*	
Decoder Channels	10	
Markers		
Intertoll or Combined Total	10	10

\* Incoming senders are assigned to decoder connector frames in accordance to type. CAMA, overseas, and non-CAMA senders cannot be assigned in the same decoder connector frame or in the same decoder channel multiple.

**Supplementary Decoder Connector Frame for Use in Separate Train or Combined Train Offices Expanded to Separate Train Combined Operation — Fig. 13**

Connectors per Frame	8
Toll Completing Markers Total	10

**Link Controller and Connector Frame — Fig. 14**

**4.15** The link controller and connector frame mounts two controllers, two connectors (each of the latter having access to a maximum of four controllers which are assigned to link frames on a pattern basis), and the cut-in test relays of the controller test circuit, which is part of the trouble recorder testing features. The cut-in test relays are required only on the link controller frames mounting the first controller of each link controller group.

**4.16** The function of the link controller and connectors, as covered in paragraph 4.26, is to establish a connection between the various type trunks through their associated sender link frames to their associated type senders. Each link frame has a choice of one of two controller connectors which in turn have access to the same group of four controllers, providing in effect, a duplicate channel to any controller in the particular group. Since each link frame has access to two connectors and odd and even connectors are fused separately, each pair of connectors must consist of an odd and even controller so that the failure of a main distributing fuse will not put both connectors out of service.

**Incoming MF Sender Frame — Fig. 15**

**4.17** The incoming sender frame mounts three or less incoming multifrequency sender units, each of which includes its own multifrequency receiver.

**4.18** The multifrequency senders are arranged for a maximum of 11 digits to record, through incoming dial and multifrequency trunks, the called code and numerical digits (station digit when required) necessary to complete connections through the No. 4A switching system and to control the selections beyond the No. 4A office over toll completing, tributary, and intertoll trunks.

**Incoming DP Sender Frame — Fig. 16**

**4.19** The incoming sender frame mounts three or less incoming dial pulse sender units. The DP sender is arranged for a maximum of 11 digits to record, through incoming dial trunks, the called code and numerical digits (station digit when required) necessary to complete connections through the switching system and to control the selection beyond the No. 4A office over toll completing, tributary, and intertoll trunks.

**4.20** Offices serving incoming DP traffic have the choice of either buying DP senders or MF senders and incoming registers (see paragraph 4.31). The choice depends on the amount of incoming DP trunks to be served. Each office must make an individual study before making a decision. In cases where the dial pulse senders are to exceed one sender group by a small amount the excess senders may be handled by the addition of incoming registers.

**Overseas Sender Frame — Fig. 17**

**4.21** The overseas sender frame mounts three or less overseas sender units, each of which includes its associated multifrequency receiver. The overseas sender is arranged to receive a maximum of 14 digits and to accept or transmit one language digit in all gateway operation calls.

**4.22** The overseas sender is provided to handle traffic over circuits derived by Time Assignment Speech Interpolation (TASI) in a No. 4A or 4M toll switching office. It is used in gateway offices to pulse to and receive pulsing from an overseas location using TASI channels. The sender receives the called number as MF pulses from a switchboard set (gateway operators) over an incoming tandem trunk, from an outgoing MF sender in a distant office over a 2-

way overseas intertoll trunk or from a regular incoming sender over a loop-around trunk in nongateway operator offices.

**Outgoing Sender Frame — Fig. 18**

**4.23** The outgoing sender frame mounts three or less revertive and PCI outgoing sender units.

**4.24** The outgoing senders are required to complete calls from No. 4A toll offices to panel offices, crossbar offices not arranged to receive multi-frequency pulsing, and manual offices arranged for panel call indicator.

**Incoming or Outgoing Sender Link Frame — Fig. 19 and CAMA or Overseas Sender Link Frame — Fig. 20**

**4.25** The incoming or outgoing, CAMA and overseas sender link frames are arranged to provide 40 primary-secondary links which have access to a maximum of 100 trunks of a type (DP, MF, OUT, CAMA or OVS) on the horizontals of the primary switches and to a maximum of 40 senders of a type (MF, DP, OUT, CAMA, or OVS) on the horizontals of the secondary switches.

**4.26** The primary function of all types of sender link frames is to provide a connection or link between a trunk (of a type) to a sender (of a type). The connections between trunks and senders, through the sender link frames, are set up by means of controllers which are provided in groups of four or less, common to a maximum of 18 sender link frames (associated with same 40 sender) per group. The controllers are reached by the sender link frames through controller connectors. The necessary connector relays for obtaining access to controller connectors are located on the sender link frames. The controller connectors and controllers are located on link controller frames.

**4.27** One hundred or less trunks (of a type) are assigned to the sender link frame while 40 or less senders (of a type) are assigned to the sender link frame group on a key frame arrangement. The key frames are the first four sender link frames of the group, and are interconnected with a slip multiple which is arranged so that the 40 senders appear on all link frames. When there are less than 40 senders per link group, all unequipped horizontals are multiplied to equipped horizontals at frame 0 by means of a "fill" cable. Thus, the trunks on all frames have access to the same senders. The key frames should be located

in consecutive order in one line-up in order to permit the use of a shop formed local cable for the slip multiple. All other sender link frames are nonkey frames and have a straight multiple of their respective key frames, that is, frames 4, 8, 12, and 16 have the same senders on the same horizontals as frame 0; frames 5, 9, 13, and 17 as frame 1; frames 6, 10, and 14 as frame 2; and frames 7, 11, and 15 as frame 3. The first key frame of the group contains a sender traffic control circuit whose function is to energize a short timer in each sender, which cuts down the awaiting sender ahead timeout interval in the senders assigned to a link frame group, when they are all busy. A minimum of two sender link frames is required.

**Sender Attachment Delay Equipment**

**4.28** The sender attachment delay equipment provides means for placing test calls through the sender link frames to record, on a sender group basis, the number of test calls placed and the number which encounter delays in sender attachment greater than 3 seconds. It also provides alarms for a maximum of four SADR groups to indicate when the number of each SADR group associated SADR frame is in trouble.

**4.29** The sender attachment delay equipment, which mounts on a miscellaneous relay rack, is connected to a selected trunk level of the sender link frames in place of a service trunk and is arranged to operate with the following maximum quantities of equipment.

Sender Link Frames	200
Peg Count and Delay Register Groups	32
Trouble Alarms	4

**Multifrequency Current Supply Frame — Fig. 21**

**4.30** This frame mounts the 6-frequency oscillator unit, used for outpulsing by the incoming senders and the switchboard operators, and the associated alarm, transfer, and distributing equipment. Two oscillator units are furnished per bay, one for even-numbered switchboard positions and sender frames, and the other for odd-numbered positions and sender frames. A minimum of two supply frames (one pair) are furnished per office and the sender frame load is divided as equally as possible between them. Monitoring and transfer arrangements are provided to permit one oscillator unit to carry the entire signaling load of its frame in the event that the

output voltage of any oscillator in either of the two units varies beyond established limits.

#### CAMA and Non-CAMA Incoming Register and Link Frame — Fig. 22

**4.31** The incoming register and link frame is composed of three bays. The basic frame consists of two bays which provide termination for a maximum of 140 dial pulse trunks and ten incoming registers while the third bay or supplementary incoming register frame, terminates ten additional incoming registers and is furnished, as required, in accordance with traffic requirements.

**4.32** The function of the incoming register and link frame is to connect CAMA or non-CAMA trunks to dial pulse registers. The incoming register link is of the fast bylink type and attaches a register to the CAMA incoming trunk with sufficient speed to assure that the first digit of the called number dialed by the subscriber is received by a register. Because of the high speed of this connection, the need for a second dial tone is eliminated. The incoming register unit is arranged to receive exactly seven or ten digits for CAMA traffic and three to eleven digits for non-CAMA traffic. The register receives and stores all the digits dialed and it requests a sender after the last digit is dialed. After a sender is attached the register outputs the stored dial pulse digits (on MF basis) through the DP trunk to the sender.

#### Trunk Frames

**4.33** The trunk frames are equipped with the trunk units of the high runner intertoll, tandem, toll switching, TX or LW, and CAMA trunk circuits. The trunk frames, with the exception of CAMA trunk frame, are equipped with modular fuse panels and each trunk frame provides the following trunk capacity.

TRUNK	CKTS PER UNIT	CKTS PER FR
CAMA DP Inc TDM	1	15
CAMA MF Inc TDM	1	15
2-way Intertoll	3	60
Inc Intertoll	4	80
Out. Intertoll	4	80
4-wire Inc TDM	3	60
2-wire Inc TDM (with amplifiers)	1	20

TRUNK	CKTS PER UNIT	CKTS PER FR
(without amplifiers)	1	30
2-wire Toll SW	1	60
Toll SW to Toll Int Sel	2	40
4-wire Toll SW, TX or LW	3	45
4-wire Toll SW	1	160

#### Relay Rack Equipment

**4.34** The trunk relay rack mounts the equipment units for low runner 2-way overseas intertoll, incoming and outgoing toll connecting, switching and service trunks that are not listed under the trunk frame units. The equipment units for the miscellaneous trunks, such as, reorder, delay quotation, monitoring, announcement, interposition, service test lines, etc, are also mounted on the trunk relay racks.

**4.35** The TX or LW and service trunks are reached by dialing or keypulsing the following codes:

TX OR LW OR SERVICE CODE	TYPE OF TRUNK
11XY* or 11XYY*	TX or LW
100	Balance and Noise Test Line
101	No. 17C or 17D Testboard
102	IT or C Train Milliwatt Supply or TC Train MW Supply in a 2-train office
103	Circuit Operation Test Line
104, 105	Transmission Measuring Test Line
108	Echo Suppressor
121	Inward Operator
131	Information
141	Route Desk
161	Trunk Trouble Reporting
181	Toll Station Operator
191	CLR Transfer
958 } 959 } 970 }	Plant Test Lines

\* X is any digit except 0, and Y is any digit.

**4.36** The following TX or LW codes have been assigned permanently to trunks other than the regular TX or LW trunks:

TX OR LW CODES	TYPE OF TRUNK
1150 or 11501	Universal TX or LW Operator
1151 or 11511	Conference Operator
1152 or 11521	Mobile or Marine Operator
1153 or 11531	Charge Operator
1154 or 11541	Long Distance Toll Terminal Operator

**4.37** The fuse panels for the battery supplies to these trunk circuits, as well as the switching frame supplies not fused on the frames themselves, are mounted on relay rack structures located at the ends of alternate relay rack line-ups or centrally located in the switching area.

**Block Relay frame — Fig. 23**

**4.38** The block relay frame mounts the block relays through which the marker reaches the test terminals of outgoing trunks. These relays together with marker connector relays make up a trunk block connector which is a dual access arrangement by which the marker can reach the trunk block and perform the tests. Each connector consists of an odd and even-half connector which have identical sets of marker connector relays, multiplied on the marker side, and trunk block relays, multiplied on the trunk side. Calls from the first, third, etc, senders of a type cause the marker to prefer the odd-half connector, and calls from second, fourth, etc, senders cause preference of the even-half connectors to provide equitable load distribution. If either half-connector is in trouble, all calls will be directed to the other half. Trunks are tested in groups of 40 maximum at a time.

**4.39** The capacity of the block relay frame is as follows:

Marker	10
Trunk Block Connectors	3
Trunks per Block Connector	400
Frames per Marker Group	10

**Traffic Register Rack**

**4.40** The traffic register rack, in conjunction with the traffic register relay rack and traffic register distributing frame, provides facilities for obtain-

ing CBA, group busy, peg count, delay, partial digit, traffic usage, position disconnect and answering time registration, and miscellaneous data on the various circuits in the office. The traffic register rack bays mount message registers and counters arranged for photographing, instantaneous recording and total load meters, and miscellaneous control keys and patching jacks. The register relay racks mount the associated register relays. The traffic register distributing frame provides flexibility between the register relays and the registers. When terminal room location of the traffic registers and counters is desired, they may be mounted in single-sided sheetmetal traffic register cabinets.

**Traffic Usage Interface and Supplementary Traffic Usage Interface Frames — Fig. 24 and 25**

**4.41** The traffic usage interface frames provide equipment to interface between the electromechanical circuits and the peripheral bus computer (PBC) to provide traffic and maintenance usage measurements. Traffic usage data terminations are provided for common control circuit usage, incoming and outgoing trunk circuit usage, and incoming and outgoing link frame usage. The traffic usage frame provides circuits for trouble detection and trouble recording. The traffic usage interface frame has a capacity for the following usage terminations:

Common Control Circuit Outputs	2303
Incoming Trunk Circuits	2304
Incoming Link Frames	80
Outgoing Link Frames	80
Outgoing Trunks via the Trunk Block Connector Frame	24,000

**4.42** The supplementary traffic usage interface frame has a capacity for 4608 usage terminations for incoming trunks.

**Traffic Control Frame — Fig. 26**

**4.43** The traffic control feature is used to cancel Follow with Second Trail — All Trunks Busy (FST-ATB), and short sender timing. The traffic control frame is used for the two reasons above and for canceling alternate routing, route skipping, and directional group busy control. All of the controls for the circuit features are located on a traffic control console, in a local or remote location. The load recorders are not remotod.

**Network Control Frame — Fig. 27**

**4.44** Network control provides manual traffic control functions in an ETS equipped office such as route cancellation, route skipping code blocking, and preprogrammed reroutes. The equipment units are the network control console which houses the control keys and lamps to invoke the various controls and the network control frame which mounts the associated relay equipment. These controls may be remotod to a distant location.

**Circuit Busy Announcement Trunk Frame — Fig. 28**

**4.45** The circuit-busy announcement trunk frame mounts several types of one- or two-plate units consisting of group-busy relays, chain relays, and two-CBA trunk units.

**4.46** The functions of the circuit-busy announcement trunk frame are as follows:

- (a) Provides indications directly to the decoders or ETS peripheral scanners as to the lowest-numbered subgroups in which there are idle trunks.
- (b) Provides means for informing the originating operator when all intertoll trunks of a group are busy either by tone or by announcement when so patched.
- (c) Provides idle indications to toll operators in the same building for all outgoing intertoll trunk groups and groups to crossbar tandem.
- (d) Provides trunk group-busy and patched condition indications at the traffic supervisory rack.

**4.47** The capacity of the circuit busy announcement trunk frame is limited by frame space and the number of fuses available on the frame fuse panel. Any combination of CBA and GB units may be provided within these limitations. A minimum of two frames must be provided per office.

**Announcement Frame—No. 5A Announcement System—Fig. 29**

**4.48** The announcement frame mounts two No. 5A Announcement Systems. Each system provides an announcement trunk, six amplifiers and a recorder-producer. The function of the equipment in this frame is to provide recorded announcement by means of magnetic tape recordings. The six channels

provided are arranged to give announcements automatically to a maximum of 100 calls, per channel, at a time. The output ends of each announcement trunk, associated with each amplifier, connect to several jacks at the traffic supervisory rack where each channel may be patched to groups of announcement connecting trunks for providing announcements. Recordings may be made on any channel of the system from a 619B telephone set which is provided for this purpose. Previous announcements may be erased, announcements may also be checked and calls directed to the announcement trunk group can be monitored from the 619B telephone set.

**Office Interrupter Frame**

**4.49** This frame is arranged to mount reciprocating bar-type interrupters which function to supply interrupted battery or ground to the various circuits in the toll switching office. Each frame has a capacity of 24 interrupters, and a minimum of two frames is provided for each office so as to divide the load approximately evenly and minimize service reaction in event of the temporary failure of the motor or drive mechanism of a frame.

**Trouble Tracing Selector Frame—Fig. 30**

**4.50** This frame provides a means for tracing trouble on a connection set up in the switching equipment between an incoming tandem trunk and an outgoing intertoll trunk. When trouble is reported on such a connection, only the identity of the incoming trunk is known to the testboard operator. The trouble tracing equipment provides step-by-step switch facilities through which he can dial and be connected to the reported incoming tandem trunk. Once this connection from the testboard is established, testing potential is applied over it to the outgoing intertoll trunk and the resulting operation of a lockout relay in the trunk lights an associated lamp in the testboard. The trouble tracing selector frame has a capacity for mounting two or three first selector units, each arranged for three first selectors, and three or four second selectors, each arranged for two second selectors. One first selector is required per testboard position and one second selector for each 300 tandem trunks so that a completely equipped frame serves nine testboard positions and 1800 trunks, or six testboard positions and 2400 trunks. Additional second selector units may be furnished and mounted on adjacent relay rack bays to provide for a maximum of 17 second selectors and 5000 trunks.

**Outgoing Trunk Identification Frame and Supplementary Outgoing Trunk Identification Frame—Fig. 31 and Fig. 32**

4.51 The outgoing trunk identification frame and supplementary frames provide facilities to identify an outgoing trunk held by a sender routing to reorder or being held for trouble. The outgoing trunks are cabled and assigned to the identification frame equipment in consecutive order as determined by floor plan considerations regardless of type or train appearance. A signal originated at the sender and received via the outgoing trunk at the identification frame is translated into a form to punch a trouble record card at the trouble recorder frame.

4.52 The capacity of the outgoing trunk identification frame is as follows:

	OUTGOING OR TWO-WAY TRUNK EQUIPMENT
Identification Frame	3600
Supplementary Frame (0-3)	5400*
Trunk Termination Unit	600*

\* Units 3, 4, and 5 on supplementary frame 1 and units 6, 7, and 8 on supplementary frame 3 are equipped for 400 trunks only, thus reducing the usable trunk capacity of these frames to 4800.

**Floor Alarm Frame**

4.53 The floor alarm frame provides mounting facilities for the alarm equipment for a variable number of frames, aisles, and main aisle of toll crossbar equipment distributed over a maximum of three floors. This equipment furnishes simultaneous audible and visual signals directing the maintenance force to the particular frame or fuse bay in trouble. The visual signals indicate the general nature and location of the trouble by the use of differently colored lamps. The audible signals, by means of distinctive tones, differentiate between major and minor circuit alarms, alarm system battery supply failure, service alarms, and power failures. Provision is also made for transferring the switchroom alarms from one switchroom to another or to the operating room when required by the distribution of the maintenance forces.

**Decoder Channel Frame—Fig. 33**

4.54 The decoder channel provides sender access to the ETS, which performs route translation for the 4A machine. The peripheral scanner reads the code digits registered in the sender via a decoder channel and presents this information via communications bus to the processor in the SPC. This information is translated into routing information from data in the program store, which is transmitted to the decoder channel and its associated marker connector from the processor via communication busses, peripheral function translator, and a distributor register dedicated to the decoder channel. After the decoder channel selects an idle marker in the proper train and the marker has registered the routing information, the decoder channel signals the SPC to reset the distributor register and releases.

4.55 A minimum of three and a maximum of ten decoder channels are required. The five even channels mount on the decoder channel frame 0 and the five odd channels on the decoder channel frame 1.

**First Auxiliary Decoder Connector Frame—Fig. 82**

**Auxiliary Decoder Connector Frame—Fig. 83**

4.56 One or more auxiliary decoder connector frames must be provided in addition to existing decoder connectors to terminate leads added by CCIS for increased address digit capacity. Each auxiliary decoder connector frame may serve a mixture of sender and outputer connectors. However, pure senders and pure outputers may not be mixed in the same connector.

4.57 The first auxiliary decoder connector frame (J67449AM-1) is equipped with 20 connectors. One auxiliary decoder connector is required for each regular decoder connector. Therefore, this auxiliary decoder connector frame will serve the first 20 decoder connectors in an office. This provides the capacity for 180 senders or 120 outputers, maximum.

4.58 Any additional auxiliary decoder connectors are provided on frame J67449AH-1. This frame is equipped with 24 connectors and has a capacity for 216 senders or 144 outputers, maximum. Auxiliary decoder connectors should be equipped with the same number of sender connector relays as the maximum possible on the regular decoder connector frame. This would be five per connector for three-connector DC frames.

**Outputpulser Link Frame—Fig. 84**

**4.59** This link frame connects an incoming call arriving over a CCIS trunk to one of 48 outputpulsers. It is a 2-bay 11 feet 6 inches high, 5 feet 4 inches wide frame utilizing small 12-level crossbar switches and terminating 360 trunks in three separate switch units of 120 trunks each. Each switch unit has access to all outputpulsers within the group. A maximum of 11 outputpulser link frames (3960 trunks) may be associated with 48 outputpulsers.

**Outputpulser Link Controller Frame—Fig. 85**

**4.60** The outputpulser link controller establishes the connection between the CCIS trunk and outputpulser and reports the trunk and outputpulser identities to the ETS processor. The link controller will also connect a continuity check transceiver to the outputpulser per DAS distribute instructions from the processor for incoming trunks from 2-wire switching offices. Three outputpulser link controller groups may be furnished, however, the total number of sender link and outputpulser link controller groups may not exceed 13. The outputpulser link controllers use the same peripheral scanner bid and information ferroids as do the sender link controllers. Therefore, each outputpulser link group displaces a sender link group. However, if all 12 sender link controller groups are provided, one outputpulser group may be added using the DAS for information scan inputs and the peripheral scanner for the bid scan input. One frame, equipped with four link controllers, is always provided for *each* outputpulser group on a single 11-foot 6-inches high, 2-foot 8-inches wide bay.

**Outputpulser Frame**

**4.61** The outputpulser is connected on every CCIS incoming call to enable the marker to establish the cross-office connection, to provide transceiver access to perform a continuity check of the CCIS trunk transmission facility, and to outputpulse the address digits to the next office if a conventional outgoing trunk is selected. Digits to be outputpulsed are loaded by the processor via DAS distribute points associated with the decoder channel serving the call. Two dedicated DAS distribute points and a scan point permit the processor to condition the outputpulser at seizure and to control the completion of outputpulsing, release and reattempts. The outputpulser is a modified MF sender without the MF receiver.

**Transceiver and Connector Frame—Fig. 86**

**4.62** The transceiver is used to make a per call check of the trunk transmission facility. The transceiver is connected to the incoming sender or outputpulser through a single-stage relay connector for calls selecting an outgoing CCIS trunk and for incoming CCIS calls from 2-wire offices. These connections are directed by the processor via the marker for outgoing trunks and via the link controller for incoming 2-wire trunks. The transceiver is conditioned for 2-wire (transmit 1780 Hz) or 4-wire (transmit 2010 Hz) operation and for the proper test level by the processor via DAS distribute points. Check results are reported via DAS scan points.

**4.63** Transceivers are furnished in groups of four with a maximum of ten groups permitted, while transceiver connectors are provided for a maximum of 510 senders and outputpulsers. While the full complement of transceiver connectors are always furnished, the number of senders and outputpulsers accessing each transceiver group is a function of the volume of CCIS traffic through the office.

**CCIS Trunk Frame**

**4.64** The CCIS trunk (J61561 BF1) is a plug-in unit using miniature components mounted on a printed circuit board. A single DAS distribute point allows ETS processor control of incoming seizure and cross-office supervision to connected conventional trunks, while a single DAS scan point informs the ETS processor of outgoing seizure by the marker and cross-office supervision from connected conventional trunks. Plug-in units are available for the following configurations: combined incoming and 2-way from 4-wire offices; combined incoming and 2-way from 2-wire offices; and outgoing. Each version is available with or without switchable A pads. External hybrid coils are required if a 2-wire transmission facility is used. A test access connector is provided on every third trunk frame to permit patching trunks to an office belt line for manual transmission testing from trunk test positions and test frames.

**Outputpulser Link Controller Test Frame—Fig. 87**

**4.65** This ETS processor-controlled test frame performs scheduled operational tests of the controllers, as well as manually requested tests for trouble clearance. Processor control is achieved by means of the DAS distribute and scan points. Scheduled test results will be printed on the switching maintenance center channel 10 teletypewriter, while manual

test requests and their results are communicated via a maintenance teletypewriter shared with the CIOT.

**4.66** It is also possible to obtain outputs from the ETS channel 0. A lamp display is also provided at the test frame for detailed trouble analysis. A single frame mounts this equipment, and must be located in the CCIS trunk and outpulser link frame complex.

#### **CCIS Intraoffice Trunk Test Frame—Fig. 88**

**4.67** The CCIS intraoffice trunk test frame (CIOT) provides automatic testing, within the No. 4A office, of all features of the CCIS trunk circuit including cabling, cross-connections, associated sender or outpulser link termination, and distribute and scan (DAS) points. The test connections are processor controlled and are performed on an automatic routine basis during light traffic hours via software schedule, and on demand when requested from the maintenance TTY facility. Test results are recorded on TTY messages. In addition, test progress may be observed on lamp displays at the test frame. Demand manual tone and transmission tests may also be performed using test lines associated with the test frame.

#### **7-Foot High Electronic Frames**

##### **Peripheral Scanner Frame—Fig. 34**

**4.68** The Peripheral Scanner (PSC) frame is used to scan points in the electromechanical control equipment and peripheral electronic equipment in order to provide the processor in the SPC portion of the ETS with information for translation and maintenance. The scanning is performed through a current sensing device called a ferrod sensor.

**4.69** Each PSC frame is equipped with 640, 1G ferrod sensors. Each ferrod sensor consists of two ferrods for a total of 1280 scan points. There are a maximum of four scanners per ETS and a minimum of two except in regional offices which require a minimum of three.

##### **Distributor Register Frame—Fig. 35**

**4.70** The Distributor Register (DREG) frame is required with the ETS as a buffer for transmitting up to 120 bits of information from the SPC to electromechanical control equipment such as decoder channels, trouble recorder and network control.

**4.71** DREG frames 0 and 1 are each equipped with a Central Pulse Distributor Applique (CPDA) unit containing a maximum of four CPDA circuits each. The CPDA is used for fast single point distribution from the SPC to the link controllers. The unit on frame 0 serves the 24 even-link controllers and the unit on frame 1 serves the 24 odd-link controllers.

**4.72** There are three DREG units per frame with a minimum of two frames and a maximum of two required.

##### **Power Distributing Frame—Fig. 37**

**4.73** The Power Distribution (PD) frame provides the distribution points for +24 volts and -48 volts from the power plant to the various frames comprising the electronic portion of the ETS.

**4.74** Two PD frames are required per ETS. Each frame has the current carrying capacity for 400 amps of +24 volts and 400 amps of -48 volt.

##### **Peripheral Function Translator Unit**

**4.75** The Peripheral Function Translator (PFT) unit is required with the ETS and acts as an interface between the SPC and peripheral units. The PFT receives binary information from the processors, checks for parity, registers it for timing reasons, and passes translated address information to PSC, and untranslated binary information to DREG.

**4.76** The PFT is arranged to mount at the top of the SPC central pulse distributor frame with PFT0 located on CPD00-0 and PFT1 or CPD00-1.

##### **Processor Frame—Fig. 38**

**4.77** The Processor (P) frame is the primary data processing portion of the SPC. The P under direction of the program stored in the memory, obtains information from the ETS peripheral units, performs logical and arithmetical operations, and causes basic actions to be carried out in all parts of the system during call processing and when detecting and correcting system troubles. The P frame is always provided in pairs for system reliability.

##### **Teletypewriter Buffer Frame—Fig. 40**

**4.78** The Teletypewriter Buffer (TTYB) frame provides a communications link between the ETS and operating company traffic personnel via teletype-

writer. Information is exchanged between the SPC and the buffer in parallel form and between the TTY sets and the buffer in serial form at a maximum rate of 100 words per minute. Two of the ETS teletypewriters are associated with this frame. These are the traffic administration TTY which is channel 2, and the traffic data TTY which is channel 3. Channel 2 set shall be located in the network managers quarters and channel 3 set shall be located in the dial administration area.

**4.79** The TTYB frame mounts four TTYB units, two data set units and a communications bus unit plus two control panels. The buffer units are furnished per job requirements and data sets are provided when the associated TTY are in another building or are over 3000 loop feet from the buffer frame.

#### Master Scanner Frame—Fig. 41

**4.80** The Master Scanner (MS) frame is used for administrative and diagnostic scanning of all other frames in the SPC. The frame contains 1024 scan points by means of the 1E ferrod. The condition of the ferrod at the time of interrogation by the processor is used to determine existing system conditions. In addition to the ferrods there is duplicated control circuits for reliability.

#### Signal Distributor Frame—Fig. 42

**4.81** The Signal Distributor (SD) frame provides +24 or -48 volt signals necessary to light lamps and operate or release relays in the processor and SPC peripheral frames. Duplicated control equipment on the frame is used to select and operate a magnetic latching relay located on the frame. This relay in turn provides loop closure which enables the signal path to be completed to preselected frames. The SD frame has a capacity of 256 SD points.

#### Central Pulse Distributor Frame—Fig. 43

**4.82** The Central Pulse Distributor (CPD) frame contains circuitry which, on instruction from the processor, transmits pulse signals for high speed control actions. The main function of the CPD is to send pulses that activate SPC and ETS peripheral units (PSCs, SDs, TTYs, etc) by operating fast, solid state devices which may in turn operate relays. This frame is furnished in pairs for reliability.

#### Store Frame—Fig. 44

**4.83** The Store (S) frame contains four Piggyback Twistor (PBT) modules and support circuitry. The PBT is an electrically alterable store device whose contents can be changed by overwriting. The S frames provide the complete memory system for the SPC. Information stored in the PBT consists of the generic program, diagnostic and maintenance programs, data pertaining to the ETS such as route and translation data. The PBT stores have been divided into two storage areas, protected and unprotected. The protected area is that in which actual SPC program and semipermanent data are stored. The protection consists of certain "locks" which must be opened before the master program can be altered. This provides a safety feature necessary in order to avoid accidental machine or man-made changes in the master program. The unprotected area of the store is that portion which is constantly being used or written into during the normal operation of the SPC.

**4.84** This frame is furnished in pairs for reliability. There is a minimum of five and a maximum of six pairs required in an ETS.

#### Peripheral Bus Computer Interface Cabinet—Fig. 45

**4.85** The peripheral bus computer (PBC) interface and control cabinet permits offices to accumulate and process all traffic and plant measurements and auxiliary recording (reorder, vacant code sender, retrieval feature, etc) data. The minicomputer (PDP-11/45) used in conjunction with PBC can administer data tables resident to both the ETS and peripheral computers. The PBC is used to accumulate and pattern ineffective attempts and sender retrials on a 24-hour basis and outputs the patterns automatically as a DATASPEED<sup>®</sup> 40 data terminal. The PBC is also used to collect plant measurements and traffic data.

#### Distributor and Scanner (DAS) Frame—Fig. 89

**4.86** The DAS is a 2-bay frame containing 2048 scan points, 2048 distribute points and duplicated controllers for processor communication via the ETS peripheral unit bus. The DAS permits the ETS processor to control the operation of CCIS trunks and switching system common control circuits, and to receive reports and/or service requests from these units. Scan points are scanned autonomously by the DAS and only transitions are reported to the processor. Transition reports may be inhibited by means of an ignore bit per individual scan point, so that rows of 16

scan points may be converted to nonautonomous reporting operation for certain common control inputs similar to the operation of the ETS peripheral ferro scanner. Each DAS frame indicates waiting autonomous scan reports via nonreporting rows in the first two DAS frames which are periodically scanned for activity by the ETS processor. Distribute points may be operated singly or in groups of four, eight, or sixteen by the processor. Scan inputs require a dry loop contact closure from the switching equipment, and distribute outputs furnish a single mercury relay loop contact.

**4.87** Two DAS frames, fully equipped with scan and distribute circuit packs, are initially required in each office to serve common control circuits and up to approximately 1700 CCIS trunks. Each additional 2000 CCIS trunks require another DAS frame. The quantity of trunks served by a DAS is directly reduced by the number of echo suppressor control points required. All DAS frames are fully wired, but circuit packs for scan and distribute points need only be furnished in groups of 512 points as required for other than the first two frames.

#### **IGFET Store Frame—Fig. 90**

**4.88** The Insulated Gate Field Effect Transistor (IGFET) store (J1C083A-1) is being designed as a replacement for the Piggy-Back Twistor (PBT) store currently furnished with the SPC-1A system. The IGFET store frame is a bay mounting up to six memory modules, each containing 32K 40-bit words and a controller for processor access. The store frames are duplicated for service reliability.

**4.89** CCIS switching offices initially require the addition of two IGFET frames, equipped with two memory modules each, for a total of 64K words of duplicated memory to support the basic software package and data for 3600 trunks. Each additional 7200 trunks requires another memory module. Thus, a single pair of IGFET store frames, each with three modules, should handle CCIS requirements in the largest office.

#### **CCIS Terminal Group Frame and CCIS Terminal Group Supplementary Frame—Fig. 91 and Fig. 92**

**4.90** This 4-bay complex contains the signaling terminal units and data modems for up to sixteen signaling links, as well as duplicated terminal access circuitry (TAC) for processor communication with each terminal unit via the ETS peripheral unit bus.

The terminal unit is a small, special purpose stored program processor which maintains data communication over the signaling link and provides buffering between itself and the ETS for received and to be transmitted data-filled signaling units. The ETS processor periodically polls the TAC to determine which terminal units, if any, contain waiting data-filled signal units. Synchronization, error detection, retransmission of signal units received in error, and acknowledgement of correctly received signal units are also handled by the terminal units independent of the ETS processor.

#### **Voice Frequency Access Frame—Fig. 93**

**4.91** The VFL access frame is a single bay frame. The VFL access frame will be used in CCIS STP offices. Due to low capacity requirements, 4A/ETS CCIS switching offices will never need a fully equipped VFL access frame A or E type VFLs connect CCIS switching office frame. A or E type VFLs connect CCIS switching office (SOs) with CCIS signal transfer point offices.

**4.92** The VFL access frame mounts up to eight VFL access units. Each VFL access unit services up to four A, B, C, D, E, or F voice frequency links. One VFL access unit is associated with up to four CCIS terminal units. The signaling link transmits or receives all supervisory and address signaling information to control call set up.

#### **7-Foot High Electronic Maintenance Center Frames**

##### **Alarm and Display Frame—Fig. 36**

**4.93** The Alarm and Display (AD) frame is required with the ETS to give status indications for the DREGs and PFC, in addition to this, provisions are made for sounding the major and minor office alarms when a system detected alarm occurs.

##### **Control and Display, Program Tape and Teletypewriter Frame—Fig. 39**

**4.94** The Control and Display, Program Tape, and Teletypewriter (CD-PT-TTY) frame is the centralized point of manual control and communications with the SPC. The CD portion of this frame is used to control and display the status of the two processor frames and the full complement of stores in addition to all of the SPC peripheral frames. Keys are provided which are used to insert binary information into the system.

**4.95** The PT is used to initially load the stores with the program of the system. In addition, this equipment is used for insertion into memory of large amounts of application system data, updating of program, extensive changes in translation data, and, in general, all additions to the store which would be too time consuming to be put in via the teletypewriter (TTY). The program tape equipment also has the ability to write information on tape under direction of the processor.

**4.96** The TTY equipment is mainly used for maintenance purposes. Information, such as diagnostic test codes, may be fed directly into the system via this equipment and test results and system diagnostics may be printed out. In addition to the TTY machine mounted on this frame the circuitry on this frame provides for a second maintenance TTY machine to be located in the No. 4A maintenance center. The TTY machine located on this frame is designated channel 0 and the one located in the No. 4A maintenance center is designated channel 10.

#### AUTOMATIC MESSAGE ACCOUNTING FRAMES

##### Trunk Class Translator Frame—Fig. 46 and Supplementary Trunk Class Translator Frame—Fig. 47

**4.97** The trunk class translator and supplementary trunk class translator frames provide for a maximum of 12 transverters, to have access to a maximum of 1800 incoming CAMA trunks arranged for a maximum of 150 trunk class combinations. Two identically equipped trunk class translator frames are furnished per transverter group. These frames are arranged so that even-numbered transverters prefer one frame while the odd-numbered transverters prefer the other. The basic trunk class translator frame, Fig. 46, provides for a maximum of 100 trunk class relays and 1200 trunk resistors (one per trunk). A single supplementary trunk class translator frame, Fig. 47, when required, provides mounting space for an additional 50 trunk class relays and 600 trunk resistors for both basic trunk class translator frames.

**4.98** The function of the trunk class translator and supplementary trunk class translator frames is to provide additional class information to the transverters for processing calls through incoming CAMA trunks. This trunk class information, traffic separation, area of origin, rate class, and recorder number, is required by the transverter for traffic separation peg count registration and billing purposes.

##### Transverter Connector Frame—Fig. 48

**4.99** The transverter connector frame has a capacity of four connectors, each of which serves to connect any one of a maximum of five senders to any one of a maximum of twelve transverters in the same transverter group. The function of the transverter connector is to connect a CAMA sender to any idle transverter in the group, when the initial recording of a call is required. A minimum of two transverter connector frames are required per transverter group.

##### Transverter Frame—Fig. 49

**4.100** The transverter frame accommodates the equipment of one transverter circuit and is arranged to operate with a maximum of twenty recorders, thirty transverter connectors, three billing indexers, and two trunk class translators. A minimum of two and a maximum of twelve transverters are required per transverter group. Two transverter groups are required when there are more than 1800 CAMA trunks or more than 200 offices to be served.

**4.101** The major functions of the transverters are to register, translate, and convert information received from a CAMA sender, trunk class translator, and billing indexer to a form or pattern satisfactory for recording, and to transmit to the recorder in ordered sequence, information to be perforated on the tape as the initial entry. It also actuates the call identity indexer through the transverter connector, sender, sender link, and trunk to provide identification of the trunk on initial entry.

##### Trouble Recorder Connector Frame—Fig. 50

**4.102** The trouble recorder connector frame accommodates the equipment required to operate with the following maximum quantities of equipment for two transverter groups:

Position Link Frames	8
Transverters	24
AMA Recorders (Including Emergency)	42
Master Timers	2
Billing Indexers	6
Incoming Register Links	30
CAMA Senders	300

**4.103** The primary function of the equipment in the trouble recorder connector frame is to receive and establish a preference chain for requests for the toll office trouble recorder frame in order to control perforation of a trouble recorder trouble card from the transverter group equipment. These requests are received from transverter group equipment, such as position link controller, register link alarm, master timers, AMA recorders, and transverters.

**Billing Indexer Frame—Fig. 51 and Supplementary Billing Indexer Frame—Fig. 52, and Auxiliary Billing Indexer Frame—Fig. 53**

**4.104** The billing indexer consists of an originating frame and a supplementary frame which accommodates the equipment for one billing indexer circuit. The supplementary frame is provided when bulk billing information and/or misrouted non-CAMA call intercept for a terminating area other than the home area is required. A minimum of two and a maximum of three billing indexers may be provided. The capacities of these frames are as follows:

	BASIC FRAME	SUPL FRAME
Originating Codes	* 800	—
Terminating Areas	1	2
Originating Rate Treatments	33	17
Terminating Rate Treatments	58	17
Rate Classes	** 3	—

\* Included in the originating codes may be a maximum of ten conflicting codes in three originating numbering areas.

\*\* A maximum of 80 originating offices may have two or three rate classes.

**4.105** The function of the billing indexer, when called into operation by the transverter, is to furnish the billing index number which is perforated on the tape by the recorder or on magnetic tape when CAMA-C is provided as part of the initial entry and is used by the accounting center in establishing the charges for the call. It also furnishes to the transverter the office index, which denotes the office of the recorder group that originated the call and the type of billing entry, that is, Message Unit (MU), Message Unit Detail (MUD), or Toll Statement (TL)

to be perforated on the tape. The auxiliary frame is provided to accommodate equipment for three billing indexers which allows each one to increase capacity from 10 to either 20 or 30 office indices per recorder group.

**Call Identity Indexer Frame—Fig. 54**

**4.106** The call identity indexer frame is arranged for four indexer units with each unit providing a maximum of 100 trunks. The fuse panel shown at the top of the frame serves a maximum of six even-numbered and six odd-numbered indexer units and is provided as required. When floor plan arrangements are such that the call identity indexer frames can be located adjacent to the associated recorder frames, the fuse panels are omitted, battery and ground being supplied from the respective recorder frame fuse panels.

**4.107** The function of the call identity indexer, which is directly associated with the recorder and trunks, on the basis of a maximum of 100 trunks per recorder per call identity indexer unit, is to identify the trunk being used on a call and to activate the recorder to cause the trunk number to be perforated on the tape or entered on magnetic tape if CAMA-C is provided. These entries occur at the beginning of the call (initial entry), at the time of answer, and at the time of disconnect.

**Recorder Frame—Fig. 55**

**4.108** The recorder frame is arranged for four recorder units with each unit providing for a maximum of 100 trunks which are served by the associated call identity indexer frame.

**4.109** The function of the recorder, or the emergency recorder, one of which is furnished in each office as a substitute for any regular recorder of out service, is to receive the necessary items of information for billing from the call identity indexer. This information is then perforated on the AMA tape as the initial entry or entered on magnetic tape if CAMA-C is provided. Subsequent answers and disconnect time entries, as timed by the master timer, are recorded with the trunk number.

**Perforator Cabinet—Fig. 56**

**4.110** The perforator cabinet, a low sheetmetal cabinet, accommodates two perforators. The perforators are mounted in the upper part of the cabinet

under a hinge cover with a transparent plastic window. The paper supply bins and motor-driven take-up reels for storing the perforated tapes are located behind a hinged door in the space below. At 3 A.M. of each day, an end-of-tape pattern is placed on each tape under control of the master timing frame. This marks the tape for cutting and provides information necessary for identification and processing at the accounting center.

#### **CAMA-C System—Fig. 57**

**4.111** The CAMA-C system is an application of a commercially available minicomputer to replace the AMA paper tape perforators in CAMA installations. The required accounting data is recorded on magnetic tape. The system connects to existing AMA recorders and their associated trunks from which are obtained the initial, answer, and disconnect entries required for complete billing of a call. This system is provided on a one per transverter group basis serving up to 20 regular AMA recorders, one emergency recorder, and 1800 associated trunks.

#### **Master Timing Frame—Fig. 58**

**4.112** The master timing frame provides one master timing circuit capable of serving the recorders associated with one group of transverters and the trouble recorder frame. The master timer circuit includes an odd and even timing circuit and a recorder test circuit.

**4.113** The primary function of the master timer is to provide time pulses every 6 seconds to all recorders of a transverter group. The recorders and associated perforators record the time in minutes and tenths of a minute on the tape. At the start of each hour, the master timing frame supplies the recorders with the hour information for each entry on the tape and at 3 A.M. an end-of-tape pattern is placed on each recorder tape. The master timing frame also tests certain features of the recorders including a check of the operation of recorder perforator magnets, recorder number leads, and the operation of recorder relays not checked in service. It also supplies day, hour, and minute timing to the trouble recorder frame for entry on trouble recorder cards.

#### **Position Link Frame—Fig. 59**

**4.114** The position link frame is equipped with 80 primary-secondary links which provide a maximum of 40 CAMA senders access to a total of 100

CAMA switchboard positions, outgoing trunks to CAMA positions, and position circuits to toll or DSA switchboards. A minimum of two position link frames are required.

**4.115** The function of the position link is to connect a CAMA sender to an idle local CAMA switchboard position through a multifrequency CAMA position via an outgoing trunk. At the switchboard, the operator obtains the calling number from the subscriber and multifrequency pulses it into the sender where it forms part of the AMA initial entry of the call. On calls from a local office equipped with Automatic Number Identification (ANI) the operator is not contacted except in case of an ANI failure or a call from a 4-party subscriber, which the ANI is not arranged to identify.

#### **Pretranslator Frame—Fig. 60**

**4.116** The pretranslator frame mounts the equipment units of the pretranslator circuit whose primary function is to reduce register holding time. The pretranslator receives and checks the A, B, and C digits of CAMA dial pulse traffic using a dial pulse register and informs the register if the digits represent an area code, nonarea code, or a conflict (a code which can be either an area code or a nonarea code). This information is used by the register to help determine how many digits it can expect to receive.

**4.117** A minimum of two pretranslator frames are required for dial pulse traffic in all CAMA offices when the area code is not dialed on all calls. The maximum capacity of the pretranslator frame is 200 incoming registers.

#### **CAMA Sender Frame—Fig. 61**

**4.118** The CAMA sender frame mounts three or less CAMA sender units and a receiver supply unit for the multifrequency receivers which are a part of each sender unit.

**4.119** The CAMA sender, arranged to receive exactly seven or ten digits, is required to handle CAMA traffic over incoming CAMA trunks. The sender registers both the called number and calling number, then calls in a transverter, through a transverter connector, to give the transverter information for making the initial entry on the CAMA tape.

**11-Foot 6-Inch High Maintenance Center Frames**

**Trouble Recorder Frame—Fig. 62**

**4.120** The trouble recorder frame consists of two shipping units; the test frame, a 2-bay framework and the perforator frame, a single-bay framework. The test frame is equipped with local cables which include arms that are arranged to connect to the equipment in the perforator frame after the frames are erected. The relay equipment enclosed in the casings in the three bays, consist in general, of units of two to five mounting plates, as required, to perform the circuit functions listed in paragraph 4.121. The frame also provides "in-use" lamps, make-busy jacks, certain alarm lamps and keys, and the jacks used to put the emergency translator and the emergency AMA recorder in service in place of the regular translator and the regular AMA recorder.

**4.121** The primary functions of the equipment in the trouble recorder frame are as follows:

- Test or Trouble Card Perforation
- Decoder-Marker Testing
- Decoder Channel—Marker Testing
- Link Controller Testing

Translator Manual Operation Control to Provide a Means of Adding or Removing Translator Cards or Selector Units.

**4.122** The capacity of the trouble recorder frame provides for operation with the following maximum quantities of equipment:

Decoder Channels		10
Intertoll or Combined Markers		10
Toll Completing Markers		10
Link Controllers	(Maximum 4	
Controller Connectors	per Group)	48
Incoming Frames		80
Outgoing Frames		80
Trunk Block Relay Connectors		60
Sender Link Frames	(Maximum 18	216
	per Group)	

Decoder Connectors		55
Overseas Senders		80*
CAMA Senders		300*
Incoming MF Senders		480*
Alternate Route Traffic Control		1
Position Link Frames		8
Transverter Connectors		60
Transverters	(Maximum 12 per Group)	24
Billing Indexers		6
AMA Recorders	(Including Emergency)	42
Master Timers		2
Line Observing, Number Matching		2
Trunk Class Translators		4
Incoming Register Links		30

\* The total number of incoming, overseas, and CAMA senders is limited to 480.

**Incoming Sender and Register Test Frame—Fig. 63**

**4.123** The main function of the incoming sender and register test frame is the routine testing of incoming senders, overseas senders, and CAMA registers on an automatic basis. Testing of either senders or registers involves seizure of a sender or register, registration of codes in sender or register as selected at the test frame on either a multifrequency or dial pulse basis, and checks on the various operations of the sender or register. The sender and register test frame can also test the AMA position and transverter circuits. These tests are made by means of calls initiated by the sender test circuit through a sender. The selection of a particular transverter or position can be made from the test frame, and, they are tested individually without automatic progression.

**4.124** The incoming sender and register test frame is arranged for use in offices with or without CAMA, and is arranged to operate with the following maximum quantities of associated equipment:

Incoming MF Senders	480*
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CAMA Senders	300*	Link Controllers	48
Overseas Senders	120*	Outgoing Sender Link Frames	40
Incoming DP Senders	300	Reorder Announcement Trunks (ROA)	100
Incoming DP Registers	600	Final Reorder Announcement Trunks (FRA)	100
Transverters	24	Trunks, Tielines, or Local Station Lines	16
AMA Positions	100		

\* The total number of incoming, overseas, and CAMA senders is limited to 480. The number of CAMA senders in each TV group is limited to 150 by this frame. Two test frames may be furnished, when required.

#### Outgoing Sender Test Frame—Fig. 64

4.125 The outgoing sender test frame functions with the outgoing senders in a manner similar to that of the incoming sender and register test frame with incoming senders. The frame is arranged to test 90 revertive or PCI outgoing senders.

#### Sender Make-Busy Frame—Fig. 65 and Auxiliary Sender Make-Busy Frame—Fig. 66

4.126 The sender make-busy frame provides make-busy jacks, lamps, keys, registers, and miscellaneous circuits. The primary function of the sender make-busy frame is to provide a central location for the maintenance of senders and incoming registers.

4.127 The auxiliary sender make-busy frame, furnished only in offices requiring a second CAMA transverter group, accommodates the jacks, lamps, and registers required for the maintenance of the incoming registers associated with the second transverter group. The trouble registers for markers and decoder channels and CAMA trouble registers are located on this frame in offices with two transverter groups.

4.128 The capacities of the sender make-busy frame and the auxiliary sender make-busy frame are as follows:

#### Sender Make-Busy Frame—Fig. 65

Revertive and PCI Outgoing Senders	}	480
MF Senders		
OVS Senders		
CAMA Senders		
Incoming Registers		300

#### Auxiliary Sender Make-Busy Frame—Fig. 66

Incoming Registers	300
Decoder Channels	10
Intertoll or Combined Markers	10
Toll Completing Markers	10
Transverters	24
AMA Recorders	42
Master Timers	2
Position Link Frames	8

#### Automatic Outgoing Toll Connecting Trunk Operational and Transmission Test Frames—Fig. 67, 68 and Au- tomatic Outgoing Toll Connecting Trunk Test Connector Frame—Fig. 69

4.129 The Automatic Outgoing Toll Connecting Trunk Operational Test (AOOT) frame is used to make overall circuit tests of toll switching trunks to local offices, trunks to TX operators and miscellaneous trunks such as CBA, reorder, etc. Automatic tests are made on all trunks which have access to local central office test lines and, by means of a tone detector, on the other nonoperator type trunks. All trunks selected can be tested manually and certain trunks which are normally tested on a manual control basis are given a lead continuity test when automatic testing is in progress. A remote transfer feature is provided to transfer trunks to a remote position manual testing frame for making manual transmission tests.

4.130 The Automatic Outgoing Toll Connecting Trunk Transmission Test (AOTT) frame is used to make automatic transmission and noise measurement tests. Two-way transmission and noise tests are made on all trunks having access to code 104- or

105-type automatic far-end measuring equipment. One-way transmission tests are made on trunks having access only to code 102 milliwatt supply terminations. In addition, this frame has all the operational and manual transmission testing capabilities of the automatic outgoing toll connecting trunk operational test frame.

**4.131** The automatic outgoing toll connecting trunk test circuits for the operational and transmission test frames appear on the incoming link frame as incoming trunks and, by means of a test connector, directs the marker to establish a connection through the incoming and outgoing links to the trunks to be tested. The two test circuits used a common set of test connectors with a preference arrangement so that a connector is held by one test circuit only long enough to establish the link connections to the trunk. When this is accomplished, the connector switch is released for use by the other test circuit. The first test circuit then proceeds to pulse forward the proper test line code to reach the desired terminating line at the local office and make the indicated tests on the trunk.

**4.132** The capacity of the AOOT frames and their associated 20-trunk test connector frames is 20,000 trunks. Each connector frame (TCC) mounts five connector units each of which provides access to 200 trunks from both test frames. The AOTT and AOOT have provisions for accessing the same group of test connectors (maximum of 20,000 trunks).

**Manual Trunk Test Frame — Fig. 70**

**4.133** The manual test frame is primarily intended for use in testing outgoing toll completing trunks. It may be used for making tests on incoming trunks when a test call is originated at the distant office. The MTF is an adjunct to the automatic trunk test frame (AOTT and AOOT) since it permits detailed testing and analysis of trunks known to be faulty. Tests of outgoing trunks normally utilize the existing trunk test connector frames, provided as part of the automatic trunk test frames, for gaining access to the MS and SM leads for busy tests and identification of outgoing link frame location. Connection to the trunk under test is established via the regular office link frames and uses the existing common control equipment for establishing the connection. Two appearances on the incoming link frames are provided for the first MTF installed and one additional appearance is provided for each subsequent MTF

for a total of five access routes. All MTFs have access to all incoming link appearances. Selection of the particular trunk to be tested is made by setting switches on the MTF to the 5-digit number representing the location of the trunk on the trunk test connector frames. During the course of establishing a test connection to an outgoing trunk a complete test of its operational characteristics is made automatically with appropriate trouble and progress lamps provided in the event a trouble condition is encountered.

**Test and Make-Busy Jack Frame— Fig. 71**

**4.134** The TMB frame is a bulb-angle frame, 11 feet 6 inches high and 2 feet 0-5/8 inch wide. The equipment in this frame consists of two jack panels which accommodate the test and make-busy jacks of the outgoing or incoming trunks to be tested. Common jacks associated with the test circuits in the MTF are also provided on these jack panels and located so that they can readily be patched by means of cords to any one of the test and make-busy jack circuits. The test and make-busy jacks are always cabled to the distributing frame and then cross-connected to the associated outgoing trunks. The jacks are arranged in groups by type of trunk with numerical sequence numbering bottom up and designated with the office name at which they terminate. Groups may be intermixed on any particular frame but all jack circuits of a group are of the same type. The capacity of the test and make-busy jack frame is as follows:

FRAMES	INCOMING CAMA-MB	JACK CIRCUITS				
		1W-MB	2W	3W	4W	E&M
1	1000	—	—	—	—	—
1	—	1000	—	—	—	1000
1	—	2800	—	—	—	—
1	—	—	2000	—	—	—
1	—	—	1000*	1000	—	—
1	—	—	500**	500**	500	—
1	500	—	500	500	—	—
1	—	1400	500	500	—	—

\* This capacity may be increased beyond the nominal 1000 by a corresponding reduction in the number of 3-wire trunks.

\*\* This capacity, for either the 2- or 3-wire trunks, may be increased beyond the nominal 500 in multi-

ples of two by a reduction of one in the number of 4-wire trunks or both the 2- and 3-wire trunks may be increased beyond the nominal 500 by one in a reduction of one in the number of 4-wire trunks.

**Automatic Incoming Trunk Test Frame—Fig. 72 and Automatic Incoming Trunk Test Connector Frame—Fig. 73**

**4.135** The Automatic Incoming Trunk Test (AITT) frame together with its associated connector frame or frames (TCC), provides the means for testing CAMA incoming dial pulsing and multifrequency pulsing trunks arranged for automatic number identification of operator-identified CAMA. The tests are made through the CAMA equipment and regular switching train and are performed either by the selection of a particular trunk or on an automatic progression basis. As on other automatic test frames, lamps are provided to indicate the progress of the test and the failure of any particular trunk. Access to the trunks is obtained through crossbar switches of the associated test connector frames.

**4.136** The capacity of the test frame (Fig. 72) and test connector frame (Fig. 73) are as follows:

Automatic Incoming Trunk Test Frame	2000 Trunks*
Automatic Incoming Trunk Test Connector Frame	5 Connector Units
Automatic Incoming Trunk Test Connector Unit	200 Trunks (Associated with 2 Recorders)

\* Two test frames are required in offices having two transverter groups.

**Emergency Alarm Frame**

**4.137** The emergency alarm frame houses the equipment associated with the automatic fire detection feature of emergency alarm systems. The equipment functions with a Pry-Alarm® fire detection system. Detectors are located on the ceiling or on auxiliary framing to detect by-products of combustion which will sound the fire alarms.

**Operating Room Equipment**

**No. 3CL Switchboard**

**4.138** The No. 3CL switchboard is a cord-type switchboard located in the same building with the No. 4A switching equipment. It provides the necessary flexibility for access to and from intertoll and toll connecting trunks. The cord and trunk circuits are designed to establish connections on a 2-wire basis using hybrids to convert to 4-wire. The primary purpose of this switchboard is to complete delayed through traffic in response to circuit request placed by toll operators. It has ten pairs of cords and three panels per position.

**No. 5 Toll Switchboard**

**4.139** The No. 5 toll switchboard is a cord-type switchboard located in the same building with the No. 4A switching equipment. The cord and trunk circuits are designed to establish connections on a 4-wire basis. The primary purpose is that of a gateway overseas switchboard and is used to complete overseas calls in response to a circuit request placed by toll operators. It has eight pairs of cords and three panels per position.

**CAMA Switchboard—Fig. 74**

**4.140** The CAMA switchboard, a low sheetmetal structure of cordless type with sloping keyshelf, consists of a number of 2-position sections and a cable turning section. Each position is equipped with a 10-button keyset, auxiliary lamps, and keys. A lamp standard containing calls-waiting lamps and a supervisor division lamp are provided per supervisor division of ten positions maximum. The associated position relay equipment is arranged in units and mounted on miscellaneous relay racks located in the terminal room. A maximum of 20 MF position units can be mounted on one relay rack bay.

**4.141** The CAMA switchboard is used for operator-identified calls to obtain the calling subscriber telephone number. The calling number is keyed into the CAMA equipment by the operator before the call is allowed to complete and forms a part of the initial entry on the tape. Calls are connected to the operator on an automatic distribution basis, and the load on the switchboard is indicated by the lighting of different

colored lamps of a calls-waiting circuit. If all positions must be abandoned, due to an emergency, CAMA traffic can be handled on a non-CAMA basis through operation of a key located either in the cable turning section or in the sender make-busy frame. Arrangements are provided for the operator to be located either in the same building with the CAMA equipment or in a remote building location. Arrangements are also provided for calls to be transferred to a toll or DSA board for night or light load operation. A combined regular and key monitoring position can be provided when CAMA switchboard monitoring is required.

**Traffic Supervisory Rack**

**4.142** The traffic supervisory rack, a floor supported, casing-enclosed rack, with a glass-paneled front door, is located in the traffic quarters for the following purposes:

- (a) To indicate outgoing trunk usage, so that the estimates may be made of the delay which will be encountered in the handling of a call on any outgoing trunk group in the office.
- (b) To provide means whereby any such group may be patched to a specific recorded announcement.
- (c) To indicate when each group is so patched.
- (d) To provide means for the control of the sender attachment delay recorder and to indicate when the number of sender attachment delays encountered in all groups of each type sender exceeds a predetermined count.
- (e) To control directional reservation circuits.

**4.143** The capacity of the traffic supervisory rack is as follows:

Sender Overload Lamps	13
Sender Group-busy Lamps	13
Sender Attachment Control	4
Sender Attachment Alarms	4
All Decoder Channel-busy Lamps	1

All Marker-busy Lamps	2
All Transverters-busy Lamp	2
Incoming Register Group-busy Lamps	30
CBA and NC Lamps	200
Directional Reservation Controls	4
Announcement Connecting Trunk Patching Jacks	280
Announcement Machine Patching Jacks	
One No. 5A Announcement System	120
Two No. 5A Announcement Systems	160

A control panel is provided for SADR and DRE controls for an optional console or a locally provided console. This console mounting is preferred.

**Traffic Supervisory and Register Rack and Auxiliary Traffic Supervisory Cabinet**

**4.144** The traffic supervisory and register rack equipment, the same design as the traffic supervisory rack, is intended primarily to be located with the associated TDA switchboard when the operating room is not located in the same building as the toll crossbar office. The traffic supervisory and register rack equipment provides the same signals and registration as does similarly designated traffic supervisory rack and traffic register equipment located in the same building with the crossbar office.

**4.145** The auxiliary traffic supervisory cabinet equipment, enclosed in a metal cabinet for wall or column mounting, is primarily intended to be located in the traffic management quarters. This cabinet provides a multiple of most of the same signals of the similarly designated traffic supervisory rack equipment located in the operating room.

**TEST AND TERMINAL ROOM EQUIPMENT**

**No. 17C Toll Testboard**

**4.146** The No. 17C testboard is used in No. 4A toll offices for making overall tests of the toll circuits in order to facilitate the location of troubles and to expedite the restoration of service when it has been interrupted. It consists of a lower unit housing testing and control equipment and a jack field with an appearance of intertoll trunks and miscellaneous trunks.

**4.147** The capacity of the No. 17C toll testboard in toll offices with and without circuit patch bays is as follows:

	WITH CKT PATCH BAY	WITHOUT CKT PATCH BAY
Lower Unit (Per Bay)		
Cord Circuits	4	4
Position and Keypad Circuit	1	1
Extension Cord Circuits	4	2
Lower Unit (Misc Tst Pos Only)		
Cord Circuits	4	2
Position and Keypad Circuit	1	1
Position Patch Cord Circuit	4	5
Jack Field in Bays With Test Jacks		
Panels	2	2
Jack Field Openings	36 In.	36 In.
Test Jacks	480	—
Test and E&M Jacks	—	400
Answering and Outgoing Trunk Jacks	40	40
Miscellaneous Jacks (Strip Mtg)	40	40
Miscellaneous Jacks (Ind Mtg)	—	32

**Automatically Directed Outgoing Intertoll Trunk Test Frame—Fig. 75 and Automatically Directed Outgoing Intertoll Trunk Test Connector Frame—Fig. 76**

**4.148** The Automatically Directed Outgoing Intertoll Trunk Test (ADOIT) Frame is used for testing outgoing and 2-way intertoll trunks. The ADOIT frame provides for high quality standards of transmission maintenance and improved operating efficiencies through the use of the Automatic Transmission Measuring System (ATMS) director and the test control and recording units. The ATMS

director provides a high degree of accuracy and speed in 2-way loss measurements and, in addition, provides quantitative noise measurements with special indications when either the loss or noise measurements deviate beyond the programmed limits. The test control and recording units with the associated console control unit (card reader), card punch and electric typewriter, makes possible a wide selection of transmission testing sequences. Operational tests can be performed on trunks selected by the wired-in sequence or by external random selection under control of the input card deck.

**4.149** The capacities of the test frame (Fig. 75) and test connector frame (Fig. 76) are as follows:

Automatic Outgoing Intertoll Trunk Test Frame	10,000 Trunks
Outgoing Intertoll Trunk Test Connector Frame	5 Connector Units
Outgoing Intertoll Trunk Test Connector Unit	200 Trunks

**Circuit Patching Bay**

**4.150** The circuit patching bay, when provided, permits reassignments of intertoll trunk relay equipment with other toll terminal equipment. This permits substitution of spare relay equipment for one on which trouble occurs or the enlargement of a particular trunk group to meet transient increases in traffic. Only temporary reassignments are made at this bay since reassignments of a more permanent nature are made by cross-connections at the trunk assignment distributing frame.

**4.151** When the circuit patching bay is not provided, the trunk circuit is cabled direct to its assigned toll terminal equipment (see Fig. 1) and additional testing facilities are provided at the 17C toll testboard in paragraph 4.116.

**Trunk Assignment Patching Bay**

**4.152** This bay permits reassignment of outgoing intertoll trunks to other trunk blocks. At this bay, groups of intertoll trunks may also be temporarily enlarged to meet increases in traffic. These patches change the test leads of the trunks from one block re-

lay to another, and are usually made in conjunction with a relay equipment patch at the voice frequency patching bay. Reassignments on a more permanent basis are made at the trunk assignment distributing frame.

**4.153** These patching changes need not be accompanied by any card change in the translator if the reassignment or enlargement is made to block relay terminals within the group start and end points of the trunk group. Thus, in order to add to the trunk groups, there must be spare, normally busied terminals on the block relay.

**4.154** The trunk assignment patching bay is arranged for 600 assignment patching jack circuits.

#### **Integrated Manual Test Frame (IMTF)—Fig. 77**

**4.155** The IMTF frame is a single bay frame and contains all of the necessary equipment and controls for gaining access to and performing tests on intertoll and toll completing trunks. Keys and switches for gaining access to incoming and outgoing intertoll and toll completing trunks are located on the control panel. Additional access and testing facilities are provided with the optionally equipped SMAS 3-3B MLCP which can be mounted on the integrated manual test frame. A minimum of two IMTFs and a maximum of 16 may be provided per office.

#### **Circuit Status and Display Board—Fig. 78**

**4.156** The voice-frequency transmission status display frame provides indications of carrier failures and traffic trunk group troubles. It also provides the means to control the carrier conditioning equipment on the utilized carrier bays, and the lock out and release of individual intertoll trunks.

#### **Test Trunk and VF Link Jack Frame (TTJ)**

**4.157** The TTJ frame is provided one per operating center and is usually located midway in the IMTF line up for easy access. The TTJ frame provides the jack circuit appearance for the various test trunks (belt lines) used in a No. 4 toll switching system. Provisions are made for patching the test trunks to the various IMTF frames.

#### **Status Concentrator Frame—Fig. 79**

**4.158** The status concentrator frames provide means to concentrate the IT trunk circuits into display groups of 40 trunks each. The concentrators identify the traffic assignment number and out of service conditions for each trunk in a group of 45 and pass this information to the status display frame. It also provides a means for the individual status display frame to lock out and release individual trunk circuits in a group of 40. This frame contains the relays for the splitting feature which permits the display groups to be divided into blocks of 34 groups each.

#### **Outgoing Trunk Testing System Frame (OTTS) Fig. 80**

**4.159** The OTTS is a test frame intended to replace both automatically directed outgoing intertoll trunk (ADOIT) test frames and automatic outgoing trunk test (AOIT) frames presently specified for the No. 4 crossbar switching office. The OTTS makes automatic transmission and operational tests on both the intertoll and toll completing trunk. It contains equipment to provide for seizure of any specified trunk outgoing from the No. 4 crossbar switching machine, signaling over the trunk to obtain a test line connection at the far end, logic circuits to recognize operational failures during call set up as well as responder equipment for transmission measurements and sequencing and controlling logic to administer the process of automatic measurements. The OTTS is capable of testing a maximum of 20,000 trunks per test connector and may connect to one or two test connectors. The OTTS provides routine and demand operational and transmission tests under computer control. This computer control is provided locally from an in-office trunk and facility maintenance (TFMS) or the trunk and facility processor (TFP); both are forms of the carrier maintenance system (CTMS).

#### **Outgoing Trunk Test Connector Frame—Fig. 81**

**4.160** The outgoing trunk test connector (OTTC) frame is designed to operate in the No. 4A toll office employing the outgoing trunk test system (OTTS) and its primary automatic trunk testing capability and the integrated manual test frame (IMTF) as the principal manual trunk testing frame. The prime function of the OTTC frame is to provide access for the OTTS to the select magnet (SM) lead on the outgoing link and connects where the desired trunk for test is terminated and to the marker sleeve

(MS) lead of the same trunk. The OTTC frame has a capacity of 1000 trunks with a maximum of 40 frames per office.

#### OTHER EQUIPMENT

##### Service Observing Equipment

**4.161** Service observing of inward traffic on the No. 4A intertoll trunk circuits may be obtained by the provision of No. 12 service observing desk and the associated toll service observing facilities. The desk equipment consists of a maximum of 20 positions. The jack field equipment includes recording indicators, lamps, keys, and other equipment required for making observations on the various types of calls. For the intertoll trunks, these observations include the incoming trunk number, the supervisory signals, and the called number as dialed or keyed by the originating operator. The observer may also monitor on the incoming and outgoing transmission circuits of the intertoll trunk. A maximum of 60 service observing multiline intertoll trunks can be associated with each desk, and each of the 60 can handle a maximum of 50 toll incoming loops. The association of intertoll trunks with the service observing trunk is affected by patching between the 50 connector sockets and loop sockets for the intertoll trunks. Approximately 10 per cent of the trunks per circuit group are cabled to the loop sockets, and connector sockets are provided for about 25 per cent of this number. This patching equipment and the relay equipment associated with the service observing trunks are located on the miscellaneous relay rack. The observing circuits connect to any idle observing position on an automatic call distribution basis.

##### Line Observing Frame (CAMA Equipment)

**4.162** The line observing frame, a single-bay framework, is equipped with a maximum of 30 line number matching circuits, and is arranged to connect to a maximum of 12 transverters. The line observing frame provides facilities for initiating the recording of detailed observing entries on the AMA tape on all calls from a maximum of 30 subscriber telephone numbers. These may be any telephone number served by the CAMA equipment of the No. 4A office and are set up on selector switches on the individual line number matching units on the frame. The frame functions with the transverters and if a calling number set up in the transverter matches one of the numbers set up on the line number matching switches, the transverter sets up the tape entry on an observed basis.

#### Test Sets

##### General

**4.163** Portable test sets available for the No. 4A offices include the following:

- (a) Incoming and Intertoll Trunk Test Set (Wagon Type)
- (b) No. 5 Switchboard Position Control Test Set
- (c) Test Set for Timing Tests
- (d) No. 35F Test Set (Relay Adjusting)
- (e) Mercury Relay Test Set
- (f) No. 1A Signaling Test Set (For CX Signaling)
- (g) No. 4A Signaling Test Set
- (h) Frame Identification Frequency Test Set
- (i) Volume Indicator
- (j) Vacuum Tube Test Set, KS-15874
- (k) Pulse Repeating Test Set
- (l) Patching Cord Test Set
- (m) KS-14510 Volt-Ohm-Milliammeter
- (n) Pulse Checking Test Set
- (o) Contact Closure Test Set
- (p) No. 1A Fault Locator Test Set
- (q) Cold Cathode Tube Test Set
- (r) Magnetic Latching Relay Test Set
- (s) Hewlett Packard Vacuum Tube Voltmeter Model 410B
- (t) No. 32A Test Set
- (u) Hewlett Packard 3400A RMS Voltmeter
- (v) Plug-In Trunk Test Set

Items (a) and (b) above have associated equipment which mounts on the relay rack. Also mounted on the relay rack is the transmission measuring test line for automatic outgoing toll connecting and intertoll trunk test frames.

**4.164** Transmission Test Sets:

- (a) 72A Frequency Meter
- (b) 23D Transmission Measuring Set
- (c) 22A Milliwatt Register Meter
- (d) 27B Par Receiver
- (e) 27A Par Generator
- (f) KS-20501 Return Loss Measuring Set
- (g) Oscillator (KS-19353)
- (h) No. 6M Impulse Counter

**Electronic Test Sets**

**4.165** An ETS requires certain special test and auxiliary equipment for testing and servicing the electronic equipment. These items are covered in J1C027 and should not be duplicated.

ITEM	NO. PER OFFICE
Tektronix Oscilloscope Model 221T presently listed under J1C027, 1.54 or Hewlett-Packard Oscilloscope E09-180A	1
Tektronix Scope Cart Type 200-1	1
Store Test Set — J1C029A — 801-820-159	1
Digital Strobe Set — J1C029B 801-820-150	1
PBT Demagnetization Set — J1C029C — 801-820-159	1
External Match Interrupt Test Set — J1C029E — 801-820-159	1
Bootstrap Transfer Card Extender Unit — ED-1C122-30	1
PTU Recorder Control Test Set J1C029D — 801-820-159	1

ITEM	NO. PER OFFICE
723B Tool for Withdrawing Circuit Pack from Apparatus Mounting	2 Per Aisle
Hewlett-Packard Model 428B Clip-On DC Milliammeter (0 to 10 Amp) — J1C027	1
KS-14510 L1 Model 630D Meter; 20,000 ohms Per Volt DC; 3000 ohms per Volt AC — J1C027	1
158A and 159A Adapters for Testing Circuit Packs — J1C027	1

**5. POWER, RINGING, AND MISCELLANEOUS SUPPLY EQUIPMENT**

**Power and Ringing Requirements**

**5.01** The circuits for a No. 4A office require the following regulated supplies:

- 48V Signal Battery
- 48V Battery (ETS)
- 24V Signal Battery
- 24V Filament Battery
- +24V Battery (ETS)
- +130V Signal Battery
- +130V Plate Battery
- 130V Signal Battery
- 20-CY, 105 VAC Continuous Ringing
- 60-CY, 55 VAC (Mkr-Cont)
- 60-CY, 22 VAC (Sdr Attach. Delay, Calendar and clock)
- LT1
- LT4
- MR-R1
- MR-SUP

**Power Plants**

**5.02** When the No. 4A office is installed in the same building as a local dial office or manual toll office, the existing power plants may be used when

applicable. When new plants are required, a No. 302A plant should be furnished for the 24- and 48-volt battery, a No. 702C plant for the +130 volt battery, and a No. 803C plant for the ringing supply. A -130 volt battery supply is required in the operation of the transmission measuring and noise checking circuit (test line 104). The -130 volt battery should be obtained from an existing plant, in the building, that serves toll terminal equipment such as teletypewriter circuits. Fuse bay-mounted filters are used to obtain 24-volt filament from the 24-volt signal battery and 130-volt signal from the 130-volt plate. The latter is required when no common filter is provided in the plate discharge circuit and prevents the introduction of noise on the plate circuits. In the event that two power plants are located in the same building with a No. 4A office, all the No. 4A common control circuits, such as markers, senders, link controllers, and all trunks associated with the No. 4 Crossbar System, must be supplied from the same battery. The associated switchboard signaling circuits, and 17C toll testboard may be supplied from a different supply providing that the two power plants are bonded together with a maximum of 0.5 volts difference in ground potential (BSP 802-001-180). For this purpose, a battery with two groups of end calls and two sets of end cell switches must be considered as two separate batteries since it is possible to have different voltages on the battery feeders.

**5.03** Two dedicated 111A power plants are required to furnish the +24 volt and -48 volt battery supplies for the electronic frames of the ETS. Four 100-amp +24 volt rectifier and three -48 volt rectifiers are required for an ETS with five duplicated store frames. This does not include a maintenance rectifier that should be furnished per voltage. The ground return for these power plants must be isolated from the office ground. The only place the two grounds are tied together is at the ground window which is located above one of the PD frames.

#### Miscellaneous Supplies

**5.04** A No. 506A power plant is provided to supply 22-volt ac, 50- to 60-cycle current to the No. 5 switchboard, master timer, perforator wind-up reels, and incoming trunk test frame. A No. 504B three-phase power plant (J86617, 802-802-161) or a No. 523A single-phase 115 kW power plant (J86641, 802-813-150) or a 524A single-phase 5 kW power plant (J86642, 802-814-150) to supply 115-volt 60-cycle current from the office battery is provided in offices arranged for CAMA or ETS operation.

## 6. WIRING AND CABLING

### Switchboard Power Cabling

**6.01** Switchboard power cabling connects miscellaneous leads from the individual frames to terminal punchings located at a central point at the end of a line-up for the purpose of combining leads to their various destinations in larger cables than would be possible if individual cables were run from each frame. The terminal punchings used for this purpose are on a Distributing Power Terminal Strip (DPTS) located on the frame end guard at the main aisle end of a line-up of frames and a Secondary Distributing Power Terminal Strip (SDPTS) located at the opposite end of the line-up. The SDPTS is utilized to provide alternate cabling for certain critical leads, and connecting points for other critical leads for which parallel leads are run. Switchboard power cabling is used only with the block relay, sender link, incoming link, outgoing link and marker frames.

### Distributing Frame Cross-Connection Facilities

**6.02** The cross-connection facilities provided by the No. 4A distributing frames are as follows:

FRAME	PURPOSE
IDF	To associate: <ol style="list-style-type: none"> <li>(a) Toll terminal equipment with circuit patching bay</li> <li>(b) Intertoll trunk relay equipment with circuit patching bay</li> <li>(c) Toll connecting trunk relay equipment with trunks to local offices.</li> </ol>
TDF	To associate: <ol style="list-style-type: none"> <li>(a) Trunk relay equipment with incoming and outgoing frames</li> <li>(b) Intertoll trunk relay equipment with No. 17C testboard</li> <li>(c) Incoming trunks with second trouble tracing selectors.</li> </ol>
ADF	To associate: <ol style="list-style-type: none"> <li>(a) SM leads of outgoing frames and MS leads of outgoing trunks with assignment patching jacks and trunk block relays</li> </ol>

## FRAME

## PURPOSE

- (b) GB leads of outgoing trunks with assignment patching jacks and CBA trunk circuits
- (c) Outgoing trunks with test and make-busy jacks.

**6.03** In order to minimize service reaction in the event of power failure, the office load on the various battery, tone and ringing supplies are divided as equally as possible into two separately fused supplies known as A and B supplies. Generally even-numbered and home circuits and even-numbered frames are connected to the A supply, and odd-numbered and mate circuits and odd-numbered frames are connected to the B supply. Most of the switchroom frames are equipped with 48-volt fuse panels located at the top of the frames and connected to line feeders running along the top of the frames. These line feeders are fused with separate A and B 100-ampere fuses located in a cabinet mounted on end guards at the main aisle. Supply leads for the other batteries are run individually from the appropriate A or B fuse panels located on the fuse bays.

**7. FLOOR PLANS**

**7.01** Fig. 7 shows the floor plan dimensions of the various frames required for a No. 4A office. Large installations with CAMA generally will require two floors for switching frames and trunk relays, with about 4 square feet per toll line in the ultimate. A small installation of less than 1000 toll lines in the ultimate will probably require about 10 per cent more space per line. The general approach to a No. 4A floor plan should have as its primary objective a layout which keeps within the critical conductor length limitation for the runs between the trunk and CX signal equipment, as well as those between the switch frames. Fig. 4 and 5 shows a typical floor plan for the switching area of a separate train, combined operation installation while Fig. 6 shows a typical floor plan for CAMA equipment.

**8. SUPPLEMENTARY INFORMATION****General**

- 800-600-000—Checking List—General Equipment Requirements
- 818-000-000—Numerical Index—No. 4 Toll Switching Systems
- 818-100-170—Centralized Automatic Message Accounting

- J1C027—801-820-157—Stored Program Control No. 1A
- J1C028—801-820-158—Stored Program Control No. 1A—Limiting Conductor Lengths
- J60101—818-030-150—Switchboard Power Cable
- J60103—818-031-150—Limiting Conductor Lengths
- J67495—808-011-153—Juncton Distribution—Direct Cabling TC Plan
- 760-555-151—Atmospheric Environment for Telephone Equipment Space

**11-Foot 6-Inch Electromechanical Frame**

- J67402—818-330-150—Incoming and Outgoing Sender Link Frames
- J67407—818-331-150—Link Controller and Connector Frame
- J67408—818-480-150—Block Relay Frame
- J67413—818-305-150—Outgoing Sender Frame
- J67422—818-040-150—Office Interrupter Frame
- J67423—818-780-151—Floor Alarm Units
- J67427—818-760-150—Trouble Tracing Selector Frame
- J67449—818-401-150—First Auxiliary Decoder Connector Frame
- J67449—818-401-150—Auxiliary Decoder Connector Frame
- J67466—818-601-150—CCIS Trunk Frame
- J67468—818-303-150—Outputer Frame
- J67499—818-335-151—Outputer Link Frame
- J67501—818-334-151—Outputer Link Controller Frame
- J67516—818-050-150—Transceiver and Connector Frame

**11-Foot 6-Inch Electromechanical Test Frames**

- J67508—818-702-151—Outputer Link Controller Test Frame
- J67515—818-709-151—CCIS Intraoffice Trunk Test Frame

**7-Foot Electronic Frames**

- J1C083—801-820-160—IGFET Store Frame
- J67504—818-425-161—CCIS Terminal Frame
- J67504—818-425-161—Supplementary CCIS Terminal Frame
- J67511—818-425-163—Distributor and Scanner Frame
- J67514—818-425-164—Voice Frequency Access Frame
- J67430—818-300-150—Incoming Dial Pulse Sender Frame

J67440—818-450-150—Marker Frame  
 J67441—818-780-150—Floor Alarm Frame  
 J67444—818-041-150—Traffic Control Frame  
 J67446—818-451-150—Marker Connector Frame  
 J67448—818-046-150—Circuit Busy Announcement  
 Trunk Frame  
 J67449—818-401-150—Decoder Connector Frame  
 J67457—818-340-150—Incoming Register and Link  
 Frame  
 J67465—818-044-150—Outgoing Trunk Identification  
 Frame  
 J67467—818-304-150—Overseas Sender Frame  
 J67468—818-303-150—Incoming Multifrequency  
 Sender Frame  
 J67471—818-425-150—Decoder Channel Frame  
 J67493—818-200-151—Incoming Frames  
 J67494—818-201-151—Outgoing Frames  
 J67509—818-082-152—Traffic Usage and Supplemen-  
 tary Traffic Usage Frames  
 J92608—818-084-150—Sender Attachment Delay  
 Equipment  
 J98609—801-620-151—Multifrequency Current Sup-  
 ply  
 J99324—818-045-150—Announcement Frame—No.  
 5A Announcement System

#### 7-Foot High Electronic Translator Frames

J1C020—801-820-150—Processor Frame  
 J1C022—801-820-152—Master Scanner Frame  
 J1C023—801-820-153—Signal Distributor Frame  
 J1C024—801-820-154—Central Pulse Distributor  
 Frame  
 J1C025—801-820-155—Filter Units  
 J1C026—801-820-156—Store Frame  
 J67444—818-041-150—Network Control Frame  
 J67472—818-425-151—Peripheral Scanner Frame  
 J67473—818-425-152—Distributor Register Frame,  
 and Central Pulse Distributor Applique Unit  
 J67475—818-425-154—Power Distributing Frame  
 J67476—818-425-155—Peripheral Function Transla-  
 tor Unit  
 J67479—818-425-155—Teletypewriter Buffer Frame  
 J67492—818-048-150—Miscellaneous Frame

#### Control Cabinet

J67506—818-085-150—PBC Interface and Control  
 Cabinet

#### 7-Foot High Electronic Maintenance Center Frames

J1C021—801-820-151—Control Display Program  
 Tape and TTY Frames  
 J67474—818-425-153—Alarm and Display Frame

#### 11-Foot 6-Inch Electromechanical Maintenance Center Frames

J28350—AA247.801—Emergency Alarm Frame  
 J67418—818-705-150—Automatic Outgoing Toll Con-  
 necting Trunk Operational and Transmission  
 Test Frames  
 J67435—818-761-150—Sender Make-Busy Frame  
 J67436—818-703-150—Outgoing Sender Test Frame  
 J67443—818-701-150—Trouble Recorder Frame  
 J67461—818-707-150—Automatic Incoming Trunk  
 Test and Connector Frames  
 J67462—818-702-150—Incoming Sender and Register  
 Test Frame  
 J67496—818-708-151—Manual Trunk Test Frame

#### CAMA Frames

J22151—818-110-150—Call Identity Indexer Frame  
 J22451—818-112-150—Master Timing Frame  
 J22456—818-111-150—Perforator Cabinet  
 J22462—818-108-150—Recorder Frame  
 J22464—818-109-150—Billing Indexer Frame  
 J28053—818-103-150—Position Link Frame  
 J67454—818-104-150—CAMA Sender link Frame  
 J67458—818-105-150—CAMA Sender Frame  
 J67459—818-107-150—Trunk Class Translator Frame  
 J67460—818-113-150—Trouble Recorder Connector  
 Frame  
 J67463—818-106-150—Transverter Frame  
 J67464—818-106-151—Transverter Connector Frame  
 J67469—818-422-150—Pretranslator Frame

#### Operating Room Equipment

J21350—818-102-150—CAMA Switchboard  
 J61558—821-701-150—No. 5 Toll Switchboard—  
 Lower Unit Equipment  
 J61559—821-701-151—No. 5 Toll Switchboard—  
 Switchboard Equipment  
 J62604—818-083-150—Traffic Supervisory Rack  
 J62607—818-083-151—Traffic Supervisory and Regis-  
 ter Rack and Auxiliary Traffic Supervisory  
 Cabinet Equipment  
 J91107—821-700-165—No. 3CL Switchboard

#### Test and Terminal Room Equipment

J1P012—824-101-103—Outgoing Trunk Testing Sys-  
 tem  
 J63519—801-225-154—17C Toll Testboard  
 J63524—801-226-163—Circuit Patching Bay

J67421—818-631-150—Trunk Assignment Patching Bay  
 J67478—818-706-151—Automatically Directed Outgoing Intertoll Trunk Test Frame  
 J67513—801-706-152—Outgoing Trunk Test Connector Frame  
 J68602—AA262.001—Signaling and Testing Panels and Units  
 J93020—801-250-167—Transmission Measuring and Noise Checking System  
 J94005—801-250-153—Transmission Measuring and Noise Measuring System  
 J94051—802-250-163—Automatic Transmission and Noise Measuring System  
 J94071—802-250-165—71C Milliwatt Reference Generator  
 J98613—801-642-150—E-Type AC Trunk Signaling Systems  
 J99361—802-408-154—Test Trunk and VF Link Jack Frame  
 J99362—801-408-155—Voice Frequency Status Display Frame  
 J99363—801-408-156—Status Connector Frame

#### Trunks and Relay Rack Equipment

J61561—818-602-150—Intertoll Trunk Units  
 J61562—818-603-150—Incoming Toll Completing Trunk Units (CAMA and non-CAMA)  
 J61563—818-604-150—Outgoing Trunk Units  
 J61564—818-081-150—Miscellaneous Relay Rack Units  
 J62603—818-082-151—Traffic Register Equipment  
 J64001—804-910-151—Transmission Measuring Panels and Units  
 J67466—818-601-150—Trunk Frames  
 J92603—801-006-150—Traffic Register Equipment—Common Systems.  
 J93016—801-025-163—Units for Traffic and Maintenance Desks  
 J93017—801-205-152—Relay Rack Mounted Test Equipment  
 J99227—801-026-151—10 IPM Interrupter and Impulse Clock Supply

#### Test Sets

J24753A,L1—817-723-150—Test Set for Timing Tests  
 J63525D,L1—818-740-150—Incoming and Intertoll Trunk Test Set  
 J64072A,L1—804-911-154—72A Frequency Meter  
 J64722A,L1—801-205-176—Pulse Repeating Test Set  
 J64727A,B,L1—818-741-150—Frame Identity Frequency Test Set

J67428A,L1—821-709-153—No. 5 Switchboard Position Control Test Set (As Required)  
 J67477A,L1—818-743-150—Plug-In Type Trunk Test Set  
 J94006H,L1—801-250-154—No. 6M Impulse Counter  
 J94022A,L2—801-150-162—22A Milliwatt Ref Meter  
 J94023D,L1—801-250-158—23D Transmission Measuring Set  
 J94027B,L1—801-150-162—27B PAR Receiver  
 J94027C,L1—801-150-162—27A PAR Generator  
 J94711C,L1—801-205-155—Patching Cord Test Set  
 J94714—801-205-158—No. 35F Relay Adjusting Test Set  
 J94723A,L4—801-205-161—Pulse Checking Test Set  
 J94724A,L1—801-205-162—Contact Closure Test Set  
 J94725—801-205-163—Mercury Relay Test Set  
 J94727A,L1—801-205-165—No. 1A Signaling Test Set  
 J94730A,L1—801-205-608—No. 1A Fault Locator Test Set  
 J94731A,L1—801-205-169—Cold Cathode Tube Test Set  
 J94735A,L1—801-205-171—Magnetic Latching Relay Test Set  
 J94743D,F,AA,AB,AC,AD—801-205-173—No. 4A Signaling Test Set  
 KS-14510—Volt-Ohm-Milliammeter  
 KS-15874—Vacuum Tube Test  
 KS-16653—Volume Indicator [Test Recorded Announcements Hewlett-Packard 3400A RMS Voltmeter (Test Tone Plant)]  
 KS-19353—Oscillator  
 KS-20501,L1—Rerun Loss Measuring Set  
 VTVM Hewlett-Packard Model 410B  
 No. 32A Test Set (WE Supplied)

#### Power Plants

802-001-180—Protective Grounding Systems for Power Plants  
 J86434—802-726-150—302A Plants—24 and 48 Volts  
 J86470—802-659-160—111A Power Plant  
 J86475—802-871-150—702C Plants—Positive and Negative 125 to 135 Volts  
 J86555—802-902-151—803C Plants—Machine Ringing Equipment  
 J86578—802-757-150—420A Plant—55-Volt AC Supply  
 J86617—802-802-161—504B Plant—AC Supply Units with Emergency Operation From Battery  
 J86641—802-813-150—523A Power Plant  
 J86642—802-814-150—524A Power Plant  
 J86724—802-805-150—506A Plant—Low Voltage AC Supply Units

**Miscellaneous**

AA613.008—Frame Numbering Plan  
 J22466—818-047-150—Line Observing  
 J25551—818-080-150—End Guards, Aisle Pilot Lamp and DPTS Supports, and Fuse Record Book and Holder  
 J67002—804-001-150—Distributing Frames  
 J67434—818-630-151—Trunk Assignment Distributing Frame  
 J69209—818-007-151—Modification of No. 4A Combined Train Offices to Provide Separate Train Combined Operation  
 J69213—818-007-153—Modification of Existing No. 4 Type Toll Offices for Electronic Translator System  
 J85505—802-015-150—Central Office Lighting Fluorescent Type  
 J85507—802-015-152—Frame and Aisle Lighting Equipment  
 J90604—801-007-150—Ladders, Benches, and Stools—Application Practices  
 J90605—801-007-151—Rolling Ladders—Track Type  
 J93009—801-601-152—Audible and Visual Maintenance Alarm Equipment  
 J93814—822-204-150—No. 12 Service Observing Desk  
 J94907—801-223-150—20 Key Cabinet  
 J94909—801-223-151—21 Key Cabinet  
 J95501—802-015-157—Central Office Lighting Equipment, Appliance Outlets, and Miscellaneous Conduits  
 J95502—802-015-158—Emergency Lighting Equipment for Central Offices  
 J97025—801-006-155—Relay Racks—Angle Type—Framework and Cabling  
 J97033—801-010-150—Fuse Bay—Angle Relay Rack Type  
 J98302—801-601-154—Emergency Alarm System—Automatic Fire Detection Feature  
 J98303—801-601-155—Emergency Alarm System Without Code Signaling  
 KS-15531—AA388.033—Operator Chairs—Metal Type  
 H-396-215—Spare Circuit Pack Requirements—ETS  
 H-450-000—Spare Circuit Pack Requirements—SPC

**9. GENERAL DRAWINGS****Circuits**

SD-68400-01—Toll Switching System No. 4A—Keysheet  
 SD-68400-02—No. 4A Current Drain Data

SD-80652-01—55 VAC Supply—Marker Continuity Test  
 SD-80700-01—Power Systems—Keysheet  
 SD-81197-01—Battery Distributing Circuit  
 SD-95571-01—Filament Supplies

**Equipment, Assembly, and Cabling****11-Foot 6-Inch Electromechanical Frames**

ED-68066-10—Method of Running Dual Power Feeders  
 ED-68088-01—Designation Cards  
 ED-68136-01—Traffic Register Distributing Frame  
 ED-68169-01—Trunk Distributing Frame—Typical Equipment  
 ED-68218-01—Intermediate Distributing Frame—Typical Equipment  
 ED-68501-01—Assignment Distributing Frame  
 ED-68870-01—Wire Gauges and Types of Insulation  
 ED-68918-12—Method of Running Power Feeders 111A Power Plant  
 ED-68966-()—Plan TC Junctor Cabling Detailed Drawing  
 ED-90595-01—Table-Type Wagon and Wire Spool Rack Assembly  
 ED-92175-31—Filament and Plate Battery Filters—Assembly and Equipment

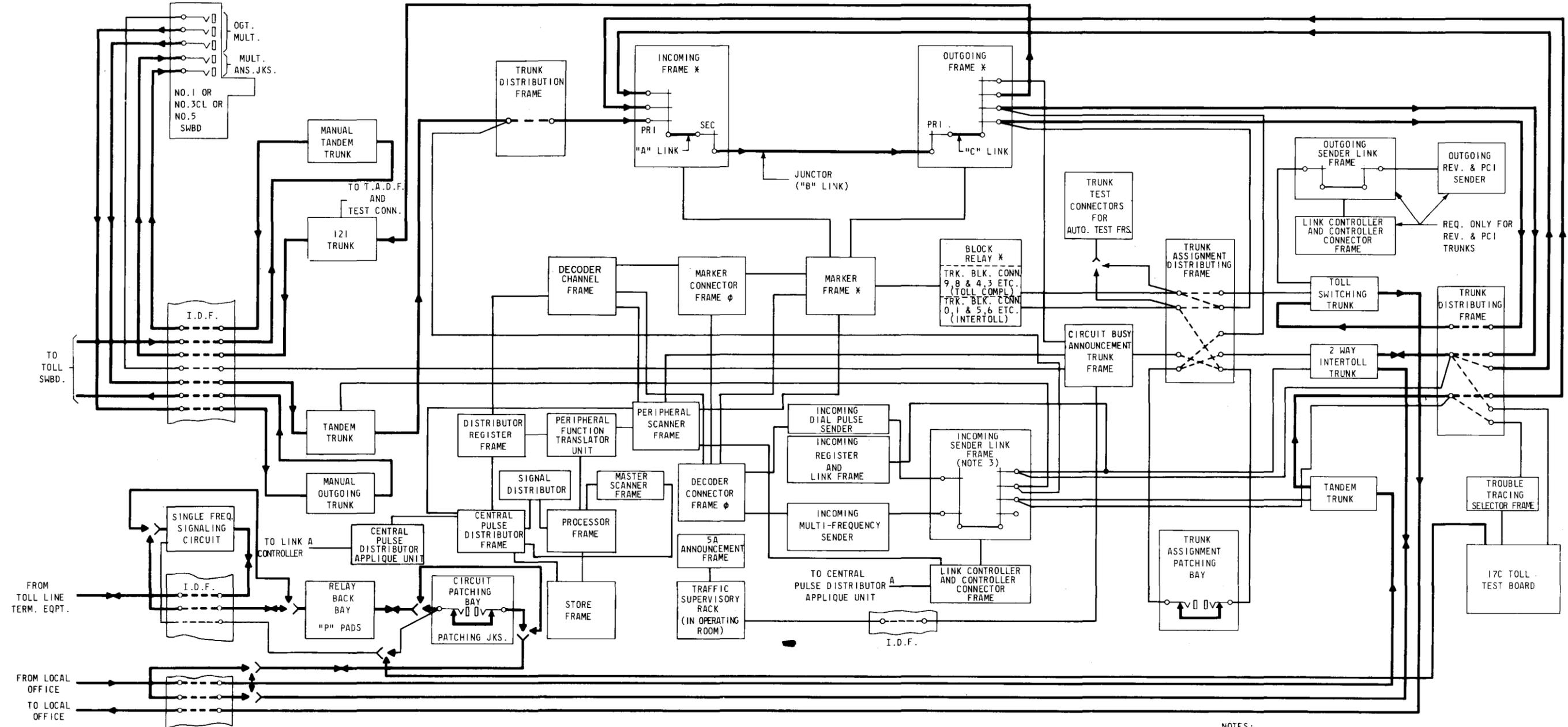
**ED-92018-01—Print Display Boards Assembly****Seven-Foot Electronic Frames**

ED-1A150-70—Single Bay Frame Assembly  
 ED-1A151-60—Double Bay Frame Assembly  
 ED-1A184-70—Line-Up Cable Racks  
 ED-1A184-73—Line-Up Cable Rack Covers  
 ED-1A197-71—Cross-Aisle Cable Rack  
 ED-1A198-71—End Guard Assemblies  
 ED-1A209-70—Cable Rack Support Stanchion Assembly  
 ED-1A210-11—Method of Installing Framework  
 ED-1A210-12—Method of Installing End Guards  
 ED-1A210-13—Method of Installing Cable Rack Support Stanchion  
 ED-1A210-14—Method of Installing Line-Up Cable Racks  
 ED-1A210-15—Method of Installing Cross-Aisle Cable Troughs  
 ED-1A227-01—Method of Running and Butting Switchboard Cables  
 ED-1A228-50—Directory and Fuse Holder Assembly for End Guards

ED-1A229-50—Spare Parts Storage Cabinets  
ED-1A232-10—Typical Cable and Equipment Arrangement for 514-Type Terminations in End Guard  
ED-1A250-70—Triple Bay Frame Assembly  
ED-1C111-31—Specific Requirements for Wiring and Cabling TSPS No. 1, SPC No. 1A, and ETS  
ED-68918-12—Method of Running Power Feeders in a Power Plant  
ED-68936-30—AC Power Distribution and Frame Base Appliance Outlets  
ED-68958-()—Office Alarm Unit for 7-Foot Electronic Frames  
ED-68959-10—Connectorization of ETS Communications Buses  
ED-82097-30—Frame Aisle Lighting

**Floor Plan Data Sheets**

Section 7.1, Sheet 108—5A Announcement Frame  
Section 7.1, Sheet 109-115—Stored Program Control Frames  
Section 7.2, Sheet 55—8-1/2 Inch Panel Switchboard  
Section 7.2, Sheet 60—Service Observing Desk No. 12  
Section 7.3, Sheet 11—Equipment Entrance and Erection Space in Dial Buildings  
Section 8—Power Plants  
Section 10—No. 4A Toll Switching System



- NOTES:
1. FRAMES MARKED WITH AN ASTERISK (\*) INDICATE THOSE FOR WHICH SEPARATE INTERTOLL AND TOLL COMPLETING FRAMES ARE FURNISHED IN A TWO TRAIN OFFICE.
  2. FRAMES MARKED φ INDICATE THOSE WHICH ARE FURNISHED IN DIFFERENT CAPACITIES IN COMBINED AND TWO TRAIN OFFICES.
  3. TYPES OF INCOMING SENDERS CANNOT BE MIXED ON THE SAME SENDER LINK FRAME.

Fig. 1 — Equipment Schematic (Non-CAMA) ETS Office

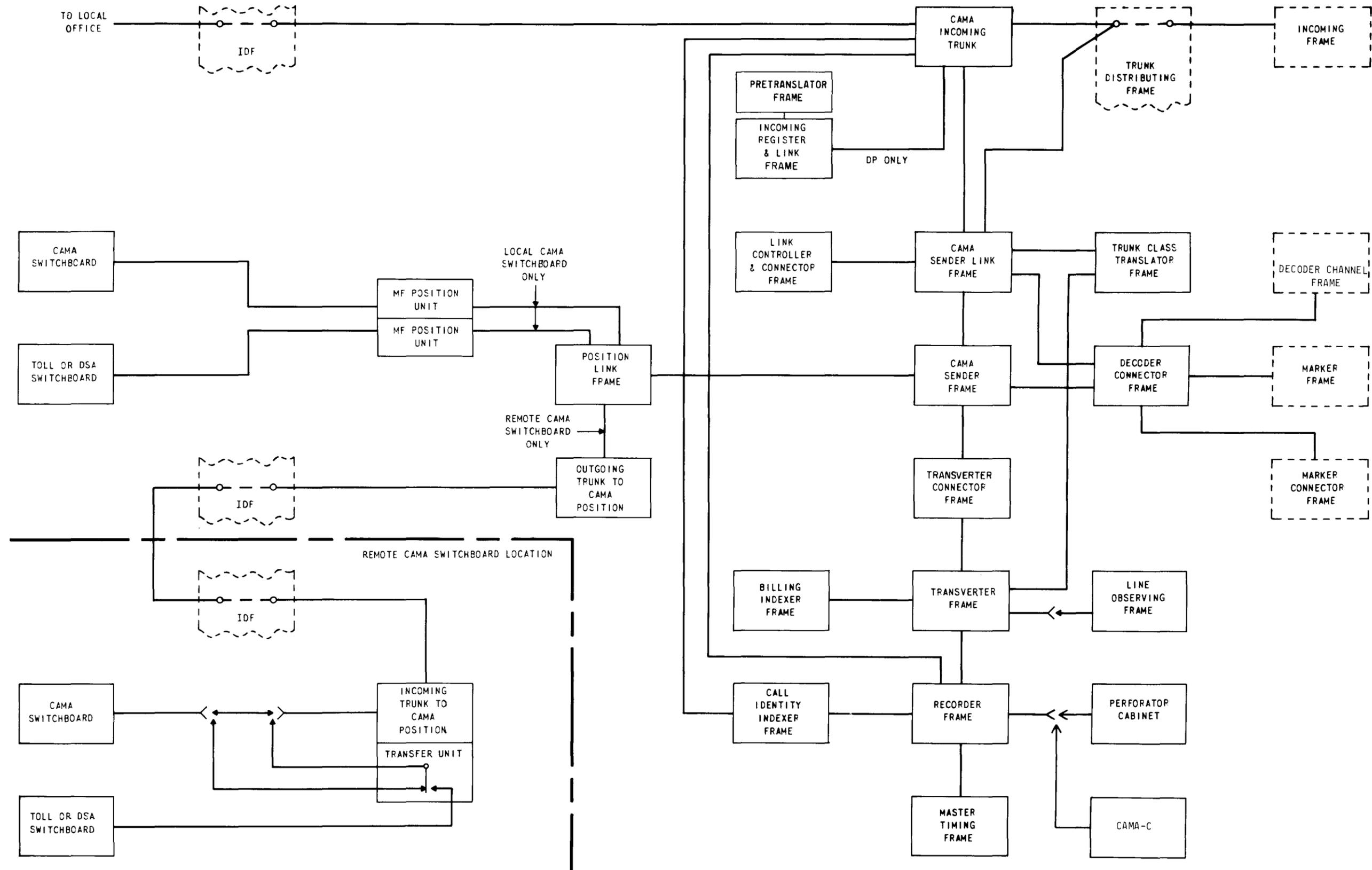
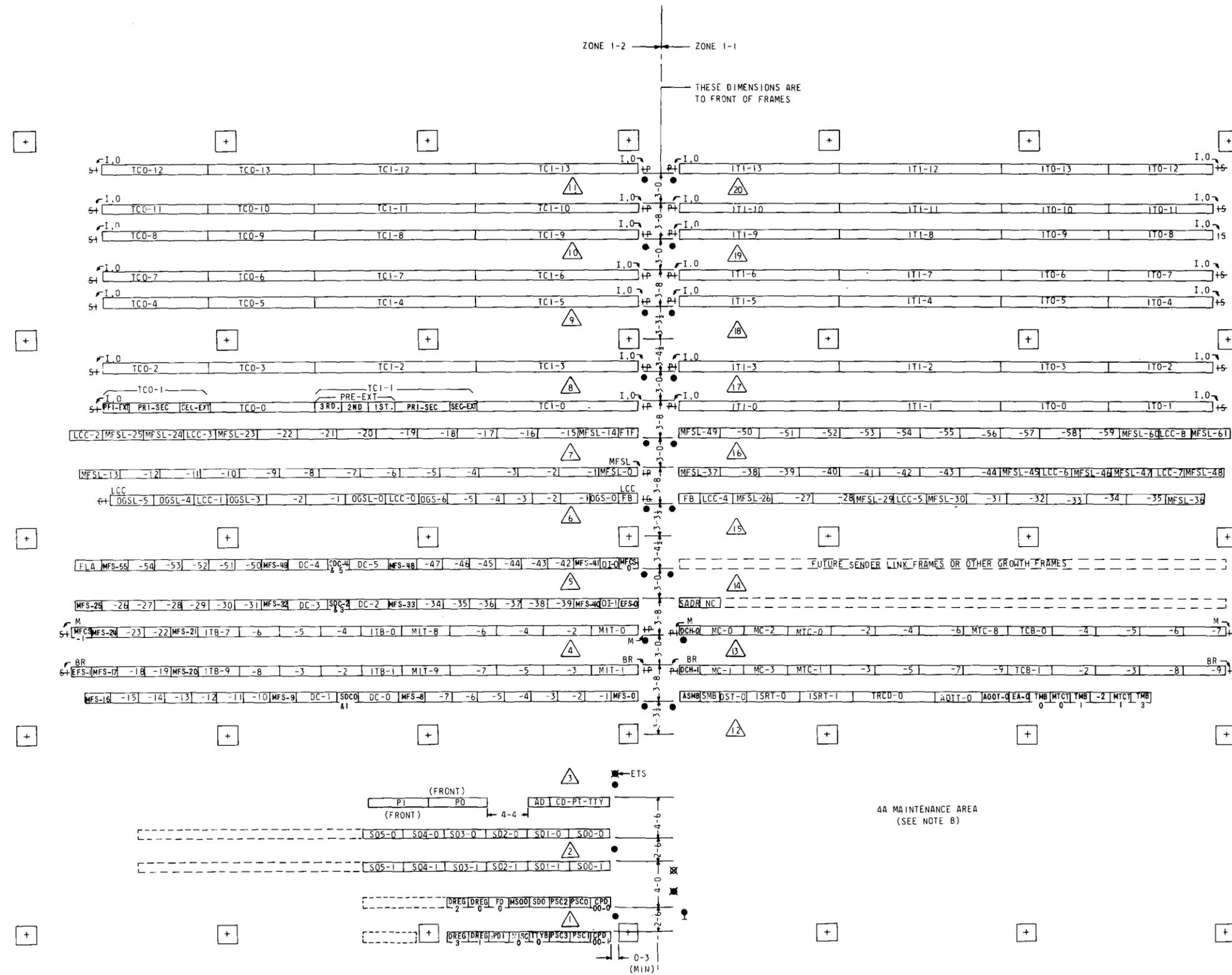


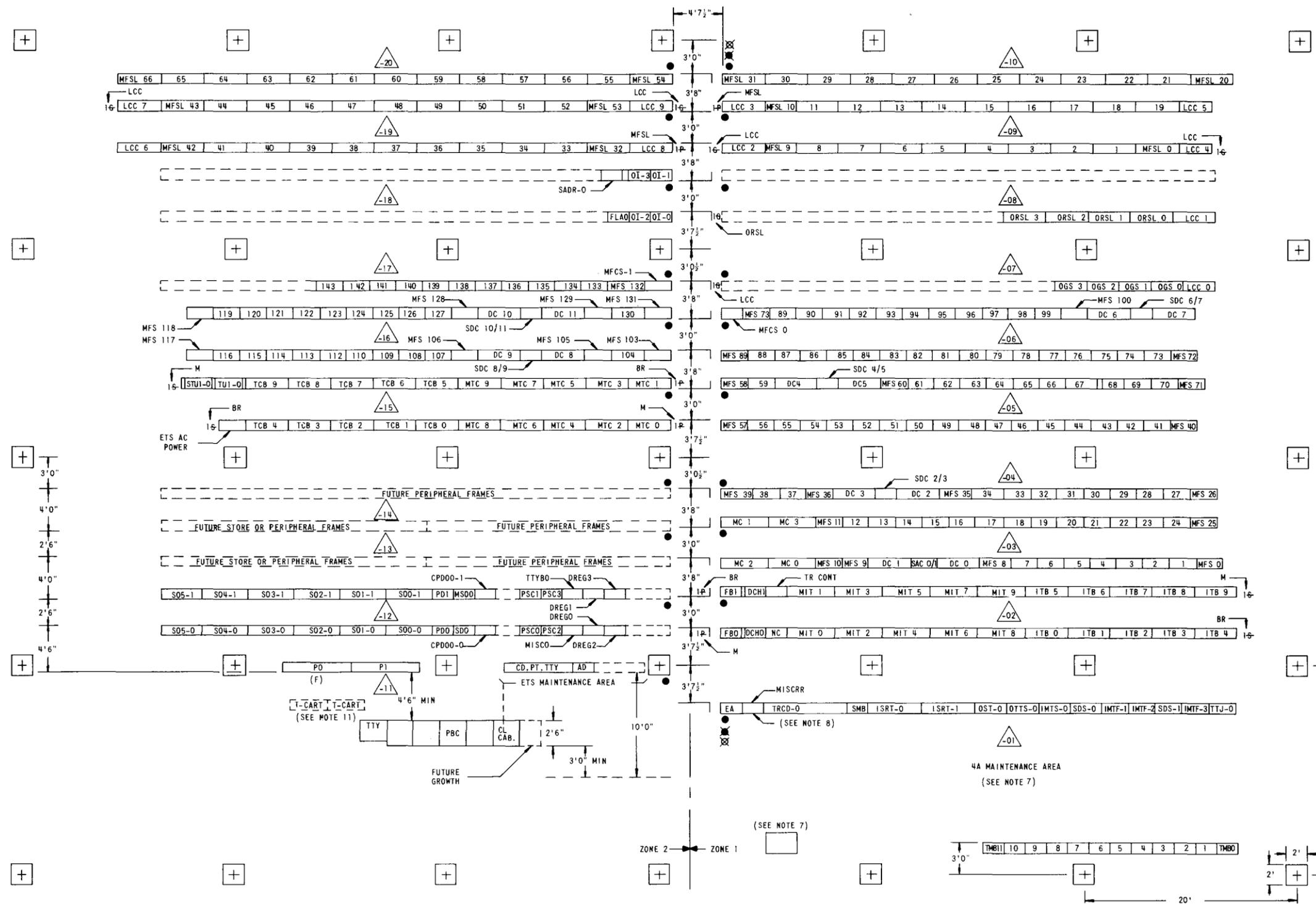
Fig. 2—Equipment Schematic (CAMA)



NOTES:

1. THE FLOOR PLAN DATA BOOK SHOULD BE CONSULTED FOR ADDITIONAL FLOOR PLAN LAYOUT REQUIREMENTS AND SIZES OF FRAMES. ALSO SEE FIG. 6.
2. EXPLANATION OF SYMBOLS
  - + D.P.T.S.
  - +6 GROUPING T.S.
  - +5 SECONDARY D.P.T.S.
  - △ AISLE NUMBER
  - AISLE PILOT LIGHT
  - ✱ MAIN CROSS AISLE PILOT LIGHT
  - EXIT PILOT LIGHT
  - ✱ OTHER FLOOR PILOT LIGHT
  - APPROX. EMERG. ALARM ZONE BOUNDARY
3. AN AISLE IS DEFINED AS THE SPACE IN FRONT OF ONE OR TWO LINES OF FRAMES BETWEEN TWO ADJACENT CROSS AISLES. AISLE NUMBERING SHALL BE IN ACCORDANCE WITH THE FOLLOWING:
  - (A) THE AISLE NUMBERS SHALL BE CONSECUTIVE FROM 1 UP, BEGINNING AT THE OUTSIDE END OF THE MAIN CROSS AISLE WHICH IS NEAREST THE M.D.F. SIDE OF THE BUILDING. THE MAIN CROSS AISLE AS REFERRED TO HEREIN SHALL BE THE CROSS AISLE NEAREST THE MAINTENANCE CENTER.
  - (B) THE PROGRESSION OF NUMBERING SHALL BE IN A DIRECTION TOWARD THE GROWING END OF THE BUILDING OR AWAY FROM THE MAIN-CROSS AISLE.
  - (C) NUMBERS SHALL BE RESERVED FOR ALL POSSIBLE FUTURE AISLES IN A GIVEN BLOCK OF FRAMES, SUCH AS UNEQUIPPED LINES AND LINES OF FRAMES IN COLUMN ROWS.
  - (D) THE NUMBERS SHALL BE ASSIGNED ON A UNIFORM BASIS AS FAR AS POSSIBLE, I.E. WHERE THE MAXIMUM NUMBERS REQUIRED AT ANY ONE SECTION OF A GIVEN FLOOR IS 16-20 (A 5-BAY BUILDING), A GROUP OF 20 NUMBERS SHALL BE ALLOTTED FOR EACH BLOCK OF FRAMES SO THAT THE FIRST NUMBER IN CONSECUTIVE BLOCKS SHALL BE 1, 21, 41, 61 ETC. WHERE THE MAXIMUM NUMBER REQUIRED IS 15 OR LESS (A 4-BAY BUILDING), THE NUMBERING SHALL BE CONTINUOUS THROUGHOUT ALL BLOCKS SUCH AS 1-12, 13-22, 23-37, 38-52 ETC.
  - (E) THE NUMBERS OR BLOCKS OF NUMBERS SHALL BE CONSECUTIVE FOR ALL EQUIPMENT MAINTENANCE AISLES SERVED BY A COMMON ALARM FRAME, REGARDLESS OF THE NUMBER OF FLOORS INVOLVED.
4. WHEN A COMBINED TRAIN INSTALLATION IS ARRANGED FOR ULTIMATE CONVERSION TO SEPARATE TRAIN COMBINED OPERATION, THE INITIAL MARKERS, INCOMING LINK FRAMES, AND OUTGOING LINK FRAMES SHALL BE STAMPED WITH INTERTOLL TRAIN DESIGNATIONS.
5. THE AITT (AUTOMATIC INCOMING TRUNK TEST FRAME) AND ASMB (AUXILIARY SENDER MAKE BUSY FRAME) ARE FURNISHED WHEN CAMA OPERATION IS REQUIRED. THE FLOOR PLAN LAYOUT FOR OTHER CAMA FRAMES SHALL BE SIMILAR TO THE TYPICAL FLOOR PLAN LAYOUT FOR CAMA EQUIPMENT SHOWN IN FIG. 5.
6. ASSOCIATED TRUNK EQUIPMENT AND GROWTH LINK FRAMES WILL BE LOCATED ON OTHER FLOORS.
7. CONSULT FLOOR PLAN DATA SHEET SECT. 10-B, SHEET 1 AND SECT. 7.1, SHEETS 109-113 BEFORE LAYING OUT THE ETS FRAMES.
8. THIS AREA WILL CONTAIN THE MAINTENANCE PERSONNEL DESKS, RECORDS, 35 TYPE TELETYPEWRITERS FOR THE AOTT AND AOOT FRAMES AND THE ETS CHANNEL 10, AND OTHER ASSOCIATED TERMS.

Fig. 3—Typical Floor Plan — Switching Area — Separate Train Combined — Operation Office (Non-CAMA) — Electronic Translator Office



- NOTES:
1. THE FLOOR PLAN DATA BOOK, SECTION 7:1, SHEET 10.1 TO 10.8, SHOULD BE CONSULTED FOR ADDITIONAL FLOOR PLAN LAYOUT REQUIREMENTS AND SIZES OF FRAMES. ALSO SEE FIG. 7.
  2. EXPLANATION OF SYMBOLS
    - IP D.P.T.S.
    - 16 GROUPING T.S.
    - 15 SECONDARY D.P.T.S.
    - △ AISLE NUMBER (THE - REPRESENTS THE FLOOR NUMBER)
    - AISLE PILOT LIGHT
    - ⊗ MAIN CROSS AISLE PILOT LIGHT
    - 1 EXIT PILOT LIGHT
    - ⊗ OTHER FLOOR PILOT LIGHT

APPROX EMERG ALARM ZONE BOUNDARY
  3. AN AISLE IS DEFINED AS THE SPACE IN FRONT OF ONE OR TWO LINES OF FRAMES BETWEEN TWO ADJACENT CROSS AISLES. AISLE NUMBERING SHALL BE IN ACCORDANCE WITH THE FOLLOWING:
    - (A) THE AISLE NUMBERS SHALL BE CONSECUTIVE FROM 1 UP, BEGINNING AT THE OUTSIDE END OF THE MAIN CROSS AISLE WHICH IS NEAREST THE M.D.F. SIDE OF THE BUILDING. THE MAIN CROSS AISLE AS REFERRED TO HEREIN SHALL BE THE CROSS AISLE NEAREST THE MAINTENANCE CENTER.
    - (B) THE PROGRESSION OF NUMBERING SHALL BE IN A DIRECTION TOWARD THE GROWING END OF THE BUILDING OR AWAY FROM THE MAIN CROSS AISLE.
    - (C) NUMBERS SHALL BE RESERVED FOR ALL POSSIBLE FUTURE AISLES IN A GIVEN BLOCK OF FRAMES, SUCH AS UNEQUIPPED LINES AND LINES OF FRAMES IN COLUMN ROWS.
    - (D) THE NUMBERS SHALL BE ASSIGNED ON A UNIFORM BASIS AS FAR AS POSSIBLE, I.E. WHERE THE MAXIMUM NUMBERS REQUIRED AT ANY ONE SECTION OF A GIVEN FLOOR IS 16-20 (A 5-BAY BUILDING). A GROUP OF 20 NUMBERS SHALL BE ALLOTTED FOR EACH BLOCK OF FRAMES SO THAT THE FIRST NUMBER IN CONSECUTIVE BLOCKS SHALL BE 1,21,41,61 ETC. WHERE THE MAXIMUM NUMBER IS 15 OR LESS (A 4-BAY BUILDING), THE NUMBERING SHALL BE CONTINUOUS THROUGHOUT ALL BLOCKS SUCH AS 1-12,13-22,23-37,38-52 ETC.
    - (E) THE NUMBERS OR BLOCKS OF NUMBERS SHALL BE CONSECUTIVE FOR ALL EQUIPMENT MAINTENANCE AISLES SERVED BY A COMMON ALARM FRAME, REGARDLESS OF THE NUMBER OF FLOORS INVOLVED.
  4. THE AITT (AUTOMATIC INCOMING TRUNK TEST FRAME) AND ASMB (AUXILIARY SENDER MAKE BUSY FRAME) ARE FURNISHED WHEN CAMA OPERATION IS REQUIRED. THE FLOOR PLAN LAYOUT FOR OTHER CAMA FRAMES SHALL BE SIMILAR TO THE TYPICAL FLOOR PLAN LAYOUT FOR CAMA EQUIPMENT SHOWN IN FIG. 6.
  5. ASSOCIATED TRUNK EQUIPMENT WILL BE LOCATED ON OTHER FLOORS.
  6. CONSULT FLOOR PLAN DATA SHEET SECT. 10:8, SHEET 1 AND SECT. 7:1, SHEETS 109-113 BEFORE LAYING OUT THE ETS FRAMES.
  7. THIS AREA WILL CONTAIN THE MAINTENANCE PERSONNEL DESKS, RECORDS, 35 TYPE TELETYPEWRITERS FOR ETS CHANNEL 10, AND OTHER ALLOTTED TERMINALS.
  8. MISC RR EQUIPPED WITH SOME REMOTE NETWORK MANAGEMENT UNITS.
  9. A SPARE PARTS CABINET (EDIA 229-10) SHOULD BE PROVIDED IN THE ETS MAINTENANCE CENTER TO HOUSE SPARE PARTS FOR THE 7-0 FRAMES.
  10. END GUARDS ARE NOT SHOWN ON THIS DRAWING. WHEN ADDED, THE RESULTING MAIN AISLE IS 4'0\".
  11. T CARTS ARE REQUIRED DURING INSTALLATION ONLY.

Fig. 4—Typical Floor Plan—Common Control



SIDE OF ROOM NEAREST MAINTENANCE CENTER

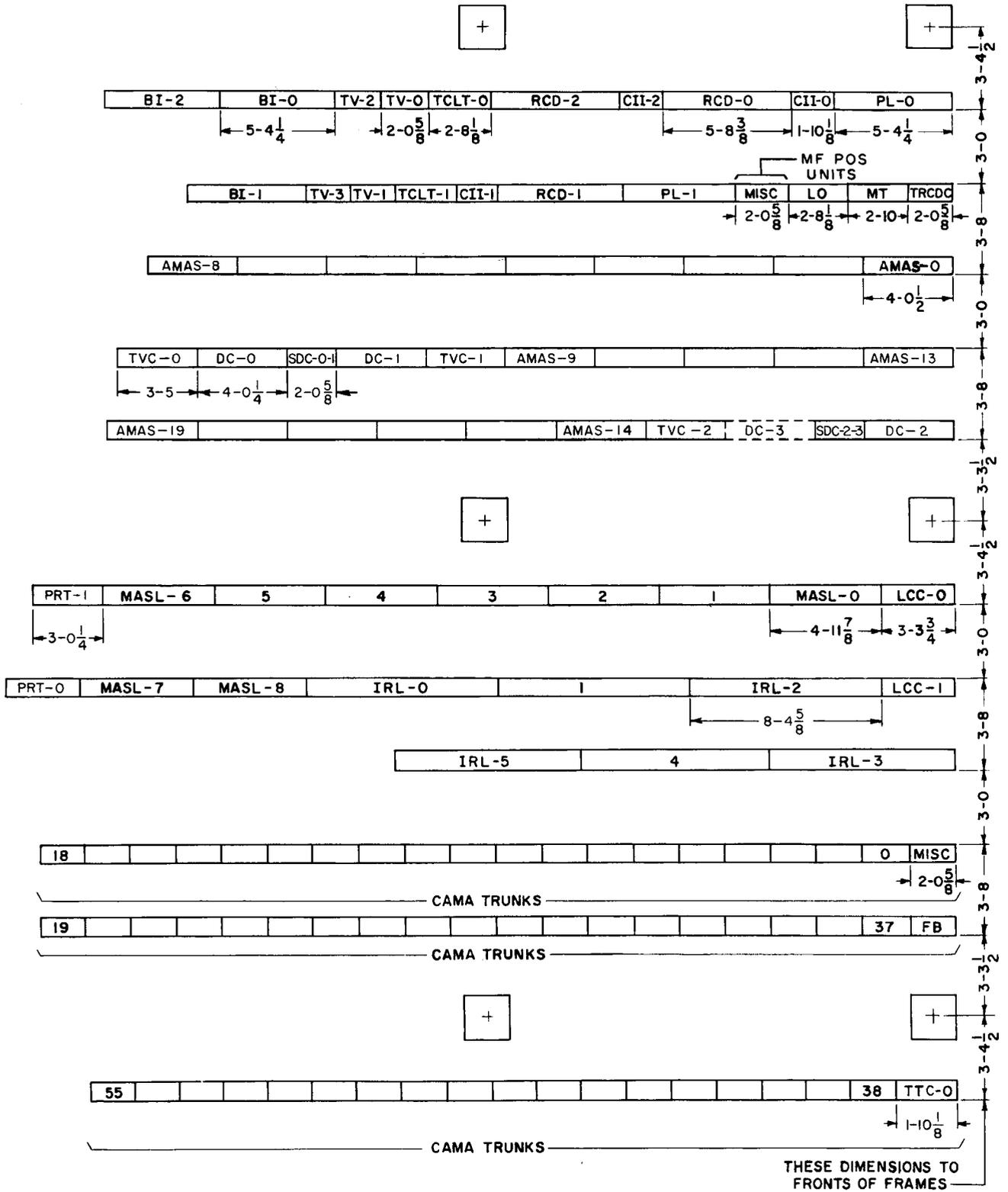


Fig. 6—Typical Floor Plan CAMA

FRAME NAME	EQUIPMENT CODE	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Incoming Basic	J67493A & B	ITI, TCI, or I	5 ft 4-1/4 in.	2	8
Juncture Extension	J67493C		2 ft 8-1/8 in.	1	
Trunk Extension	J67493D		2 ft 8-1/8 in.	1	
Outgoing Basic	J67494A & B	ITO, TCO, or O	5 ft 4-1/4 in.	2	9
Junction Extension	J67494C		2 ft 8-1/8 in.	1	
Trunk Extension	J67494D		2 ft 8-1/8 in.	1	
Marker	J67440A	MIT, MTC, or M	4 ft 8-3/4 in.	2	10
Marker Connector (separate Train)	J67446J	MC	4 ft 5-1/4 in.	2	11
Decoder Connector (12 DR, 10 MIT-Markers)	J67449Y	DC	4 ft 0-1/2 in.	1	12
Separate and Combined Train Supplementary Decoder Connectors (10 MTC-Markers, 8 Connectors)	J67449AA	SDC	2 ft 0-5/8 in.	1	13
Separate and Expanded Combined Train					
Link Controller and Connector	J67407F	LCC	3 ft 3-3/4 in.	1	14
Incoming Multifrequency Sender	J67468A	MFS	2 ft 8-1/8 in.	1	15
Incoming Dial Pulse Sender	J67430	DPS	4 ft 7-1/2 in.	2	16
Overseas Sender	J67467	OVSS	4 ft 0-1/2 in.	1	17
Outgoing Sender	J67413	OGS	2 ft 10 in.	1	18
Incoming or Outgoing Sender Link	J67402	MFSL or ORSL	3 ft 11-1/4 in.	2	19
CAMA or Overseas Sender Link	J67454	MASL or OVSSL	4 ft 11-7/8 in.	2	20
Multifrequency Current Supply	J98609	MFCS	2 ft 0-5/8 in.	1	21
Incoming Register and Link	J67457	IRL	Basic	2	22
			5 ft 8-3/8 in.		
			Supl	1	
			2 ft 8-3/8 in.	1	
Block Relay	J67408B	ITB, TCB, or BR	4 ft 0-1/2 in.	1	23
Traffic Usage Interface	J67509A	TU1	3 ft 0-1/4 in.		24
Supplementary Traffic Usage Interface	J67509B	ST01	3 ft 0-1/4 in.		25
Traffic Control	J67444E	TR CONT	2 ft 0-5/8 in.	1	26
Network Control	J67444E	NC	2 ft 0-5/8 in.	1	27
Circuit Busy Announcement	J67448	CBA	2 ft 8-1/8 in.	1	28
Announcement	J99324	ANN	2 ft 0-5/8 in.	1	29
Trouble Tracing Selector	J67427	TT	2 ft 0-5/8 in.	1	30
Outgoing Trunk Identification	J67465	OGTI	2 ft 8-1/8 in.	1	31
Supplementary Outgoing Trunk Identification	J67465	SOGTI	2 ft 8-1/8 in.	1	32
Office Interrupter	J67422	OI	1 ft 10-1/2 in.	1	—
Marker Connector (Combined Train)	J67446	MC	2 ft 2-5/8 in.	1	—
Floor Alarm Units	J67423	FLA	2 ft 0-5/8 in.	1	—

Fig. 7—Frame Sizes (Sheet 1 of 4)

FRAME NAME	EQUIPMENT CODE	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Traffic Supervisory Rack	J62604	TSR	2 ft 1-11/16 in.	1	—
Relay Rack	ED-68537-( )	—	2 ft 0-5/8 in.	1	—
Trunk Frame	J67466	TUB, TUC	2 ft 0-5/8 in.	1	—
Trunk Frame	J67466	TUA	2 ft 8-1/8 in.	1	—
Trunk Frame (Plug-In)	J67466	II, IT, OGI, 2I, OS	2 ft 8-1/8 in.		
Fuse Bay	J97033	—	2 ft 0-5/8 in.	1	—
Decoder Channel	J67471	DCH	2 ft 2-5/8 in.	1	
Peripheral Scanner	J67472	PSC	2 ft 2 in.	1	
Distributor Register	J67473	DREG	2 ft 2 in.	1	
Alarm and Display	J67474	AD	2 ft 2 in.	1	
Power Distributing	J67475	PD	2 ft 2 in.	1	
Processor	J1C020	P	6 ft 6 in.	3	
Control and Display, Program Tape, and Teletypewriter Frame	J1C021	CD-PT-TTY	6 ft 6 in.	3	
Teletypewriter Buffer	J67479	TTYB	2 ft 2 in.	1	
Master Scanner Frame	J1C022	MS	2 ft 2 in.	1	
Signal Distributor	J1C023	SD	2 ft 2 in.	1	
Central Pulse Distributor	J1C024	CPD	2 ft 2 in.	1	43
Store	J1C026	S	4 ft 4 in.	2	44
Miscellaneous	J67492	MISC	2 ft 2 in.	1	—
Interface and Control Cabinet	J67508		2 ft 3 in.	1	45
Trunk Class Translator	J67459	TCLT	2 ft 8-1/8 in.	1	46
Supplementary Trunk Class Translator	J67459	STCLT	2 ft 8-1/8 in.	1	47
Transverter Connector	J67464	TVC	3 ft 5 in.	1	48
Transverter		TV	2 ft 0-5/8 in.	1	49
Trouble Recorder Connector	J67460	TRCDC	2 ft 0-5/8 in.	1	50
Billing Indexer	J22464	BI	5 ft 4-1/4 in.	2	51
Supplementary Billing Indexer	J22464	BIS	2 ft 10 in.	1	52
Auxiliary Billing Indexer	J22464	BIA	2 ft 0-5/8 in.	1	53
Call Identity Indexer	J22151	CII	1 ft 10/1/8 in.	1	54
Recorder	J22462	RCD	5 ft 8-3/8 in.	1	55
Perforator Cabinet		[A-]	2 ft 8 in. by 1 ft 10-1/2 in.	—	56
Computerized Recording (AMA)	J1P004	CAMA-C	17.6 ft 18.4 in.		57
Master Timer	J22451	MT	2 ft 10 in.	1	58
Position Link	J28053	PL	5 ft 4-1/4 in.	2	59
Pretranslator	J67469	PRT	3 ft 0-1/4	1	60
CAMA Sender	J67454	AMAS	4 ft 0-1/2 in.	1	61
CAMA Switchboard	J21350	[1]	1 ft 10 in. by 4 ft 3 in.	(1 Sec) (2 Pos)	74
Trunk Frame	J67466	AMAT	2 ft 0-5/8 in.	1	—

Fig. 7 — Frame Sizes (Sheet 2 of 4)

FRAME NAME	EQUIPMENT CODE	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Trouble Recorder	J67443	TRCD	8 ft 2-3/8 in.	3	62
Incoming Sender and Register Test	J67462	ISRT	5 ft 4-1/4 in.	2	63
Outgoing Sender Test	J67436	OST	2 ft 8-1/8 in.	1	64
Sender Make-Busy	J67435	SMB	2 ft 0-5/8 in.	1	65
Auxiliary Sender Make-Busy	J67435	ASMB	2 ft 0-5/8 in.	1	66
Automatic Outgoing Toll Connecting Trunk Operational Test	J67418	AOOT	2 ft 8-1/8 in.	1	67
Automatic Outgoing Toll Connecting Trunk Transmission Test	J67418	AOTT	4 ft 8-3/4 in.	2	68
Automatic Outgoing Toll Connecting Trunk Test Connector	J67418	TCC	1 ft 10-1/8 in.	1	69
Manual Test Frame	J67496	MFC	2 ft 8-1/8 in.	1	70
Test and Make-busy Jack Bay	ED-68988-10	TMB	2 ft 0-5/8 in.	1	71
Outgoing Trunk Test Connector	J67513A	OTTC	1 ft 10-1/8 in.	1	72
Automatic Incoming Trunk Test	J67461	AITT	2 ft 0-5/8 in.	1	73
Automatic Incoming Trunk Test Connector	J67461	TCC	1 ft 10-1/8 in.	1	74
Emergency Alarm	J28350	EA	2 ft 0-5/8 in.	1	—
Automatically Directed Outgoing Intertoll Trunk Test Frame	J67478	ADOIT	4 ft 8-3/4 in.	2	76
Automatically Directed Outgoing Intertoll Trunk Test Connector Frame	J67478	ITC	1 ft 10-1/8 in.	1	77
Circuit Patching Bay	J63524	[1]	2 ft 0-3/8 in.	1	—
Trunk Assignment Patching Bay	J67421	[1]	2 ft 0-3/8 in.	1	—
No. 17C Toll Testboard Positions	J63519	[1]	2 ft 0-3/8 in.	1	—
Integrated Manual Test Frame	J99361	IMTF	2 ft 8-1/8 in.	1	78
Test Trunk and VF Link Jack Frame	J99361	TTJ	2 ft 0-5/8 in.	1	—
Voice Frequency Status Display Frame	J99362	STAT DISPL	2 ft 8-1/8 in.	1	79
Status Concentrator Frame	J99363	SC	2 ft 8-1/2 in.	1	80
Outgoing Trunk Testing System	J1P012	OTTS	2 ft 8-1/8 in.	1	81
First Auxiliary Decoder Connector Frame	J67449AM	1st Aux DC	4 ft 0-1/2 in.	1	82
Auxiliary Decoder Connector Frame	J67449AH	Aux DC	4 ft 0-1/2 in.	1	83
Outputer Link Frame	J67499A	OPL	5 ft 4-1/4 in.	2	84
Outputer Link Controller Frame	J67501A	OPLC	2 ft 8-1/8 in.	1	85
Outputer Frame	J67468A	OP	2 ft 8-1/8 in.	1	—
Transceiver and Connector Frame	J67516A	TRCVR/Conn	3 ft 0-1/2 in.	1	86
CCIS Trunk Frame	J67466F	2C/OROCC	2 ft 8-1/8 in.	1	—
Outputer Link Controller Test Frame	J67508A	OPLEF	2 ft 0-5/8 in.	1	87
CCIS Intraoffice Trunk Test Frame	J67515A	CIOT	2 ft 0-5/8 in.	1	88

Fig. 7—Frame Sizes (Sheet 3 of 4)

FRAME NAME	EQUIPMENT CODE	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Distributor and Scanner Frame	J67511A	DAS	6 ft 6 in.	2	89
IGFET Store Frame	J1C083A	IGFETS	2 ft 2 in.	1	90
CCIS Terminal Frame	J67504A	CCISTG Basic	4 ft 4 in.	2	91
CCIS Terminal Group Supplementary Frame	J67504B	CCISTG Suppl	2 ft 2 in.	1	92
Voice Frequency Access Frame	J67514A	VFL	2 ft 2 in.	1	93
Intermediate Distributing	ED-68218-01	IDF	—	—	—
Trunk Distributing	ED-68169-01	TDF	—	—	—
Trunk Assignment Distributing	J67434	ITADF, TCADF, or ADF			

Fig. 7—Frame Sizes (Sheet 4 of 4)



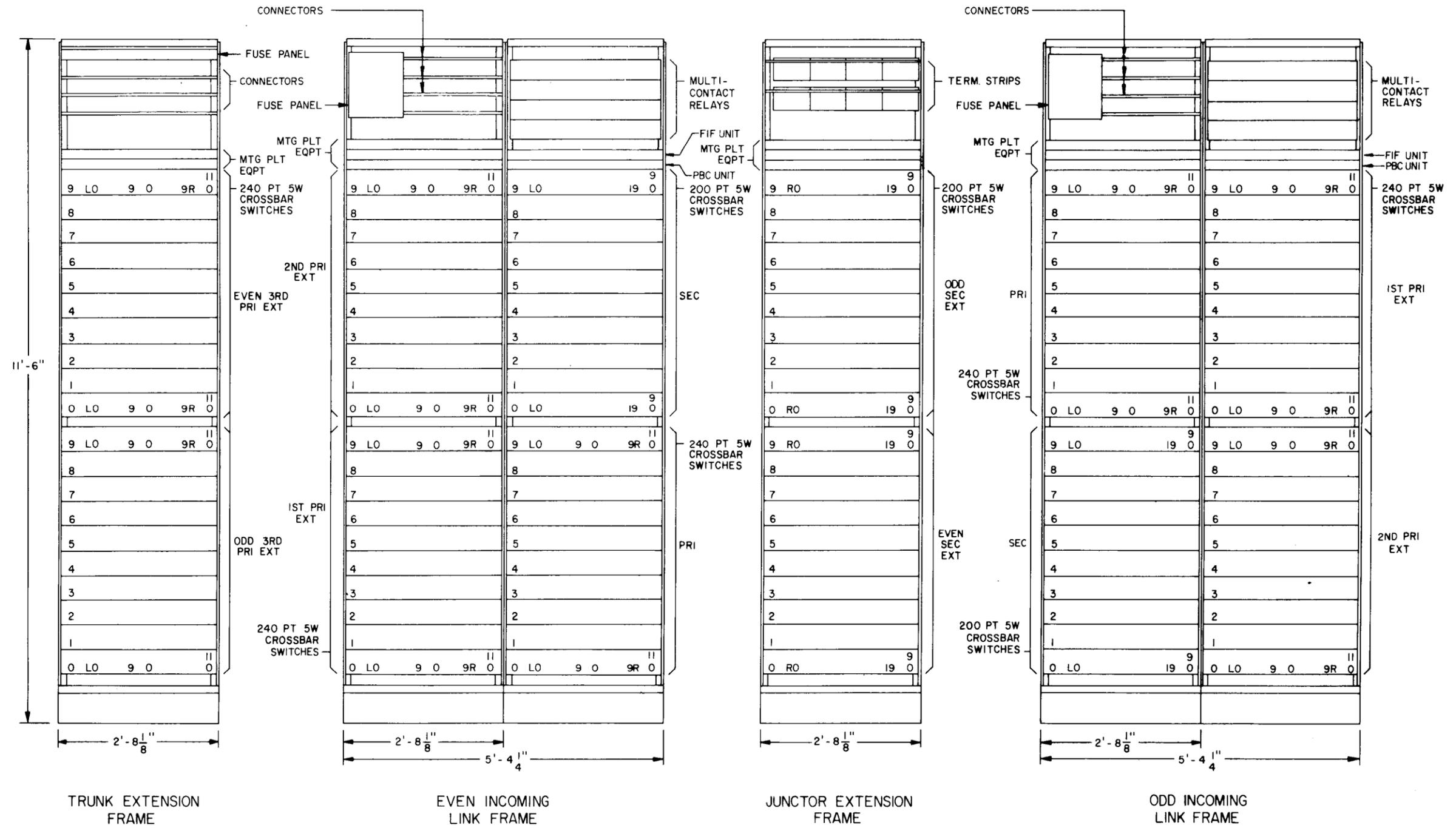


Fig. 8—Incoming Frame

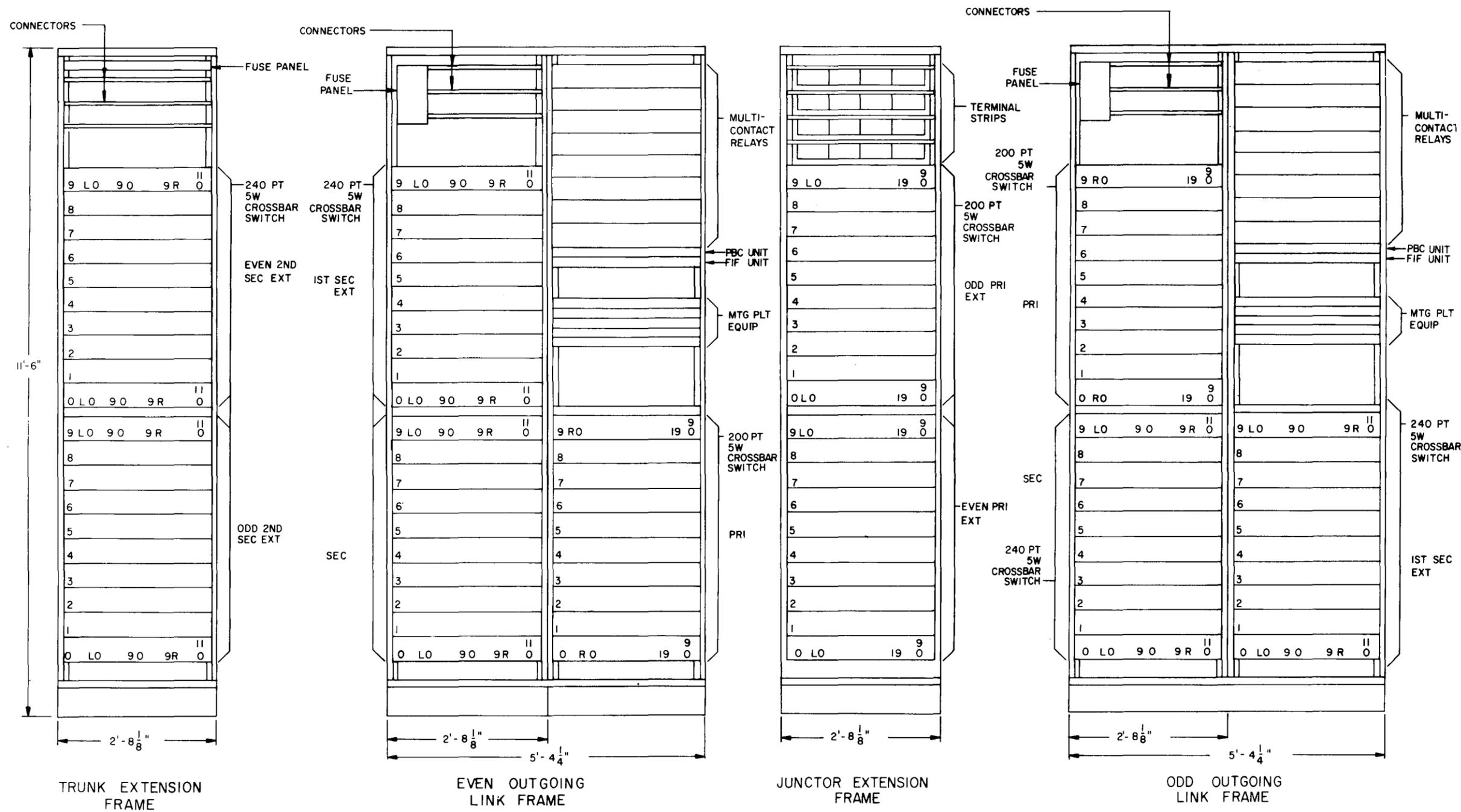


Fig. 9—Outgoing Frame

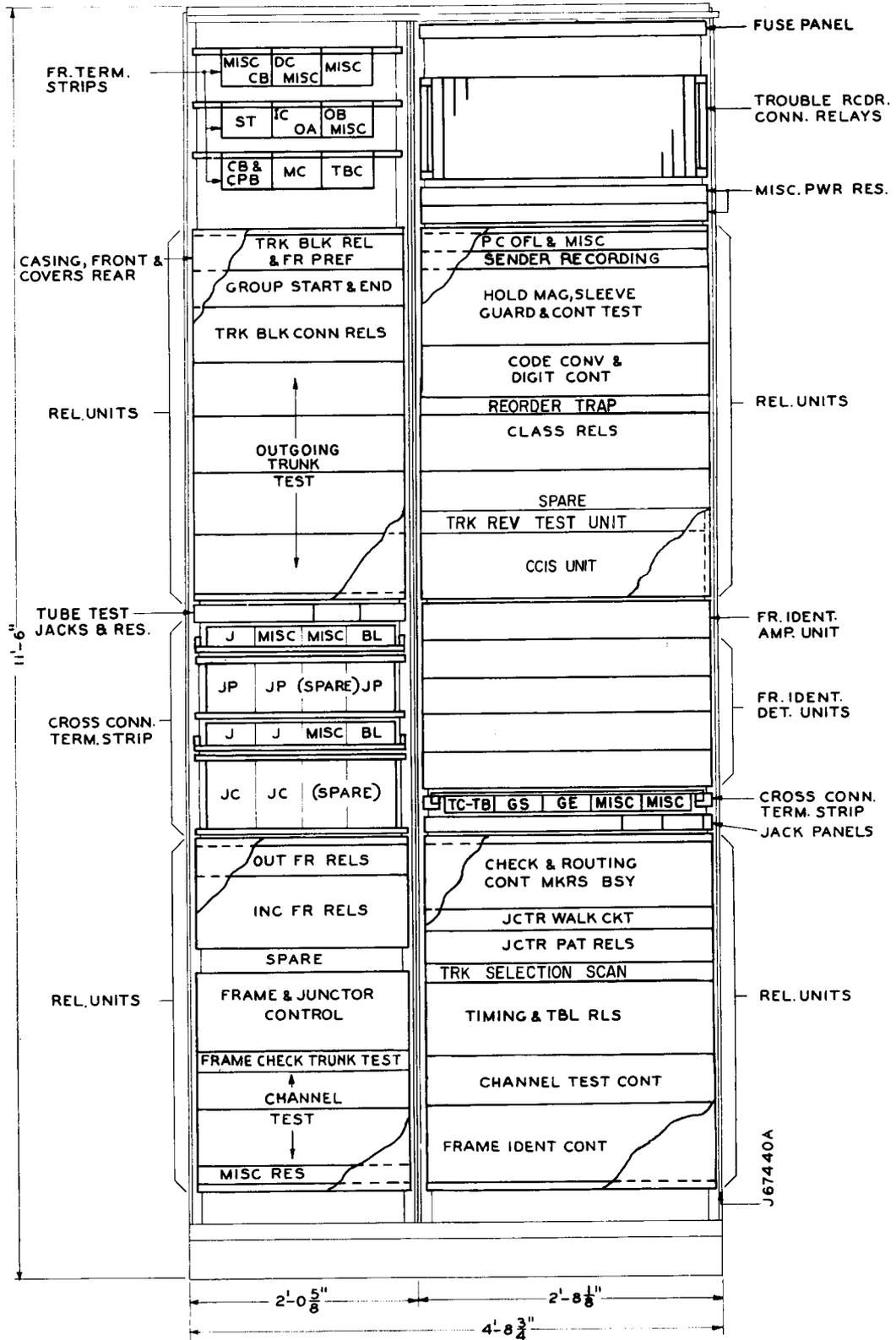


Fig. 10—Marker Frame

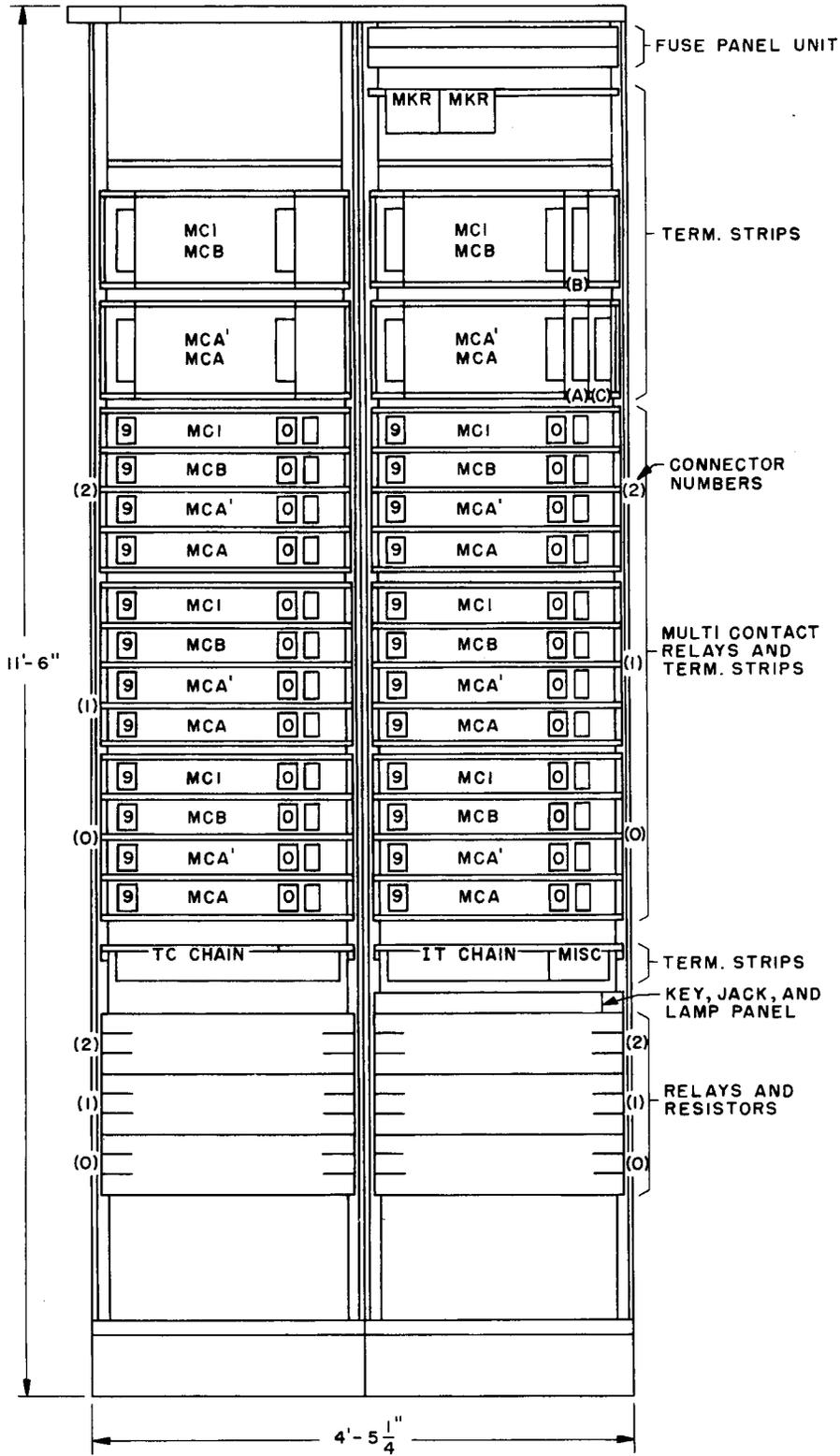


Fig. 11 — Marker Connector Frame for Use in Separate Train Offices

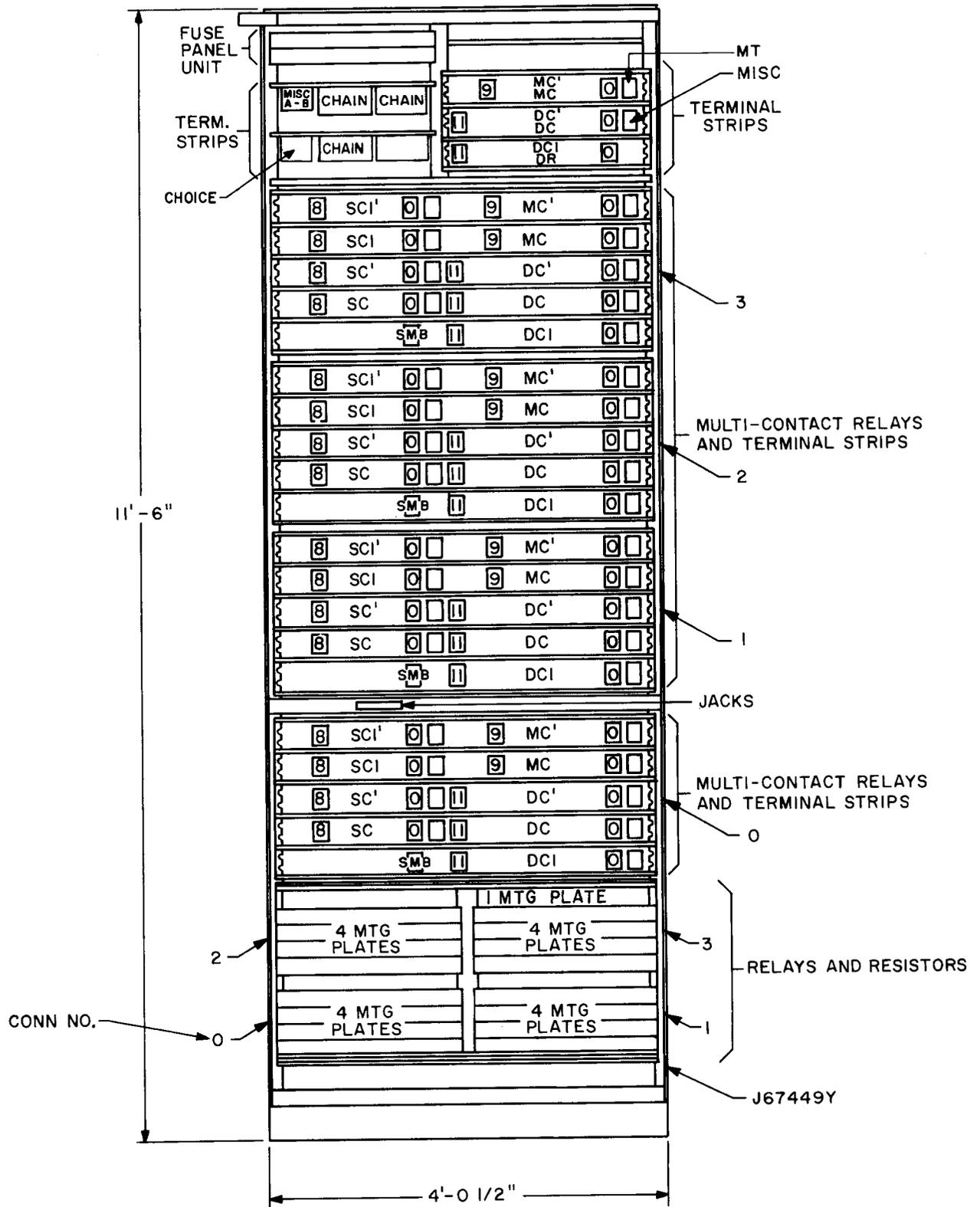


Fig. 12—Decoder Connector Frame for Separate or Combined Train Offices

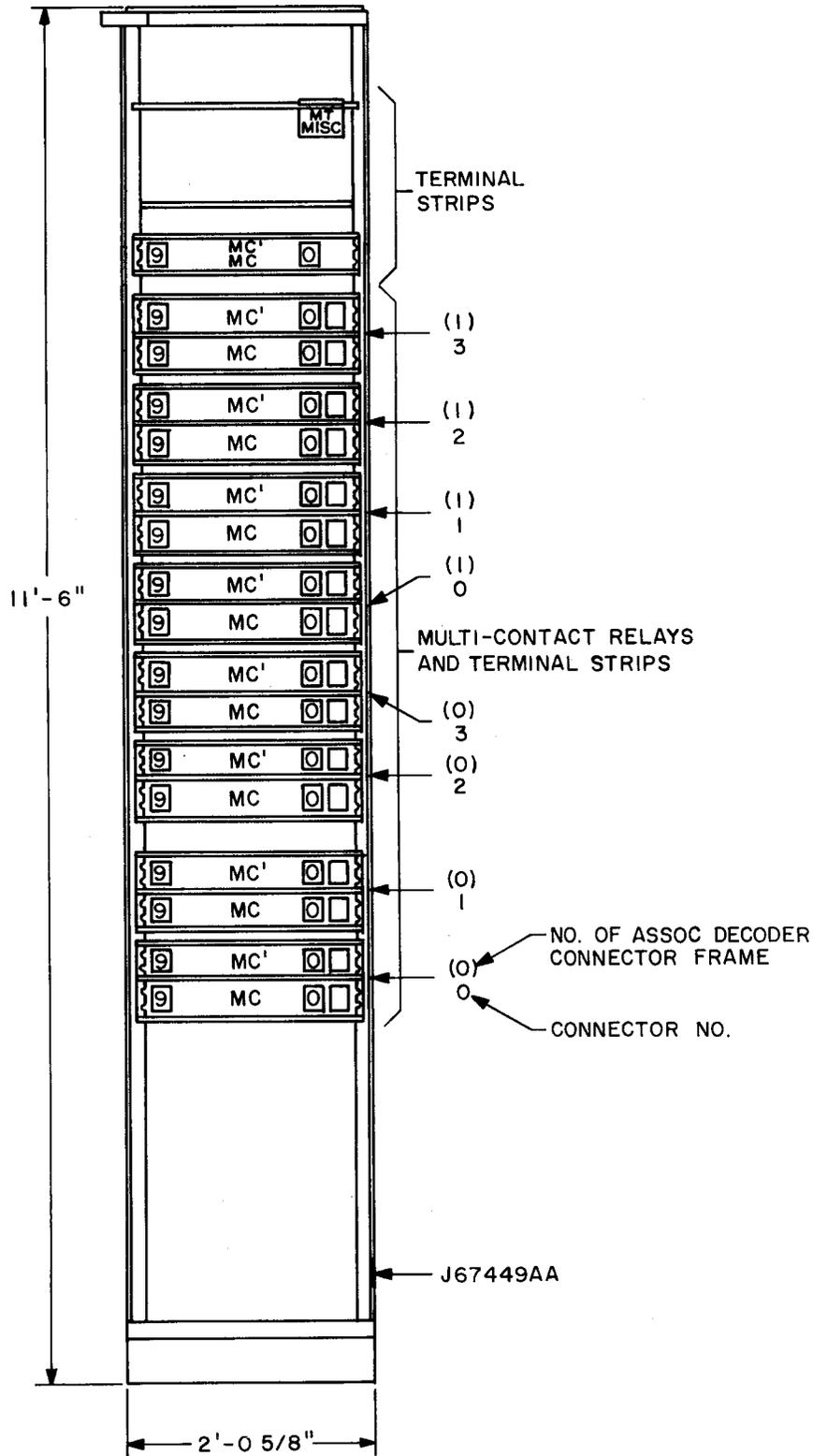


Fig. 13—Supplementary Decoder Connector Frame for Use in Separate Train Offices, Combined Train or Offices Expanded to Separate Train Combined

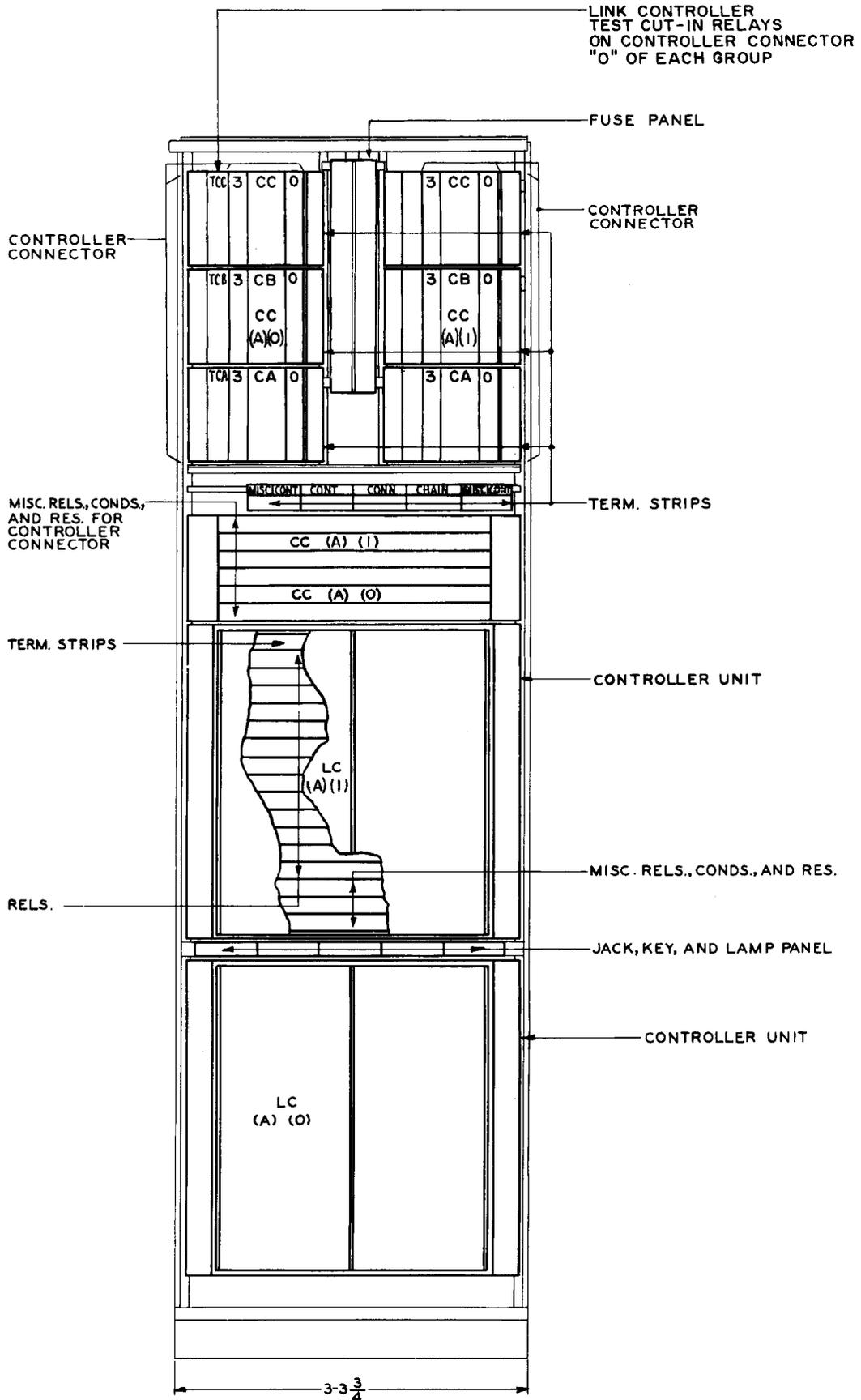


Fig. 14—Link Controller and Connector Frame

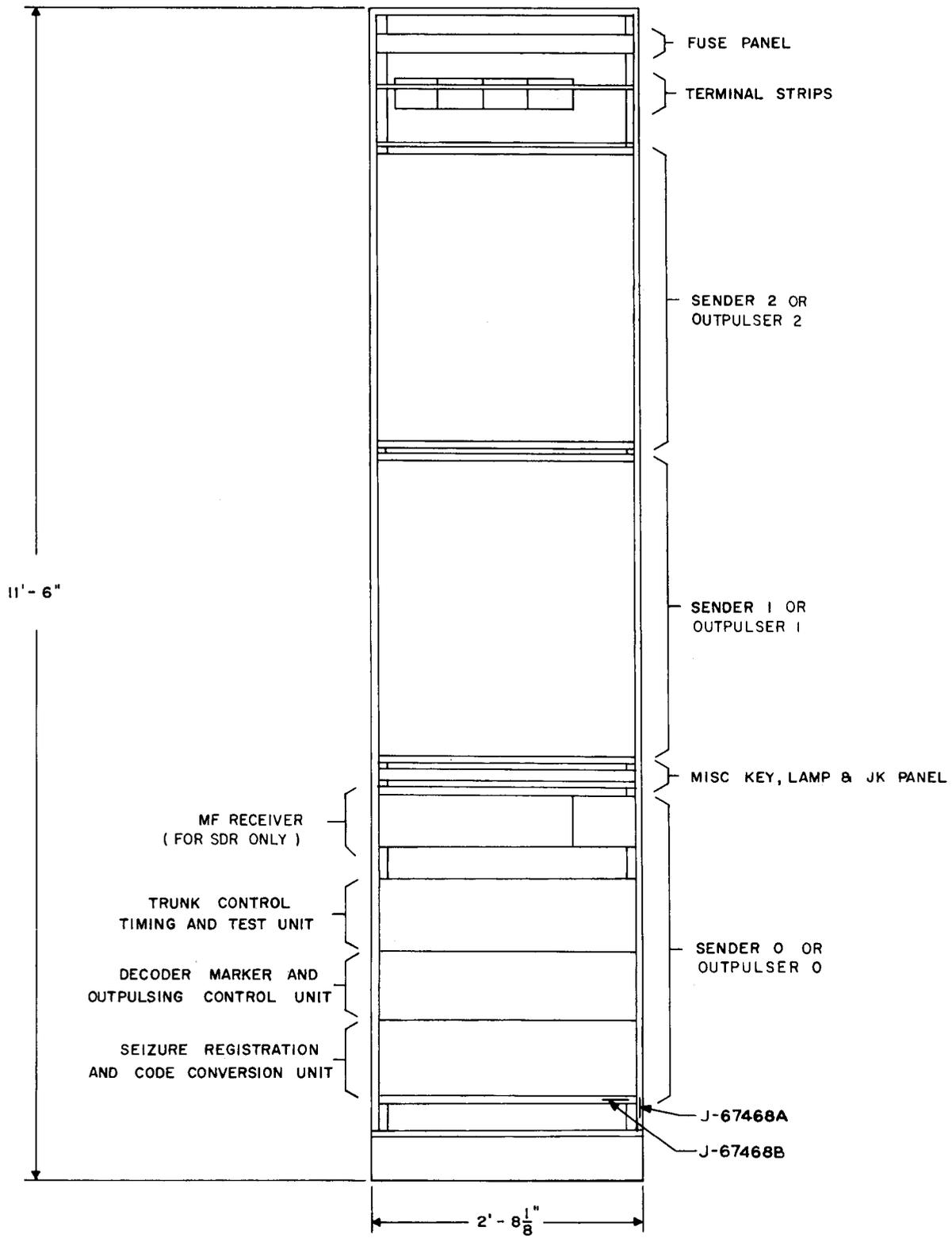


Fig. 15 — Incoming Multifrequency Sender Frame



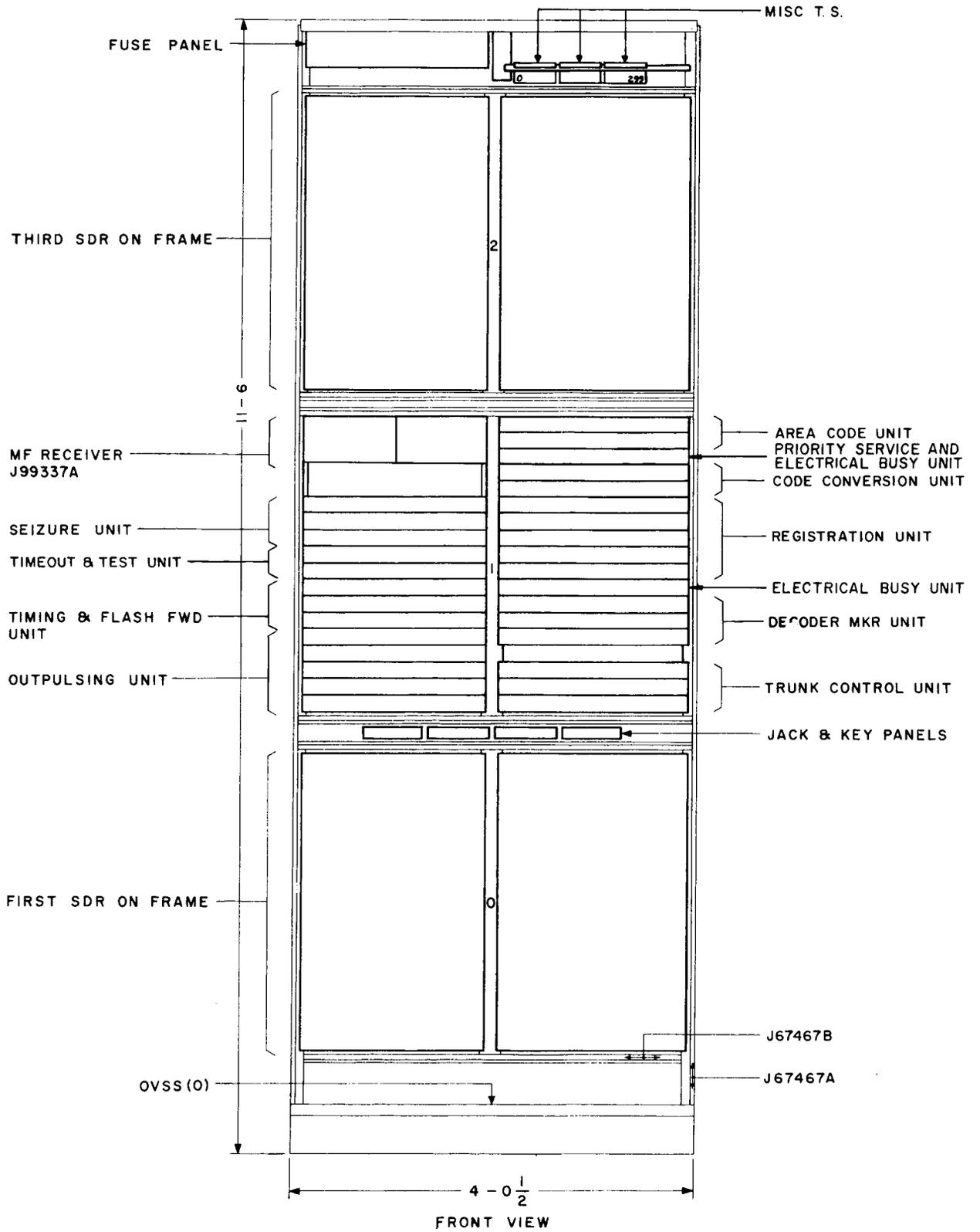


Fig. 17—Overseas Sender Frame

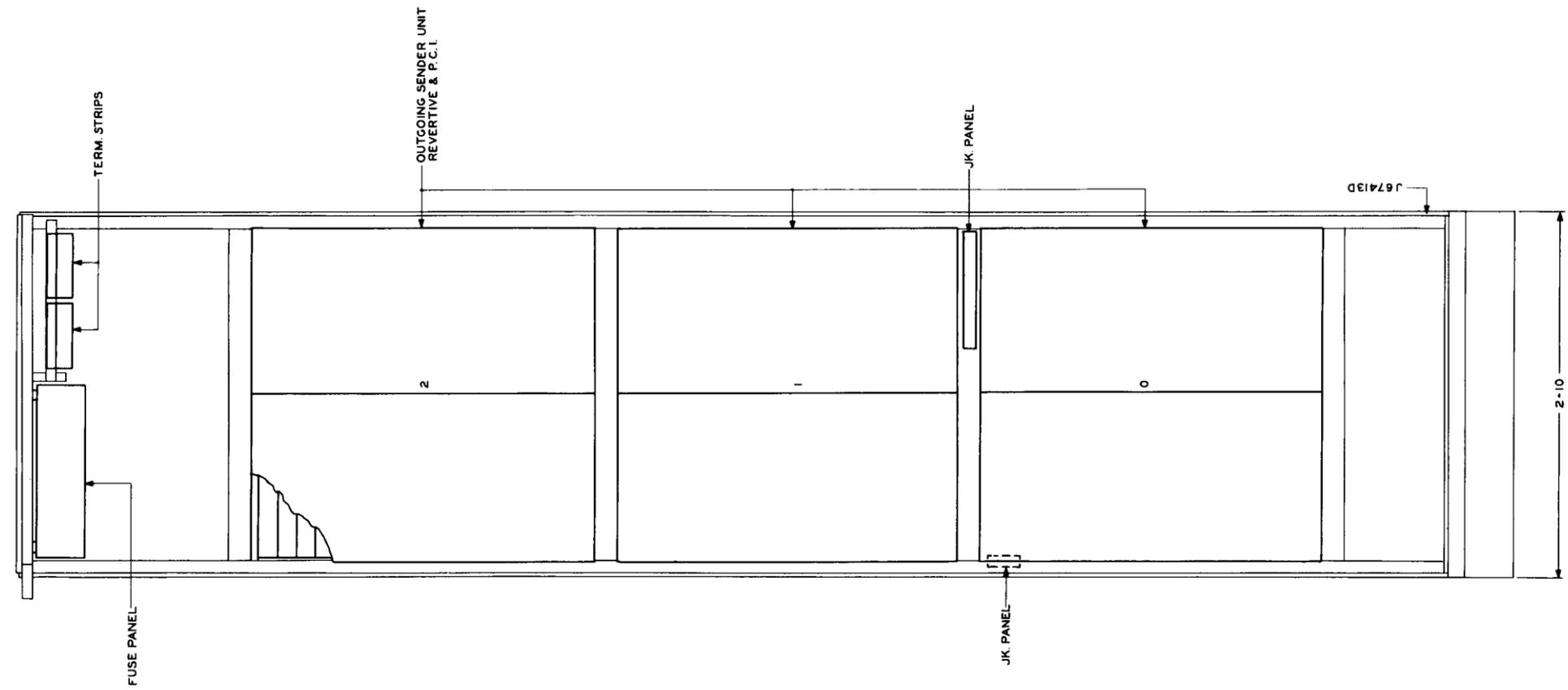


Fig. 18—Outgoing Sender Frame



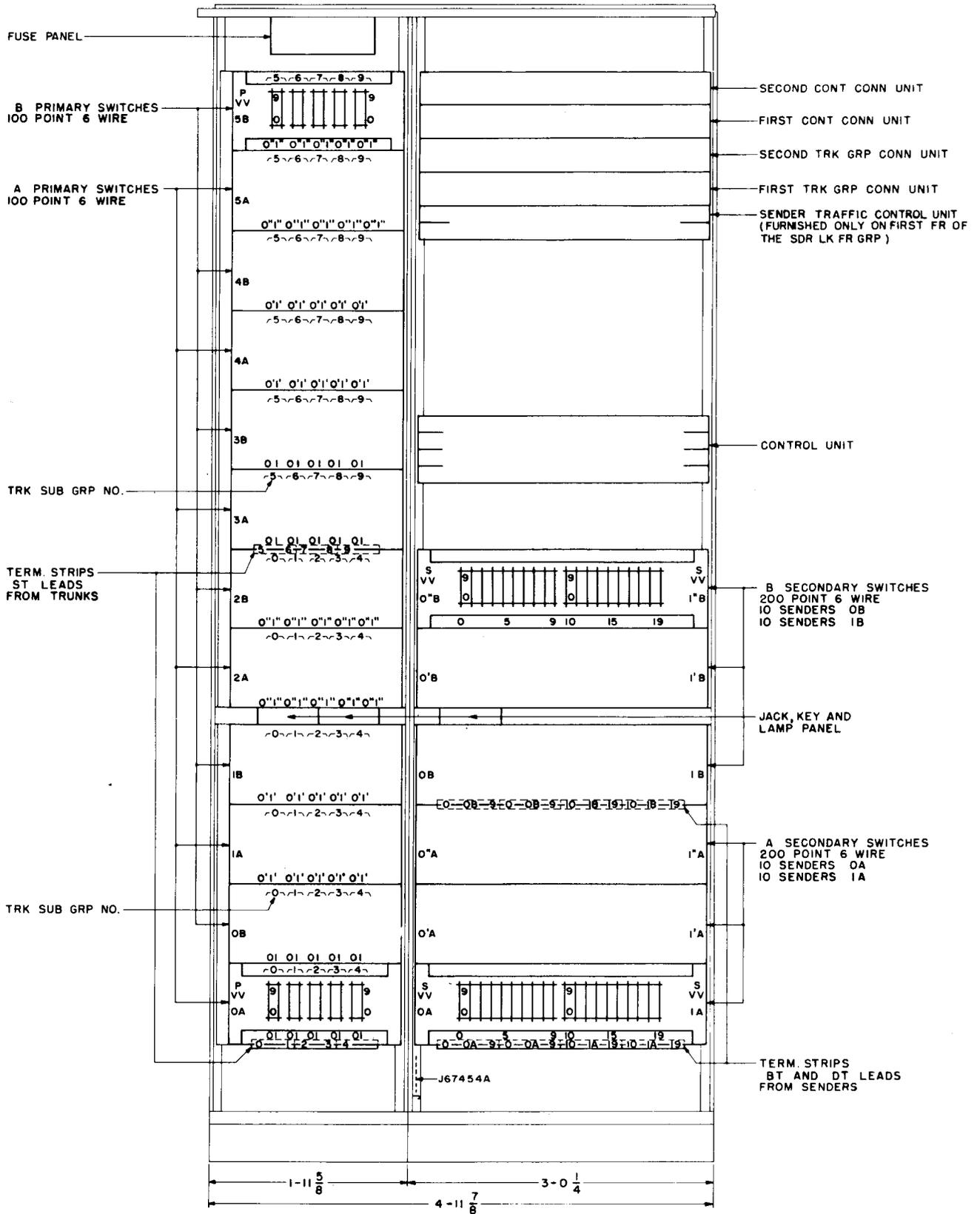


Fig. 20—CAMA or Overseas Sender Link Frame

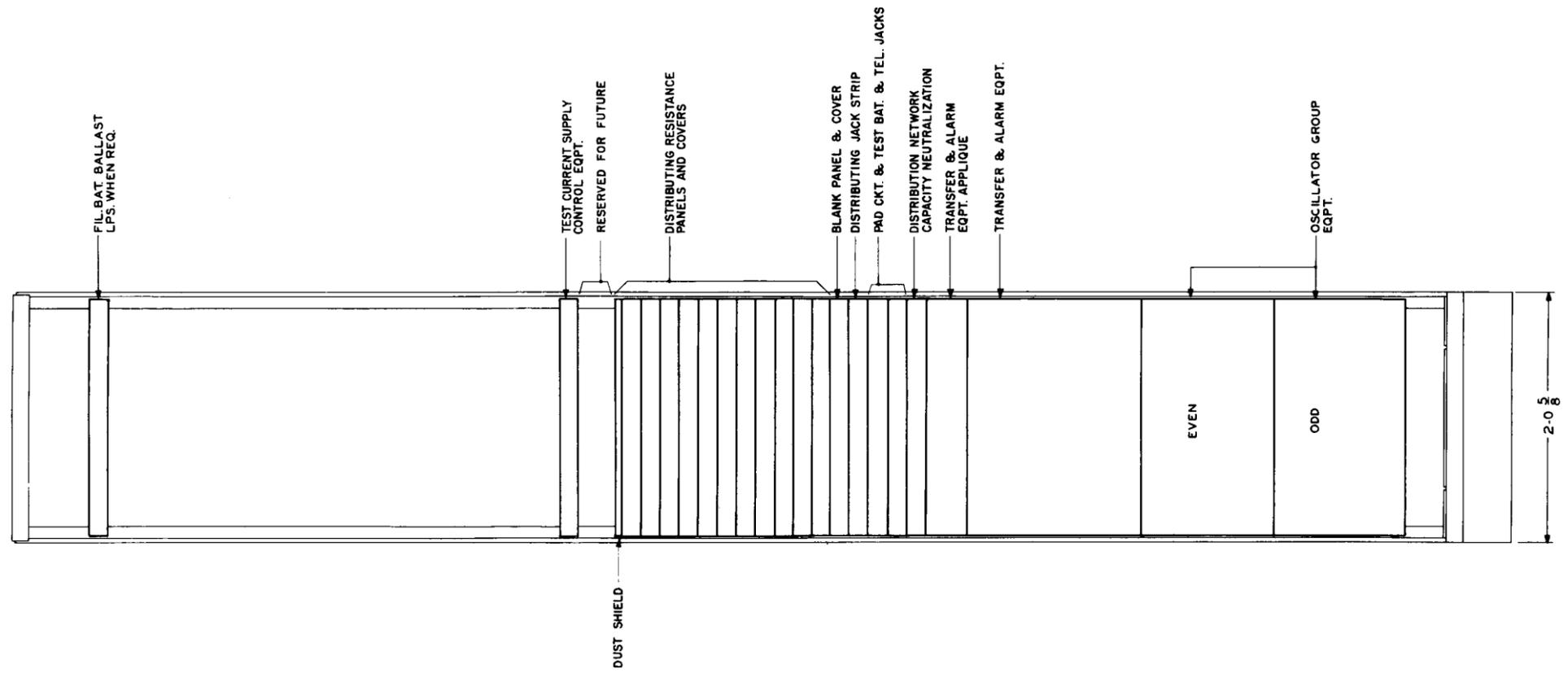


Fig. 21 — Multifrequency Current Supply Frame

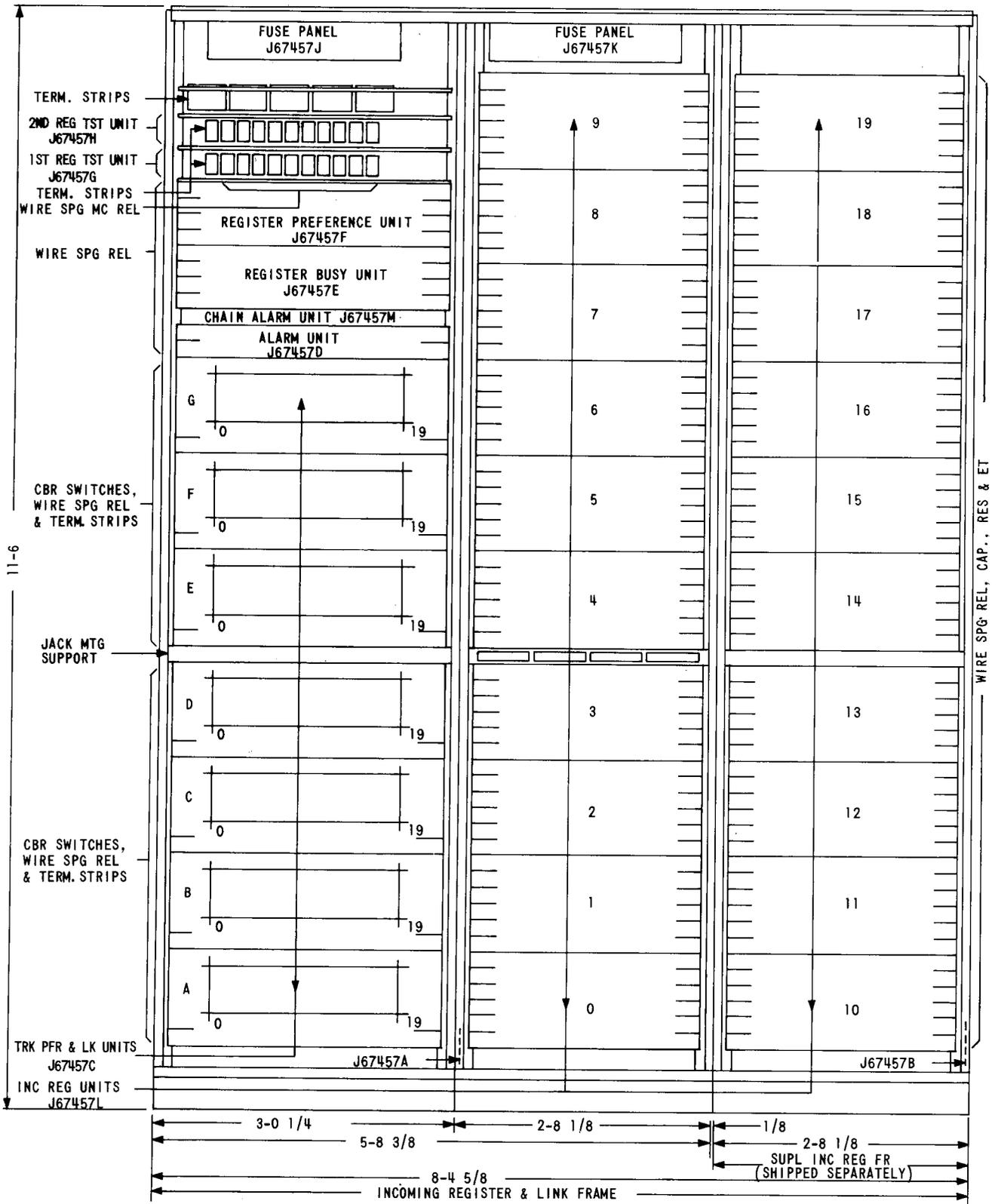


Fig. 22 — CAMA and Non-CAMA Incoming Register and Link Frame

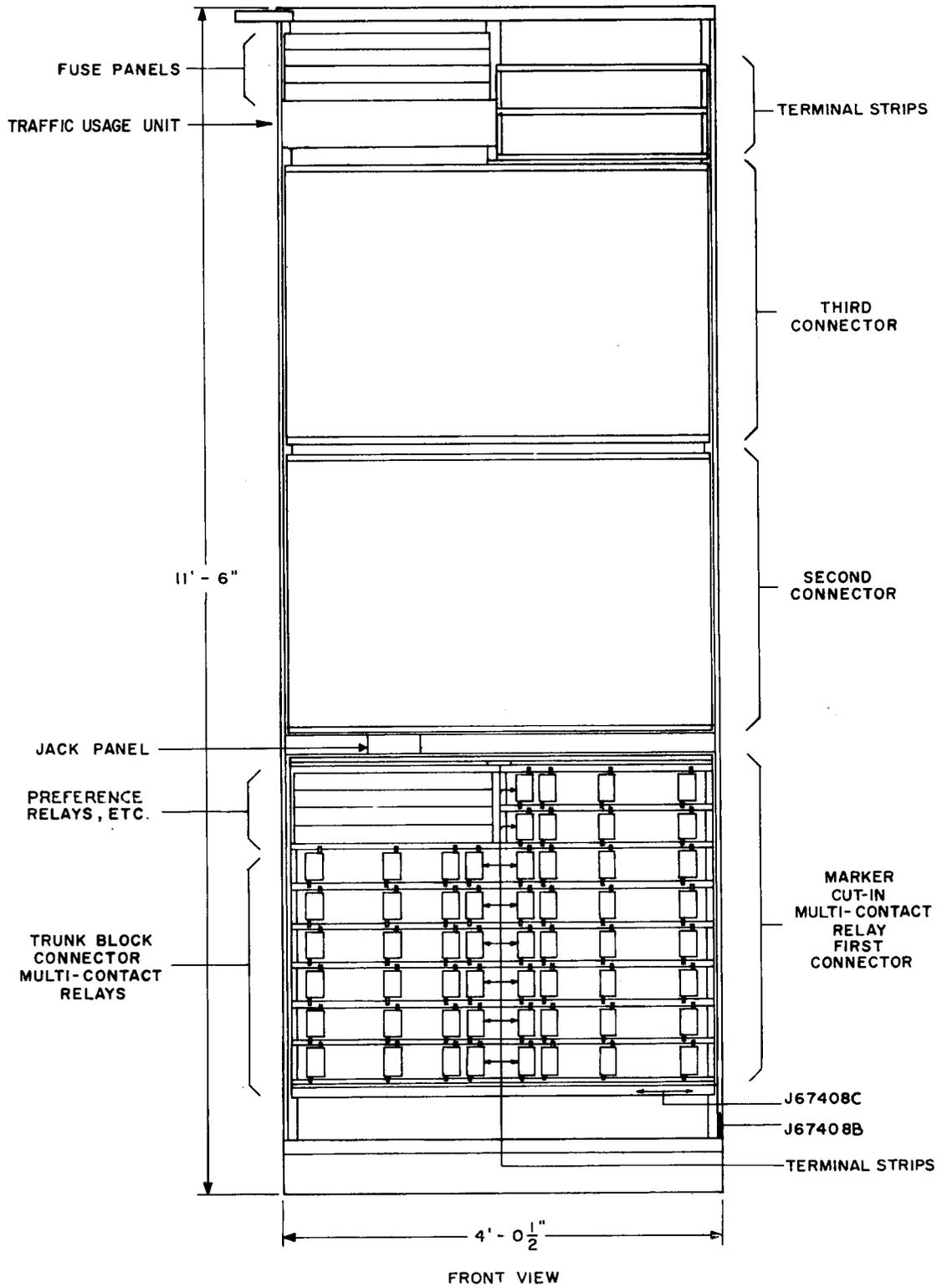


Fig. 23—Block Relay Frame

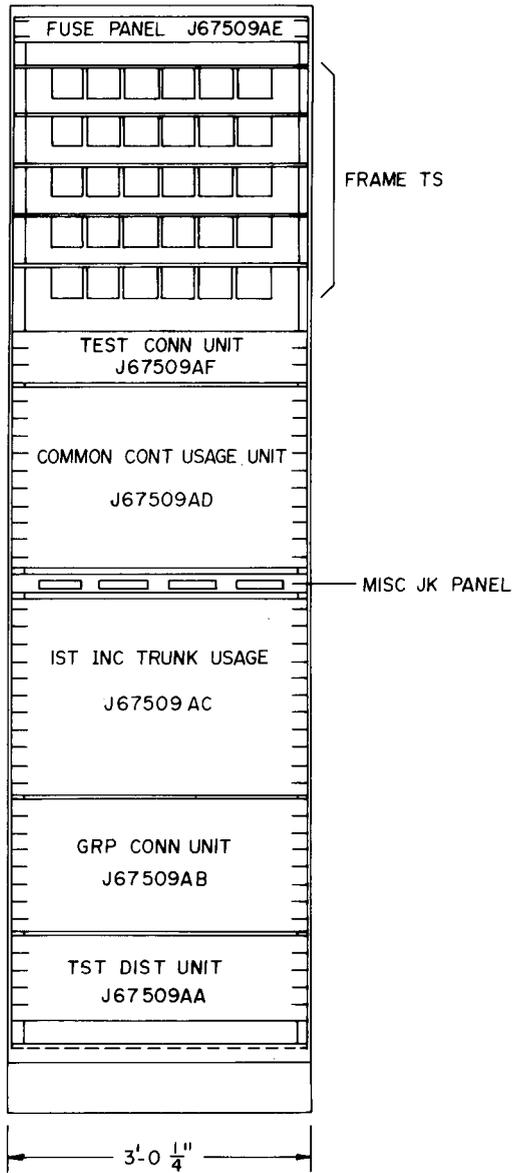


Fig. 24—Traffic Usage Interface Frame

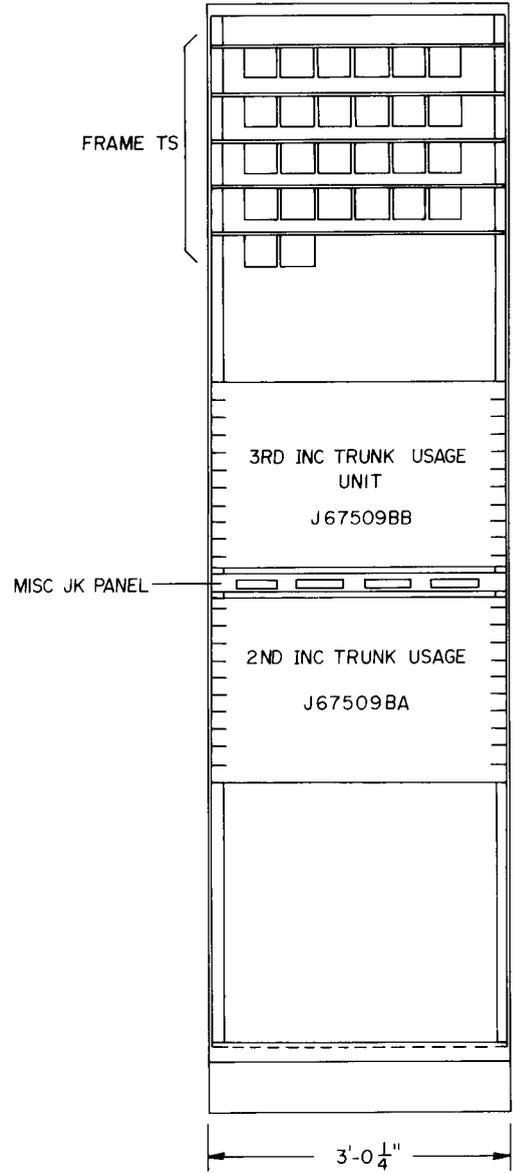


Fig. 25—Supplementary Traffic Usage Interface Frame

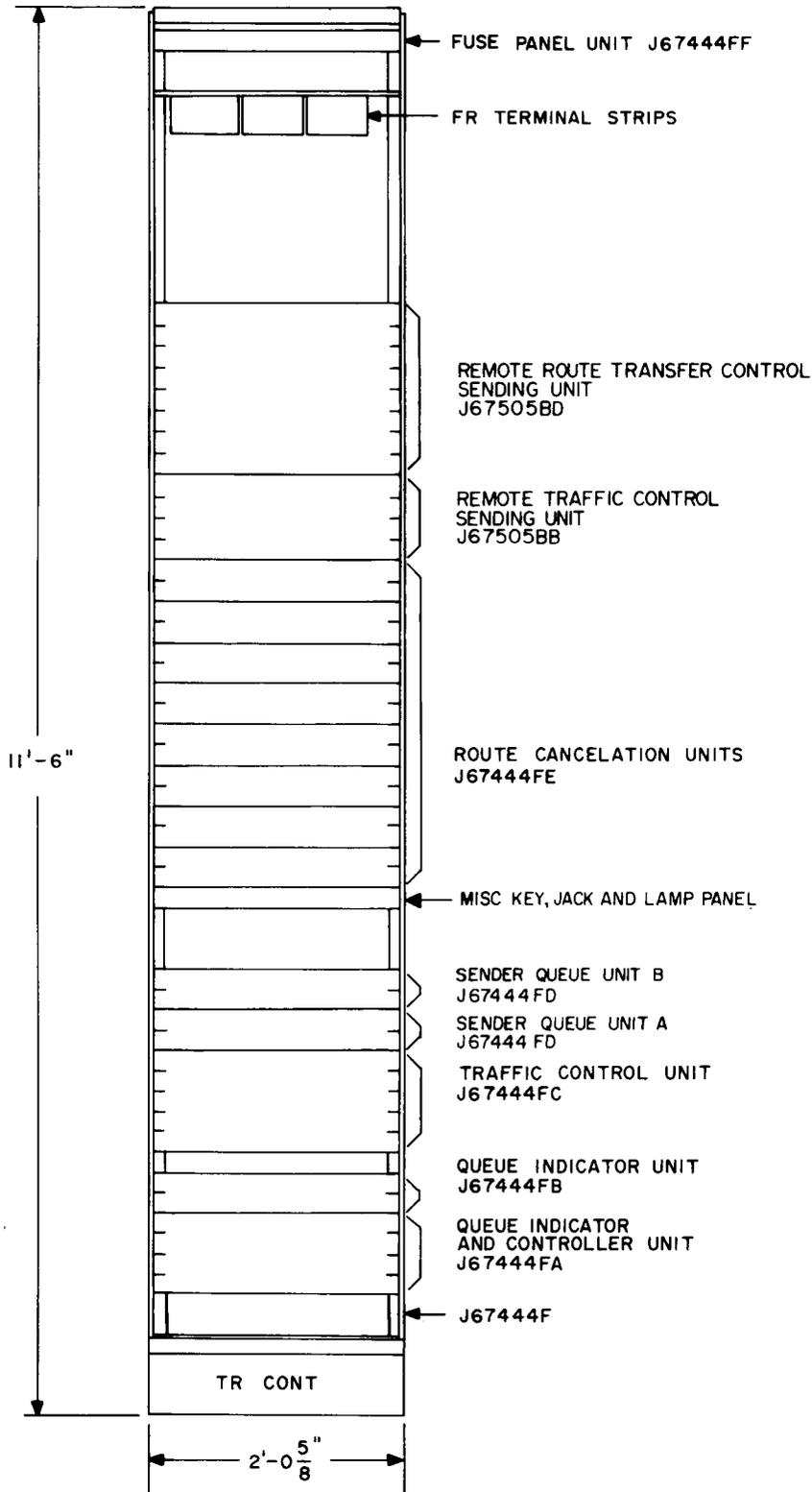


Fig. 26—Traffic Control Frame

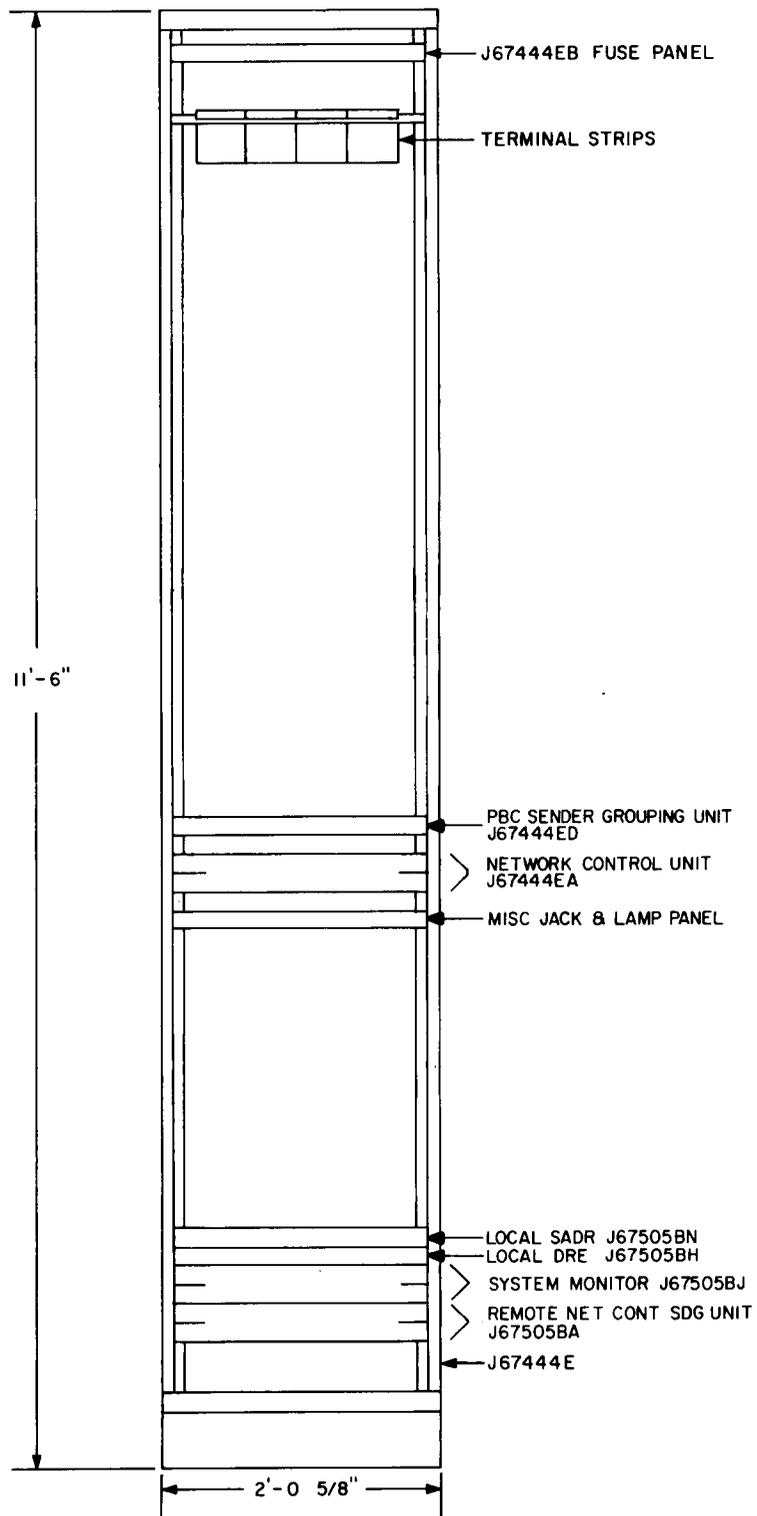


Fig. 27 — Network and Control Frame

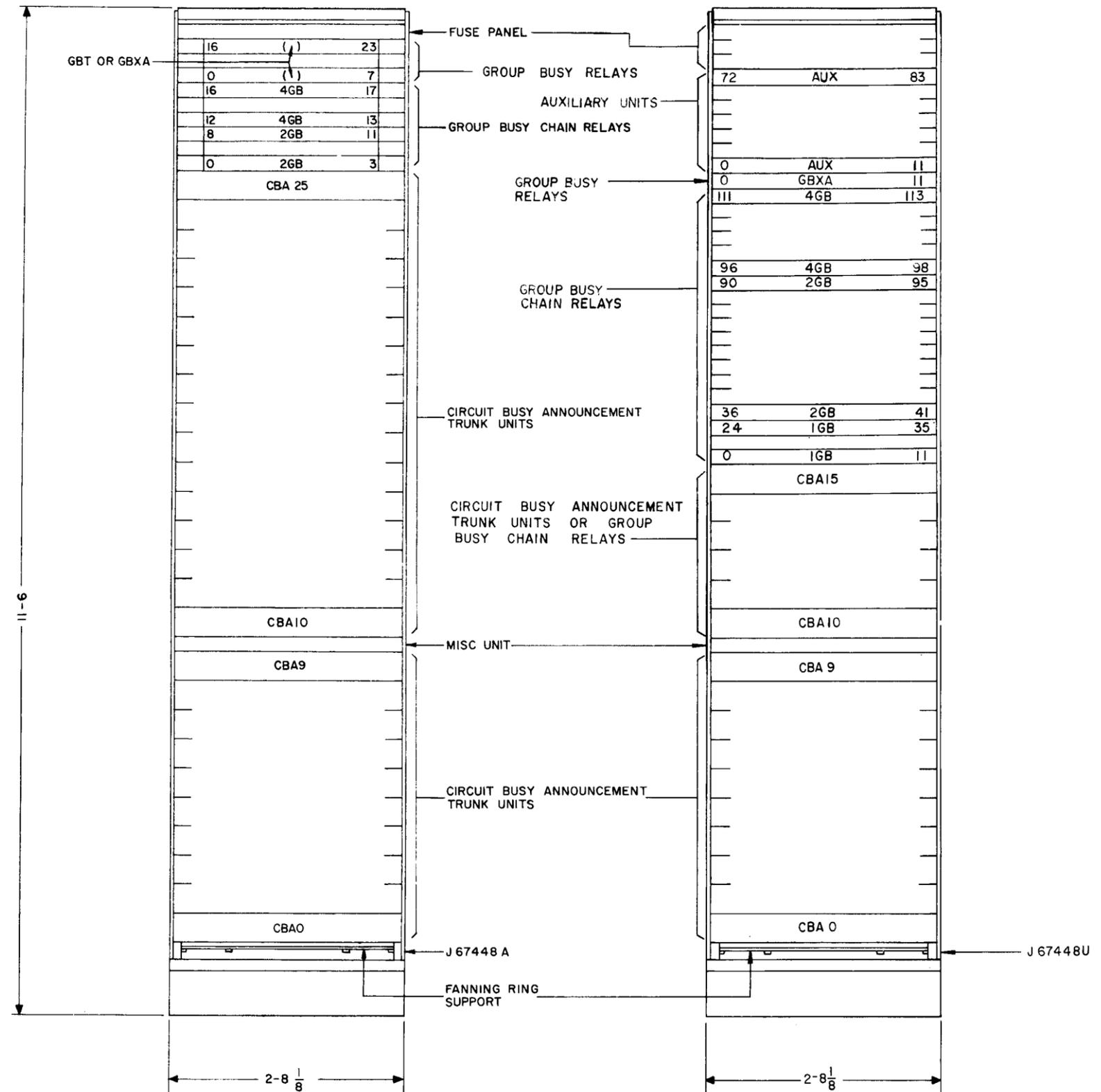


Fig. 28—Circuit Busy Announcement Frame

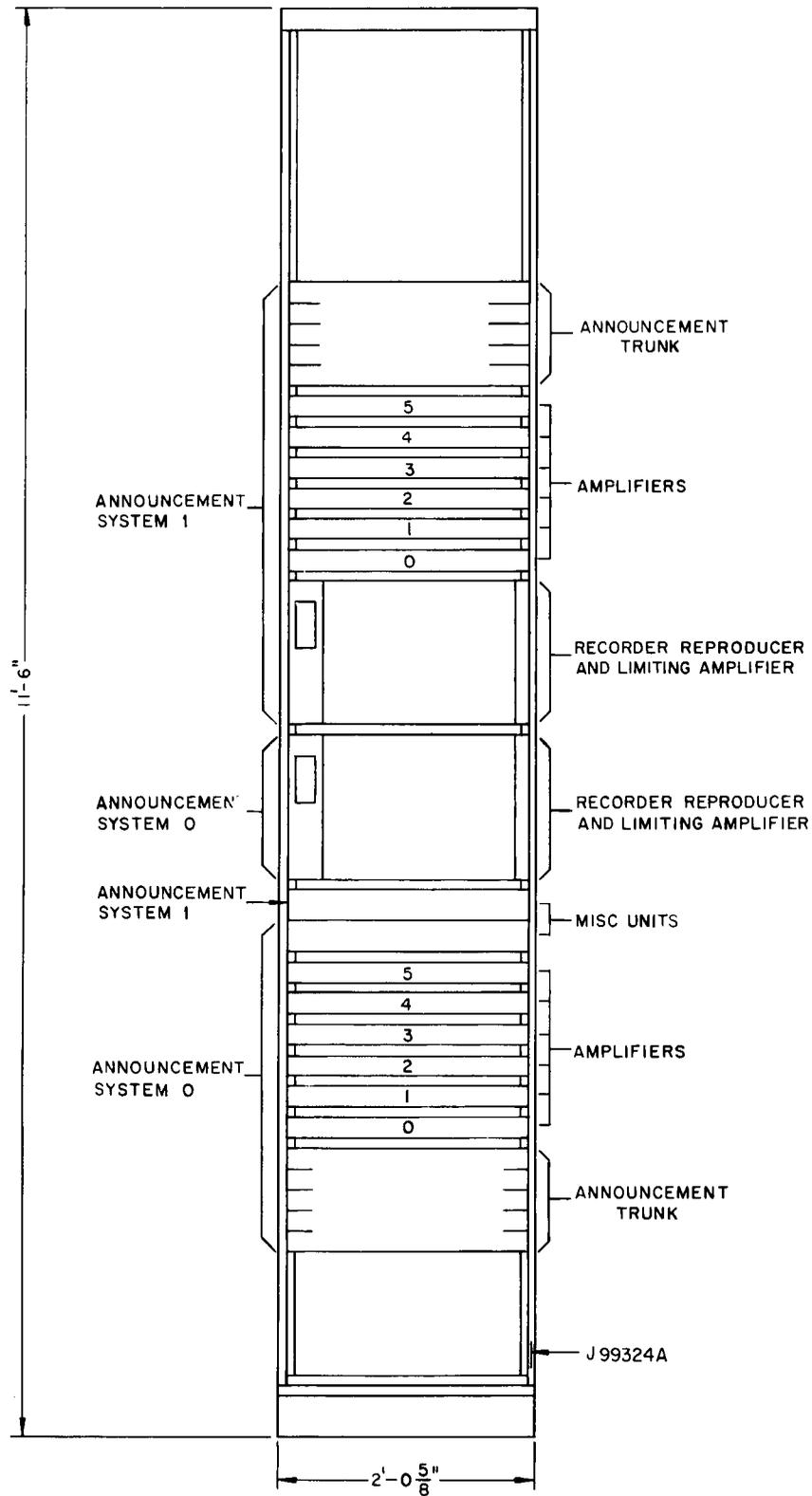


Fig. 29 - Announcement Frame

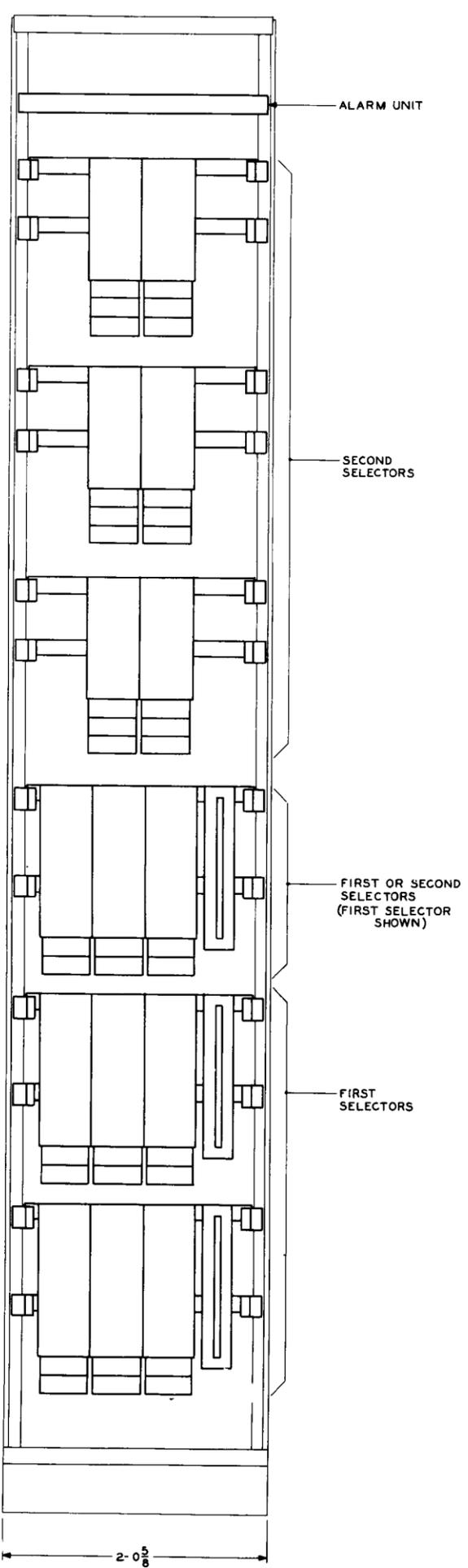


Fig. 30— Trouble Tracing Selector Frame

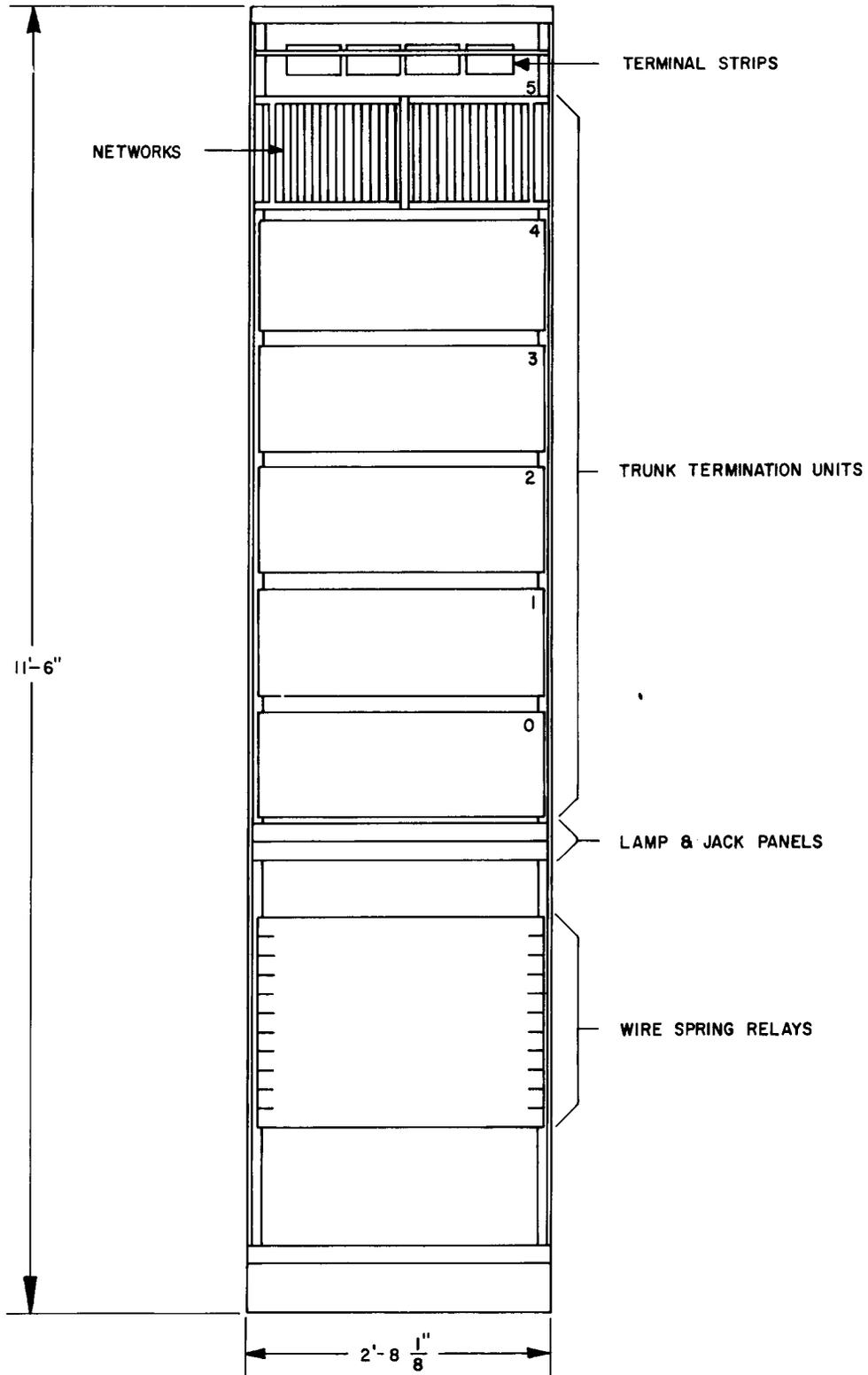


Fig. 31 — Outgoing Trunk Identification Frame

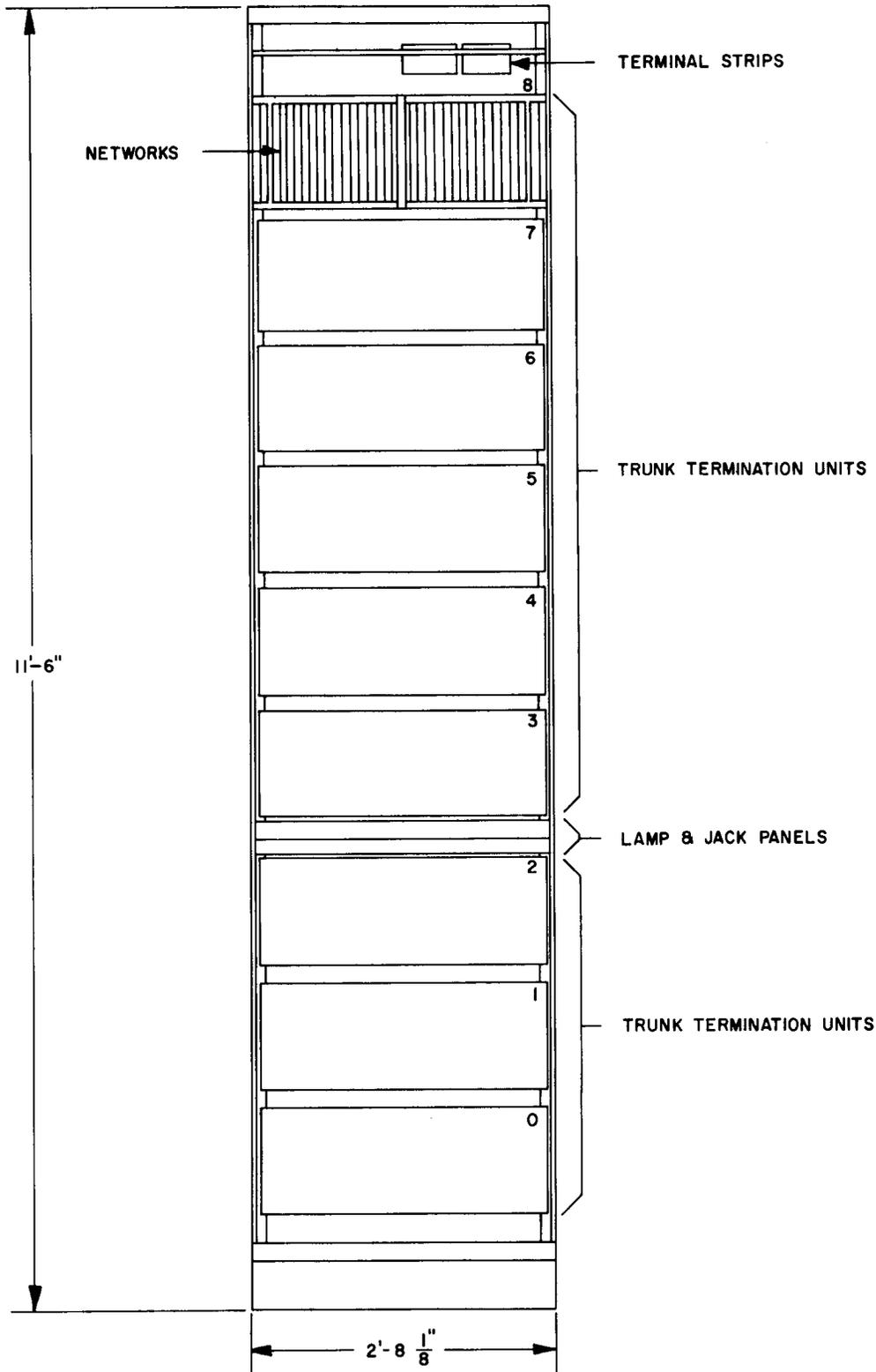


Fig. 32—Supplementary Outgoing Trunk Identification Frame

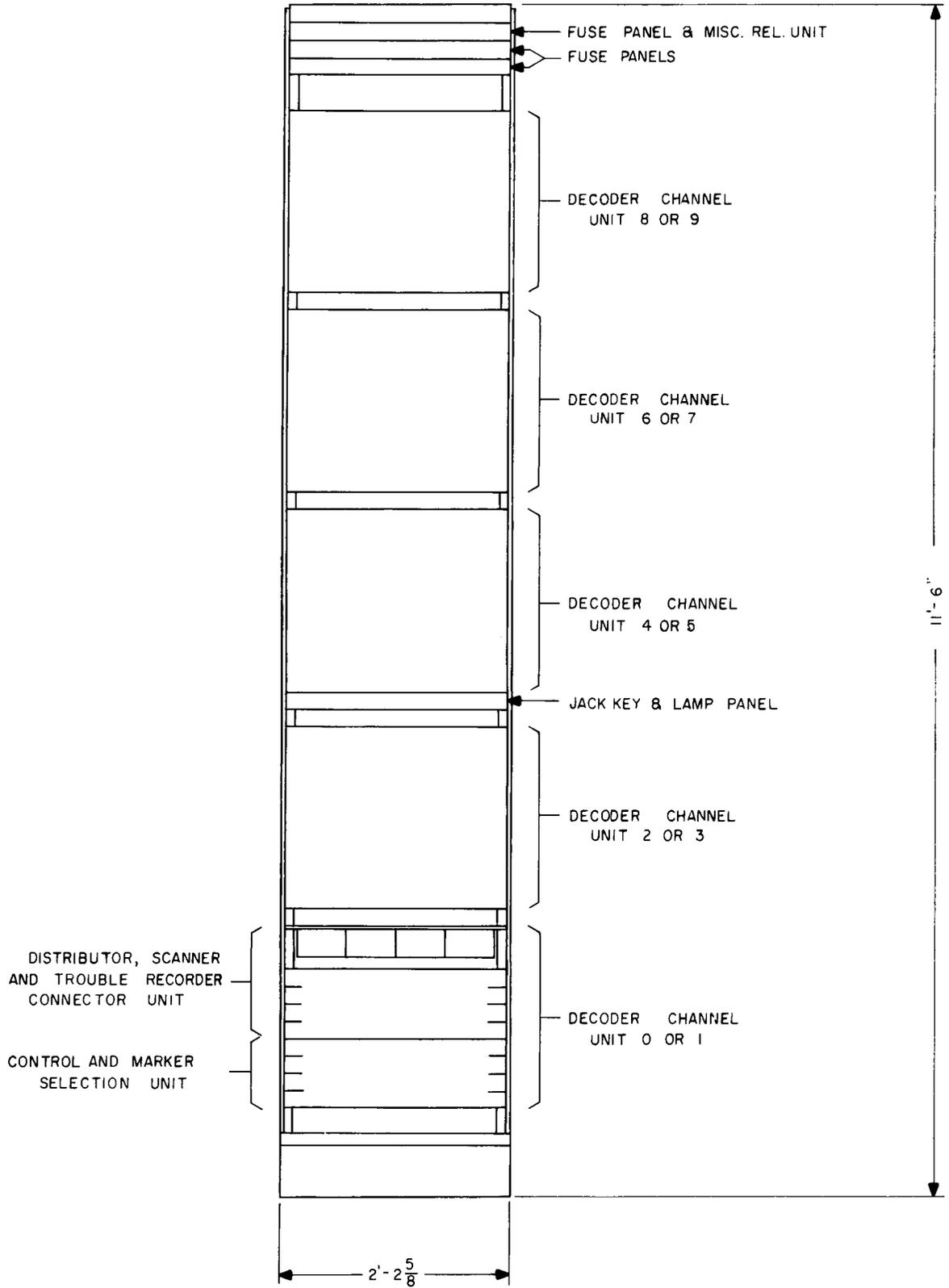


Fig. 33—Decoder Channel Frame

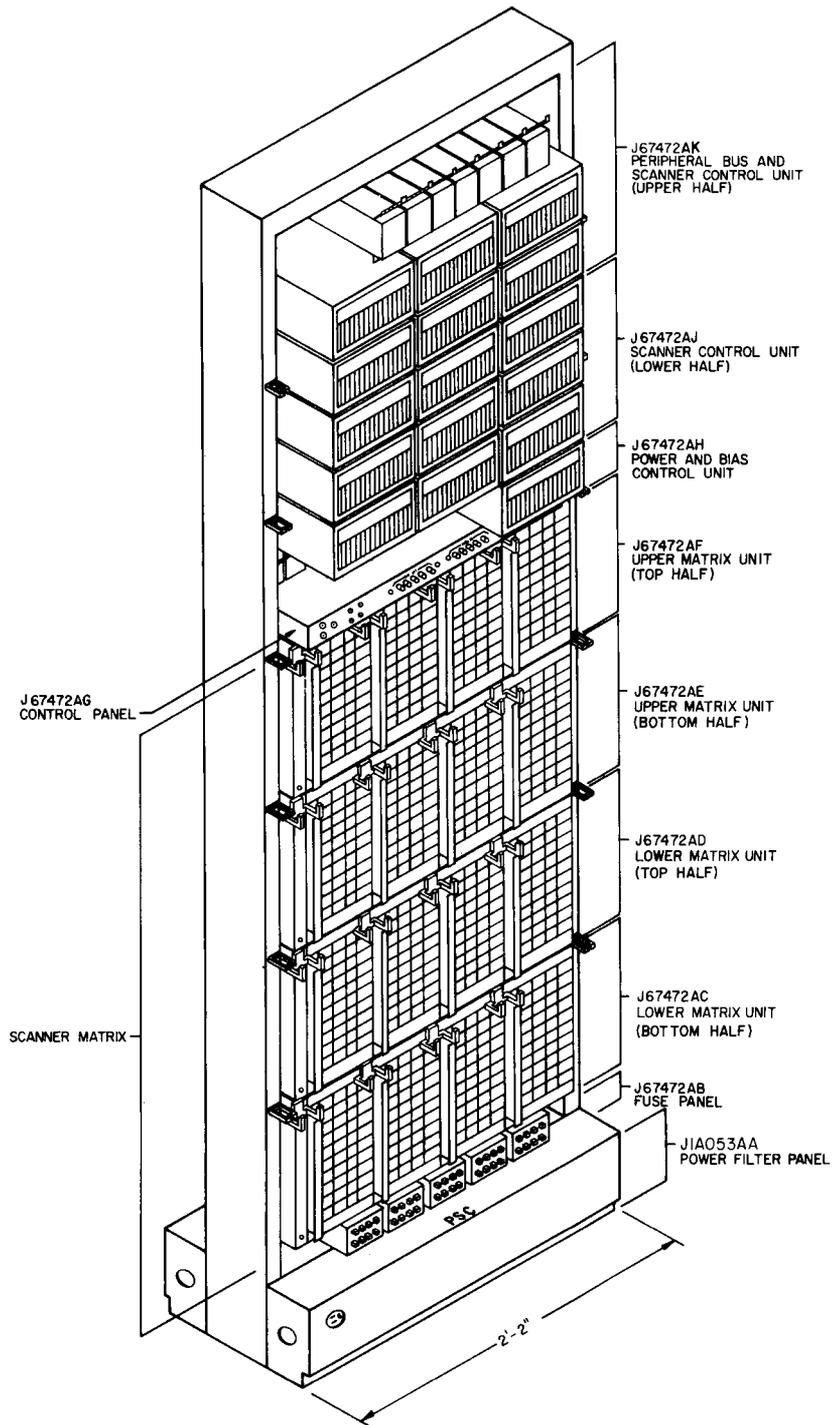


Fig. 34—Peripheral Scanner Frame

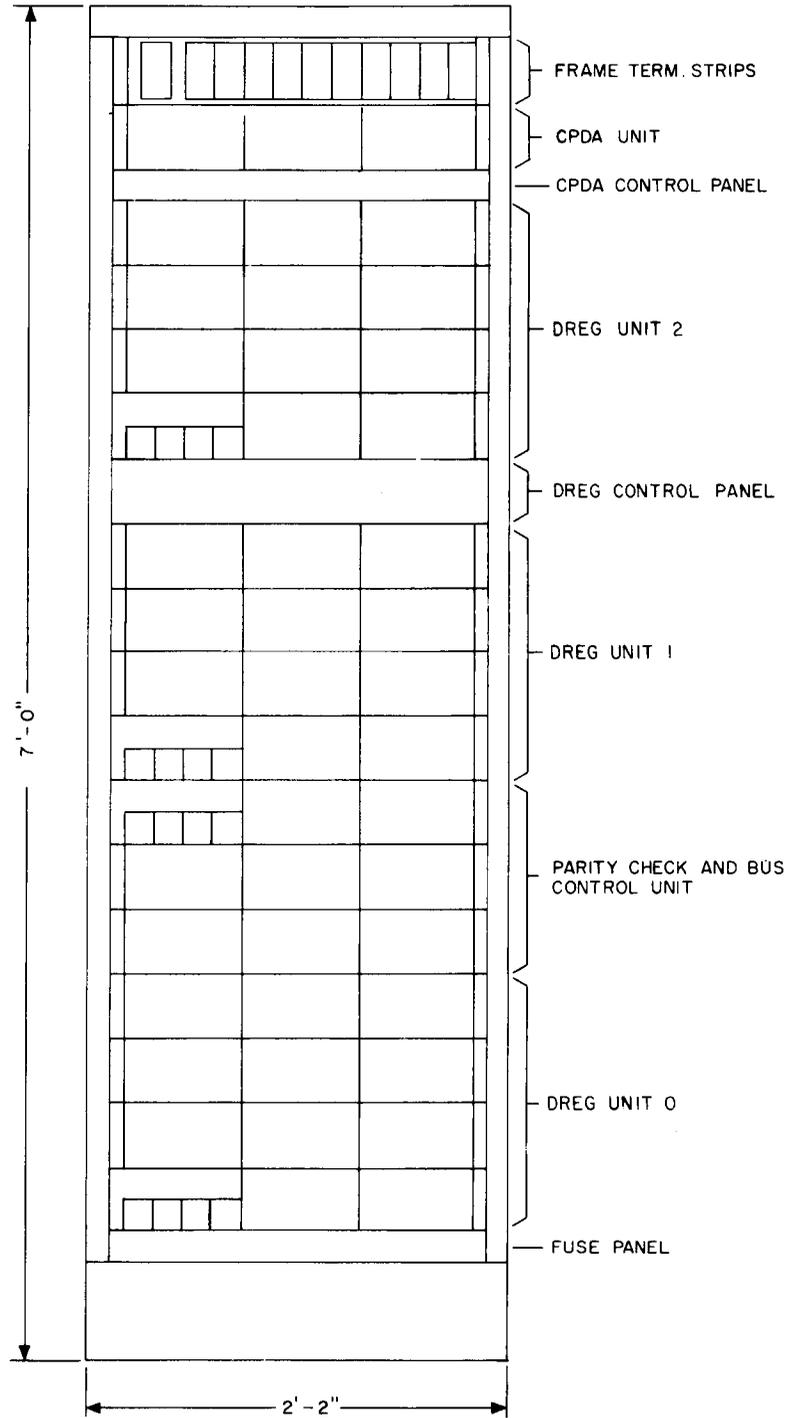


Fig. 35 — Distributor Register Frame

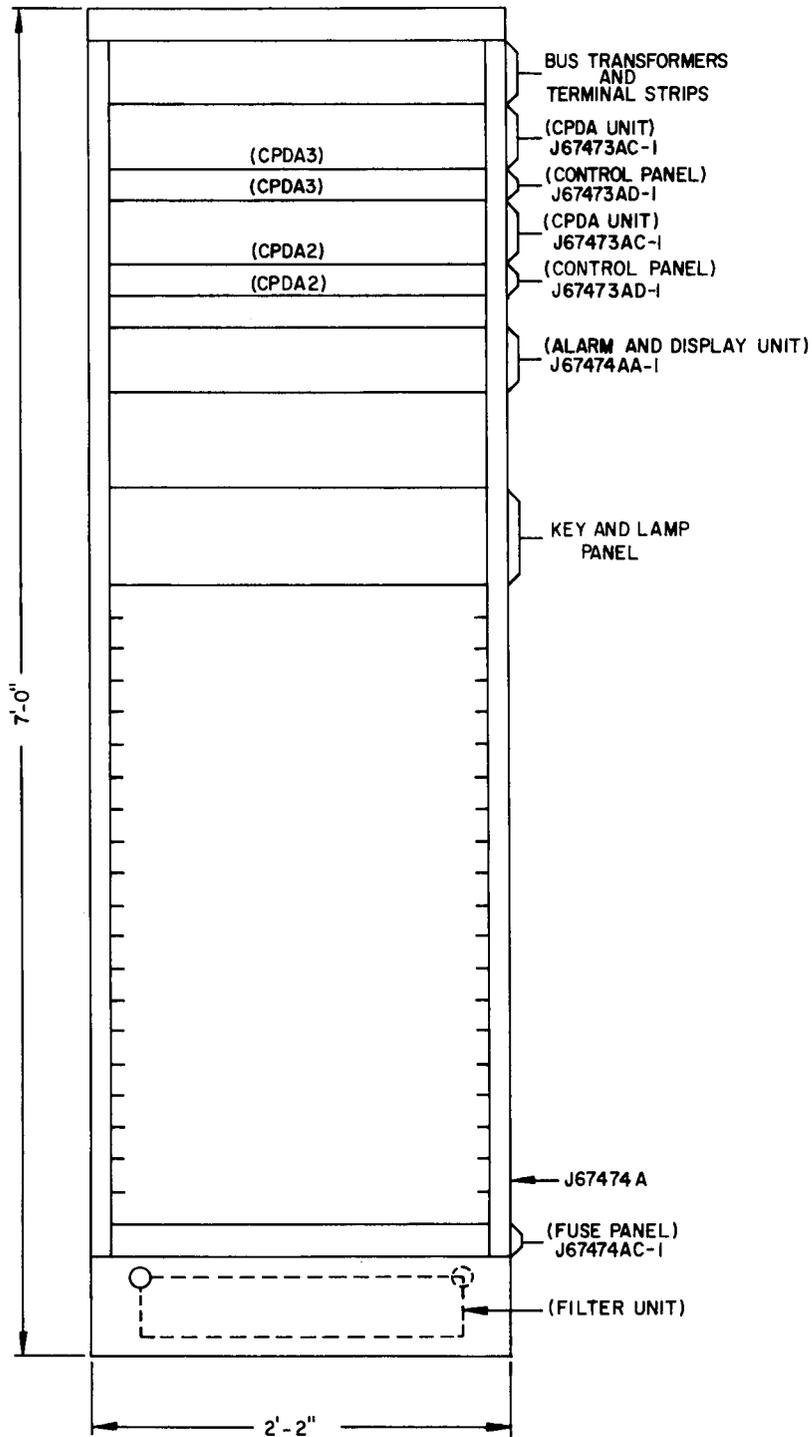


Fig. 36—Alarm and Display Frame

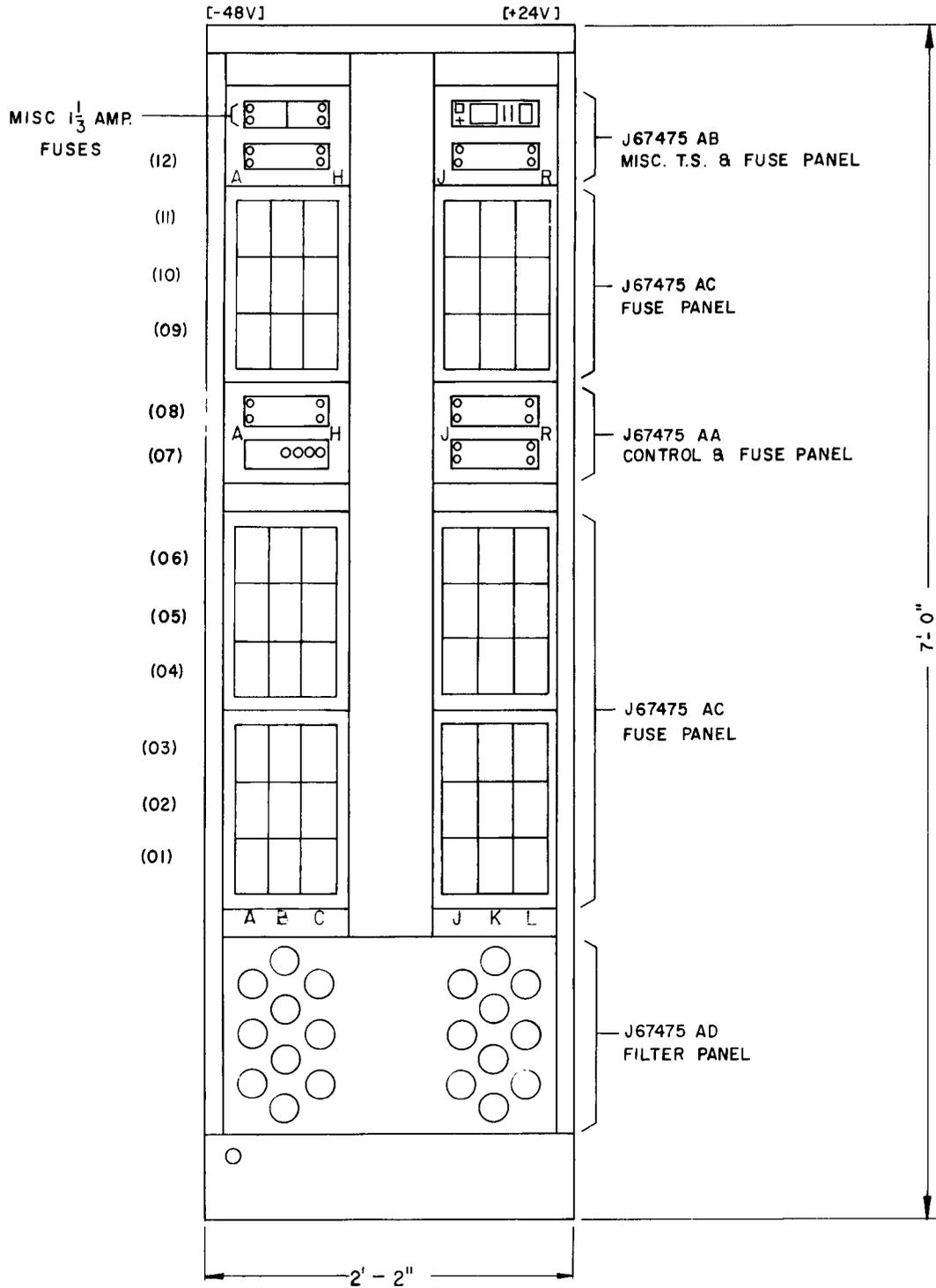


Fig. 37 — Power Distributing Frame

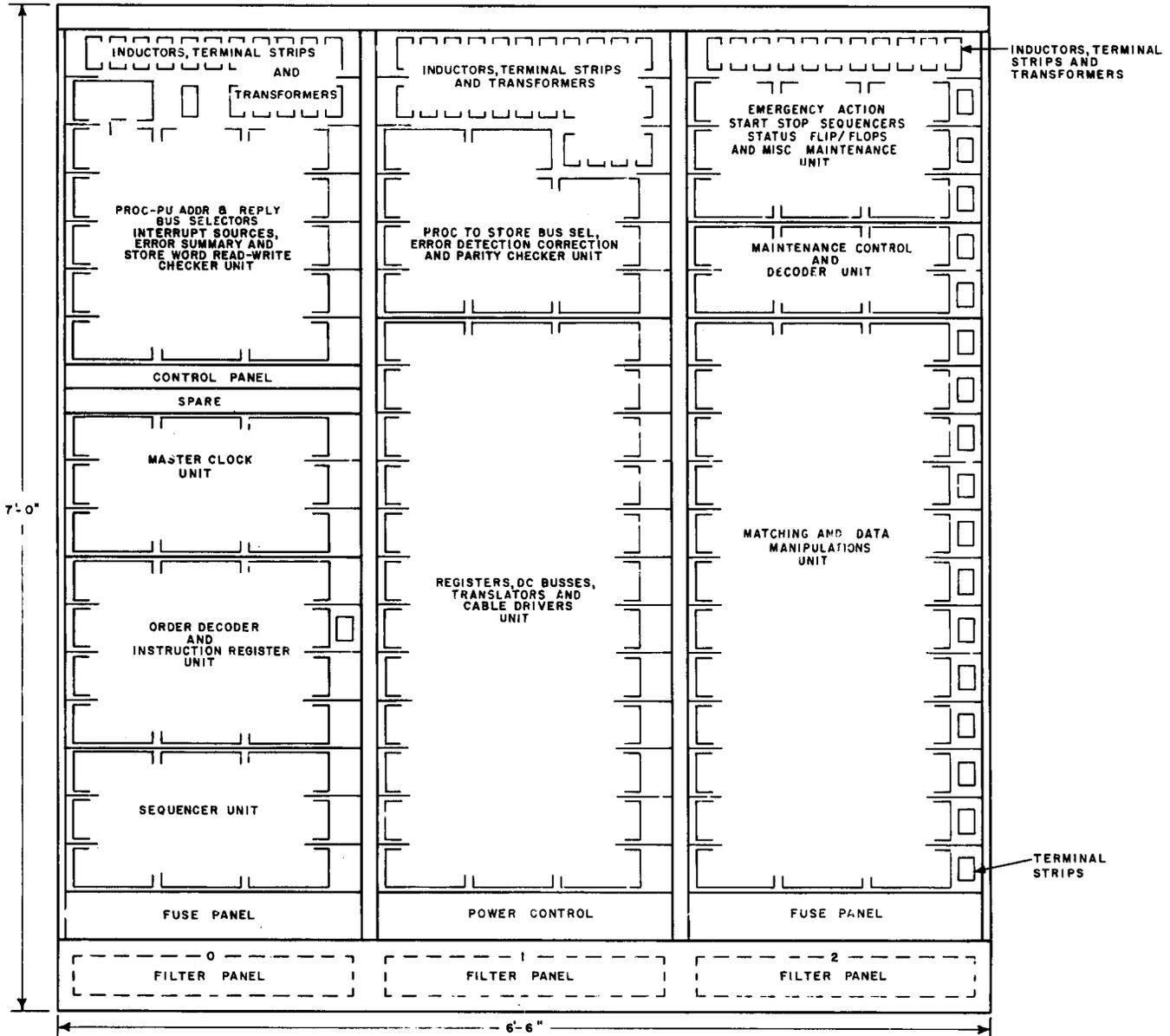


Fig. 38—Processor Frame

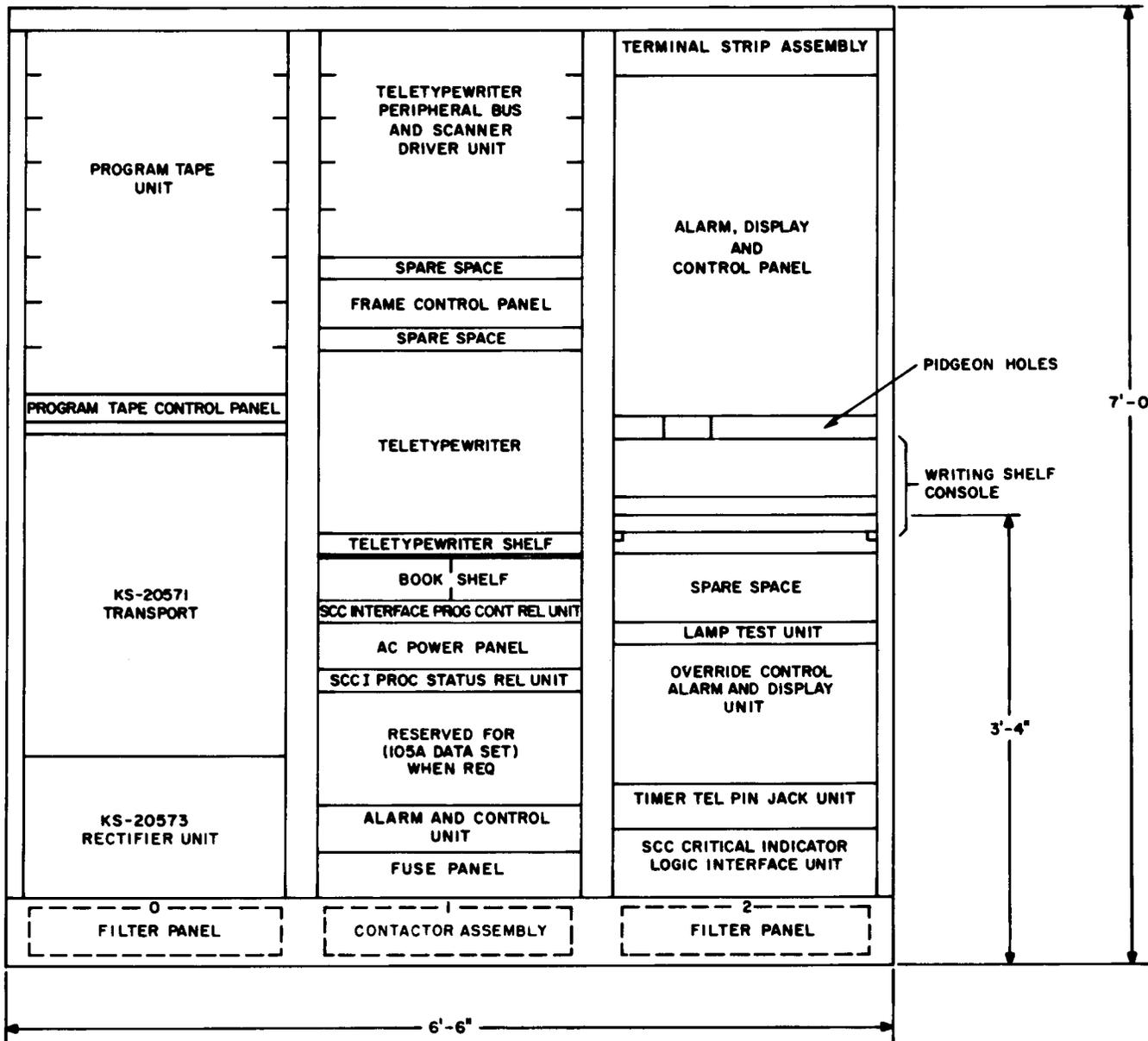


Fig. 39—Control and Display Program Tape and Teletypewriter Frame

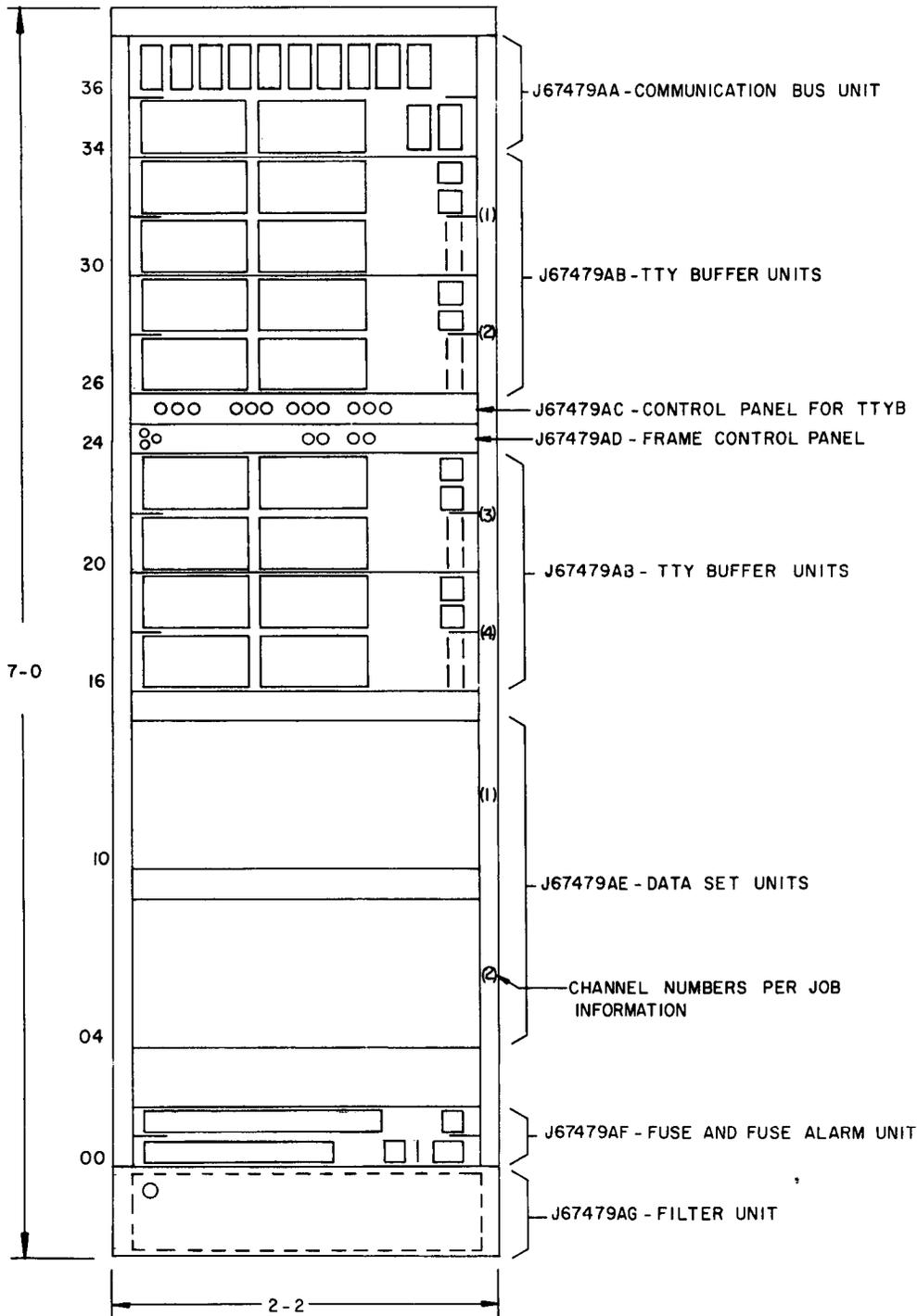


Fig. 40—Teletypewriter Buffer Frame

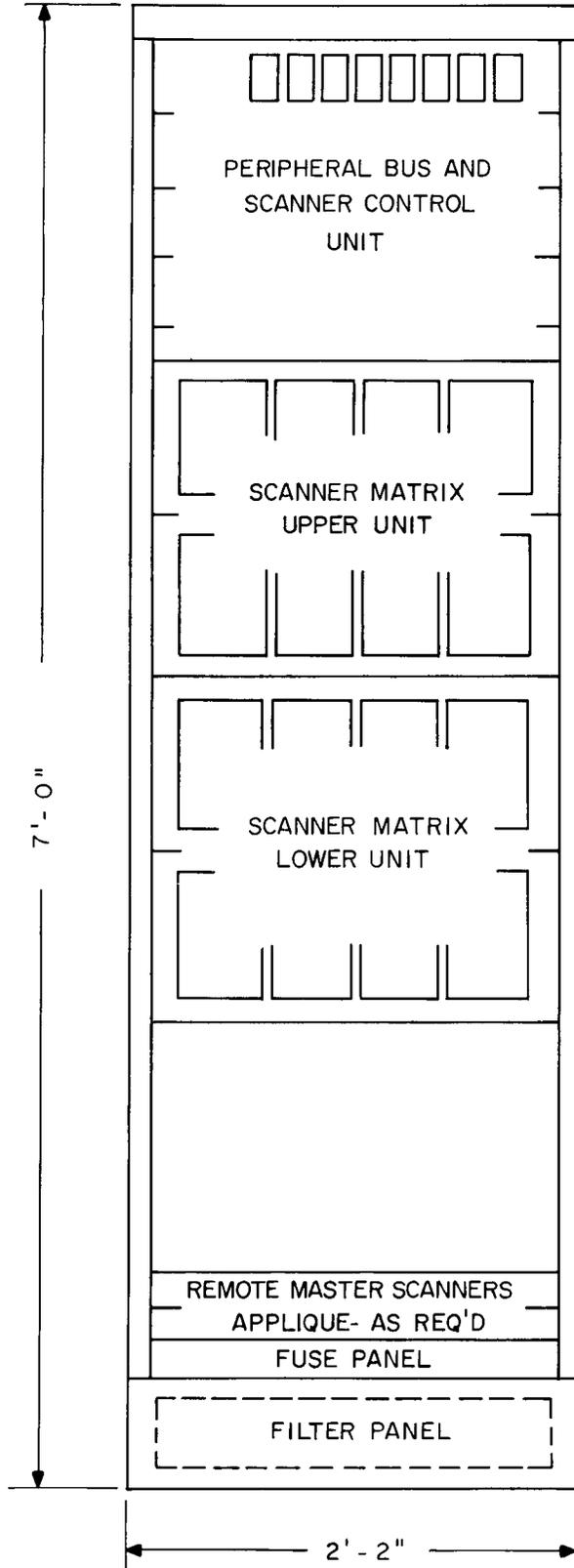


Fig. 41 — Master Scanner Frame

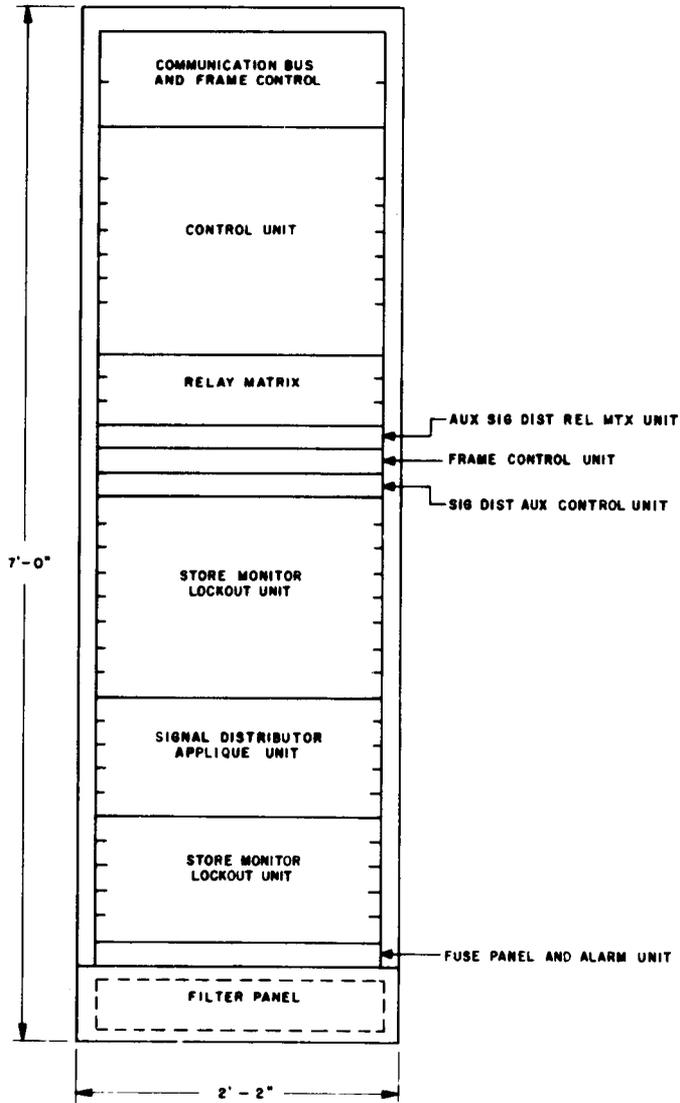


Fig. 42—Signal Distributor Frame

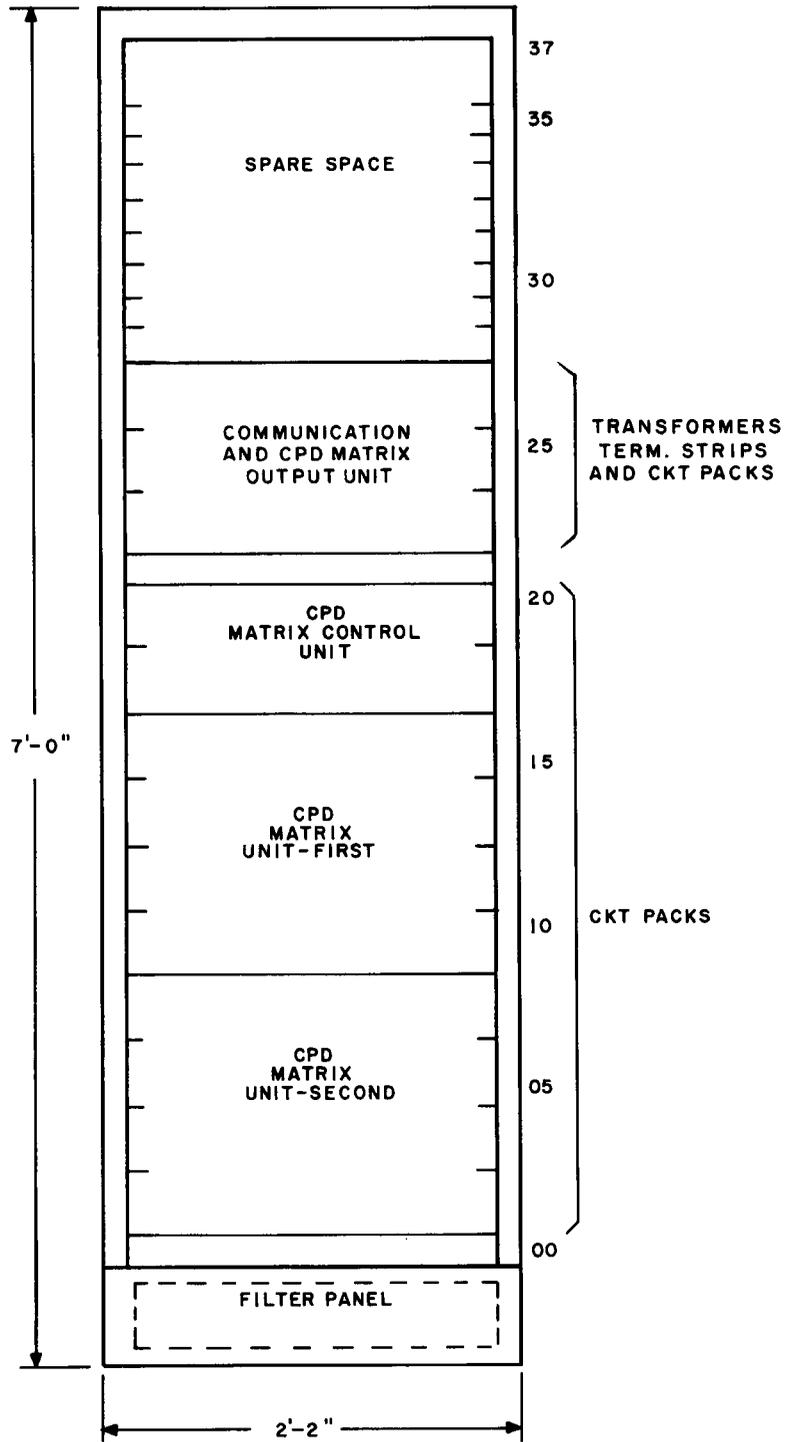


Fig. 43—Central Pulse Distributor Frame

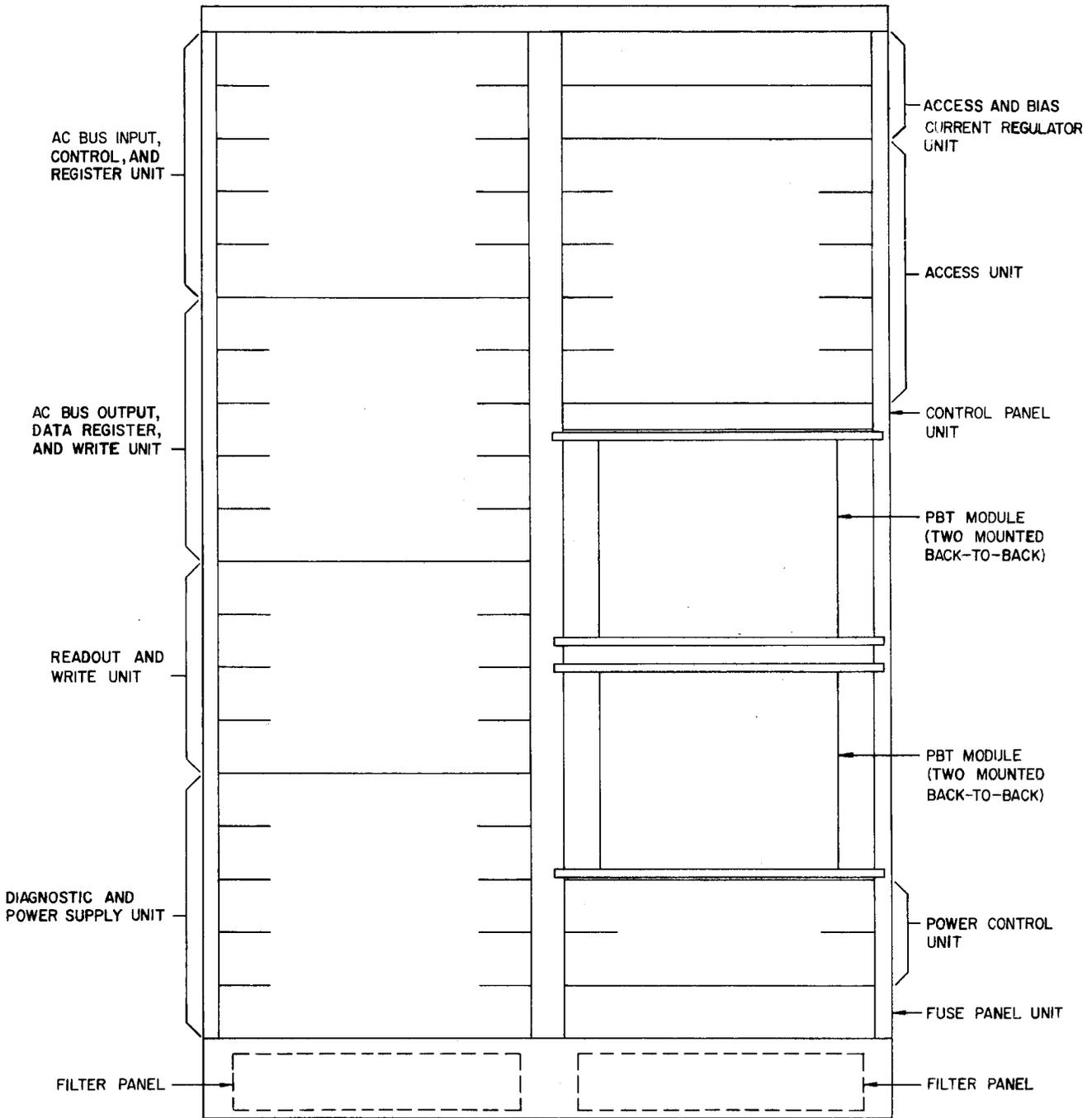


Fig. 44—Store Frame

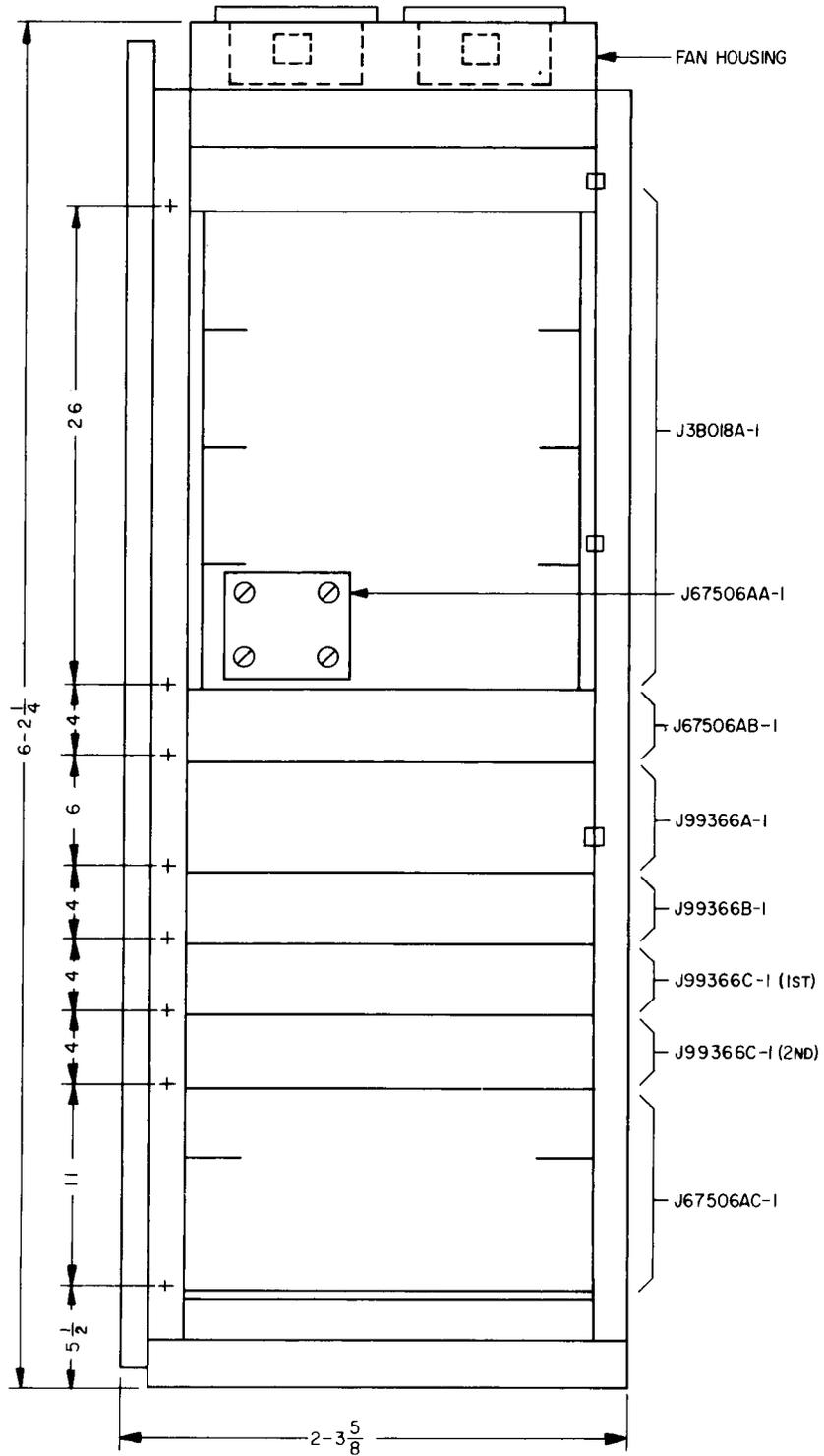


Fig. 45 — PBC Interface and Control Cabinet

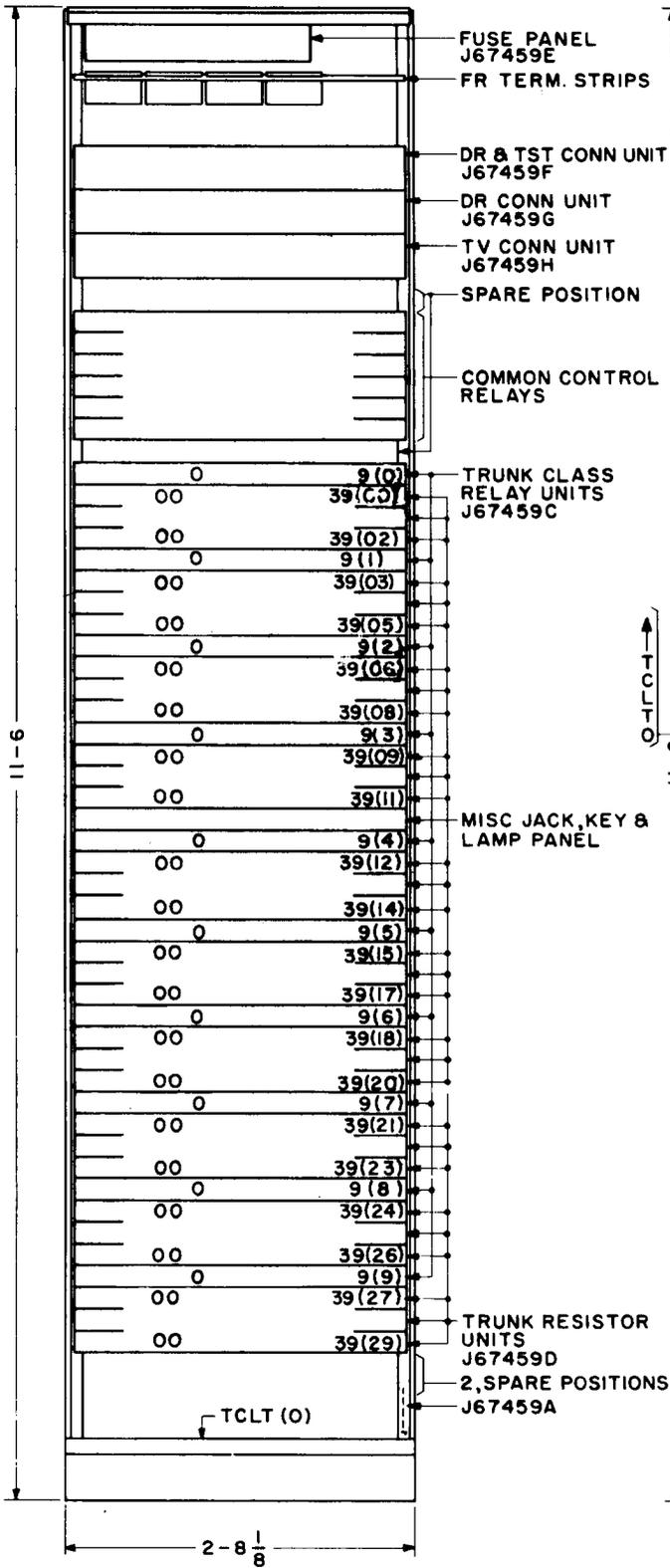


Fig. 46—Trunk Class Translator Frame

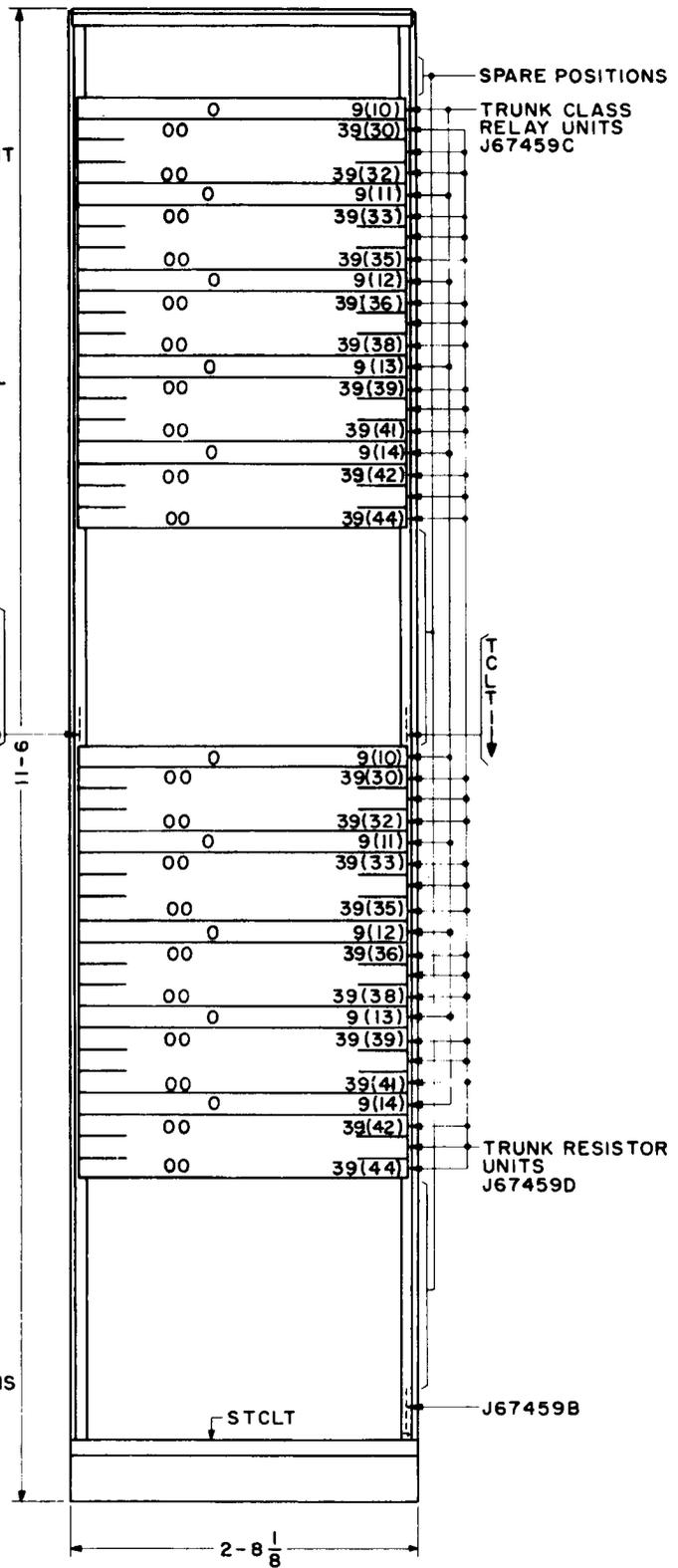


Fig. 47—Supplementary Trunk Class Translator Frame

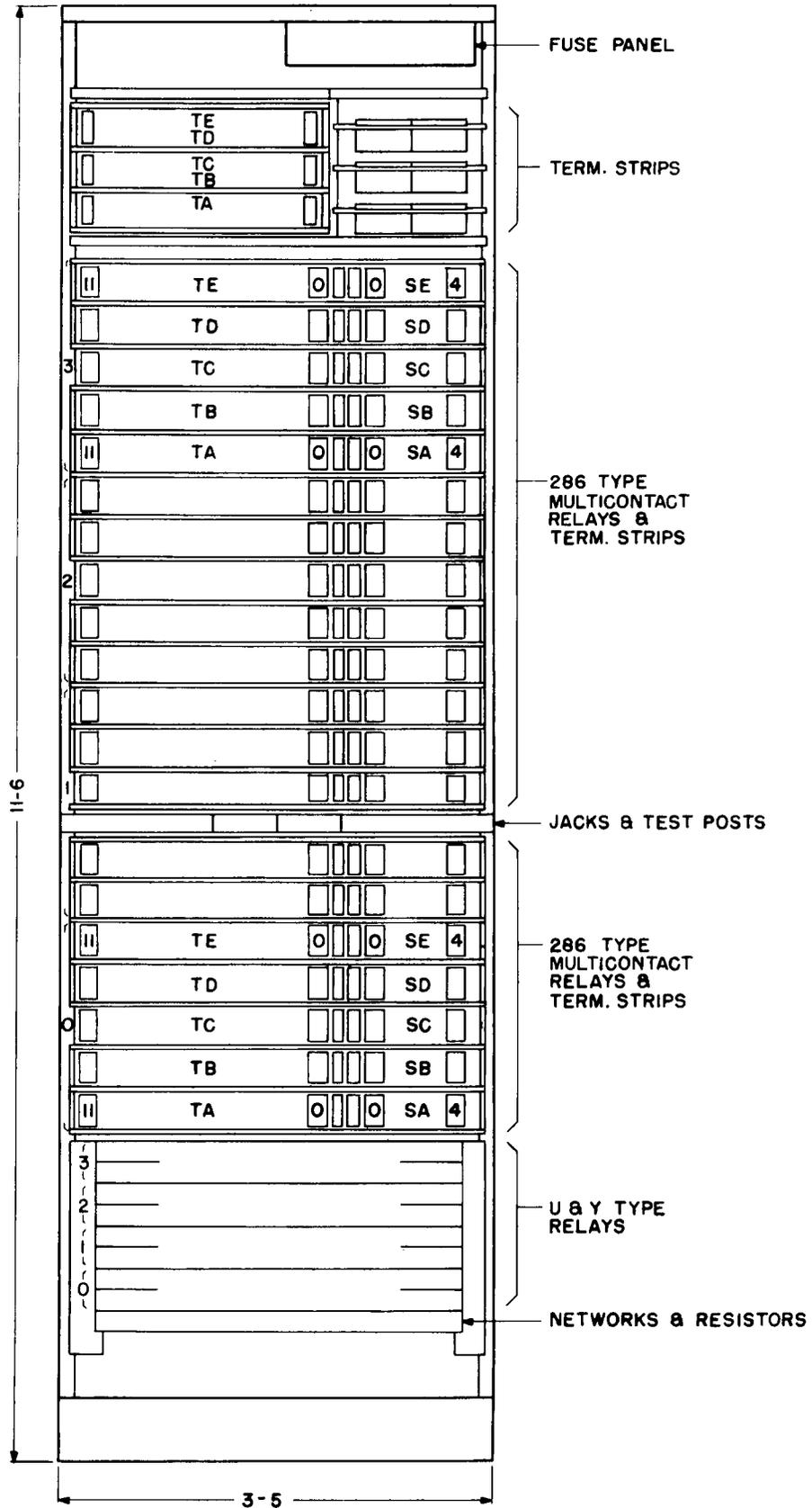


Fig. 48—Transverter Connector Frame

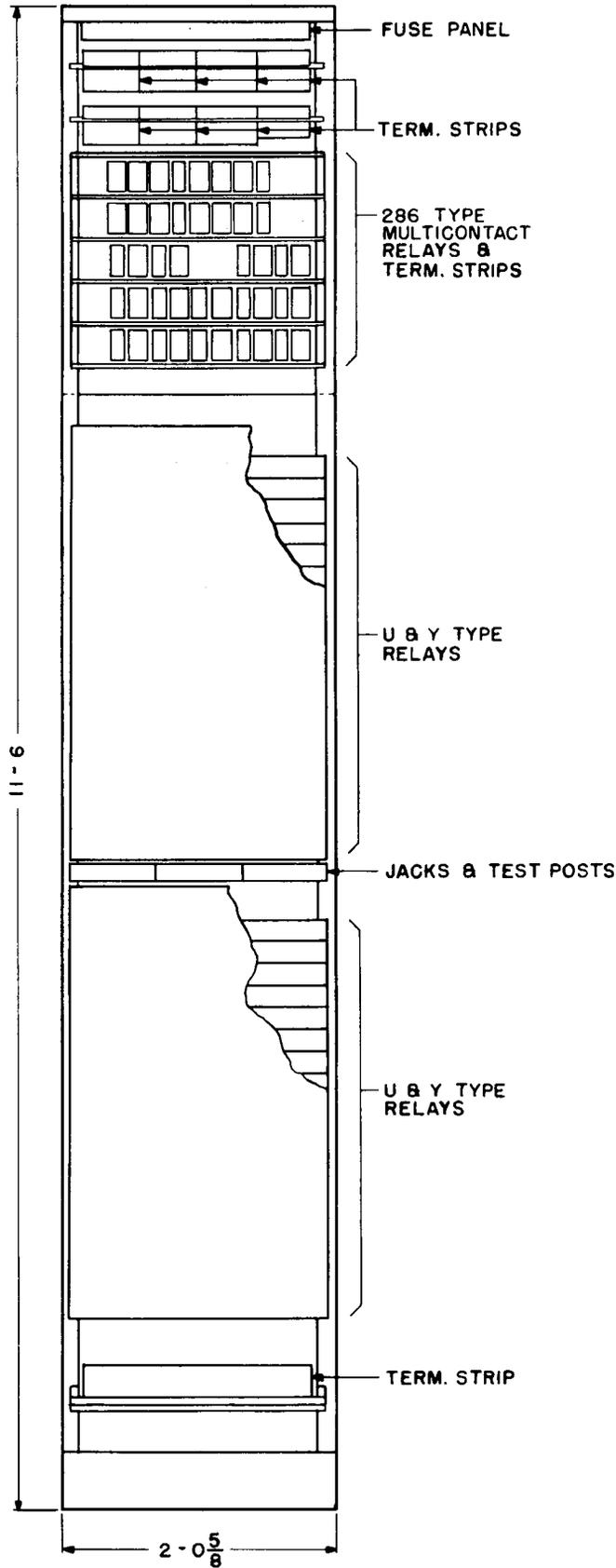


Fig. 49—Transverter Frame

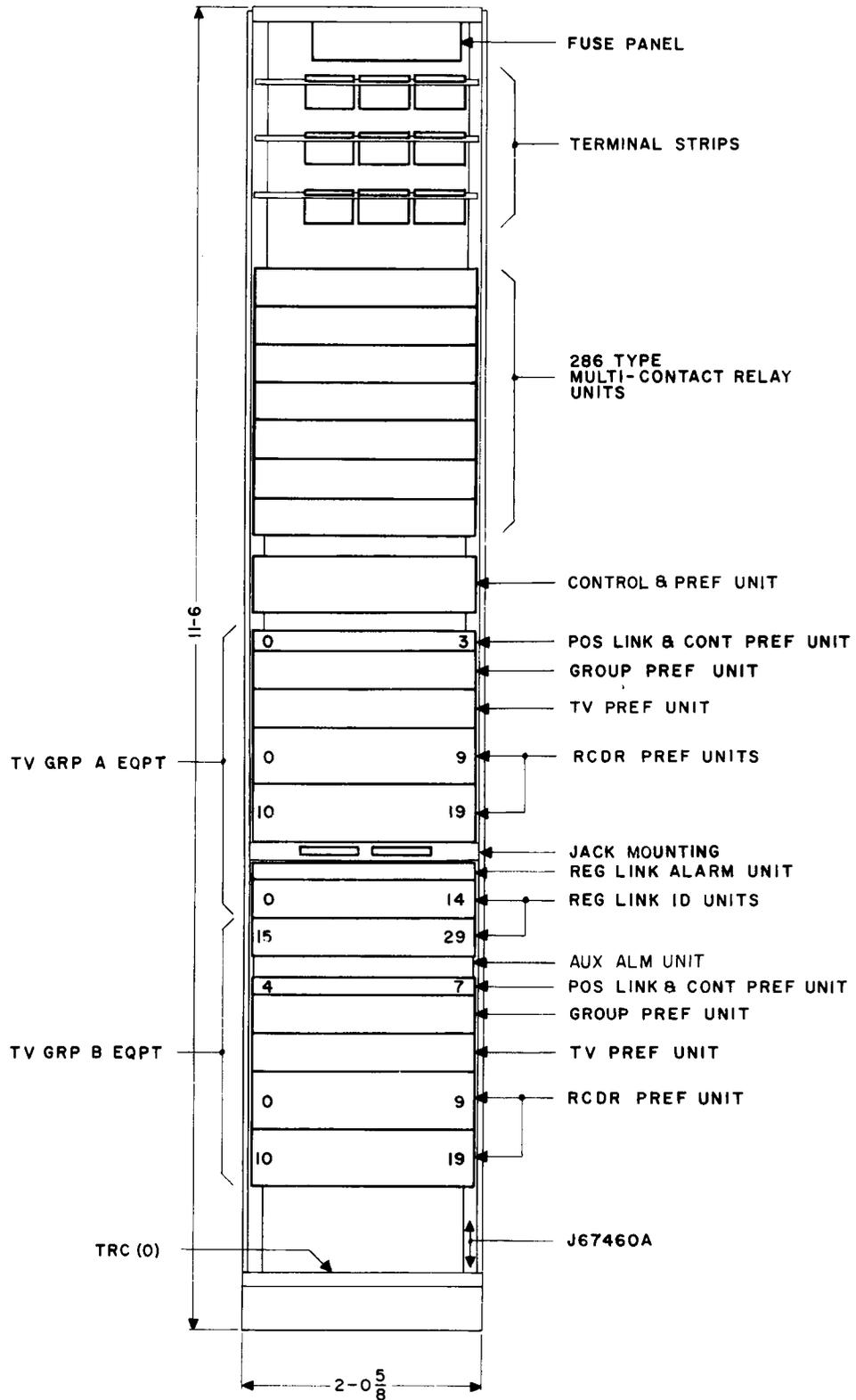


Fig. 50—Trouble Recorder Connector Frame

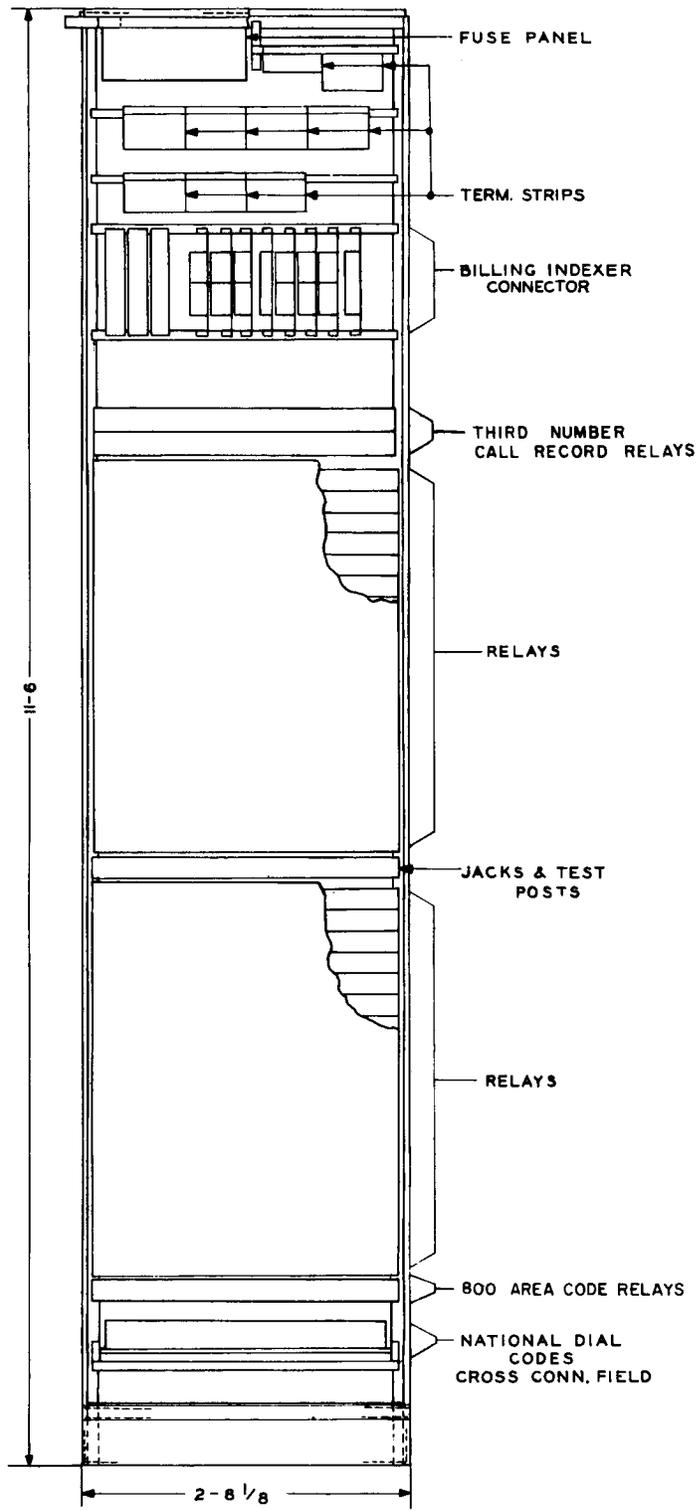


Fig. 51 — Billing Indexer Originating Frame

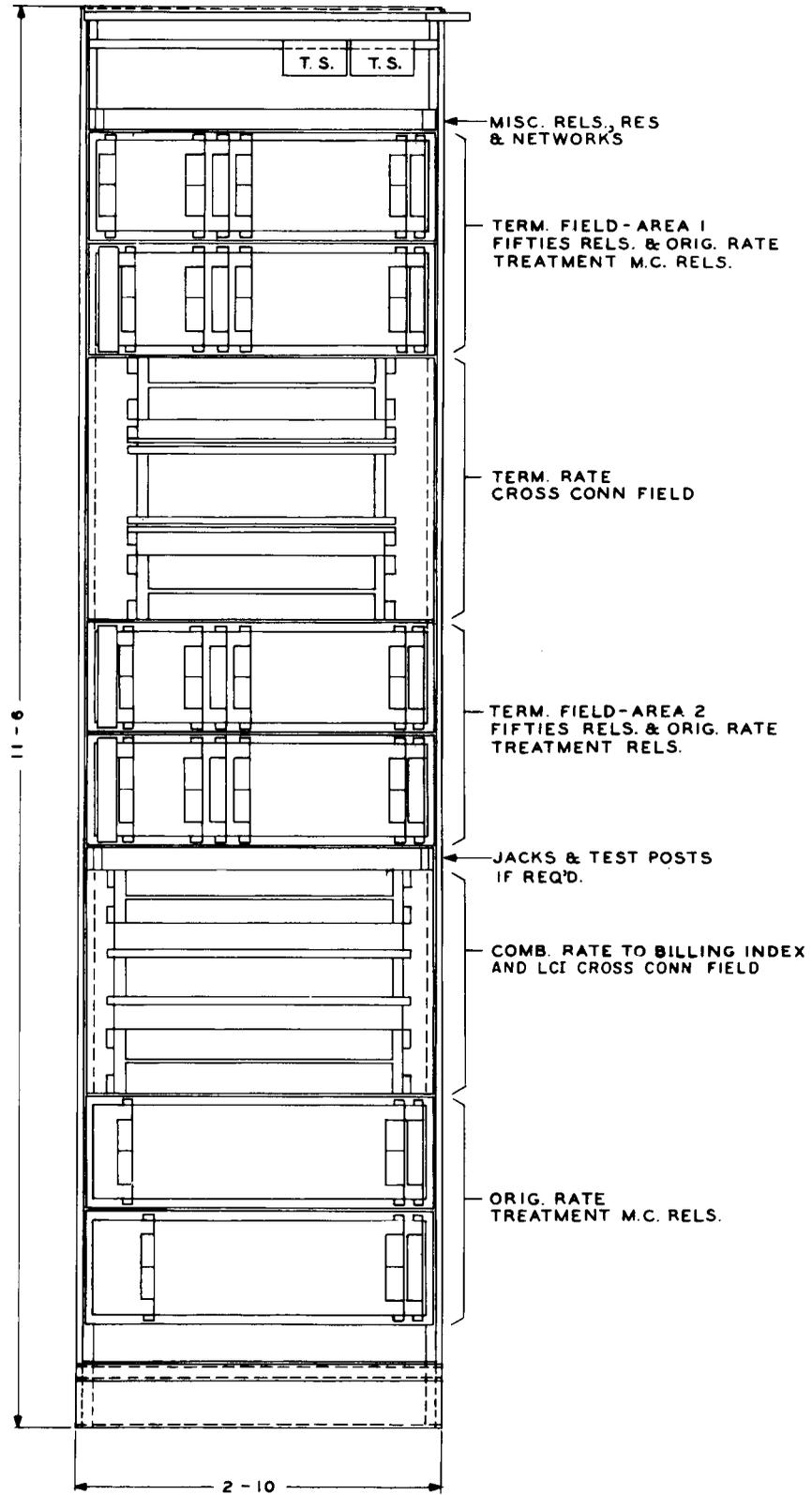


Fig. 52— Supplementary Billing Indexer Frame

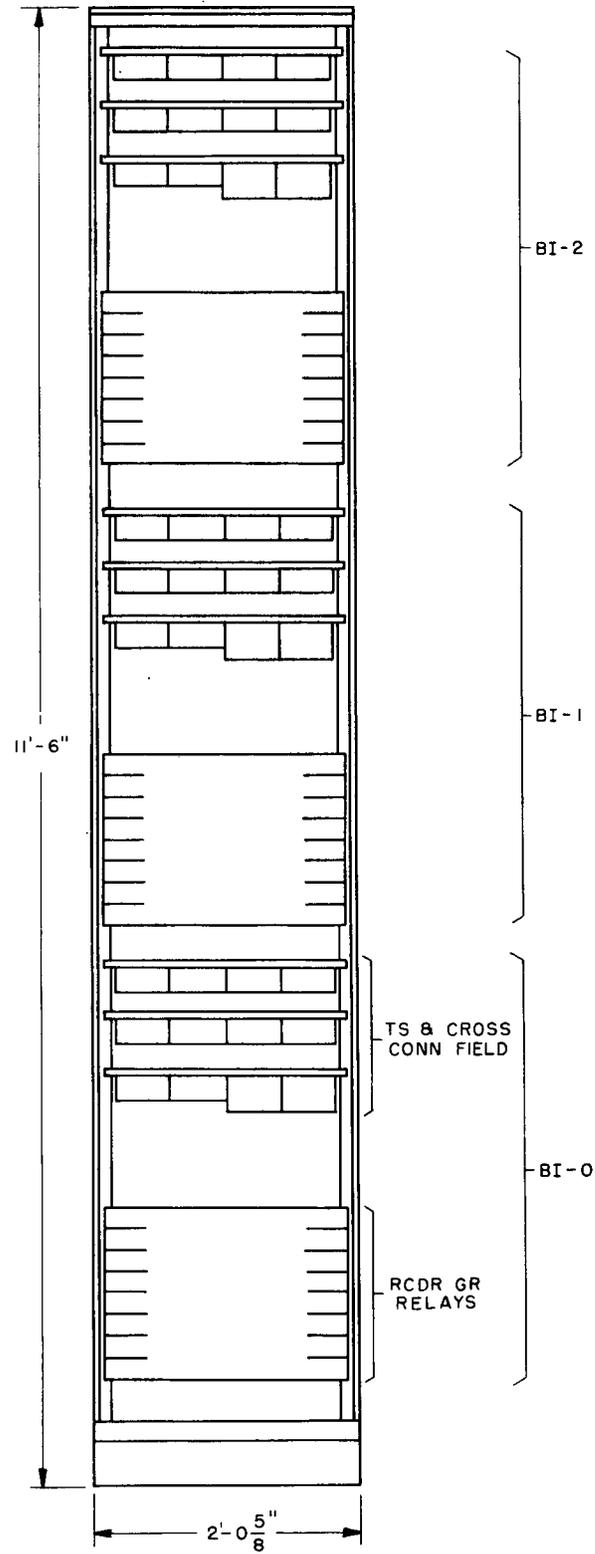


Fig. 53—Auxiliary Billing Indexer Frame

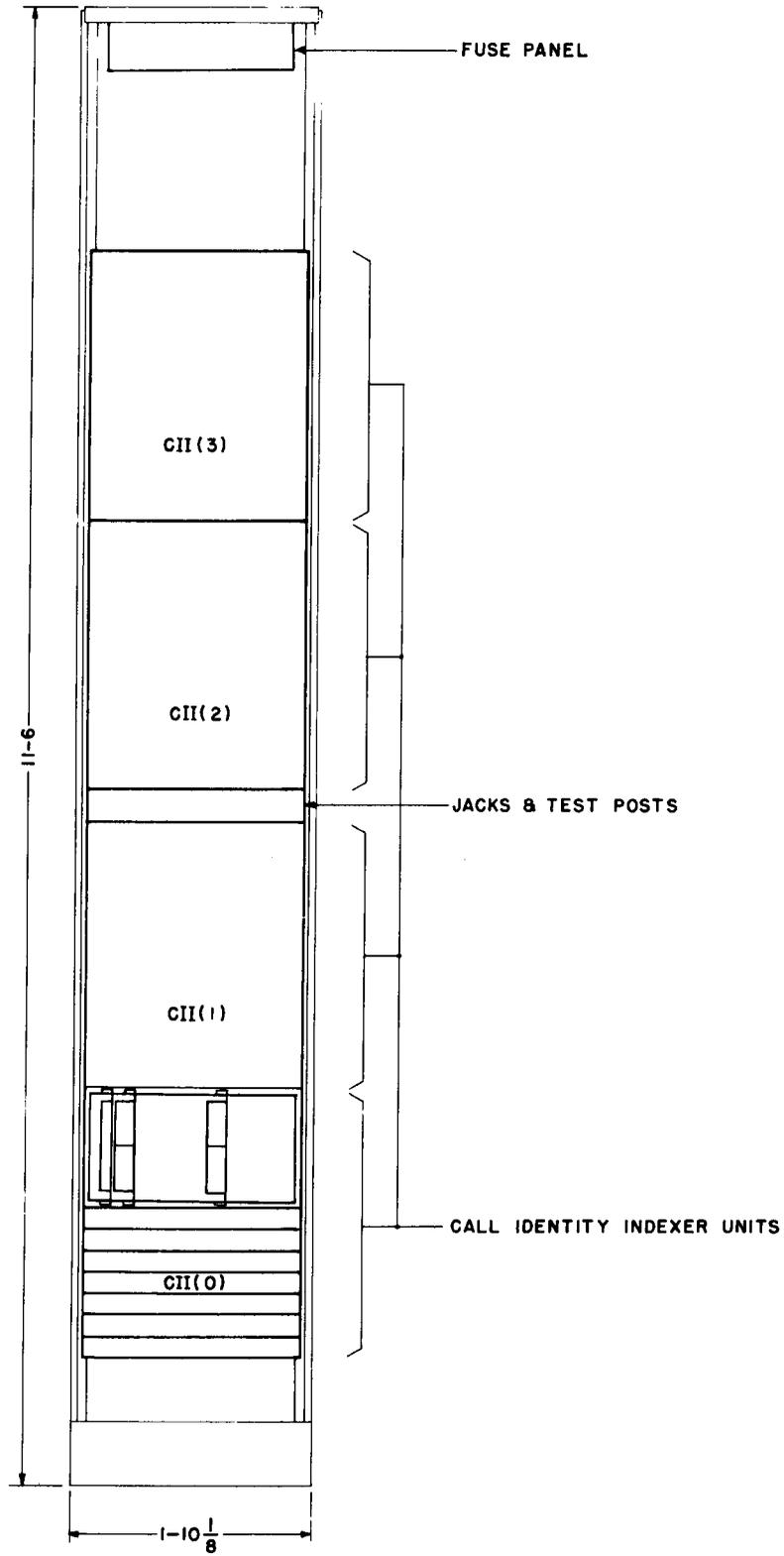


Fig. 54—Call Identity Indexer Frame

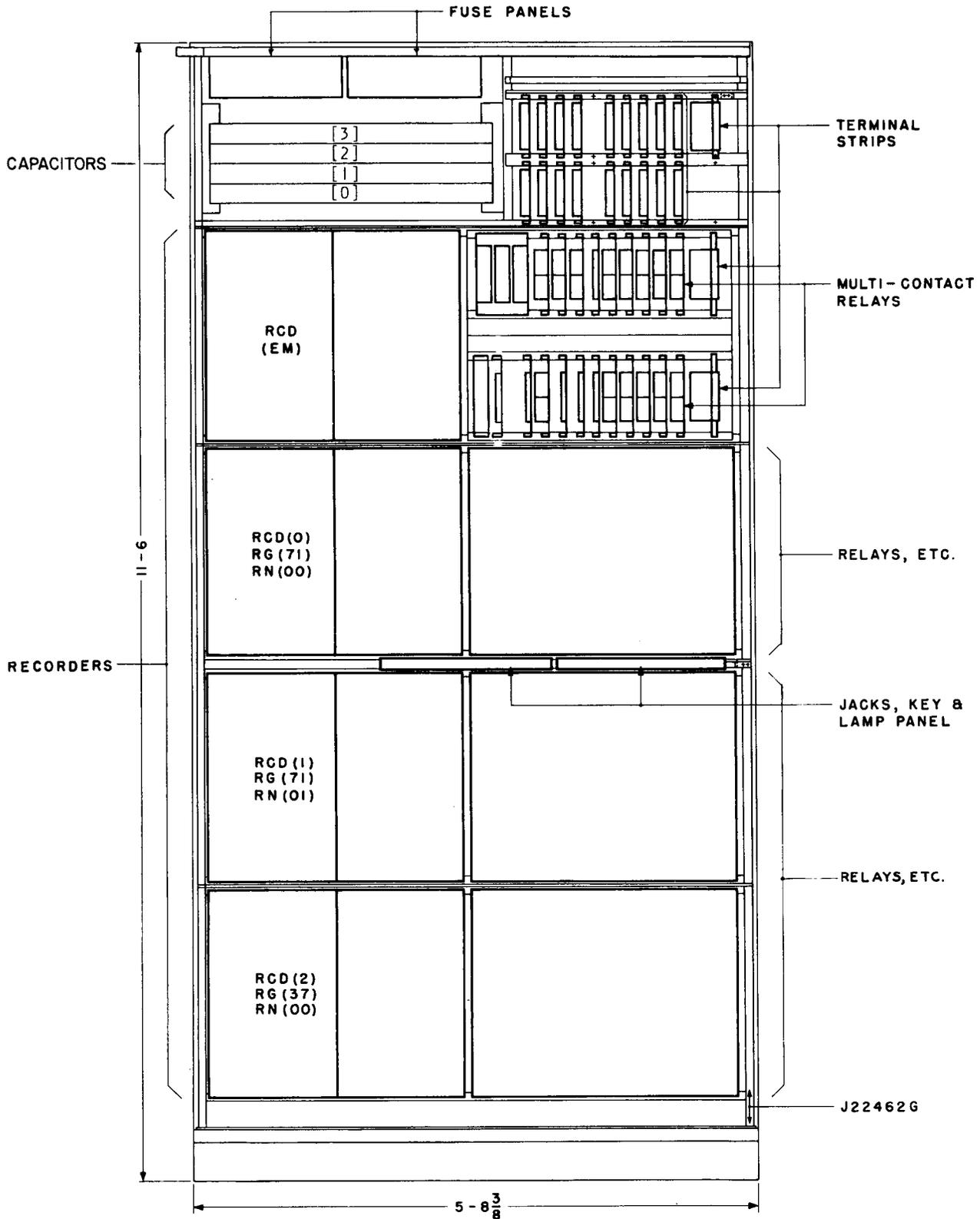


Fig. 55—Recorder Frame

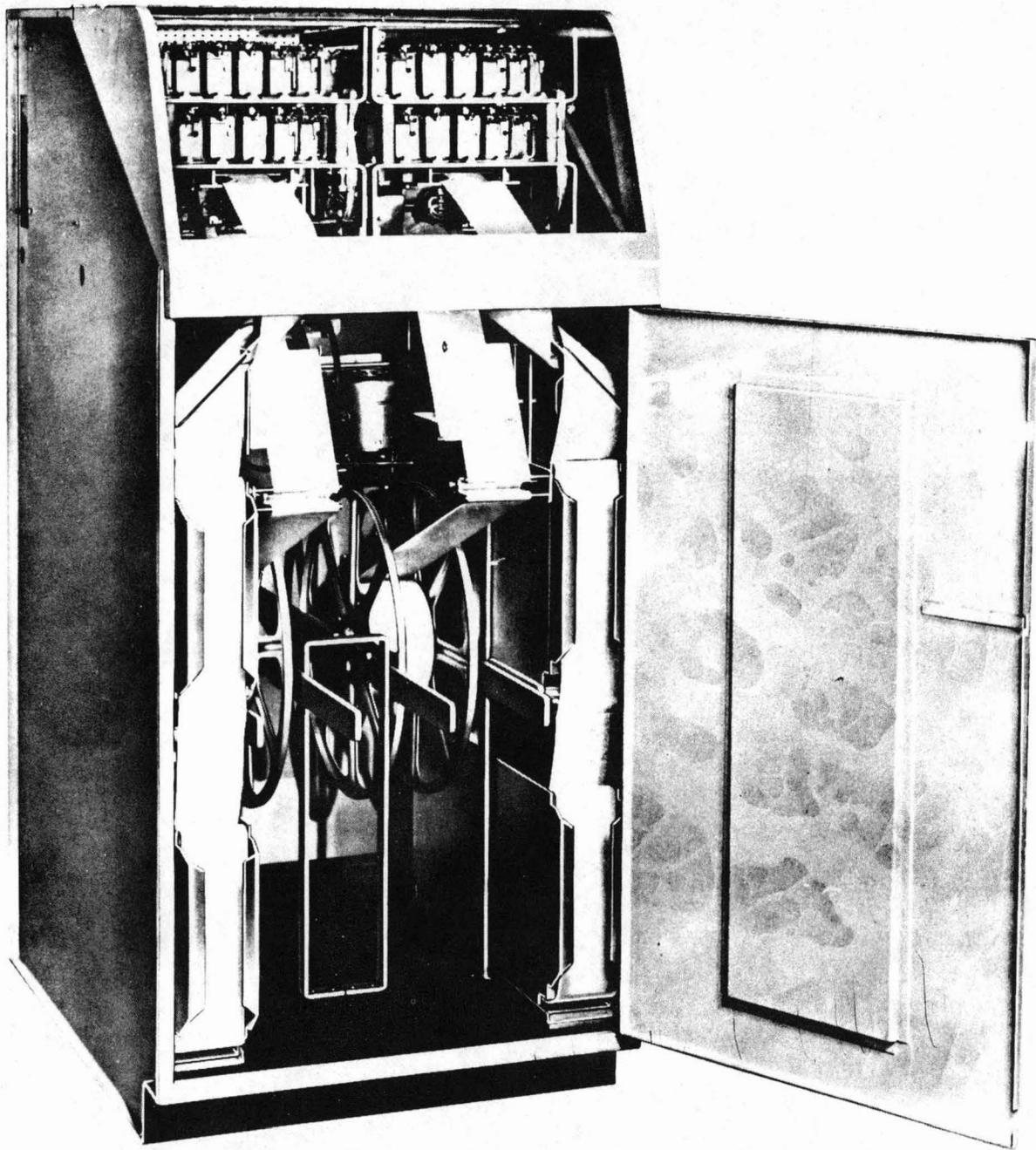
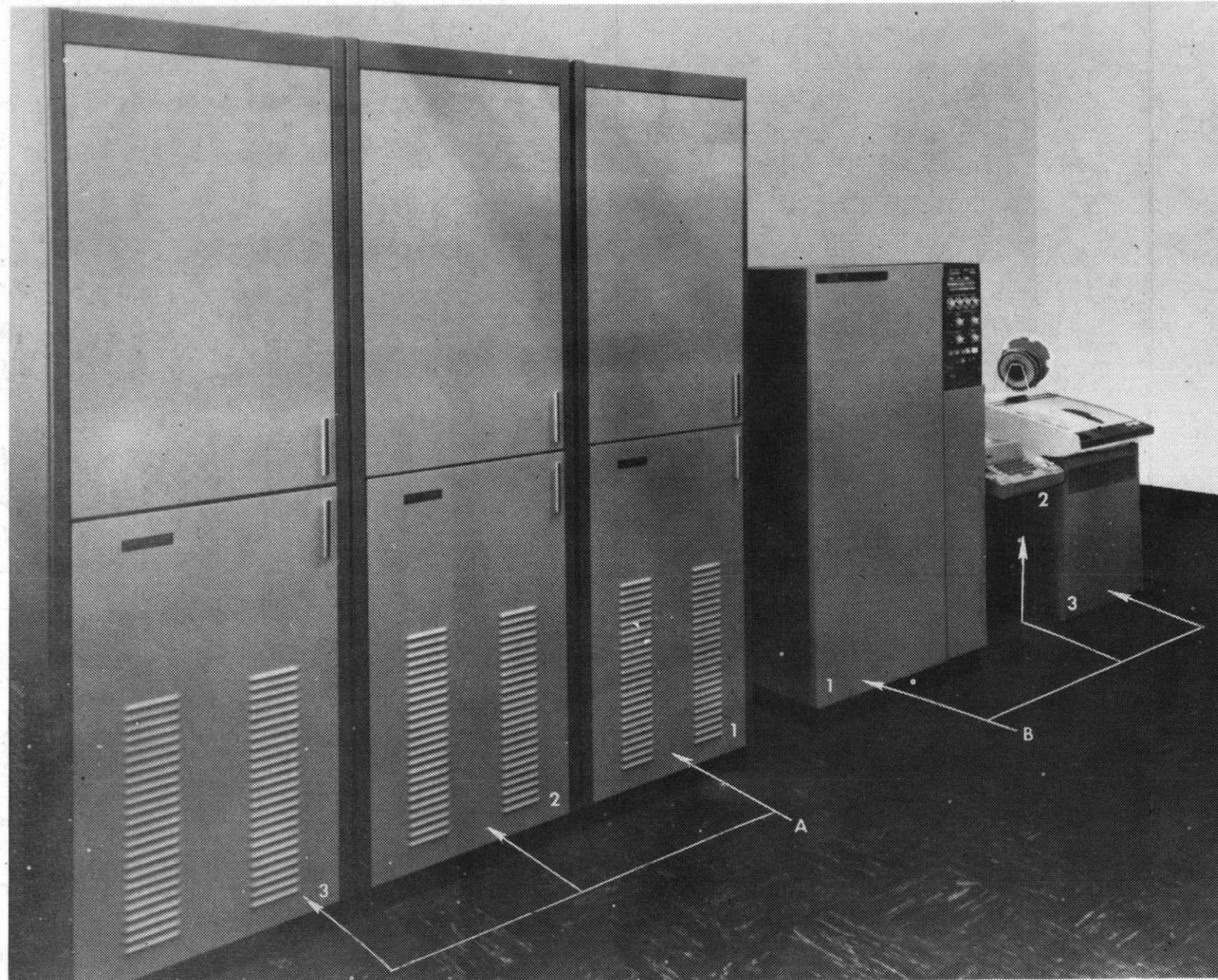


Fig. 56—Perforator Cabinet



**A. SCAN CABINETS**

- 1. PS 0
- 2. PS 1
- 3. PS 2

**B. IBM SYSTEM/7**

- 1. PROCESSOR 5026-C3
- 2. OPERATOR STATION 5028
- 3. TAPE DRIVE CONSOLE 3140

Fig. 57—CAMA-C System

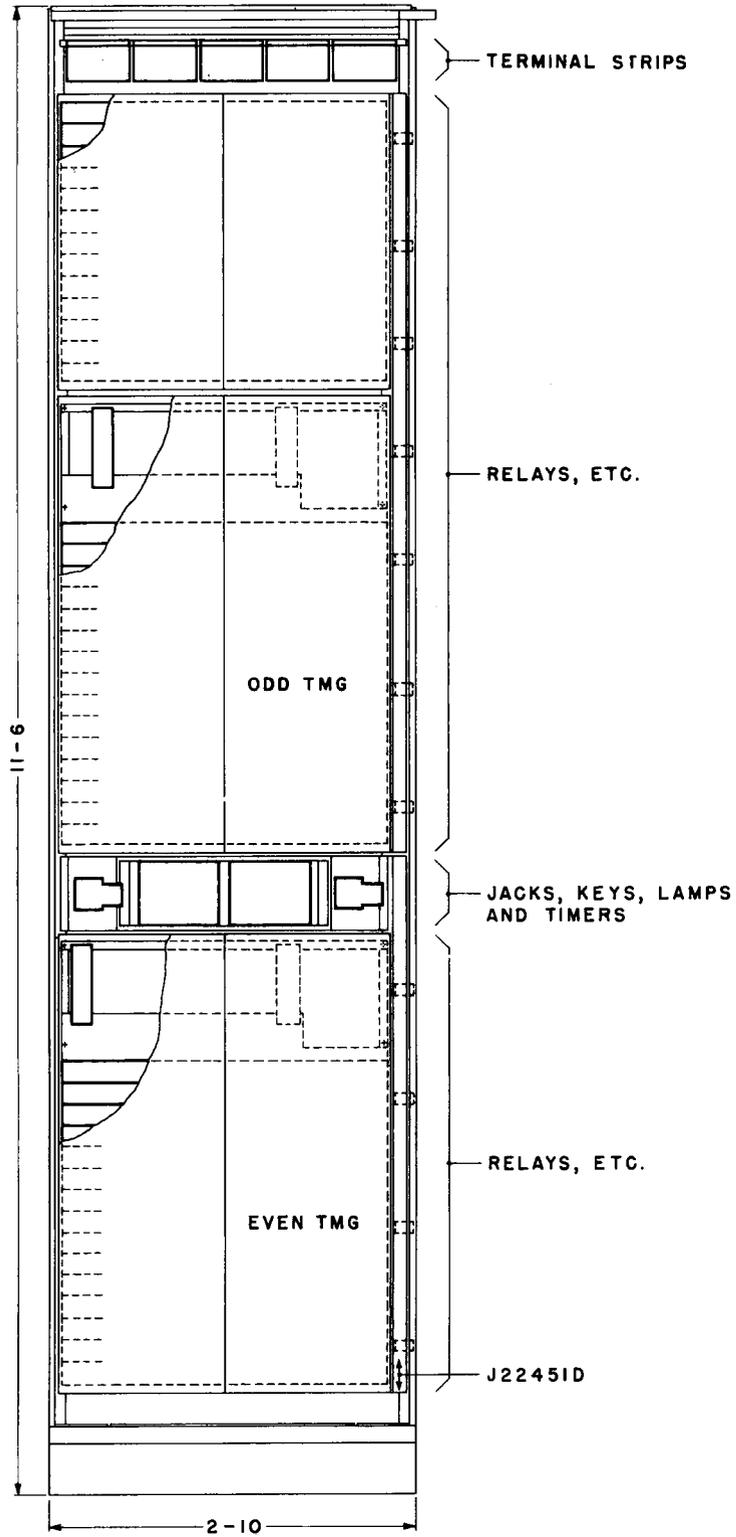


Fig. 58 — Master Timing Frame

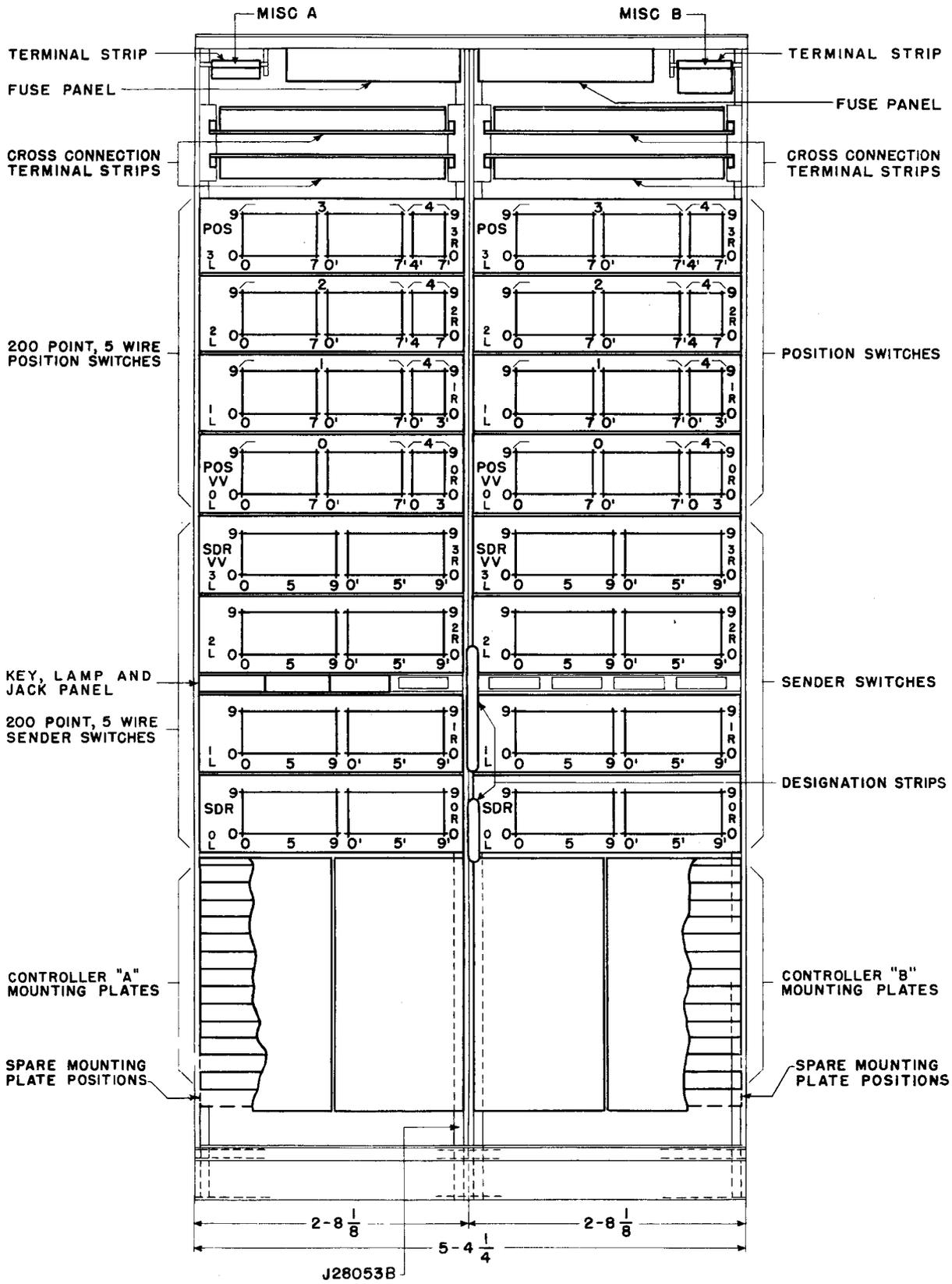


Fig. 59—Position Link Frame



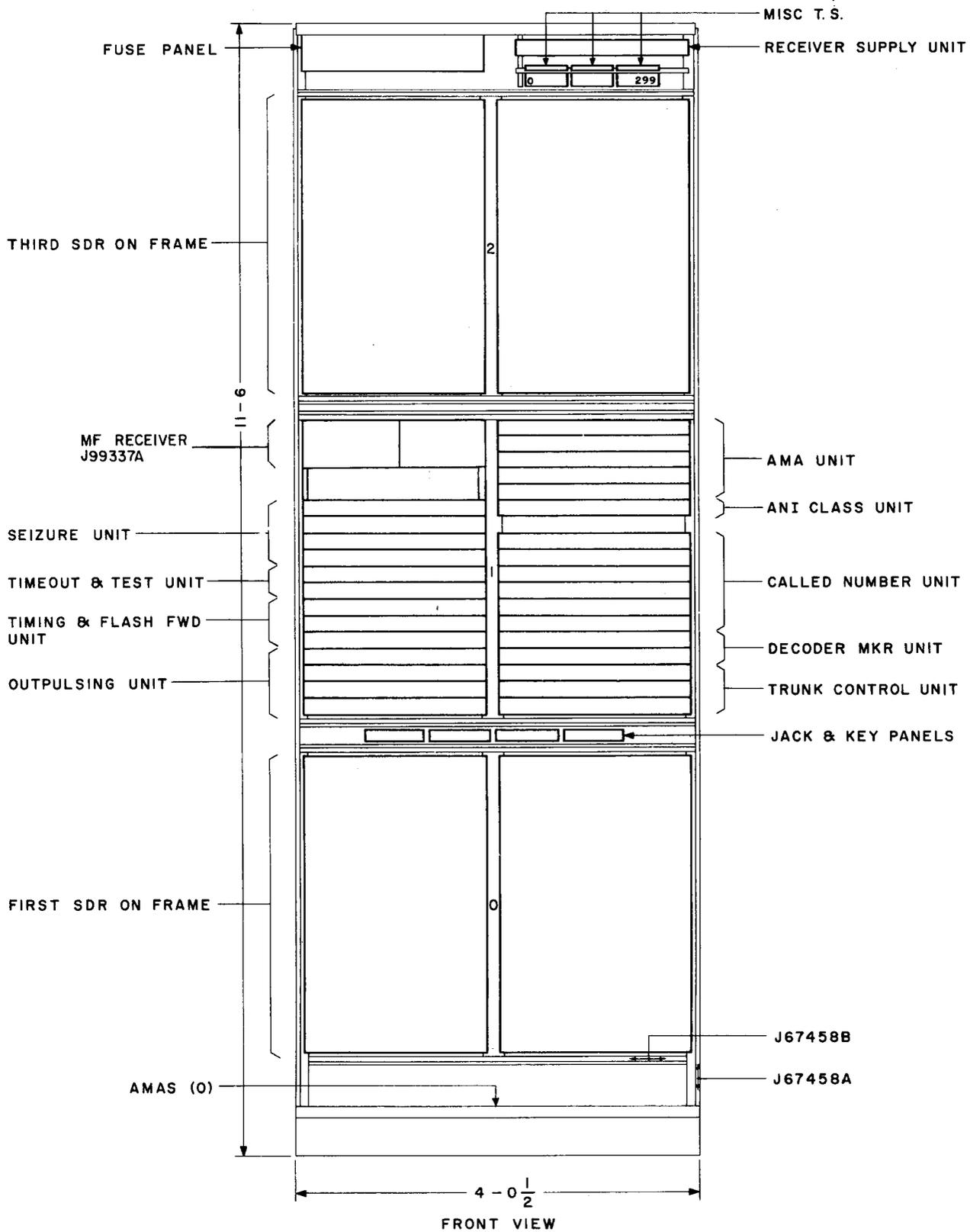


Fig. 61 — CAMA Sender Frame

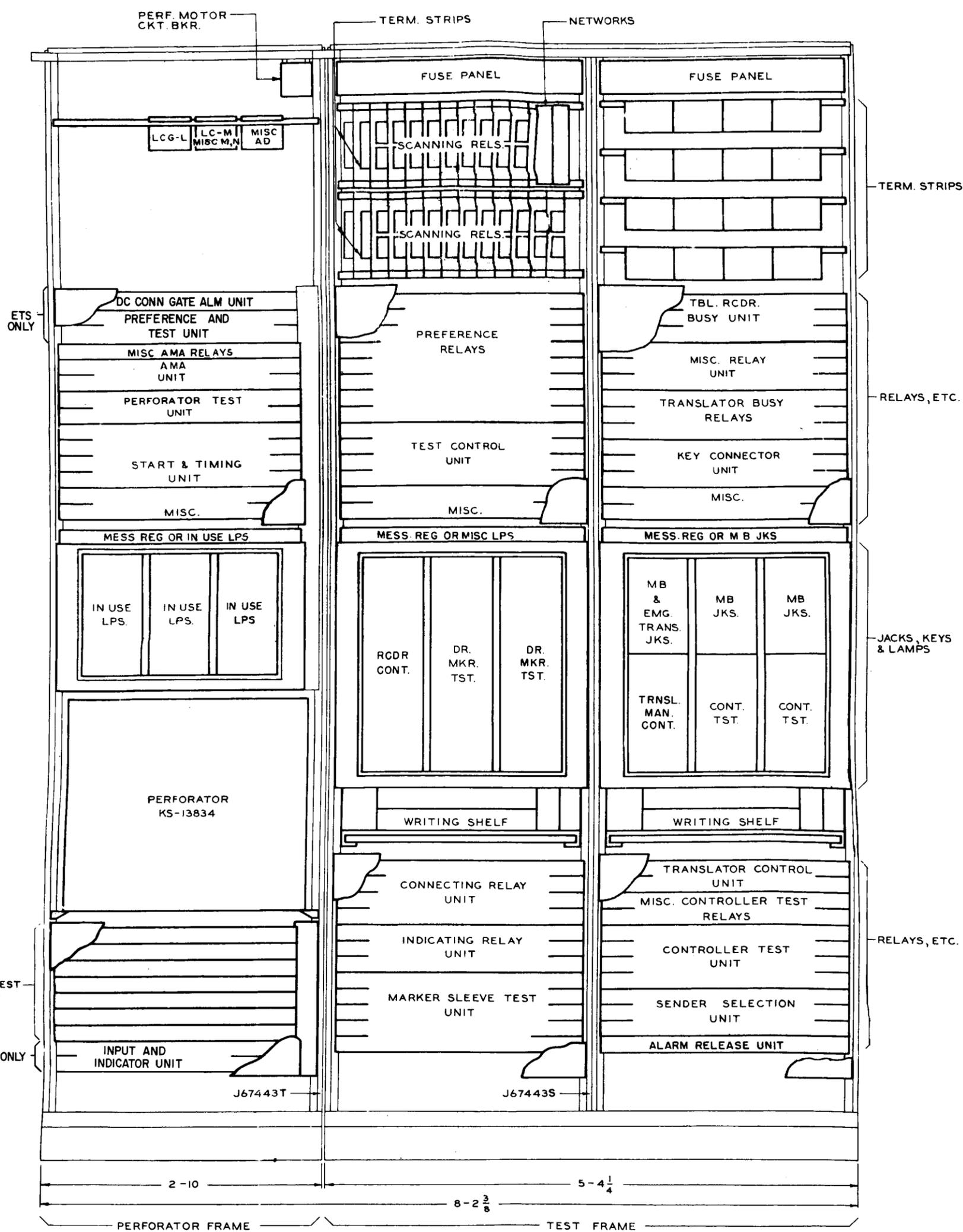


Fig. 62—Trouble Recorder Frame

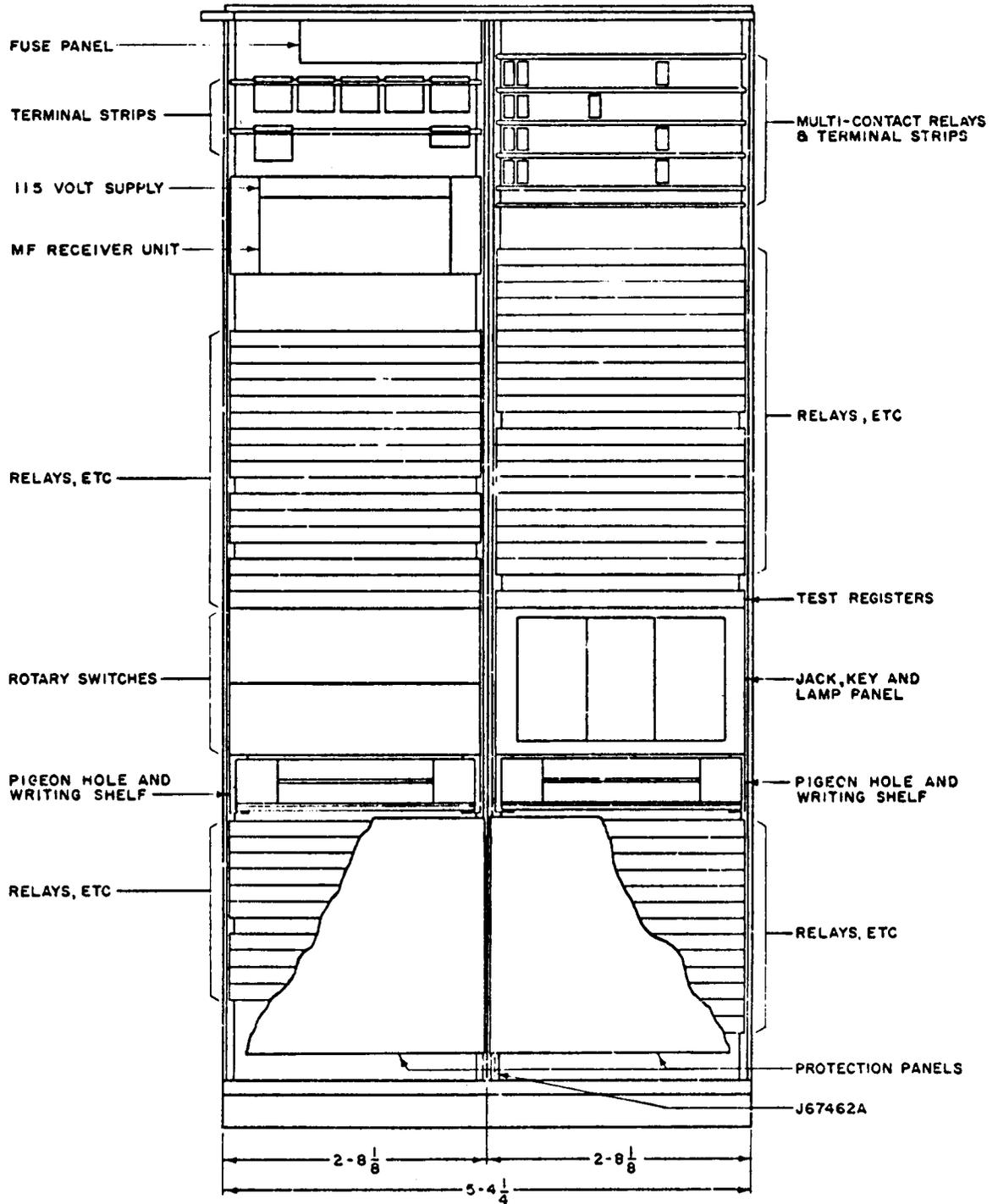


Fig. 63—Incoming Sender and Register Test Frame

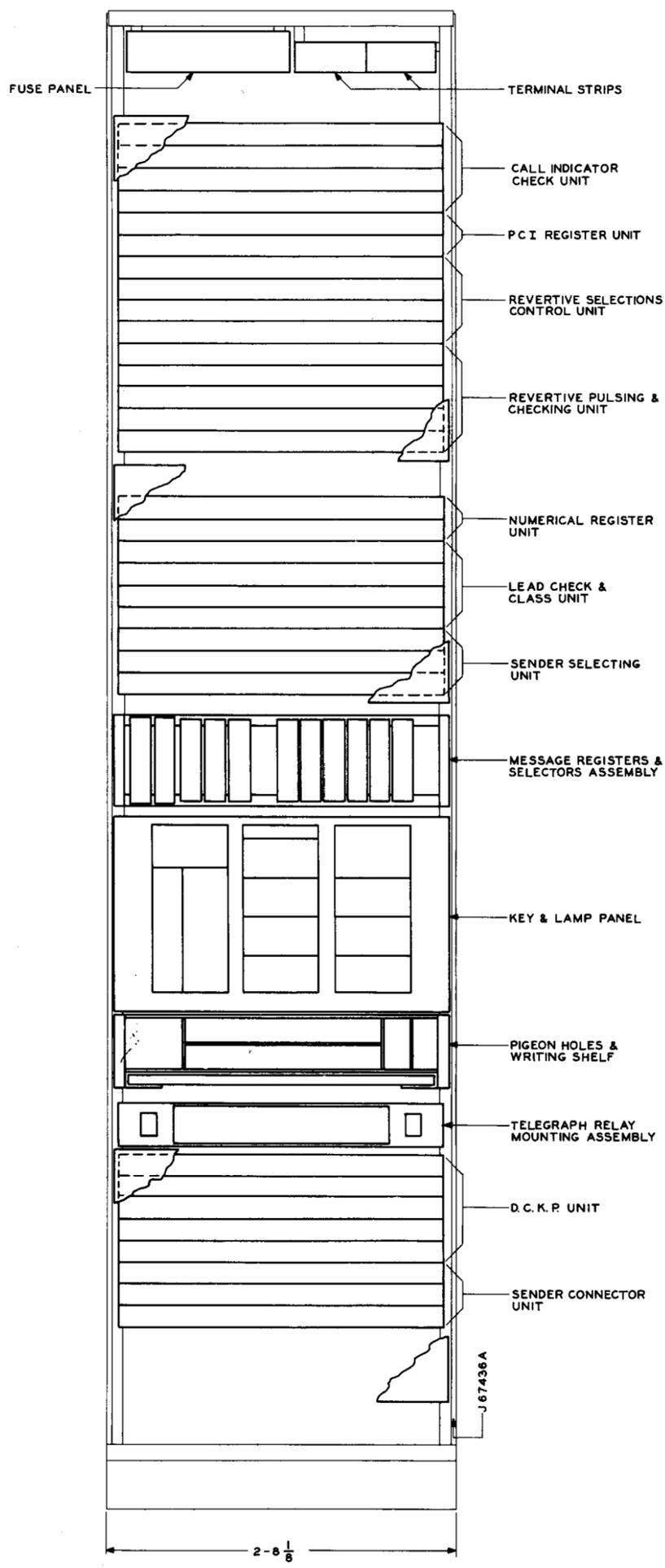


Fig. 64—Outgoing Sender Test Frame

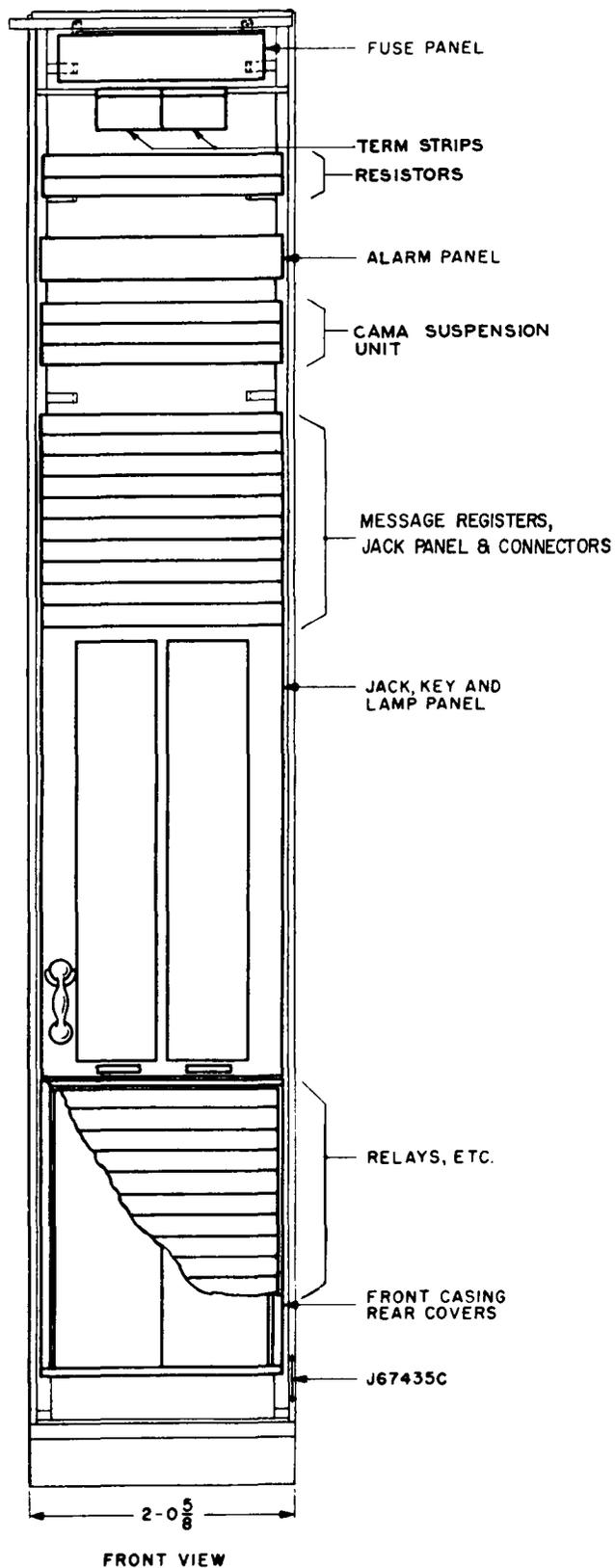


Fig. 65 — Sender Make-Busy Frame

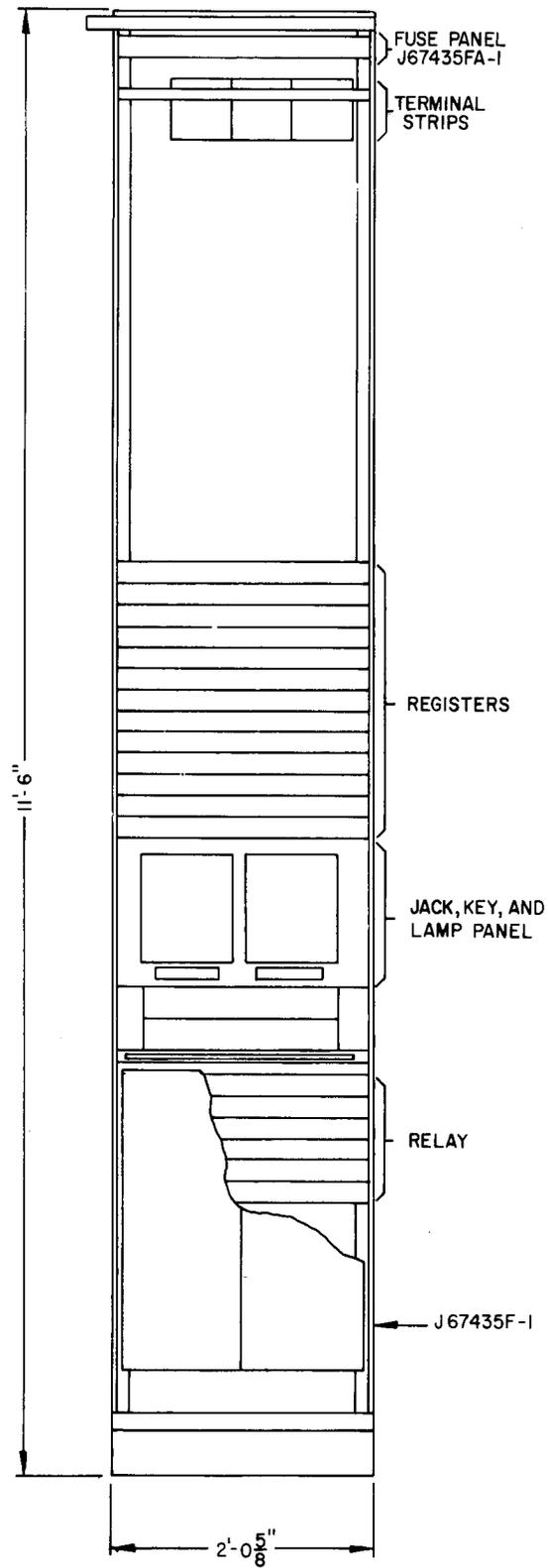


Fig. 66—Auxiliary Sender Make-Busy Frame

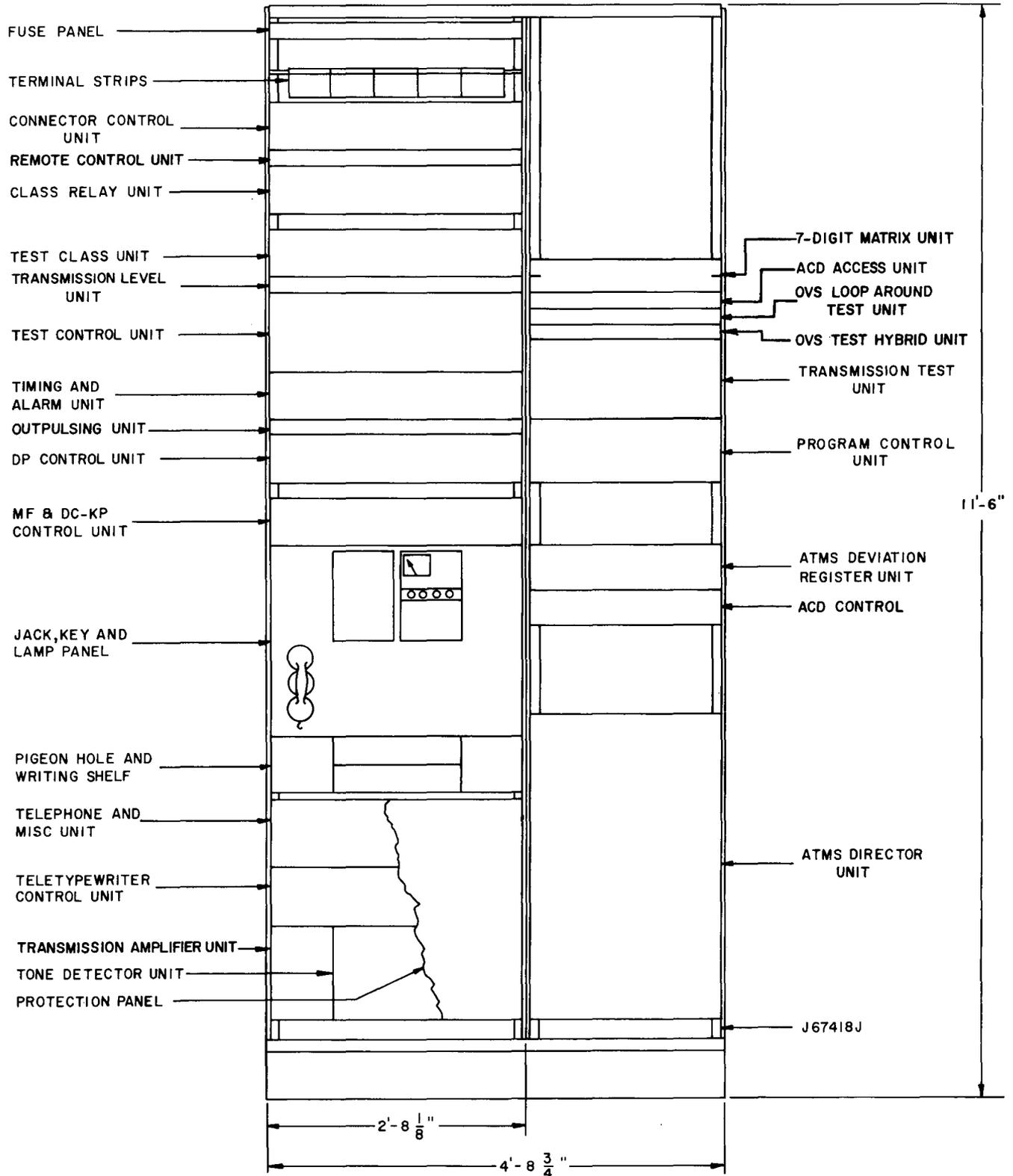


Fig. 67— Automatic Outgoing Toll Connecting Trunk Transmission Test Frame

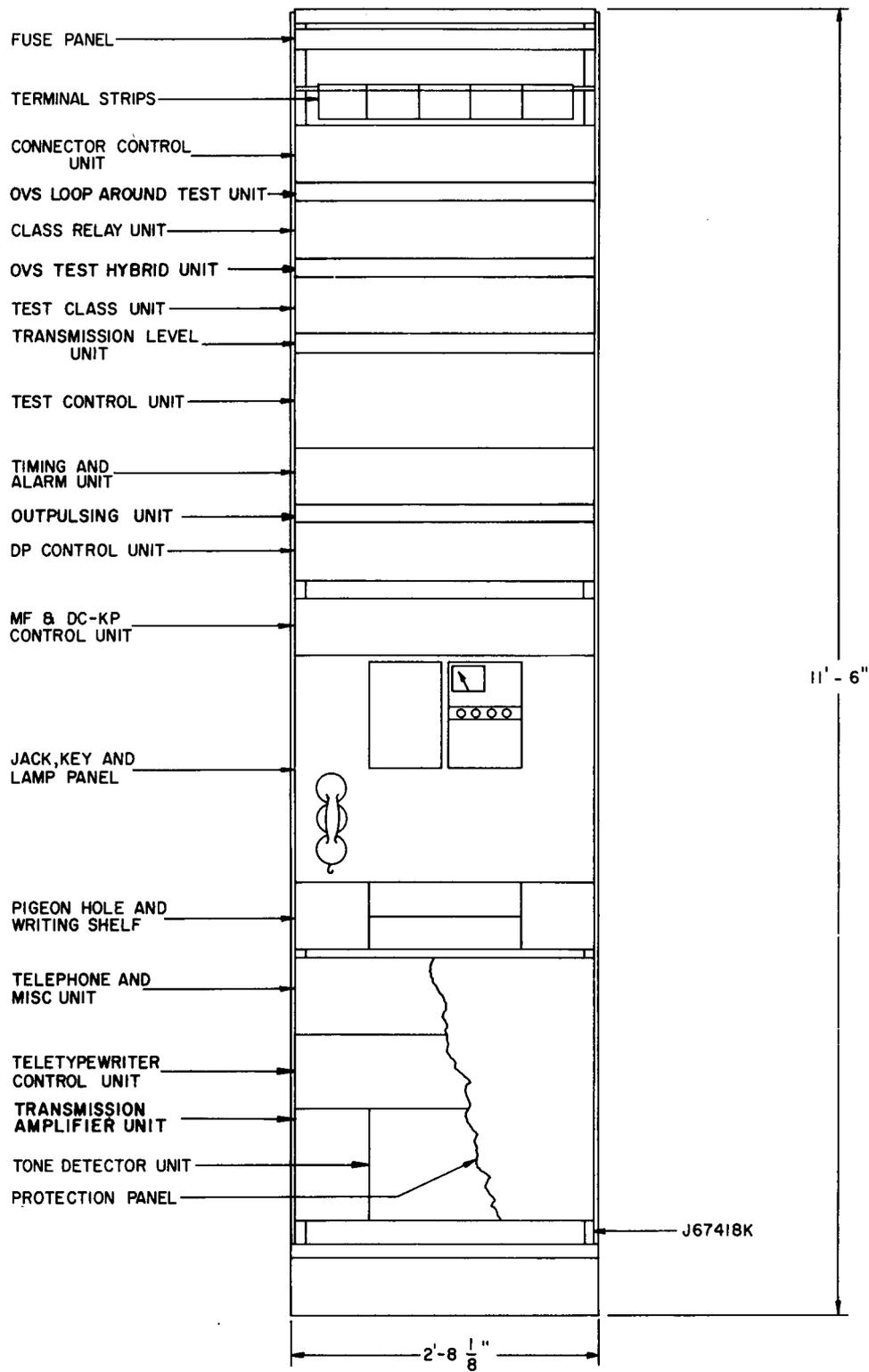


Fig. 68— Automatic Outgoing Toll Connecting Trunk Operational Test Frame

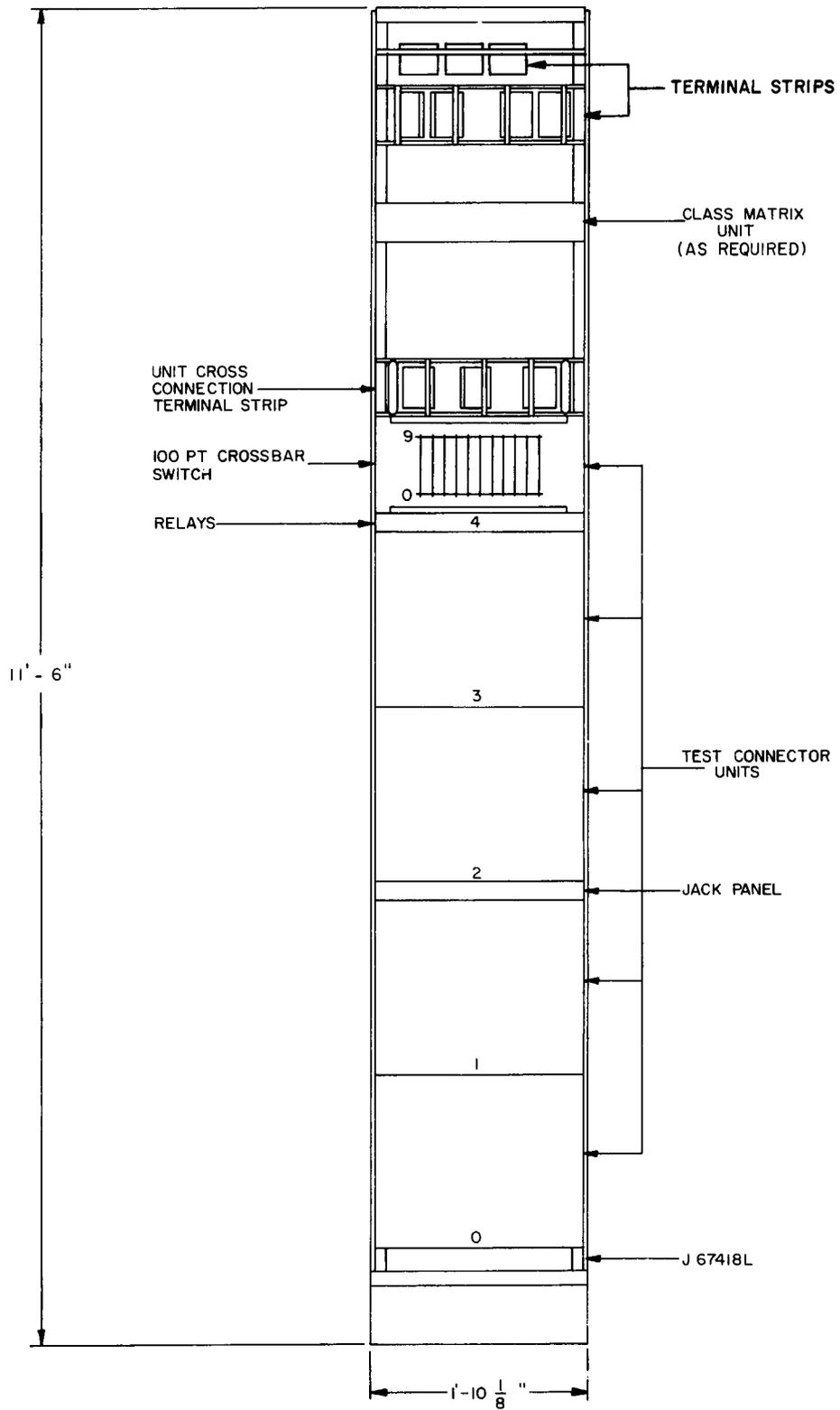


Fig. 69— Automatic Outgoing Toll Connecting Trunk Test Connector Frame

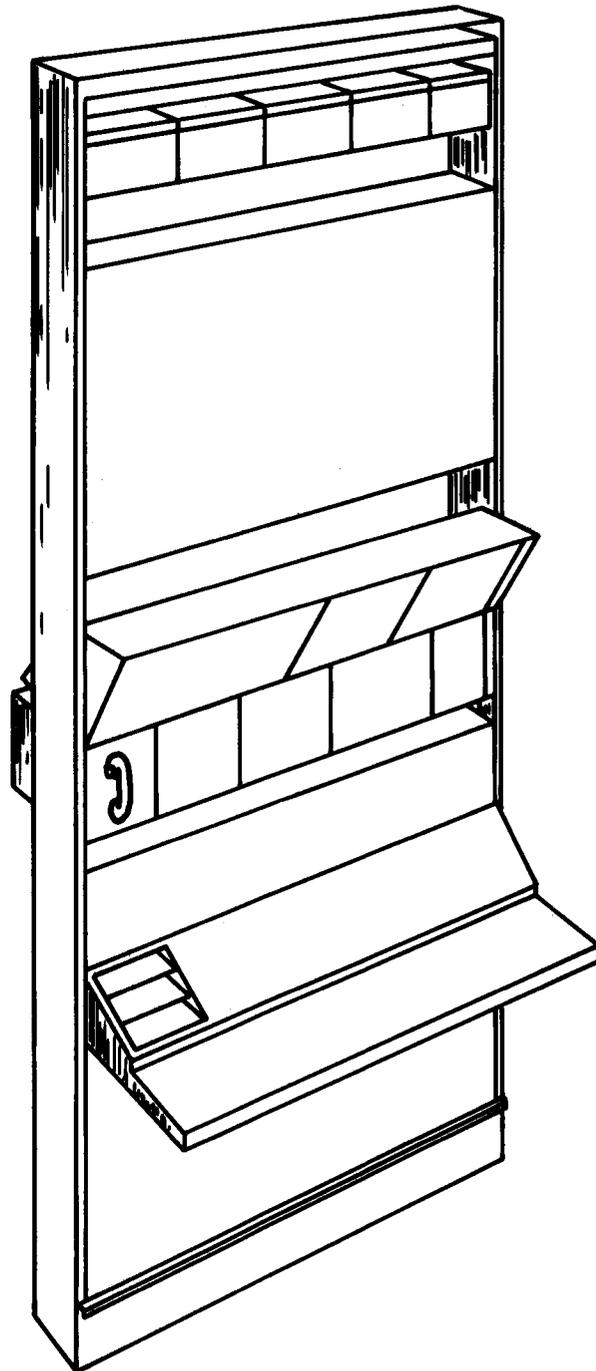


Fig. 70—Trunk Test Frame

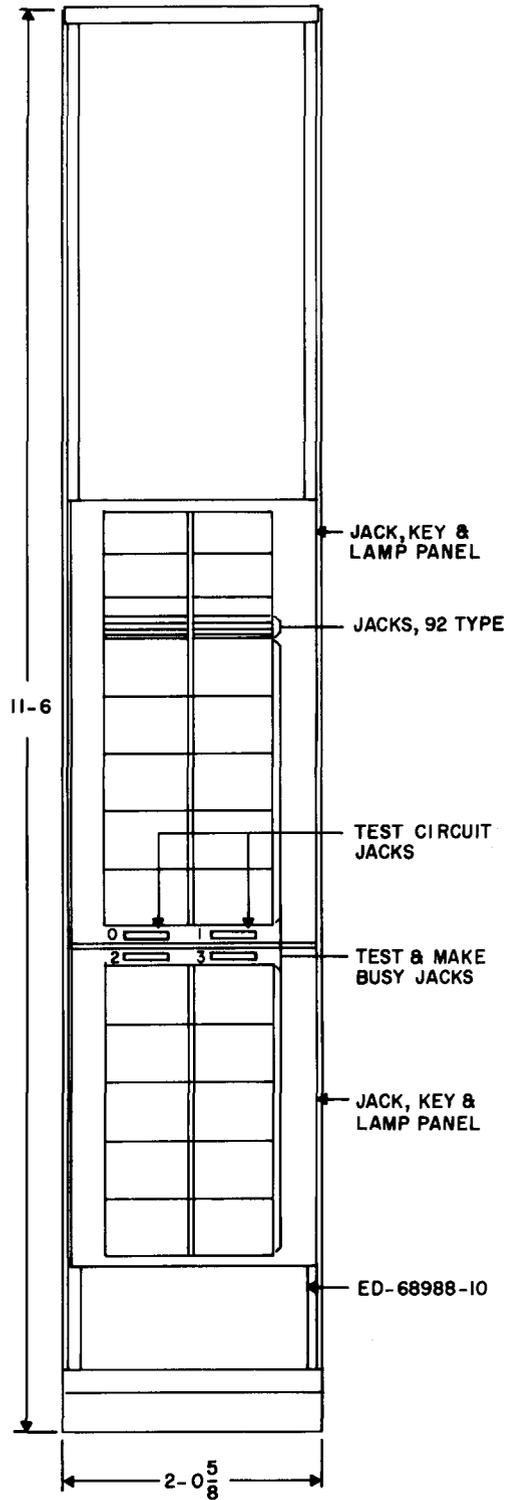


Fig. 71 — Trunk Test and Make-Busy Jack Bay

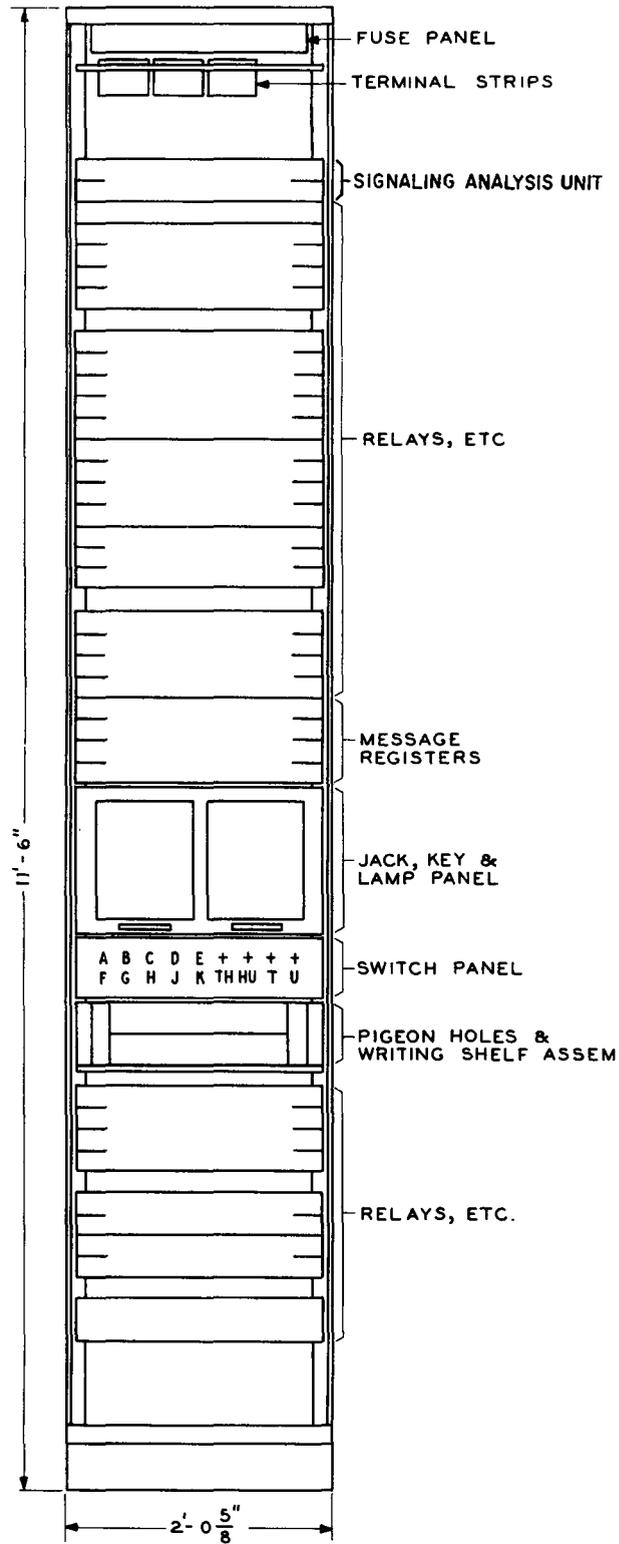


Fig. 72— Automatic Incoming Trunk Test Frame

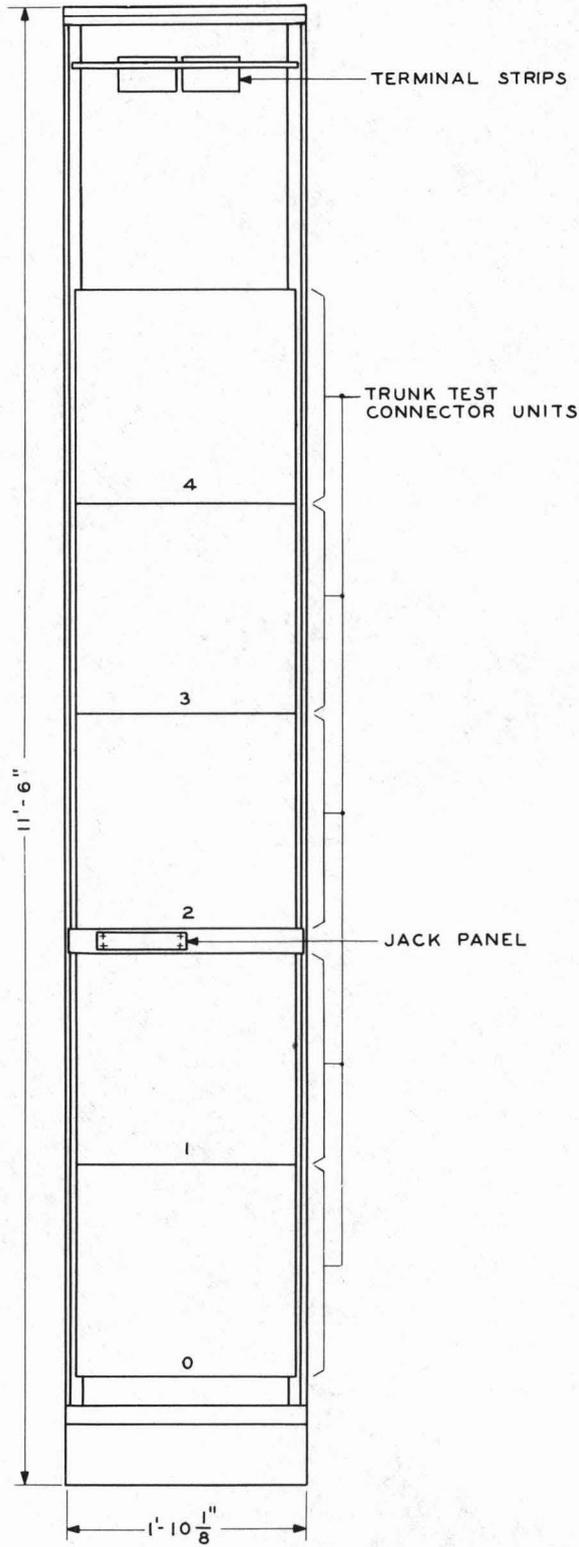


Fig. 73—Automatic Incoming Trunk Test Connector Frame

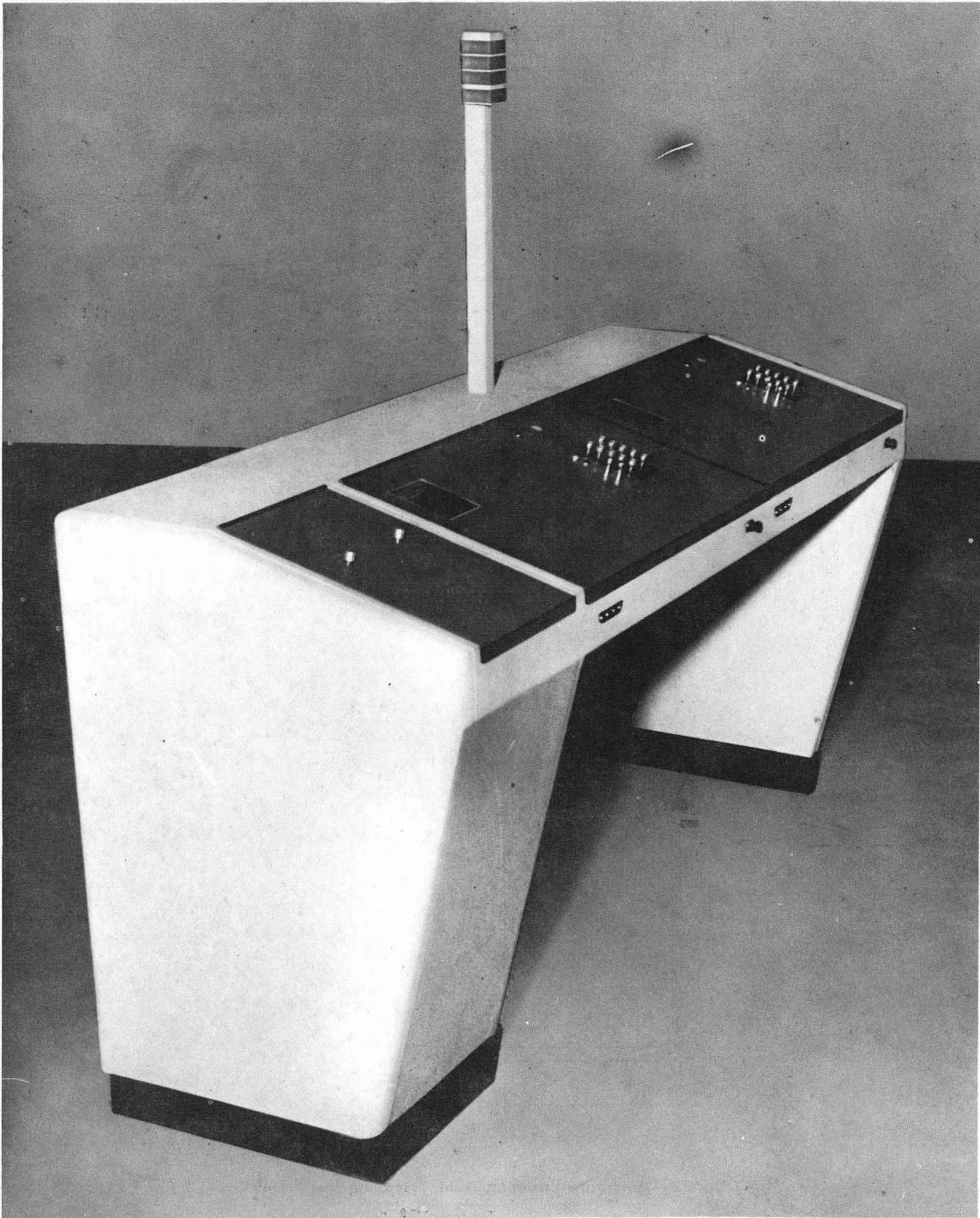


Fig. 74—CAMA Switchboard

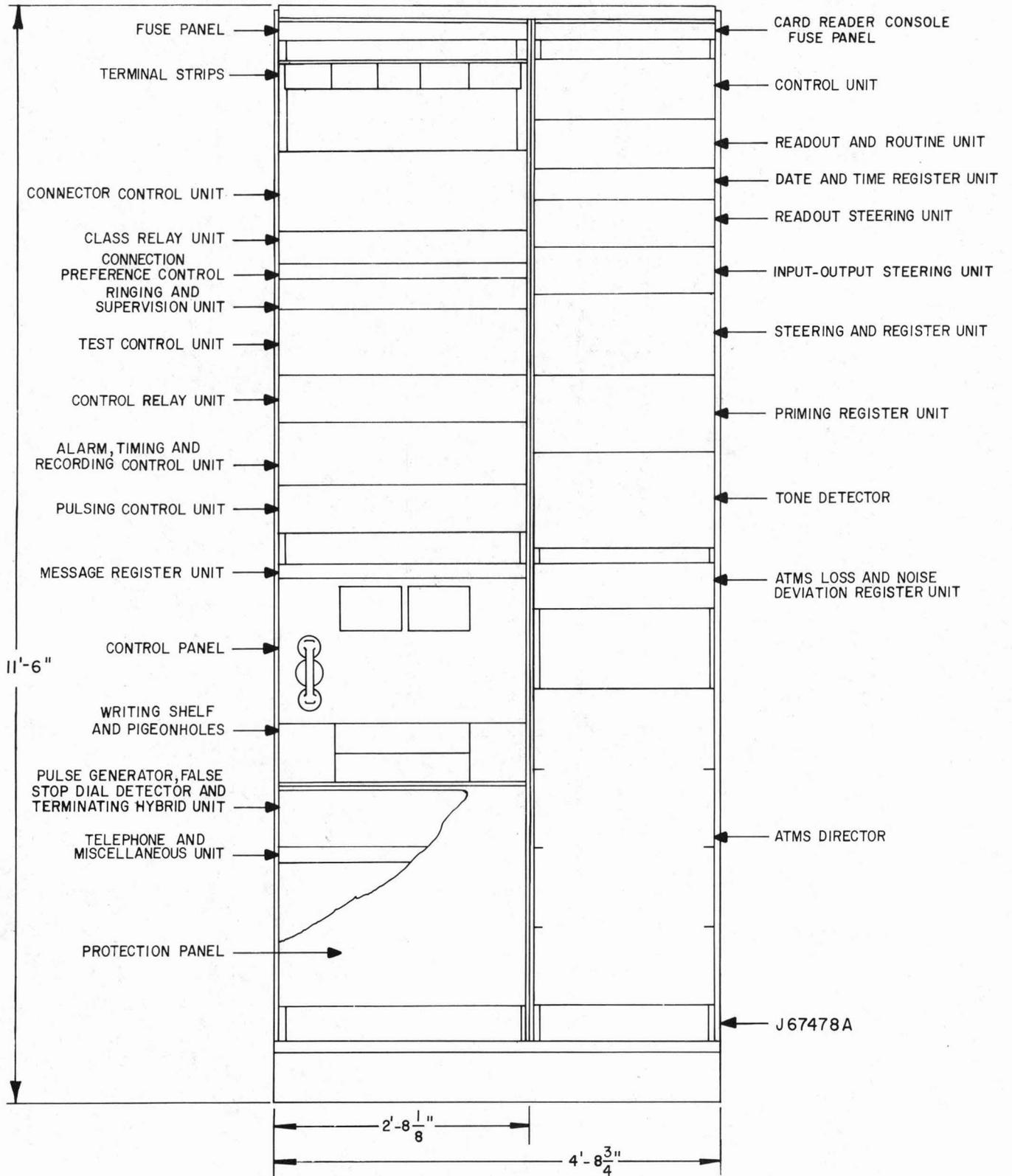


Fig. 75 — Automatically Directed Outgoing Intertoll Trunk Test Frame

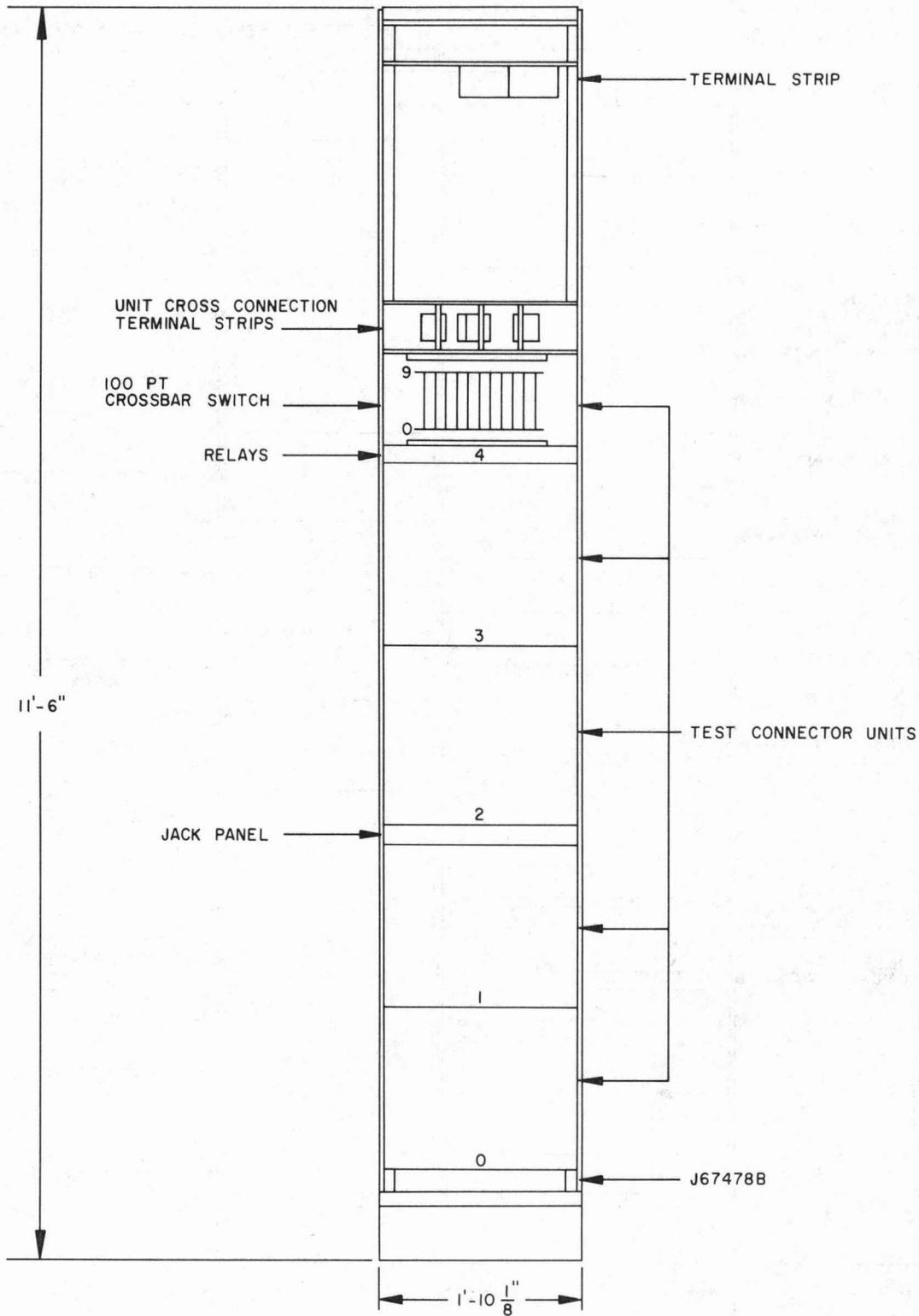


Fig. 76—Automatically Directed Outgoing Intertoll Trunk Test Connector Frame

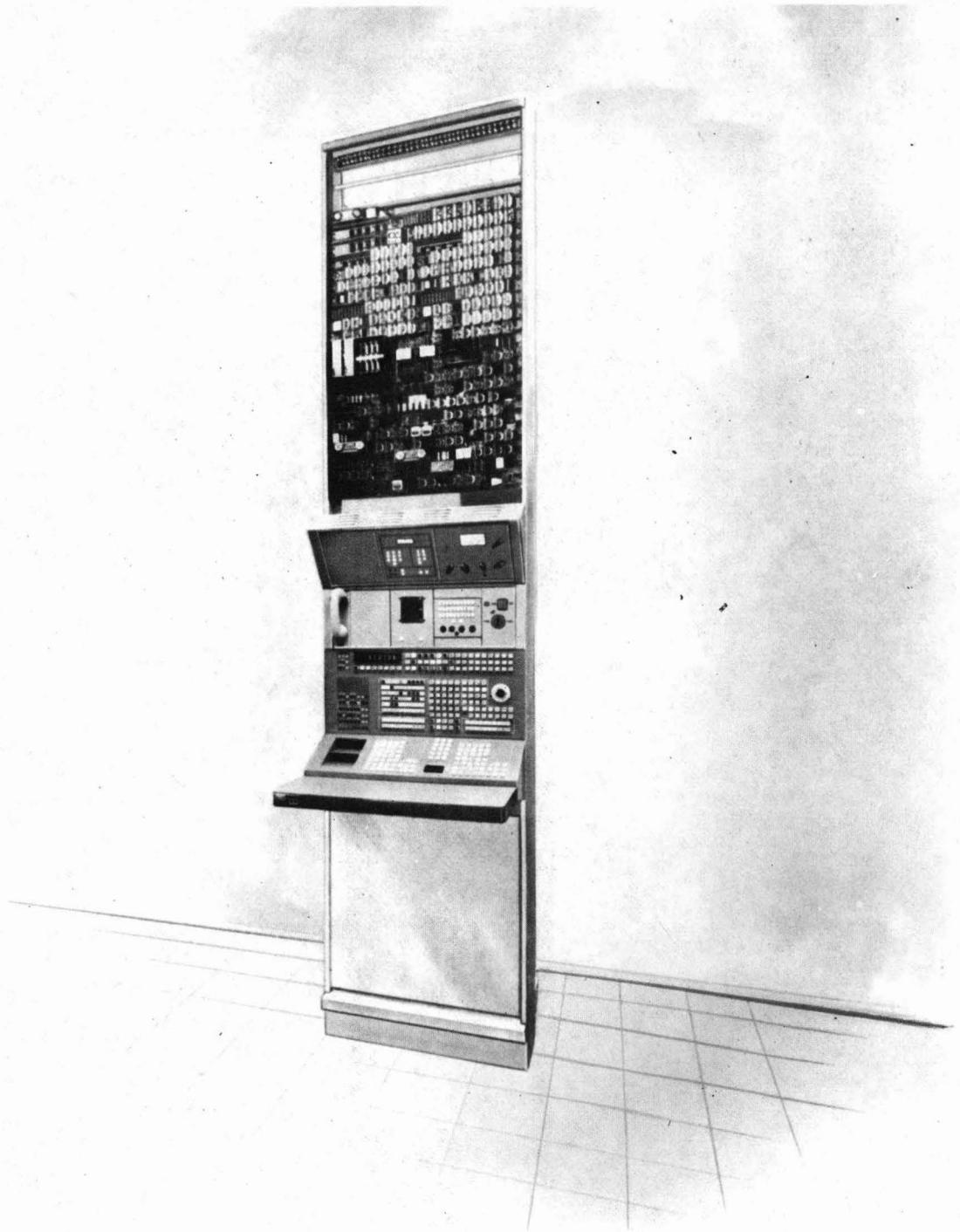


Fig. 77—Integrated Manual Test Frame

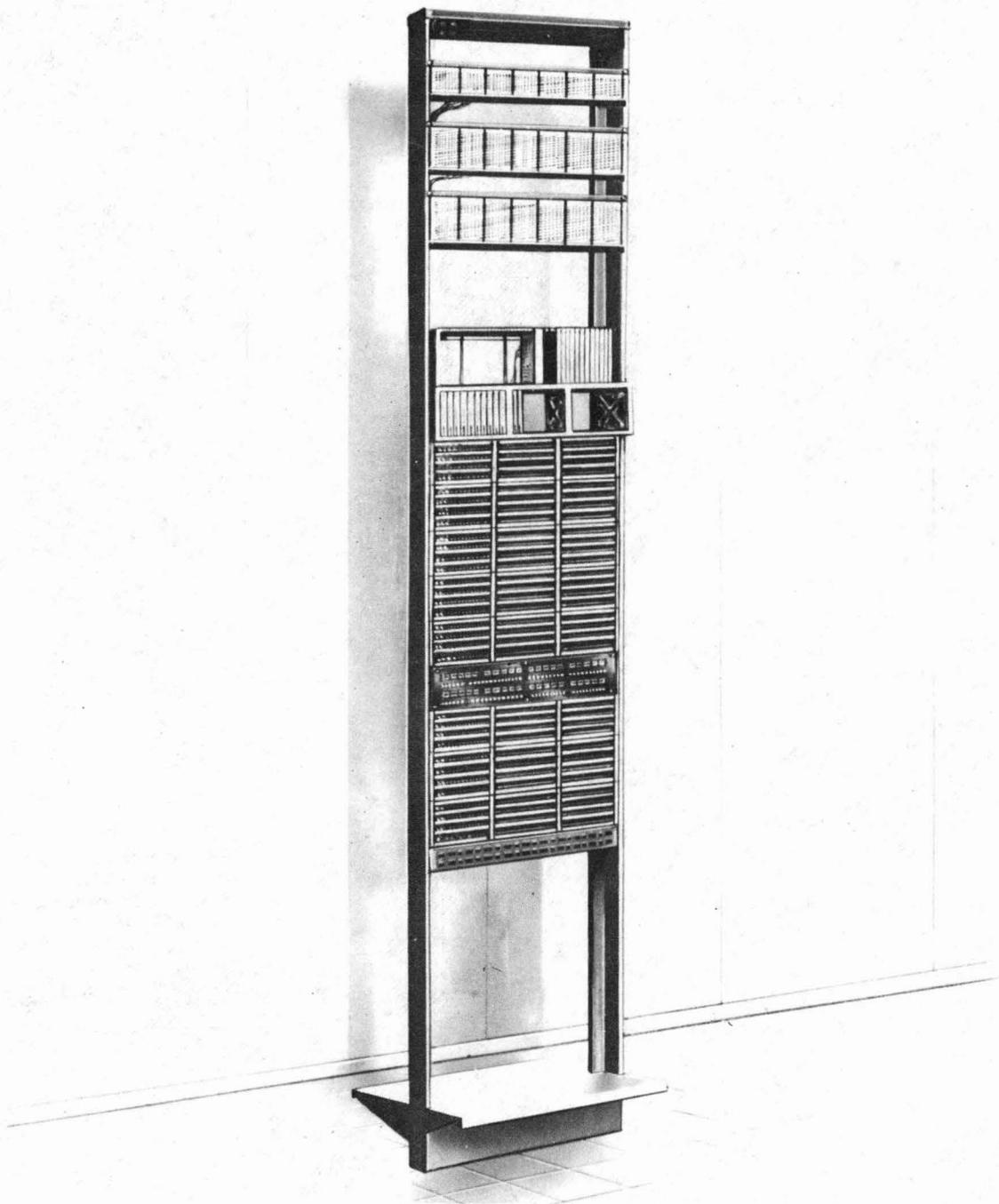


Fig. 78—Circuit Status and Display Board

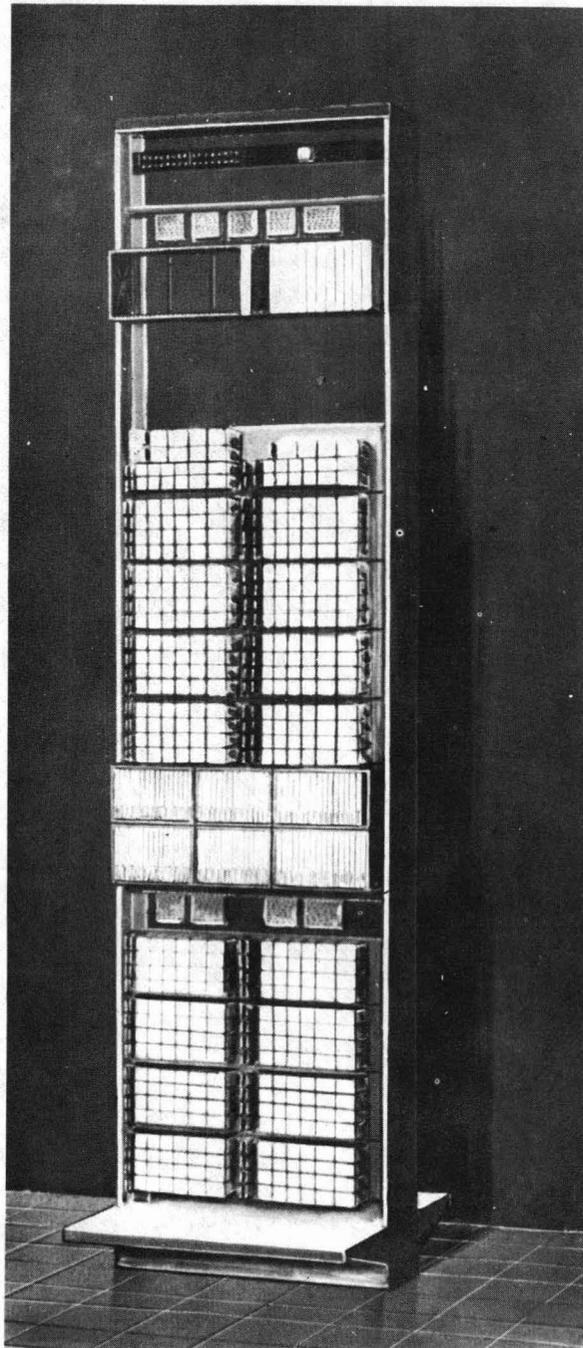


Fig. 79—Status Concentrator Frame

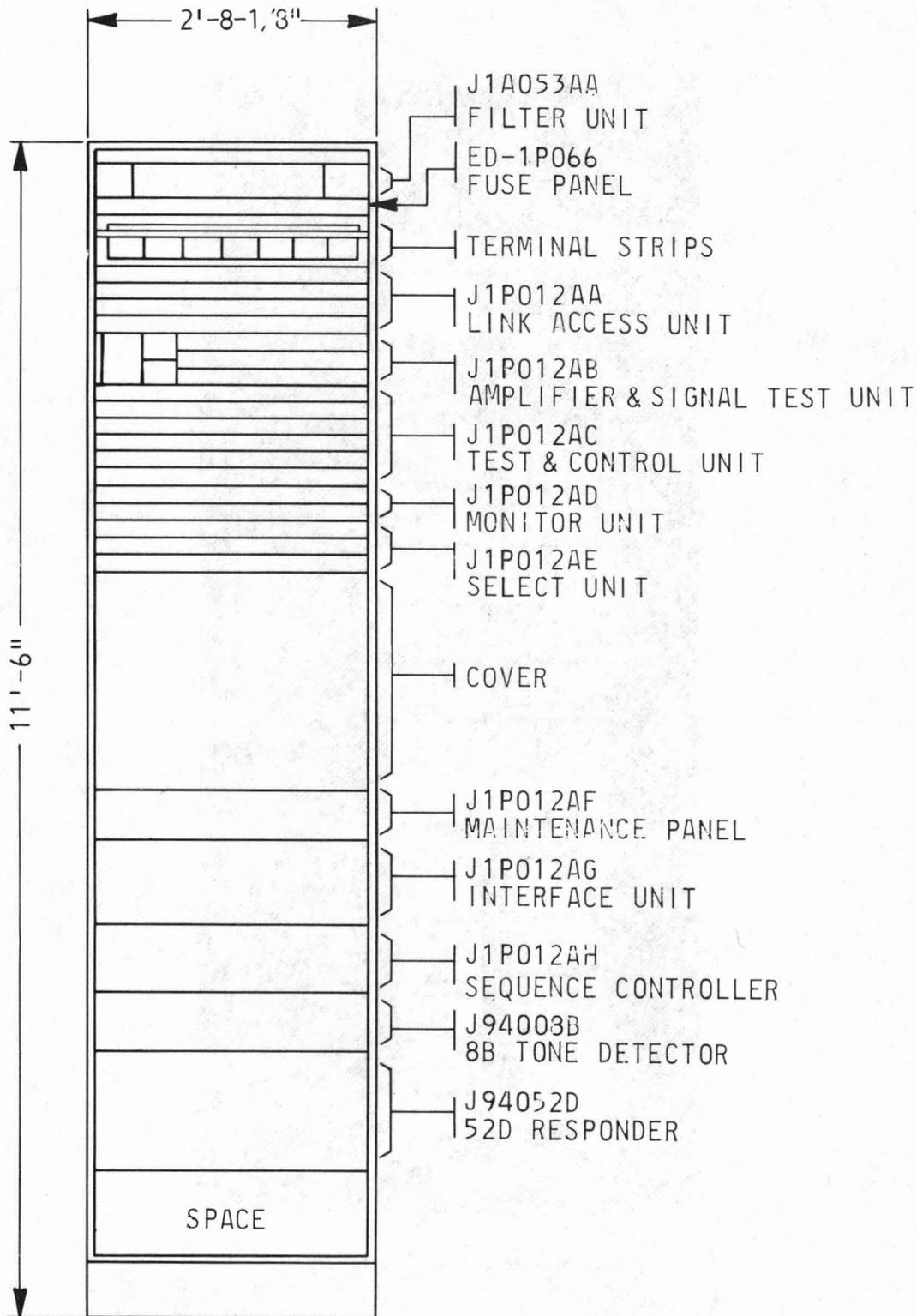


Fig. 80—Outgoing Trunk Testing System Frame

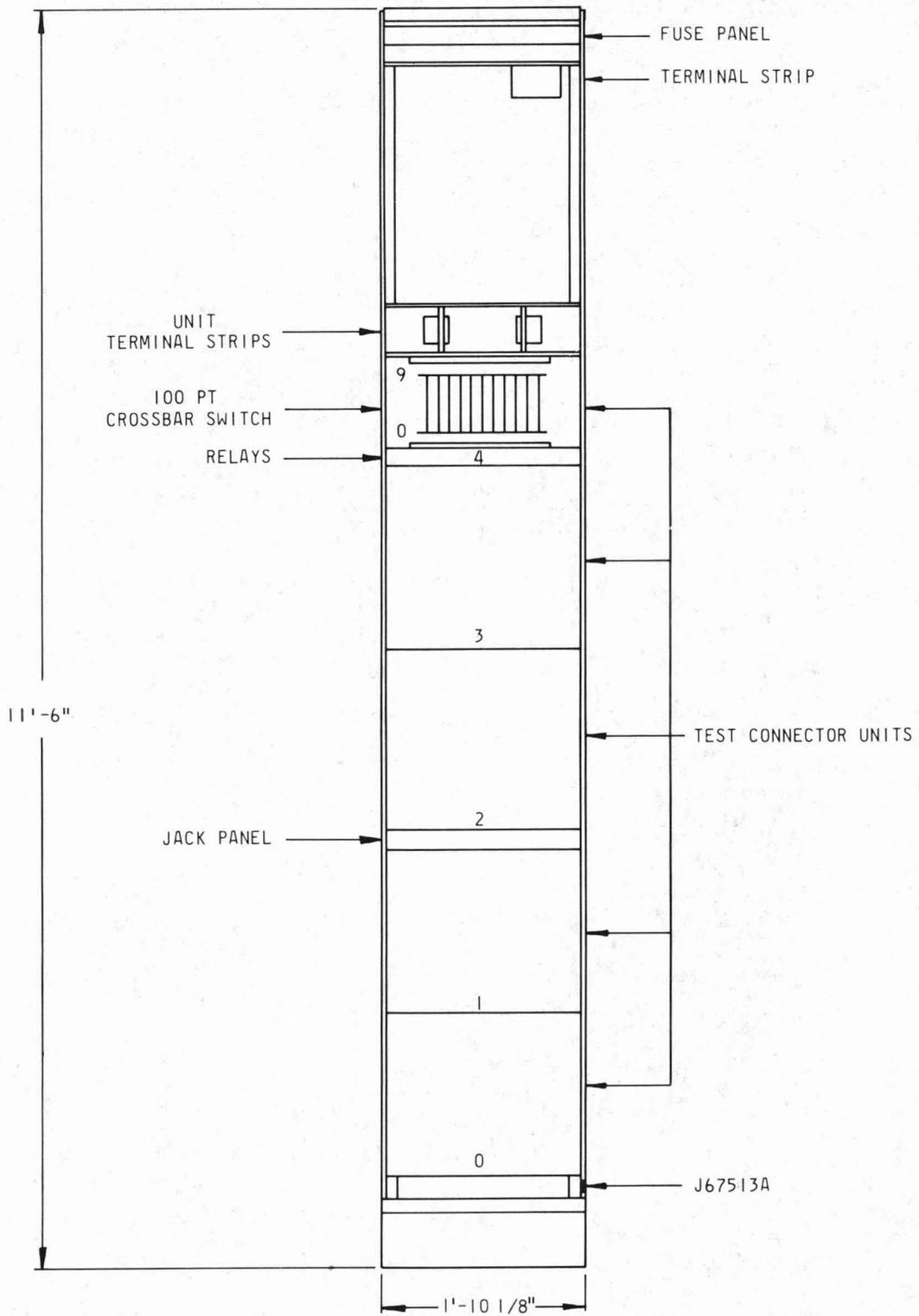


Fig. 81 — Outgoing Trunk Test Connector



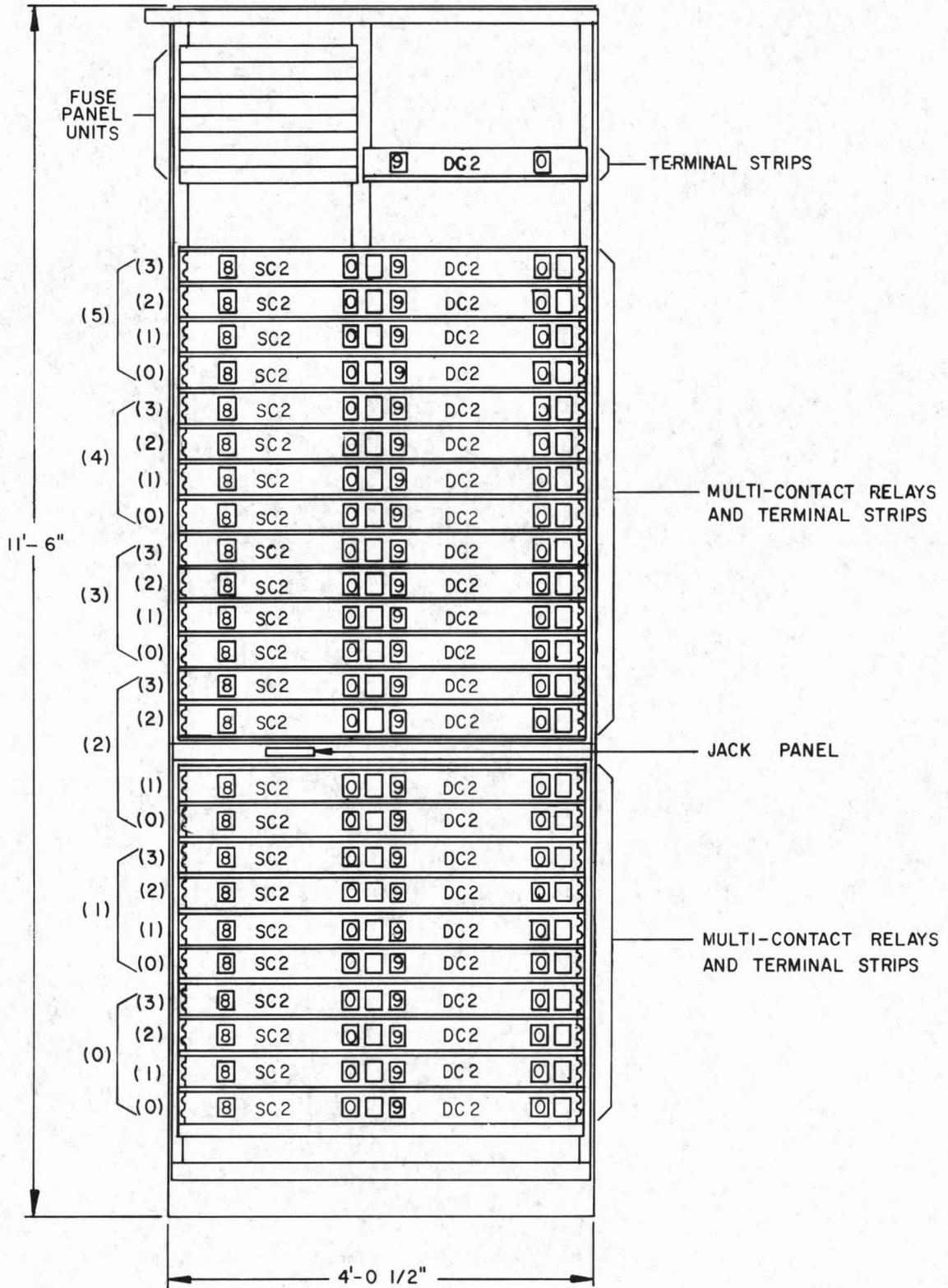


Fig. 83— Auxiliary Decoder Connector Frame

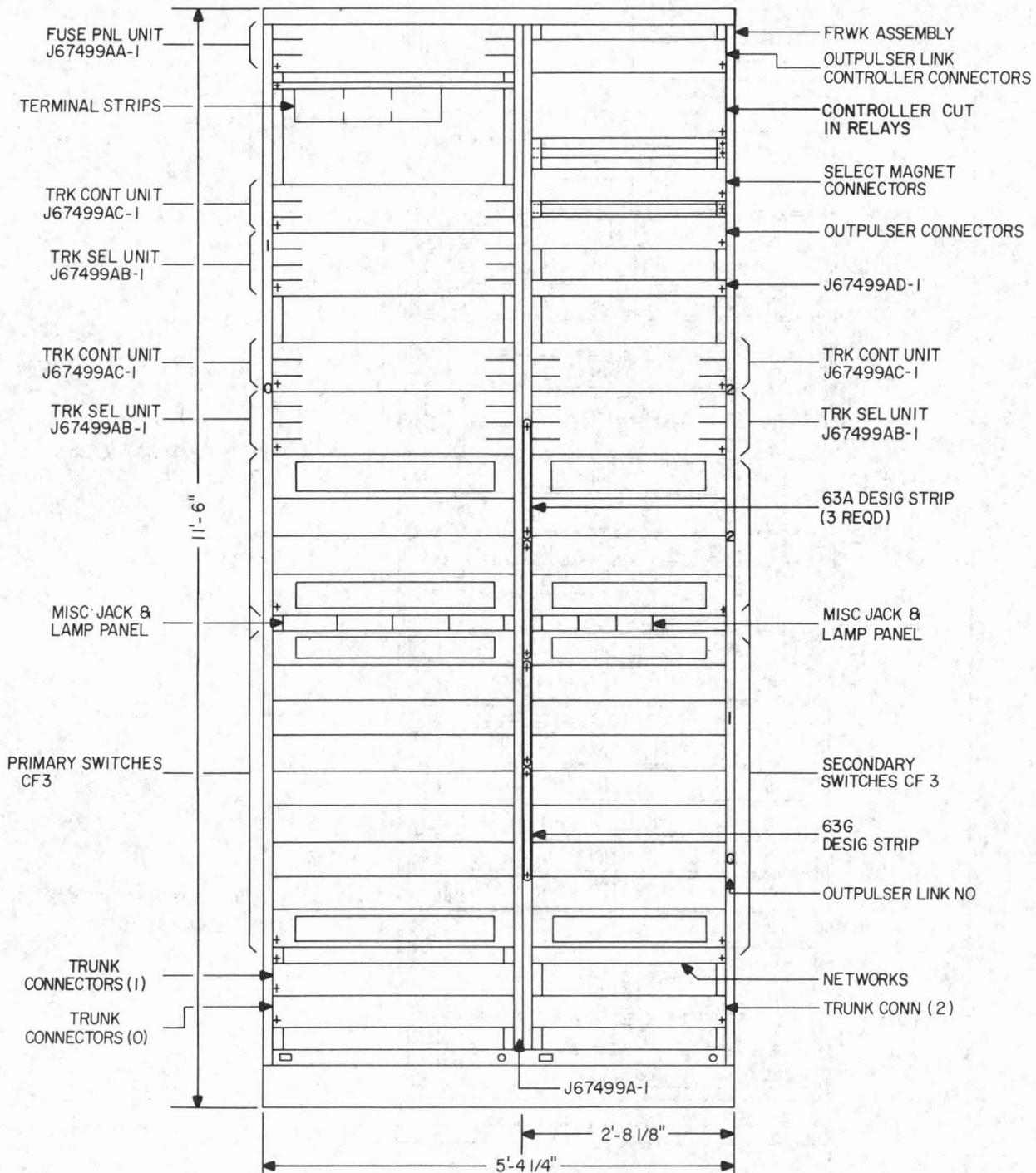


Fig.84 — Outpulser Link Frame

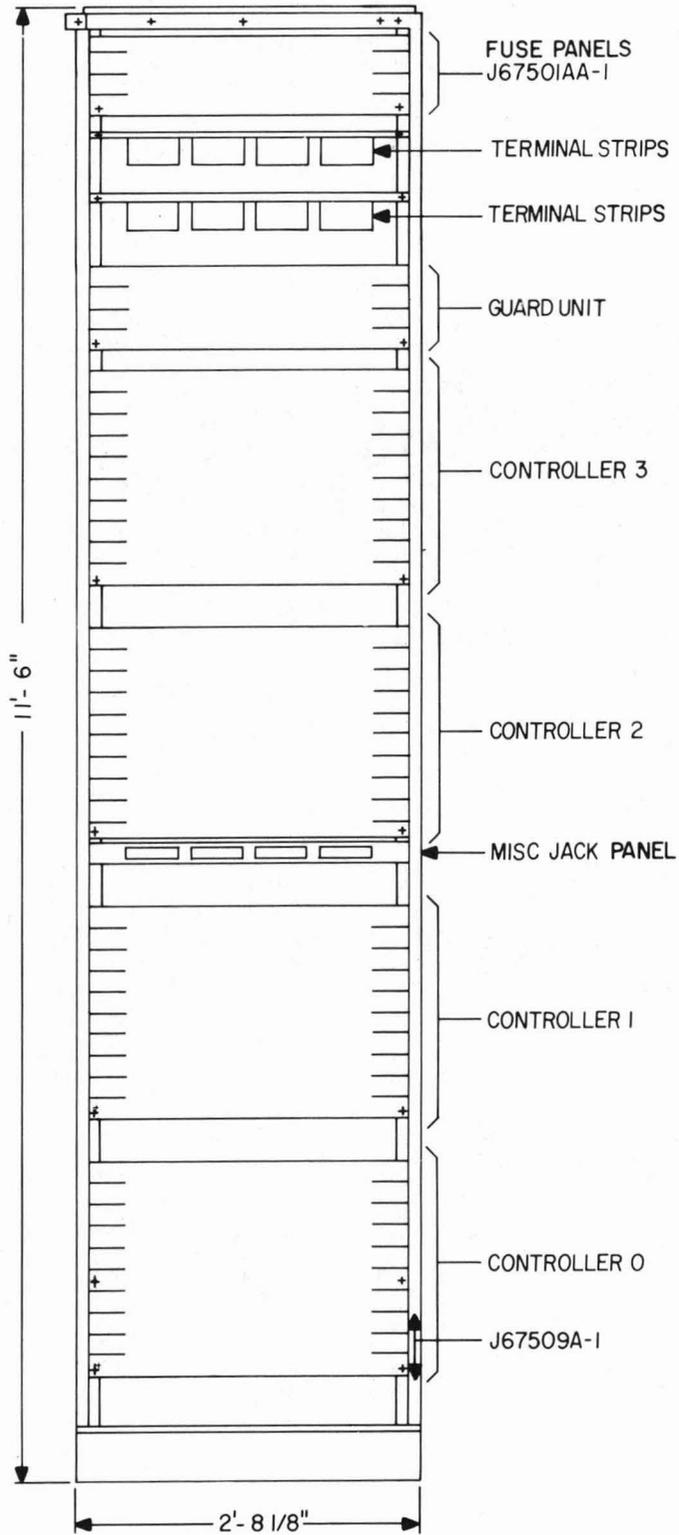


Fig. 85 — Outpulser Link Controller Frame — Outpulser Frame

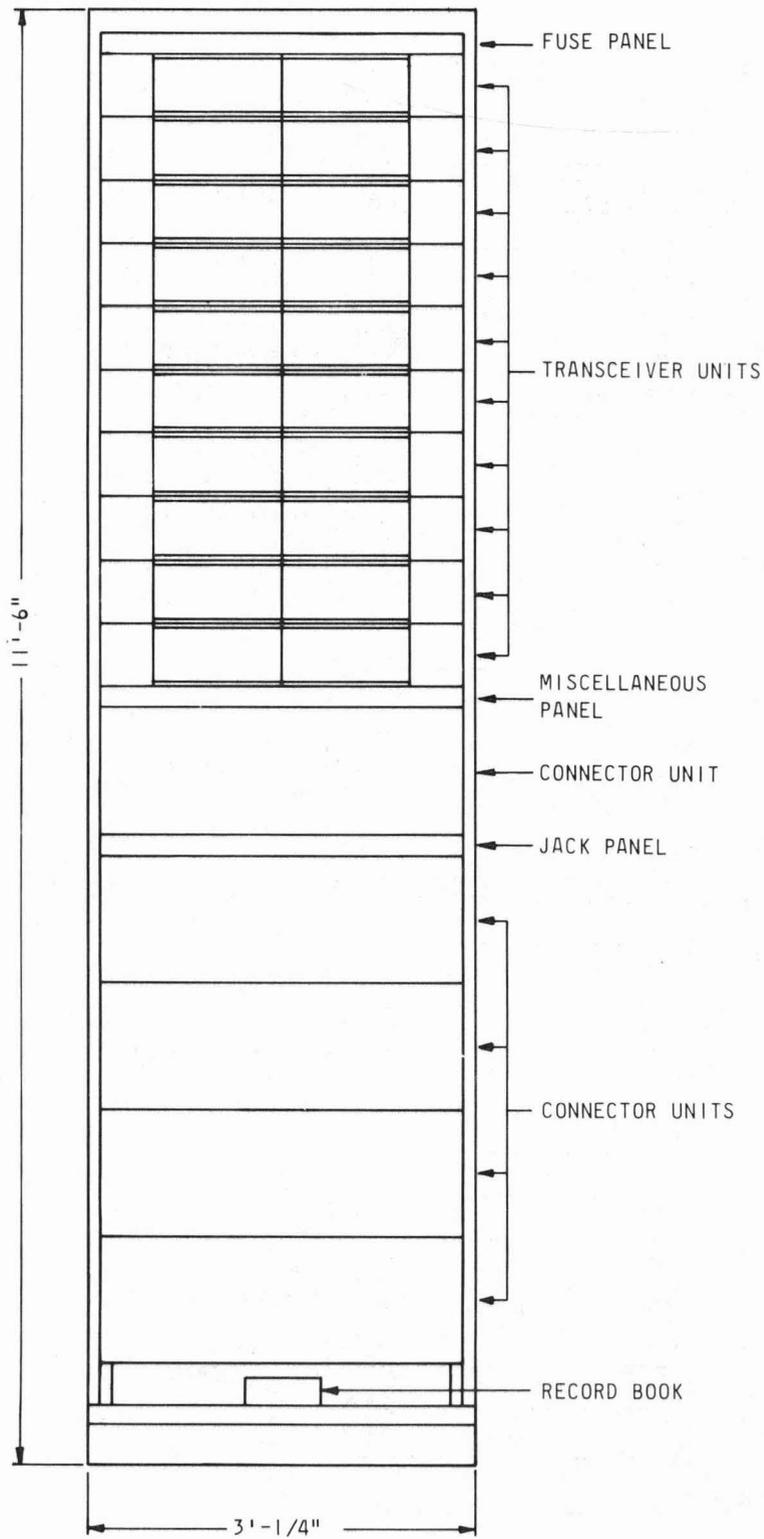


Fig. 86—Transceiver and Connector Frame—CCIS Trunk Frame

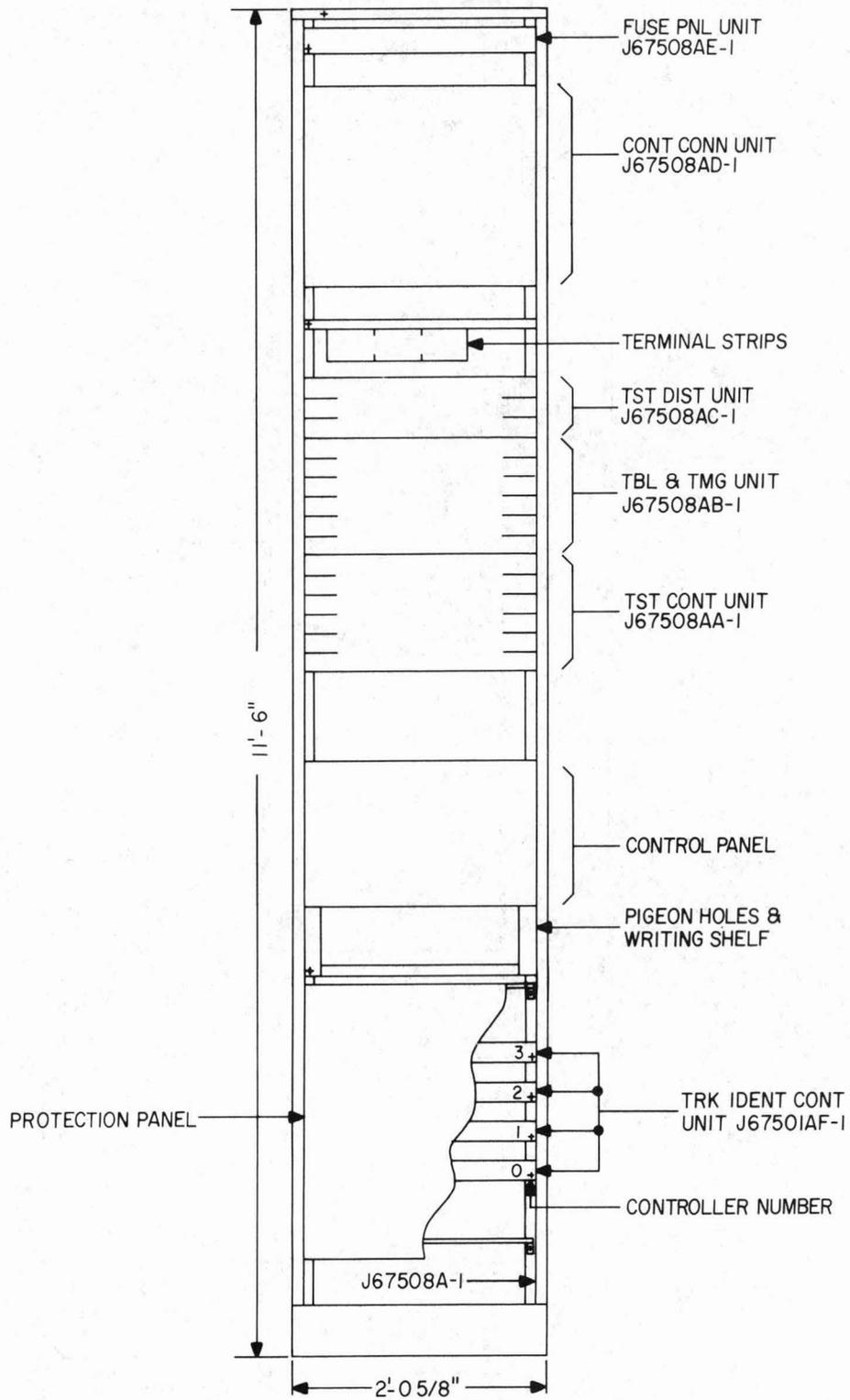


Fig. 87 — Outpulser Link Controller Test Frame

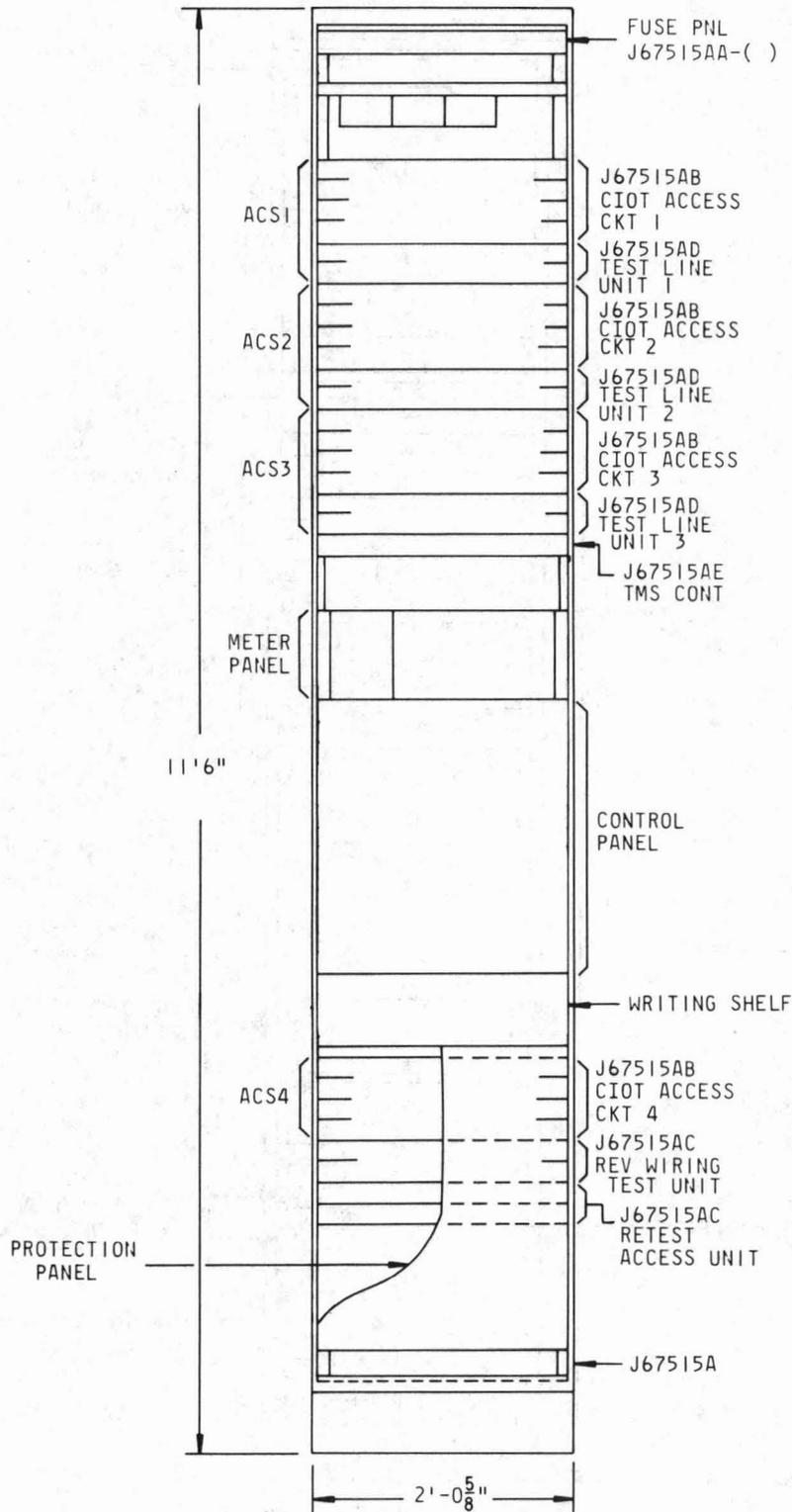


Fig. 88 — CCIS Intraoffice Test Frame

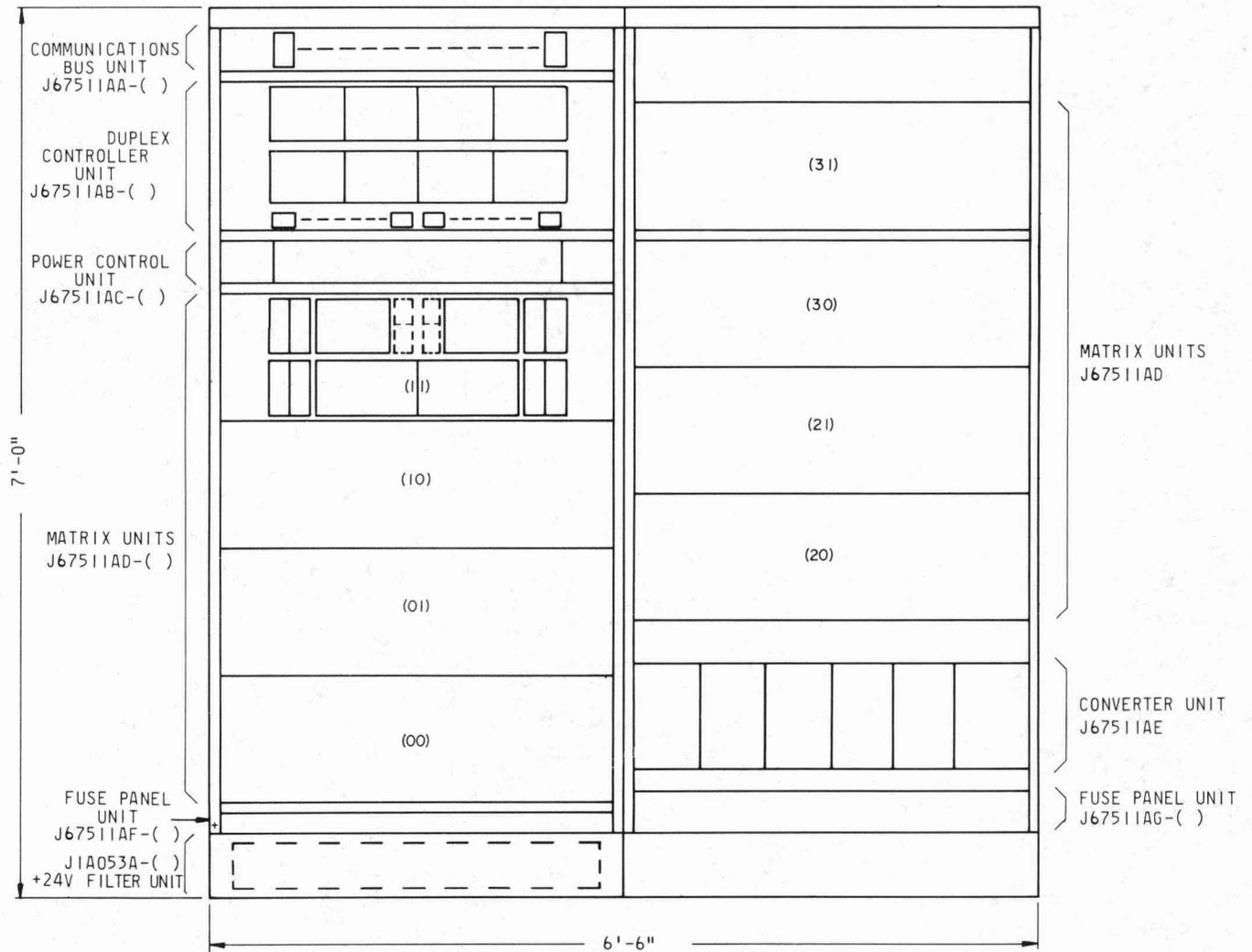


Fig. 89 — Distributor and Scanner Frame

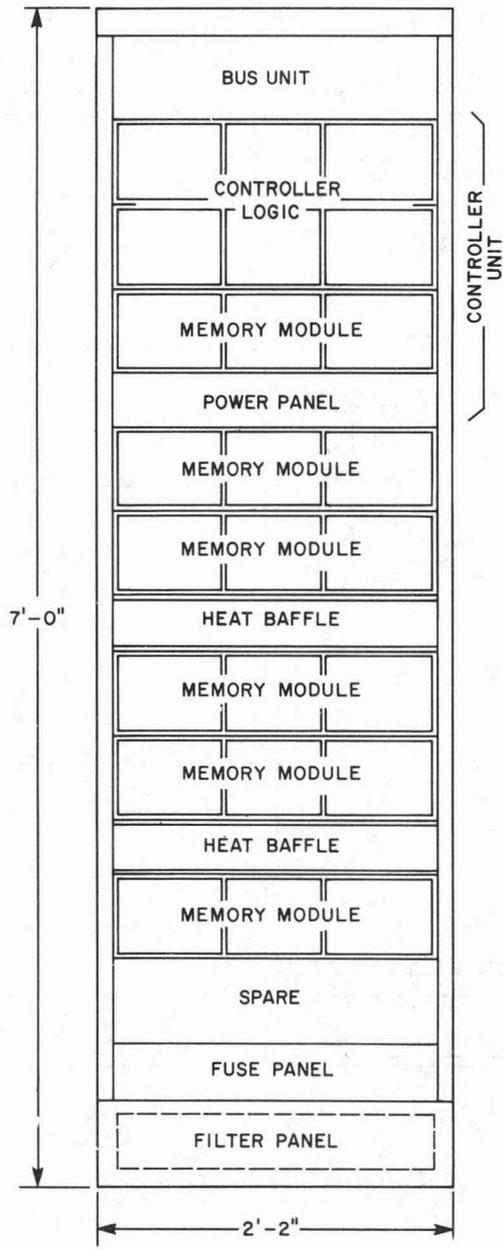


Fig. 90—IGFET Store Frame

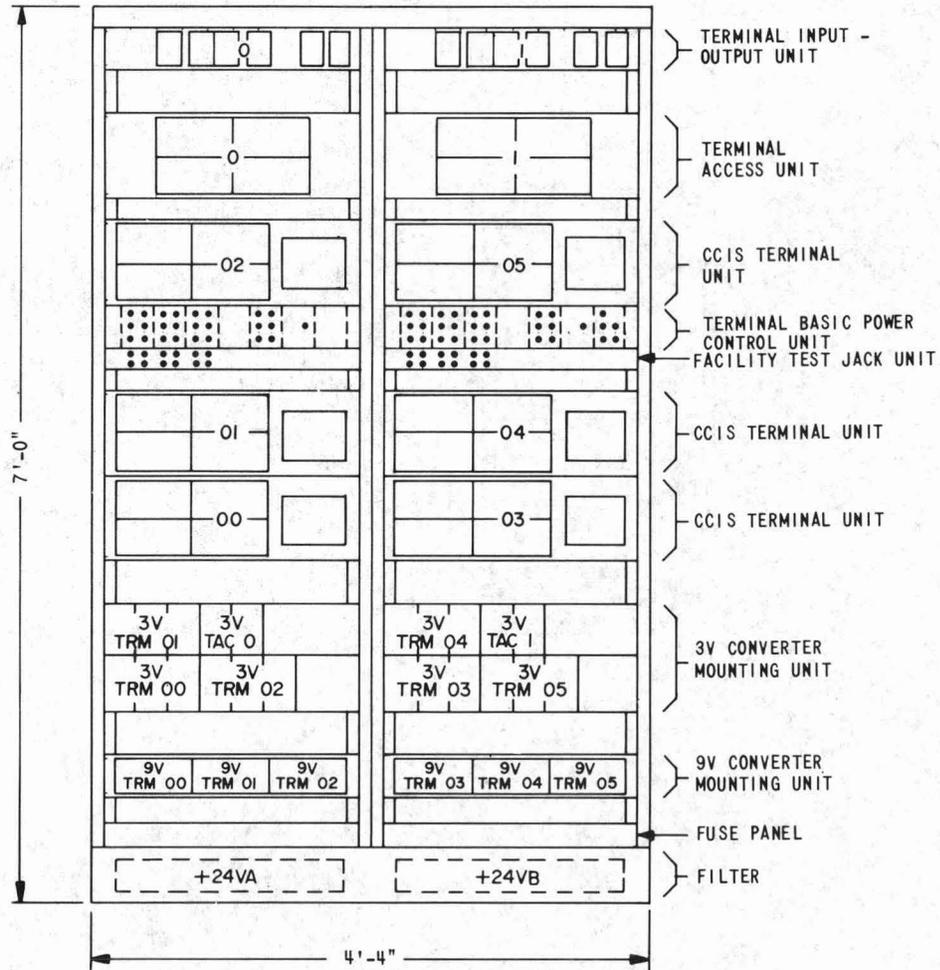
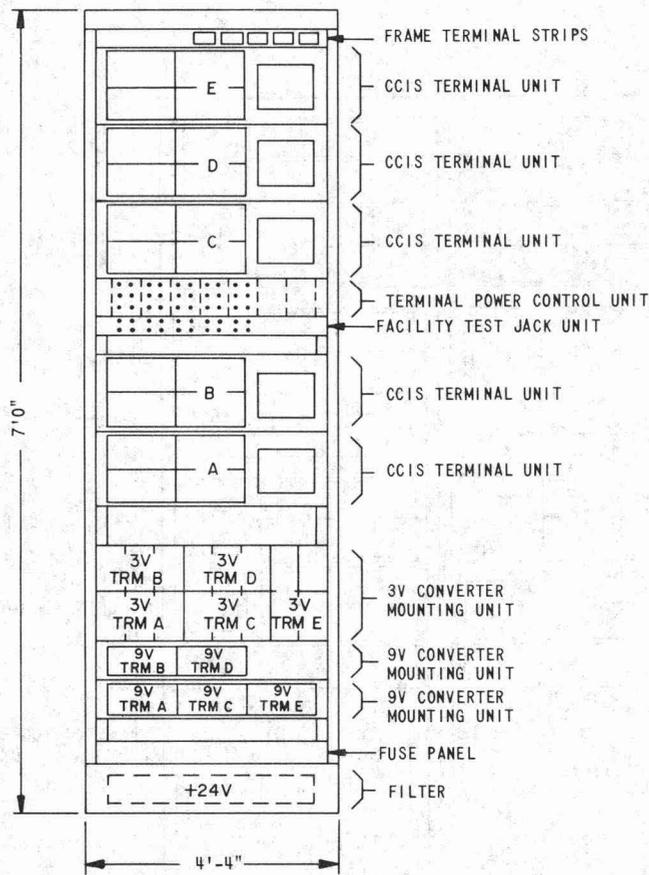


Fig. 91 — CCIS Terminal Group Frame



LEGEND:

	1st SUPL FR	2nd SUPL FR
A	06	11
B	07	12
C	08	13
D	09	14
E	10	15

Fig. 92—CCIS Terminal Group Supplementary Frame

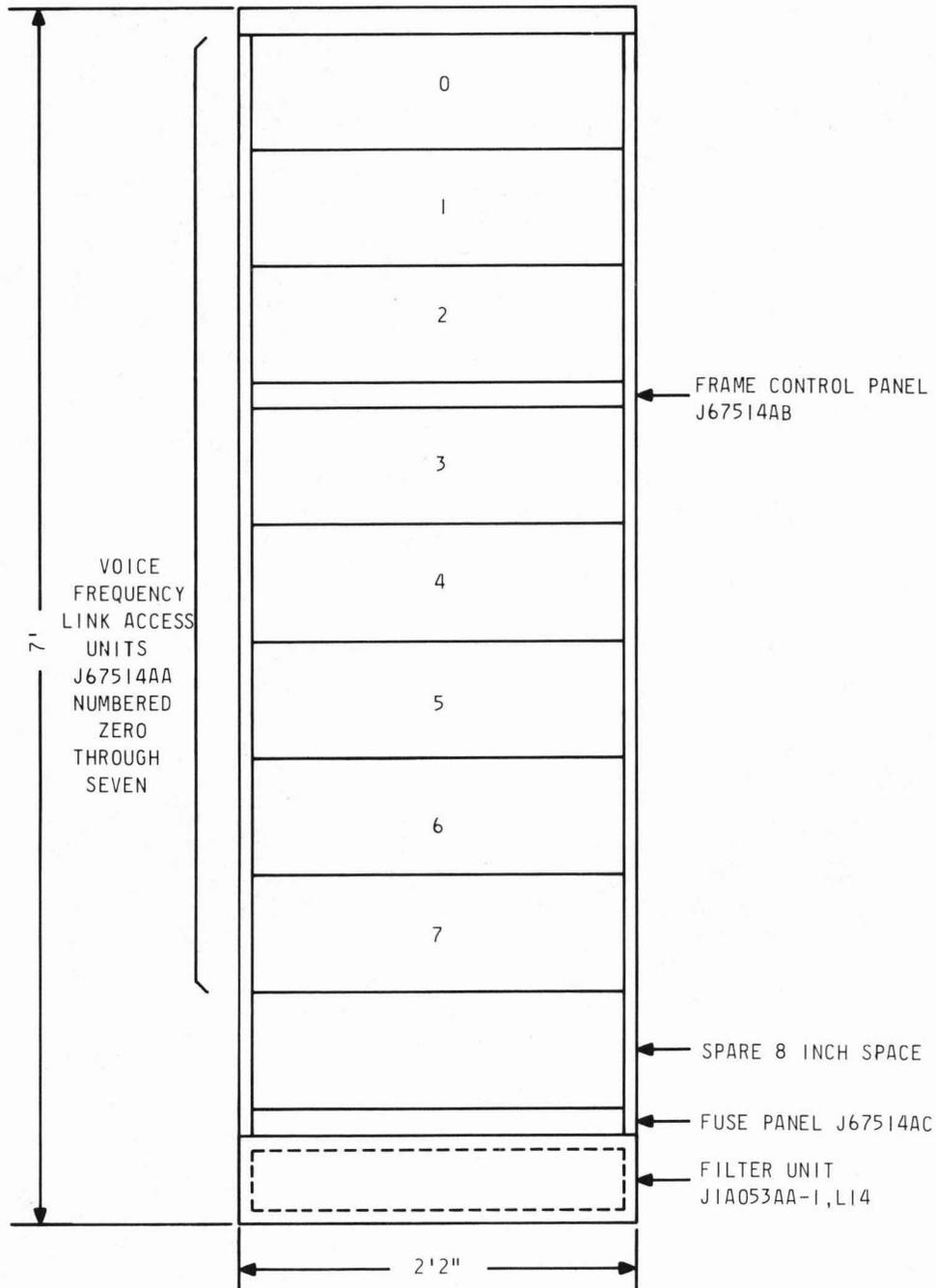


Fig. 93—VFL Access Frame

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