

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

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<b>1. GENERAL</b>	
<b>Scope</b>	
1.01 This specification presents an outline of the operating and equipment features of the No. 4A Toll Switching System. Equipment design requirements are covered in the specifications listed in Part 8.	
1.02 This specification is reissued to reflect current standard equipment design. The added information includes the new automatically directed outgoing intertoll trunk test frame and expands the information previously furnished on the Electronic Translator System (ETS).	
1.03 Part 8, Supplementary Information, lists the specifications covering the engineering requirements for the various equipment required for No. 4A toll switching offices. Part 9 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 (Card Translator)	
Fig. 2 — Equipment Schematic (Electronic Translator)	
Fig. 3 — Equipment Schematic (CAMA)	
Fig. 4 — Typical Floor Plan — Switching Area Separate-Train Combined-Operation Office (Non-CAMA) — Card Translator Office	

Fig. 4A - Typical Floor Plan — Switching Area  
— Separate-Train Combined-Operation  
Office (Non-CAMA) — Electronic  
Translator Office

Fig. 5 - Typical Floor Plan—CAMA Equipment

Fig. 6 - Frame Sizes

Fig. 7 through 77 - 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 (income tandem, CAMA) within the toll center area, and (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 designation 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 and
- (d) automatic alternate routing.

### Type 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 ringdown. 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 Card Translator Office

**2.05** As shown in the equipment schematic per Fig. 1, a non-CAMA incoming call is connected from the trunk equipment through an incoming sender link to an incoming sender. After the MF or DP sender has registered all digits, it is connected to a decoder through a decoder connector. From this code, or in some cases from both the area and office codes, the decoder selects the proper card in its associated home translator or in one of the foreign area transla-

tors. This is a metal card coded by means of perforations which, in conjunction with a light sensitive phototransistor system, provides information on trunk selection, alternate routing, code conversion, variable spilling of digits, and trunk class to the decoder and, through it to a marker via a marker connector. The marker then connects to the trunk block connector having, among others, the test leads for the proper outgoing trunk group. Having found an idle trunk, it seizes the outgoing frame to which this trunk is connected and then seizes the incoming frame to which the calling incoming trunk is connected. On gaining access to these two frames, the marker finds an idle path through them and establishes the connection. Prior to this, the decoder has disconnected, and the marker has sent back to the sender such information as the sender needs for its further guidance. The marker then dismisses its connections to the sender, the trunk block connector, and the incoming and outgoing frames, leaving the call connection held on the switches of the selected frames. The sender then outpulses the necessary digits either to the distant equipment 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.

#### **General Methods of Operation for Electronic Translator Office**

**2.06** A non-CAMA call through an office equipped with an ETS is similar to that for a card translator equipped office. The difference being the manner of route translation. As stated in 2.05, the translation is handled in the decoder-card translator complex in a card translator office. In an ETS equipped office the translation is done in the Stored Program Control (SPC) via peripheral electronic and electro-mechanical units. The main part of the SPC is the processor-store complex. As shown in Fig. 2 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, and (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.

**2.07** The general method of operation remains the same for Centralized Automatic Message Accounting (CAMA) operation except that in a card translator office the traffic separation trunk class information is sent to the decoder by a trunk class translator. In an ETS office this function is part of the normal operation of the SPC. In both offices the trunk class translator sends trunk class information to the transverter. 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 inter-toll 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 along 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 as subsequent entries by the recorder operating in conjunction with the master timer.

#### Train Arrangements

**2.08** 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 twelve decoders or 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 twenty-four common decoders or 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 completing 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

**2.09** In order to meet a variety of office sizes and conditions, the No. 4A Toll Switching System possesses considerable flexibility both 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 1,000,000 attempts a day. Engineered busy-hour marker capacity is approximately 115,000 attempts.

#### Transmission

**2.10** The No. 4A Toll Switching System is a 4-wire switching system with separate paths carried 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

**2.11** 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

**2.12** 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 2.11.

#### **Assistance Facilities**

**2.13** 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**

**2.14** The CAMA equipment for a No. 4A office is furnished on a transverter group basis containing 1800 CAMA trunks. These facilities provide the means for recording the data for billing calls. The billing data are recorded as perforations in paper 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.

#### **Maintenance Facilities**

**2.15** 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**

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

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

#### **Power Plant**

**2.17** 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 and duplicated +24 volt and -48 volt for ETS equipped offices.

#### **Building Requirements**

**2.18** 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 be-

tween ladder guards. Fig. 6 lists the frame designations and lengths. Fig. 4 and 4A show typical floor plan layouts for offices without CAMA equipment and Fig. 5 shows a typical floor plan for CAMA equipment.

### 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. 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 fuseboards. 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.

### 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. 6. 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 Part 8.

#### BASIC FRAMES

##### Incoming and Outgoing Frames — Fig. 7 and 8

**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 secondary and outgoing primary switches. An incoming primary extension and outgoing secondary extension frame are always furnished to provide for at least 200 trunk capacity. The secondary extension frame must be furnished regardless of trunk capacity since it mounts the outgoing link marker connector. The basic frames have a capacity of 100 trunks, 200 links and 200 junctors. The incoming primary extension and outgoing secondary extension frame can each accommodate an additional 100 trunks using the same 200 link paths through the frame. The incoming secondary extension and outgoing primary 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 groups are always furnished, while

outgoing groups are required only when junctor plan TC is used.

**4.03** A maximum of 400 incoming and 300 outgoing trunks can be connected to the incoming and outgoing link frames, respectively. The 400 trunk capacity is for use only in 2-train offices where all incoming trunks are multiplied to both trains. The overall trunk capacity for a maximum size single-train office is 12,000 incoming and 12,000 outgoing trunks and, for a 2-train office, 16,000 incoming and 24,000 outgoing trunks.

**Direct Cabling TBC Junctor Distributing Plan**

**4.04** The terminal strips shown at the top of the incoming frame secondary and secondary extension bays in Fig. 7 and the outgoing frame primary and primary extension bays in Fig. 8 permit direct cabling of the junctors. The row A terminals are connected to the switch verticals through a shop-connected local cable and to the junctors by switchboard cable or cross-connections from the row B terminals. The latter serve as permanent doubling up points for certain of the switchboard cables or temporary terminations for the other switchboard cables which may be looped at their ultimate location. These arrangements provide a single junctor plan which permits orderly growth from a minimum of three incoming groups and six outgoing frames to a maximum of twenty incoming and outgoing groups. The outgoing primary extension frame is not furnished until the TB junctor plan is converted to plan TC. The nonpaired outgoing frame arrangement is called the "TB Size" and the paired outgoing group arrangement the "TC Size". No arrangements are provided for starting an office with paired outgoing groups (under six groups) since the change from "TB" to "TC" presents no special problems. Likewise, no provision has been made in the cabling arrangements for an ultimate in the "TB" size since the only penalty consists of extra rows of terminal strips and the cross-connections on the incoming secondary extension frame and floor space allocation for outgoing primary extension frame.

**Marker Frame — Fig. 9**

**4.05** The principal function of the marker, with the information furnished by the decoder-card translator or 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. In a card translator office the marker provides routing instructions for calls requiring routing to reorder, final reorder, no circuit vacant code, system overload, misrouted non-CAMA, unauthorized CAMA route, and circuit busy announcement trunks. In an ETS office 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 or decoder and card translator 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	ETS	M
Incoming Frames	40	40	40	
Outgoing Frames	40	40	40	
Trunk Block Connectors	30	30	30	
Block Relay Frames	10	10	10	
	ETS	CT	ETS	CT
Decoder Frames	—	24	—	12
Decoder Channel Frames	2	—	2	—

	ETS	CT	ETS	CT
Decoder Channels	10	—	5*	—
Decoder Connectors Frames	14	18	7*	9*
Decoder Connectors	55	70	28*	35*
Marker Connector Frames	4	8	2*	4
Marker Connectors	10	24	5	12
Trouble Recorder Frame	1	1	1	1
Incoming Sender and Register Test Frame	2	2	1	1

\* Recommended equipment limitation for single train office.

#### Marker Connector and Supplementary Marker Connector Frame — Fig. 10

**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. 10.

**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 or 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
Decoders per Connector	1
Decoder Channels per Connector	1

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

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

Connectors per Frame	3
Decoders per Connector	1
Decoder Channels per Connector	1
Decoders per Frame	3
Decoder Channels per Frame	3
Markers Total	10

#### Decoder Connector Frame — Fig. 11, Supplementary Decoder Connector Frame — Fig. 12

**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, of the decoder group, or decoder channel, or marker in the office. MF and DP senders are connected to the decoders or 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 or 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. 11**

	ETS	CT
Connectors per Frame	4	4
Senders per Connector	9	7
Senders per Frame	36*	28*
Decoders Total	—	12
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 or decoder channel multiple.

**Supplementary Decoder Connector Frame for Use in Separate Train or Combined Train Offices Expanded to Separate Train Combined Operation — Fig. 12**

Connectors per Frame	8
Toll Completing Markers Total	10

**Link Controller and Connector Frame — Fig. 13**

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 4.27, 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.

**Frame Identification Frequency Supply and Control Frame — Fig. 14**

4.17 This frame mounts the generators, amplifiers, mixing resistors and control equipment for the regular and alternate frame identification frequency supplies. These frequencies are used by the marker in identifying the incoming and outgoing link frames. The control equipment includes a timer which provides a periodical transfer from one supply to the other so as to insure that both supplies are operating satisfactorily.

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

4.18 The incoming sender frame mounts three or less incoming multifrequency sender units, each of which includes its own multifrequency receiver, and a filament supply unit. The transfer control and emergency filament supply units, furnished to provide for the transfer of the receiver filament supply from the commercial ac power to the 48-volt office battery in the event of a commercial power failure, are mounted on a miscellaneous relay rack bay. (See Fig. 26).

4.19 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**

4.20 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 com-

plete connections through the switching system and to control the selection beyond the No. 4A office over toll completing, tributary, and inter-toll trunks.

**4.21** Offices serving incoming DP traffic have the choice of either buying DP senders or MF senders and incoming registers (see 4.32). 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**

**4.22** 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.

**4.23** 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**

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

**4.25** The outgoing senders are required to complete calls from No. 4A toll offices to panel offices, crossbar offices not arranged to receive multifrequency 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**

**4.26** 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.

**4.27** 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 16 sender link frames (associated with same 40 senders) 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.

**4.28** 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, and 12 have the same senders on the same horizontals as frame 0; frames 5, 9, and 13 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 time-out 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**

4.29 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 or 7 seconds, as desired. It also provides alarms for a maximum of two sender types to indicate when the number of such delays encountered in all groups of each type sender exceeds a predetermined count.

4.30 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
Peg Count Delay Alarm Groups	2

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

4.31 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**

4.32 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.

4.33 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 outpulses the stored dial pulse digits (on MF basis) through the DP trunk to the sender.

**Trunk Frames**

4.34 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

TRUNK	CKTS PER UNIT	CKTS PER FR
2-wire Inc TDM (with amplifiers)	1	20
(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

**4.35** 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.

**4.36** 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.

**4.37** 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

**4.38** 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

**4.39** 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.

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

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

### Traffic Register Rack

4.41 The traffic register rack, in conjunction with the traffic register register relay rack and traffic register distributing frame, provides facilities for obtaining 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 sheet-metal traffic register cabinets.

### Traffic Usage Recorder Frame — Fig. 24

4.42 The function of the traffic usage recorder frame is to provide traffic data by the switch count method. Test terminals of the circuits being studied are scanned at 100-second intervals and those found busy on each scan are scored on registers for the various circuit groups. The cumulated busies at the end of 1 hour (36 scans) indicate the traffic load that was carried in terms of hundreds call-seconds (CCS). The test leads from circuits being measured are connected through contacts of crossbar scan switches to detector circuit input. The detector circuit outputs are connected through contacts of crossbar register switches and a register terminal grouping field to registers assigned for the test leads. When the frame is in operation, the corresponding crosspoints of the scan and register switches operate in synchronism to test for and record the busy condition.

4.43 The traffic usage recorder frame provides termination for a maximum of 3600 items for scanning and 1200 traffic usage registers for registration. Also, associated with the traffic usage recorder frame is a traffic usage recorder control panel, which when equipped with the appropriate optional equipment, can serve a maximum of 12 traffic usage recorder frames. This control panel permits the operating personnel to operate the traffic usage recorder frames on an automatic or manual basis, to score

traffic usage registers on one or more circuit groups at different times, and to photograph traffic usage registers and peg count registers at set intervals on an automatic or manual basis, as desired.

### Traffic Control Frame — Fig. 25

4.44 The traffic control feature is used, in a sectional or primary center, to cancel Follow with Second Trial — All Trunks Busy (FST-ATB), and short sender timing. This is a miscellaneous relay rack unit. In a regional center 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.

### Circuit Busy Announcement Trunk Frame

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. 27

**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. 28

**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 asso-

ciated 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. 29 and Fig. 30

**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 fur-

nishes 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.

### ELECTRONIC TRANSLATOR FRAMES

#### Decoder Channel Frame — Fig. 31

**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 to 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.

#### Network Control Frame

**4.56** 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.

#### Peripheral Scanner Frame — Fig. 32

**4.57** The Peripheral Scanner (PSC) frame is used to scan points in the electro-mechanical 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.

**4.58** 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. 33

**4.59** 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.

**4.60** 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.

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

#### Alarm and Display Frame — Fig. 34

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

#### Power Distributing Frame — Fig. 35

**4.63** 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 adjunct portion of the ETS.

**4.64** 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

**4.65** 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.

**4.66** 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. 36

**4.67** 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.

#### Control and Display, Program Tape, and Teletypewriter Frame — Fig. 37

**4.68** 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.

**4.69** 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.

**4.70** 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.

#### Teletypewriter Buffer Frame — Fig. 38

**4.71** The Teletypewriter Buffer (TTYB) frame provides a communications link between the ETS and operating company traffic personnel via teletypewriter. 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.

**4.72** 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. 39

**4.73** 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. 40**

4.74 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. 41**

4.75 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. 42**

4.76 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.

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

**CARD TRANSLATOR FRAMES****Card Translator — Fig. 43**

4.78 The card translator equipment is mounted in a shop-wired, enclosed sheet metal, floor-mounted cabinet arranged to mount the card translator machine on the cabinet top with the relay and transistor amplifier equipment within the cabinet.

4.79 The functions of the card translator equipment are to select a particular card in response to the code digits which have been registered in the incoming sender and to read and register this information to assist the decoder, sender, and marker in completing the call.

4.80 There are three types of translators used in the No. 4A Toll Switching System as follows:

(a) *The Home Translator* (HT) contains all of the cards necessary for completing all calls in the home area of the Control Switching Point (CSP) and an area code card for each foreign area (the cards for codes required 6-digit translation contain the number of the particular foreign area translator to which the decoder should connect for complete card information on these calls). In addition, it may contain some 6-digit cards.

(b) *The Foreign Area Translator* (FT) contains all 6-digit cards necessary for completion of calls to a particular foreign area. (A particular FT usually contains cards for several foreign areas.)

(c) *The Emergency Translator* (ET), furnished only when foreign area translators are provided, is arranged to substitute for a HT or FT after transferring the card stack from the particular translator in trouble and inserting the proper plug at the trouble recorder frame. After such a transfer, the ET assumes the identity of the translator it replaces until the trouble is cleared and the cards are restored.

4.81 The capacity of the card translator is 1176 cards (input codes) arranged in 12 card bins holding 98 cards in each bin. A minimum of three HT shall be furnished per office.

**Decoder Frame — Fig. 44**

**4.82** The function of the decoder, together with a card translator and a marker, is to translate the code received from the sender into the necessary information for the completion of a call through a No. 4A toll switching office.

**4.83** The decoder frame may serve either in a 1- or a 2-decoder group (with a 12-decoder maximum per group) with each group serving its own decoder connector group of 240 senders and is arranged to function with the following maximum quantities of equipment:

EQUIPMENT	QUANTITY
Alternate Route Traffic Control Frame	1
Marker Connector	1
Intertoll Markers	10
Toll Completing Markers	10
Combined Markers	10
Decoder Connectors	70 (2 groups)
	35 (1 group)
Home Translator	1
Trunk Class Translator	4
Emergency Translator Connector	1
Emergency Translator	1
Foreign Area Translator Connectors	19
Foreign Area Translators	19*
Incoming Sender and Register Test Frame	2
Trouble Recorder Frame	1

\* Either eight or sixteen of these translators may be paired for duplicate card operation.

**Foreign Translator Connector Frame or Supplementary Foreign Translator Connector Frame— Fig. 45**

**4.84** The foreign translator connector frame is so arranged that it may be used as a basic and supplementary frame in combined train

offices requiring 12-decoder capacity and as basic and as supplementary frames for the 24-decoder capacity of the separate train offices. The foreign translator and supplementary foreign translator connectors provide the facilities for closing through the channel and control leads of any decoder in the office to a foreign translator.

**4.85** The capacity of the frame is as follows:

**Foreign Translator Connector Frame or Supplementary Foreign Translator Connector Frame**

Connectors per Frame	2
Foreign Translators per Frame	2
Foreign Translators per Connector	1
Decoders per Frame	10

**Emergency Translator Connector Frame or Supplementary Emergency Translator Connector Frame — Fig. 46**

**4.86** The emergency translator connector provides facilities for connecting any decoder in the office to the ET which may be substituted for any HT or FT by making the proper plug connections at the trouble recorder frame.

**4.87** The frames furnished for the emergency translator connector are determined by the office size. The capacities of the frames are as follows:

**Emergency Translator Connector Frame, or Supplementary Emergency Translator Connector Frame, — Separate Train and Combined Train Offices**

Connectors per Frame	1
Emergency Translators per Frame	1
Decoders per Frame	18

**Alternate and Supplementary Alternate Route Traffic Control Frame — Fig. 47**

**4.88** The alternate route and supplementary alternate route traffic control frames provide centralized facilities for interconnecting the alternate route relays of each decoder in accordance with the alternate route trunking plan. It also provides facilities to cancel alternate routing from a particular route. This latter function is under control of the alternate route traffic control keys (RT- and CR-) located on the traffic supervisory rack in the operating room. The ca-

capacity of the alternate route and supplementary alternate route traffic control frames is as follows:

	ARC	SARC
Decoders	12	12
Alternate Route Relays per Decoder (Relay-to-Relay)	100	100
*Alternate Route Relays per Decoder (Card-to-Relay)	20	20

\* A maximum of 20 routes per decoder may be cross-connected into the circuit to cancel card-to-relay traffic or all alternate route relay-to-relay traffic into the route. This function is controlled by the CR- keys.

**AUTOMATIC MESSAGE ACCOUNTING FRAMES**

**Trunk Class Translator Frame — Fig. 48 and Supplementary Trunk Class Translator Frame — Fig. 49**

4.89 The trunk class translator and supplementary trunk class translator frames provide for a maximum of 12 transverters, plus 18 decoders in a card translator office, 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 and decoders prefer one frame while the odd-numbered decoders and transverters prefer the other. The basic trunk class translator frame, Fig. 48, provides for a maximum of 100 trunk class relays and 1200 trunk resistors (one per trunk). A single supplementary trunk class translator frame, Fig. 49, when required, provides mounting space for an additional 50 trunk class relays and 600 trunk resistors for both basic trunk class translator frames.

4.90 The function of the trunk class translator and supplementary trunk class translator frames is to provide additional class information to the decoders and 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 decoder and transverter for traffic separation peg count registration and billing purposes.

**Transverter Connector Frame — Fig. 50**

4.91 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. 51**

4.92 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.

4.93 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. 52**

4.94 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

**4.95** 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. 53 and Supplementary Billing Indexer Frame — Fig. 54 and Auxiliary Billing Indexer Frame — Fig. 55**

**4.96** 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.

**4.97** 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 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 per-

forated 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. 56**

**4.98** 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.

**4.99** 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. 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. 57**

**4.100** 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.

**4.101** 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. Subsequent answers and disconnect time entries, as timed by the master timer, are recorded with the trunk number.

**Perforator Cabinet — Fig. 58**

**4.102** The perforator cabinet, a low sheet-metal 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.

#### **Master Timing Frame — Fig. 59**

**4.103** 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.

**4.104** 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. 60**

**4.105** 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.

**4.106** 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. 61**

**4.107** 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.

**4.108** 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. 62**

**4.109** 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.

**4.110** 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.

#### **MAINTENANCE CENTER FRAMES**

##### **Trouble Recorder Frame — Fig. 63**

**4.111** 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 4.112. 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.

**4.112** 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

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

Decoders	24
Decoder Channels	10
Intertoll or Combined Markers	10
Toll Completing Markers	10
Link Controllers (Maximum 4)	48
Controller Connectors (per Group)	48
Incoming Frames	80
Outgoing Frames	80
Trunk Block Relay Connectors	60
Sender Link Frames (Maximum 16 per Group)	192
Decoder Connectors (Card Translator)	70
(ETS)	55
Overseas Senders	80*
CAMA Senders	300*
Incoming MF Senders	480*

Home Translators	24
Foreign Area Translators	19
Emergency Translator	1
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. 64

**4.114** 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.

**4.115** 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*
CAMA Senders	300*
Overseas Senders	120*
Incoming DP Senders	300

Incoming DP Registers	600
Transverters	24
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. 65**

4.116 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. 66 and Auxiliary Sender Make-busy Frame — Fig. 67**

4.117 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.

4.118 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 decoders or decoder channels and CAMA trouble registers are located on this frame in offices with two transverter groups.

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

**Sender Make-busy Frame — Fig. 66**

Revertive and PCI Outgoing Senders	}	480
MF Senders		
OVS Senders		
CAMA Senders		
Incoming Registers		300
Link Controllers		48

Outgoing Sender Link Frames	40
Reorder Announcement Trunks (ROA)	100
Final Reorder Announcement Trunks (FRA)	100
Trunks, Tielines, or Local Station Lines	16

**Auxiliary Sender Make-busy Frame — Fig. 67**

Incoming Registers	300
Decoders	24
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. 68, 69 and Automatic Outgoing Toll Connecting Trunk Test Connector Frame — Fig. 70**

4.120 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.

4.121 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.

**4.122** 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.

**4.123** The capacity of the AOOT frames and their associated 10-trunk test connector frames is 10,000 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 10,000 trunks).

**Manual Outgoing Toll Connecting Trunk Test Frame—  
Fig. 71 and Outgoing Toll Connecting Trunk Test and  
Make-busy Jack Bay — Fig. 72**

**4.124** In addition to the automatic test frame described in the foregoing, a manual outgoing toll connecting trunk test frame is provided to test outgoing trunks independently of the outgoing trunk relay equipment by means of test jacks which are bridged across the cable side of the trunk circuit. Test facilities at this frame include a voltmeter test circuit and sender and supervisory circuits for testing the incoming trunk and selector equipment at the terminating office. The test jacks are grouped with trunk made-busy jacks in the jack panels of the test and make-busy frame (Fig. 72) which are located adjacent to the manual test frame (Fig. 71).

**4.125** The capacity of the test and make-busy frame is as follows:

Frames	Jack Circuits					
	INCOMING CAMA-MB	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 multiples 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. 73 and  
Automatic Incoming Trunk Test Connector Frame —  
Fig. 74**

**4.126** 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 or 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.

**4.127** The capacity of the test frame (Fig. 73) and test connector frame (Fig. 74) 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

**4.128** The emergency alarm frame houses the equipment associated with the automatic fire detection feature of emergency alarm systems. This equipment functions with fuseable fire detection wire which is installed on top of the skimmers and on the surface of the local cables to sound alarms when any break occurs in the series circuit setup. These alarms may be arranged with or without code signaling, as required.

### OPERATING ROOM EQUIPMENT

#### No. 3CL Switchboard

**4.129** 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

**4.130** 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. 75

**4.131** The CAMA switchboard, a low sheet-metal 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.

**4.132** 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

**4.133** The traffic supervisory rack, a floor-supported, casing-enclosed rack, with a glass-panelled 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 of denying access to trunk groups for alternate route traffic.
- (e) To indicate when only VO or only NVO calls are receiving announcements on final routes (card translator office only).
- (f) 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.

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

Sender Overload Lamps	12
Sender Group-busy Lamps	12
Sender Attachment and Group Delay Lamps	3
All Decoder-busy Lamps	2
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
Alternate Route Traffic Control Keys and Lamps (Each)	
Relays-to-Relay (RT)	100
Card-to-Relay (CR)	20
Announcement Connecting Trunk Patching Jacks	280
Announcement Machine Patching Jacks	
One No. 5A Announcement System	120
Two No. 5A Announcement Systems	160

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

**4.135** The traffic supervisory and register rack equipment, the same design as the traffic supervisory rack, is intended primarily to be lo-

cated 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.

**4.136** 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**

**4.137** 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.

**4.138** 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
<b>Lower Unit (Per Bay)</b>		
Cord Circuits	4	4
Position and Keyset Circuit	1	1
Extension Cord Circuits	4	2
<b>Lower Unit (Misc. Tst Pos Only)</b>		
Cord Circuits	4	2
Position and Keyset Circuit	1	1
Position Patch Cord Circuit	4	5

	WITH CKT. PATCH BAY	WITHOUT CKT. PATCH BAY
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. 76 and Automatically Directed Outgoing Intertoll Trunk Test Connector Frame— Fig. 77**

**4.139** 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.

**4.140** The capacities of the test frame (Fig. 76) and test connector frame (Fig. 77) are as follows:

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

Outgoing Intertoll Trunk Test Connector Unit 200 Trunks

**Circuit Patching Bay**

**4.141** 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.

**4.142** 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 4.138.

**Trunk Assignment Patching Bay**

**4.143** 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 relay 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.

**4.144** 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.

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

**OTHER EQUIPMENT****Service Observing Equipment**

**4.146** 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)**

**4.147** 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**

- 4.148** 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. 2B Signaling Test Set
  - (h) Frame Identification Frequency Test Set
  - (i) No. 72A Frequency Meter
  - (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) No. 100A Test Set (Card Translator)
  - (s) Measurement Corp. Model 62 Vacuum Tube Voltmeter or 410B H.P. VTVM
  - (t) No. 32A Test Set
  - (u) Translator Test Set (Card Translator)
  - (v) No. 23 Transmission Measuring Set Order, as required)

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.

**4.149** Certain maintenance and auxiliary equipment used in connection with the card translators require manufacturing intervals of such length that they should be included in the original order for the No. 4A switching equip-

ment. These items and the recommended quantities to be furnished per office are as follows:

ITEM	NUMBER PER OFFICE
200A Blank	1200 (or Actual Number Required) per Translator Plus 10 Per Cent Spare
659E Card Coding Tool	1
Bulk Card Handling Tool	2
Portable Selector Elevating Table	1
Single Card Handling Tool	2
Template Tab Coding Tool	2 Minimum
Template Punch Board Tool	2 Minimum
Rack (Selector Handling)	1
Deburring Tool	1
R-3109 Deburring Block	1

4.150 An ETS requires certain special test and auxiliary equipment for testing and servicing the electronic equipment. These items and the recommended quantities to be furnished per office are as follows:

ITEM	NUMBER PER OFFICE
Tektronix 545B Model 22-IT Oscilloscope with Cart, Type 200-1	1
(a) type CA amplifier (standard dual trace)	1
(b) type M differential preamp (wideband)	1
(c) type 134 current probe amplifier	1
(d) type P6017 10X voltage probes	
1. 6 foot long cable	2
2. 12 foot long cable	2
(e) type P6016 current probe	1

ITEM	NUMBER PER OFFICE
Hewlett-Packard model 428B clip-on dc milliammeter (0 to 10 amp)	1
158A and 159A adapters for testing of circuit packs	3 each
723B Tolls for withdrawing circuit packs	2 per aisle
J94735A Magnetic latching relay test set	1
Display Boards	
1. T44A } or equivalent	2
2. T44B }	
Tone Buzzer (low current)	1
Program Tape Unit Control Test Set	1
KS-19353 Oscillator	1
No. 3C Noise Measuring Set	1
No. 6 Type Impulse Counter	1
J94735 Magnetic Latching Relay Test Set	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, 105V AC Continuous Ringing
- 60-CY, 55V AC (MKR-CONT)

60-CY, 22V AC (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 teletype-writer 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 trunk and signal circuits (CX and SF operation) associated with the No. 4 Crossbar System, as well as the associated switchboard and the 17C toll testboard, must be supplied from the same battery. For this purpose, a battery with two groups of end calls and two sets of end call switches must be considered as two separate batteries since it is impossible 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 power plant, to supply 115-volt, 60-cycle current from the office battery is provided, in offices arranged for CAMA operation, as an auxiliary plant to the No. 506A plant as assurance against exceeding the 60-cycle frequency requirement of the master timer circuit during a commercial power failure. A No. 420A power plant is provided to furnish 55-volt ac supply for the marker continuity testing.

## 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, decoder, 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:
	(a) Toll terminal equipment with circuit patching bay.

FRAME	PURPOSE
	(b) Intertoll trunk relay equipment with circuit patching bay.
	(c) Toll connecting trunk relay equipment with trunks to local offices.
TDF	To associate:
	(a) Trunk relay equipment with incoming and outgoing frames.
	(b) Intertoll trunk relay equipment with No. 17C testboard.
	(c) Incoming trunks with second trouble tracing selectors.
ADF	To associate:
	(a) SM leads of outgoing frames and MS leads of outgoing trunks with assignment patching jacks and trunk block relays.
	(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. 6 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 4A show a typical floor plan for the switching area of a separate train, combined operation installation while Fig. 5 shows a typical floor plan for CAMA equipment.

## 8. SUPPLEMENTARY INFORMATION

### General

- 818-000-000 — No. 4 Type Switching Systems Index
- AA128.006 — List of General Equipment Requirements Section
- 818-100-170 — Centralized Automatic Message Accounting
- J60101 (818-030-150) — Switchboard Power Cable
- J60103 (818-031-150) — Limiting Conductor Lengths
- J67470 (818-011-152) — Junctor Distribution — Direct Cabling TBC Plan
- J1C027 (AA381.344) — Stored Program Control No. 1A
- J1C028 (AA381.345) — Stored Program Control No. 1A — Limiting Conductor Lengths
- 760-555-151 — Atmospheric Environment for Telephone Equipment Space

### Basic Frames

- J62603 (818-082-151) — Traffic Register Equipment
- 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
- J67424 (818-043-150) — Frame Identification Frequency Supply and Control Frame
- J67427 (818-760-150) — Trouble Tracing Selector Frame

J67430 (818-300-150) — Incoming Dial Pulse Sender Frame  
 J67437 (818-200-150) — Incoming Frames  
 J67438 (818-201-150) — Outgoing Frames  
 J67440 (818-450-150) — Marker Frame  
 J67441 (818-780-150) — Floor Alarm 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  
 J92603 (AA381.324) — Traffic Register Equipment — Common Systems  
 J92604 (AA381.327) — Traffic Usage Recorder Frame  
 J92608 (818-084-150) — Sender Attachment Delay Equipment  
 J98609 (AA388.062) — Multifrequency Current Supply  
 J99324 (818-045-150) — Announcement Frame— No. 5A Announcement System

**Electronic Translator Frames**

J67471 (818-425-150) — Decoder Channel Frame  
 J67472 (818-425-151) — Peripheral Scanner Frame  
 J67473 (818-425-152) — Distributor Register Frame, and Central Pulse Distributor Applique Unit  
 J67474 (818-425-153) — Alarm and Display Frame  
 J67475 (818-425-154) — Power Distributing Frame  
 J67476 (818-425-155) — Peripheral Function Translator Unit  
 J67479 (818-425-155) — Teletypewriter Buffer Frame  
 J67492 (818-048-150) — Miscellaneous Frame  
 J1C020 (AA381.337) — Processor Frame  
 J1C021 (AA381.338) — Control Display — Program Tape and TTY Frame  
 J1C022 (AA381.339) — Master Scanner Frame  
 J1C023 (AA381.340) — Signal Distributor Frame

J1C024 (AA381.341) — Central Pulse Distributor Frame  
 J1C025 (AA381.342) — Filter Units  
 J1C026 (AA381.343) — Store Frame

**Card Translator Frames**

J67439 (818-400-150) — Decoder Frame  
 J67442 (818-420-150) — Card Translator Equipment  
 J67444 (818-041-150) — Alternate Route Traffic Control and Traffic Control Frames  
 J67445 (818-421-150) — Translator Connector Frame

**Maintenance Center Frames**

J28350 (AA247.801) — Emergency Alarm Frame  
 J67418 (818-705-150) — Automatic Outgoing Toll Connecting Trunk Operational and Transmission Test Frames  
 J67462 (818-702-150) — Incoming Sender and Register Test Frame  
 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  
 J98501 (818-708-150) — Manual Outgoing Toll Connecting 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 (AA261.443) — No. 5 Toll Switchboard  
 — Lower Unit Equipment  
 J61559 (AA261.444) — No. 5 Toll Switchboard  
 — Switchboard Equipment  
 J62604 (818-083-150) — Traffic Supervisory  
 Rack  
 J62607 (818-083-151) — Traffic Supervisory  
 and Register Rack and Auxiliary Traffic  
 Supervisory Cabinet Equipment  
 J91107 (AA388.067) — No. 3CL Switchboard

**Test and Terminal Room Equipment**

- J63519 (AA267.014) — 17C Toll Testboard  
 J63524 (AA267.016) — Circuit Patching Bay  
 J67421 (818-631-150) — Trunk Assignment  
 Patching Bay  
 J67478 (818-706-151) — Automatically Directed  
 Outgoing Intertoll Trunk Test Frame  
 J68602 (AA262.001) — Signaling and Testing  
 Panels and Units  
 J93002 (AA382.511) — Transmission and Noise  
 Measuring Systems  
 J93020 (AA387.045) — Transmission Measuring  
 and Noise Checking System  
 J94005 (AA387.053) — Transmission Measur-  
 ing and Noise Checking System  
 J94051 (AA387.061) — Automatic Transmission  
 and Noise Measuring System  
 J94071 (AA387.049) — 71C Milliwatt Reference  
 Generator  
 J98613 (AA388.091) — E-Type AC Trunk  
 Signaling Systems

**Trunks and Relay Rack Equipment**

- J61561 (818-602-150) — Intertoll Trunk Units  
 J61562 (818-603-150) — Incoming Toll Com-  
 pleting 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 (AA268.504) — Transmission Measuring  
 Panels and Units  
 J92603 (AA381.324) — Traffic Register Equip-  
 ment — Common Systems

- J93016 (AA382.528) — Units for Traffic and  
 Maintenance Desks  
 J93017 (AA387.040) — Relay Rack Mounted  
 Test Equipment  
 J99227 (AA388.054) — 10 IPM Interrupter and  
 Impulse Clock Supply  
 J67466 (818-601-150) — Trunk Frames

**Test Sets**

- J24753 (817-723-150) — Test Set for Timing  
 Tests  
 J63525 (818-740-150) — Incoming and Intertoll  
 Trunk Test Set  
 J64072 (AA268.534) — 72A Frequency Meter  
 J64722 (AA268.611) — Pulse Repeating Test  
 Set  
 J64727 (818-741-150) — Frame Identification  
 Frequency Test Set  
 J64728 (AA261.439) — No. 5 Toll Switchboard  
 Position Control Test Set  
 J64730 (AA268.207) — No. 2B Signaling Test  
 Set  
 J67453 (818-742-150) — Translator Test Set  
 J67477 (818-743-150) — Plug-In Trunk Test Set  
 J94003 (AA387.048) — Noise Measuring Set  
 J94006 (AA387.055) — Impulse Counter  
 J94714 (AA387.001) — 35F Test Set  
 J94723 (AA387.031) — Pulse Checking Test Set  
 J94724 (AA387.032) — Contact Closure Test Set  
 J94725 (AA387.033) — Test Set for Mercury  
 Contact Relays  
 J94727 (AA387.035) — 1A Signaling Test Set  
 J94730 (AA387.042) — 1A Fault Locator Test  
 Set  
 J94731 (AA387.043) — Cold Cathode Tube Test  
 Set  
 J94735 (AA387.062) — Magnetic Latching  
 Relay Test Set  
 KS-15874 — Vacuum Tube Test Set  
 KS-19353 — Oscillator

**Auxiliary Equipment**

- KS-14545 — Bulk Card Handling Tool  
 KS-14550 — Portable Selector Elevating  
 Table  
 KS-14553 — Single Card Handling Tool  
 KS-14558 — Template Tab Coding Tool  
 KS-14590 — Template Punch Board Tool  
 KS-14663 — Punch  
 KS-16088 — Deburring Tool  
 KS-16498 — Rack

**Power Plants**

- J86475 (AA367.715) — 702C Plants — Positive and Negative 125 to 135 Volts  
 J86434 (AA367.304) — 302A Plants — 24 and 48 Volts  
 J86470 (802-659-160) — 111A Power Plant  
 J86555 (AA367.809) — 803C Plants — Machine Ringing Equipment  
 J86578 (AA367.402) — 420A Plant — 55-Volt AC Supply  
 J86617 (AA367.506) — 504B Plant — AC Supply Units with Emergency Operation From Battery  
 J86724 (AA367.504) — 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 (AA381.128) — 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  
 J90604 (AA381.803) — Ladders, Benches, and Stools — Application Practices  
 J90605 (AA381.804) — Rolling Ladders — Track Type  
 J93009 (AA388.046) — Audible and Visual Maintenance Alarm Equipment  
 J93814 (AA382.018) — No. 12 Service Observing Desk  
 J94907 (AA382.514) — 20 Key Cabinet  
 J94909 (AA382.526) — 21 Key Cabinet  
 J95501 (AA388.025) — Central Office Lighting Equipment, Appliance Outlets, and Miscellaneous Conduits  
 J85505 (802-015-150) — Central Office Lighting Fluorescent Type  
 J85507 (802-015-152) — Frame and Aisle Lighting Equipment

- J95502 (AA388.026) — Emergency Lighting Equipment for Central Offices  
 J97025 (AA381.319) — Relay Racks — Angle Type — Framework and Cabling  
 J97033 (AA381.321) — Fuse Bay — Angle Relay Rack Type  
 J98302 (AA388.012) — Emergency Alarm System — Automatic Fire Detection Feature  
 J98303 (AA388.013) — 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 — Key Sheet  
 SD-68400-02 — No. 4A Current Drain Data  
 SD-80652-01 — 55V AC Supply — Marker Continuity Test  
 SD-80700-01 — Power Systems — Key Sheet  
 SD-81197-01 — Battery Distributing Circuit  
 SD-95571-01 — Filament Supplies

**Equipment, Assembly, and Cabling****High Bay**

- ED-68066-01 — Method of Running Dual Power Feeders  
 ED-68918-01 — Method of Running Power Feeders 111A Power Plant  
 ED-68088-01 — Designation Cards  
 ED-68169-01 — Trunk Distributing Frame — Typical Equipment  
 ED-68218-01 — Intermediate Distributing Frame — Typical Equipment  
 ED-68920-01 — Direct Cabling TBC Junctor Distribution Plant — Typical Cabling  
 ED-68870-01 — Wire Gauges and Types of Insulation  
 ED-90595-01 — Table-Type Wagon and Wire Spool Rack Assembly  
 ED-92175-31 — Filament and Plate Battery Filters — Assembly and Equipment

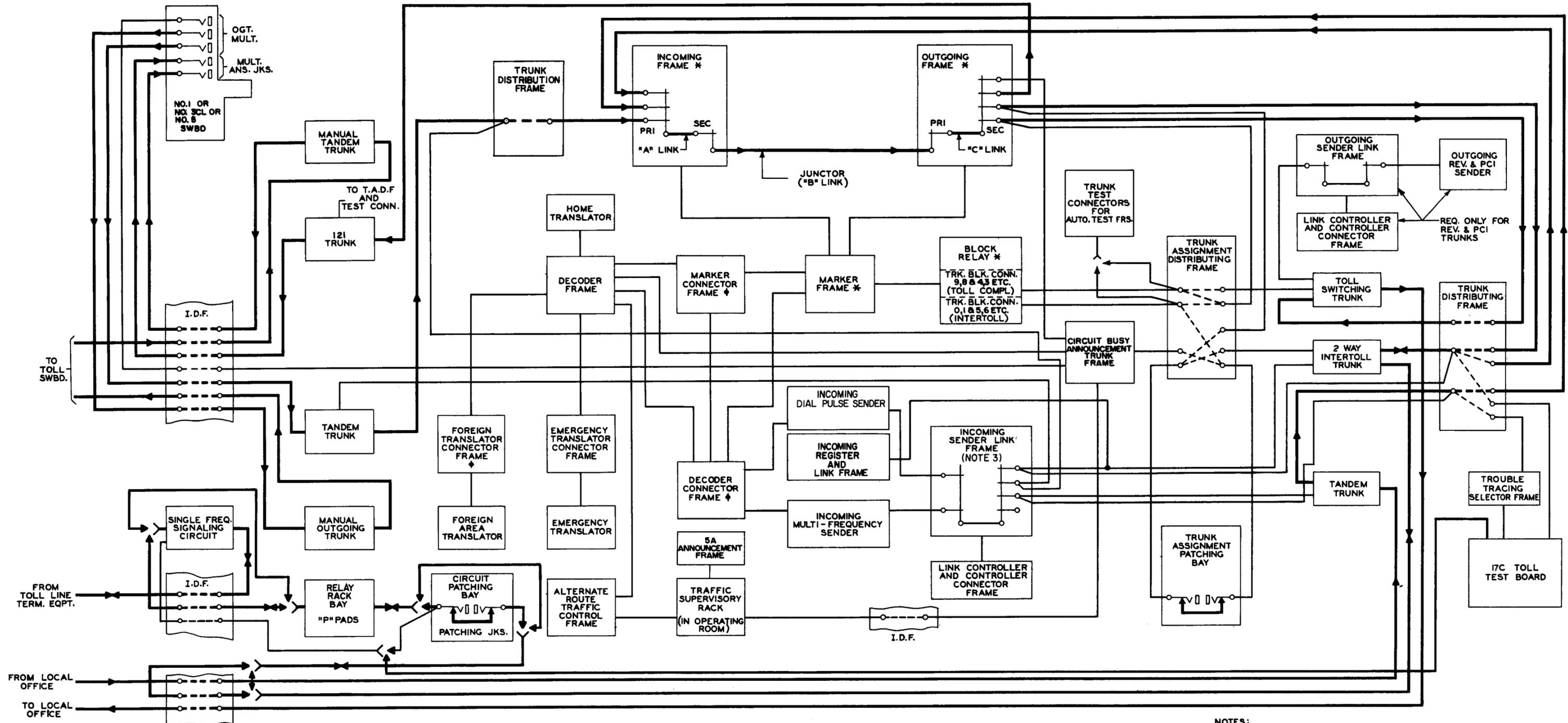
**ED-92018-01 — Print Display Boards Assembly****Low Bay**

- ED-1A150-70 — Single Bay Frame Assembly
- ED-1A151-60 — Double Bay Frame Assembly
- ED-1A159-10 — Method of Terminating Battery and Ground Feeders
- 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-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-82097-30 — Frame Aisle Lighting
- ED-68959-10 — Connectorization of ETS Communications Buses
- ED-68936-30 — AC Power Distribution and Frame Base Appliance Outlets
- ED-68958-( ) — Office Alarm Unit for 7-Foot Electronic Frames

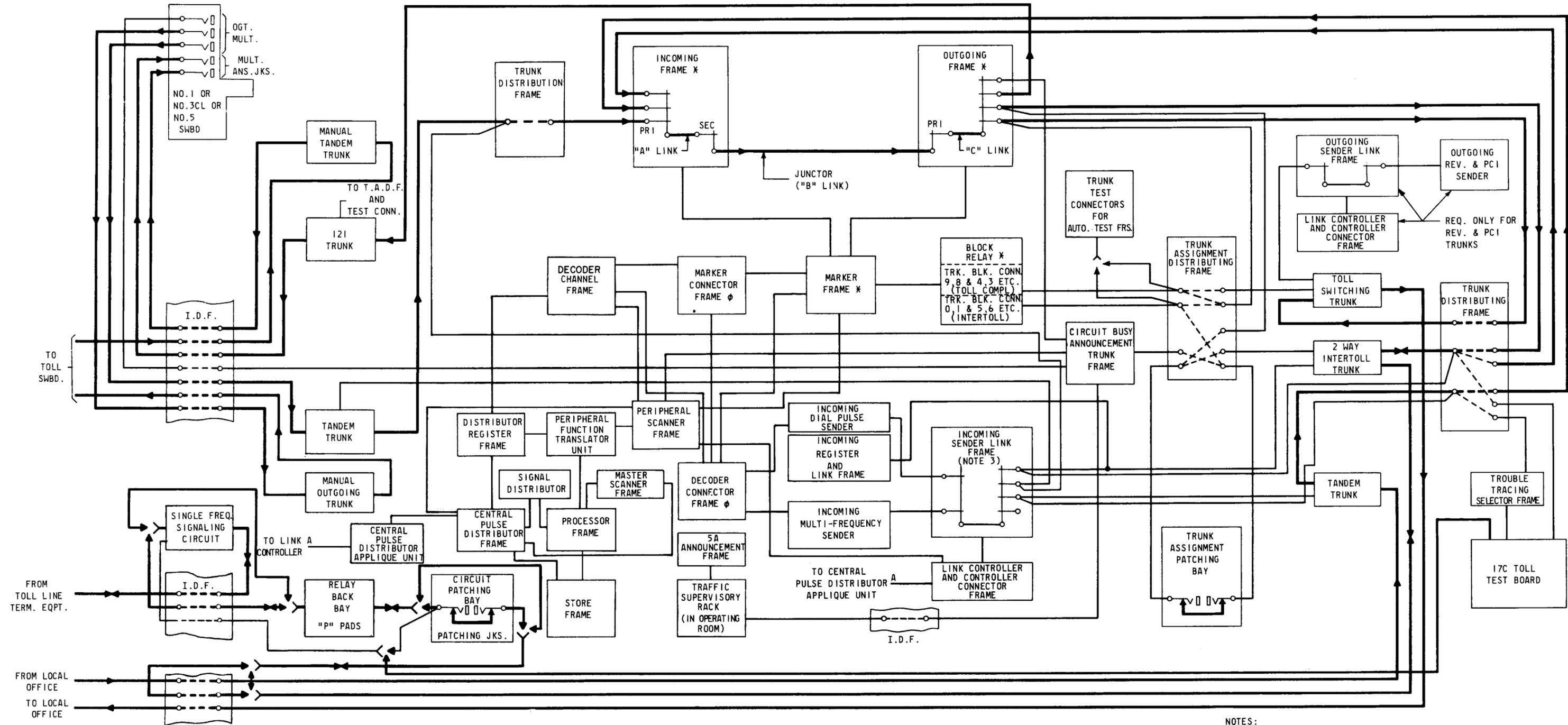
**Floor Plan Data Sheets**

- Section 7.1, Sheet 39 — Traffic Usage Recorder Frame
- 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 † 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) — Card Translator Office



- 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  $\phi$  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. 2 - Equipment Schematic (Non-CAMA) Electronic Translator Office

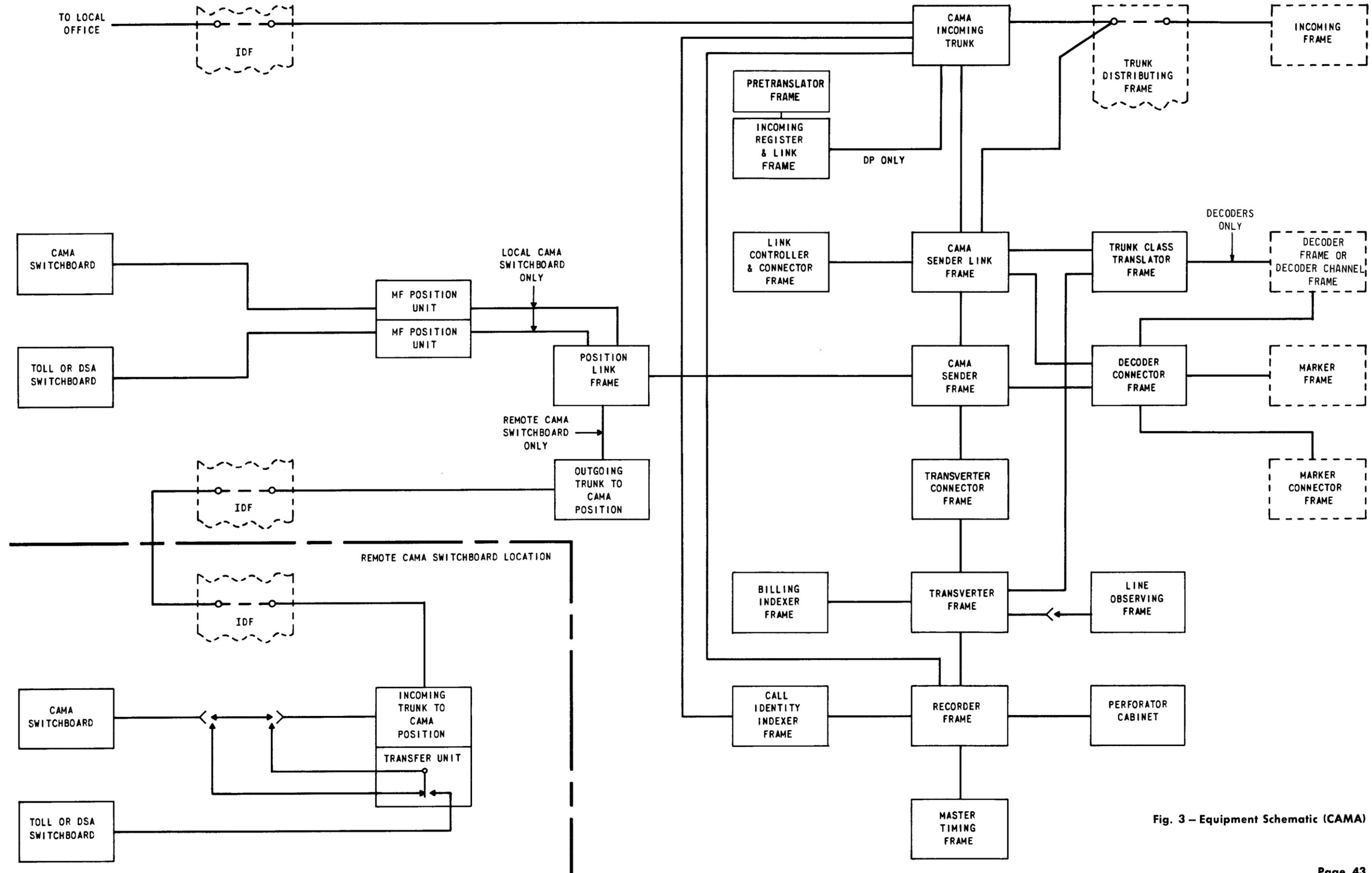


Fig. 3 - Equipment Schematic (CAMA)

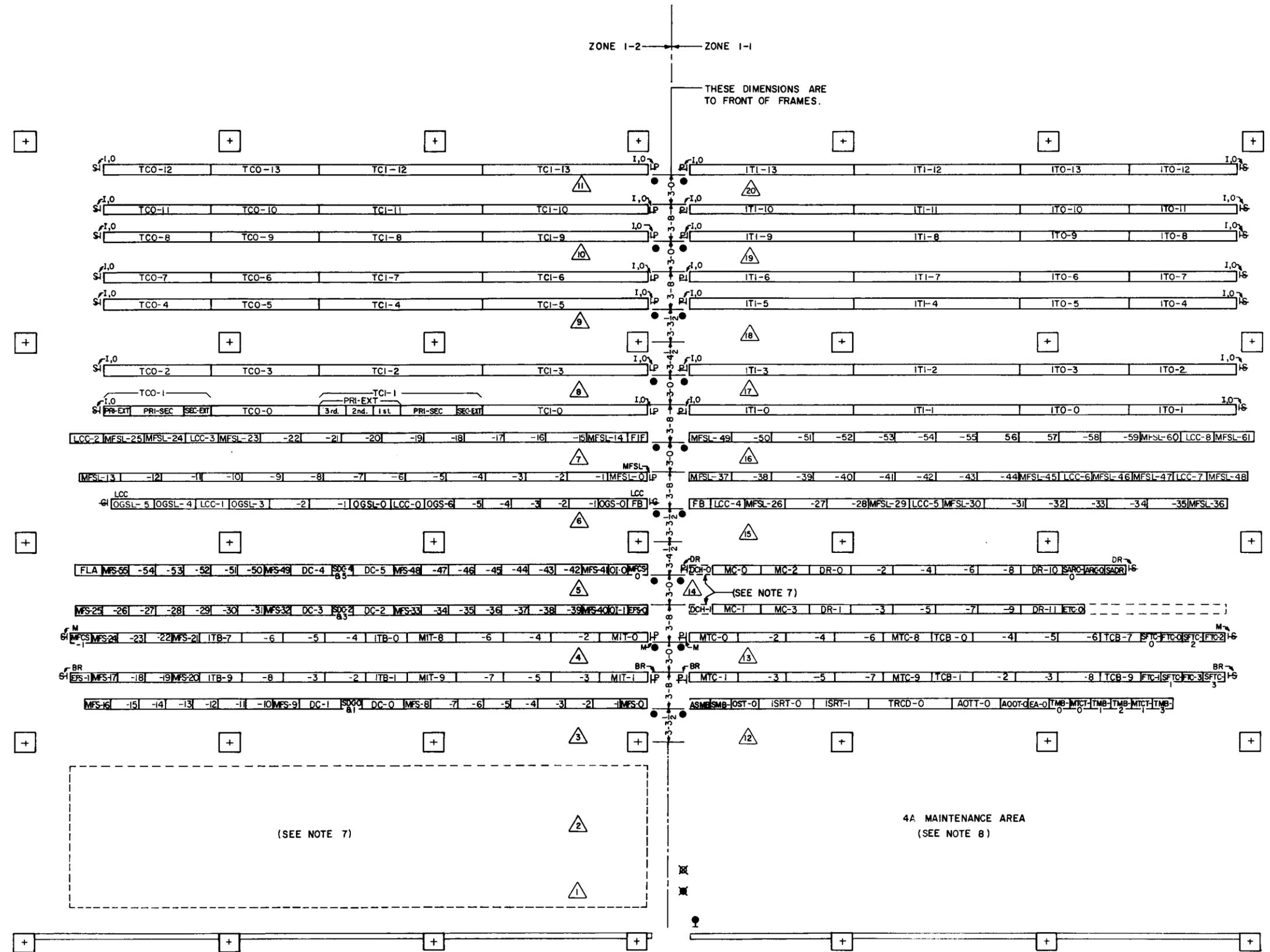


Fig. 4 - Typical Floor Plan - Switch Operation Office (Non-CAMA)



SIDE OF ROOM NEAREST MAINTENANCE CENTER

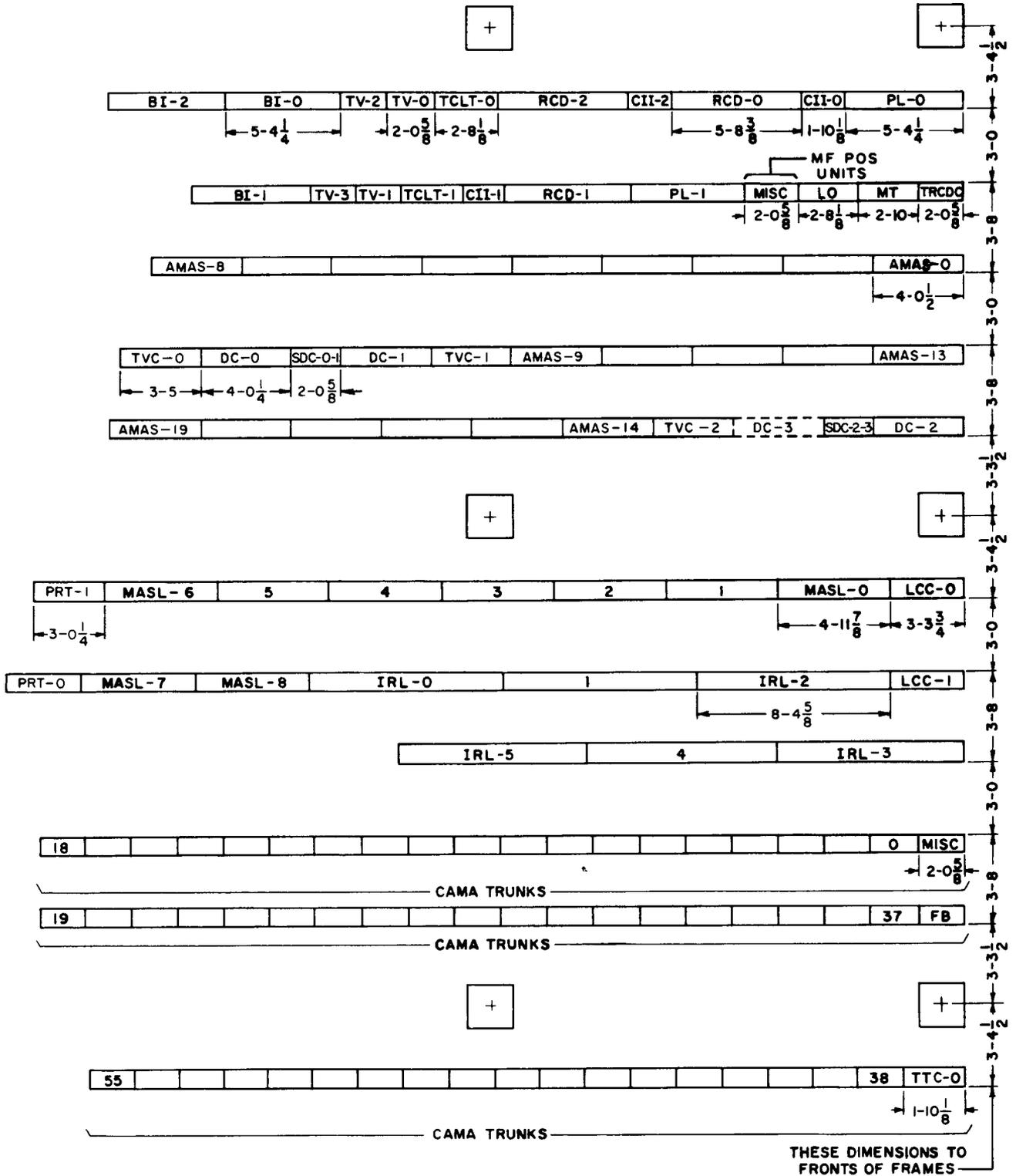


Fig. 5 - Typical Floor Plan - CAMA Equipment

FRAME NAME	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Incoming	ITI, TCI, or I			7
Basic		5 Ft 4-1/4 In.	2	
Secondary Extension		2 Ft 8-1/8 In.	1	
First Primary Extension		2 Ft 8-1/8 In.	1	
Second Primary Extension		2 Ft 8-1/8 In.	1	
Third Primary Extension		2 Ft 8-1/8 In.	1	
Outgoing	ITO, TCO, or O			8
Basic		5 Ft 4-1/4 In.	2	
Primary Extension		2 Ft 8-1/8 In.	1	
First Secondary Extension		2 Ft 8-1/8 In.	1	
Second Secondary Extension		2 Ft 8-1/8 In.	1	
Marker	MIT, MTC, or M	4 Ft 8-3/4 In.	2	9
Marker Connector (Separate Train)	MC	4 Ft 5-1/4 In.	2	10
Decoder Connector (12 DR, 10 MIT-Markers) Separate and Combined Train	DC	4 Ft 0-1/2 In.	1	11
Supplementary Decoder Connectors (10 MTC-Markers, 8 Connectors) Separate and Expanded Combined Train	SDC	2 Ft 0-5/8 In.	1	12
Link Controller and Connector	LCC	3 Ft 3-3/4 In.	1	13
Frame Identification Frequency Supply and Control	FIF	2 Ft 0-5/8 In.	1	14
Incoming Multifrequency Sender	MFS	2 Ft 8-1/8 In.	1	15
Emergency Filament Supply	EFS	2 Ft 0-5/8 In.	1	15A
Incoming Dial Pulse Sender	DPS	4 Ft 7-1/2 In.	2	16
Overseas Sender	OVSS	4 Ft 0-1/2 In.	1	17
Outgoing Sender	OGS	2 Ft 10 In.	1	18
Incoming or Outgoing Sender Link	MFSL or ORSL	3 Ft 11-1/4 In.	2	19
CAMA or Overseas Sender Link	MASL or OVSSL	4 Ft 11-7/8 In.	2	20
Multifrequency Current Supply	MFCS	2 Ft 0-5/8 In.	1	21
Incoming Register and Link	IRL	Basic 5 Ft 8-3/8 In. Supl 2 Ft 8-3/8 In.	2  1 1	22

Fig. 6 – Frame Sizes

FRAME NAME	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Block Relay	ITB, TCB, or BR	4 Ft 0-1/2 In.	1	23
Traffic Usage Recorder	TUR	4 Ft 1-1/4 In.	2	24
Traffic Control	TR CONT	2 Ft 0-5/8 In.	1	25
Circuit Busy Announcement	CBA	2 Ft 8-1/8 In.	1	26
Announcement	ANN	2 Ft 0-5/8 In.	1	27
Trouble Tracing Selector	TT	2 Ft 0-5/8 In.	1	28
Outgoing Trunk Identification	OGTI	2 Ft 8-1/8 In.	1	29
Supplementary Outgoing Trunk Identification	SOGTI	2 Ft 8-1/8 In.	1	30
Office Interrupter	OI	1 Ft 10-1/2 In.	1	—
Marker Connector (Combined Train)	MC	2 Ft 2-5/8 In.	1	—
Floor Alarm Frame	FLA	2 Ft 0-5/8 In.	1	—
Traffic Register Rack	TR	2 Ft 1-11/16 In.	1	—
Traffic Register Relay Rack	TRRR	2 Ft 0-5/8 In.	1	—
Traffic Supervisory Rack	TSR	2 Ft 1-11/16 In.	1	—
Relay Rack	—	2 Ft 0-5/8 In.	1	—
Trunk Frame	TUB, C	2 Ft 0-5/8 In.	1	—
Trunk Frame	TUA	2 Ft 8-1/8 In.	1	—
Fuse Bay	—	2 Ft 0-5/8 In.	1	—
Decoder Channel	DCH	2 Ft 2-5/8 In.	1	31
Peripheral Scanner	PSC	2 Ft 2 In.	1	32
Distributor Register	DREG	2 Ft 2 In.	1	33
Alarm and Display	AD	2 Ft 2 In.	1	34
Power Distributing	PD	2 Ft 2 In.	1	35
Processor	P	6 Ft 6 In.	3	36
Control and Display, Program Tape, and Teletypewriter Frame	CD-PT-TTY	6 Ft 6 In.	3	37
Teletypewriter Buffer	TTYB	2 Ft 2 In.	1	38
Master Scanner Frame	MS	2 Ft 2 In.	1	39
Signal Distributor	SD	2 Ft 2 In.	1	40

Fig. 6 (Cont'd)

FRAME NAME	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Central Pulse Distributor	CPD	2 Ft 2 In.	1	41
Store	S	4 Ft 4 In.	2	42
Network Control	NC	2 Ft 0-5/8 In.	1	—
Miscellaneous	MISC	2 Ft 2 In.	1	—
Card Translator Cabinet	HT, ET, or FT	5 Ft 2-1/2 In.		43
Decoder	DR	4 Ft 1-1/4 In.	2	44
Foreign Translator Connector or Supplementary Foreign Translator Connector	FTC or SFTC	2 Ft 2-5/8 In.	1	45
Emergency Translator Connector or Supplementary Emergency Translator Connector	ETC	2 Ft 0-5/8 In.	1	46
Alternate Route Traffic Control or Supplementary Alternate Route Traffic Control	ARC or SARC	2 Ft 2-5/8 In.	1	47
Trunk Class Translator	TCLT	2 Ft 8-1/8 In.	1	48
Supplementary Trunk Class Translator	STCLT	2 Ft 8-1/8 In.	1	49
Transverter Connector	TVC	3 Ft 5 In.	1	50
Transverter	TV	2 Ft 0-5/8 In.	1	51
Trouble Recorder Connector	TRCDC	2 Ft 0-5/8 In.	1	52
Billing Indexer	BI	5 Ft 4-1/4 In.	2	53
Supplementary Billing Indexer	BIS	2 Ft 10 In.	1	54
Auxiliary Billing Indexer	BIA	2 Ft 0-5/8 In.	1	55
Call Identity Indexer	CII	1 Ft 10-1/8 In.	1	56
Recorder	RCD	5 Ft 8-3/8 In.	1	57
Perforator Cabinet	[A-]	2 Ft 8 In. by 1 Ft 10-1/2 In.	—	58
Master Timer	MT	2 Ft 10 In.	1	59
Position Link	PL	5 Ft 4-1/4 In.	2	60
Pretranslator	PRT	3 Ft 0-1/4	1	61
CAMA Sender	AMAS	4 Ft 0-1/2 In.	1	62
CAMA Switchboard	[1]	1 Ft 10 In. by 4 Ft 3 In.	(1 Sec) (2 Pos)	75
Trunk Frame	CAMA	2 Ft 0-5/8 In.	1	—

Fig. 6 (Cont'd)

FRAME NAME	ABBREVIATION	FRAME LENGTH	NO. OF BAYS	FIG.
Trouble Recorder	TRCD	8 Ft 2-3/8 In.	3	63
Incoming Sender and Register Test	ISRT	5 Ft 4-1/4 In.	2	64
Outgoing Sender Test	OST	2 Ft 8-1/8 In.	1	65
Sender Make-Busy	SMB	2 Ft 0-5/8 In.	1	66
Auxiliary Sender Make-Busy	ASMB	2 Ft 0-5/8 In.	1	67
Automatic Outgoing Toll Connecting Trunk Operational Test	AOOT	2 Ft 8-1/8 In.	1	68
Automatic Outgoing Toll Connecting Trunk Transmission Test	AOTT	4 Ft 8-3/4 In.	2	69
Automatic Outgoing Toll Connecting Trunk Test Connector	TCC	1 Ft 10-1/8 In.	1	70
Manual Outgoing Toll Connecting Trunk Test	MTCT	2 Ft 0-5/8 In.	1	71
Outgoing Toll Connecting Trunk Test and Make-busy Jack	TMB	2 Ft 0-5/8 In.	1	72
Automatic Incoming Trunk Test	AITT	2 Ft 0-5/8 In.	1	73
Automatic Incoming Trunk Test Connector	TCC	1 Ft 10-1/8 In.	1	74
Emergency Alarm	EA	2 Ft 0-5/8 In.	1	—
Automatically Directed Outgoing Intertoll Trunk Test Frame	ADOIT	4 Ft 8-3/4 In.	2	76
Automatically Directed Outgoing Intertoll Trunk Test Connector Frame	ITC	1 Ft 10-1/8 In.	1	77
Circuit Patching Bay	[1]	2 Ft 0-3/8 In.	1	—
Trunk Assignment Patching Bay	[1]	2 Ft 0-3/8 In.	1	—
No. 17C Toll Testboard Positions	[1]	2 Ft 0-3/8 In.	1	—
Intermediate Distributing	IDF	—	—	—
Trunk Distributing	TDF	—	—	—
Trunk Assignment Distributing	ITADF, TCA DF, or ADF			
Traffic Register Distributing Initial Unit (5 Verticals)	TRDF	3 Ft 3-7/8 In.		
Supplementary Unit (4 Verticals)		2 Ft 7-7/8 In.	—	—

Fig. 6 (Cont'd)

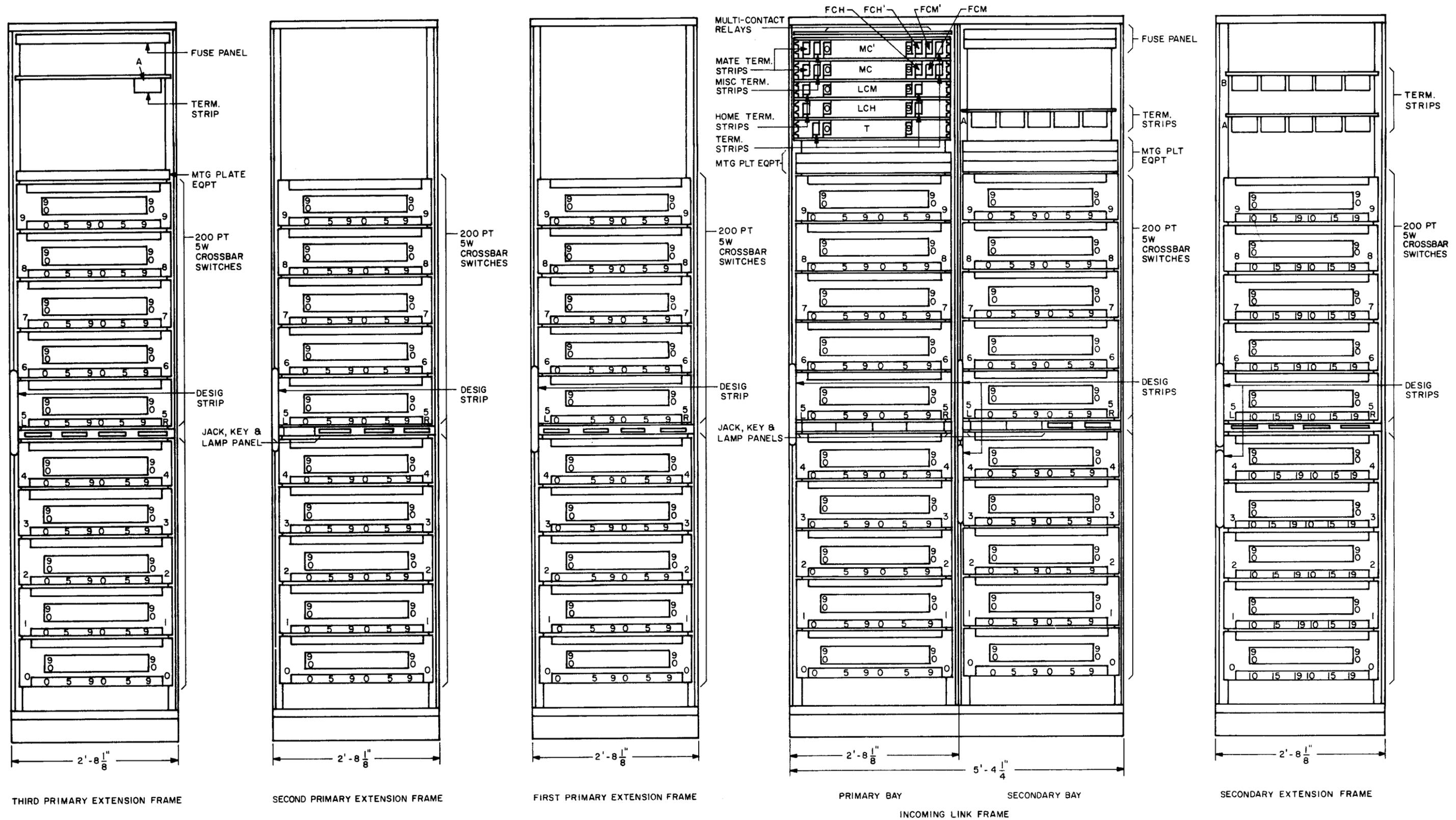


Fig. 7 - Incoming Frame

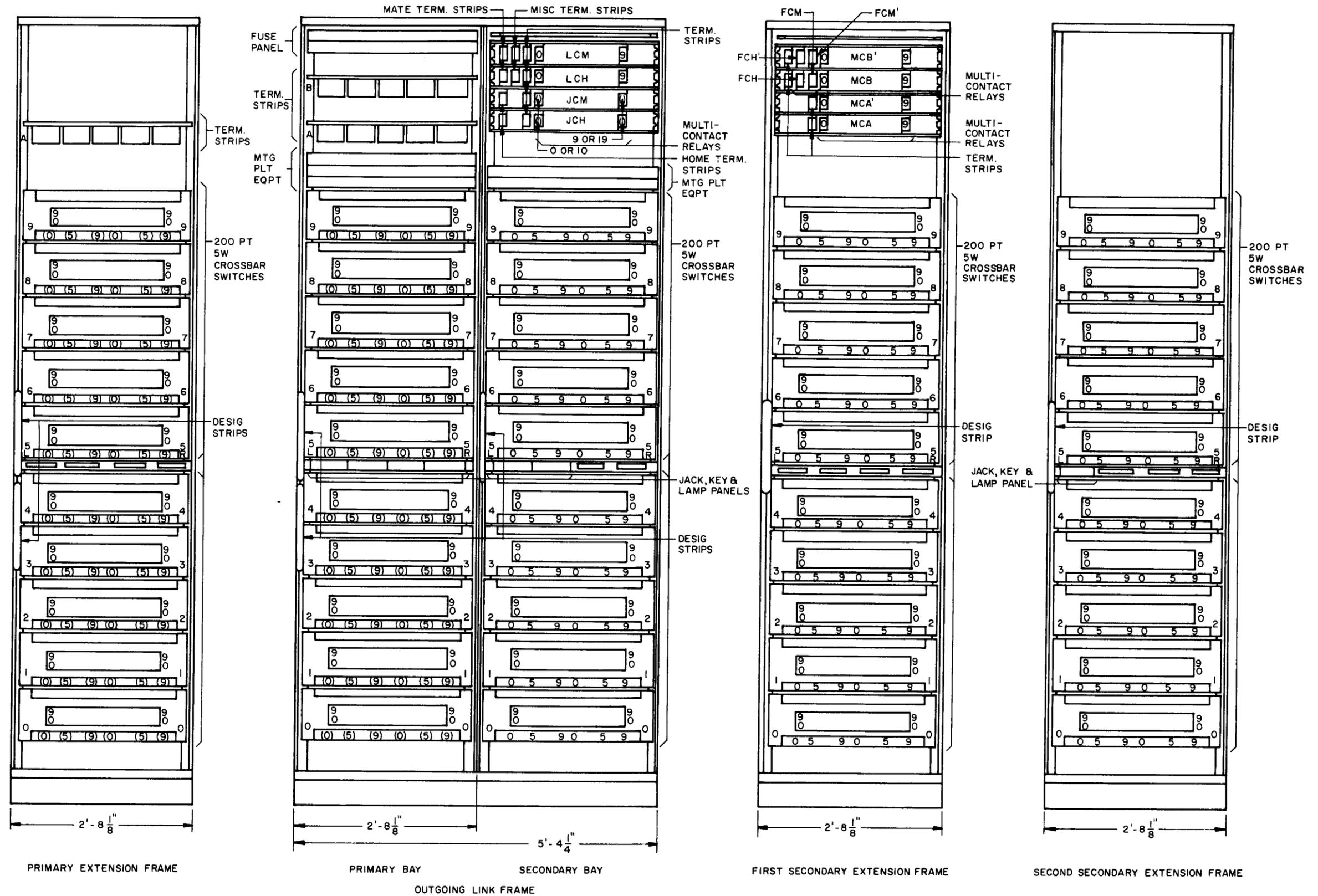


Fig. 8 - Outgoing Frame

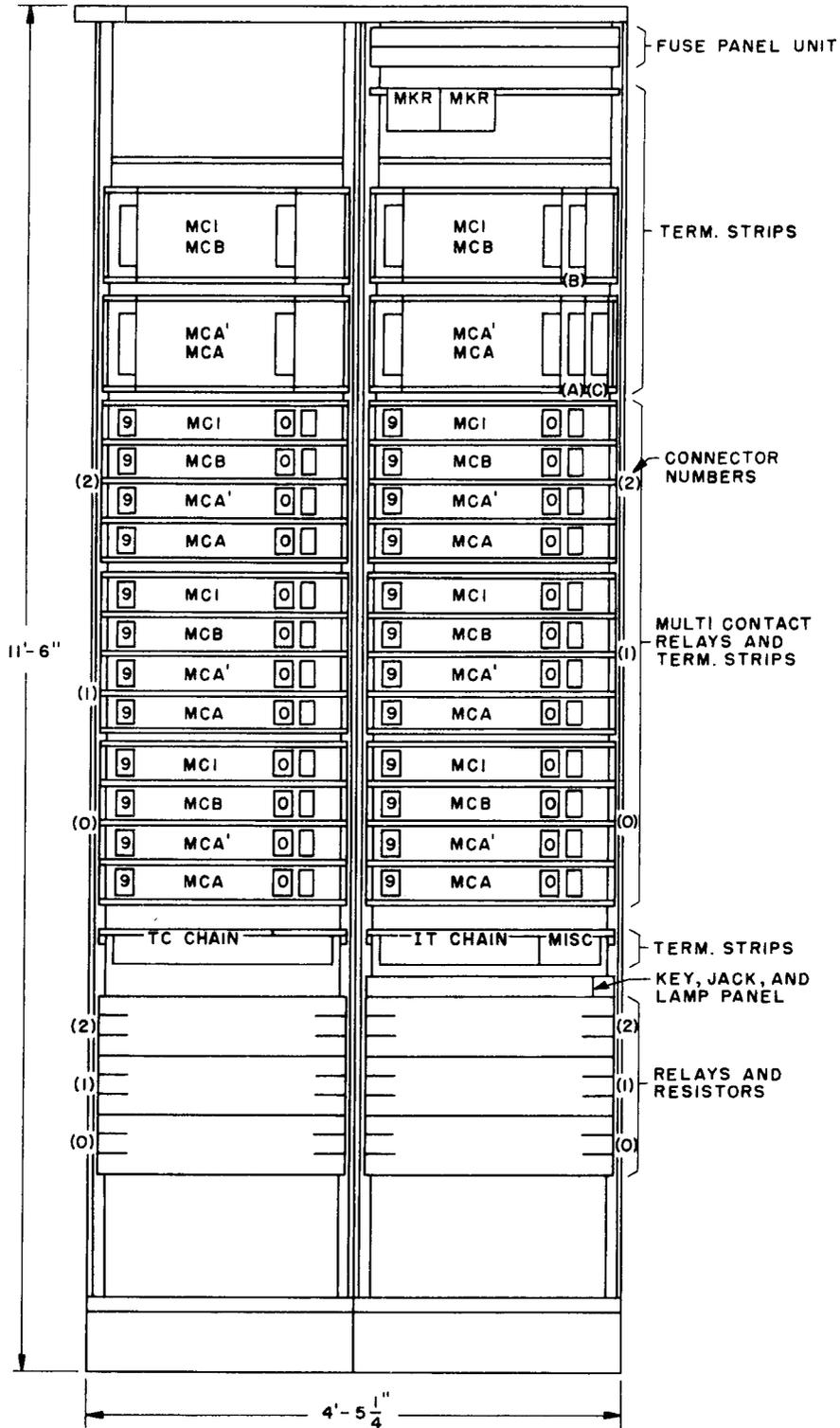


Fig. 9 - Marker Frame



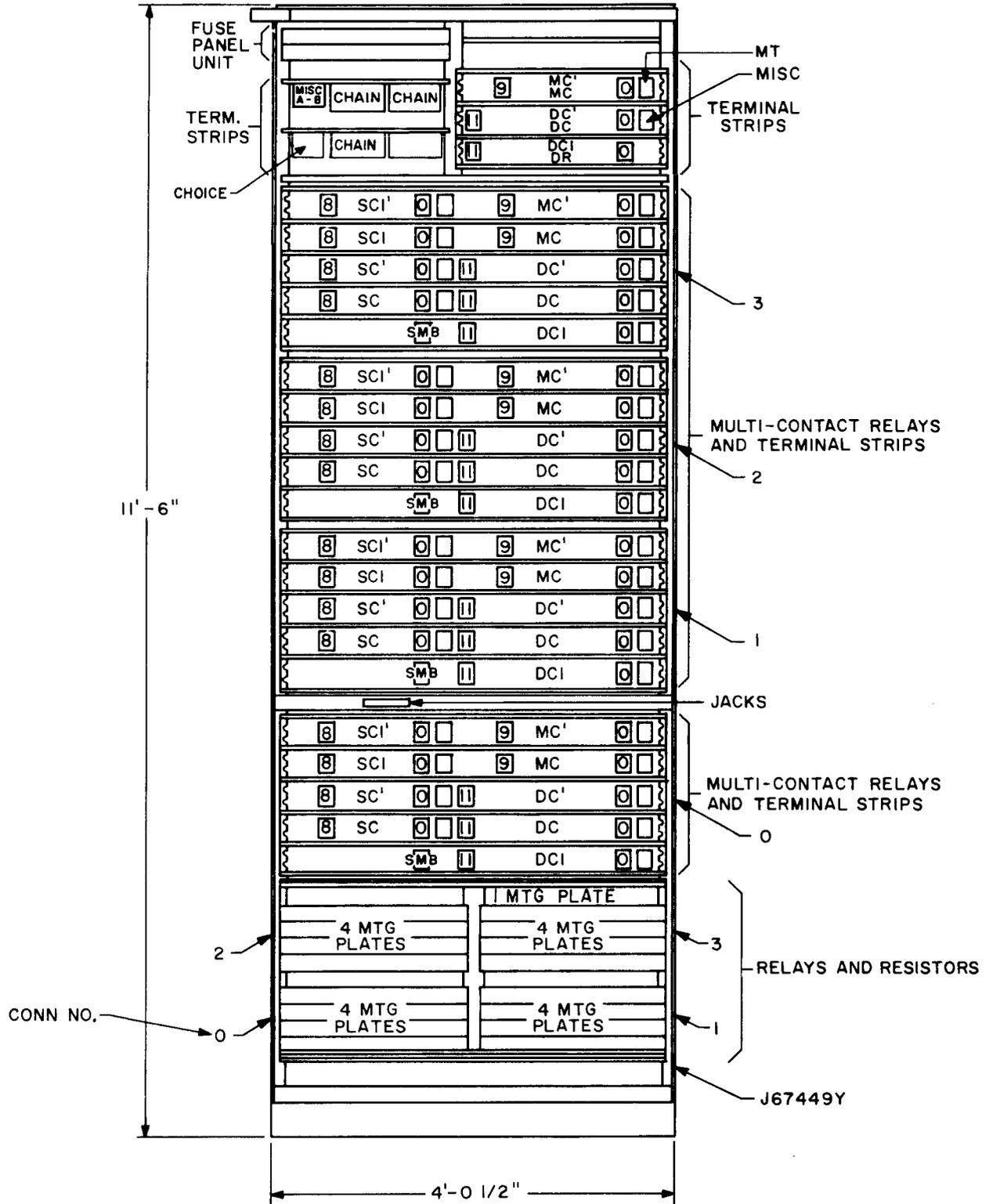
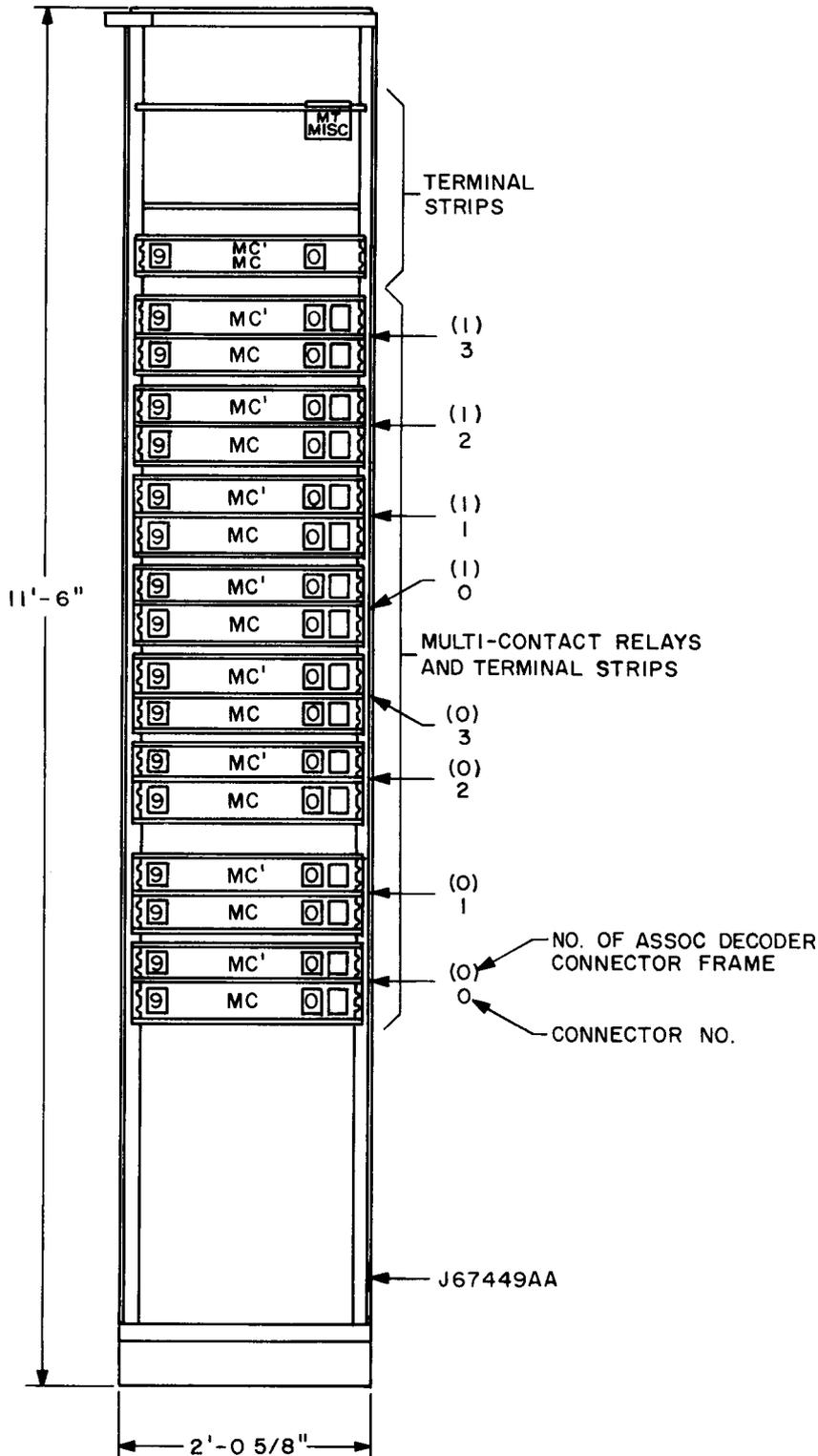


Fig. 11 - Decoder Connector Frame for Separate or Combined Train Offices



**Fig. 12 – Supplementary Decoder Connector Frame for Use in Separate Train Offices, Combined Train or Offices Expanded to Separate Train Combined Operations**

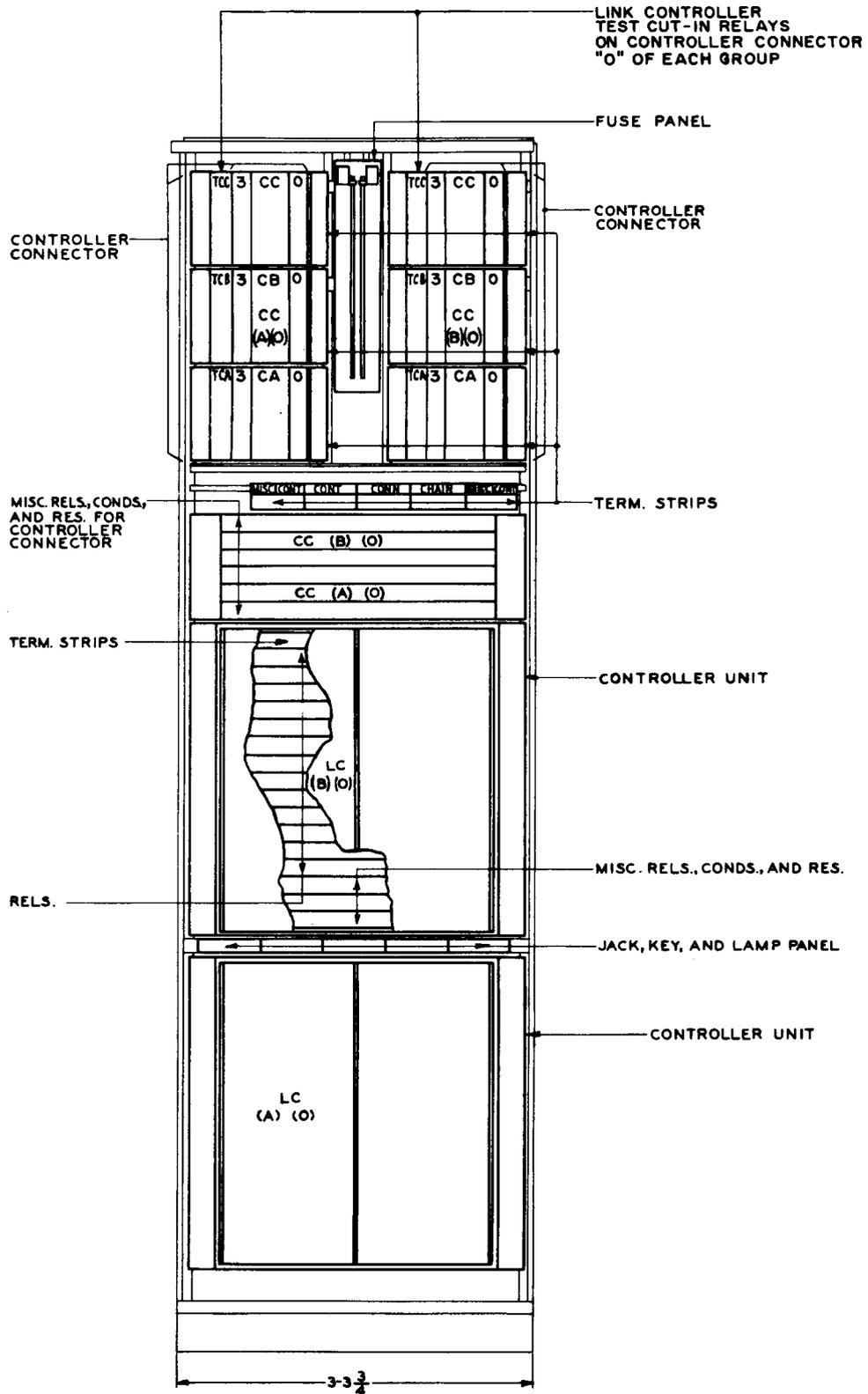


Fig. 13 – Link Controller and Connector Frame

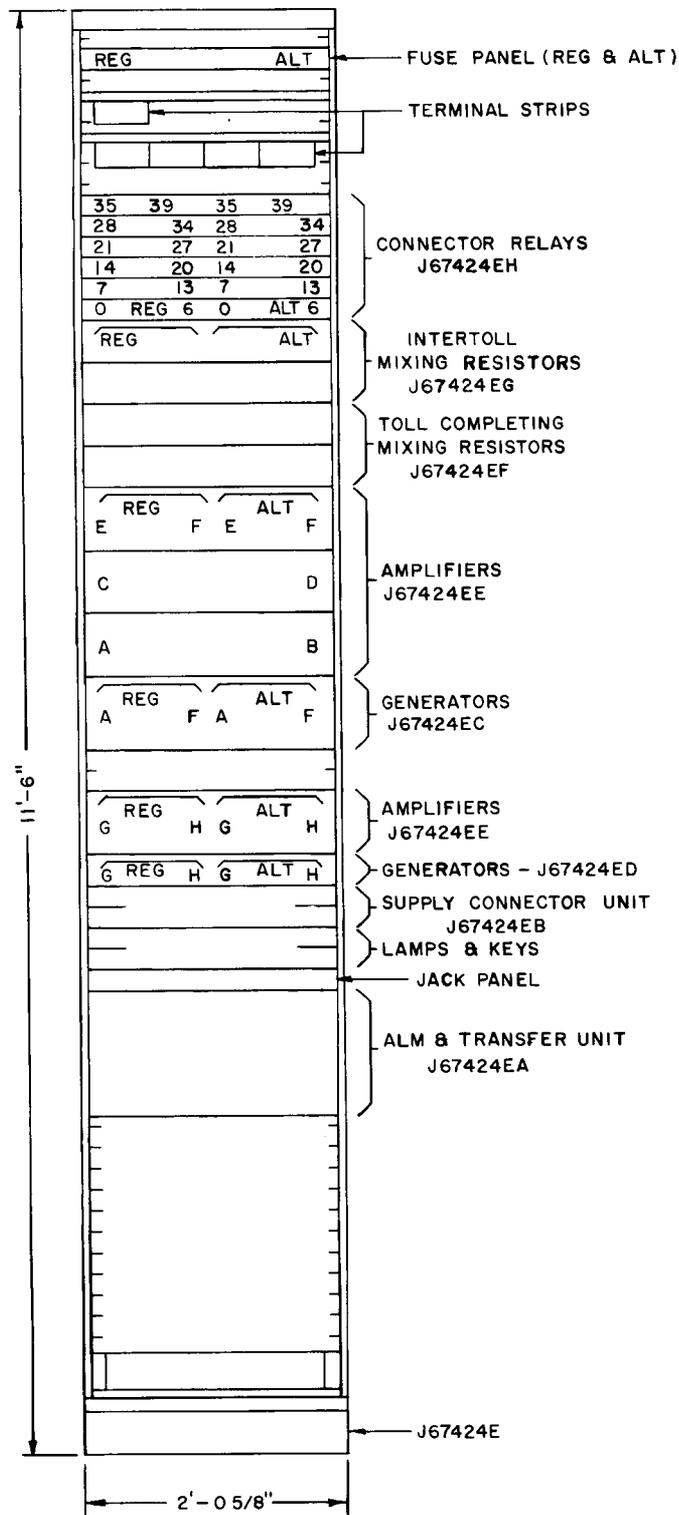


Fig. 14 - Frame Identification Frequency Supply and Control Frame

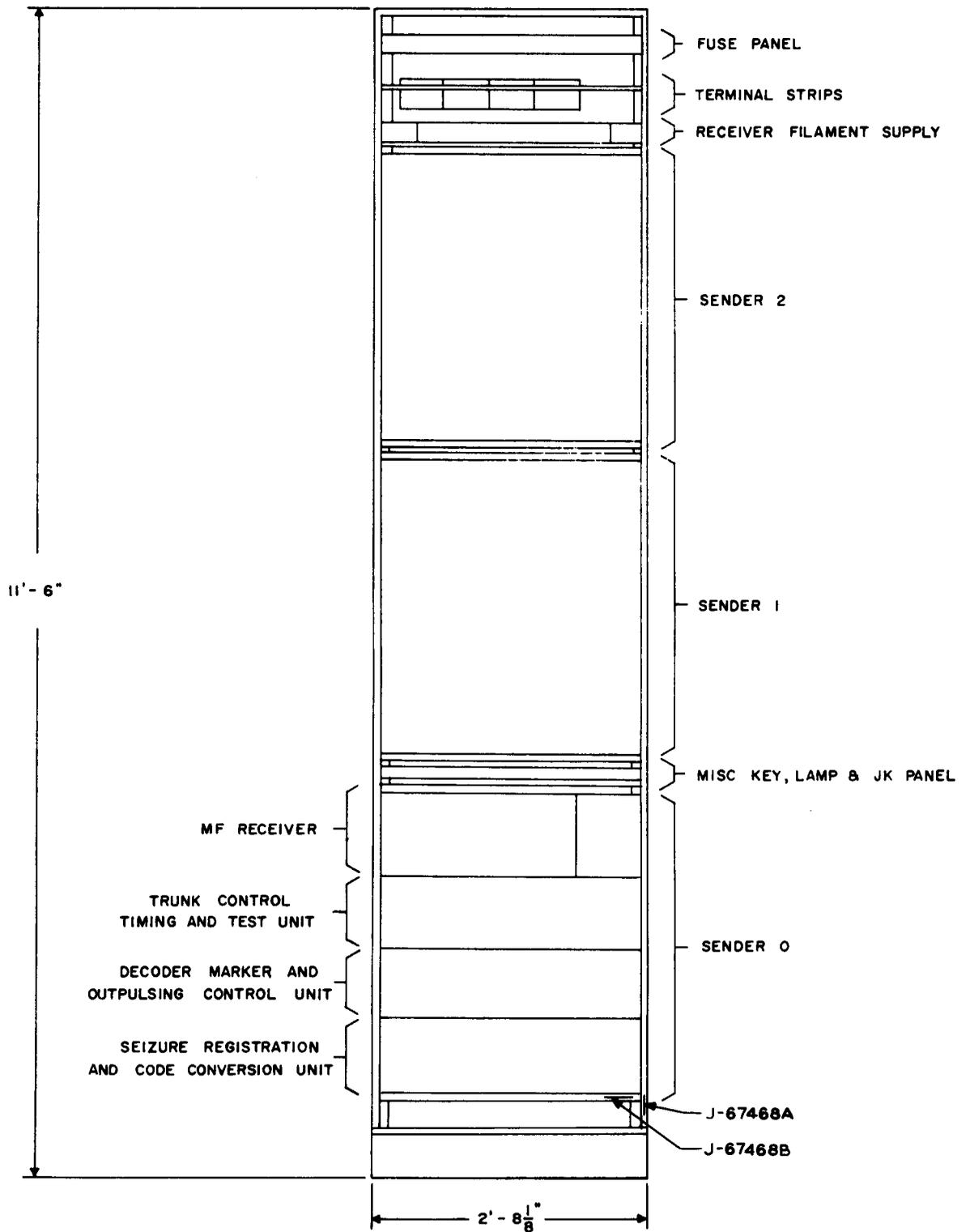


Fig. 15 - Incoming Multifrequency Sender Frame

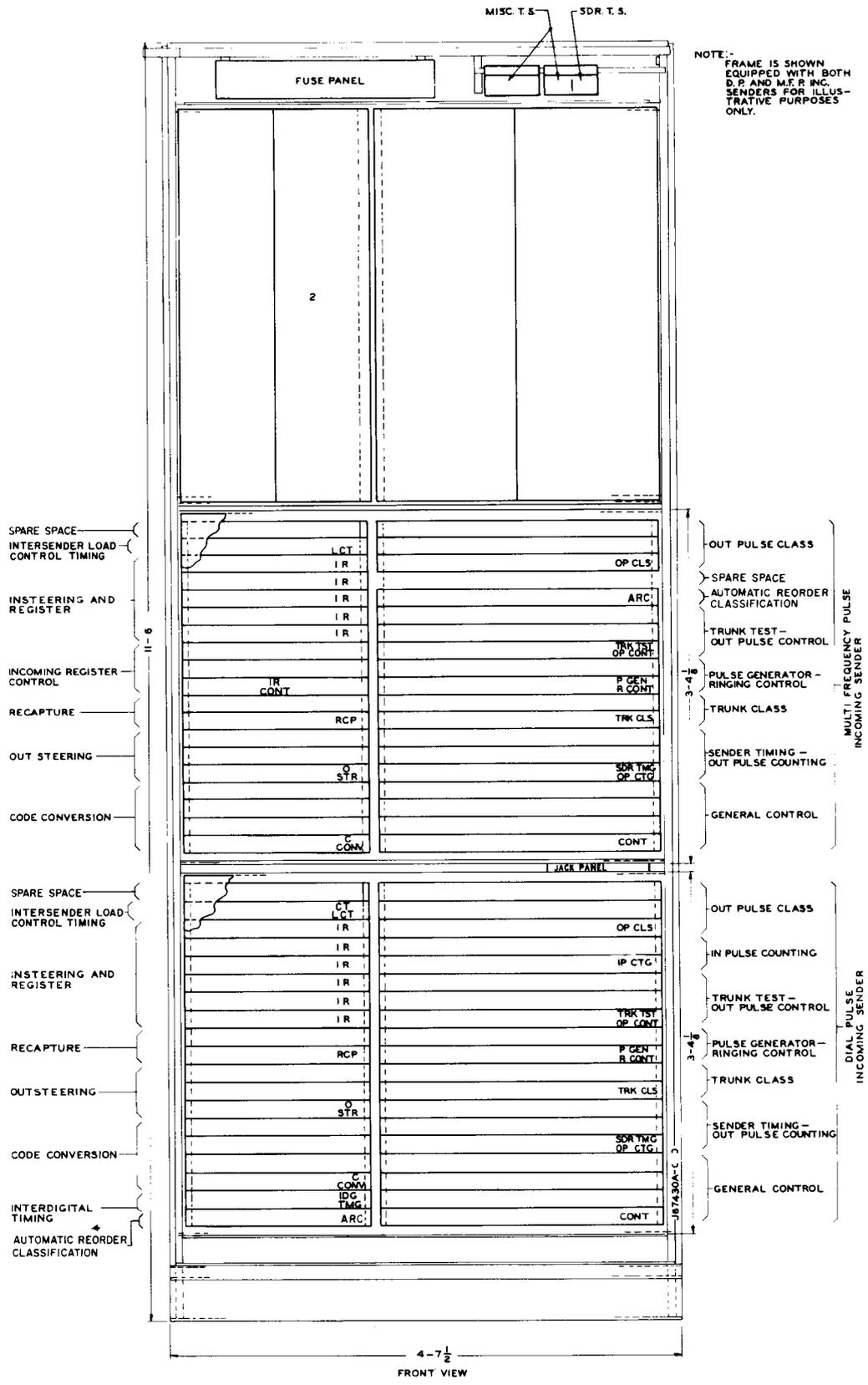


Fig. 16 - Incoming Dial Pulse Sender Frame

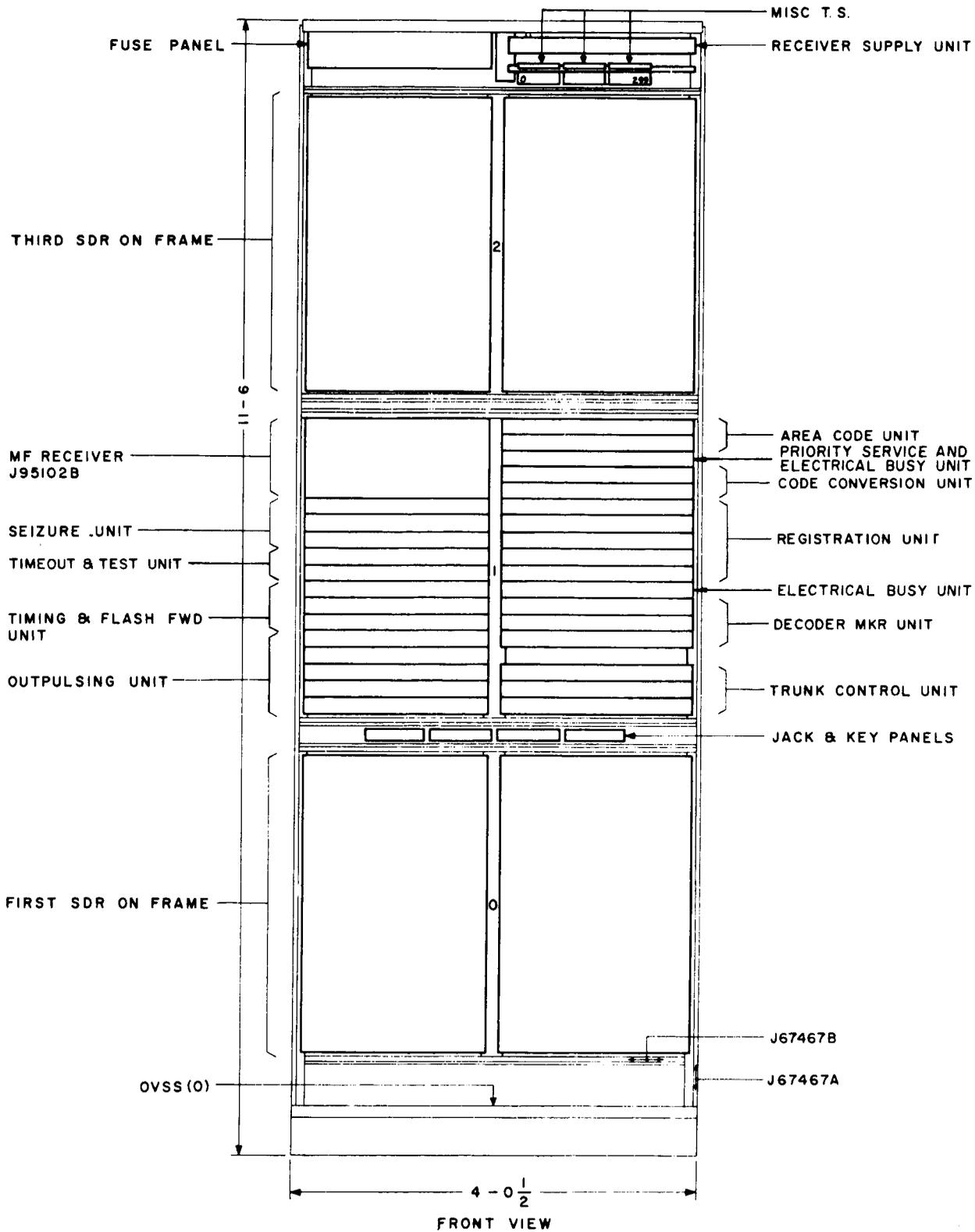


Fig. 17 - Overseas Sender Frame

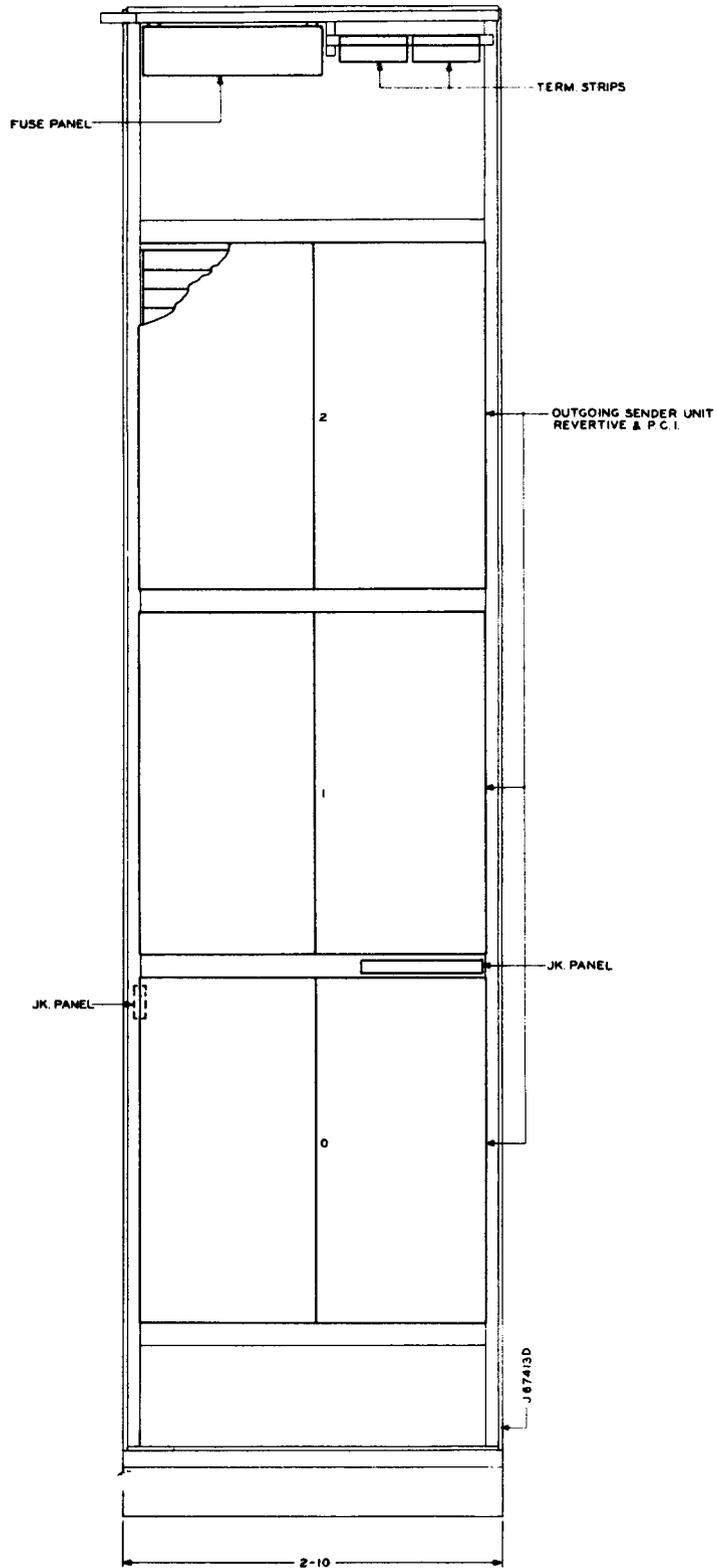


Fig. 18 - Outgoing Sender Frame

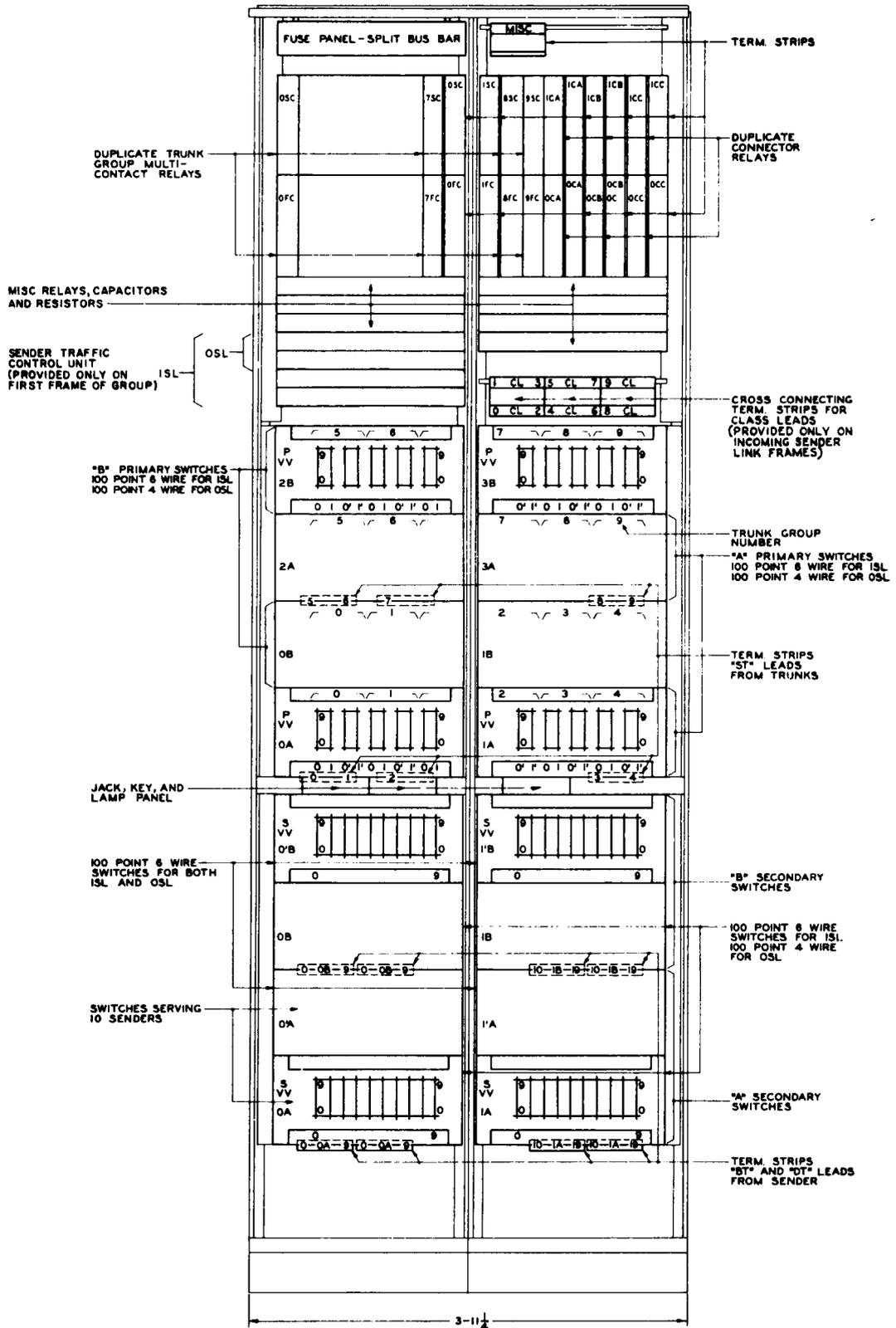


Fig. 19 - Incoming or Outgoing Sender Link Frame

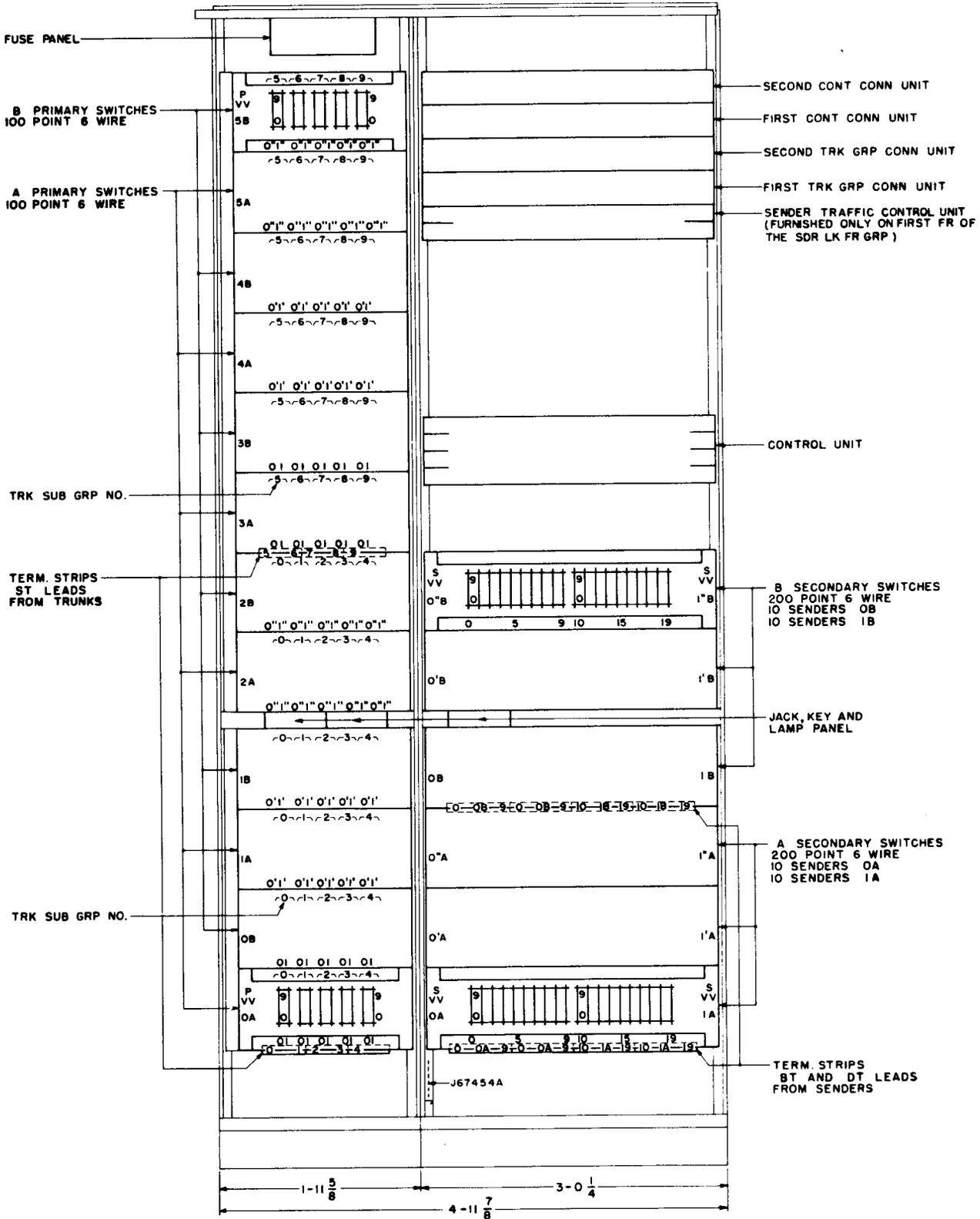


Fig. 20 - CAMA or Overseas Sender Link Frame

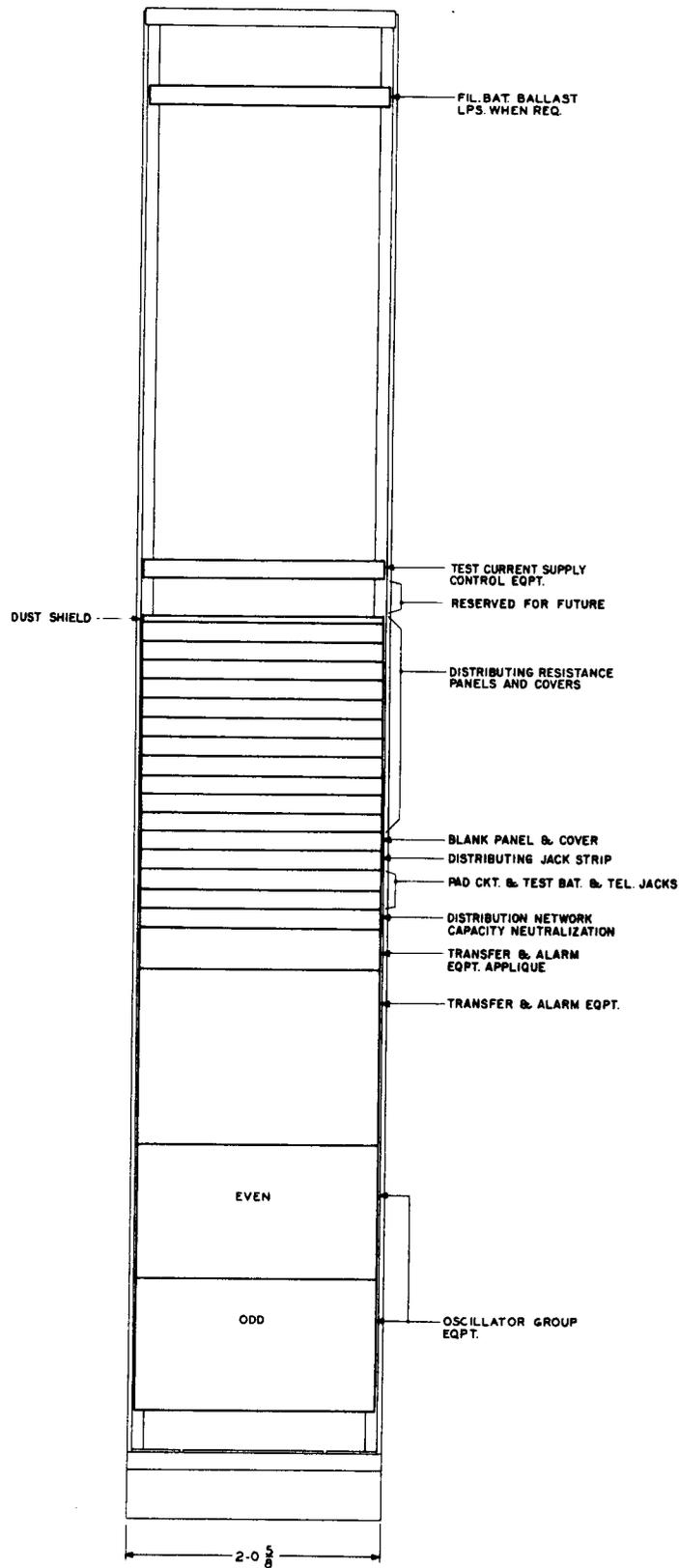


Fig. 21 – Multifrequency Current Supply Frame

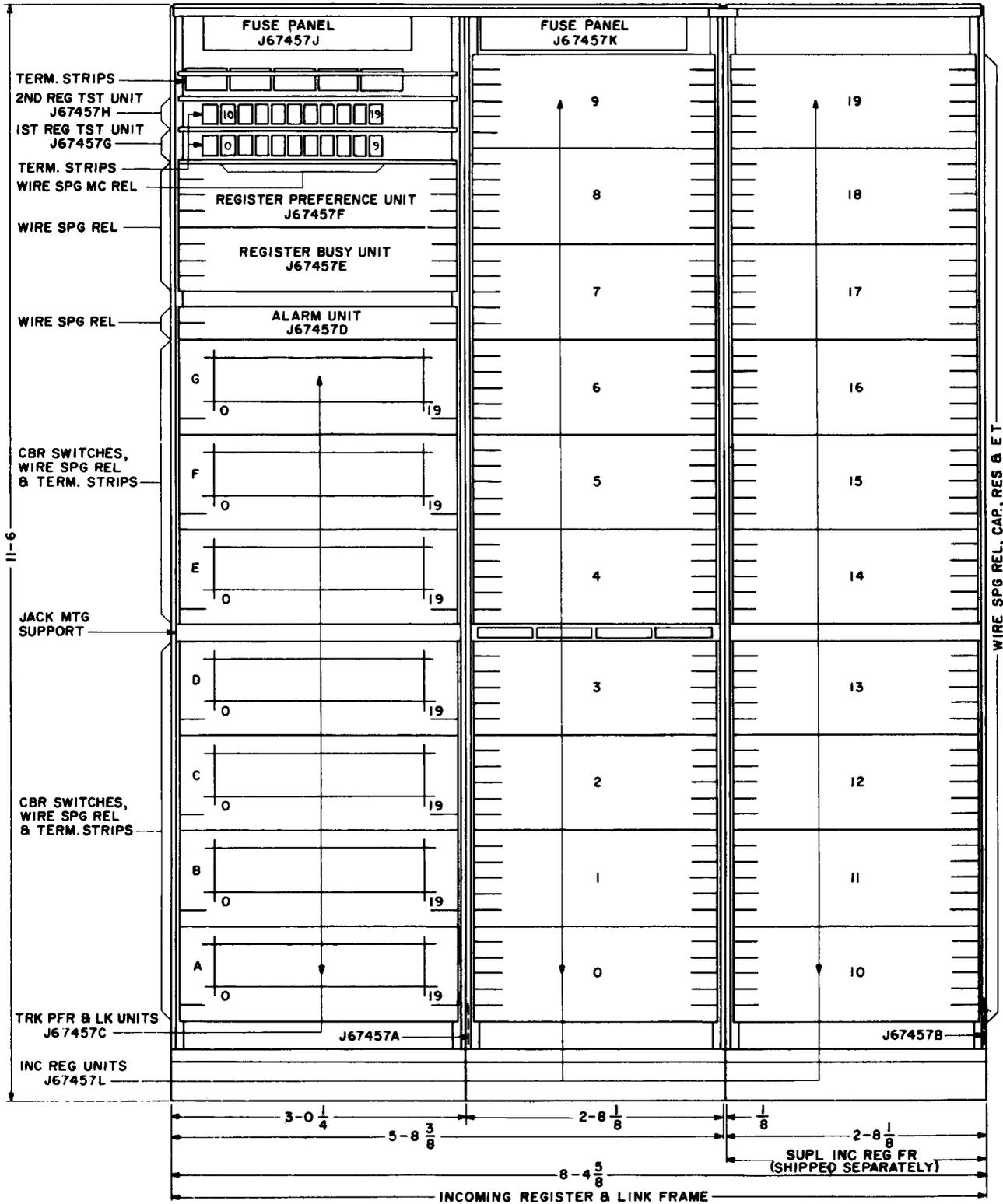


Fig. 22 – CAMA and Non-CAMA Incoming Register and Link Frame

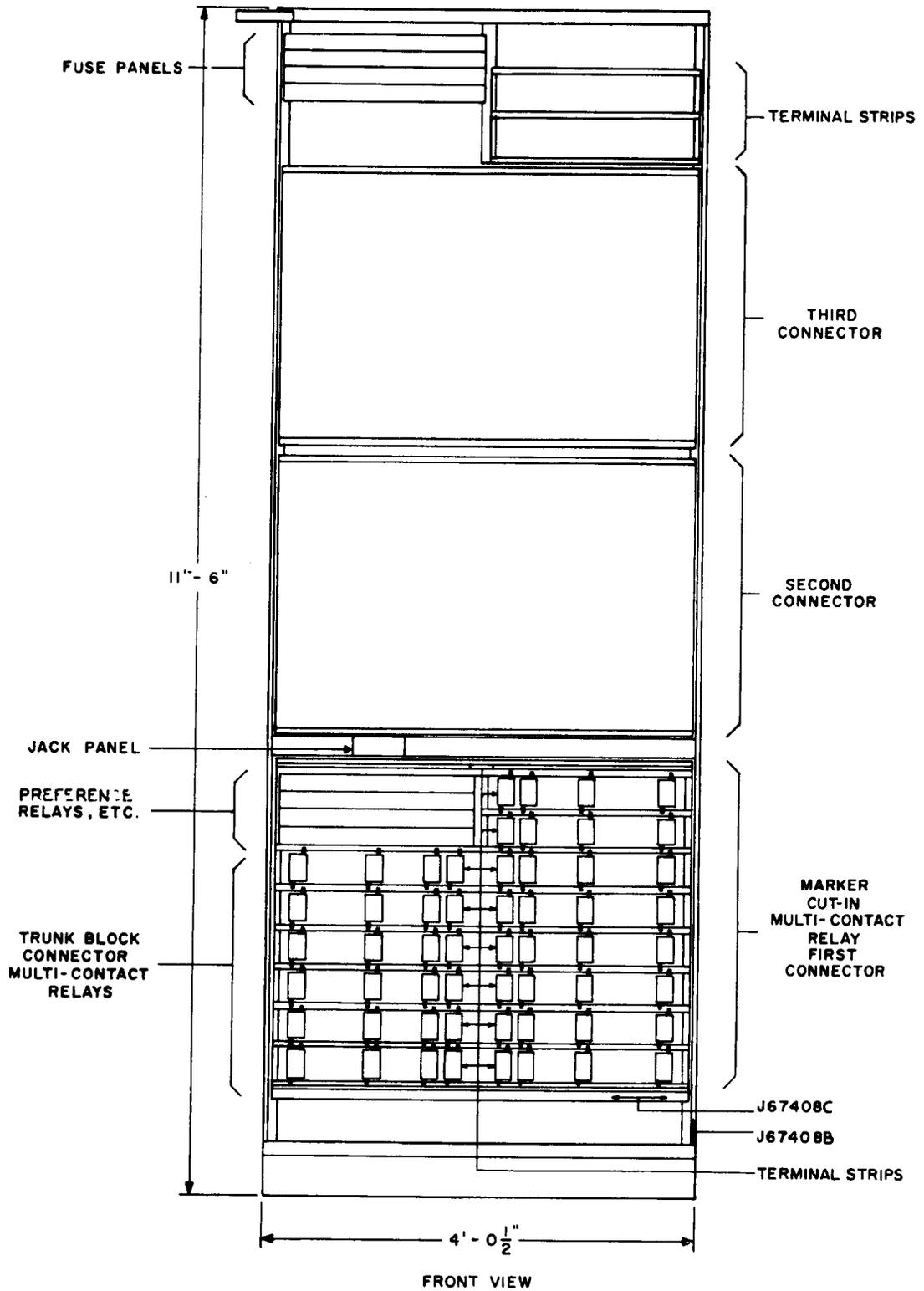


Fig. 23 - Block Relay Frame

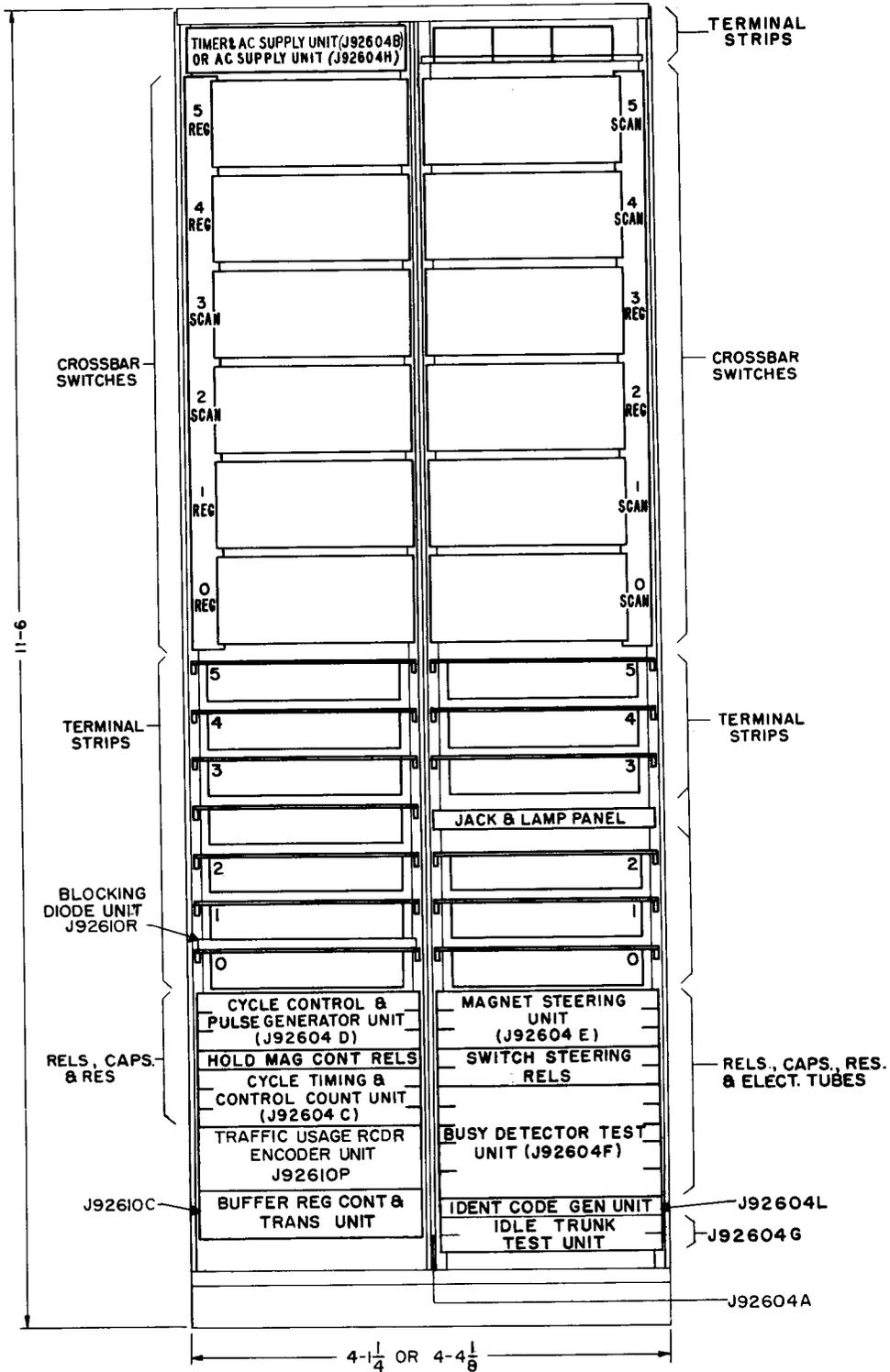


Fig. 24 - Traffic Usage Recorder Frame

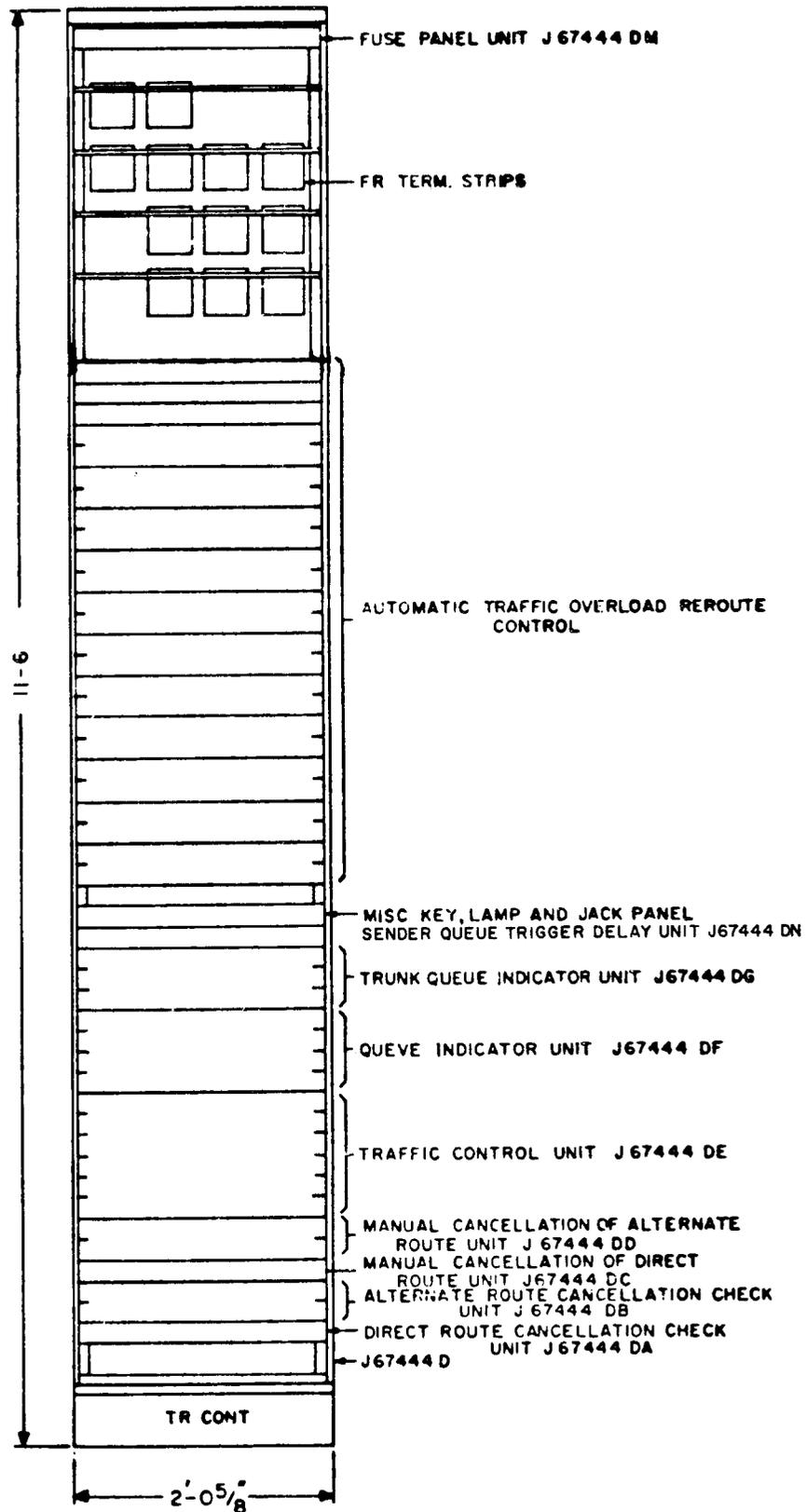


Fig. 25 - Traffic Control Frame

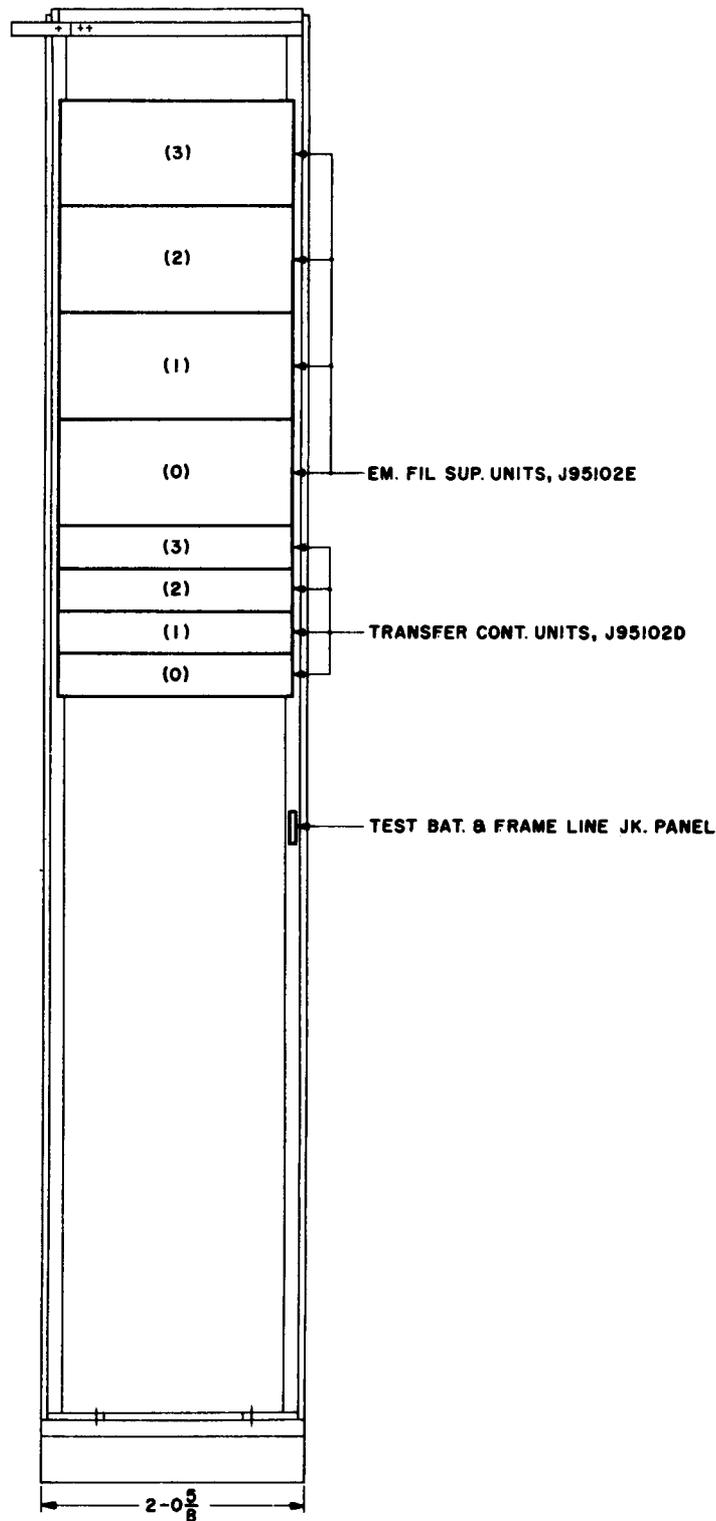


Fig. 26 – Emergency Filament Supply Bay

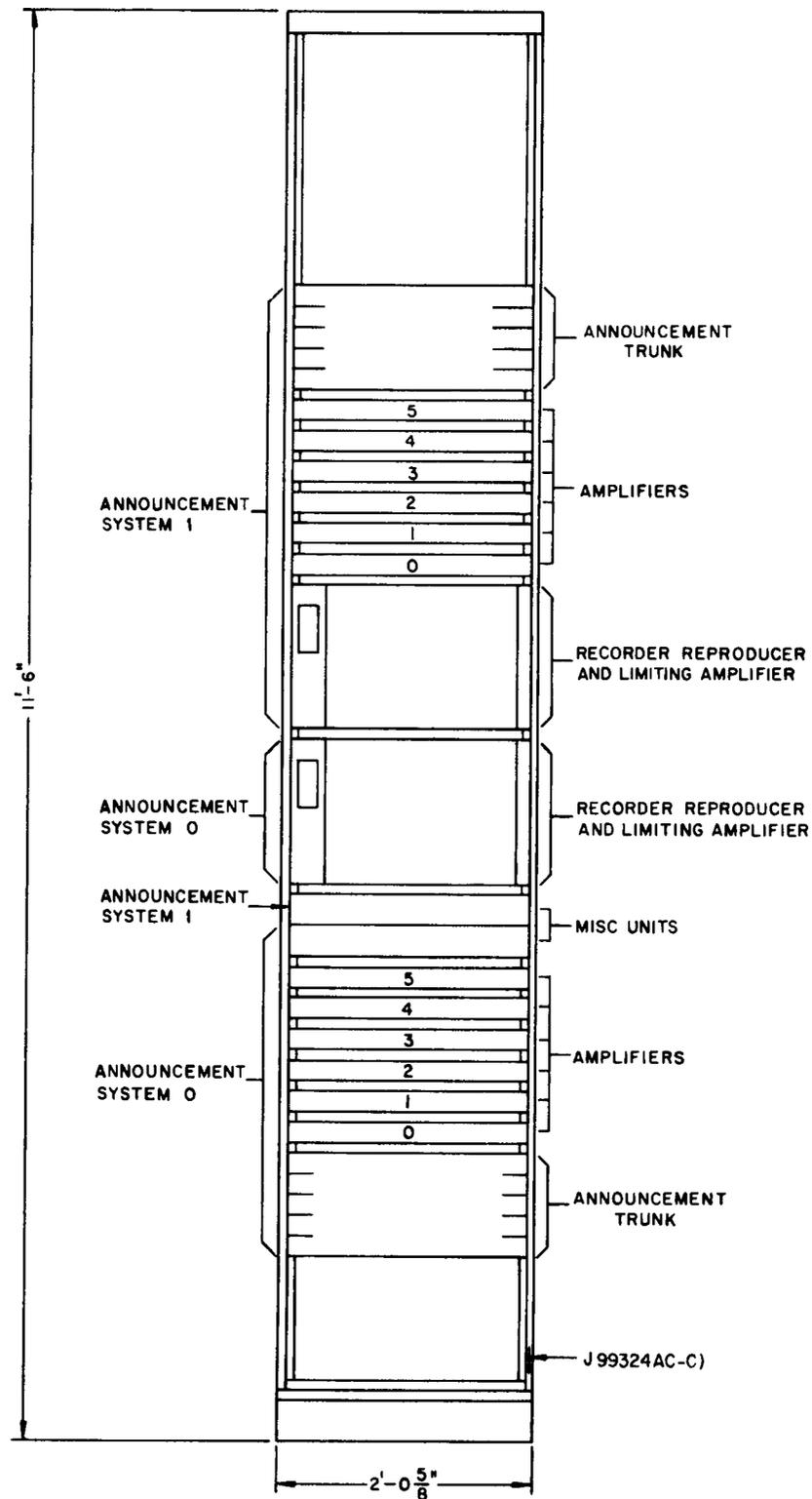


Fig. 27 - Announcement Frame

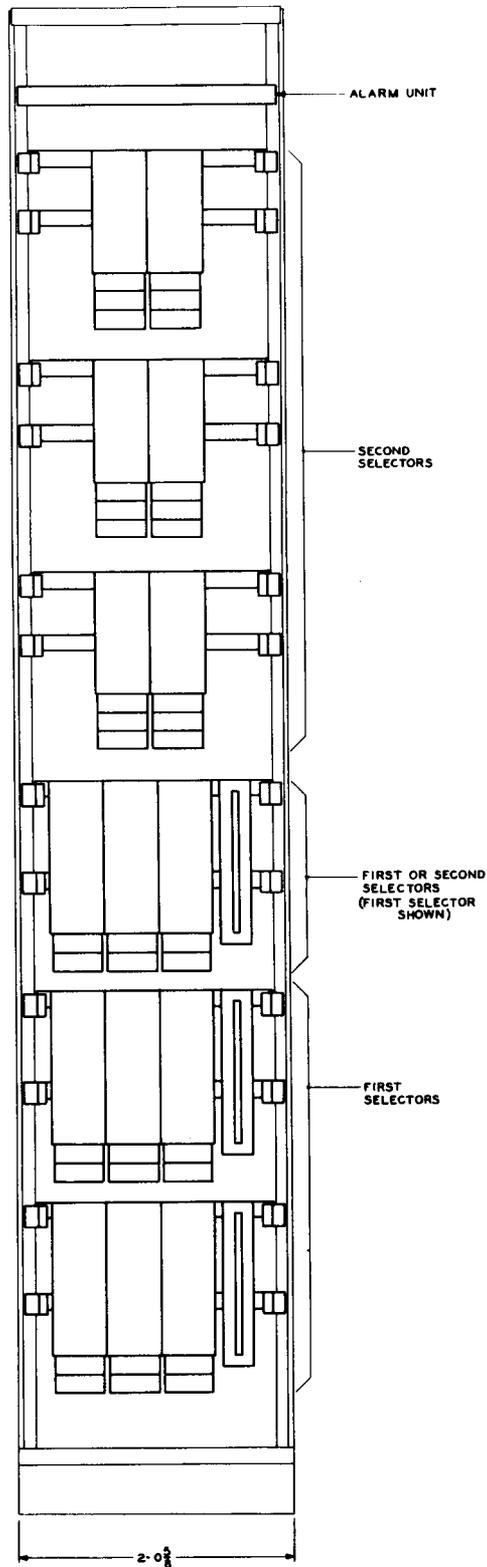


Fig. 28 – Trouble Tracing Selector Frame

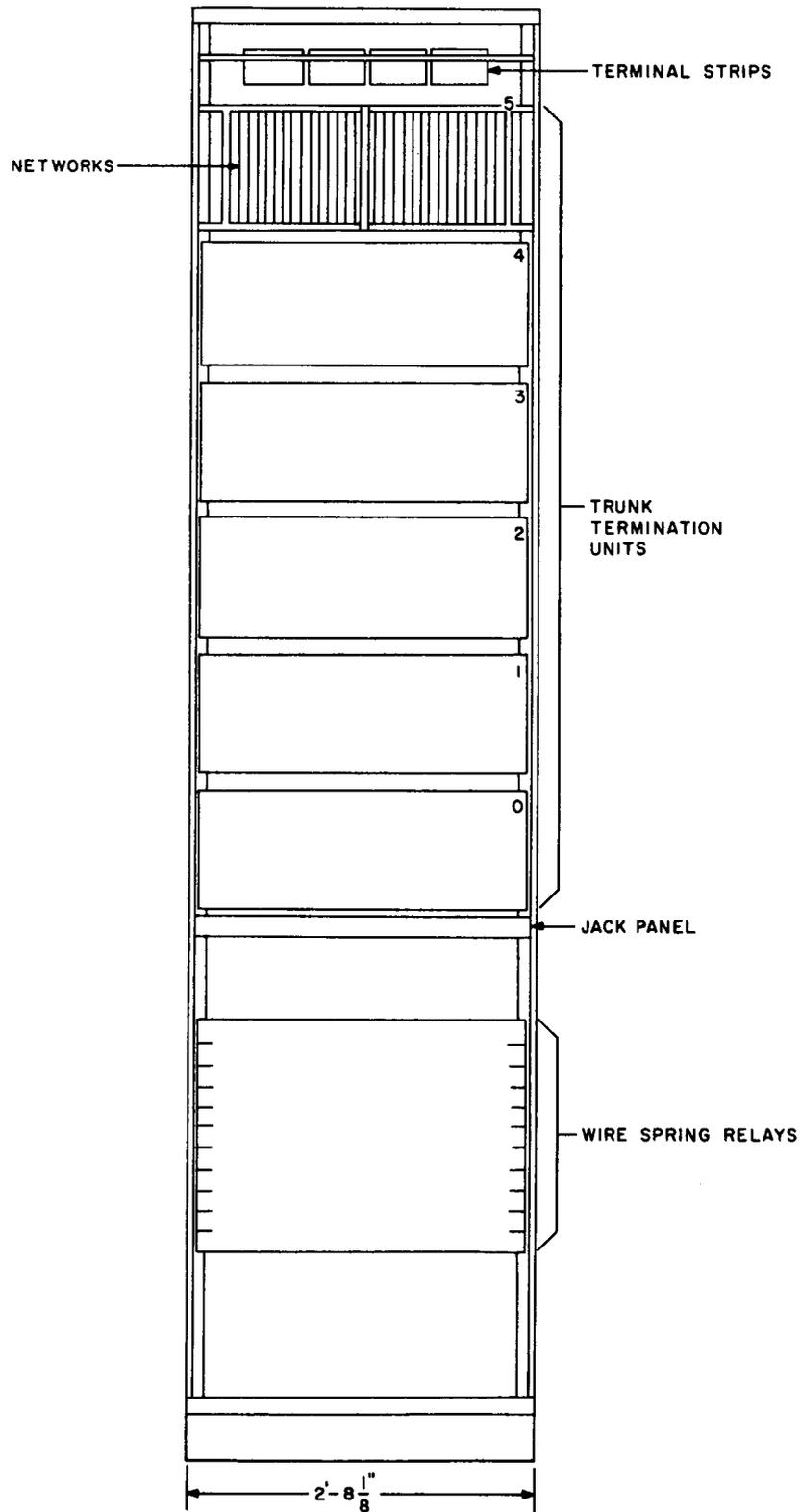


Fig. 29 – Outgoing Trunk Identification Frame

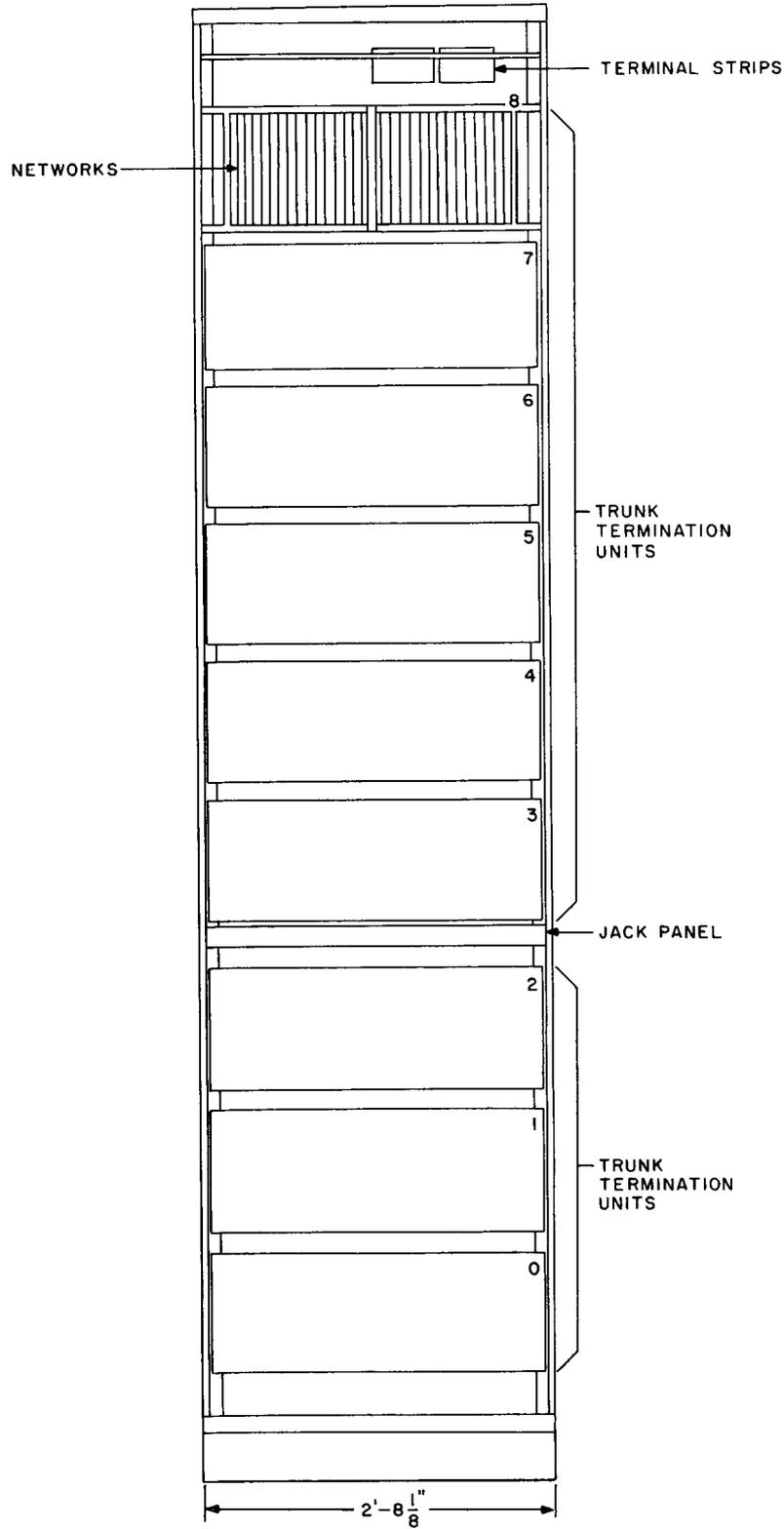


Fig. 30 – Supplementary Outgoing Trunk Identification Frame

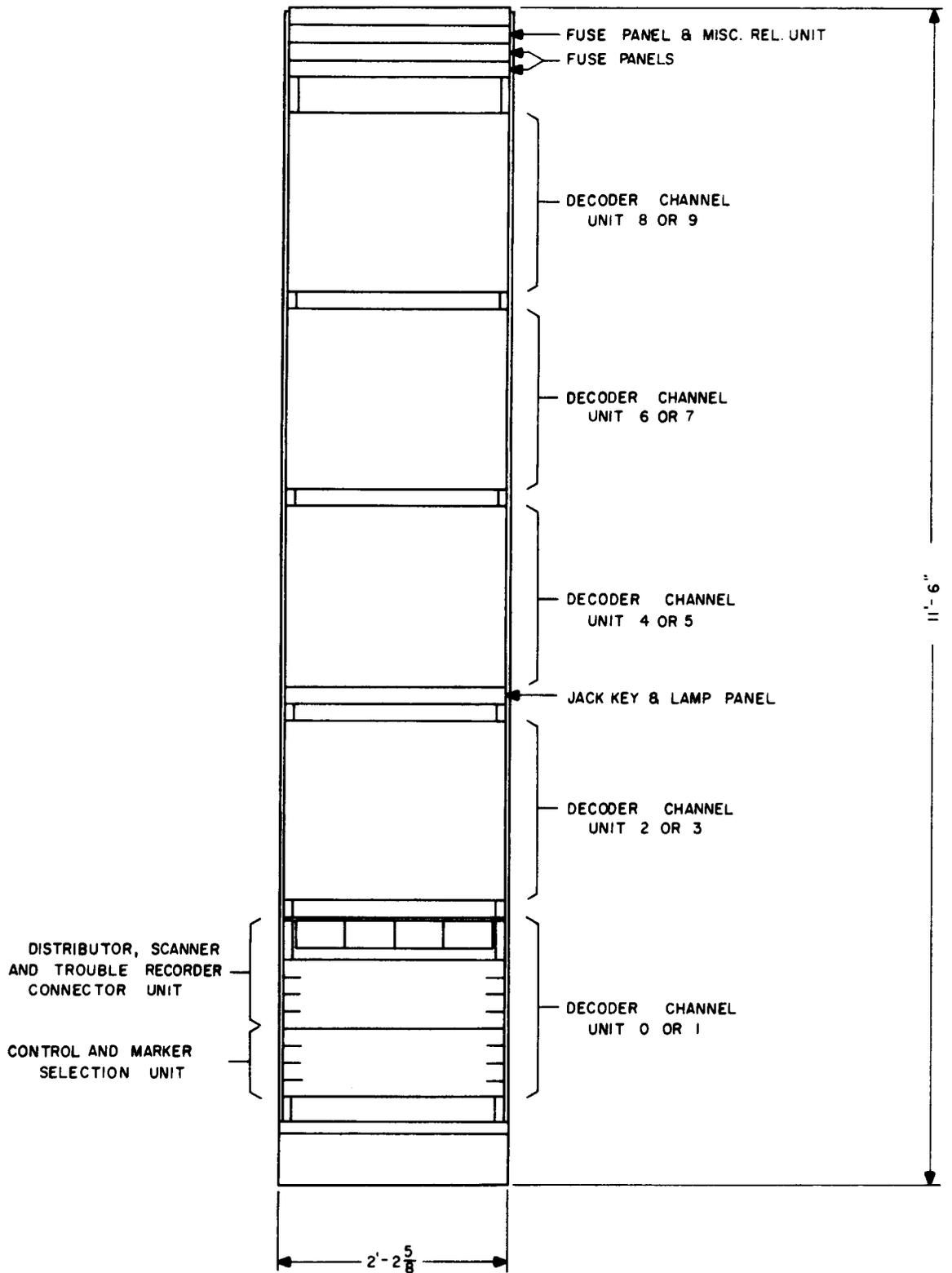


Fig. 31 - Decoder Channel Frame

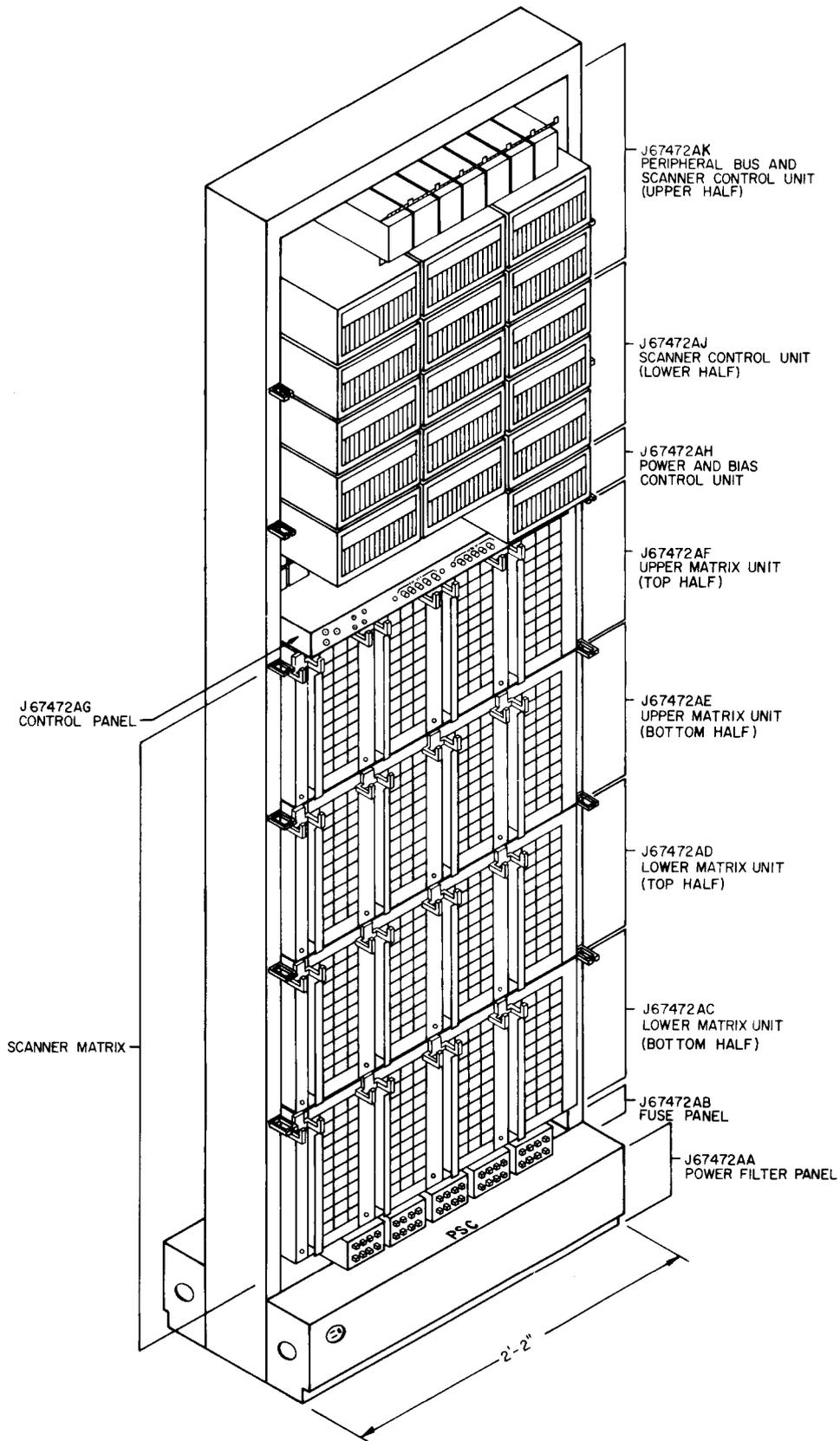


Fig. 32 – Peripheral Scanner Frame

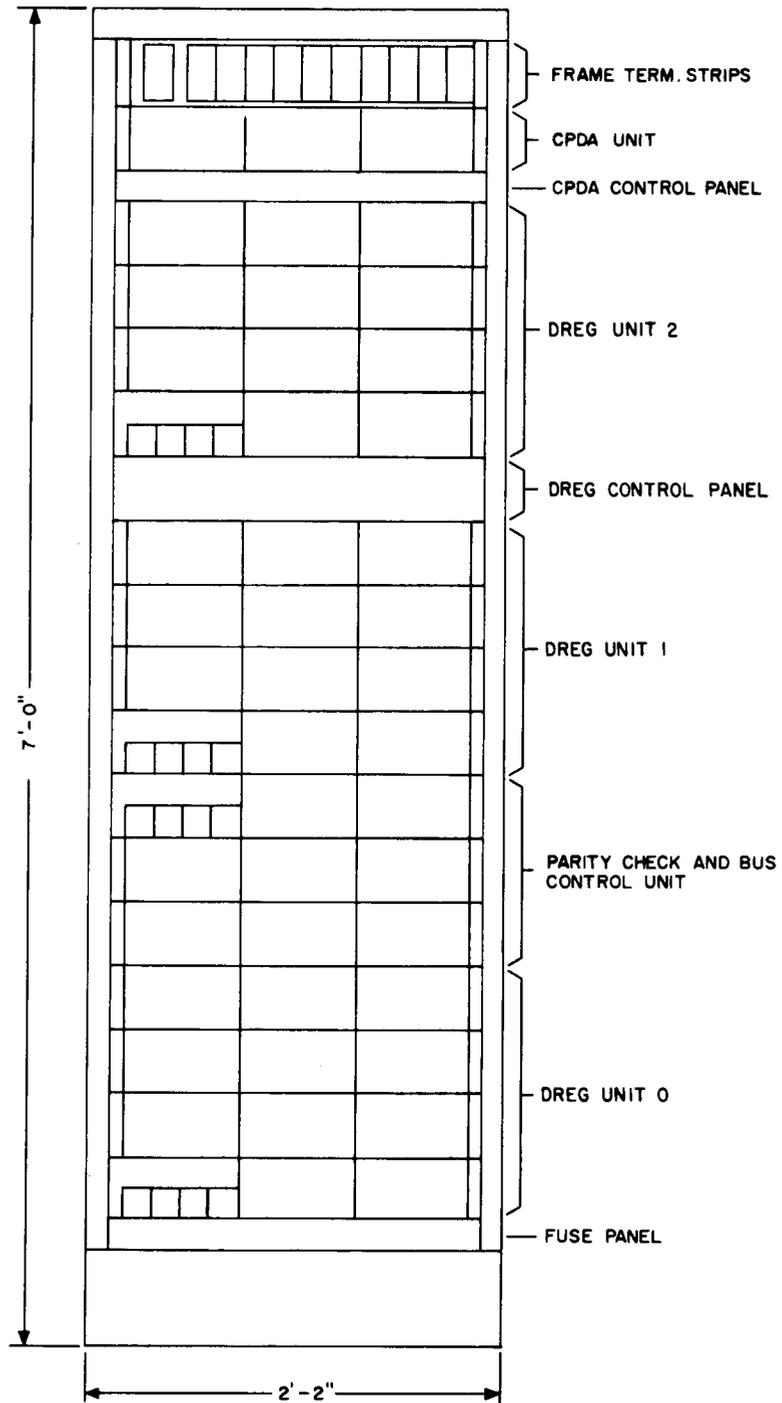


Fig. 33 – Distributor Register Frame

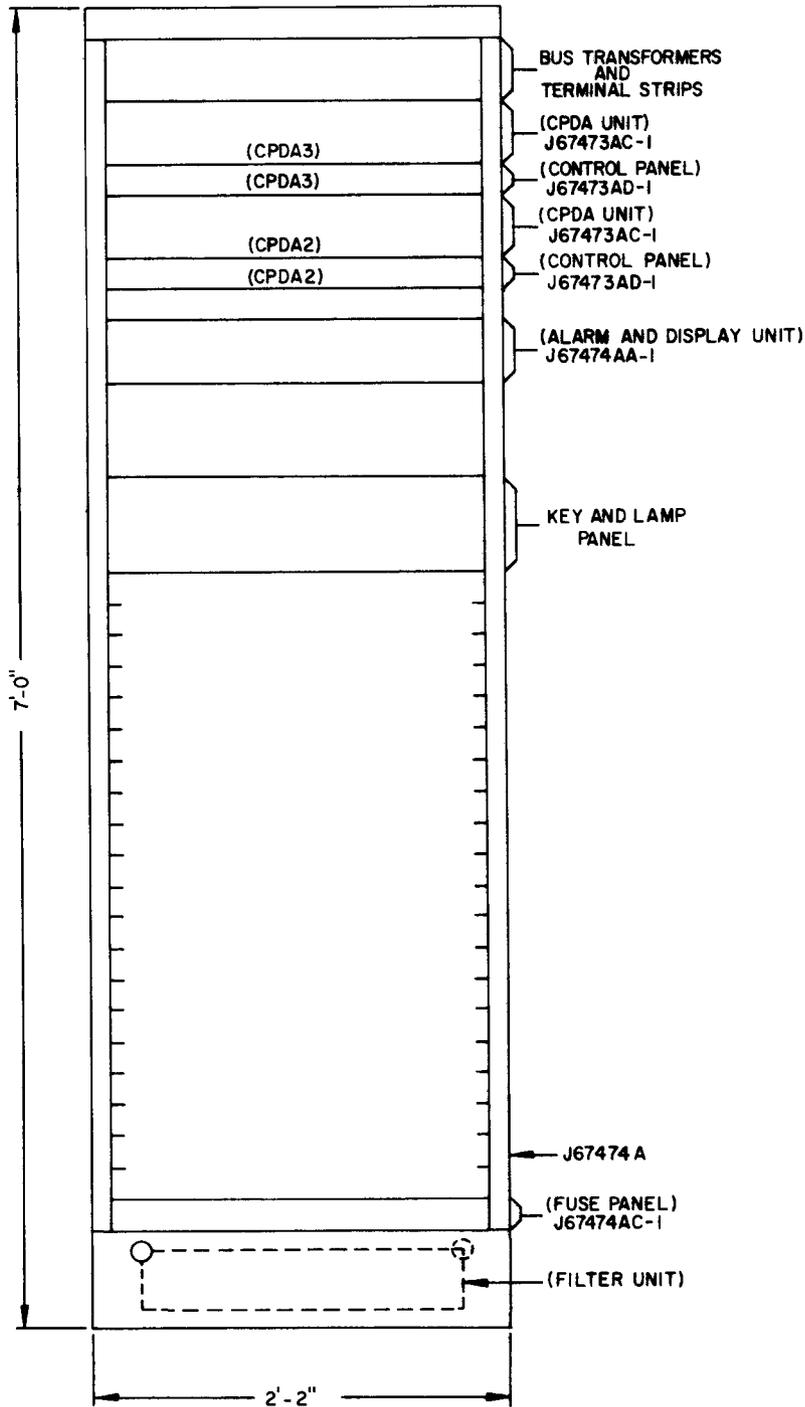


Fig. 34 - Alarm and Display Frame

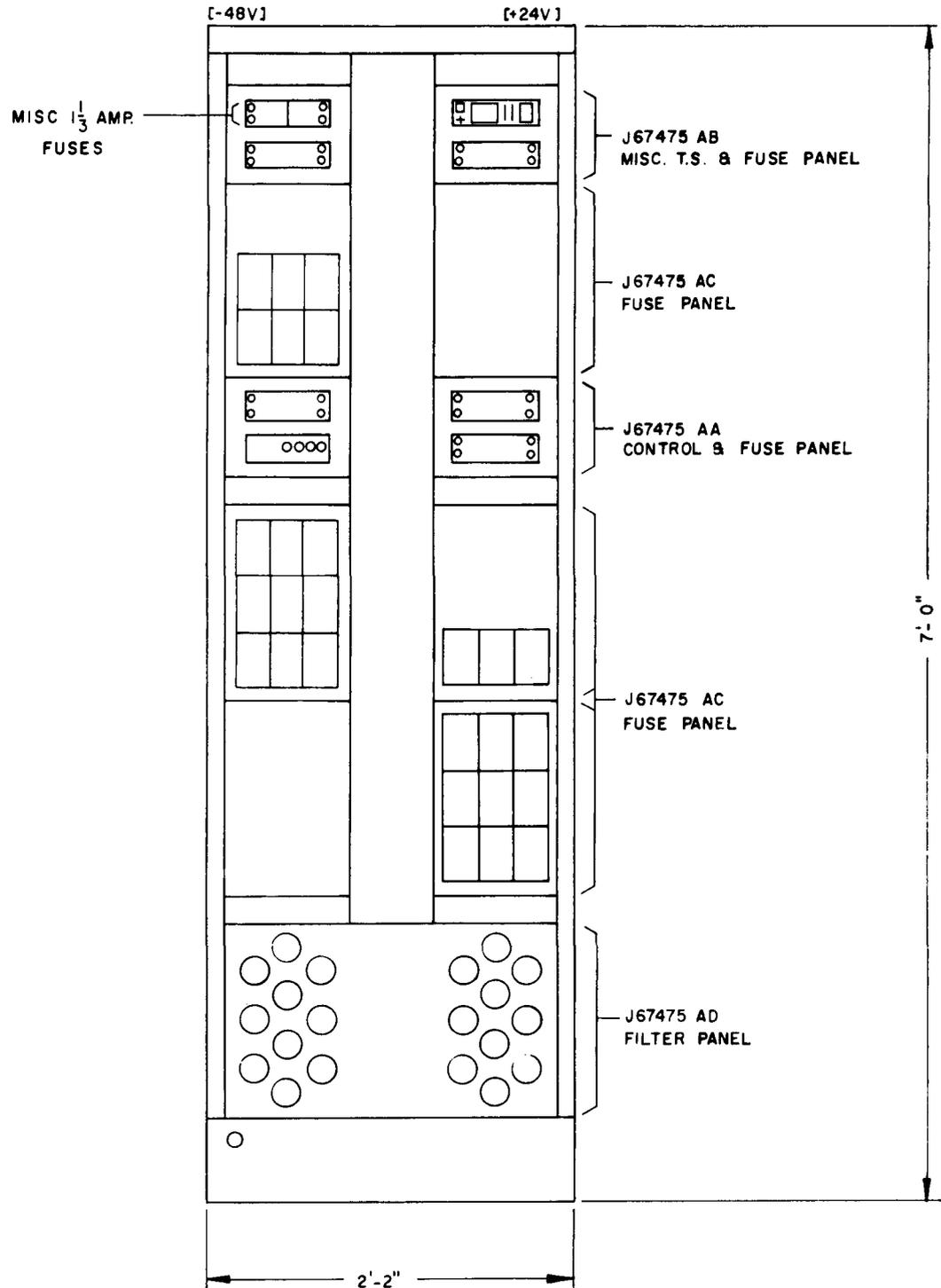


Fig. 35 - Power Distributing Frame

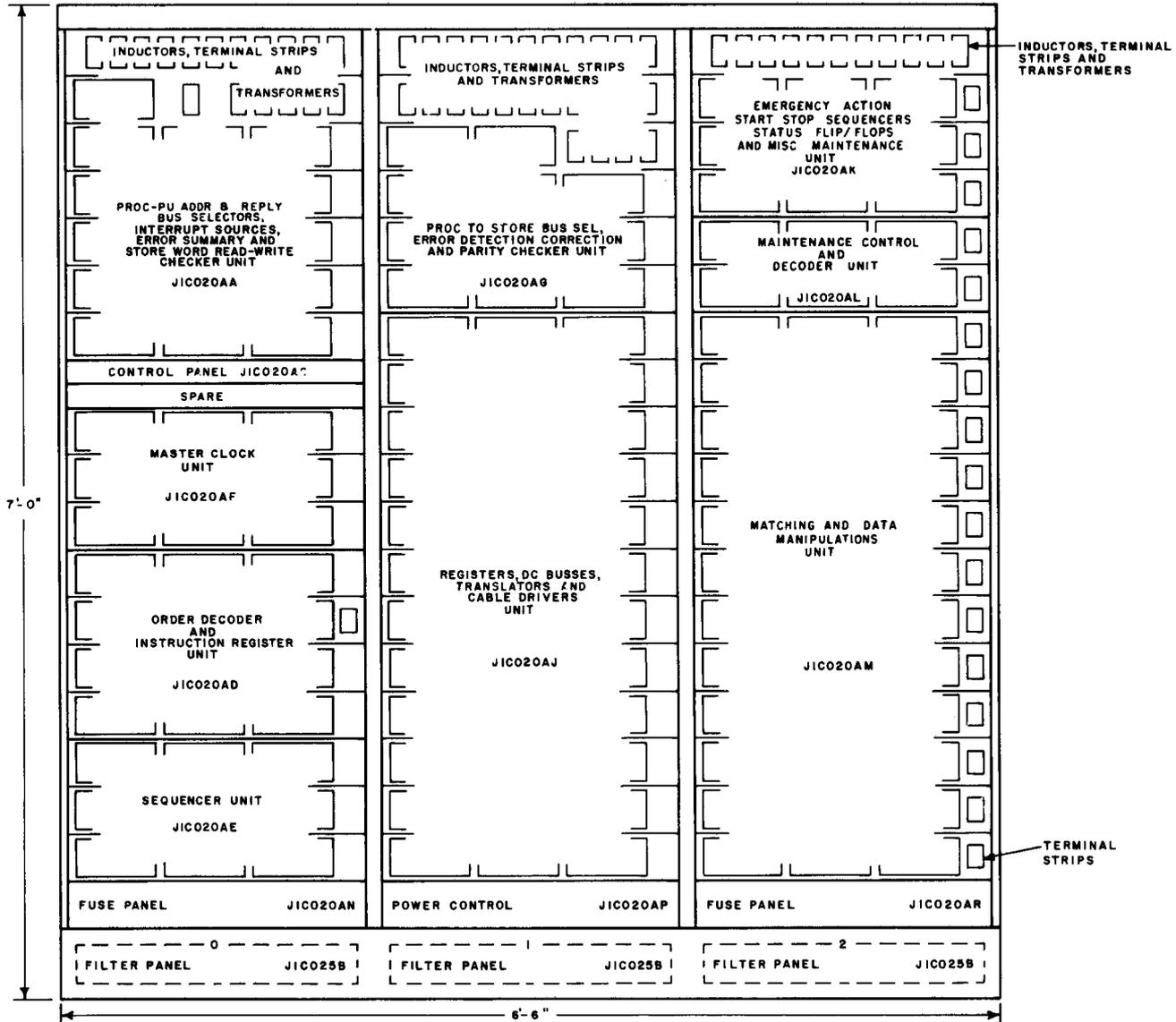


Fig. 36 - Processor Frame

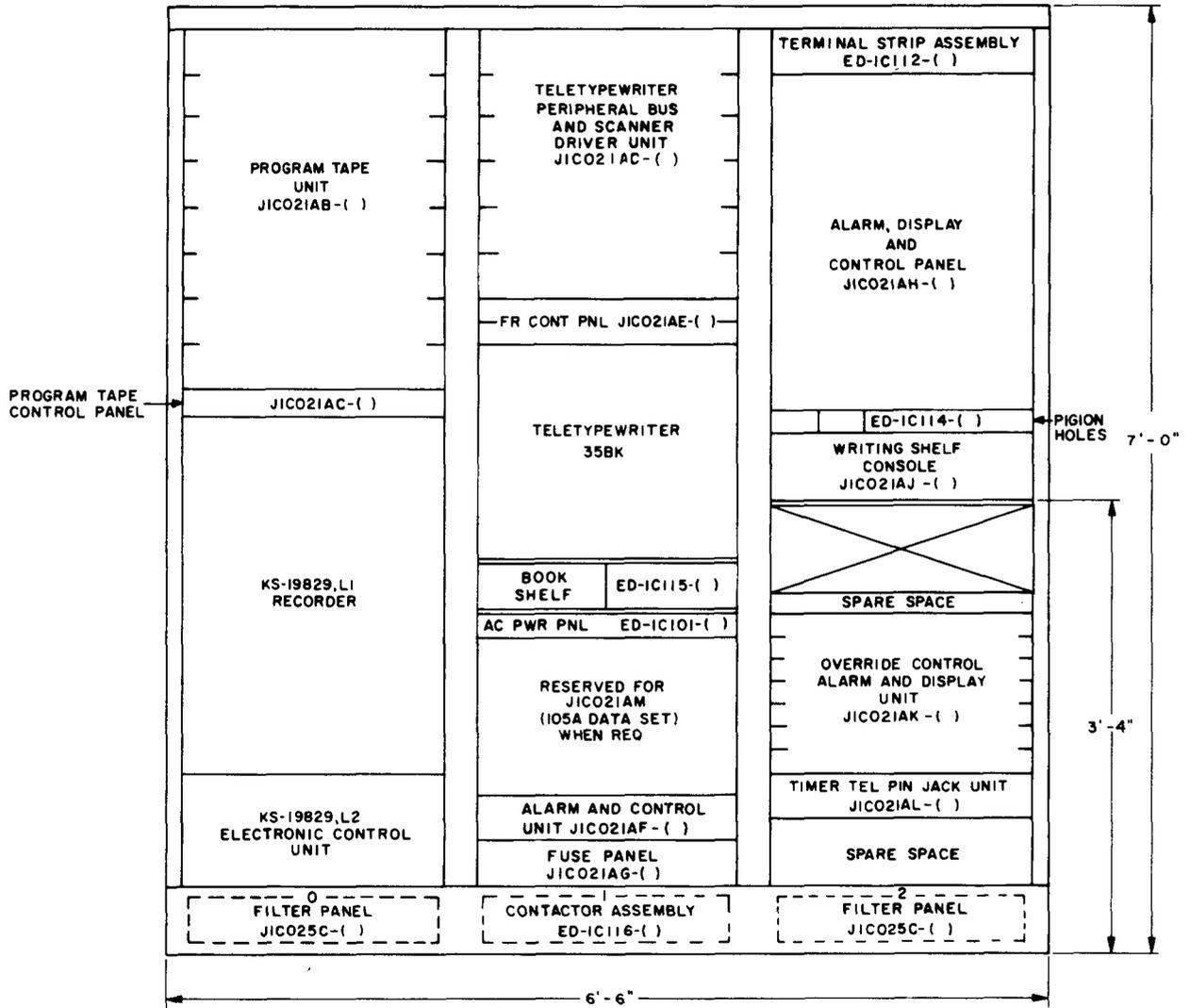


Fig. 37 – Control and Display Program Tape and Teletypewriter Frame

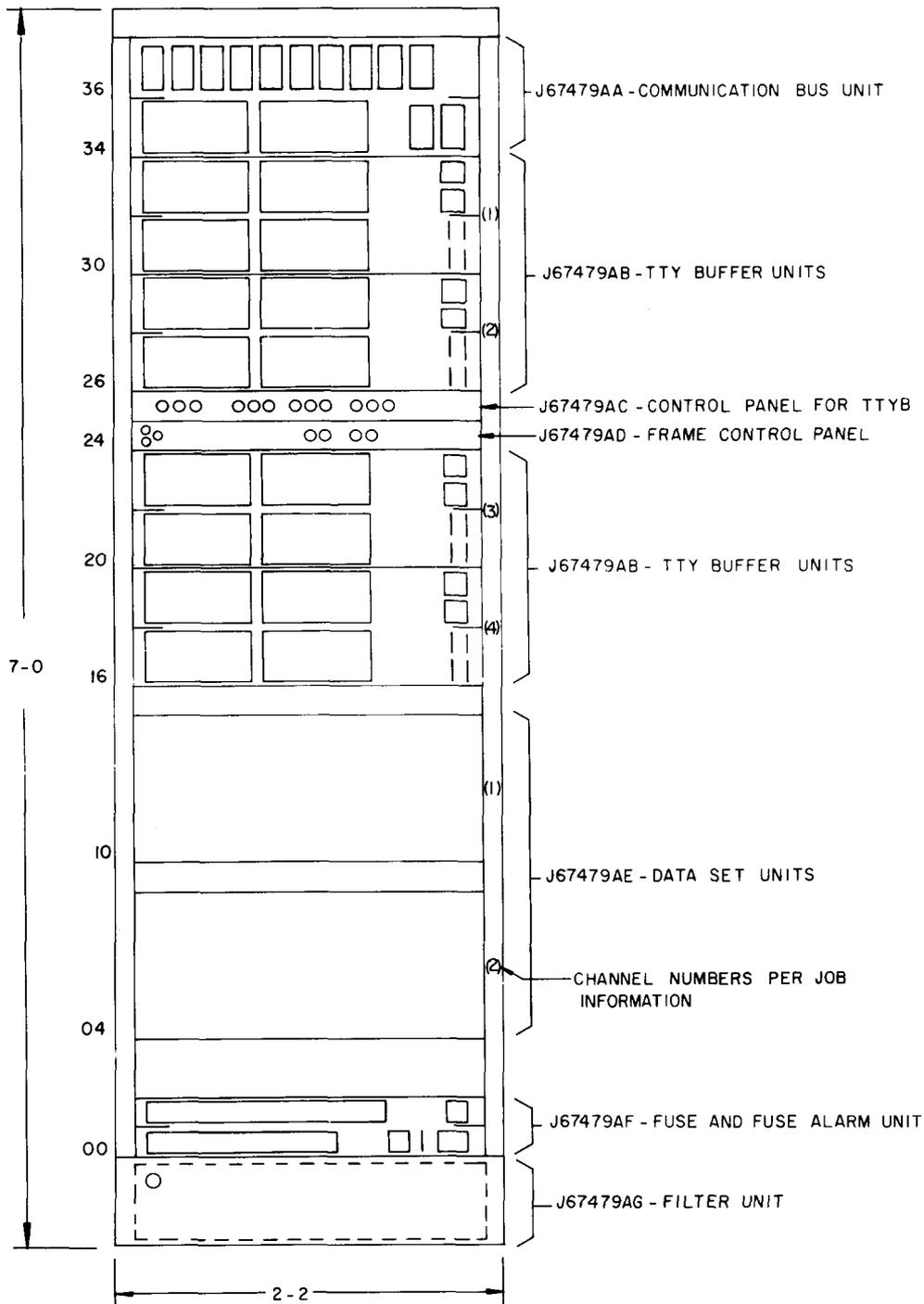


Fig. 38 - Teletypewriter Buffer Frame

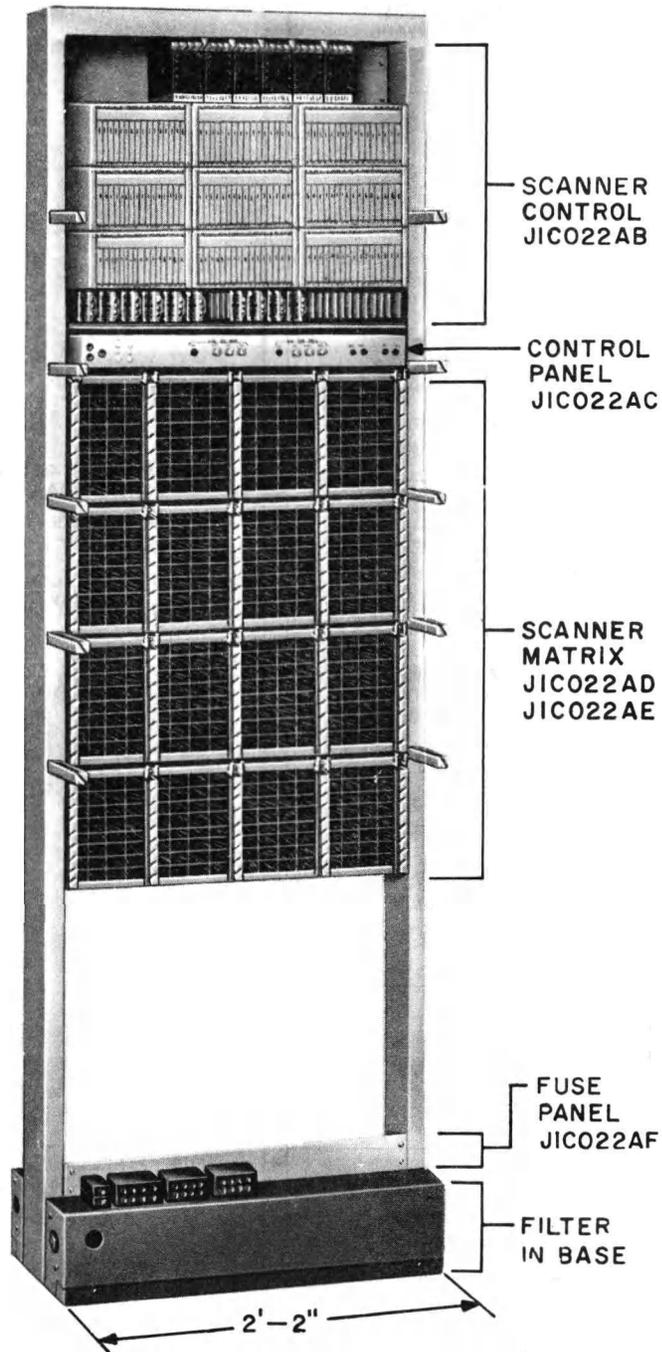


Fig. 39 - Master Scanner Frame

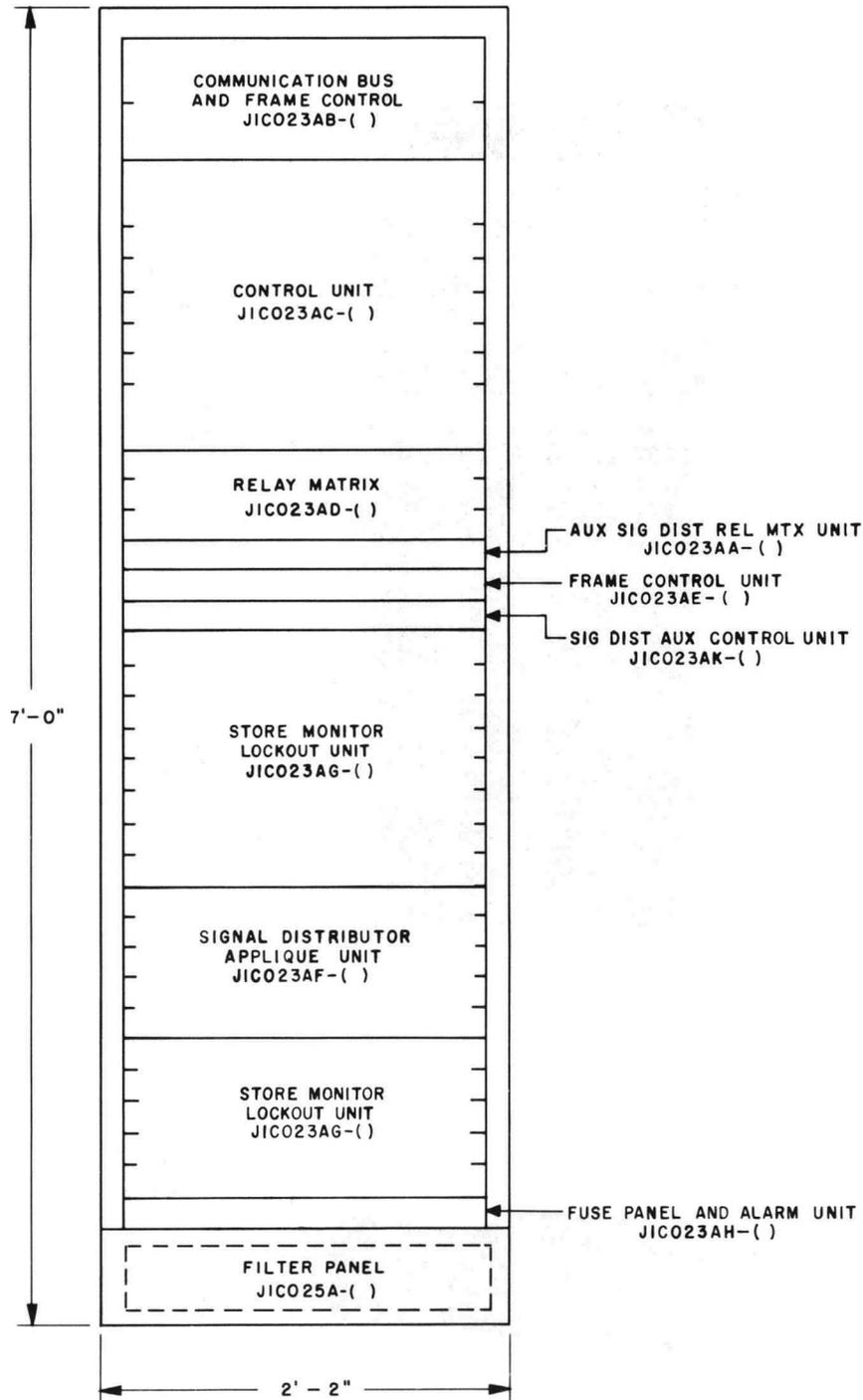


Fig. 40 - Signal Distributor Frame

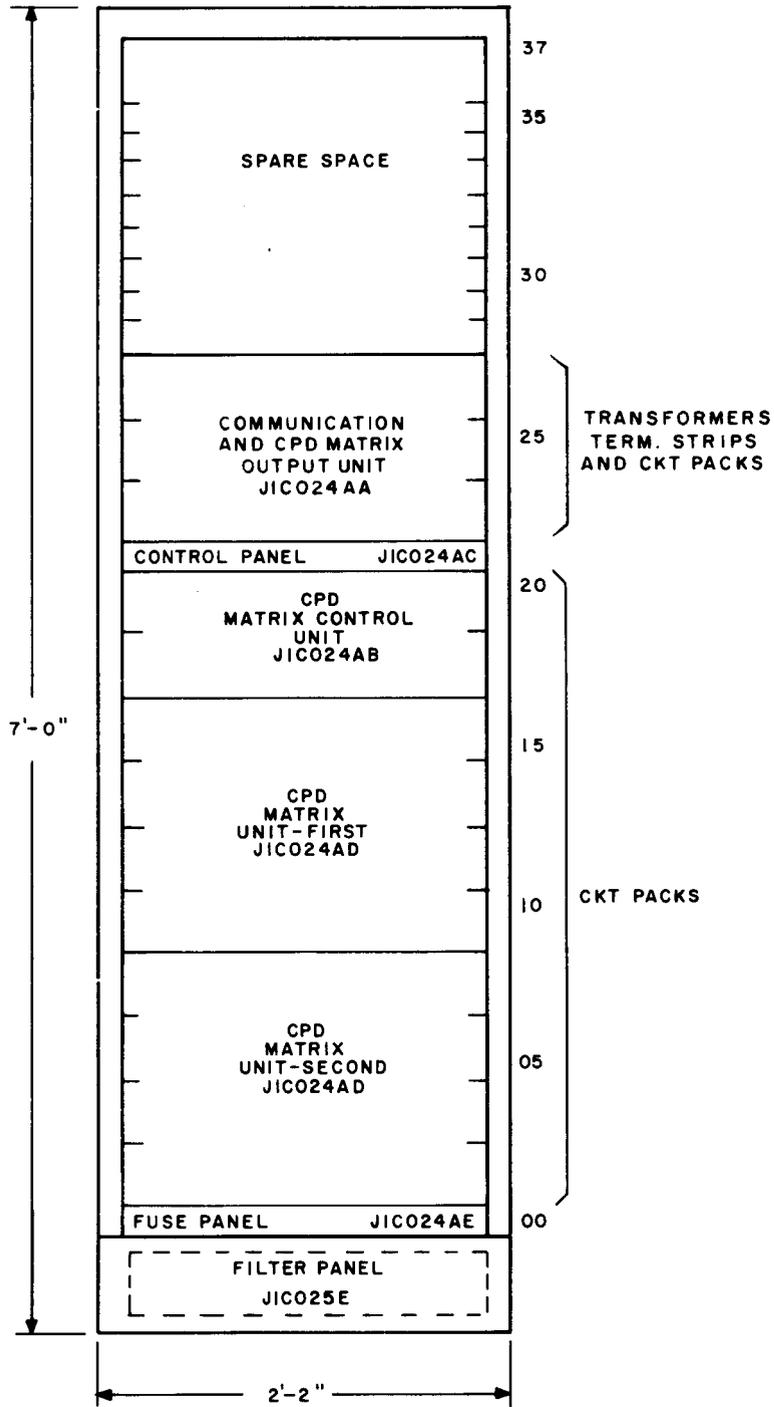


Fig. 41 - Central Pulse Distributor Frame

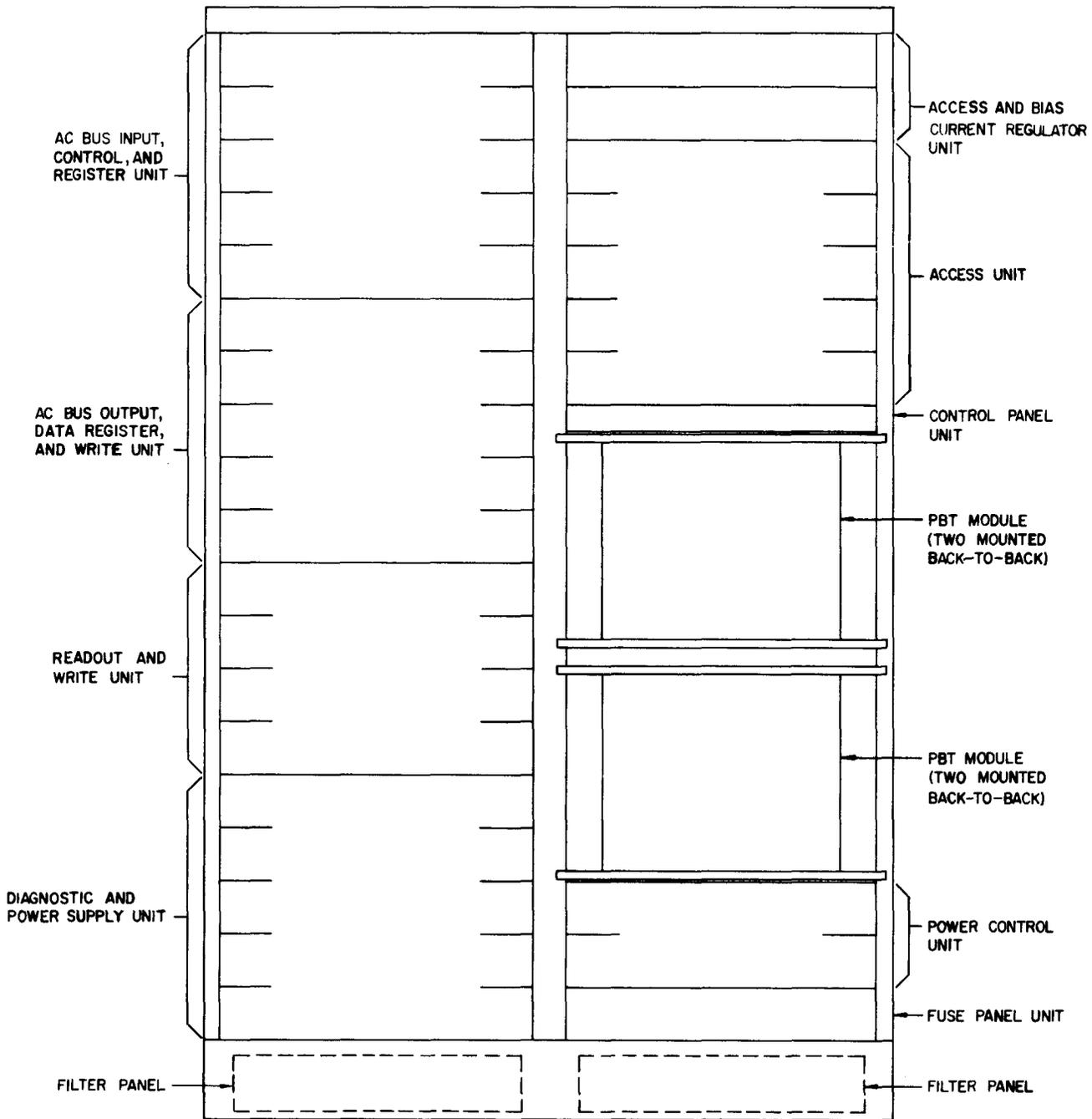


Fig. 42 - Store Frame

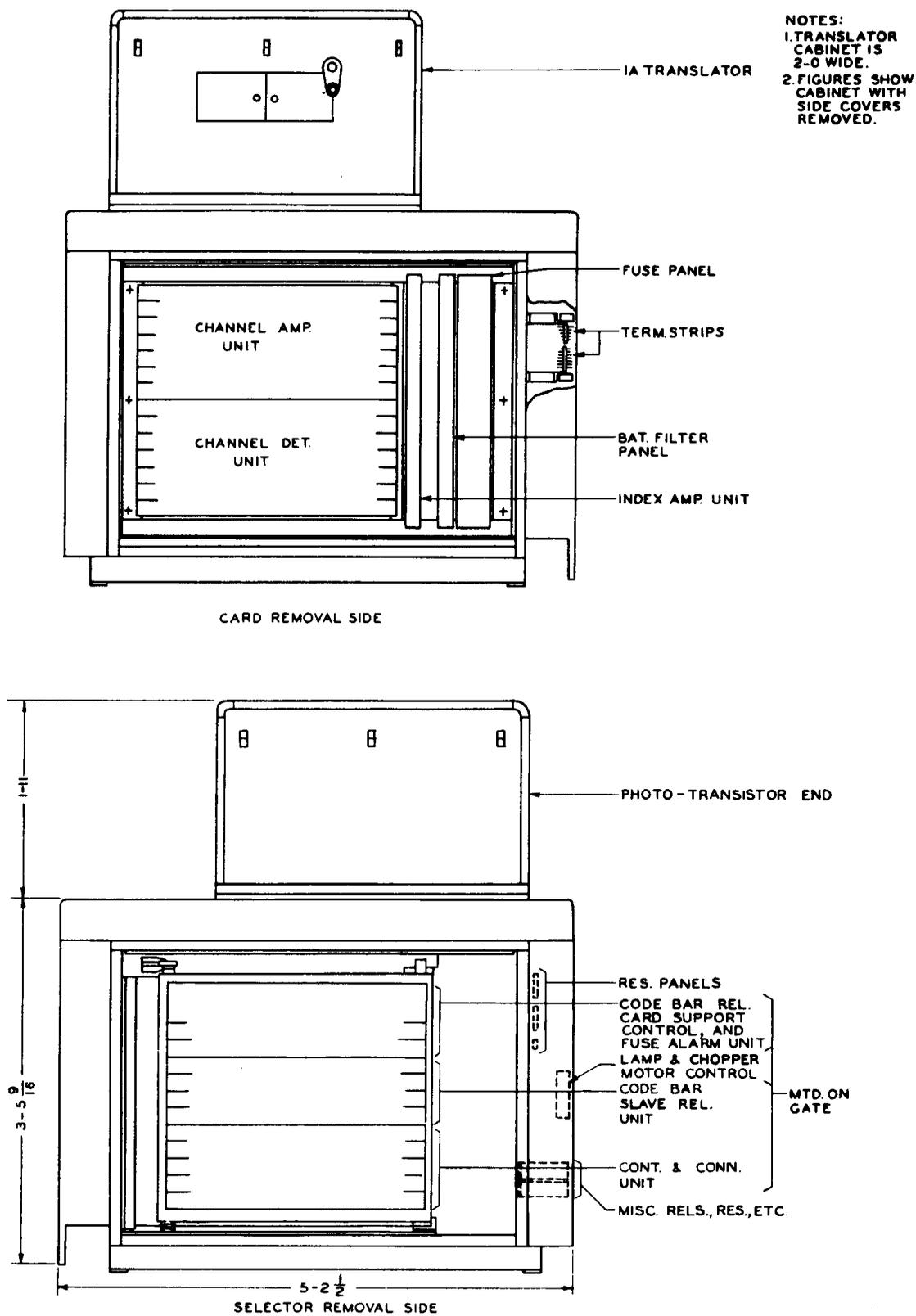


Fig. 43 - Card Translator Cabinet

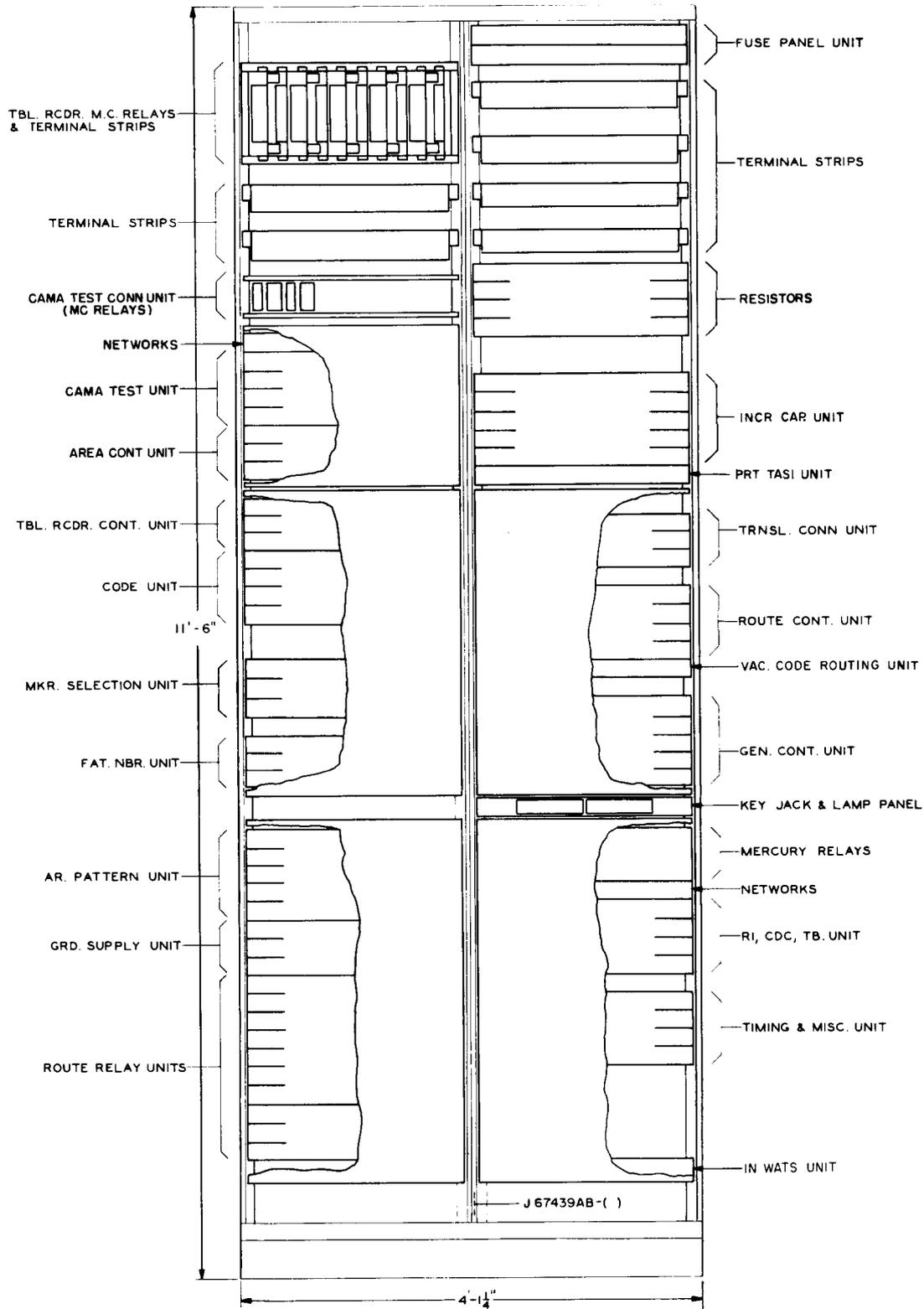


Fig. 44 - Decoder Frame

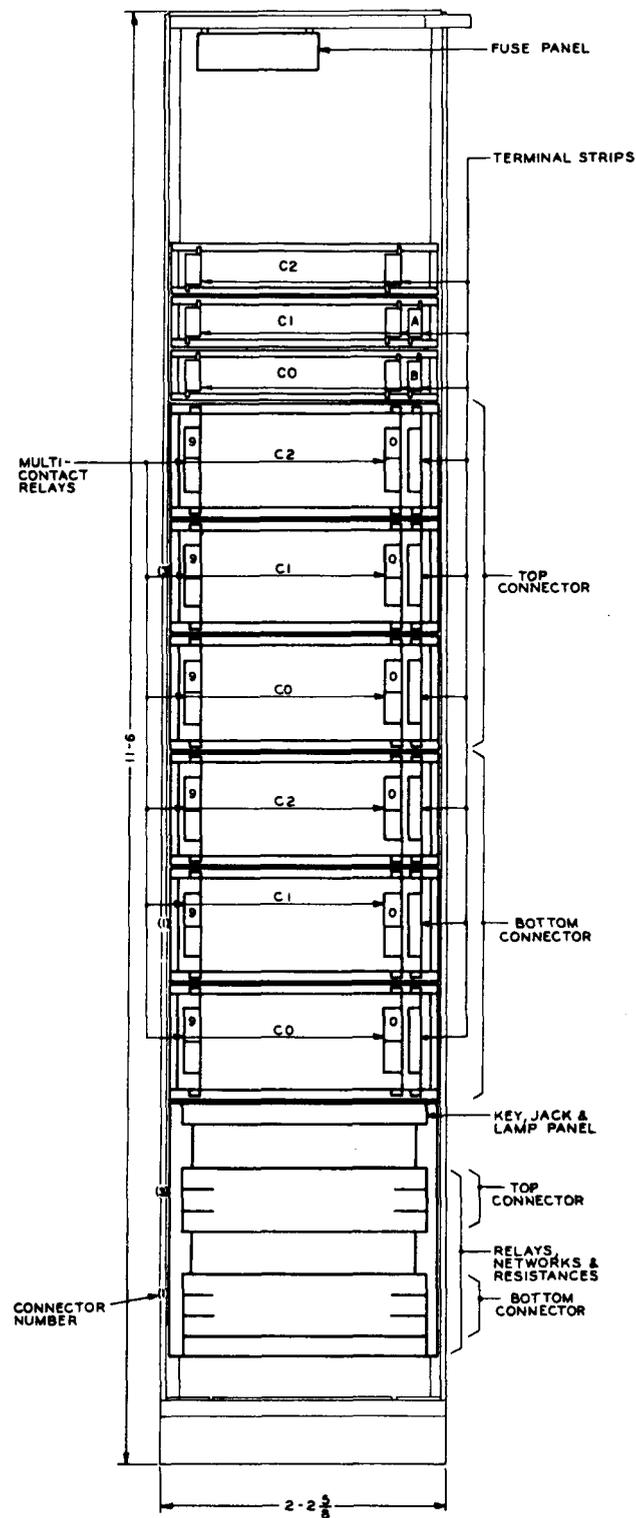


Fig. 45 – Foreign Translator Connector Frame or Supplementary Foreign Translator Connector Frame

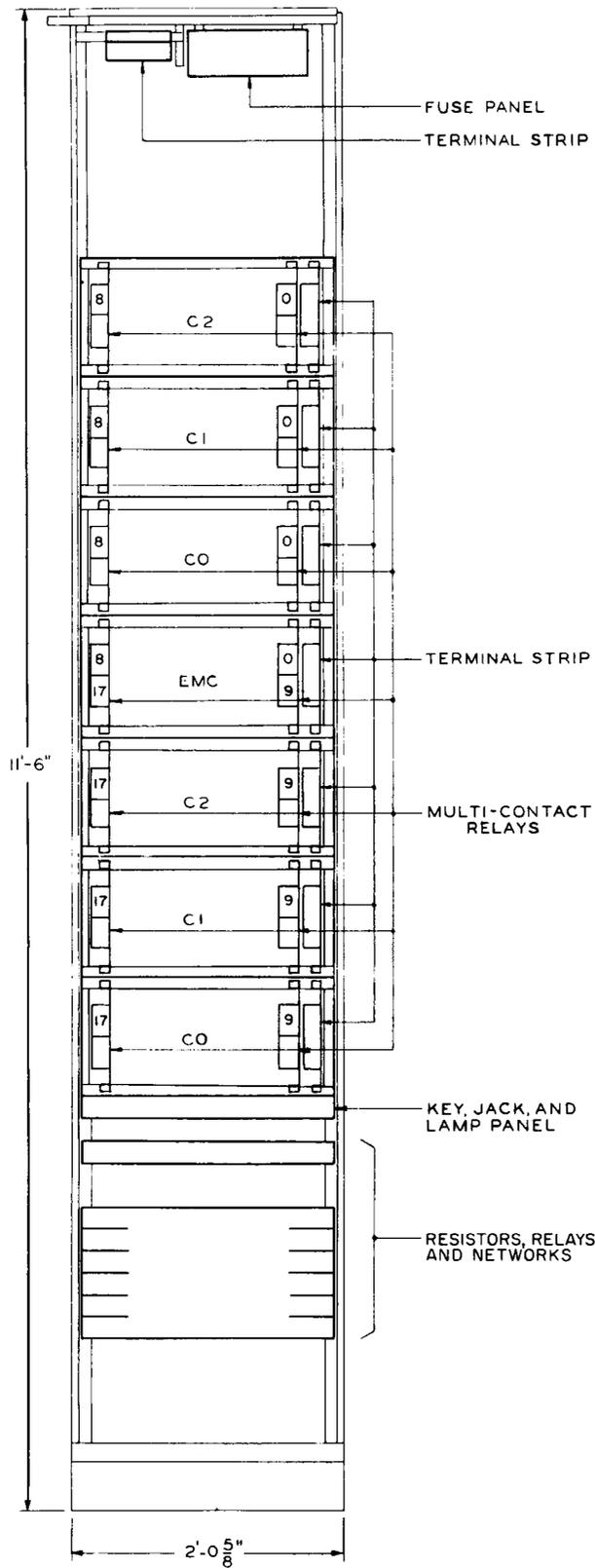


Fig. 46 - Emergency Translator Connector Frame for 18-decoder Capacity

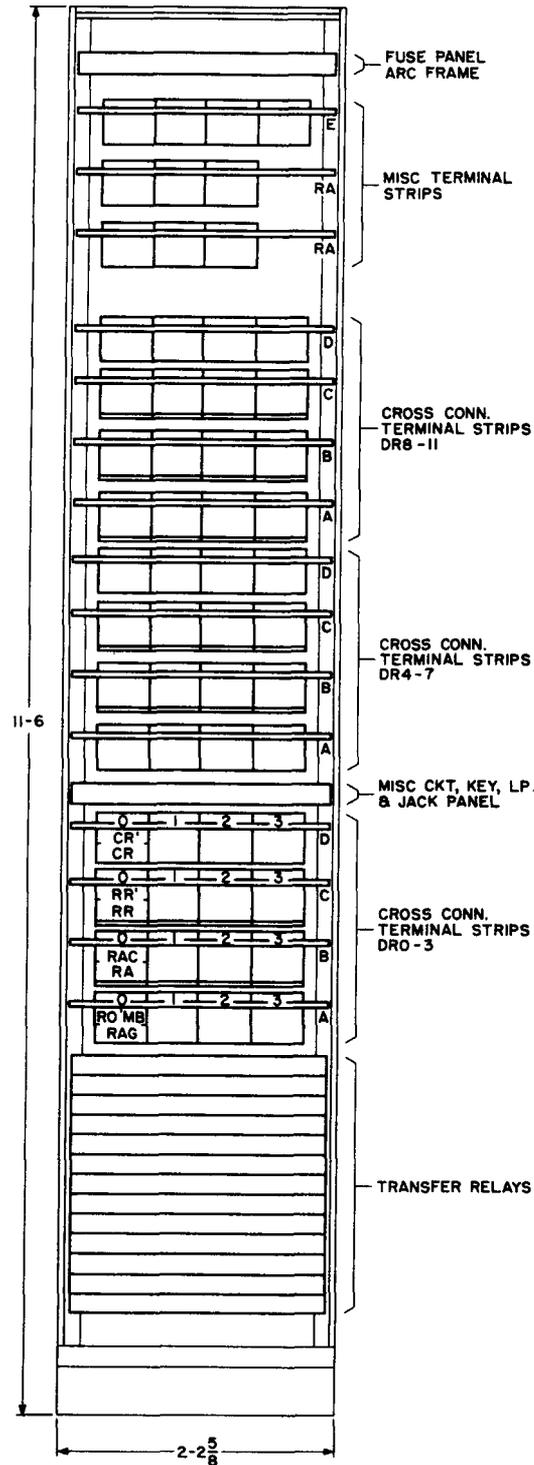


Fig. 47 – Alternate Route Traffic Control Frame or Supplementary Alternate Route Traffic Control Frame

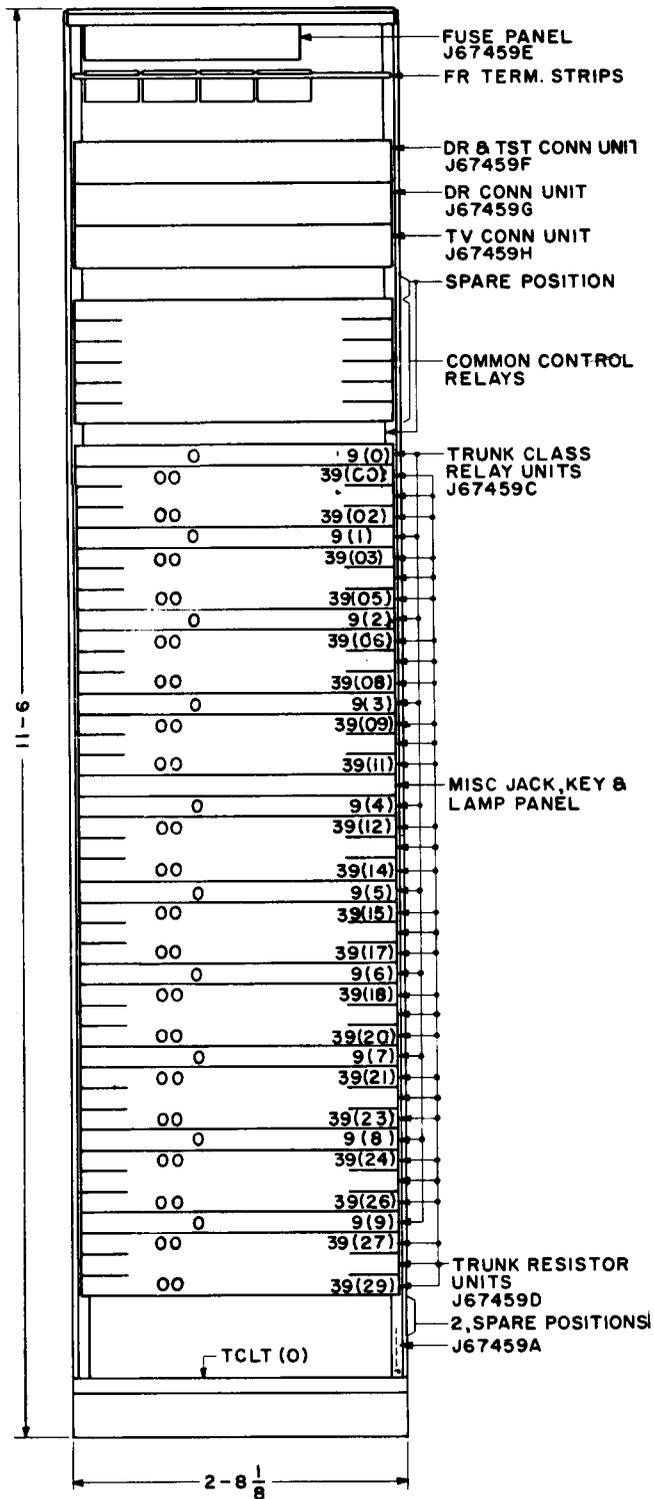


Fig. 48 - Trunk Class Translator Frame

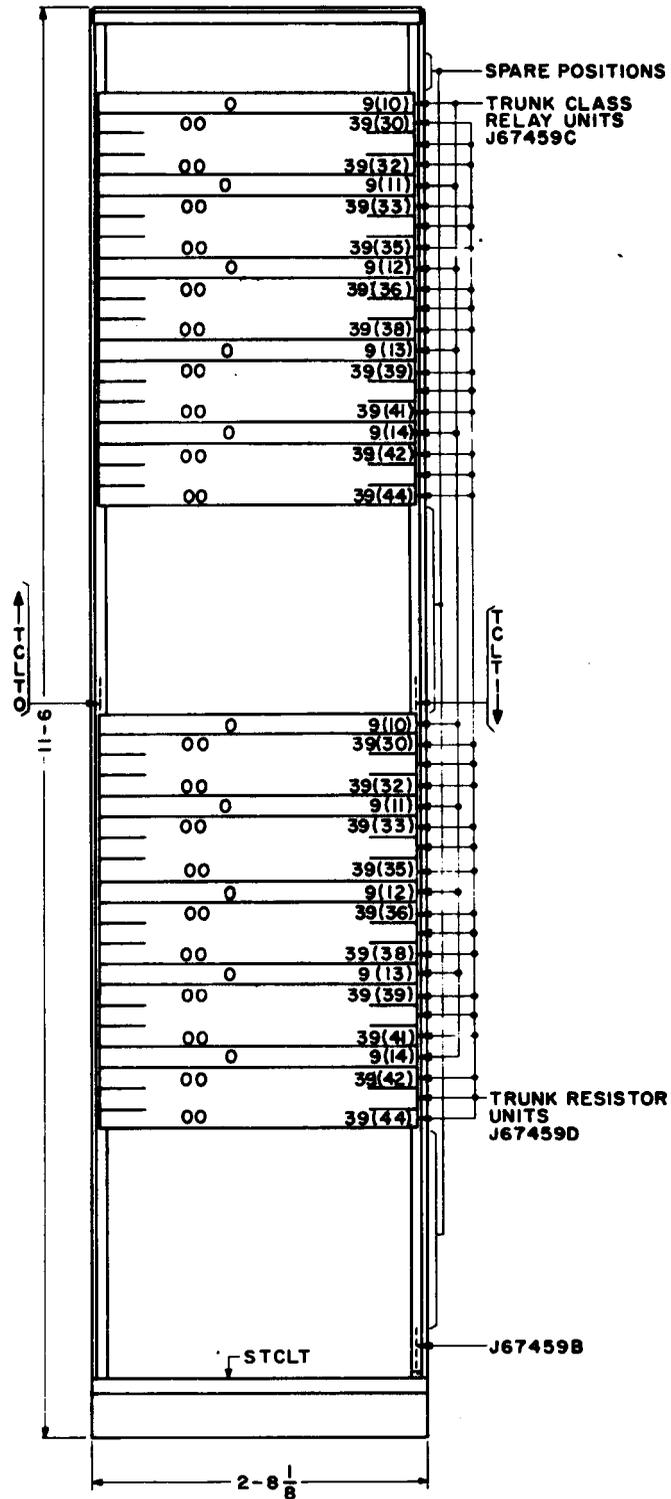


Fig. 49 – Supplementary Trunk Class Translator Frame

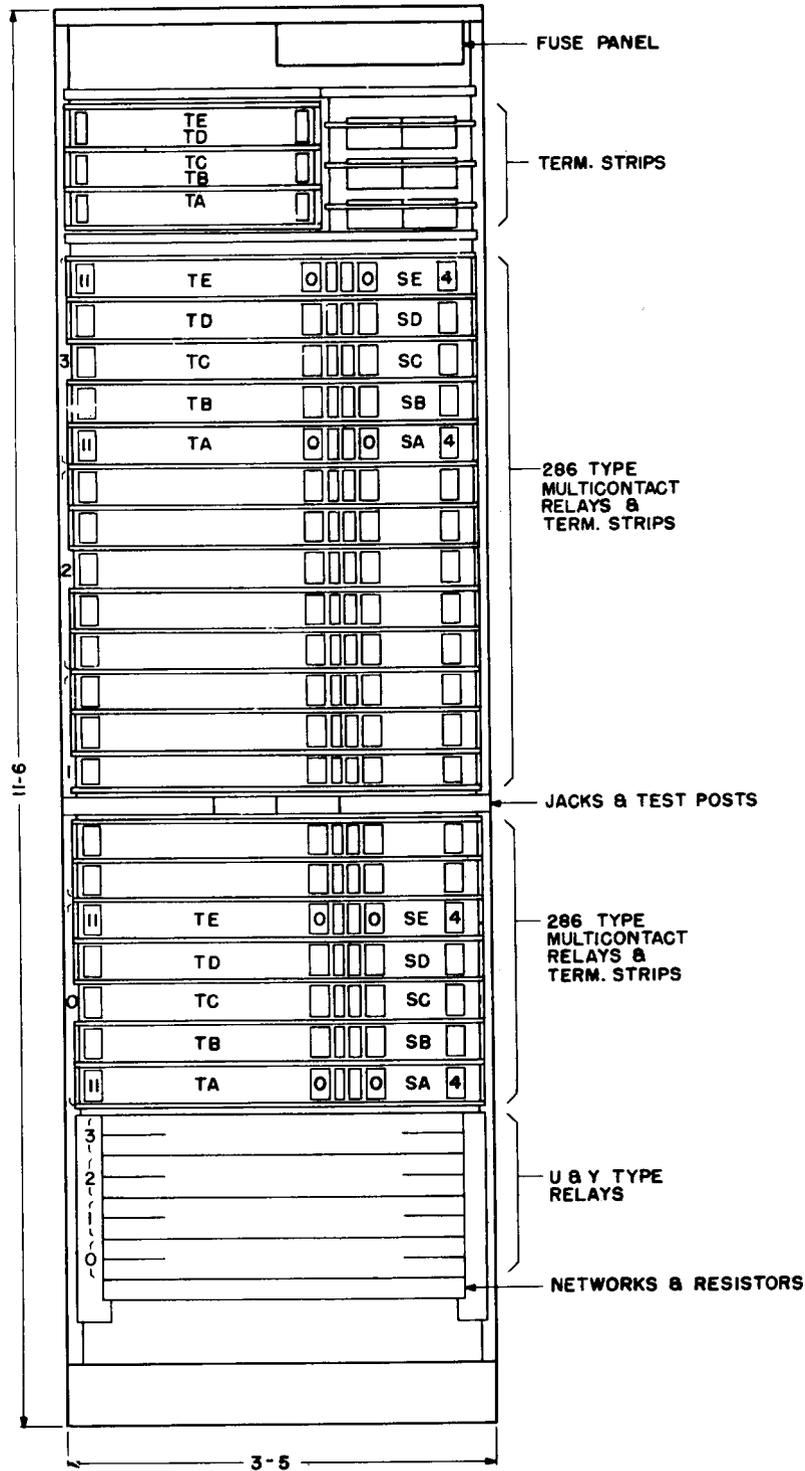


Fig. 50 - Transverter Connector Frame

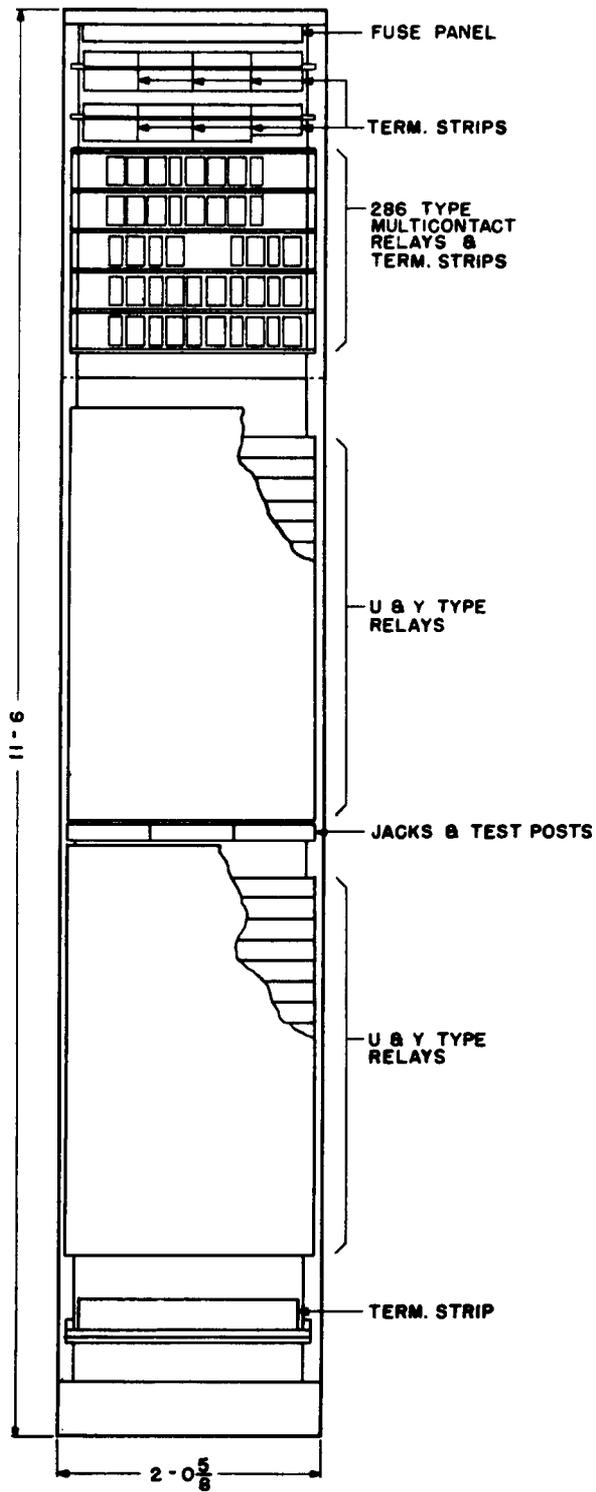


Fig. 51 - Transverter Frame

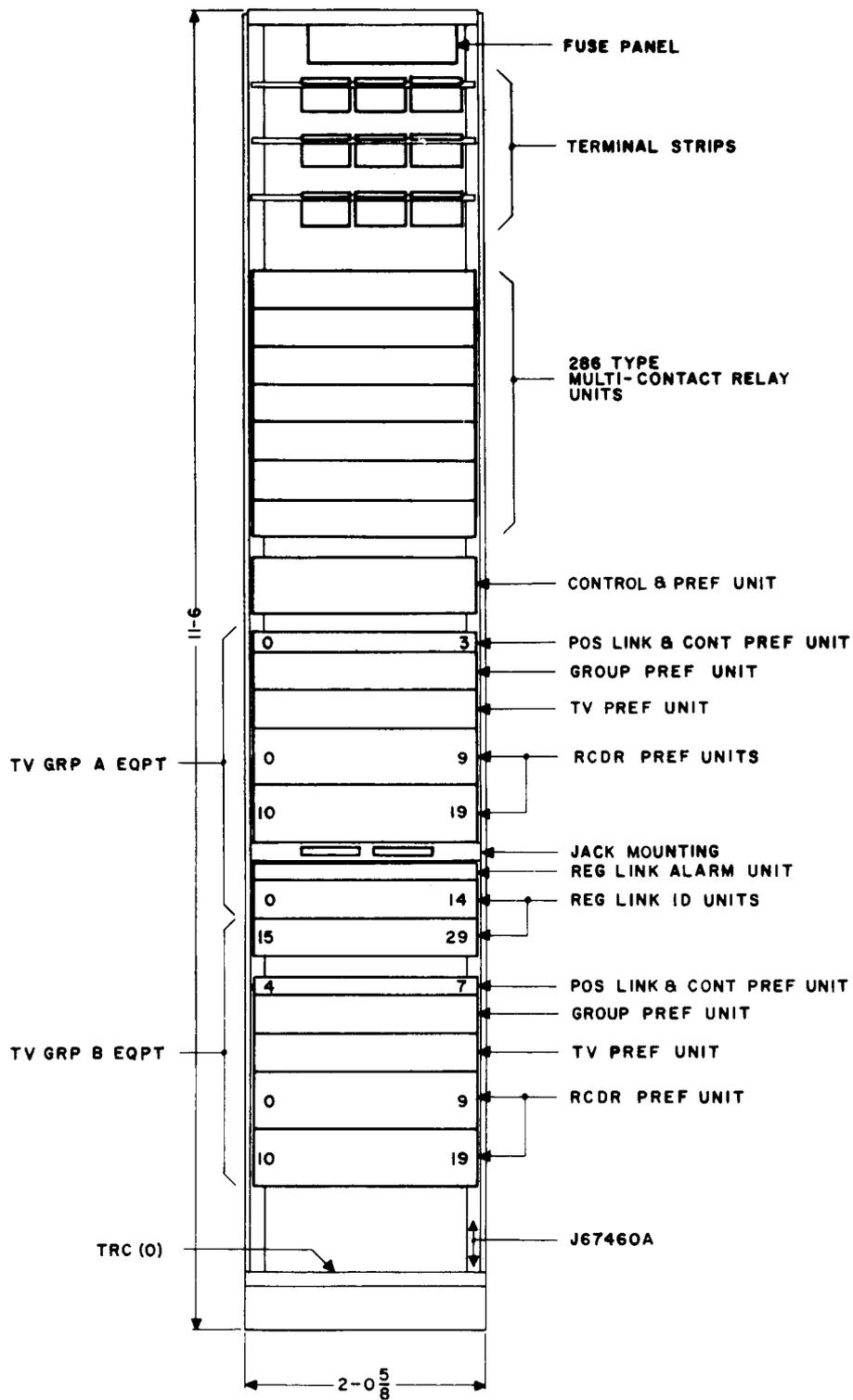


Fig. 52 - Trouble Recorder Connector Frame

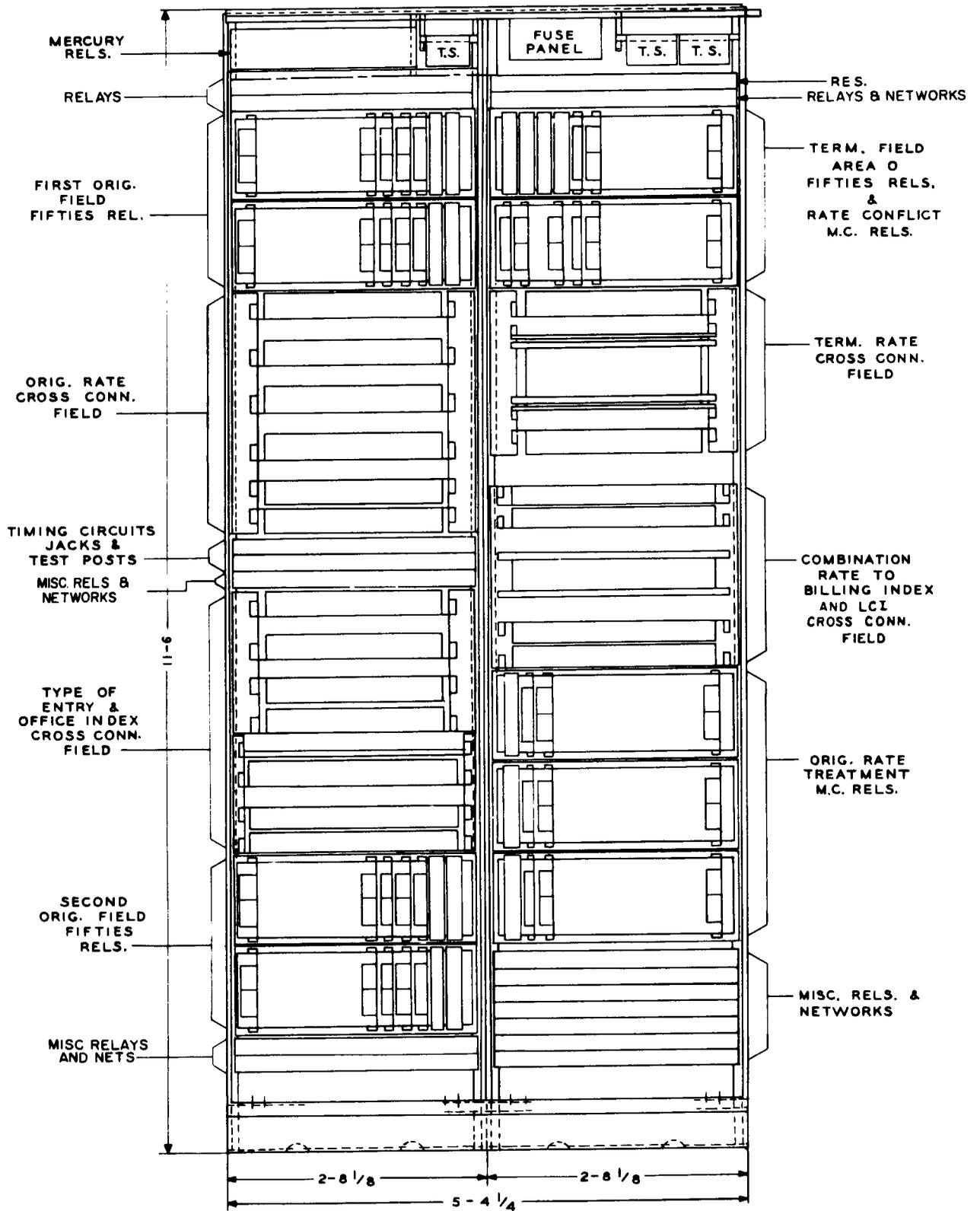


Fig. 53 - Billing Indexer Originating Frame

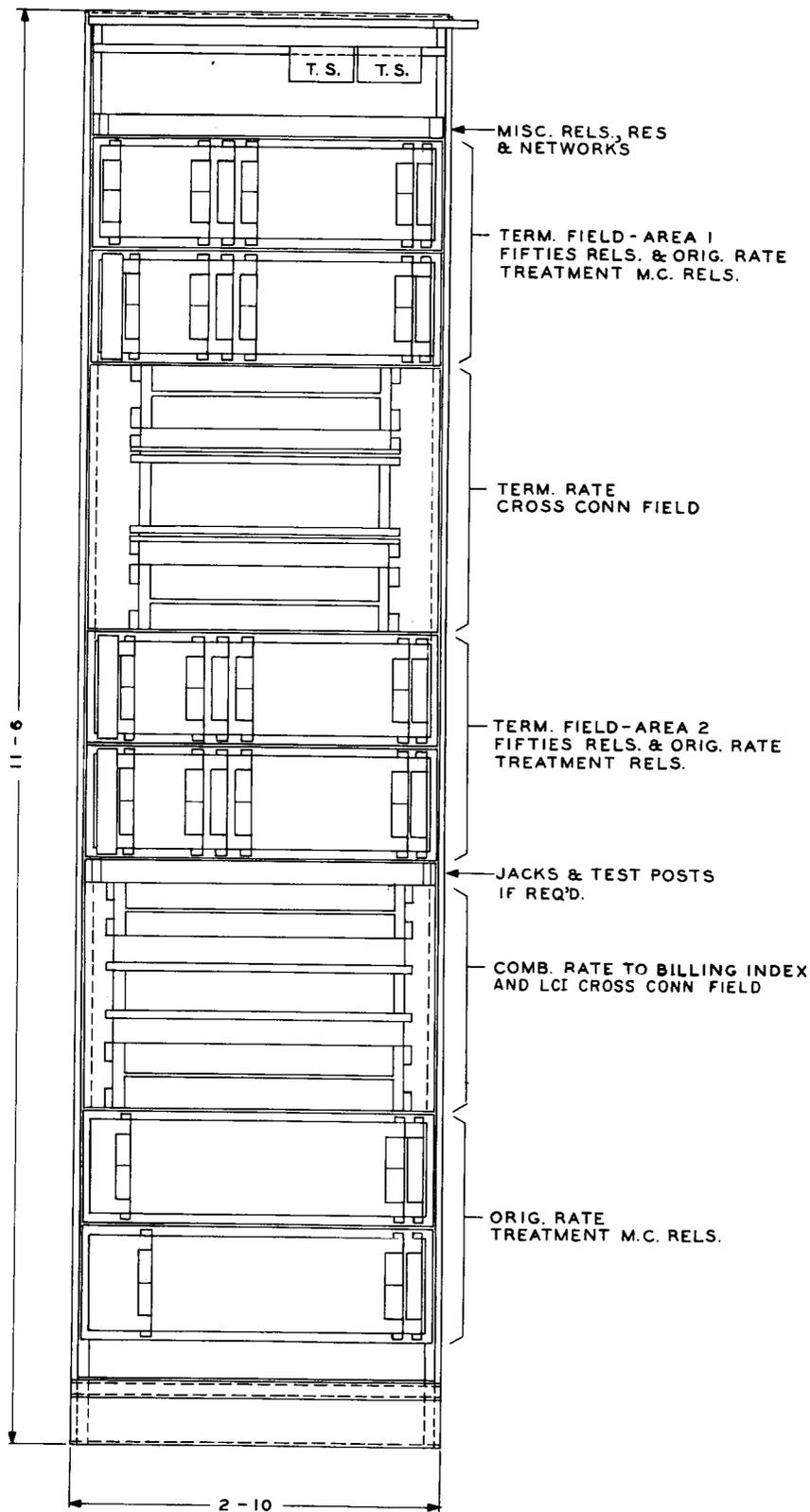


Fig. 54 - Supplementary Billing Indexer Frame

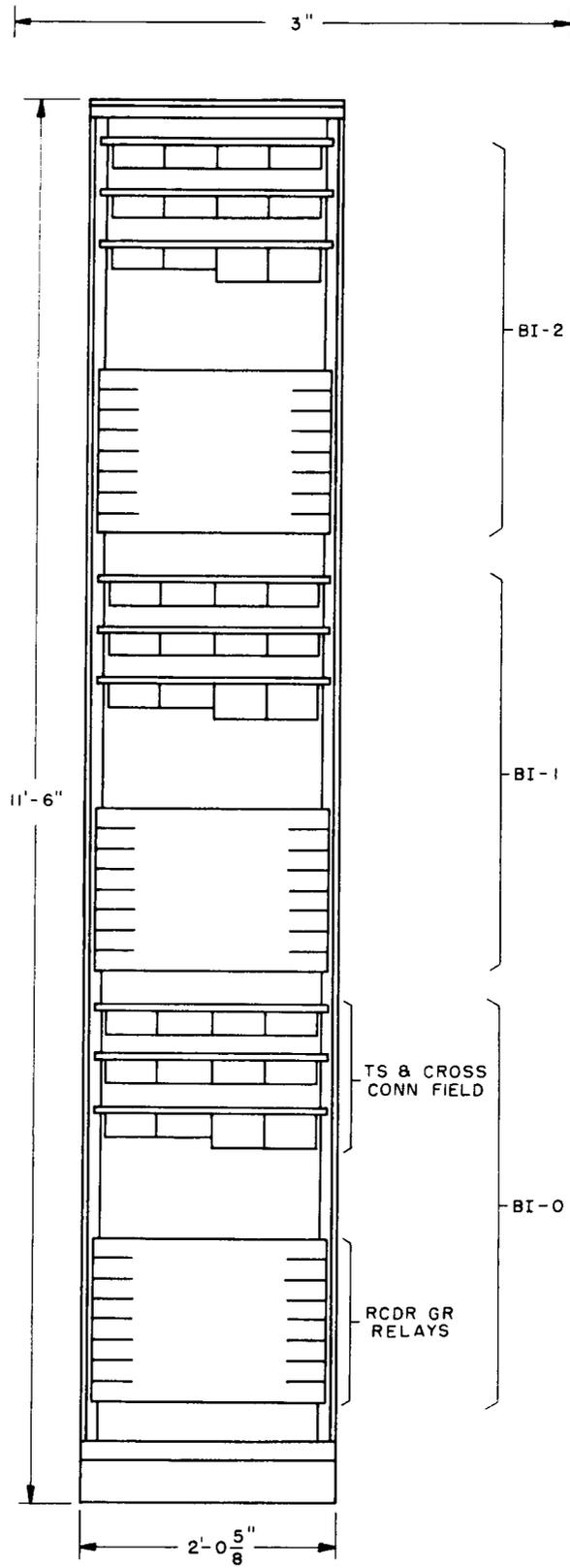


Fig. 55 – Auxiliary Billing Indexer Frame

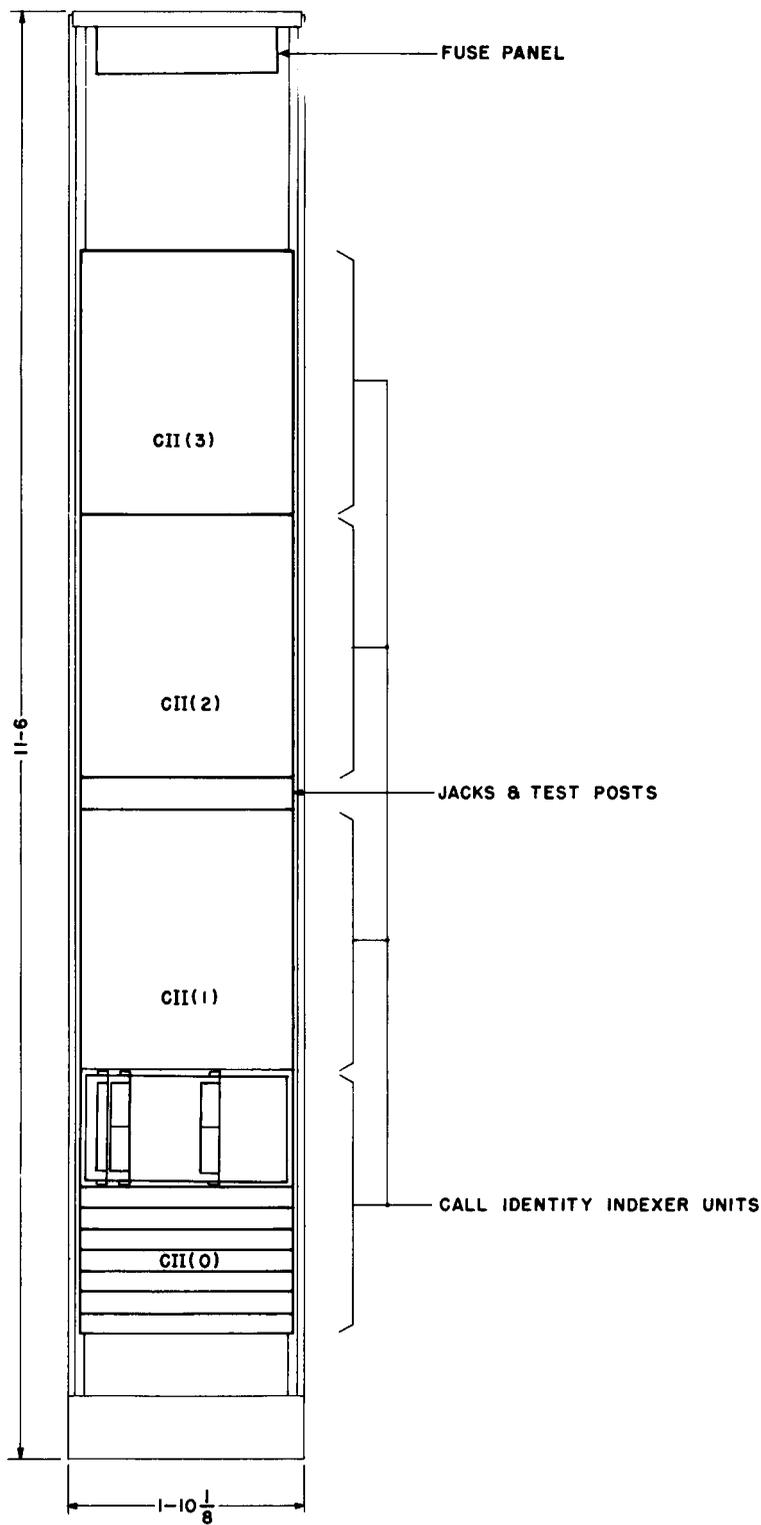


Fig. 56 - Call Identity Indexer Frame

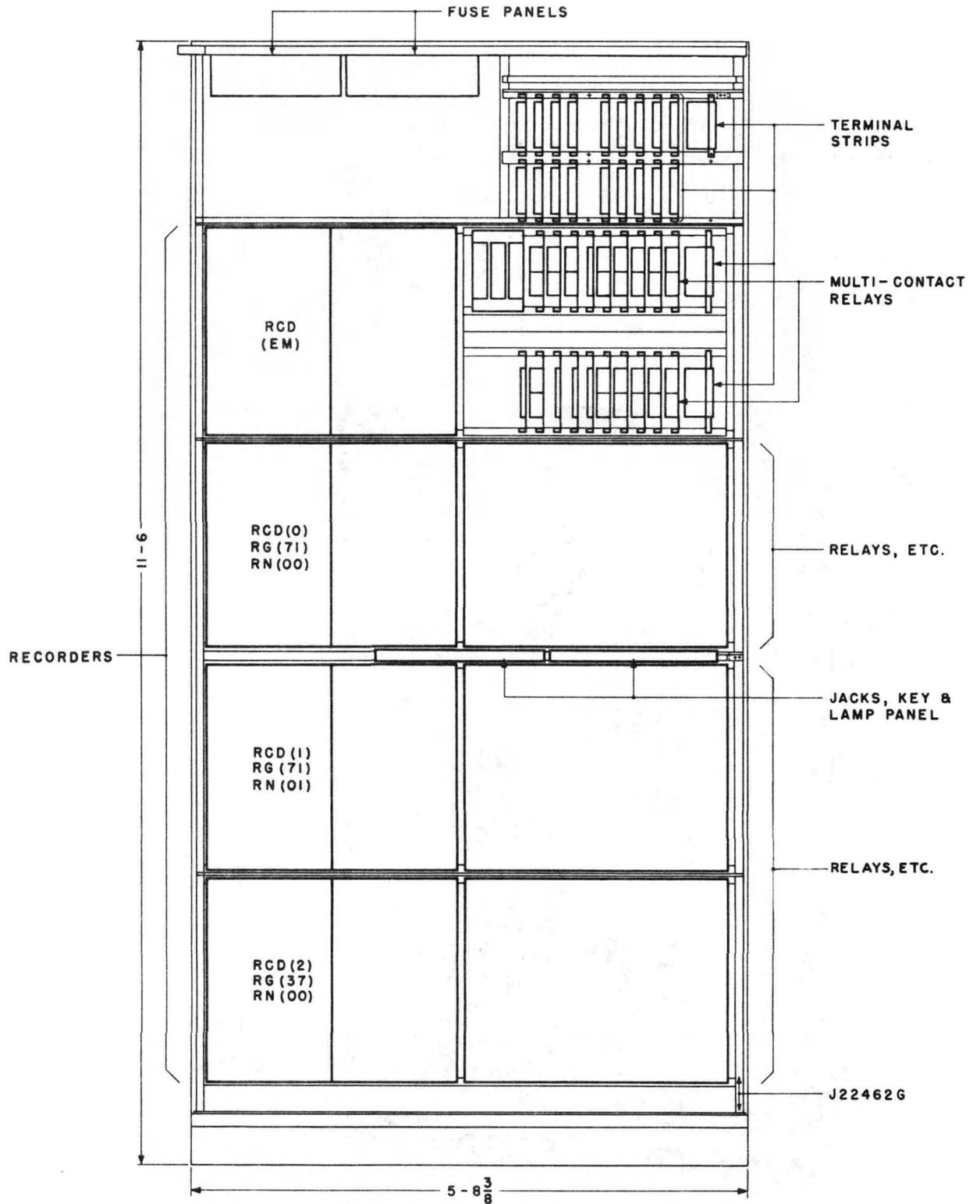


Fig. 57 - Recorder Frame

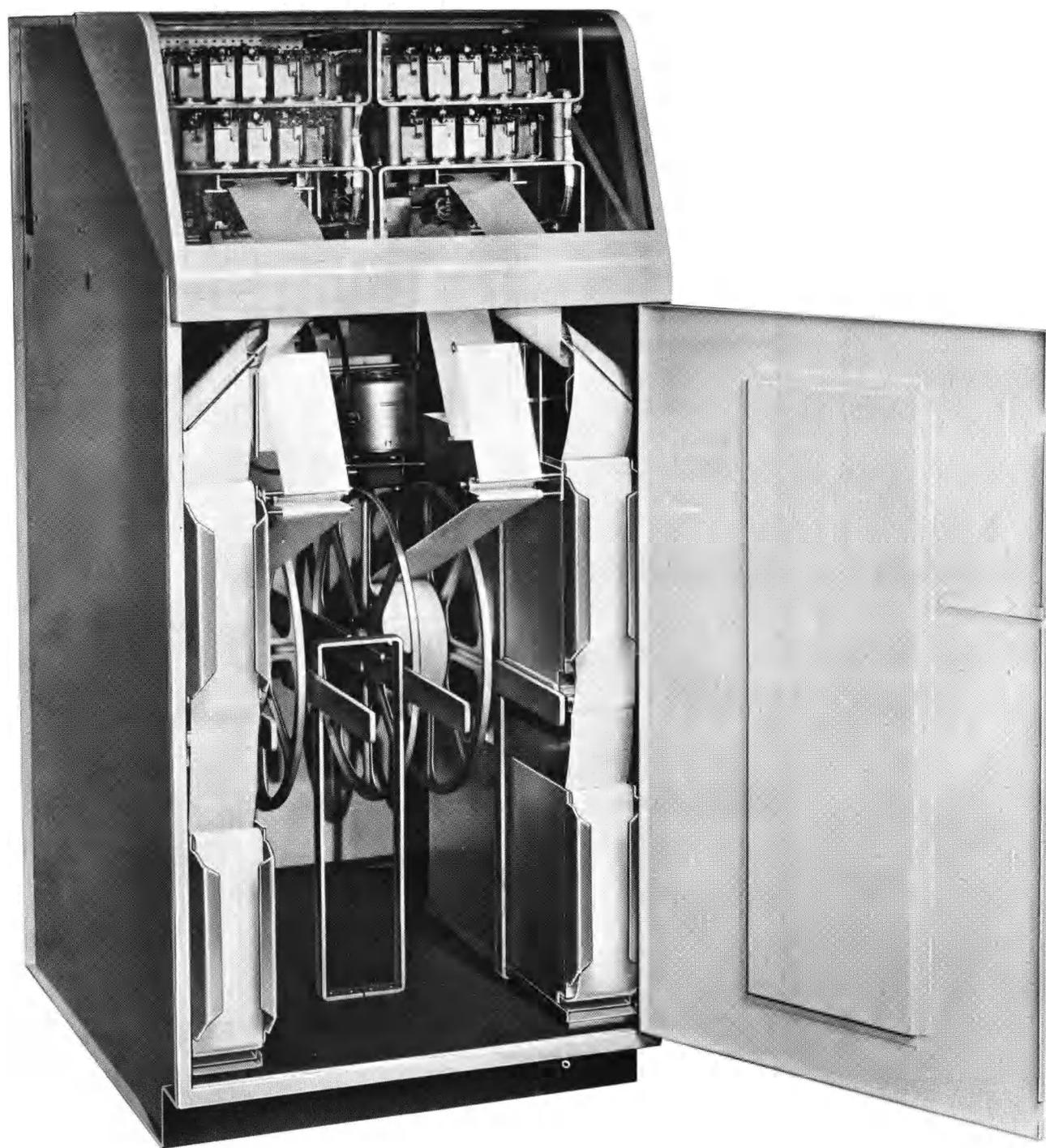


Fig. 58 – Perforator Cabinet

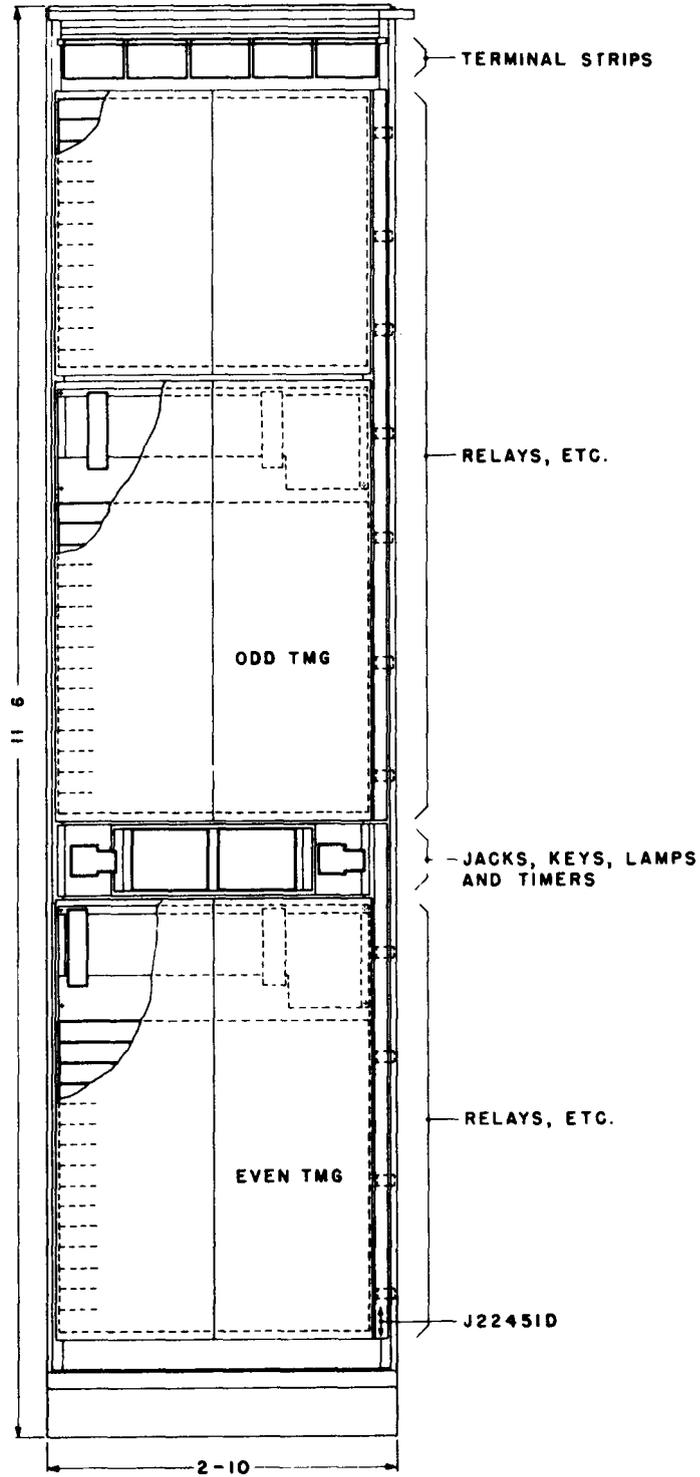


Fig. 59 - Master Timing Frame

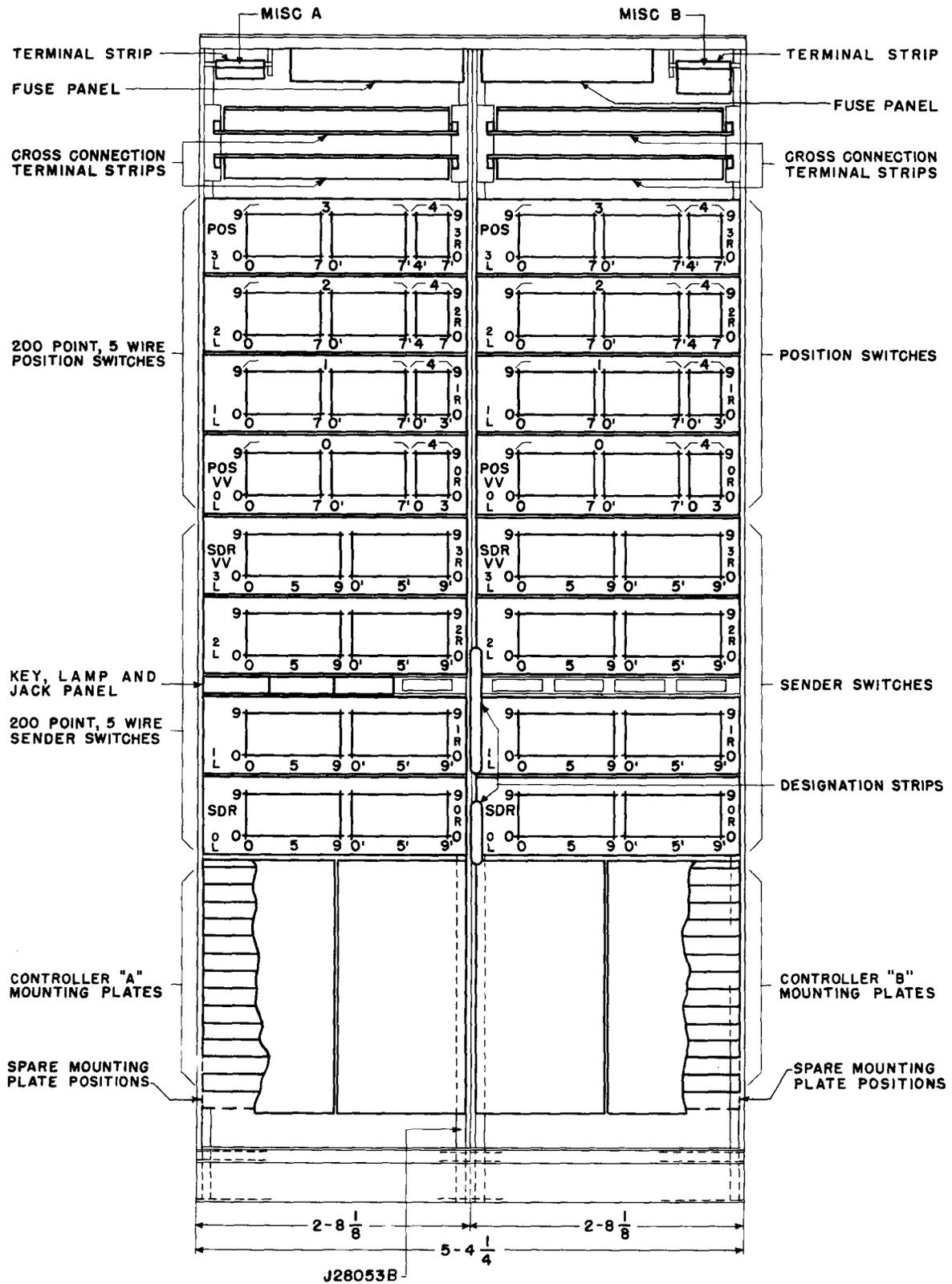


Fig. 60 - Position Link Frame

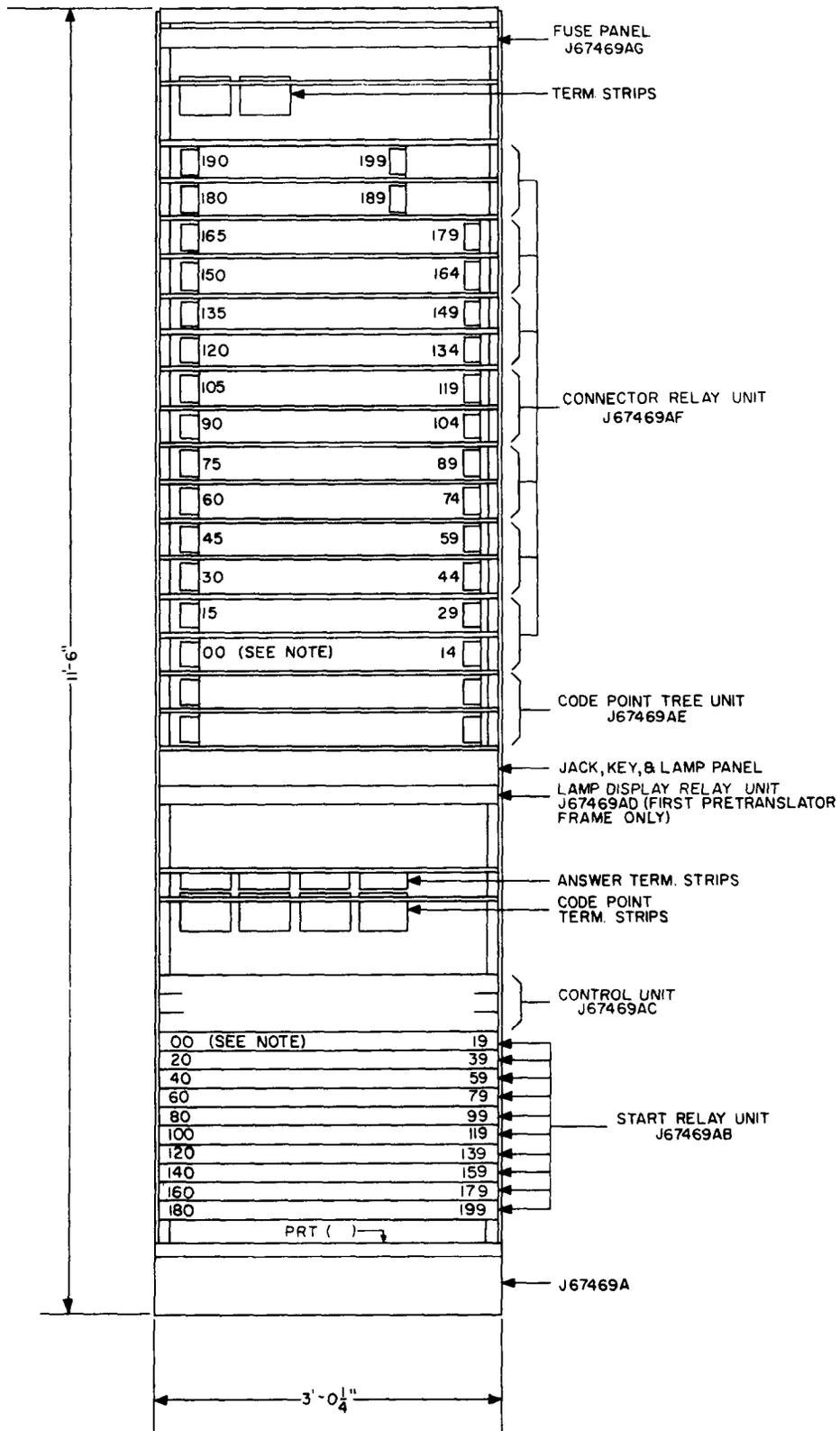


Fig. 61 - Pretranslator Frame

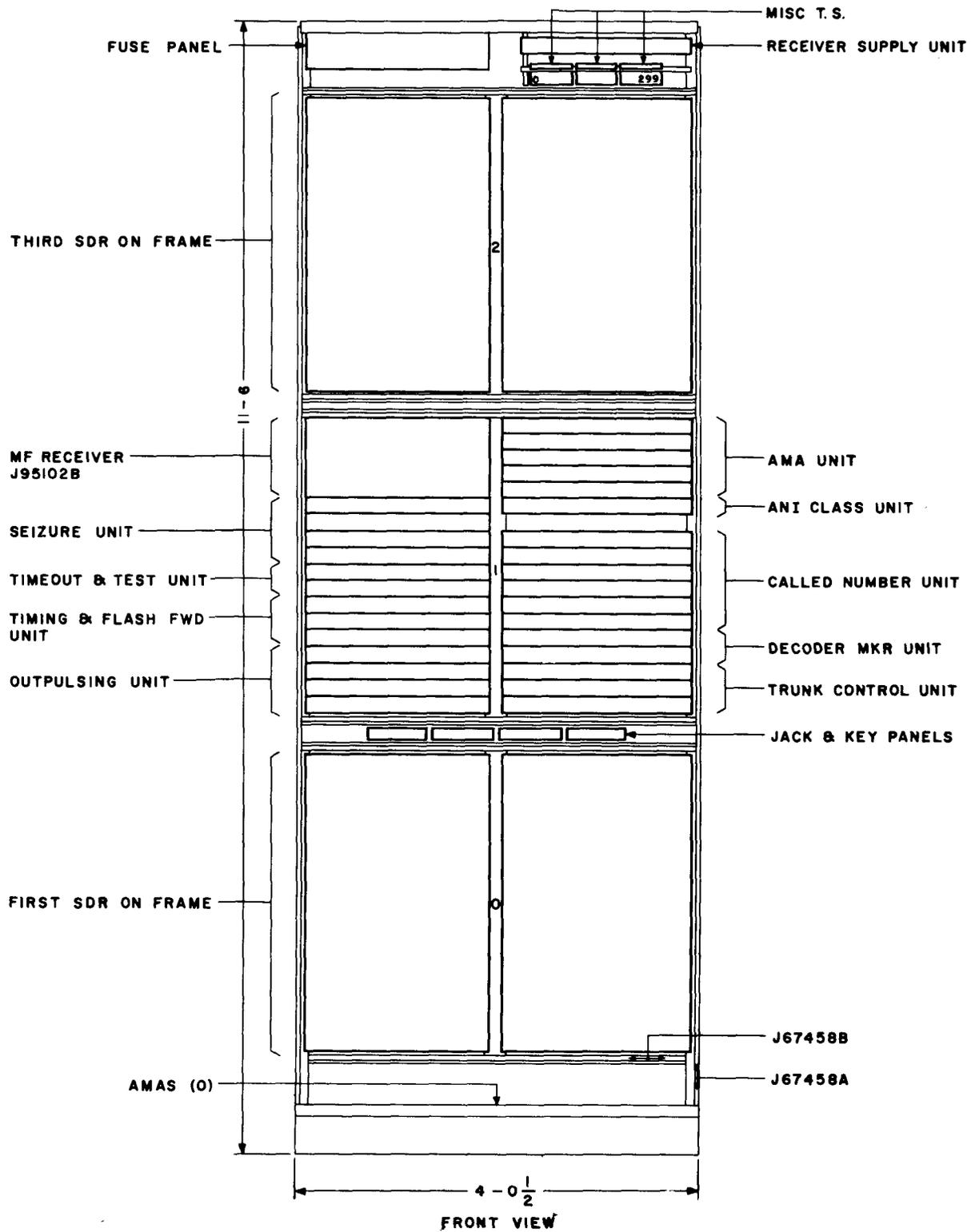


Fig. 62 - CAMA Sender Frame

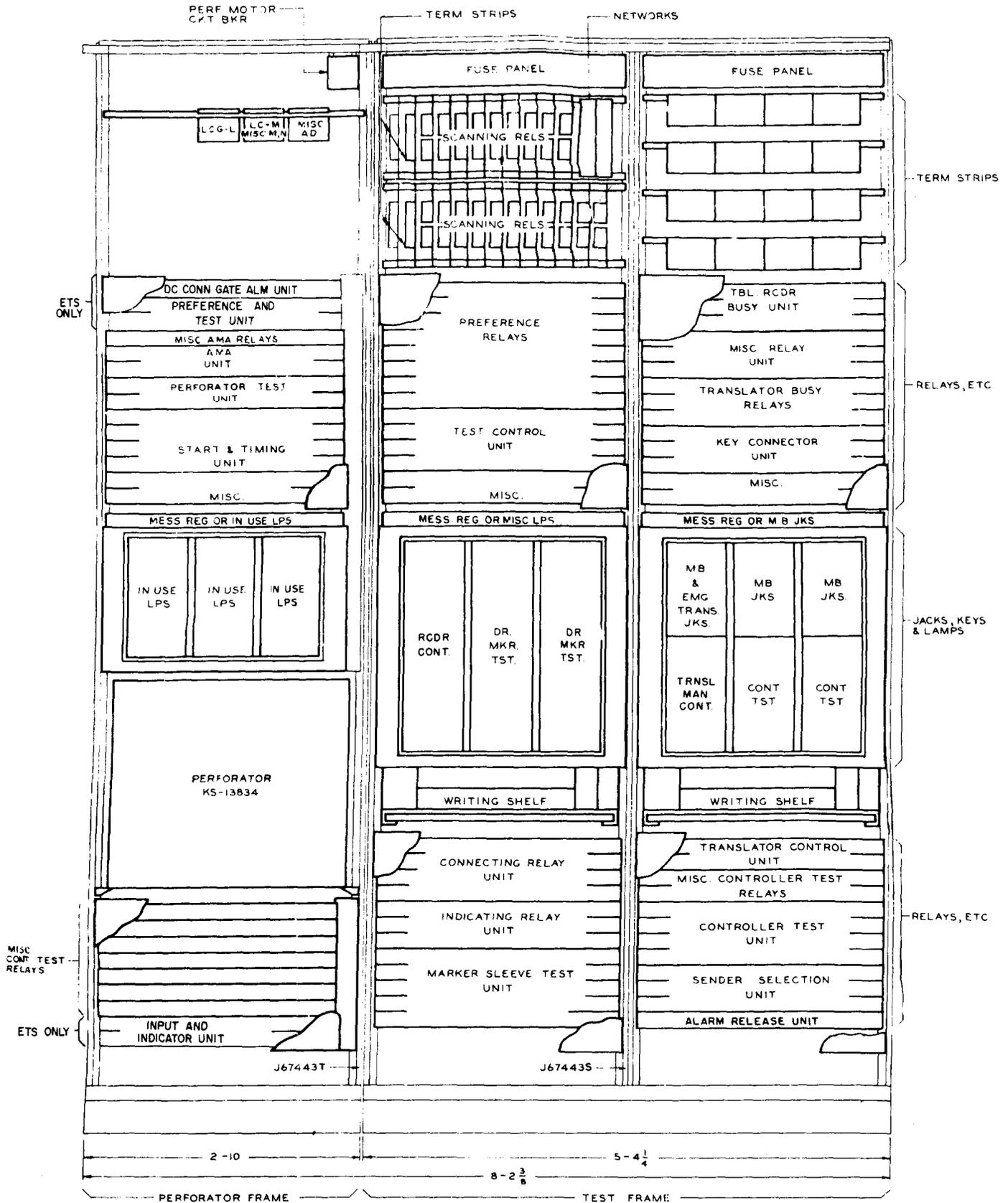


Fig. 63 - Trouble Recorder Frame

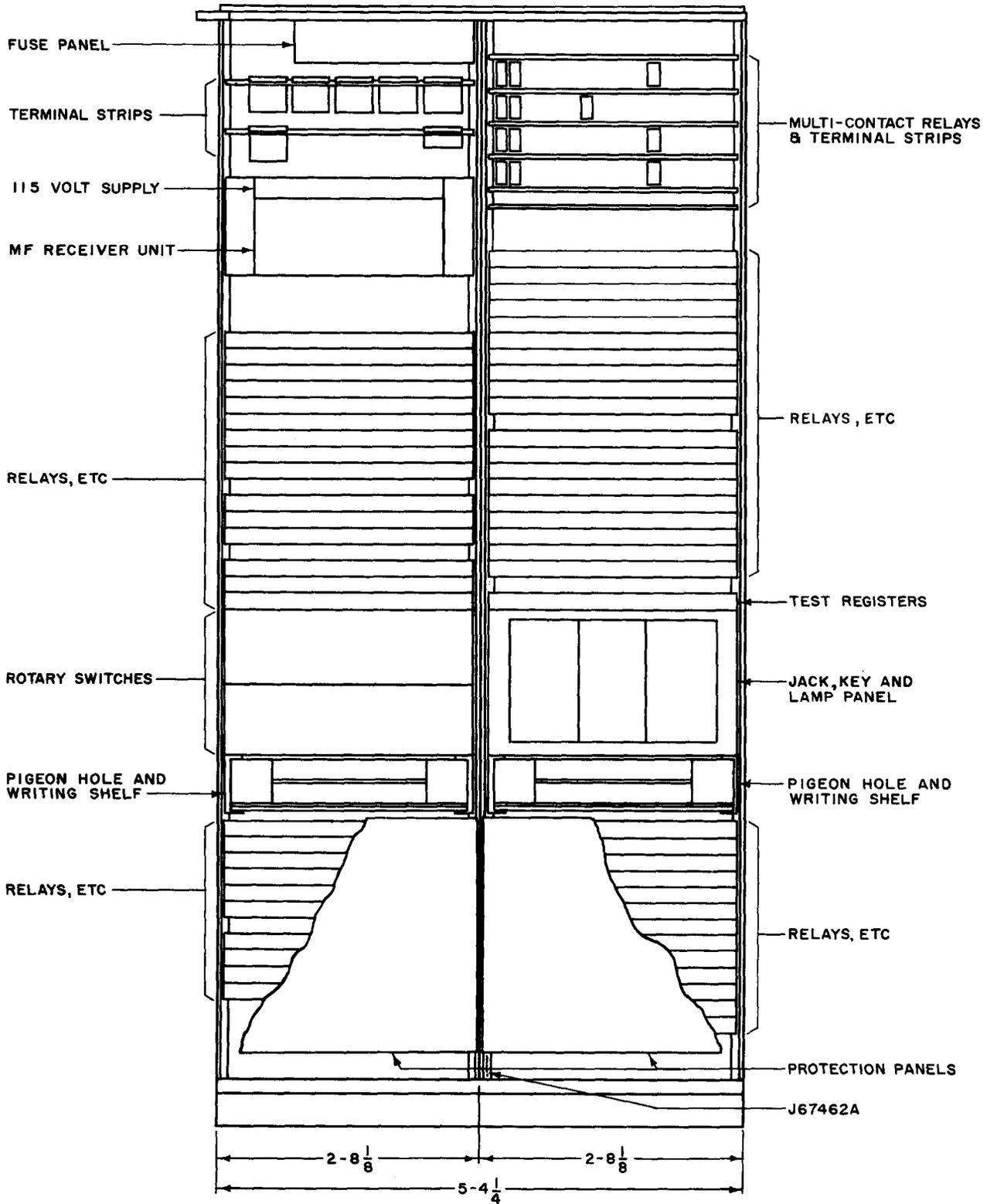


Fig. 64 - Incoming Sender and Register Test Frame

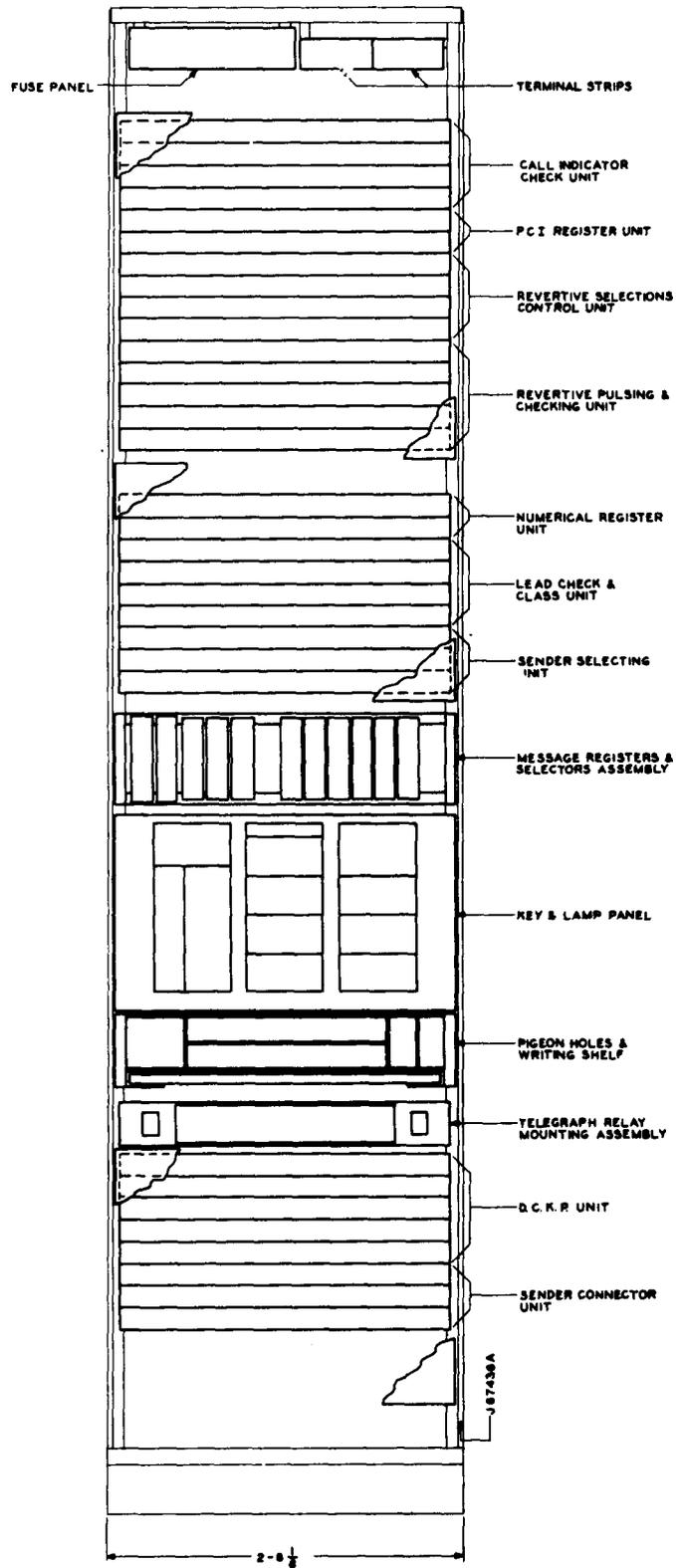


Fig. 65 - Outgoing Sender Test Frame

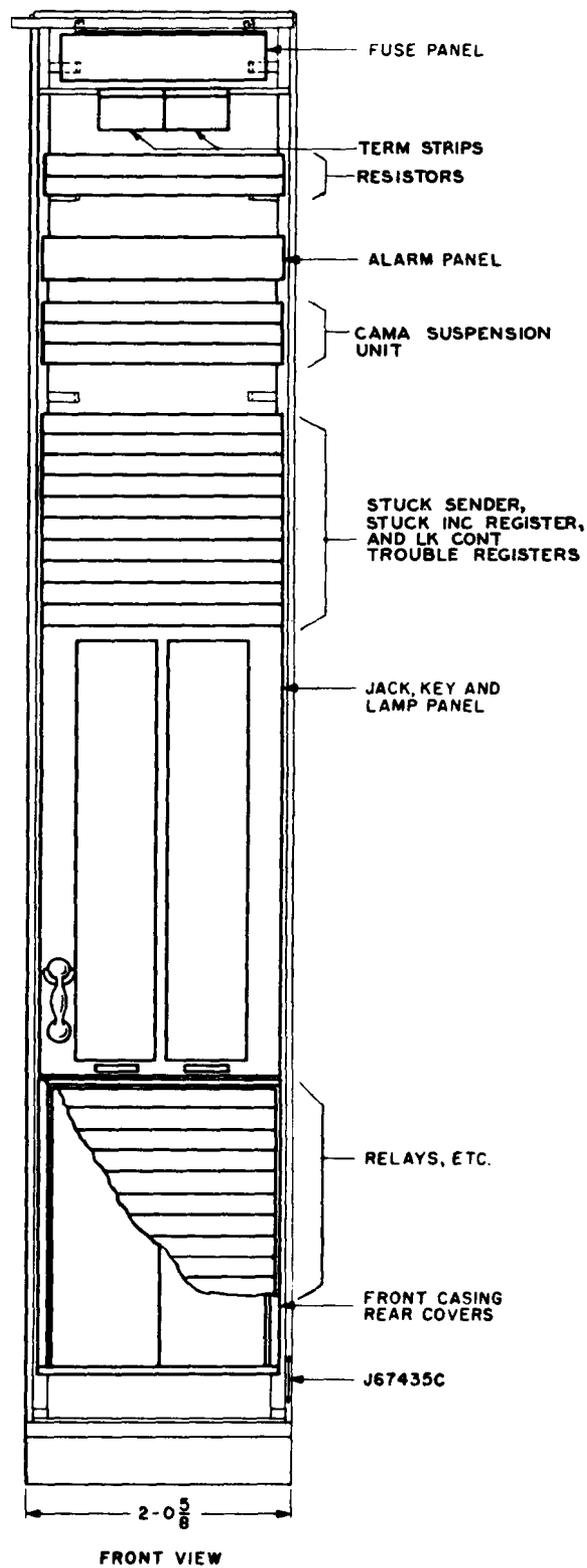


Fig. 66 - Sender Make-busy Frame

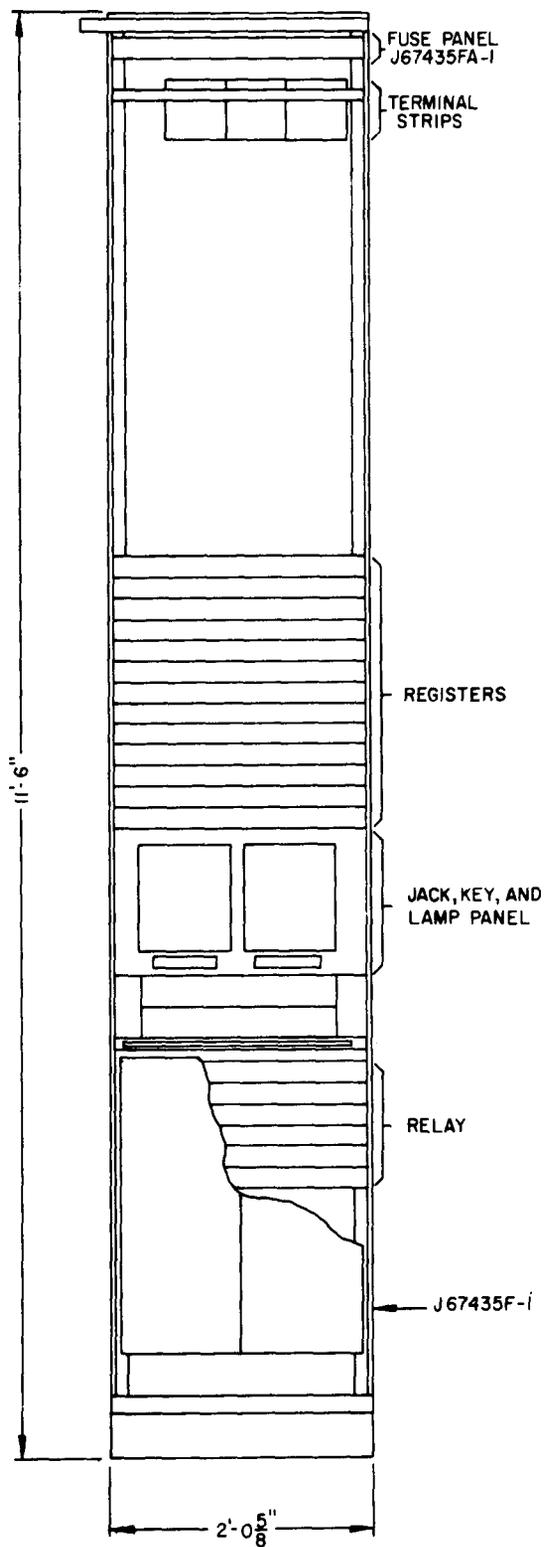


Fig. 67 - Auxiliary Sender Make-Busy Frame

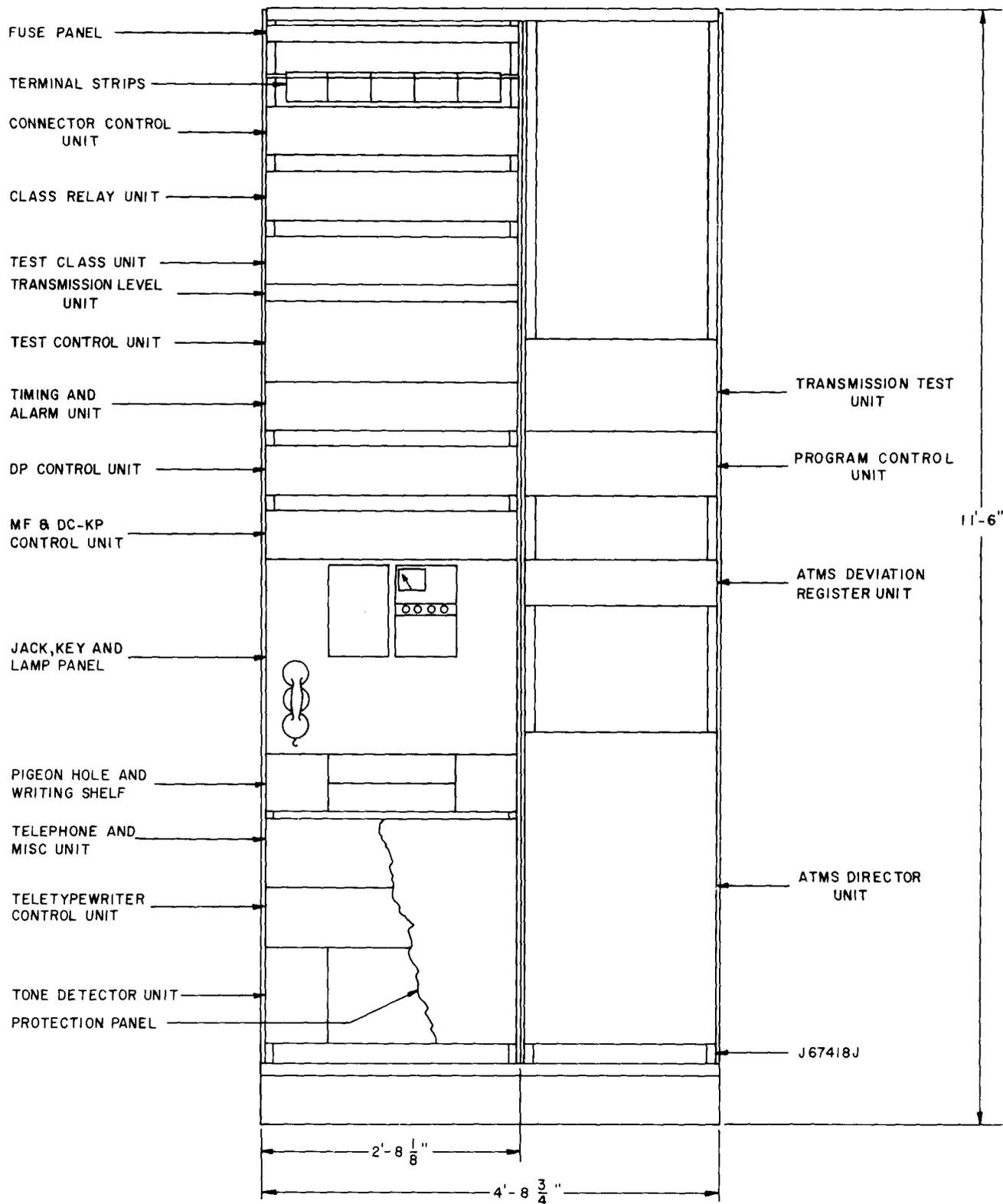


Fig. 68 - Automatic Outgoing Toll Connecting Trunk Transmission Test Frame

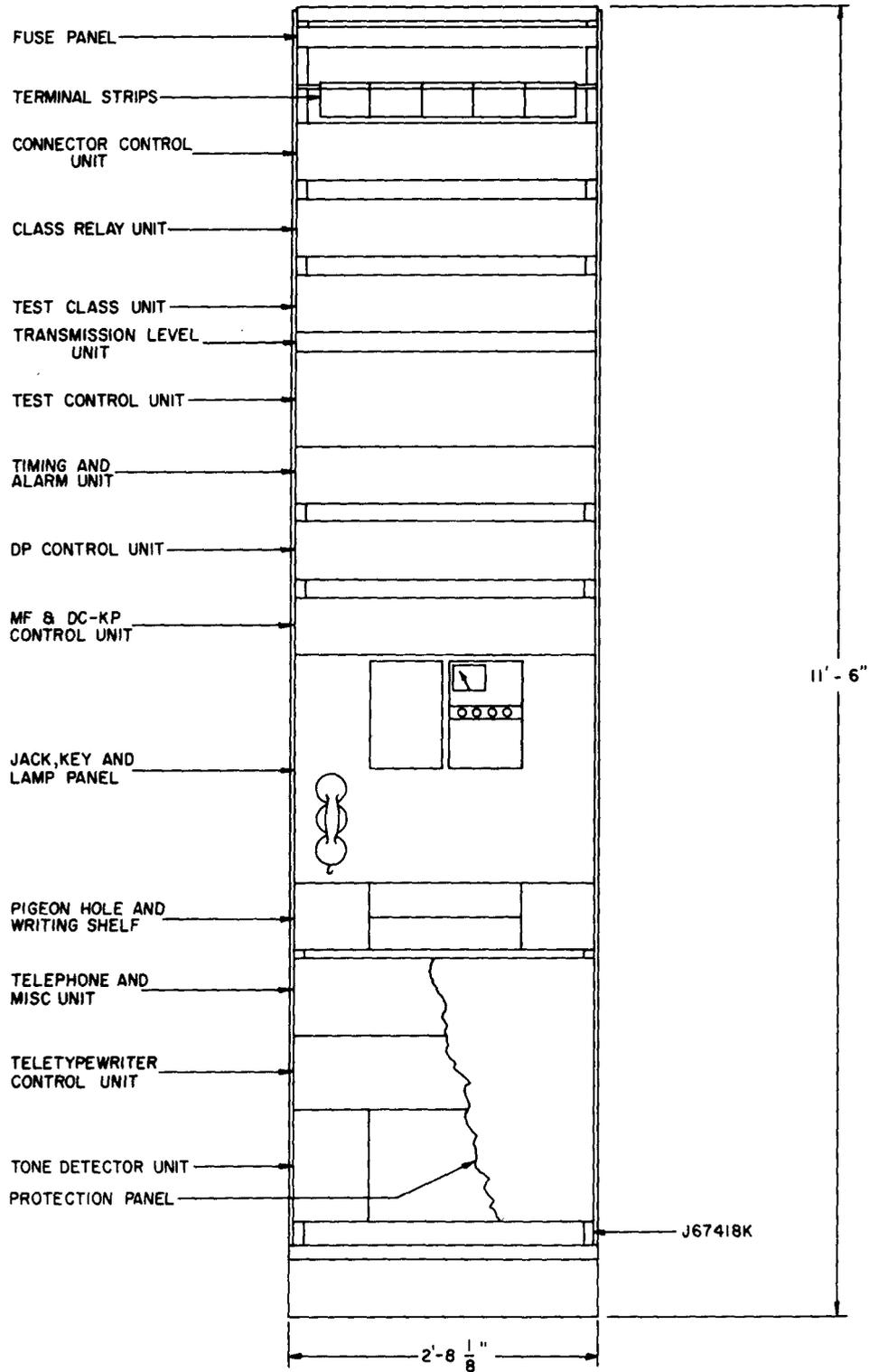


Fig. 69 - Automatic Outgoing Toll Connecting Trunk Operational Test Frame

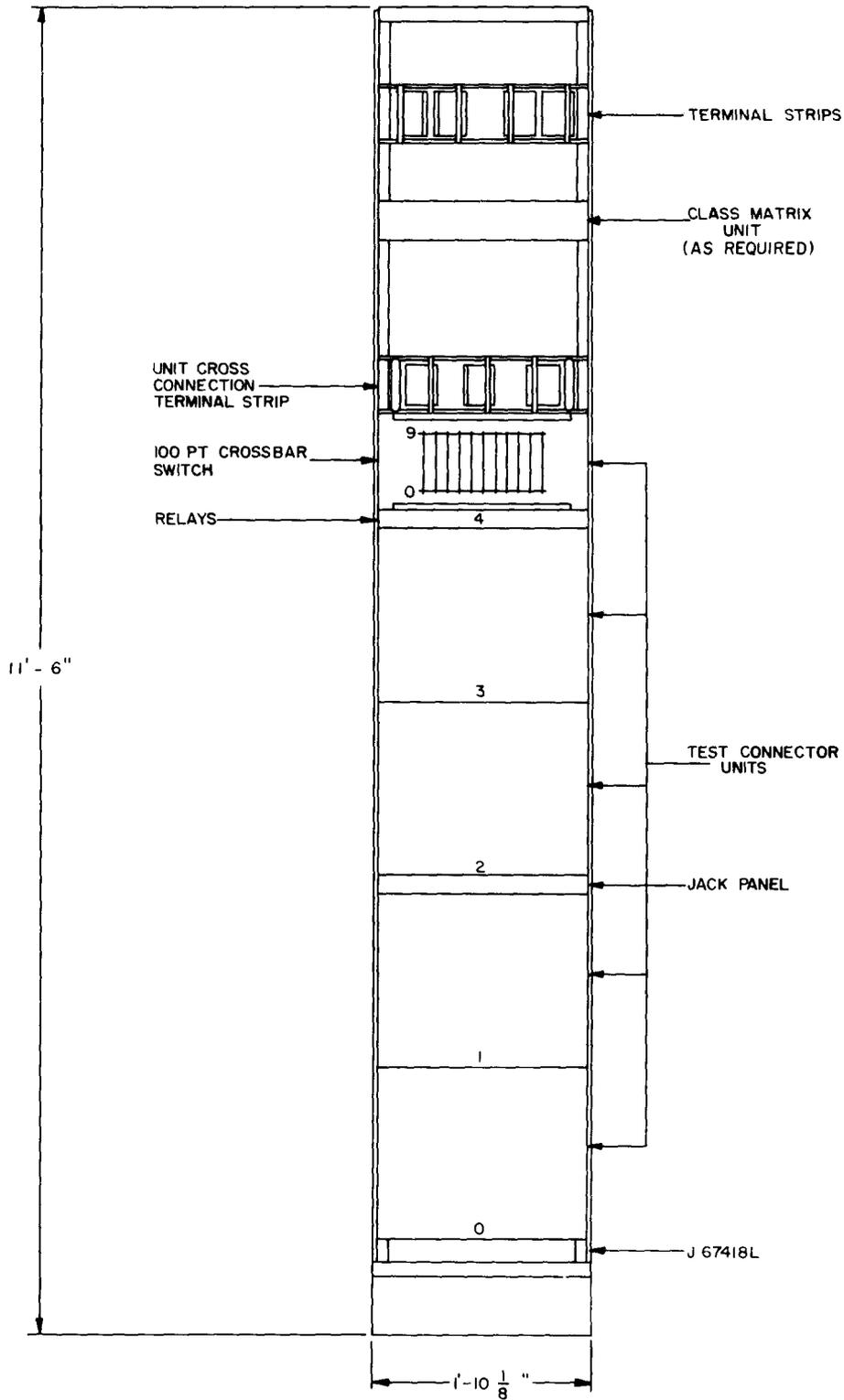


Fig. 70 – Automatic Outgoing Toll Connecting Trunk Test Connector Frame

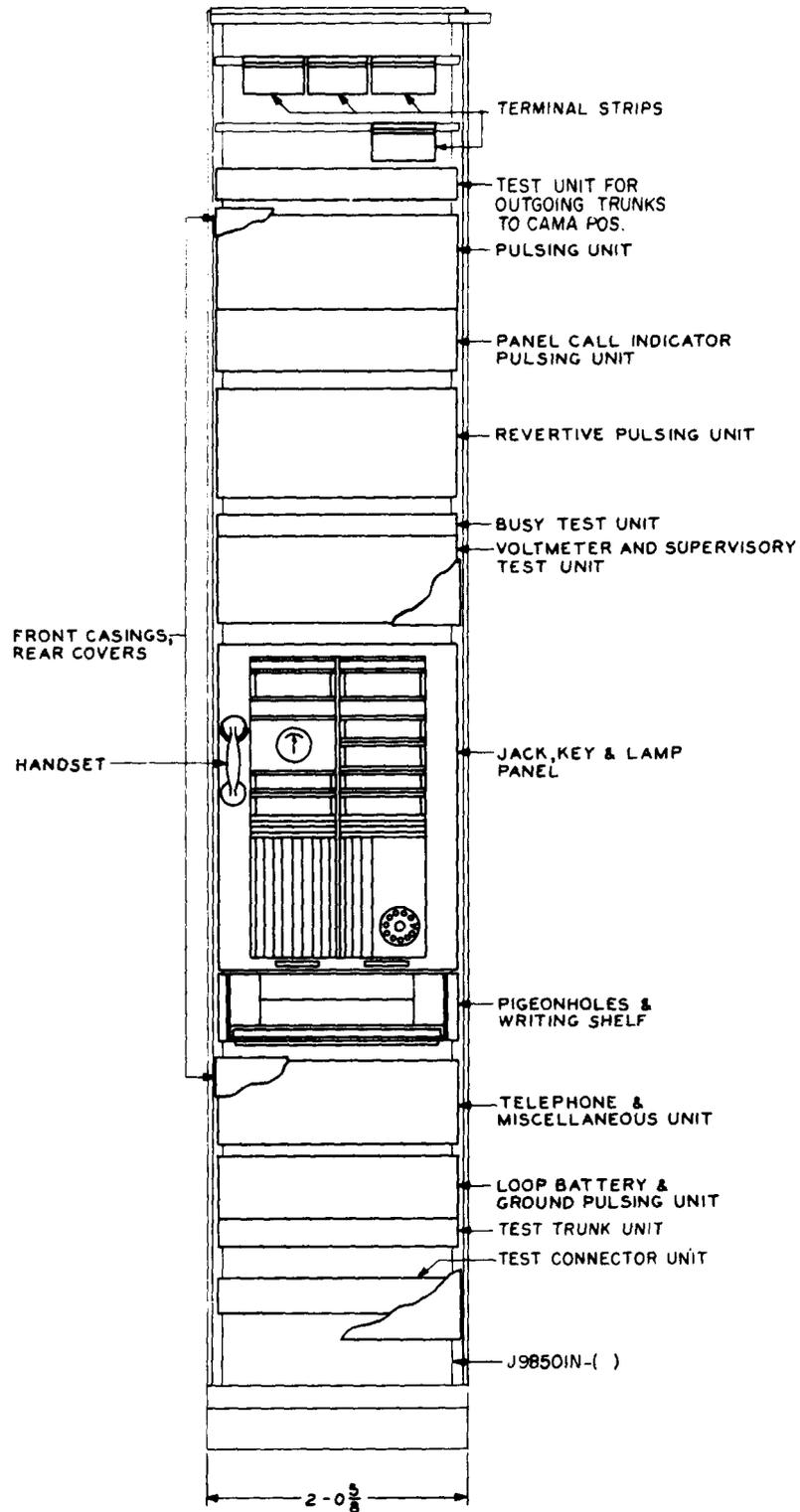


Fig. 71 - Manual Outgoing Toll Connecting Trunk Test Frame

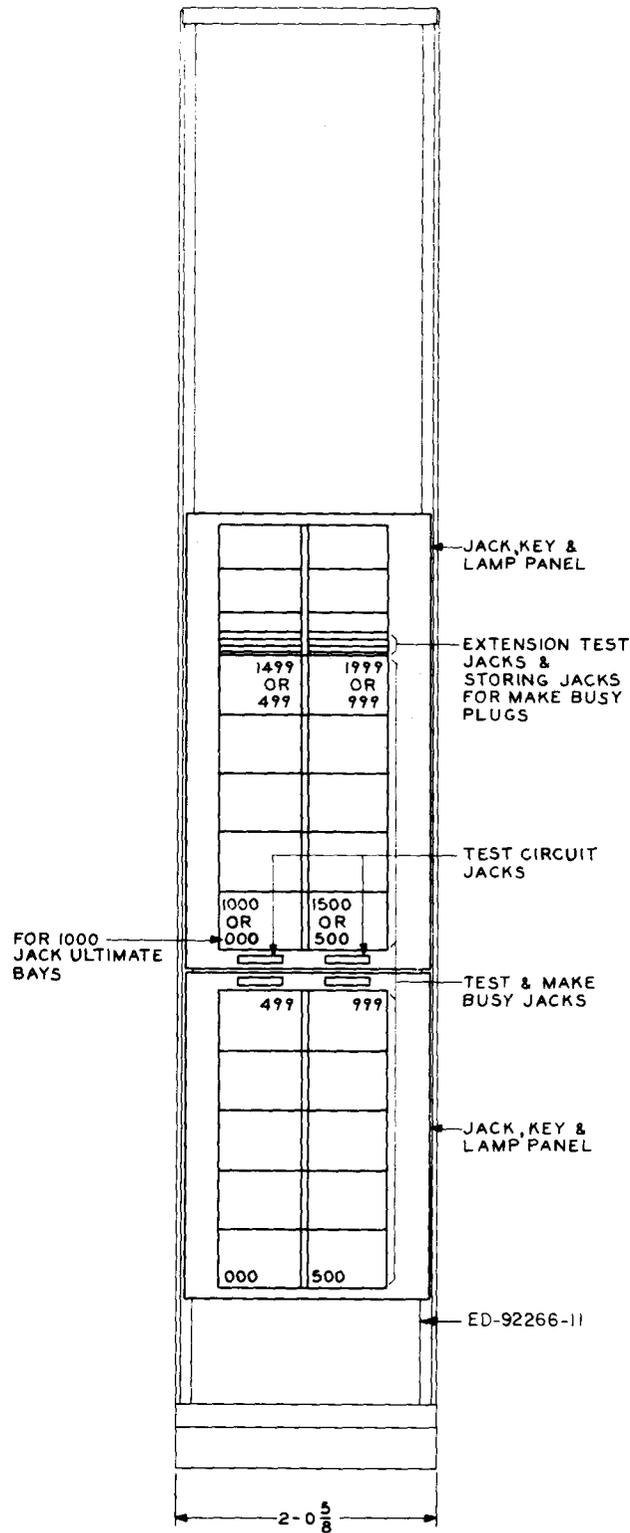


Fig. 72 – Outgoing Toll Connecting Trunk Test and Make-busy Jack Bay

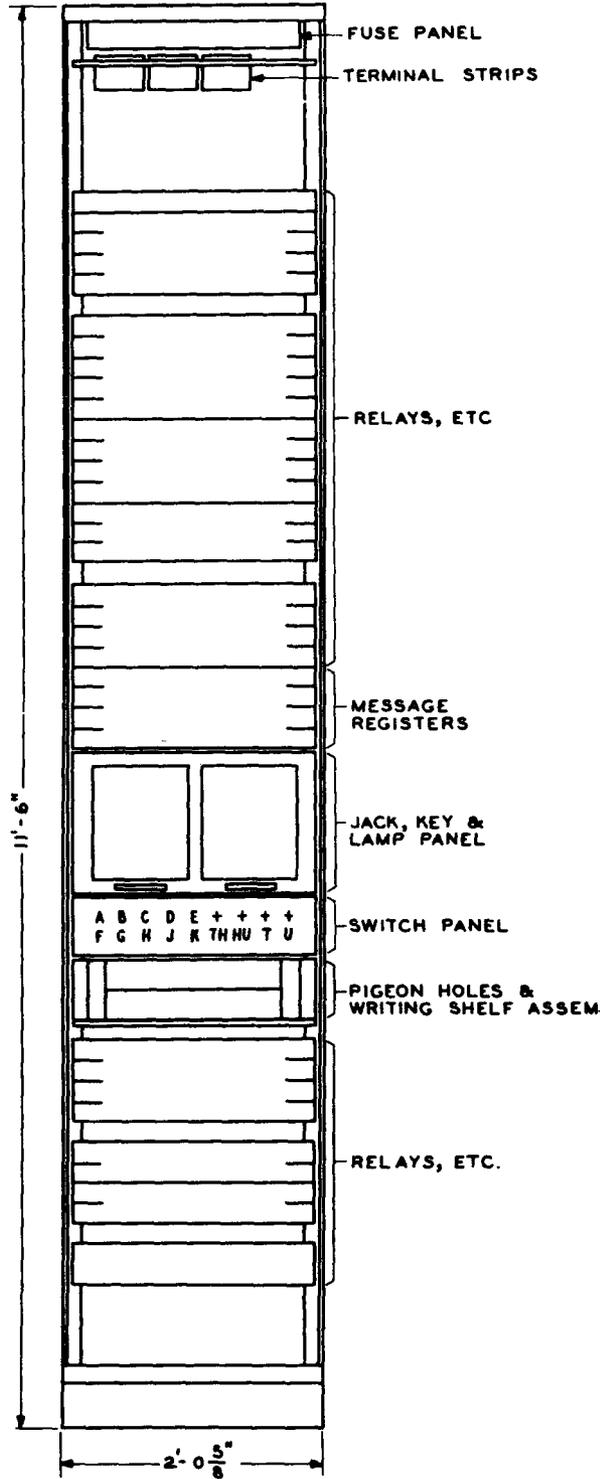


Fig. 73 - Automatic Incoming Trunk Test Frame

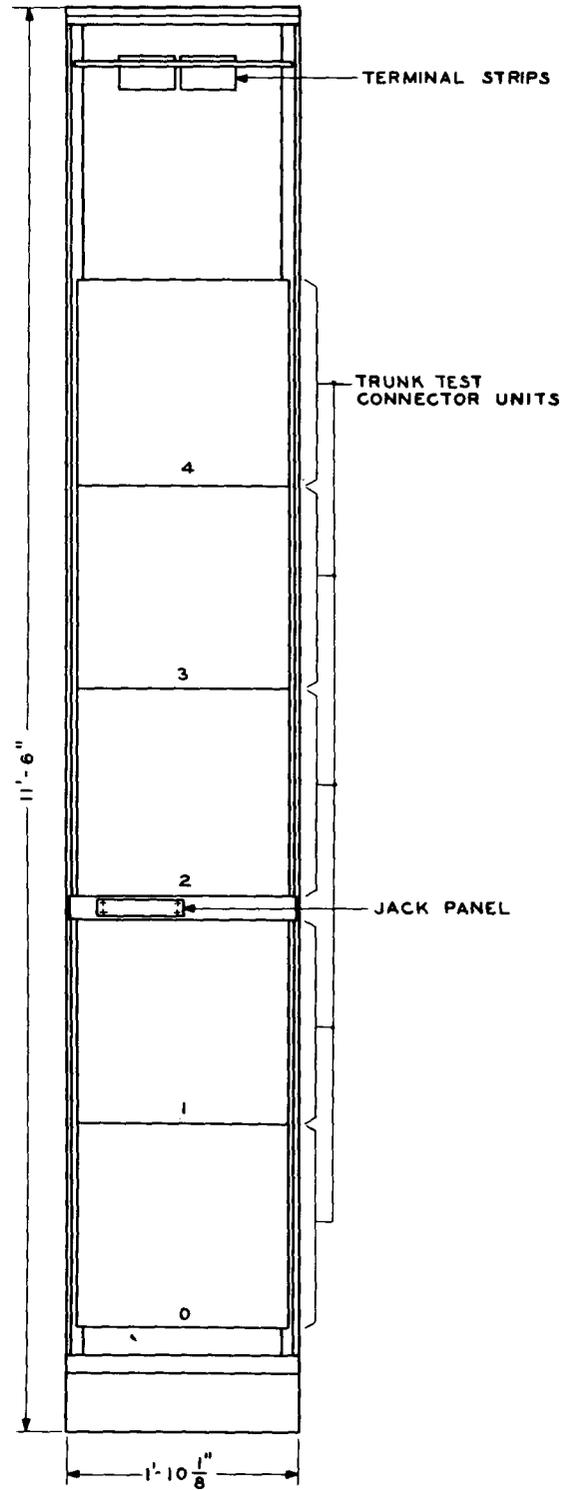


Fig. 74 – Automatic Incoming Trunk Test Connector Frame

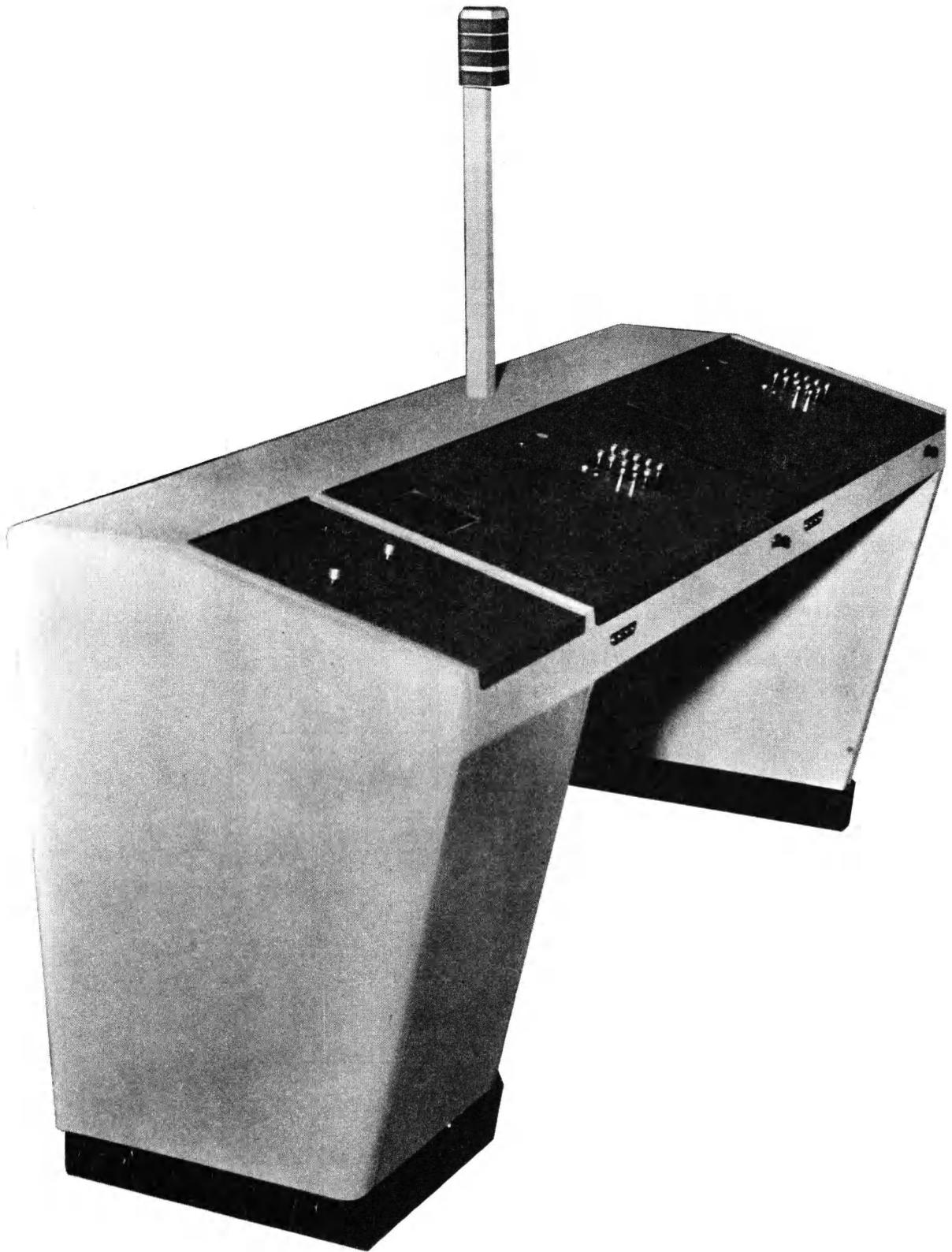


Fig. 75 - CAMA Switchboard

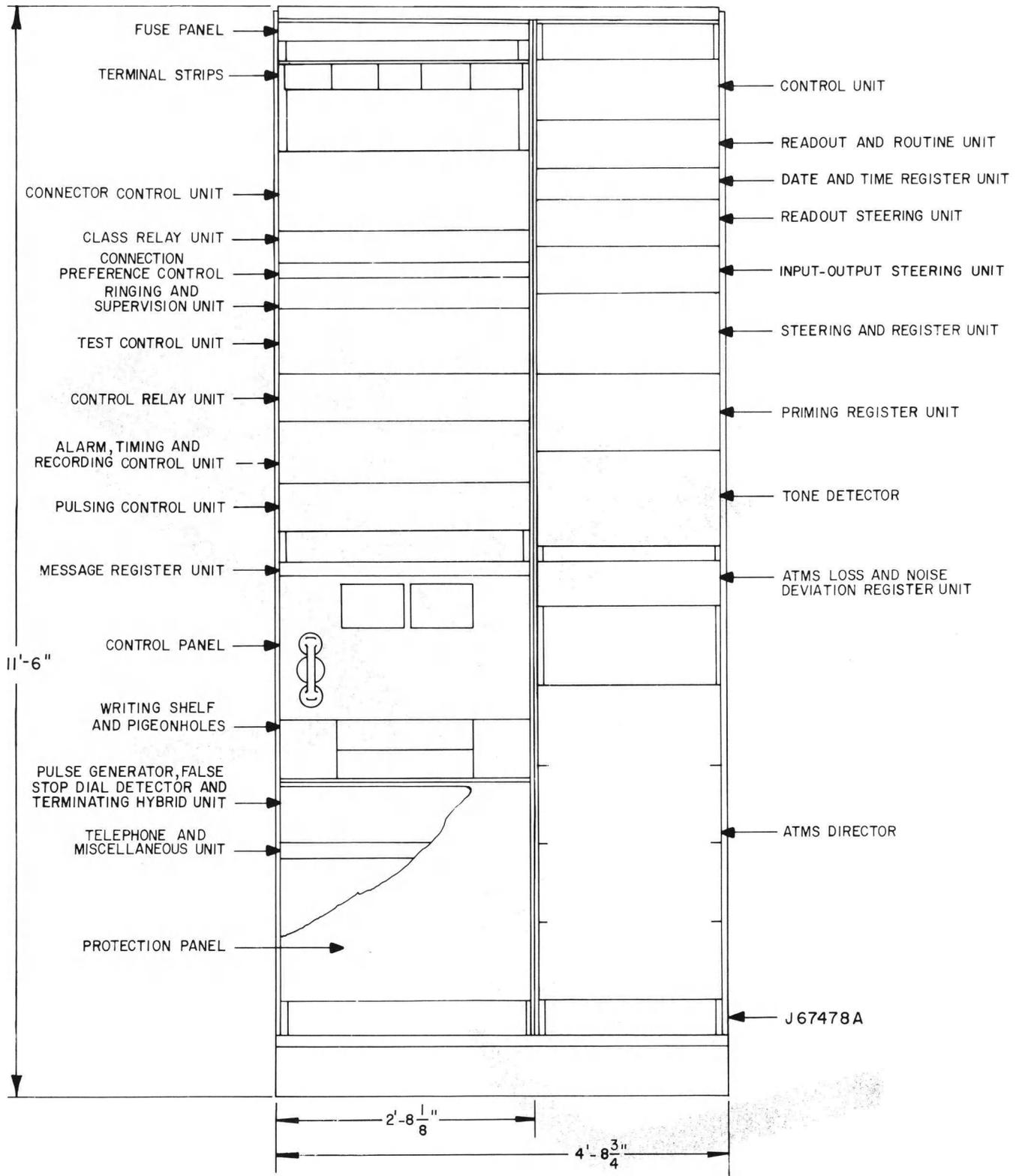


Fig. 76 – Automatically Directed Outgoing Intertoll Trunk Test Frame

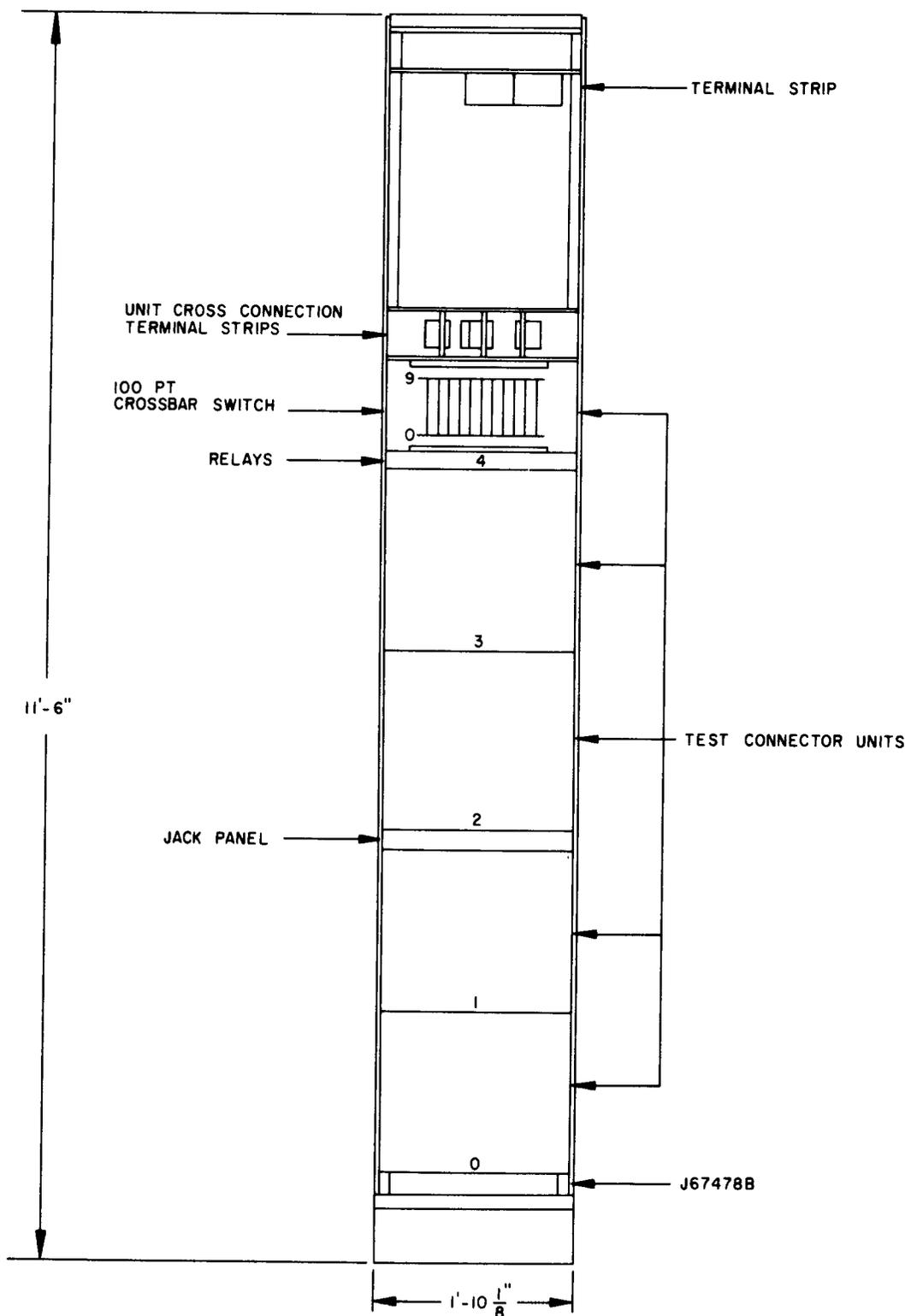


Fig. 77 - Automatically Directed Outgoing Intertoll Trunk Test Connector Frame

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