

COPY FOR GENERAL PLANT MANAGER
Switching System No. 400 (20-40 DIAL PAK)

20-40
DIAL PAK

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7, N. Y.

AREA CODE 212 393-3195

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ASSISTANT CHIEF ENGINEER

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P.E.L. 6976
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Our expanding line of station switching equipments to meet the more demanding requirements of our customers includes a small and economical dial communicating system capable of handling the telephone needs of customers having less than 40 lines. This new system is designed to provide traffic handling capabilities significantly greater than that of the 6A Key Telephone System, but obviously it will not provide the extended features of the 756A PEX. It affords a means of providing station switching service at attractive rates to those customers whose traffic characteristics fall between a 756A PEX and a 6A Key Telephone System.

We are, therefore, pleased to announce that the Switching System No. 400 has been developed and features:

- a completely packaged 20 line - 6 link basic system expandable to 30 and 40 lines on a plug-in basis.
- two-digit dial communicating service between stations.
- direct central office lines terminated in key telephone sets for stations with heavy outside traffic.
- access from keyless stations to the central office via an add-on feature at an answering station.
- Optional Direct Station Selection (station-to-station).
- provision for future Touch-Tone Calling.
- a new crown terminal assembly featuring the "clip terminal" within the cabinet, thus shortening the installation interval and helping to reduce cost.

The new system is designed, based on studies, for installations where a few of the stations make or receive most of the outside calls. The system provides for direct central office lines terminated in the key telephone sets of the stations having high outside traffic. It provides Direct Inward and Identified Outward Dialing to these key stations - in effect, it provides for the small business some of the features that are usually available only in CENTREX service.

A detailed description of the new system is contained in the attached notes and photographs. Attachment A contains information concerning prices, availability, ordering information, and classification for accounting purposes. Based on these prices, the estimated installed investment of the #400, exclusive of stations, is approximately:

20 lines	\$160 per line
30 lines	\$115 per line
40 lines	\$ 95 per line

These estimates indicated that the new system should find a ready market in the range from 20 lines up to 40 lines. It should also contribute appreciably to improving our performance in "Readiness to Provide Business Service".

The Western Electric Company expects to approach maximum production during the Third Quarter of 1962. They will, however, start shipments on a limited basis in April 1962. The method of allocation to be followed initially will be included in the letter to the Marketing people.

At the request of Mr. Stecker copies of this letter are included for the General Plant Managers. Mr. Landry is writing a separate letter to the Marketing people.

Sincerely,

L. M. Mapes

Assistant Chief Engineer

Attachments

- (A) Ordering, price and availability information
- (B) Notes

To all Chief Engineers

(Copies included for General Plant Managers)

The Western Electric Company advises that price, availability, and ordering information for the Switching System No. 400 is as follows:

<u>Item</u>	<u>Available</u>	<u>Price</u>	<u>Station Accounting Class*</u>
J53035 A-1, List 1 Assembly 20 Line Basic System with 2 add-on circuits (#0, 1) with 4 associated line circuits	4-1-62	\$2785	Major
✓ All-Amer Distrib. J53035 A-1, List 2 Assembly 20 Line Basic System with 2 add-on circuits (#0, 1) with 4 associated line circuits and 2 J53035 BC-1 List 1 Direct Station Selection Units (4 stations per unit - total 8)	4-1-62	3300	Major
J53035 CF-1, List 1 Add-on Line Unit	4-1-62	48	Major
J53035 CG-1, List 1 Key Telephone Line Unit (3 lines per unit)	4-1-62	41	Major
J53035 EB-1, List 1 Line, Link and Connector Unit for 10 lines	4-1-62	200	Major
J53035 BC-1, List 1 Direct Station Selection Unit (4 sta. per unit)	4-1-62 ✓	79	Major
List 2, Diode Assembly (1 per sta.) 8		11.00	Minor
J53035 E-1, List 1 Call Progress Indicating Unit	4-1-62	188	(Tool)

*For ordering as station apparatus,

Switching System No. 400
(20-40 DIAL PAK)

General

The 20-40 DIAL PAK, coded Switching System No. 400, can best be described as a "marriage" of the intercommunicating functions of the 756A PBX and the multi-line switching functions of the 1A1 Key Telephone System. It is a system designed primarily to provide multi-link internal communicating traffic with limited access to outside traffic - including add-on facilities to central office or other PBX lines. The system is a completely packaged crossbar switching unit providing six links (simultaneous talking paths) and twenty station lines in the basic unit. It is expandable to thirty and forty station lines by adding 1 or 2 plug-in (ten station lines) supplementary units. The basic unit also contains two central office line units arranged with the add-on feature. There is space within the cabinet for providing combinations of Direct Station Selection, Touch-Tone Calling and additional add-on units on an optional basis.

Group hunting by a simple strapping arrangement is available in any group of lines having the same tens digit. Hunting can be sequential or non-sequential and in ascending or descending order.

Six simultaneous talking paths (links) are provided, using originating and terminating junctors. Each call uses one originating junctor and one terminating junctor. The capacity of the system is 12 junctors (6 of each).

Contained in this system are three Universal Line Circuits in addition to the regular station line circuits. The Universal Line Circuits are accessible by dialing a single digit 6, 7 or 8, and can be arranged in a hunting group of two or three if desired. Digits are assigned by a simple strapping arrangement in the same manner as assigning a hunting group. These units can be assigned as access circuits to a 3A Code Call System, a customer-owned paging system or a recorded dictation system. There is no junctor in the connection between a regular station line and a universal line, consequently, dial pulses from the station can be transmitted to the associated auxiliary circuit. Appropriate trunk termination circuits must, of course, be provided. Dial "nine" service shall not be provided with this system.

Operation

As stated above, the system has a capacity of forty station lines. However, this station line capacity is reduced by one for each line provided with an add-on circuit.

For example, consider a system having 28 stations, four of which are equipped with key telephone sets, not including primary answering station (Call Director), and the remainder with non-key sets. There are three central office lines in the listed number group and in addition four auxiliary central office lines (other than in listed series).

In this example, the three lines in the listed number group appear on the first three keys of the Call Director, the fourth and fifth keys are vacant, and the sixth key is, as usual, the HOLD key. Each of the three lines has a "companion" dial station line, a requirement inherent in the add-on circuit. Thus, in the second row of six keys in the Call Director, the first three keys pick up the "companion" station lines, the fourth and fifth key may be vacant, and the sixth key can be the ADD-ON key, which is non-locking. Ordinarily, the dial station lines are strapped to hunt in the reverse of the central office line hunting order, that is:

C.O. Line No. 1	is associated with	Station Line C
" " No. 2	" " " "	" B
" " No. 3	" " " "	" A

In this manner, the C.O. line having the highest usage "mates" with the station line having the lowest usage and vice versa.

With the above arrangement, the operation of the add-on feature is as follows:

Incoming Call

1. C.O. line lamp flashes (30 IPM).
2. Primary answering station attendant operates C.O. line key and goes off-hook.
3. C.O. line lamp steady.
4. Attendant operates HOLD key.
5. C.O. line lamp winks.
6. Attendant operates companion station line key and receives dial tone if a link is idle. Station lamp steady.
7. Attendant dials desired station.
8. After ringing starts attendant operates ADD-ON key and goes on-hook.
9. C.O. line and station line lamps steady.
10. Both lamps go dark when called station disconnects.

Outgoing Call

1. The calling station dials the primary answering station.
2. Station line lamp flashes (30 IPM).
3. Attendant operates station line key and goes off-hook. Station lamp goes steady.
4. Attendant operates HOLD key.
5. Station line lamp winks.
6. Attendant operates companion C.O. line key and receives C.O. dial tone. C.O. line lamp steady.
7. Attendant dials desired number.
8. Attendant operates ADD-ON key and goes on-hook.
9. Station line and C.O. line lamps steady.

NOTE
Disconnect is under control of the #400 station whether call is incoming or outgoing, and the attendant may stay in or rejoin the connection by operating the C.O. line or station line key and going off-hook. There are no arrangements for recall in this system. If the #400 station flashes the switchhook, it signals a disconnect releasing the add-on circuit and extinguishing the C.O. and station line lamps.

The four auxiliary lines are terminated in regular 1A1 K.T.S. C.O. or PBX line circuits, and appear on line pickup keys at the four key telephone equipped stations. Also appearing on a pickup key at each of these stations is the #400 line assigned to the station. Hold and illumination may be provided on these stations by terminating them in 1A1 K.T.S. C.O. or PBX Line circuits as above. Auxiliary and station lines appearing at one key station may be bridged at other key station or the Call Director at the primary answering station.

A station-to-station call proceeds in the usual manner. If all links are busy, no dial tone is received by the calling station.

In the foregoing example, the number of station lines are assigned as follows:

Non-key station	24
Key stations	4
Companion Lines at	
Primary Answering Station	3
Total stations	<u>31</u>

Equipment

The Switching System No. 400 is contained in a single cabinet of the 756A PBX-type. The equipment is covered by specification J-53035, and is subdivided as follows:

J-53035 A, List 1

This is the basic, 20 line - 6 link cabinet assembly equipped with two Add-On Line Units (J-53035 CF,L1). Slide No. 2, the center slide, contains the marker and registers (2). The marker is very similar to the marker of the 756A, except that virtually all of the duality has been removed. In addition, all C.O. trunk and attendant facilities have been eliminated. There is space on this slide for four additional mounting plates, and the utilization of this space is discussed in succeeding paragraphs. Slide No. 3, the right-hand slide, contains the line, link, and marker connector control circuits for lines 20 thru 29 and 30 thru 39 and the 3 universal line circuits. This slide also contains the crossbar switches for these lines as well as those for the junctors and dial pulse registers. Slide No. 1, the left-hand slide, contains the power supply, interrupter, and fuse panel. There is space available on this slide for adding two Line, Link, and Marker Connector Control Units for lines 40 thru 49 and 50 thru 59. Connector-ended cables are factory-placed on this slide to connect these 10-line supplementary units.

NOTE

In the crown of the cabinet are located a number of Connecting Blocks, a variation of the 66A-type, quick-connect, clip-type connecting blocks now in wide use in the System.

Also in the crown of the cabinet are capacitors that will supply the System with power during momentary interruptions of the commercial power source. These capacitors will carry the System DC load for approximately $\frac{1}{4}$ second. There are no provisions in the #400 for battery operation.

NOTE

The cabinet of the #400 differs from those of the 756A only in that it has a lift off panel on the front as well as the sides. During maintenance and installation operations these covers can be removed and set aside.

J-53035 E, List 1 - Marker Call Progress Set

This is a separate test set for installation and maintenance activity and consists of a number of lamp and designation strips contained in a portable metal cabinet with a plug-ended cable. When the connection cable is mated with the connectors on the marker slide, Slide No. 2, a series of ground signals are passed from the marker to the lamp field in direct relationship to the progress of a call through the marker. Under normal circumstances, the call progress lamps flash only momentarily as the marker relays operate and release. If, however, the function in the marker is blocked, the lamps will indicate the point of failure in the progress of a call. Reference to the Circuit Description will enable tracing the path of the call.

J-53035 BB, List 1 - Line, Link, and Connector Unit

This is the 10-line supplementary unit required to expand the System to 30 to 40 lines. It consists of a crossbar switch and a number of relays wired to three 50-point connectors on the rear of the unit. This unit is mounted on the slide by means of four screws. It is connected by plugging in the multi-connector-ended cable provided with the slide.

J-53035 CF, List 1 - Add-On Line Unit

This is a single 2" x 23" mounting plate unit, containing all the apparatus required to provide the add-on feature on one C.O. line. The unit is made up of three parts: a C.O. line circuit, an add-on circuit, and a station line circuit. The C.O. line and the station line circuits are functionally the same as the C.O. or PBX Line Circuit of the 1A1 Key Telephone System (SD-69270-01) (202-, 230-, 238-, 239-type K.T.U.), and, as such, provide for pickup wink and hold with illumination. The add-on circuit is functionally similar to the PBX Bridging Circuit (237-type K.T.U.) of the 1A1 K.T.S. The major differences are that the Add-On Line Unit operates on 48 VDC rather than 24 VDC and the apparatus is mounted on a 2" mounting plate rather than a 7" panel. Lamp, ringing, and DC power is provided by the main power plant which contains an interrupter for ringing as well as lamp flash and wink.

48V DC

J-53035 CG, List 1 - C.O. Line Unit

This is a single 2" x 23" mounting plate unit, containing three C.O. Line Circuits. These circuits are identical in services and features to the aforementioned 1A1 K.T.S., C.O. or PBX Line Circuit, the only difference being 48 VDC operation rather than 24 VDC. The unit can be used to terminate auxiliary C.O. or PBX lines where the add-on feature is not required.

Key Telephone Unit - 24V Add-On Line Circuit (Under development)

This will be functionally the same as the Add-On Line Unit (J-53035 CF, List 1) but arranged for 24 VDC operation with the apparatus is mounted on a 7" panel. It is used in those systems where the C.O. line with add-on requirement exceeds the available space within the cabinet. It can be mounted in any standard apparatus cabinet designed to mount 200-type Key Telephone Units, and a separate power plant and common circuit unit (232-type K.T.U.) is required. ← NOE

J-53035 BC, List 1 - Direct Station Selection Auxiliary Station Relay Unit

Each 4" x 23" mounting plate unit contains the equipment to enable up to four stations to originate a call to any one of ten other stations. This is done by operating a non-locking button designated with the called party's number or initials (after dial tone has been received). One button per station called is required at the originating station. All stations in the #400 may be equipped with this feature by ordering the proper number of units (one unit per four calling stations). The 10 stations called can be any of the stations in the #400 and the four originating stations are not limited to calling the same 10 stations.

J-53035 BC, List 2

Plug-in diode assembly that is required in addition to List 1 for each station arranged for DSS. A maximum of four List 2 will be required to fully equip each List 1.

Miscellaneous

As stated previously, there are a total of six mounting plate spaces on Slide No. 2 that can be used for any of three equipment units. Since two of these spaces are taken up by the two factory-equipped Add-On Line Units, there are four spaces remaining for growth or added feature units. The various ways in which this space can be utilized are shown in the following table.

<u>Unit</u>	<u>Number of Circuits Equipped</u>		
	<u>T-TC Receiver</u>	<u>Add-On Lines (J-53035 CF, L-1)</u>	<u>C.O. Lines (J-53035 CG, L-1)</u>
Circuits per unit	1	1	3
Mount Plate Spaces per unit	2	1	1
Combinations of Units	0	2 (min.)	12
	0	3	9
	0	4	6
	0	5	3
	0	6	0
	1	2	6
	1	3	3
	1	4	0

The optional Direct Station Selection Units (J-53035 BC, L-1) may be mounted in the space provided on Slide No. 1 in place of the Line, Link and Connector Units for Lines 50-59 if these are unequipped.

When the maximum number of stations are equipped, it will be necessary to mount the Direct Station Selection Units externally. Standard cabinets similar to Fig. 8 are available for this use.

Drawings and Practices

Circuits and equipment of the No. 400 are covered in the following drawings. Equipment Description is covered in BSP AA 321.025.

Keysheet	SD-69473-01
Marker	SD-69468-01
Line, Link & Connector Ckt.	SD-69469-01
Dial Pulse Register	SD-69470-01
Alarm and Test	SD-69471-01
Cabling Diagram	SD-69463-01
Junctor	SD-69464-01
Busy Tone Trunk	SD-69465-01
Key Tel. and Add-On Line	SD-69466-01
Aux. Rel. Ckt. for DSS at Stations	SD-69467-01
Power Supply	SD-81577-01
Call Progress Indicating Ckt.	SD-69472-01

Plant Series practices are being issued covering installation, maintenance, and testing of the new system. They are as follows:

C71.861.00	Identification
C71.861.01	Installation
C71.861.02	Connections
C71.861.10	Alarm Circuit - Operation Tests
C71.861.11	Key Tel. Line and Add-On Circuits - Operation Tests
C71.861.12	Line, Link and Marker Circuits - Operation Tests
C71.861.13	Junctor Circuits - Operation Tests
C71.861.14	Dial Pulse Register Circuits - Operation Tests
C71.861.15	Busy Tone Trunk - Operation Tests
C71.861.16	Call Progress Indicator Set - Description and Use

CJN:KT

Attachments

- Figure 1. Diagram - Switching System No. 400
2. No. 400 Cabinet - Closed
 3. No. 400 Cabinet - Panels removed, Crown raised
 4. No. 400 Cabinet - Slide 1
 5. " " - " 2
 6. " " - " 3
 7. " - Call Progress Indicator connected to marker
 8. Auxiliary Apparatus Cabinet enclosing Direct Station Selection equipment and/or additional C.O. line and Add-On conference equipments
 9. Floor plan
 10. Call Progress Indicator

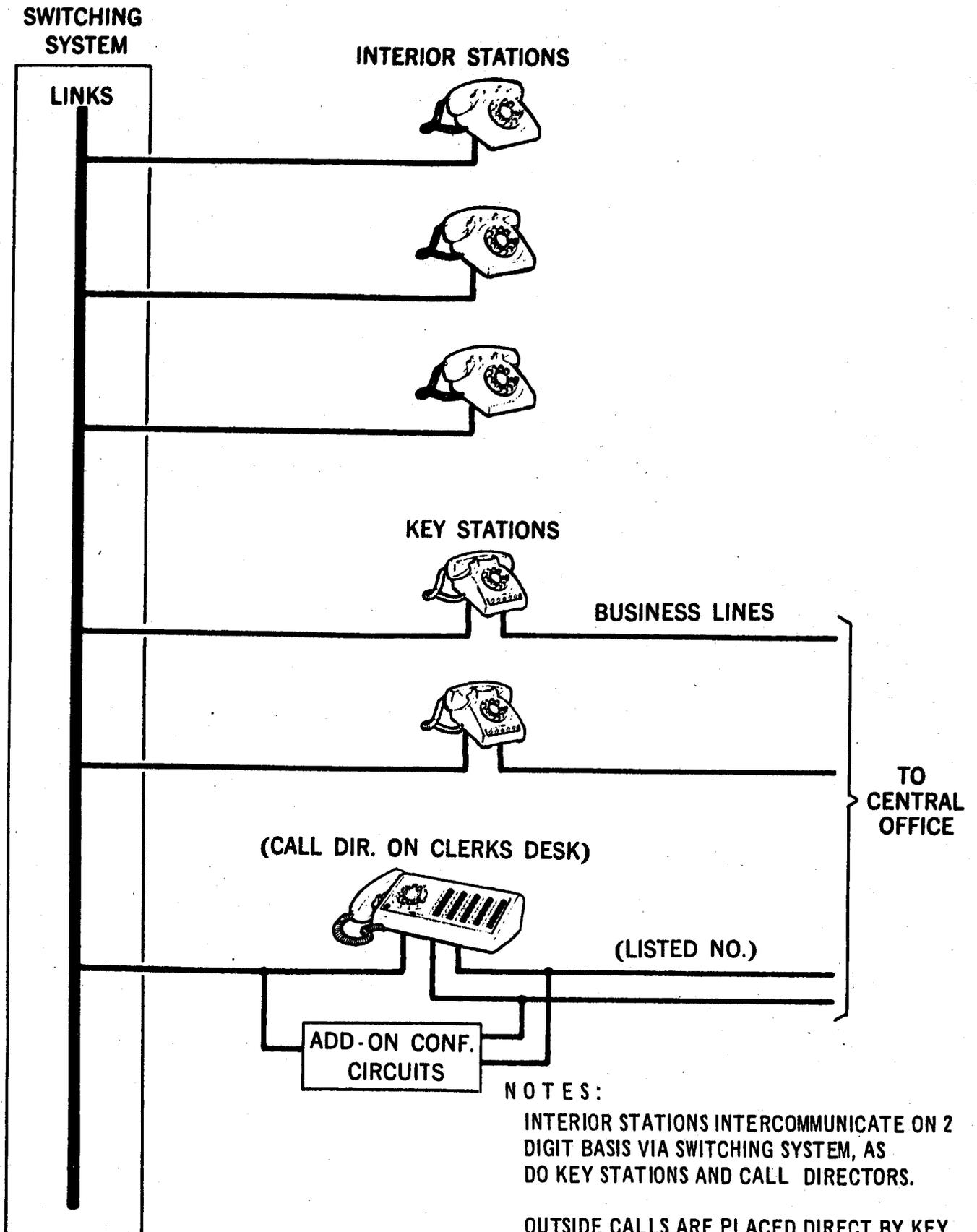


FIG. 1
Switching System No. 400
Diagram

NOTES:

INTERIOR STATIONS INTERCOMMUNICATE ON 2 DIGIT BASIS VIA SWITCHING SYSTEM, AS DO KEY STATIONS AND CALL DIRECTORS.

OUTSIDE CALLS ARE PLACED DIRECT BY KEY STATIONS. INTERIOR STATIONS HAVE ACCESS TO CENTRAL OFFICE VIA CALL DIRECTOR WITH ADD-ON CONFERENCE CIRCUITS.

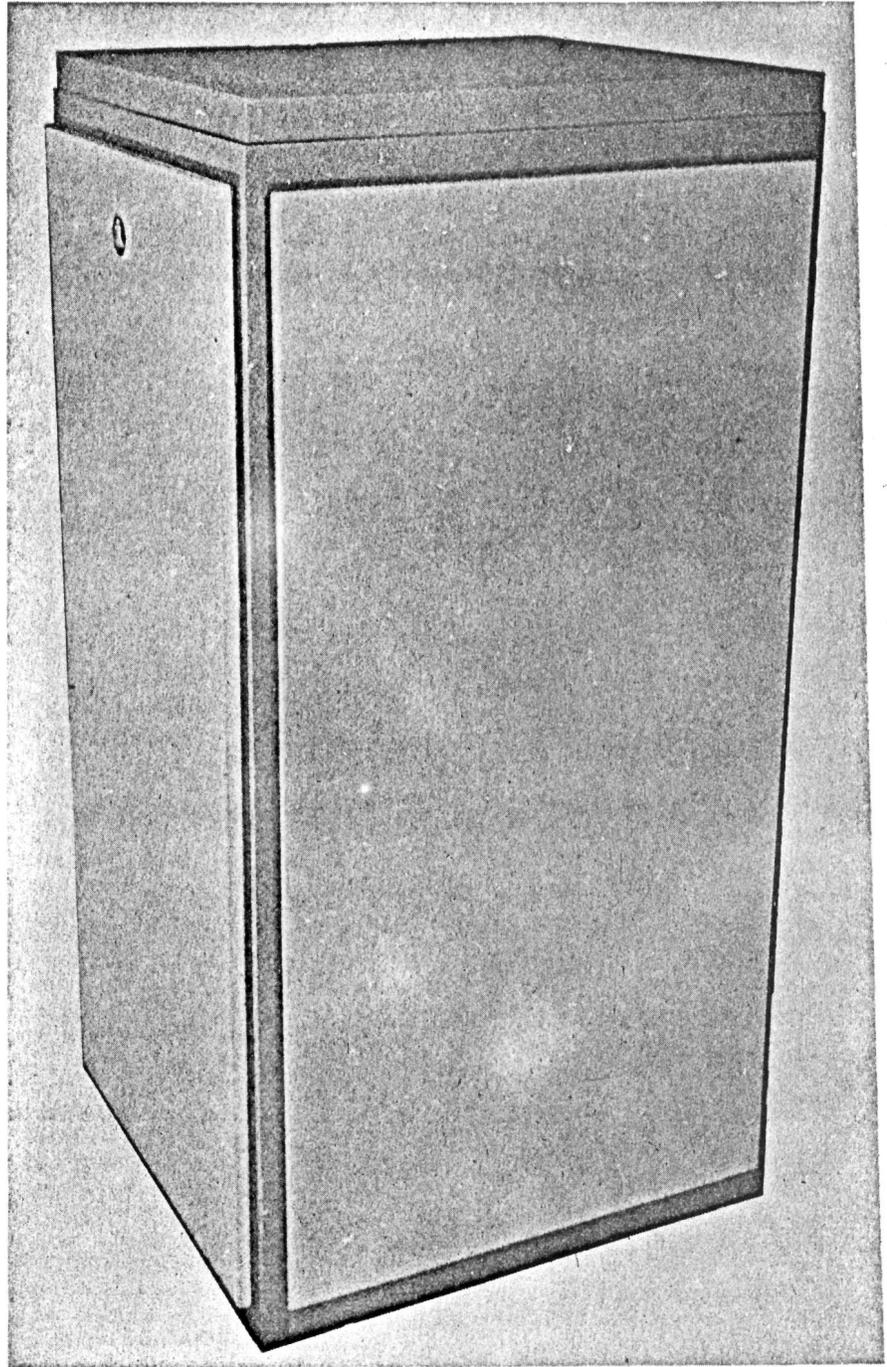


FIG. 2
Switching System No. 400
Equipment Cabinet-Closed

Capacitor
Panel

Crown Connecting
Blocks

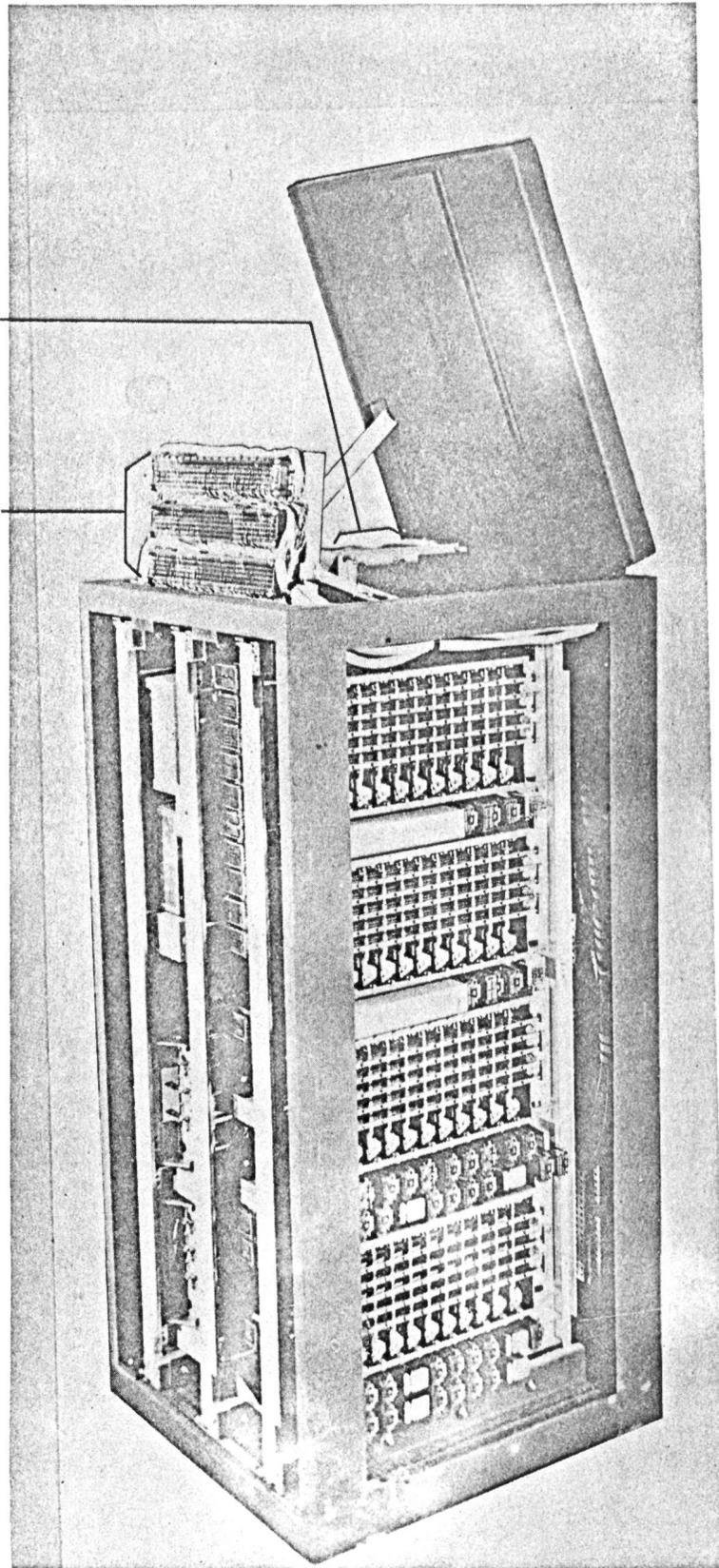


FIG. 3

Switching System No. 400
Equipment Cabinet - Front and Side
Panels Removed With Crown Raised
And Terminal Strip In Vertical Position

Slide No. 1

Power Supply

Alarm, Test & Fuse Panel

Line No's 50-59

Line No's 40-49

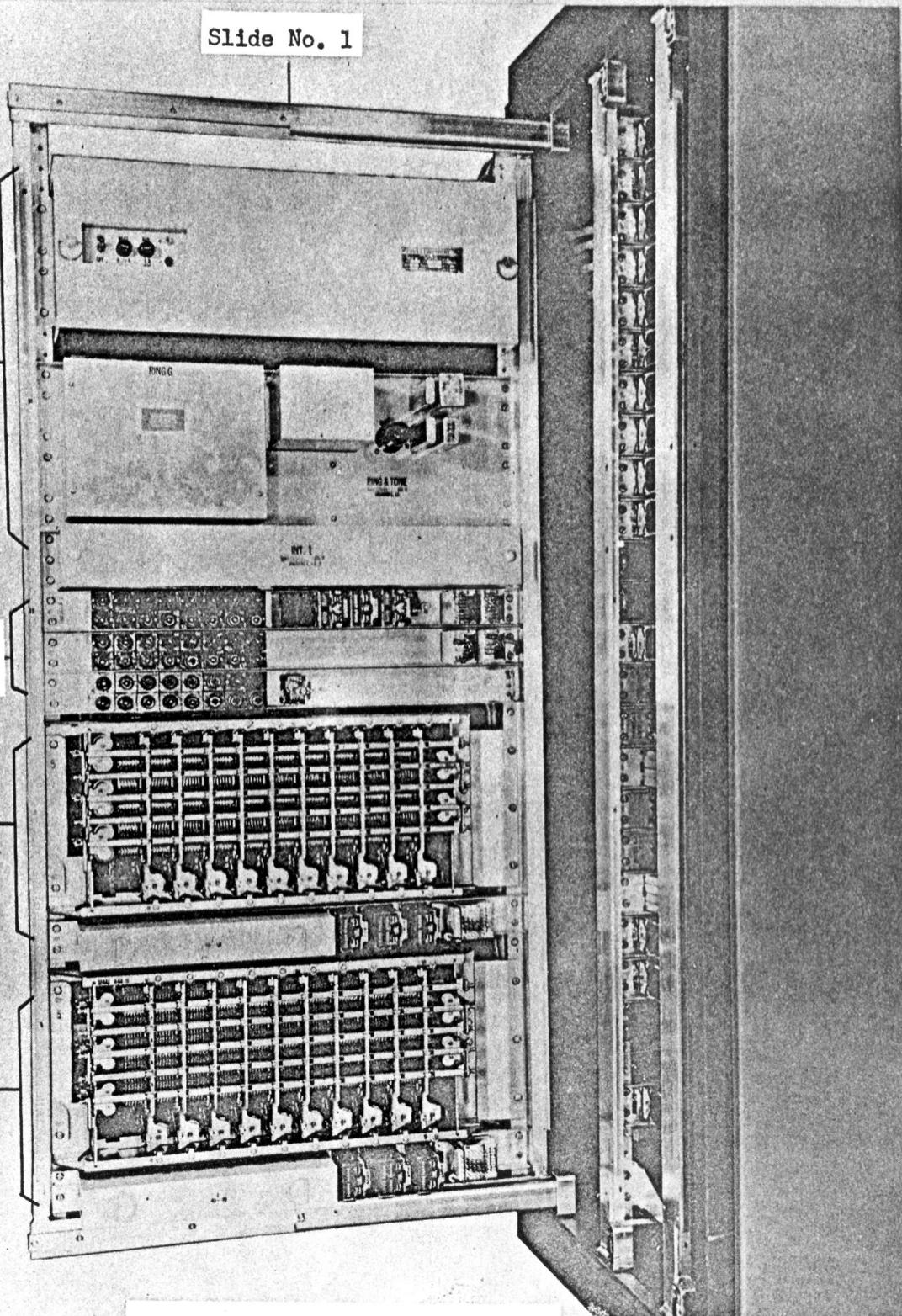


FIG. 4

Switching System No. 400
Equipment Cabinet - Front Panel
Removed and Slide No. 1 Open

Slide No. 2

Marker

Reg. 1

Reg. 0

Add-On

Key Tel
Unit

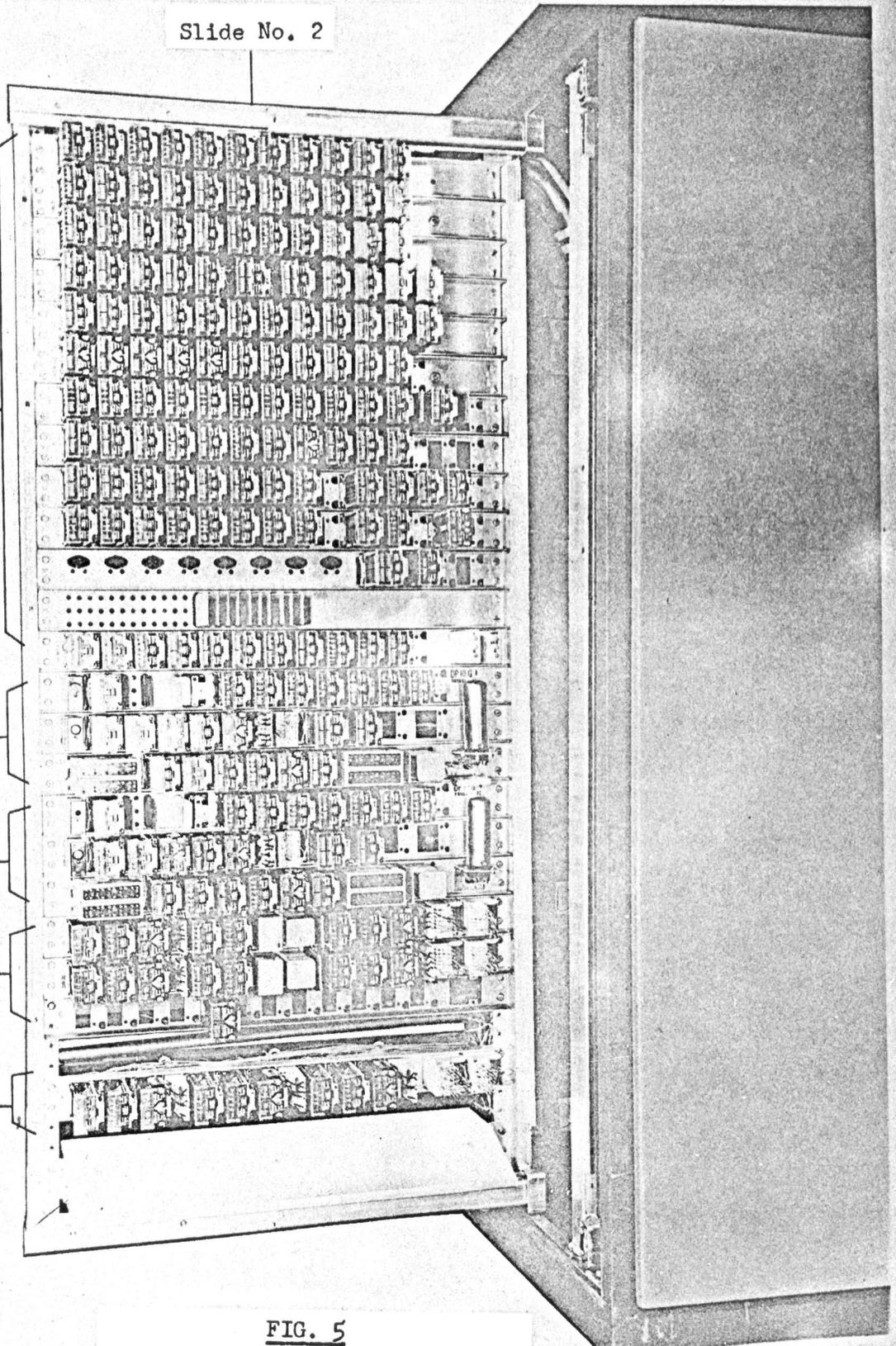


FIG. 5

Switching System No. 400
Equipment Cabinet - Front Panel
Removed and Slide No. 2 Open

Slide No. 3

Line
No's
30-39

Line
No's
20-29

Universal
Lines,
Busy Tone,
Juncture

Juncture

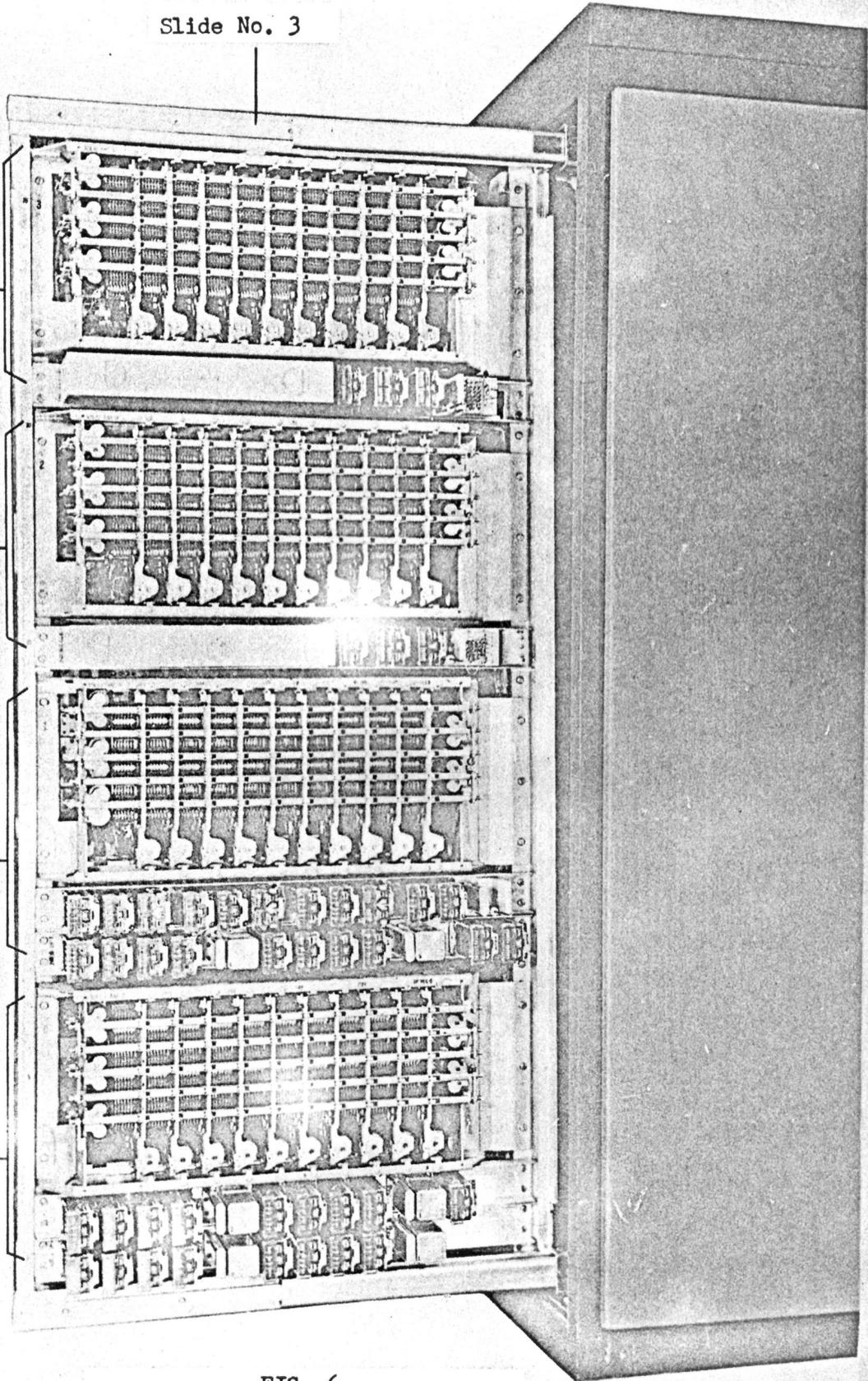


FIG. 6

Switching System No. 400
Equipment Cabinet - Front Panel
Removed and Slide No. 3 Open

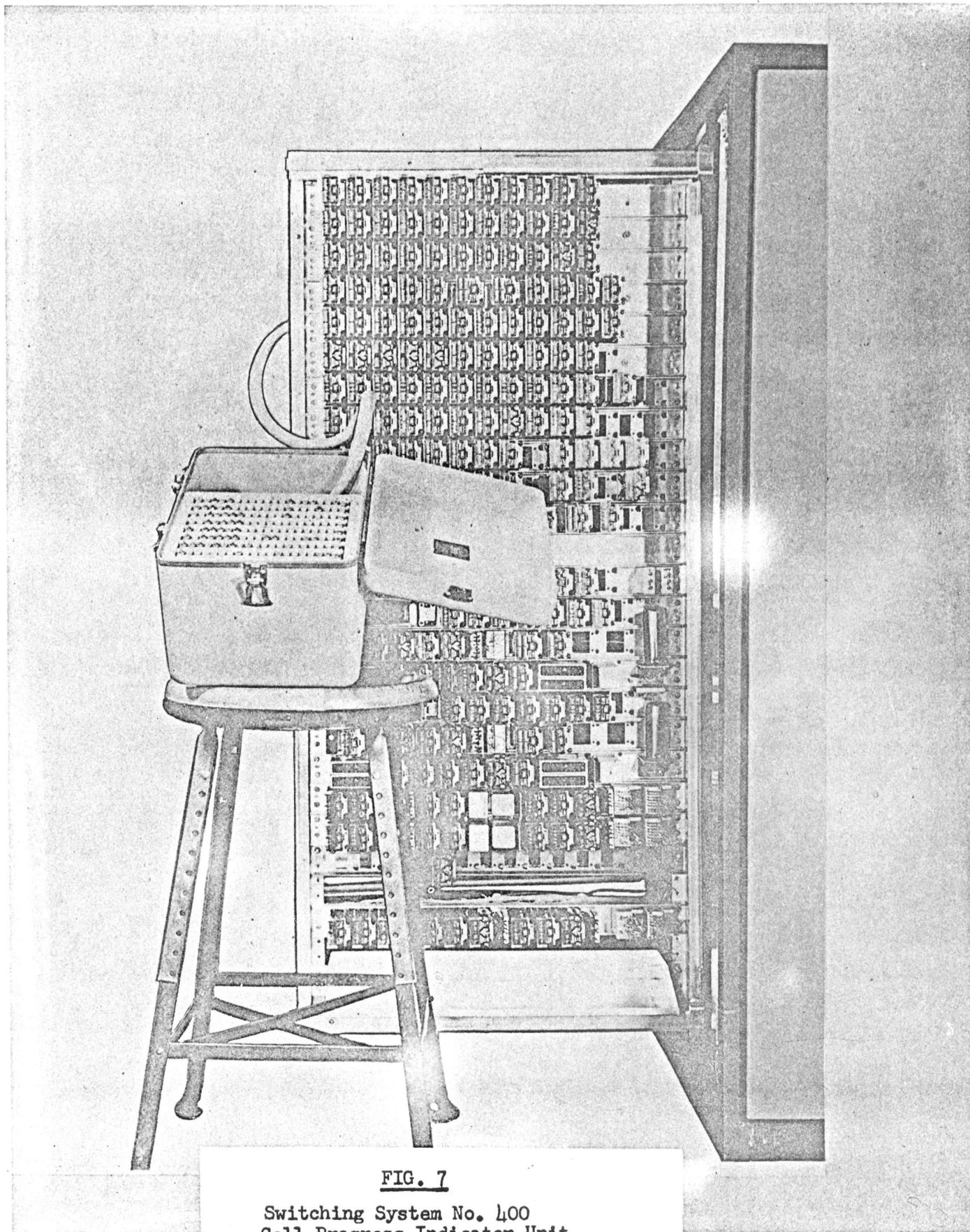


FIG. 7

Switching System No. 400
Call Progress Indicator Unit
Connected To Marker At. Slide No. 2

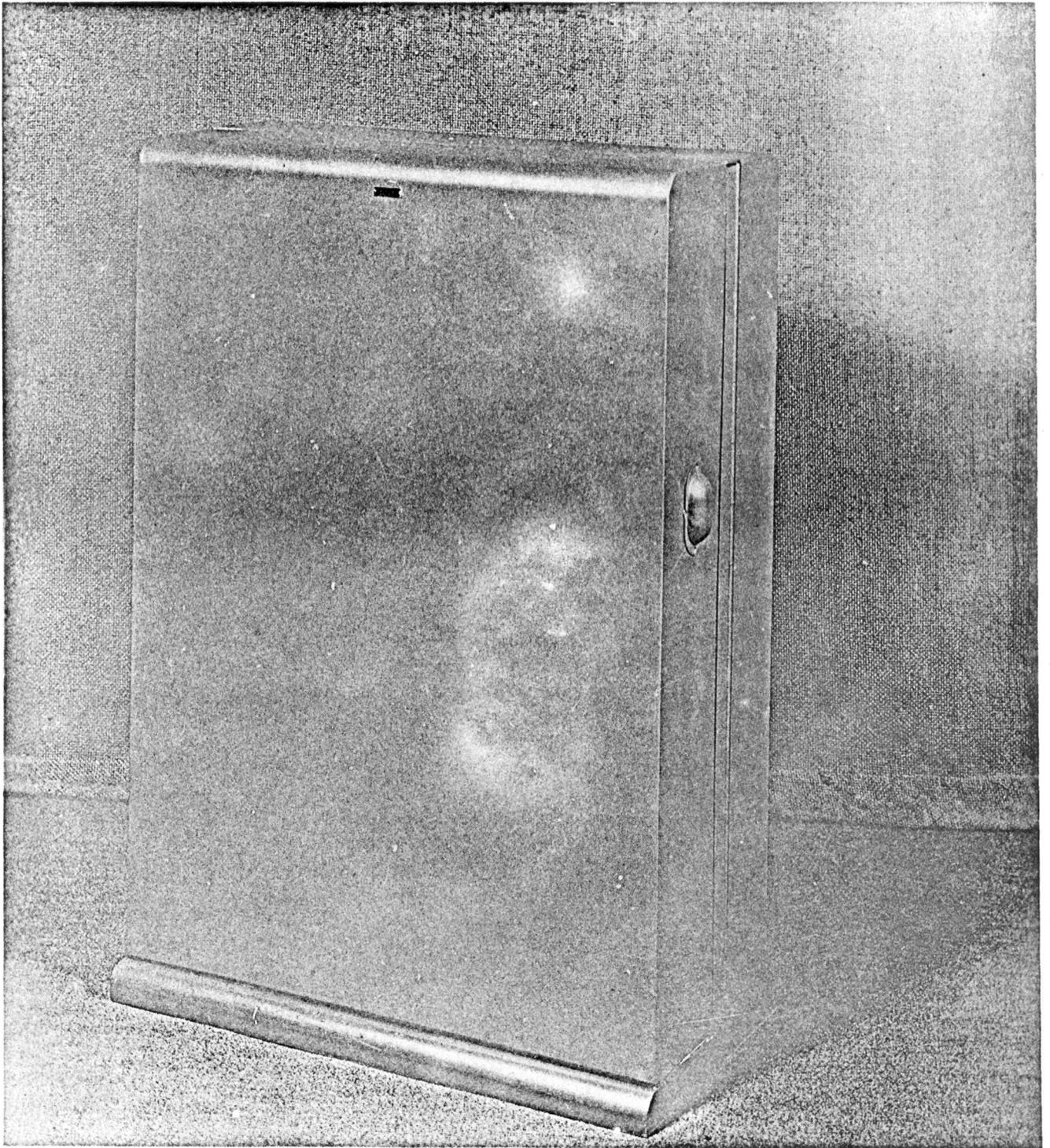
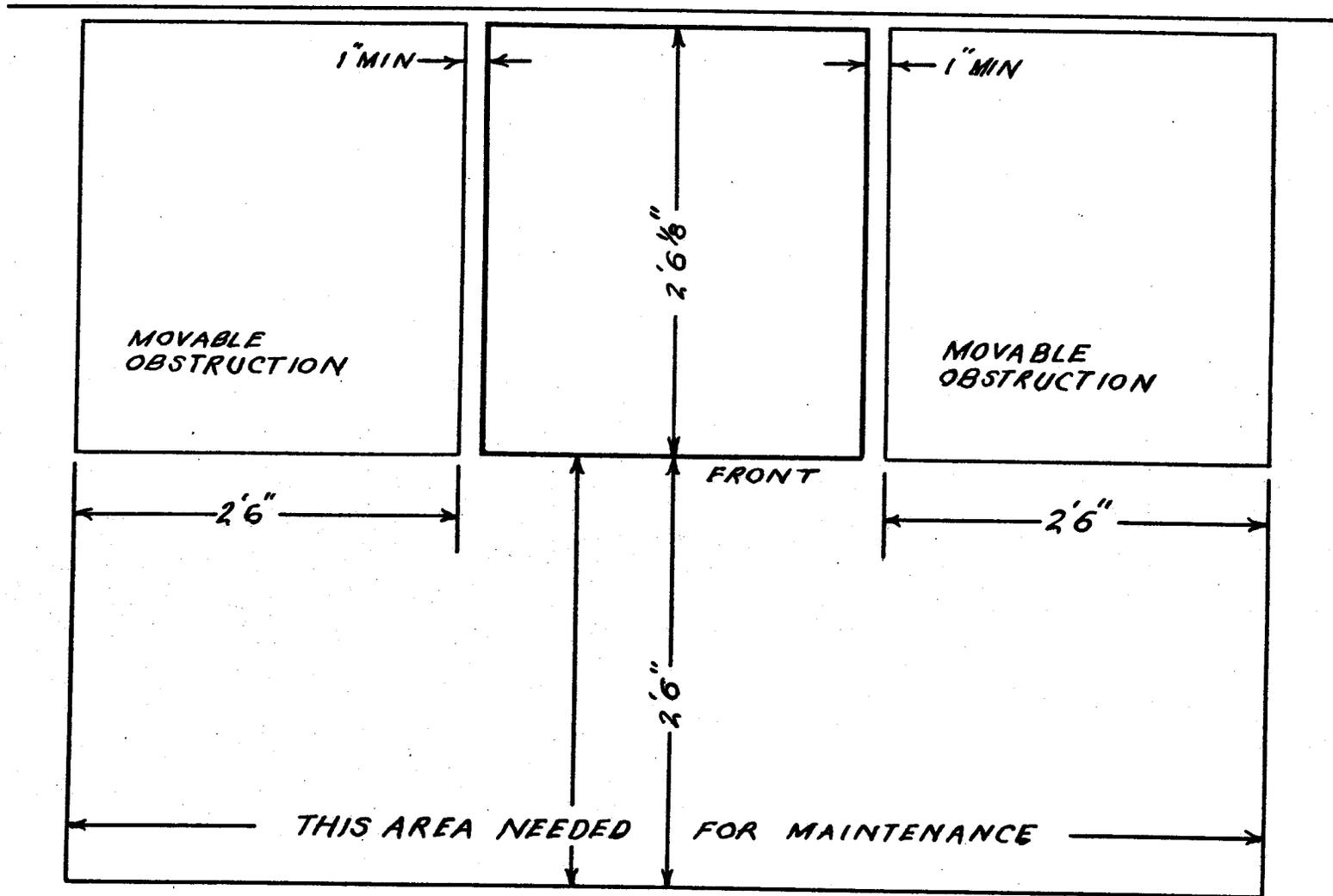


Fig. 8
Switching System No. 400
Auxiliary Apparatus Cabinet



Note: Cabinet is 2'-3-1/4" wide, 5'-3-5/8" high, and with top fully open 7'-8-1/2"

FIG. 9
Switching System No. 400
Floor Space Requirements

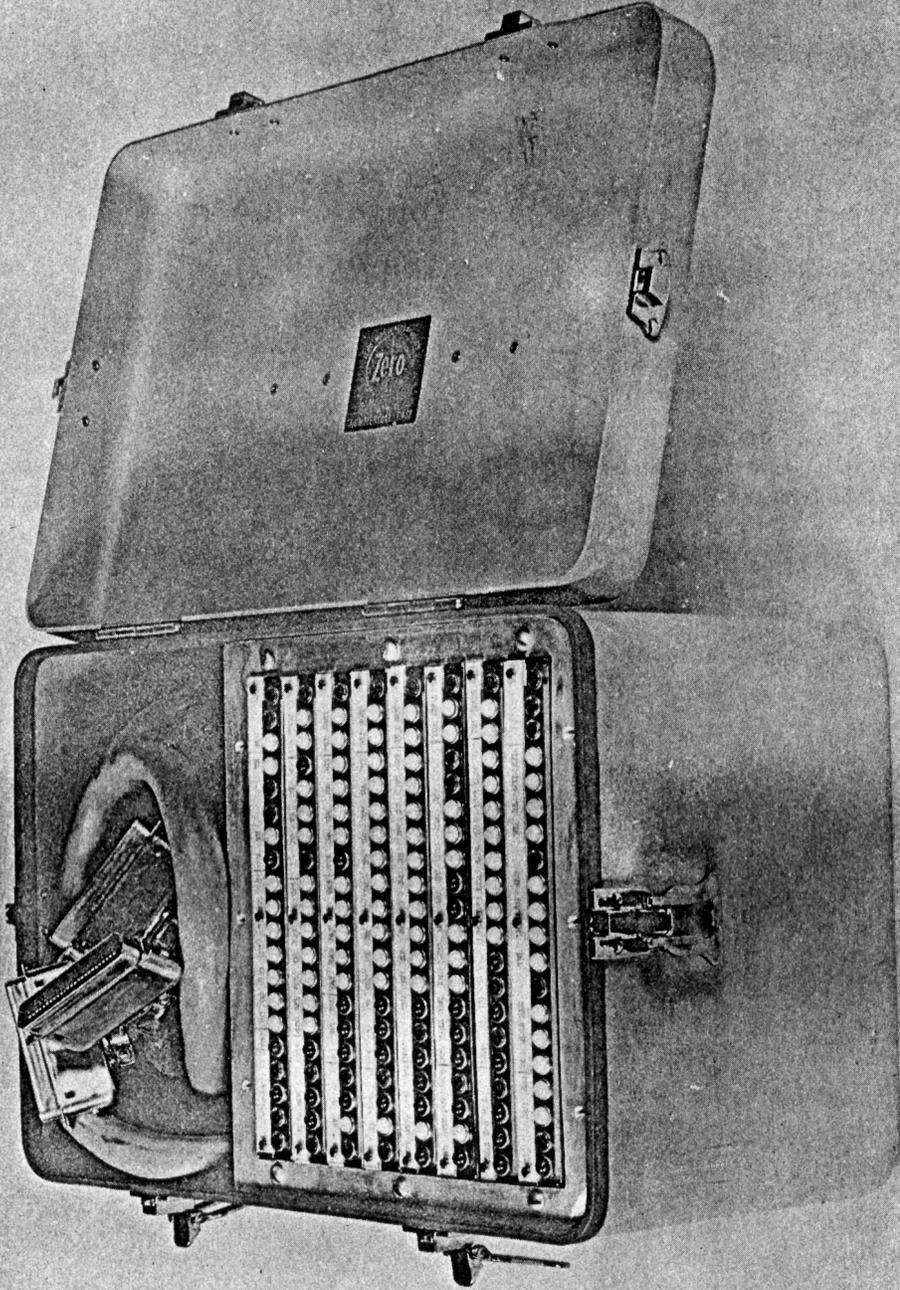


FIG. 10

Switching System No. 400
Call Progress Indicator Unit