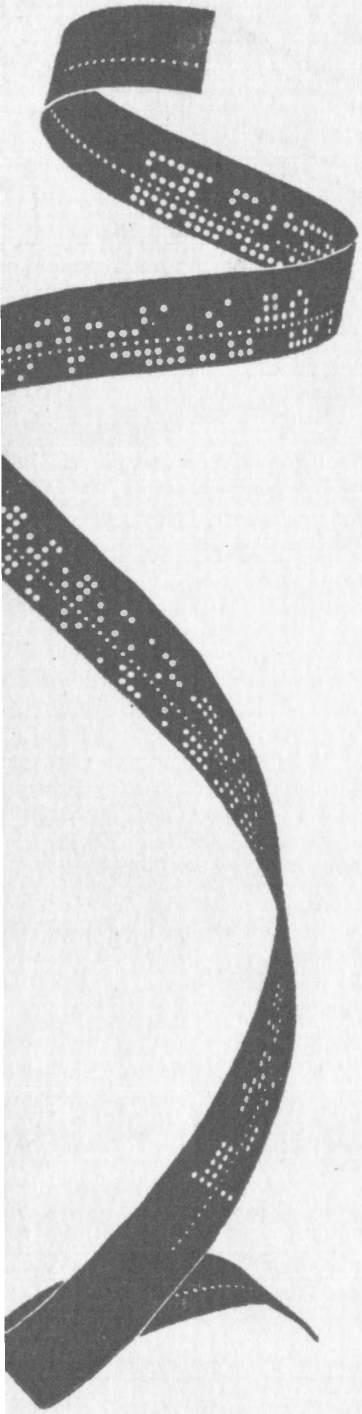
WILSON

5.6

CENTRAL OFFICE TELETYPEWRITER AN/FGC-30



•

Operating Features, Techniques, Advantages and System Operation

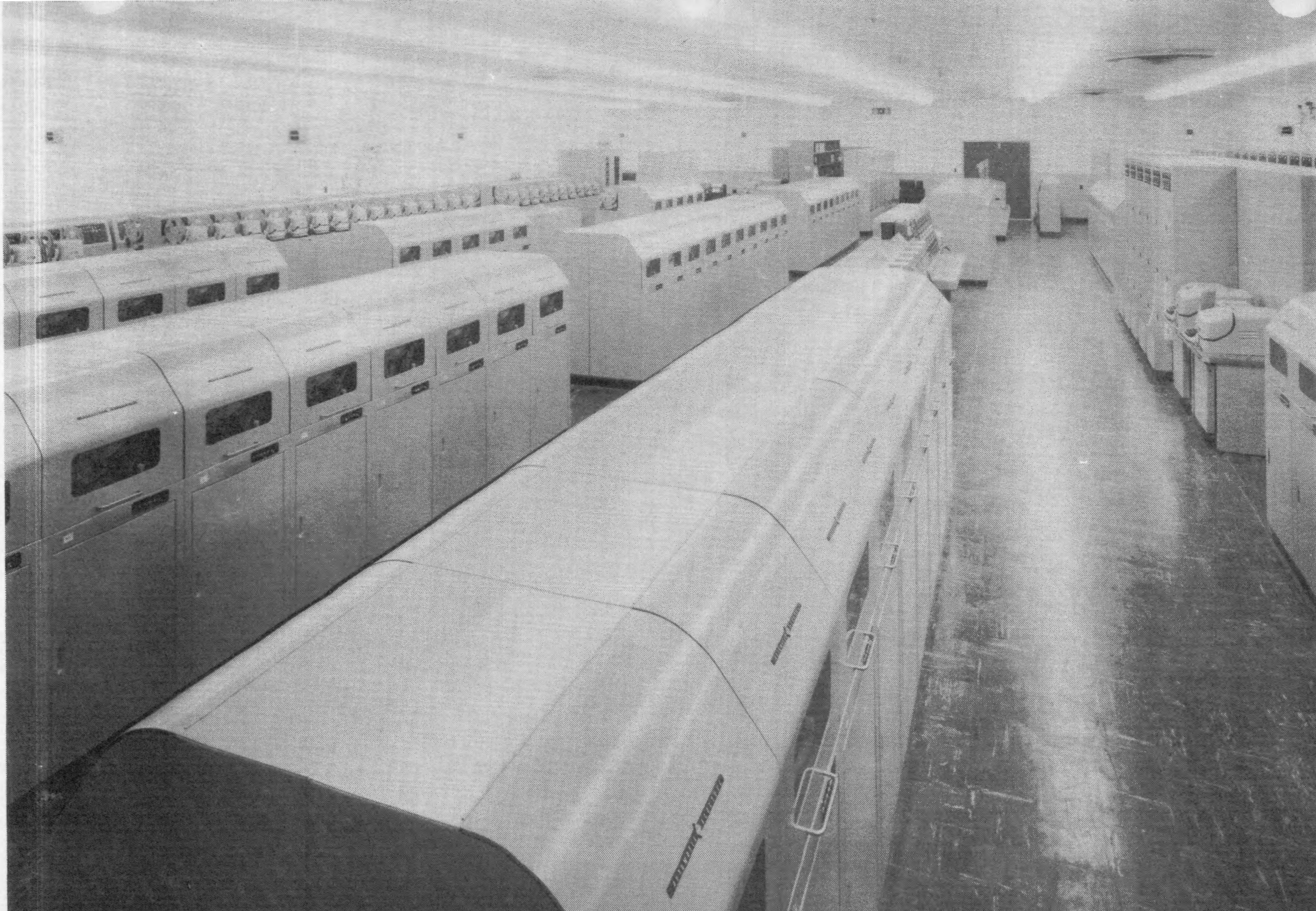
•

Automatic Electric Sales Corporation
1033 West Van Buren Street
Chicago 7, Illinois

•

AUTOMATIC ELECTRIC

I72I



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
DAVIS INSTALLATION - VIEW OF OPERATION ROOM
LOOKING NORTH

F-2723-L

Introduction

The need for faster and better military teletypewriter communication became apparent soon after World War II when the armed forces began the task of establishing permanent communications on a global basis. As a major step in this direction the Automatic Electric Company began the development of a teletypewriter switching system which would be specifically adapted for military use. Working in conjunction with the U.S. Army Signal Corps a plan of switching was conceived which would meet military requirements. The first installation of such equipment was a 20 line fully automatic switching center which was installed on an experimental basis at the Fifth Army Headquarters in Chicago. This installation is operating in the Signal Corps Army Command and Administrative Network and has proved conclusively the value of the switching principles which were under test.

The success of the experimental system led to the highly refined system described herein and known as Central Office, Teletypewriter, AN/FGC-30. A prototype model of this equipment has been installed at the Sixth Army Communications site at Davis, California.

The Automatic Electric Sales Corporation is pleased to be in a position to offer this system to meet the rigid requirements of military teletypewriter networks.

Operational Features

The AN/FGC-30 is a fully automatic switching center for routing teletypewriter messages toward destinations in accordance with joint and combined military procedures. In order to provide a clear understanding of the system its outstanding features are listed below. These and many other minor features combine to form a highly efficient switching system.

Fully Automatic Operation

The system is fully automatic in that it is capable of receiving teletypewriter messages on incoming reperforators and routing them to suitable outgoing lines or to temporary storage for subsequent retransmission without the intervention of operators or any manual processing. The usual intercept facilities are provided, however, to receive traffic which cannot be handled automatically or traffic which is addressed to switching supervisors. In addition a means is provided to monitor and scan traffic on marginal radio circuits before it is switched.

Single Installations in Network

The system is designed to be installed at any point of a network without the necessity of similar equipment at other points of the network. This provides a means of equipping a network on a point by point basis.

Compatability With All Military Types of Systems

The equipment is designed to work into networks using communication procedure as outlined in ACP-127 (B), and thus it is compatable with all other existing types of U.S. Military switching systems. This feature permits interchange of traffic between networks using other types of equipment.

Greatest Possible Use of Circuit Facilities

This system is unique in that it makes theoretical maximum use of circuit facilities on both incoming and outgoing lines. Since all traffic is diverted away from an incoming line immediately, these lines are continually held ready for immediate action on any incoming message. By maximum use of pooled and common equipment the system insures that a particular outgoing line is in use at all times whenever there is traffic in the switching center destined for that line or destination.

Pooled and Common Equipment

This system makes maximum use of pooled and common equipment. This practice follows known standards of the telephone switching industry to provide the highest degree of efficiency in use of equipment. The extensive use of pooled equipment also provides a means of insuring that equipment is always available for traffic to a given point regardless of the current traffic load to that point.

Printed Tapes Used Throughout the System

All teletypewriter tapes used in the system are fully perforated and typed in the margin, thus providing operating personnel an easy means of identifying any message in the office. This also provides a means of scanning tapes to detect garbles.

Special Teletypewriter Equipment

The teletypewriter equipment of the AN/FGC-30 has been designed and produced by the Kleinschmidt Laboratories, Inc., especially for use with switching center equipment. This has afforded a means of providing special message safeguards and has permitted the inclusion of many desirable features.

Maximum Flexibility

The system is highly flexible from both operational and maintenance standpoints. Equipment can be shifted easily from one line to another within the office, thus permitting equipment to be maintained without disrupting operations. All equipment can be arranged as desired. A centralized cross connecting point greatly facilitates this flexibility. In addition each outgoing circuit can provide a wide variety of message termination sequences which can be used depending upon the type of facility to which messages are being transmitted.

Immediate Handling of Message Traffic

One highly important feature is its ability to act immediately on any message arriving at the switching center. In this system each normal message is immediately switched to some type of cross office position without delay, thus keeping the incoming lines free for receipt of a high precedence message. This feature is one of the unique fundamental features of the system. Its use renders unnecessary the complete receipt of a message at an incoming reperforator prior to switching. It also insures that no normal-message will have to wait for a transmission path away from the incoming position. All messages are switched immediately to some type of cross office position except in cases of alarm conditions.

Ease of Expansion

The system has been designed on a "Building block" principle which permits expansion up to a maximum of 250 lines by the addition of like components. The switching equipment is arranged in basic 25 line packages. Any intermediate number of operating components can be used.

Full Precedence Consideration

Messages of any of the six degrees of military precedence can be switched. Each message is given access to the outgoing lines in strict accordance with the interpretations of the six degrees of precedence.

Automatic "Break In" on High Precedence

Messages of the three highest degrees of precedence require cancellation of messages of lower precedence in gaining access to a particular outgoing line. This process is automatic, thus providing a path through the switching center which is always available. Messages which must be "Busted" in this manner are provided with a cancellation and termination sequence. Such messages requre a minor manual operation for re-transmission. A high precedence message will not cause cancellation of a transmission of a message of the same or higher degree of precedence.

High Degree of Message Security

Each message is individually safeguarded in its path through the switching center. Special alarm circuits indicate nearly every possible abnormal function of equipment due to either equipment failure or an incorrect message format. An indication is placed before a centralized supervisor of any condition which might result in a lost message. In addition many alarm and traffic indications are indicated both locally and at a supervisors position. This permits the entire switching center to be under direct control of one supervisor.

Automatic Number of Messages

Message channel serial numbers are automatically verified at the incoming line position before processing is allowed to continue.

In case of non verification an alarm is indicated and further processing is halted. Each message which leaves the switching center on an outgoing line is automatically provided with a channel designation and number. All intermediate channel numbers are automatically deleted from the message, so that each message will be forwarded with only two sets of numbers -- the sent number and the received number.

Multiple Call Messages

Multiple call messages are handled in such a manner that two or more resulting outgoing messages are transmitted independently of each other. They are handled in accordance with precedence. Each multiple call message is routed to special processing equipment, where processing of each message is on a routing line segregation basis. Any number of routing indicators may be processed in each message, and new transmissions may be originated containing as many routing indicators as are required.

Multi-Point Circuit Operation

Multi-point circuits may be equipped with as many as 10 stations operating on a full duplex basis. Transmission to and from these stations is controlled from the switching center. Individual station message channel number registers are maintained for both incoming and outgoing traffic. Selection of stations to receive traffic is on an in turn basis within any precedence classification. All six degrees of precedence are considered in selecting a station to receive a message. Stations desiring to transmit do so on a "High-Low" precedence classification under control of the switching center. Any station may obtain immediate control of the line for transmission of a high precedence message if the line is being used by another station with a low precedence message. Automatic and manual cancellation sequences are available for traffic entering the switching center on multi-point lines.

Three Speed Operation

Incoming and outgoing line transmission may be at any of the three standard speeds of 60-75-100 words per minute. Any switching center of this type may be used with all three speeds simultaneously.

High Cross Office Speeds Not Required

Because a suitable path for a cross office transmission is normally available for immediate transmission of a message to a cross office position, transmission may begin immediately to the selected unit. This permits use of a cross office speed only slightly higher than the highest incoming line speed used in any one office. This makes excessively high cross office speeds unnecessary. Normal cross office transmission is at either 75-100- or 115 words per minute.

Routing Indicator Flexibility

Routing indicators may be selected from the military plan on the basis of either 4,5,6, or 7 letters to identify stations. Normally, the first 4 letters identify the relay center and succeeding characters identify tributary stations of the designated relay center. Any of 4 characters may be used in the first position, 8 may be used in the second position, 15 may be used in the third position, and any of 26 letters may be used in the fourth, fifth, sixth and seventh positions. Normally, the seventh position is used only to identify a tributary of a minor relay center. Routing assignment is made by single conductor pin jack patch cords, thus providing immediate re-assignment flexibility.

Multi-Channel Selection

Any number of channels may be used to any given destination and traffic is distributed approximately equally to all channels of the group. Channels may be immediately subtracted from the group, leaving traffic approximately equally divided among the remaining channels.

Alternate Routing Facilities

An alternate routing patch panel is provided which permits temporary reassignment of traffic in storage to an alternate channel. When an alternate route patch is removed traffic which was originally stored for the patched out channel will be again assigned to the original channel. This feature provides a high degree of flexibility in alternate routing.

Emergency Facilities

Provisions have been made to operate the system as a torn tape system without automatic numbering facilities in case of a complete failure of switching equipment.

Ease of Maintenance

Most of the relay and switching equipment is packaged in "Jacked in" components to permit easy withdrawal and replacement for maintenance. Care has been given in the design of the equipment to provide suitable test points and circuit access facilities for use in service testing.

Message Sequence Control

The system is thoroughly interlaced with alarms and controls to provide individual protection for each message. At all tape handling positions automatic circuits insure that start and end of message indicators are passed in proper sequence. In addition safeguards are employed to insure that signals received contain a start of message indicator within a specified number of characters. These features permit scrambled and encoded message texts to pass through the system without fear of action on fallacious end of message indicators. Any unacceptable message format situation will result in an alarm condition.

Polar or Neutral Signalling

Incoming transmission may be received either 20 or 30 mills polar or 60 mills neutral. This is accomplished by use of a polar type receiving selector on the incoming reperforators. It is not necessary to repeat incoming signals with a polar relay or to provide regeneration. Outgoing circuits can be arranged for either polar or neutral signalling. All transmission within the office is 30 mills polar. Use of this type of signalling within the office permits a rigid control over circuit continuity.

Return Routing

One problem associated with the operation of a completely automatic network is the danger that a message may be shunted back and forth between automatic centers indefinitely without manual attention. The AN/FGC-30 equipment contains a unique feature which guards against this possibility by routing to an intercept position any message for which a translation is made which would return the message to the station which transmitted it.

Lock Out

All normal messages are transmitted away from an incoming line position immediately. Any message which is defective or cannot be routed normally may be routed to an intercept position. In the event that a message cannot be routed to intercept either due to equipment failure or to non availability of a cross office position the incoming line position is locked out and an alarm is indicated. This feature insures that common equipment will not be held unnecessarily.

Manual Forwarding Facilities

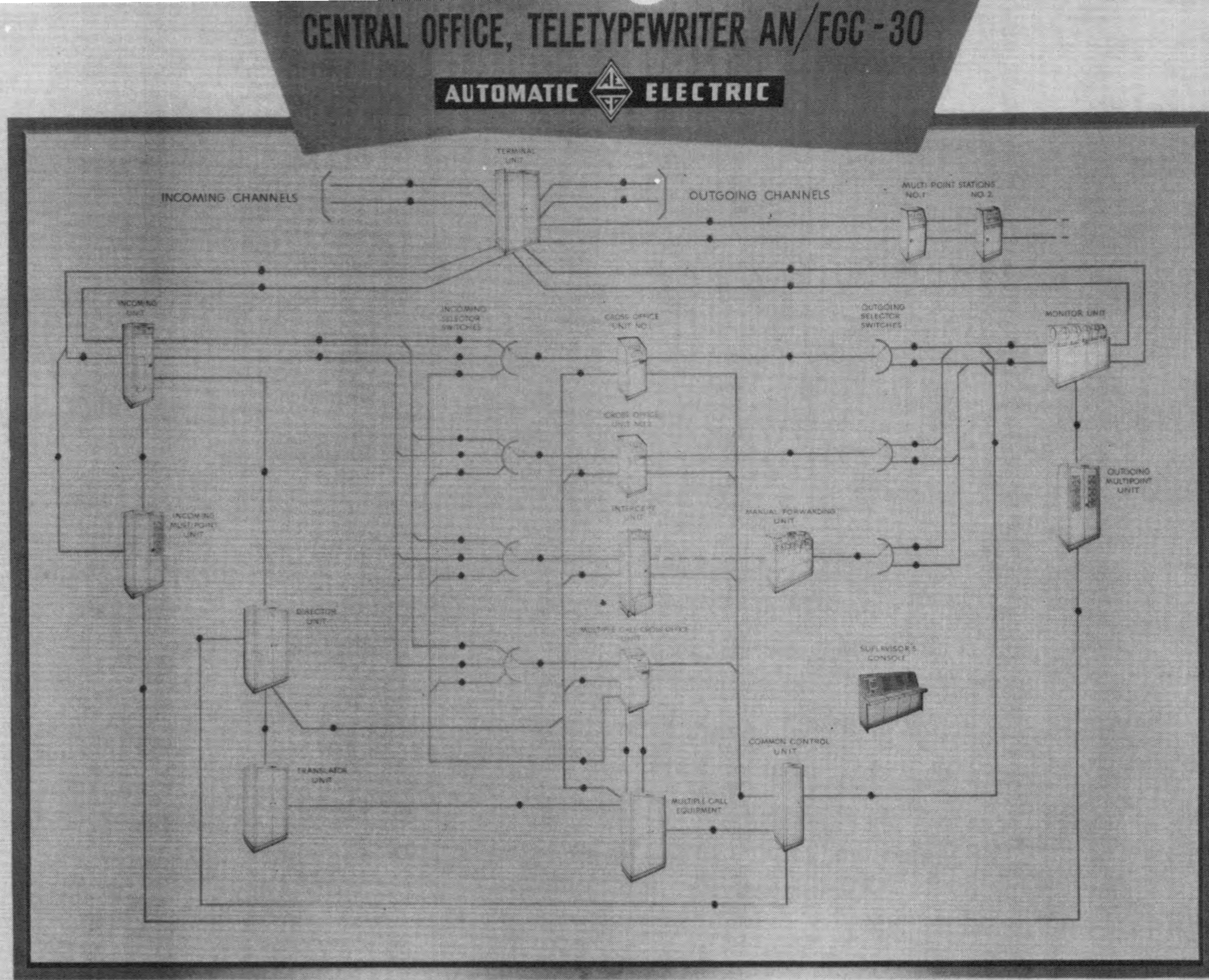
Several positions are supplied which are equipped with transmitters to permit manual forwarding of message tapes which must be inserted into the system. These tapes would be intercepted messages, supervisory messages, and re-run messages. A control panel is provided to permit an operator to select any desired outgoing line for seizure.

Cross Office Unit Numbering

Each message appearing in an outgoing line monitor has a three digit number associated with it. This number identifies the cross office unit from which the message was transmitted. This feature greatly assists operating personnel in tracing messages through the system.

Unit Identification

The centralized supervisors console is equipped with a set of push buttons and lamps which permit an operator to determine which units of the system are temporarily tied together for message traffic.



DEMONSTRATION BOARD
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
FRONT VIEW MODEL #2

F-2632-C

System Operation

In order to explain the system adequately it is best to consider several individual messages passing through the system. Several types of messages are described below.

A. Single Call Message - No Other Traffic in The Center

A single call message enters the system via one of the incoming channels and the Terminal Unit to the typing reperforator in the Incoming Unit. The terminal unit serves to provide circuit access jacks for monitoring and patching if required. By means of the jacks it is possible to interconnect different channels and incoming units.

As the message tape is cut in the incoming reperforator the tape is advanced in the associated tape reader until the start of message indicator, (SOM) is read and registered. This action conditions the channel number comparator for this channel to verify the message channel serial number, which follows on the tape immediately after the SOM. A non verification of the number will cause an alarm at the Supervisor's Console and locally at the incoming unit. Verification of the number will cause the incoming unit to demand the services of a Director*, into which the precedence indicator and routing indicator are transmitted by the tape reader. There are normally two Directors associated with each 25 incoming positions.

*The word Director as used herein is a registered trade mark of the Automatic Electric Company.

The Director records and stores the precedence indicator and the first routing indicator. When the first routing indicator has been stored the tape reader is stopped and the Translator Unit is demanded by the Director. The translator unit is common to all Directors of the switching center. When the translator has been seized the routing indicator is transferred into the translator, and following this the translator returns an outgoing line identification to the Director.

The Director must find a suitable cross office position for the message. Since we are assuming that there is no other traffic in the center, the Director uses the Common Control Unit as a means of selecting an empty and idle cross office unit. The cross office units are pooled in such a manner that they are not permanently associated with any incoming or any outgoing line. After seizure of one of these units the Director sets into the unit an indication of the precedence of the message, sets its incoming selector switch to the incoming line, and sets its outgoing switch to the outgoing line. When this has been accomplished the Director is no longer required, so it releases itself from the connection and the message is transmitted to the reperforator of the cross office unit. The Director has been held by this incoming unit for a period of only about 4 to 6 seconds.

In the cross office unit, the new tape which is being cut is advanced through the tape reader until the start of message indicator has been advanced just past the transmitter. At this stage the cross office unit demands the outgoing line. In this case the line is available and thus the line is seized. Immediately upon seizure of the line a special transmitter in the Monitor Unit is used to transmit to the line a new start of message indicator. While this is being done a special transmitter temporarily associated with the cross office unit is used to transmit a three digit serial number to the monitor reperforator. This serial number is used to identify the cross office unit involved, and is not transmitted to the outgoing line. After this has been accomplished the new outgoing channel designation and number are transmitted to both the monitor tape and the outgoing line. Following this the message is transmitted from the cross office unit transmitter to the monitor tape and to the outgoing line.

Up to this point the complete message has not necessarily been received at the incoming unit. When it has been received and transmitted to the cross office unit the incoming selector switch is reset. After the message has completely cleared the transmitter in the cross office unit, the outgoing selector switch is reset and the cross office unit is restored to its pool status.

At this point the special transmitter in the monitor unit transmits an end of message sequence to the outgoing line and then the monitor unit is restored to normal.

B. Single Call Message - Use of a Pre-Set Cross Office Unit

In this example a message is being processed as described in "A" above, and the message has been completely received by the cross office unit, but has not been completely transmitted by the cross office unit.

As the message is received at an incoming line unit the channel number is verified as before and the Director is used as before. However, in this case the Director notes that there is a cross office unit already positioned to the desired outgoing line and has been set for the desired degree of precedence. In addition it notes that the particular cross office unit in question is not busy receiving a message at the incoming side. In this case, then, the Director seizes the cross office unit and causes a second message to be transmitted into it. This message goes into storage behind the first message.

When the first message has been completed the line becomes idle for a moment. In this brief interval all cross office units which are set to the line will demand the line. Only a cross office unit of the highest degree of indicated precedence will gain control of the line. Eventually, then, and strictly in accordance with precedence the last message of our example will be transmitted.

Several points should be kept in mind concerning the use of the cross office pool. These are:

1. Any cross office unit may be set to any line.

2. Any number of cross office units may be set to any line.

3. Any cross office unit may be set to any degree of precedence.

4. Many messages may be stored in any one cross office unit providing they are destined for the same line and carry the same degree of precedence.

5. At no time will any one cross office unit contain messages of more than one degree of precedence.

6. At no time will any one cross office unit contain messages destined for more than one line.

7. When a line is idle it is demanded simultaneously by all cross office units set to the line and only one of the highest indicated degree of precedence will be permitted to sieze the line.

C. <u>Single Call Message - Intercept</u>

We may assume that a message has been received by an incoming unit. It is handled in a routine manner in the Director, but the translator unit fails to find a suitable line indication from the routing indicator, which may have become garbled, or which may have been erroneously punched by an originating operator. In this case the translator directs that the message should be transmitted to an intercept position. An Intercept Unit is seized and set in the usual manner to the incoming unit. When this has been accomplished the Director releases and the message is translated to the intercept unit where it emerges from the cabinet as a piece of message tape.

In this example an operator would be available to repair the garbled indicator and re-insert the message into the network. This is accomplished by use of the Manual Forwarding Unit. At this unit the operator selects a transmitter to receive the message tape and then operates selector switches to position the unit to the desired line and the desired degree of precedence. After this has been accomplished the manual forwarding unit is electrically identical to a cross office unit, and line seizure is on the same basis. Transmission of the message to the line is automatic.

D. Single Call Message - High Precedence

In this example we can assume that a message is being received on one line, that it has been switched to an outgoing line, and that it is of a routine degree of precedence.

A second message is received on another line. As before the Director and translator are used in a normal manner except that the Director in this case has a stored indication of a high precedence (one of the top three) message. Instead of attempting to seize a preset unit, the Director immediately seizes an empty cross office unit and after set up causes transmission to be made to it.

When the high precedence message arrives in a transmitting position an examination of the line indicates that the line is busy and that it is transmitting a routine message. This situation calls for an automatic termination of the routine message. A special transmitter is called into use and is used to transmit a cancellation sequence to the outgoing line. After the completion of the cancellation sequence the line becomes idle momentarily and then is seized by the high precedence unit. A new channel number is transmitted by the monitor and the high precedence message is then transmitted. The "Busted" message remains in the cross office unit and a lamp indicates the presence of a "Busted" message. An operator backs the tape up for re-transmission and then operates the alarm release key. This cross office unit then may again gain access to the line when it becomes available. The "Busted" message will pick up a new number when it is re-transmitted later.

E. Multiple Call Message

We may assume that a message is being received on an incoming unit. It is processed in a normal manner up to the point that the first routing indicator has been read by the Director. After this point the tape reader in the incoming unit continues to read the incoming tape, but in this case a second routing indicator is read and stored before the end of routing line indication has been reached. As the second routing indicator is translated a comparison with the first routing indicator is made. If the second is for a different line an immediate indication of multiple call is made. This causes the Director to seize an idle Multiple Call Cross Office Unit. The unit's incoming selector switch is positioned to the desired incoming line and transmission begins into the multiple call cross office unit. If all routing indicators of any message were translated for the same line the message would be routed by the Director as a single call message and directly into a cross office unit.

When the SOM of the multiple call message arrives at the tape reader in the multiple call cross office unit a demand is made for a set of multiple call processing equipment. This equipment acts very much as a Director, and stores the precedence and the first routing indicator of the message. After translation a suitable cross office unit is seized and the heading and routing information is transmitted into the cross office unit reperforator. This unit is then held temporarily while a second routing indicator is read from the tape. A second cross office unit is seized and the heading and second routing indicator are transmitted into it. In like manner as many cross office units as required are seized and routing indicators are distributed as required. It should be noted that each seized cross office unit may receive as many routing indicators as necessary to building up new multiple call messages for breakdown at further relay centers.

When all routing indicators have been assigned and transmitted to cross office units a multiple transmission of the message is made to all seized cross office units. From this point on transmission to each of the individual outgoing lines is independent of any other line. The multiple call processing equipment is released soon after multiple transmission begins, thus making it immediately available for further processing. Each set of processing equipment has a page printer which monitors all transactions, printing only sufficient characters of the heading to permit an operator to check the routing.

F. Multipoint Operation

When a multipoint station desires to send a message into the switching center, it sends a signal into the Incoming Multipoint Unit.

This signal is reflected into the Outgoing Multipoint Unit which then sends a selective sequence to the remote station. This signal is of such a nature that it causes the indicated station to transmit its message. Selection of this station causes all other stations to be locked out against transmission. When the message arrives at the switching center the channel number of the message is verified against the appropriate register for that particular station. When the message has been completely received the outgoing multipoint unit causes a sequence to be sent to the line which puts all stations back in a standby condition.

If a high precedence message is originated at a station while the line is in use the station having the high precedence message causes a signal to be sent into the switching center thus overriding the low precedence message. This causes a cancellation sequence to be added to the low precedence message which then causes the line to become idle so that the high precedence message may be received.

When the switching center desires to send a message to a remote station the line is seized by a cross office unit in the usual manner. Prior to transmission a selective sequence is sent to the line which causes the proper station to condition its page printer for receiving a message. In the switching center the proper channel number register associated with the station is used to send out a channel number sequence for the particular station.

If the switching center must transmit a selective sequence for incoming line control while the outgoing line is busy transmitting a message, individual characters of the message may be used as the selective sequence. These are coded in a timed sequence. By this means no extraneous characters are inserted in any message as a result of a selective sequence.

Packaging And System Expansion

The AN/FGC-30 equipment is designed for a basic 25 line installation. Additions to the basic system may be made in any quantity up to 250 lines, but the expansion of the common equipment is primarily in units of 25 lines. The equipment was designed for minimum requirement of floor space consistant with convenience of operation and servicing.

All of the equipment is packaged in cabinets which afford ample protection for the teletypewriter and switching equipment. The switching equipment is all mounted on jacked in bases which can be removed quickly and easily for servicing. The teletypewriter equipment likewise is all plug connected and easily removed from the units for servicing. Incoming line equipment is packaged two to a cabinet while the outgoing monitor equipment is packaged five to a unit. Cross Office Intercept Units contain three intercept positions and the Manual Forwarding Unit also contains three positions. Cross Office Units and Multiple Call Cross Office Units are individually packaged. Multipoint equipment is packaged five positions to a unit except for the remote station equipment which is naturally individual.

Operations room equipment has been designed for convenient servicing by operators and for back to back installation to conserve floor space. Switching room equipment is mounted in cabinets 4 feet wide, 2 feet deep and 6 feet 9 inches high and requires access both front and rear since equipment is mounted on both sides.

The number of cross office positions is determined by the amount and type of traffic. Cross office positions consist of cross office units, cross office intercept units and multiple call cross office units. All of these units may be supplied in quantities to fit any given set of traffic requirements.

The common control equipment expands in different patterns. A Translator Unit services up to 125 lines and above that requires a Translator Auxiliary Unit. A Director Unit is required for each 25 lines or part thereof and auxiliary equipment for each Director is required for each added 25 crossoffice positions. One Common Control Unit is required up to 125 lines and above that another one is required. The Common Control Auxiliary Units expand as each 25 lines are added. The Multiple Call Processing Unit with its associated Director Unit will service up to 25 Multiple Call Cross Office Units.

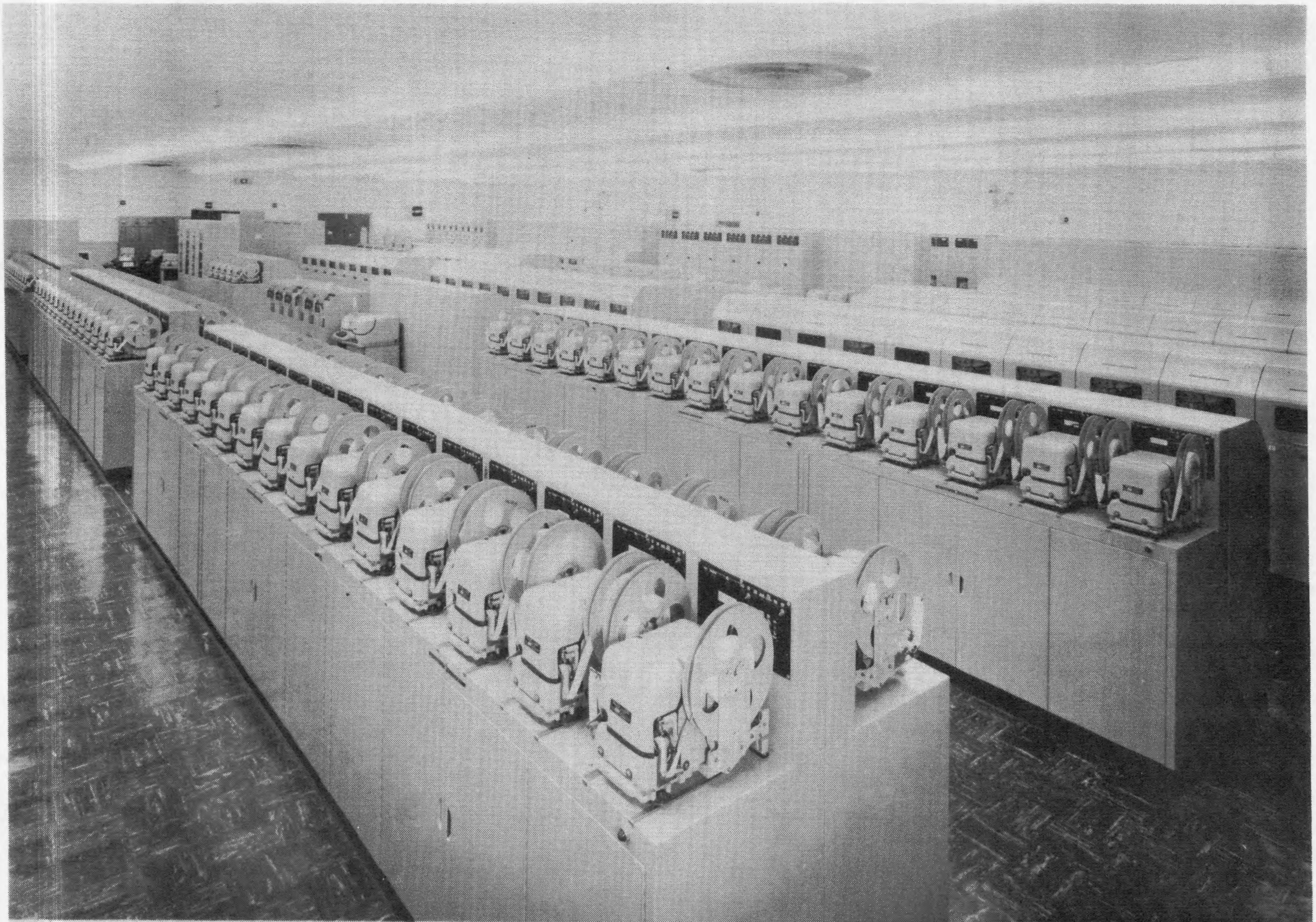
A selector switch is required by each cross office position for each 50 incoming lines or Multiple Call Cross Office Units and another selector switch is required by each Cross Office Unit and manual forwarding position for each 25 outgoing terminals. These switches are packaged 10 to a shelf and five shelves to a cabinet.

The banks of these selector switches are multipled so that any cross office position has access to any incoming line or Multiple Call Cross Office Unit; and any Cross Office Unit or manual forwarding position has access to any outgoing terminal.

The equipment is designed for either under floor or overhead cabling. The under floor method is preferred since no cables show in the room and the installation is easier. Cables from all units terminate on a cable distributing frame where cross connections are made. This reduces the number of cables and provides test points, easy expansion, and a high degree of flexibility.

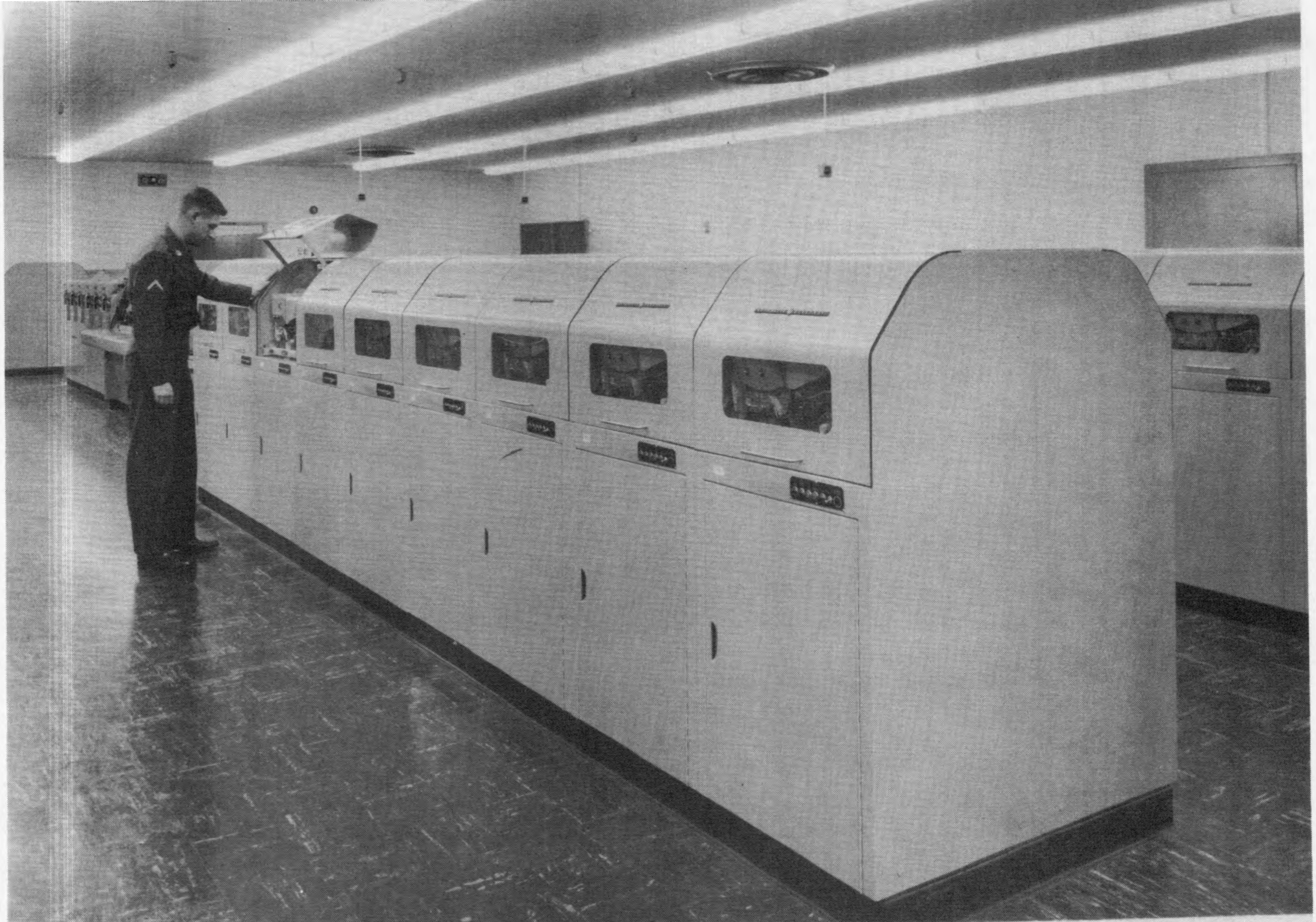
:rk

12-19-56



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
DAVIS INSTALLATION - VIEW OF OPERATION ROOM
LOOKING NORTH

F-2723-I



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
OPERATOR OBSERVING CROSS OFFICE UNIT

F-2709-K

CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
OPERATOR RESETTING CHANNEL NUMBER
INDICATOR ON INCOMING UNIT

F-2702-L

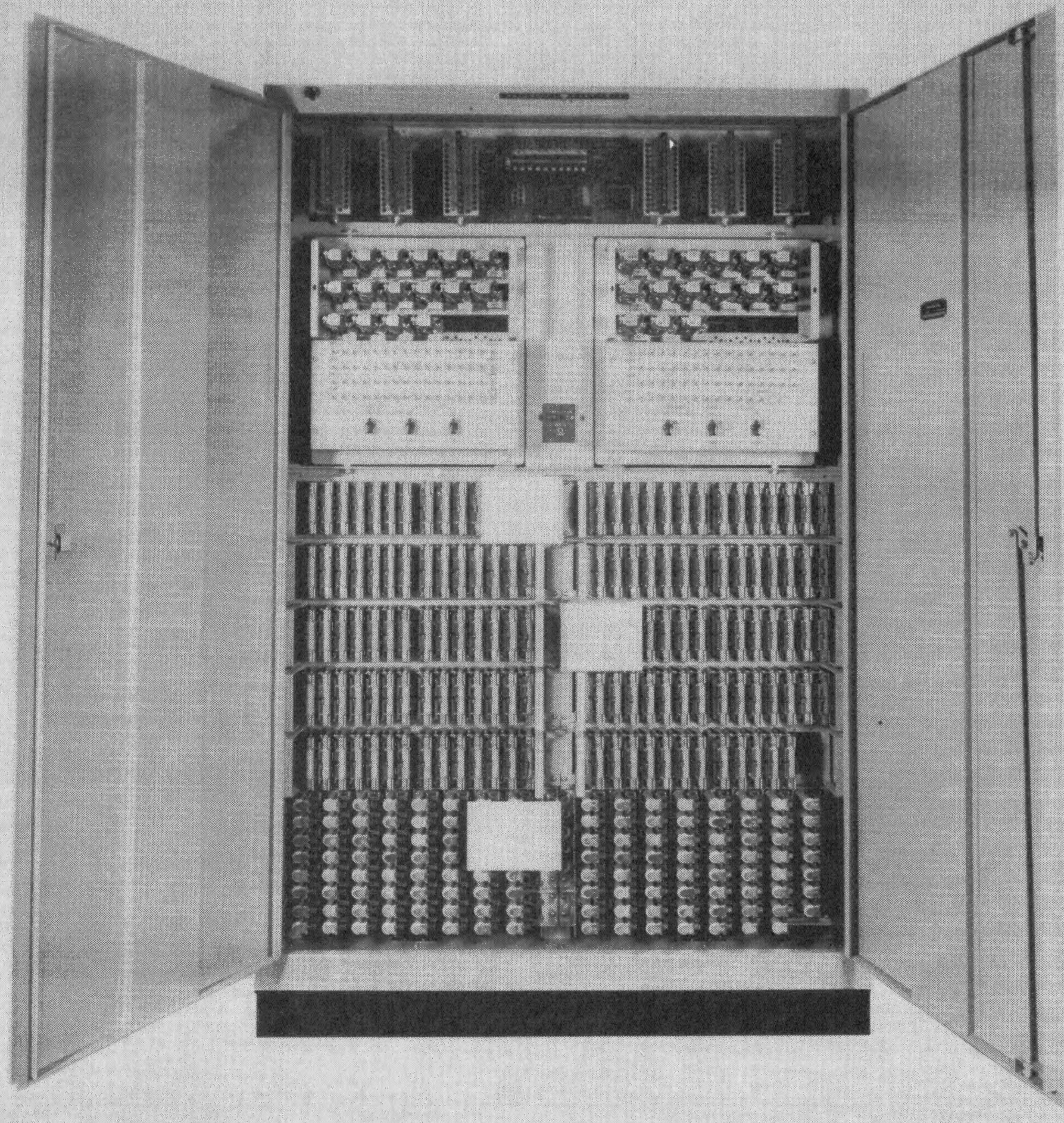
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
OPERATOR AT SUPERVISOR'S CONSOLE UNIT

F-2717-H

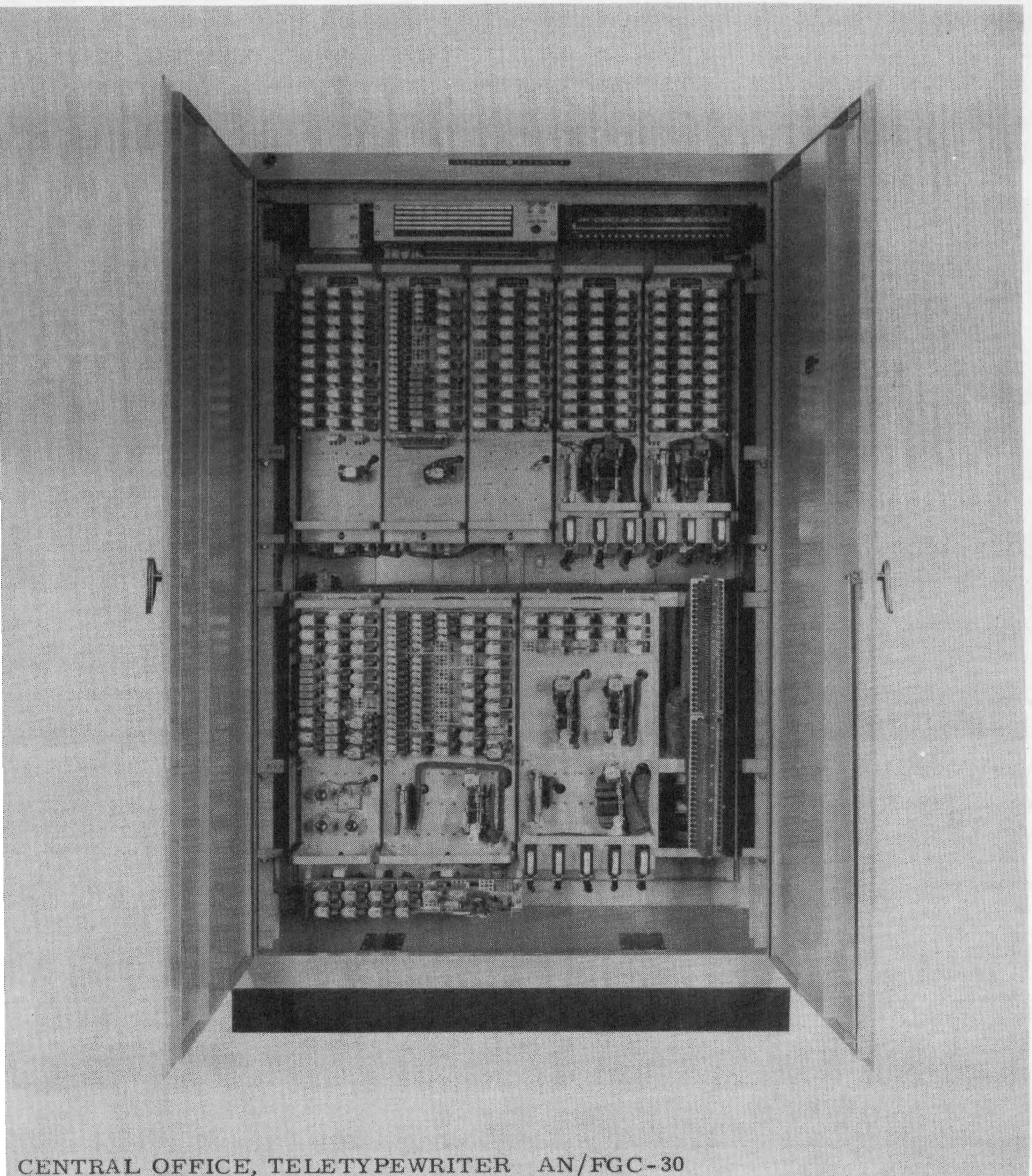
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
OPERATOR SERVICING MANUAL FORWARDING UNIT F-2713-L

CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
DAVIS INSTALLATION - VIEW OF SWITCHING ROOM
LOOKING SOUTH FROM OPERATIONS ROOM

F-2723-G

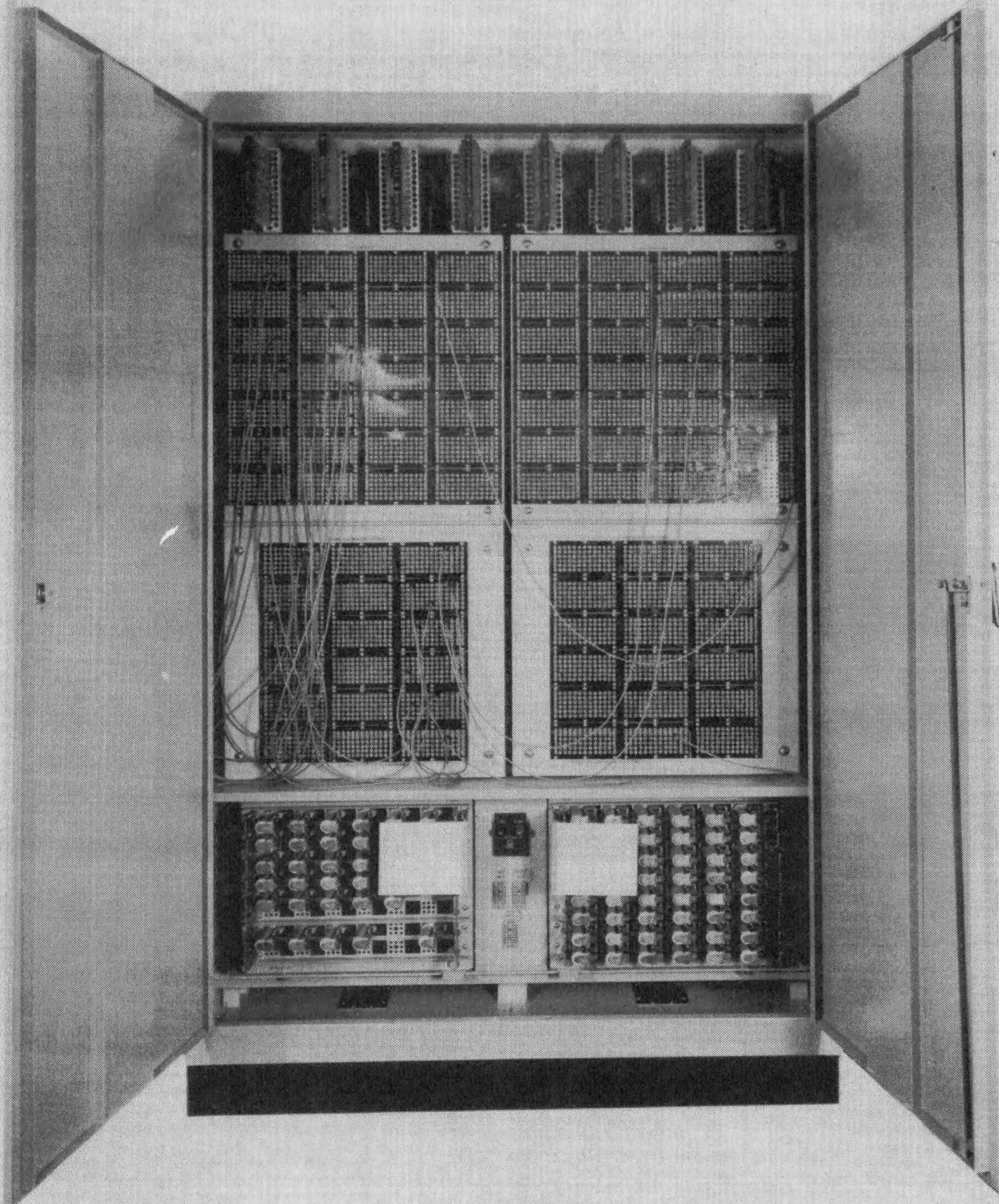


CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
TRANSLATOR UNIT H-881037-1
FRONT VIEW - DOORS OPEN - FULLY EQUIPPED F-2705-A



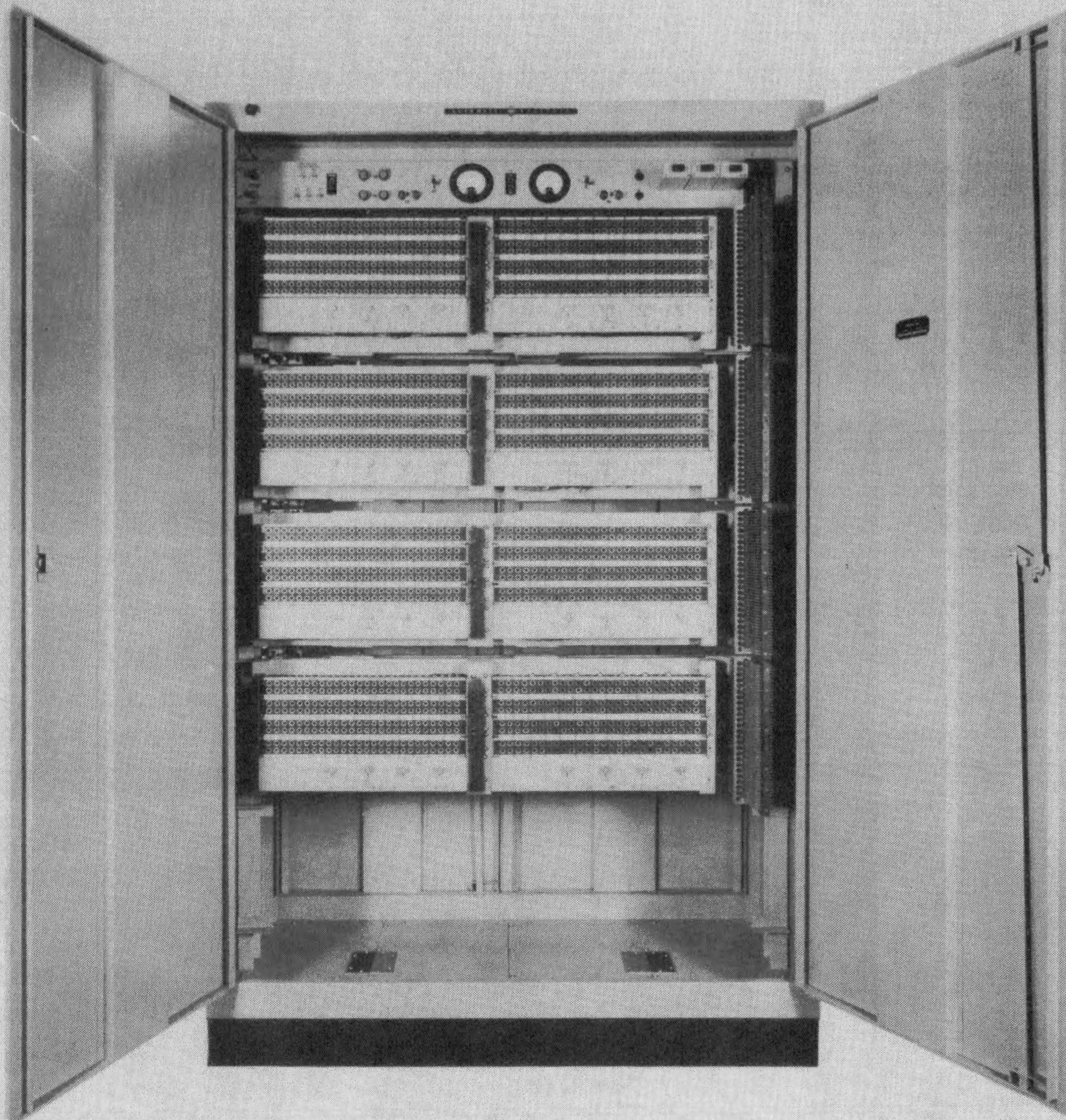
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
DIRECTOR UNIT H-881015-1
FRONT VIEW - DOORS OPEN

F-2703-A



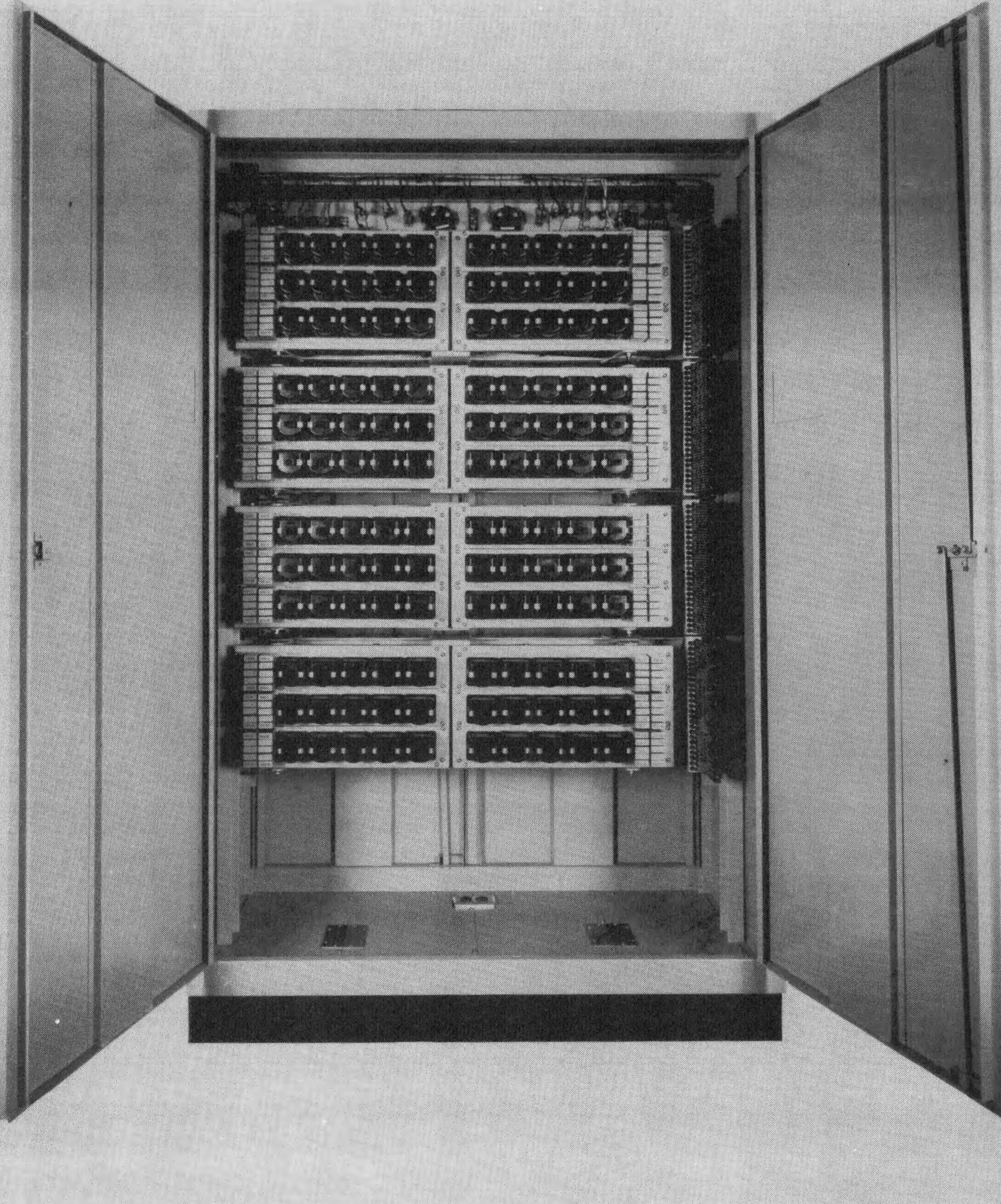
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
TRANSLATOR UNIT H-881037-1
REAR VIEW - DOORS OPEN - FULLY EQUIPPED

F-2705-B



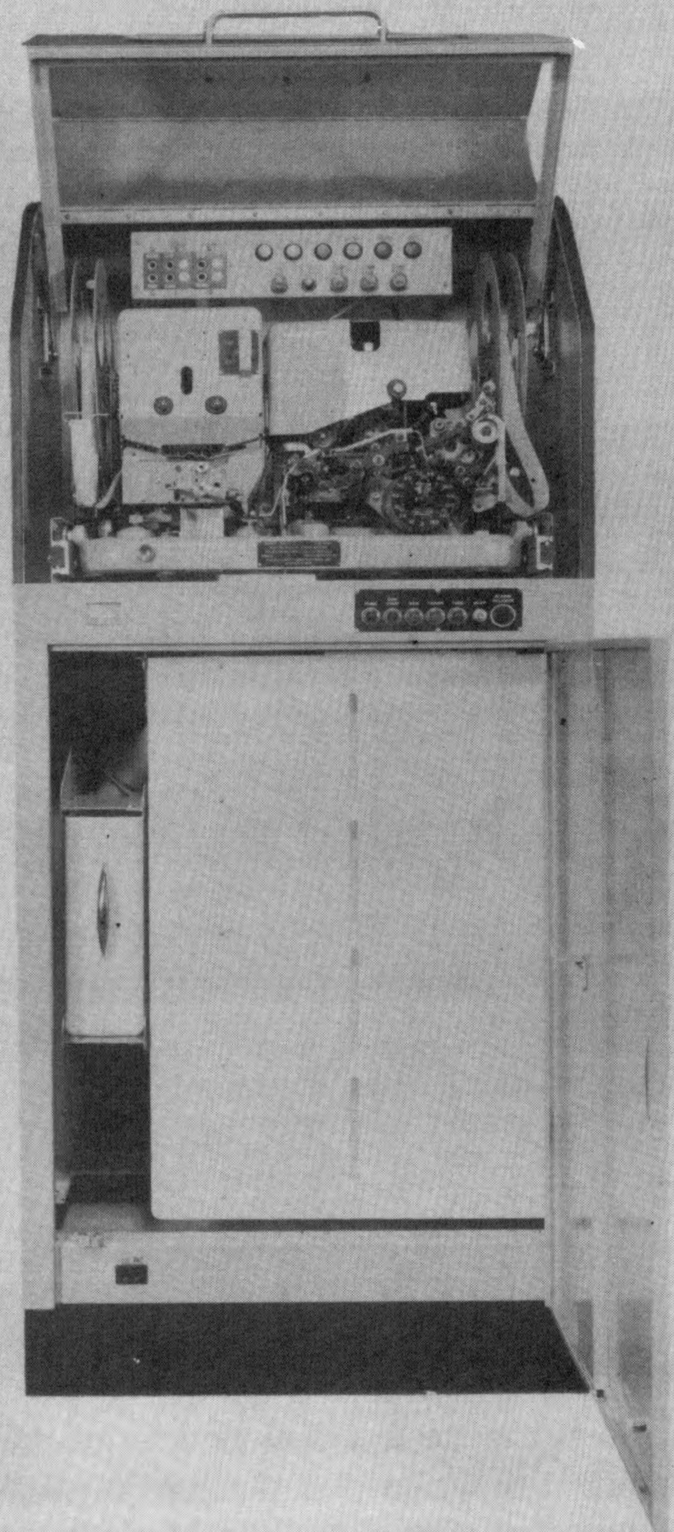
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
TERMINAL UNIT H-881035-1
FRONT VIEW - DOORS OPEN
EQUIPPED WITH 4 TERMINAL UNIT PANELS

F-2701-C



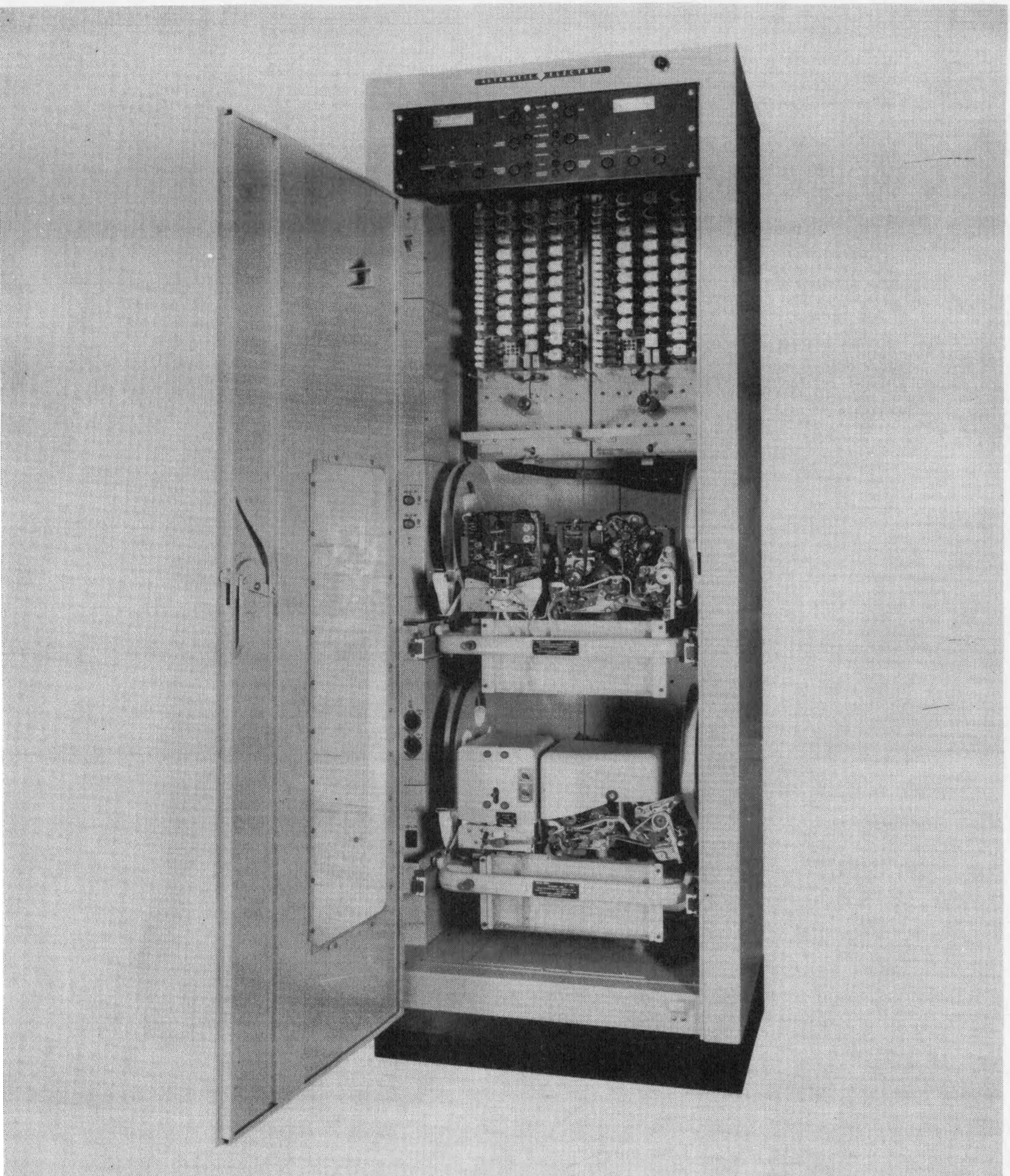
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
TERMINAL UNIT H-881035-1
REAR VIEW - LESS COVER
EQUIPPED WITH 4 TERMINAL UNIT PANELS

F-2701-B



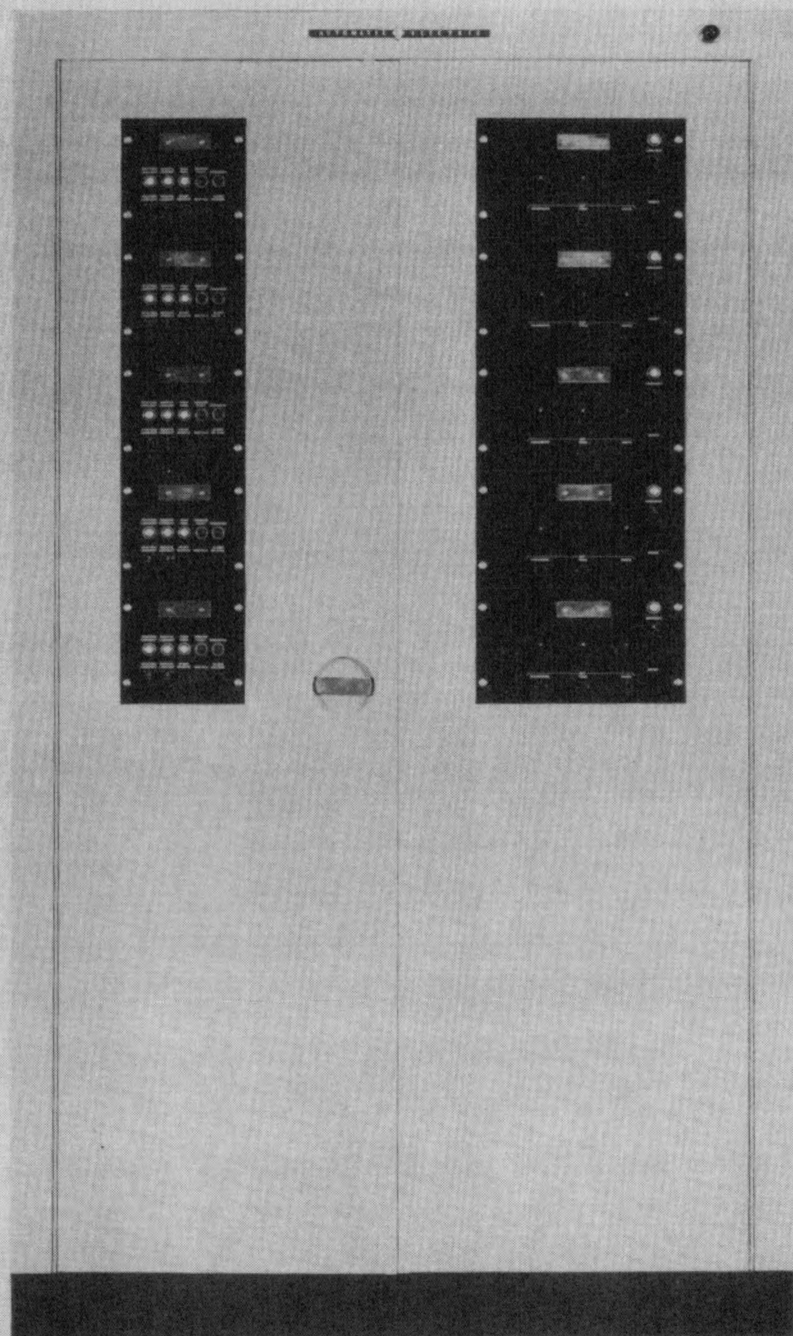
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
CROSS OFFICE UNIT H-881038-1
FRONT VIEW - DOORS OPEN

F-2709-B



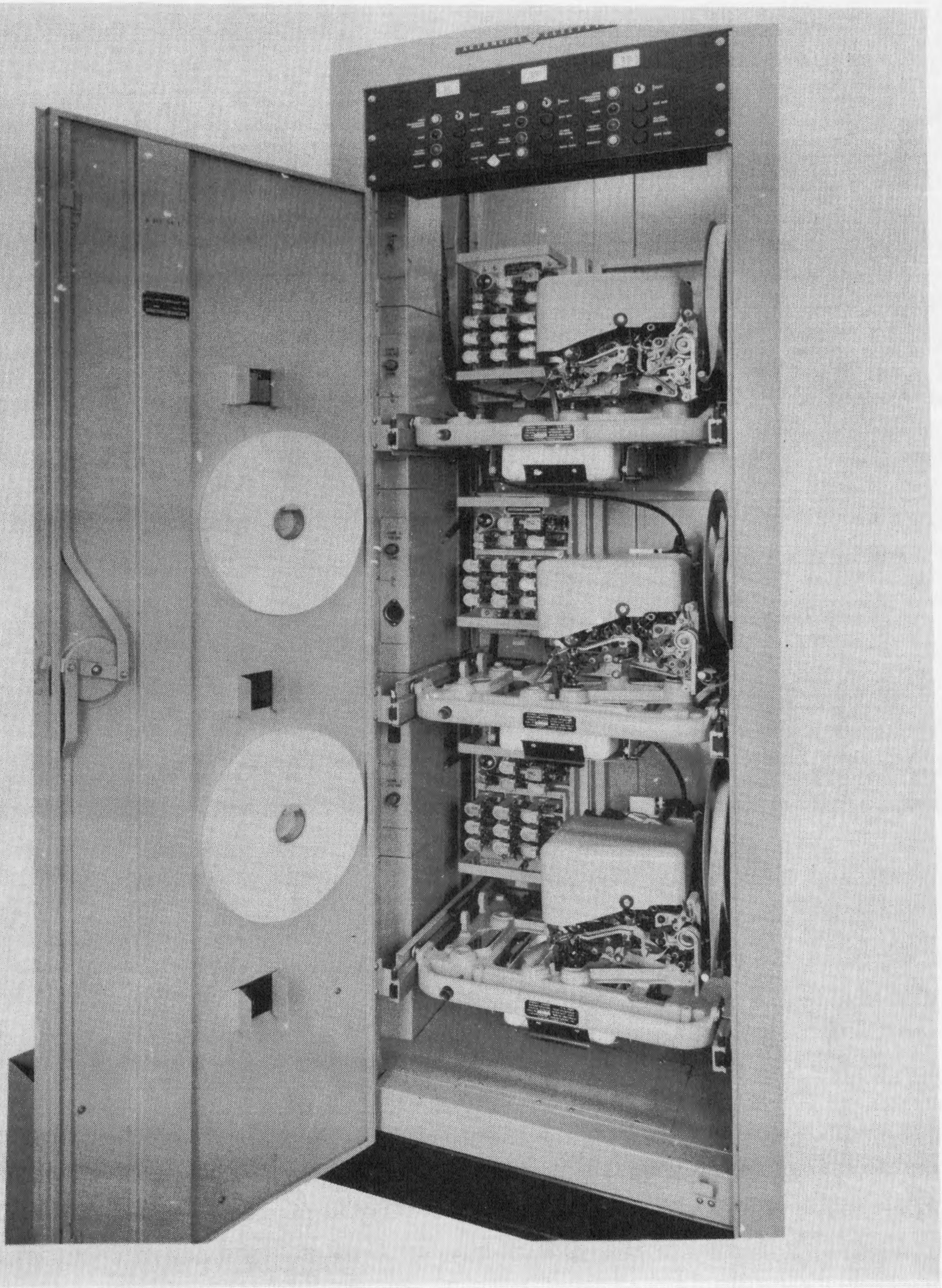
CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
INCOMING UNIT H-881036-1
FRONT VIEW - DOOR OPEN - FULLY EQUIPPED

F-2702-B



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
MULTIPOINT OUTGOING UNIT H-881060-1
FRONT VIEW

F-2725-A



CENTRAL OFFICE, TELETYPEWRITER AN/FGC-30
CROSS OFFICE INTERCEPT UNIT H-881039-1
FRONT VIEW - DOOR OPEN

F-2710-G