

NOTES

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THE BELL TELEPHONE LABORATORIES, INCORPORATED

NORTH CX TYPE DIAL CENTRAL OFFICE EQUIPMENT

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NORTH CX TYPE DIAL CENTRAL OFFICE EQUIPMENT

These notes describe briefly the all relay dial central office equipment manufactured by the North Electric Mfg. Co. This equipment is available in five general arrangements for use where suitable in the community dial office field.

As this equipment is designed, considerable variation in arrangement and features is possible. The arrangements herein described are those which have been selected from information supplied by the manufacturer as appearing best adapted to the needs of the Bell System.

GENERAL DESCRIPTION

In this type of office the switching operations are performed entirely by relays grouped into basic circuits called line finders, selectors and connectors, each with the functions usually associated with such circuits. The combination of a line finder and a connector is known as a link.

The switching equipment for offices with an ultimate of less than 100 lines consists of line circuits, line finders and connectors usually mounted on a single switch frame.

Where the ultimate capacity required is between 100 and 200 lines the line finders and connectors are arranged for 200 line access. In this case the initial switch frame has capacity for the line circuits, line finders and connectors for the first 100 lines and supplementary switch frames are added as necessary to expand the office to 130, 150 or 200 lines. This arrangement is known as a "broadspan" system.

In offices where the ultimate number of lines is greater than 200, selectors are required in the switching train. For each group of 100 lines, a switch frame equipped with the necessary line circuits, line finders and connectors is provided. Selectors, mounted on separate frames, are interposed between the line finders and connectors so that calls may be completed between lines in different groups.

Schematic drawings showing the switching plans used are attached.

CAPACITIES AND CLASSES OF SERVICE

The following are the maximum capacities in terminals for lines and trunks for the various arrangements:

<u>Type</u>	<u>Capacity</u>
CX-30	30
CX-60	60
CX-100	100
CX-200	200
CX-1000	900 or less, depending on trunking

All lines are served on a terminal per line dial basis, with provision for the following general classes of service:

A. Metallic Lines

1. Individual
2. P.B.X. Trunk
3. Two-Party Full Selective
4. Four-Party Semi-Selective
5. Ten-Party Bridged or Divided Ringing
6. 20-Party Bridged or Divided Ringing
7. Post-Payment Coin Box

B. Ground Return Lines - Code Ringing with Maximum of 20 Stations

No provision is made for manual or message rate lines. Normal operation is on a common battery basis, but local battery talking may be used if necessary.

TRUNKS TO OTHER OFFICES

Master or non-master office trunks may be provided for connection to any type of local manual or toll office or to any type of DSA board. Two-way dialing trunks may be provided between two CX-type of offices. The provision of interconnection between this type of office and other types of dial offices now used in the Bell System will be considered if occasion arises.

NUMBERING PLAN

Subscribers' Directory Numbers

In the CX-30, CX-60 and CX-100 systems all subscribers directory numbers are four digit numbers consisting of an initial digit "2" or "3" to indicate whether the ringing code is in the first or second set of ten codes, followed by the two digit terminal number and then a single digit to indicate the ringing code.

In the CX-200 system the subscribers directory numbers are four digit numbers consisting, first of a digit indicating the hundreds group and code set, then the tens and units digits and finally the ringing code number. The numbers used for initial digits are as follows:

- | | | | | | | | |
|---|---|--------|---------|-----|--------|------|-----|
| 2 | - | first | hundred | and | first | code | set |
| 3 | - | " | " | " | second | " | " |
| 4 | - | second | " | " | first | " | " |
| 5 | - | " | " | " | second | " | " |

In the CX-1000 system all subscribers directory numbers are five digit numbers consisting of an initial digit to indicate the hundreds group, followed by the digit "2" or "3" to indicate whether the ringing code is in the first or second set of ten codes, then the tens and units digits of the line terminal number and finally the ringing code number.

The following is the numbering of line terminals:

CX-30	20-49
CX-60	20-79
CX-100	00-99
CX-200	00-99 in each 100 line group
CX-1000	00-99 in each 100 line group

Line numbers may be assigned without restrictions other than that grounded lines not equipped with adapters must be segregated in tens groups to permit discrimination by the equipment.

Ringling Codes

Ringling codes are as follows:

<u>Code</u> (Final Digit)	<u>Side of</u> <u>Line</u>	<u>Code Ringling Signal</u>	
		<u>First Set</u>	<u>Second Set</u>
1	Ring	1 long	1 short 1 long
2	Tip	2 shorts	3 shorts
3	Ring	4 shorts	5 shorts
4	Tip	2 longs	1 short 2 longs
5	Ring	2 longs 1 short	1 short 2 longs 1 short
6	Tip	2 shorts 1 long	3 shorts 1 long
7	Ring	2 shorts 1 long 1 short	3 shorts 1 long 1 short
8	Tip	1 long 1 short	1 short 1 long 1 short
9	Ring	1 long 2 shorts	1 short 1 long 2 shorts
0	Tip	1 long 3 shorts	1 short 1 long 3 shorts

Trunks to Other Offices

The codes available for trunks to other offices are as follows:

<u>Type of</u> <u>Office</u>	<u>Codes</u> <u>Available</u>	<u>Connects to</u> <u>Line Terminal No.</u>
CX-30, CX-60	0	20, 21, etc. as req'd.
CX-100 & CX-200	230	30, 31 etc. as req'd.
	240	40, 41, etc. as req'd.
CX-200 only	420	20, 21, etc. as req'd. (2nd group)
	430	30, 31, etc. as req'd. (2nd group)
	440	40, 41, etc. as req'd. (2nd group)
CX-1000	0	Selector terminals
	9	as req'd.
	8	
	etc.	
	as vacant	

Provision is made for a maximum of 3 trunks per group in the CX-30 and CX-60 offices and a maximum of 5 trunks per group in the CX-100 and CX-200 offices. The CX-1000 is arranged for a maximum of ten trunks per group.

P.B.X. Trunks

The following terminals in each line group may be used for P.B.X. trunks in all types of offices:

20, 21, etc. as reqd.
30, 31, etc. as reqd.
40, 41, etc. as reqd.

A maximum of 3 trunks per P.B.X. group is provided for in the CX-30 and CX-60 offices and a maximum of 5 trunks per group in the other offices.

The first trunk of a P.B.X. group should have a units digit of zero. Trunk hunting is effective only with the zero units digit. This permits P.B.X. trunks other than the first to be used for night listing service.

Any of the P.B.X. trunk numbers not used for P.B.X. trunks may be used for regular subscribers numbers.

GENERAL NOTE ON OPERATION

It will be noted that base metal contacts are used on some of the relays. However, twin contacts are used throughout to minimize the possibility of contact trouble. It will also be noted that some of the relays and resistances will, in case of trouble grounds or crosses, develop more heat than is usually considered desirable. On the other hand, the likelihood of grounds or crosses appears to be minimized by the method of wiring employed.

A study of the advantages and disadvantages of these and similar points is contemplated and if any changes are found advisable, supplementary information will be issued.

GENERAL OPERATION

The basic switching elements and their general functions are as follows:

1. Line circuits which, in addition to performing the operations usual in dial offices, supply talking battery on reverting calls and hold or "lock-out" lines with permanent signal conditions.
2. Line finder circuits, which connect a calling line to an idle selector or connector when the subscriber removes the receiver. There is one line finder group in each office except in the case of the CX-1000, where a line finder group is provided for each 100 line group. Each line finder group has a common set of guard relays which control the operation of the line finders and a set of distributing relays which assign the idle line finders to service in rotation. The common equipment controls

the operation in such a way that calling lines are connected to line finders one call at a time with a sequence in which lowest numbers take precedence if calls are waiting.

3. Selectors, which respond to the dialing of the first digit to extend the calling line to an idle connector in the desired connector group or to a trunk to another office. Selectors are used only with the CX-1000 system. Each selector is permanently associated with a line finder and has access to all connectors or all trunks in all groups. Selectors are arranged for time release on permanent signals.
4. Connectors, which respond to the dialing of the tens, units and ringing code digits to extend the calling line to the called line, and to ring the called station or return busy tone to the calling subscriber. In all systems except the CX-1000, the connector also completes calls to trunks to other offices. In systems where selectors are not used, each connector is permanently associated with a line finder.

The following are the principal miscellaneous circuits used:

1. A ringing and code interrupter circuit, which generates continuous ringing current by means of a vibrating pole changer and which contains relays for producing pick-up and ground pulses corresponding to ringing codes. These pulses are used by the connectors to interrupt continuous ringing current to produce code ringing.
2. Tone and timing circuits consisting of relays for producing dial tone, busy tone, and timing pulses for controlling the automatic time release features.
3. Trunk rotation selecting circuits associated with each group of trunks to P.B.X.'s or distant offices. They allot idle trunks for service in rotation.
4. Trunk circuits.
5. A power circuit consisting principally of a storage battery and means for automatic charging.
6. A test circuit for testing subscribers lines and making operation tests of switching equipment.
7. Alarm circuits.

FEATURES

Ringling Code Interrupter

The total cycle of the ringling interrupter is in the neighborhood of 12 seconds. The ringling codes are sent out during the first half of the cycle. Tripping can occur only during the long silent interval following the completed code.

Ground Return Lines

Ground return lines may be operated by providing a grounded line adapter for each line. Metallic links are used in that case.

All offices except the CX-1000 are arranged so that it is possible to operate these lines without adapters by providing universal line finders and connectors which are arranged to operate with either ground return or metallic lines. In this case the ground return lines must be segregated by tens groups and a slight change made in the wiring of the line circuits. With this segregation the links convert themselves for grounded line operation on calls to or from these groups. Such tens groups may contain metallic lines with bridged ringing, but this should be avoided, if possible, as the metallic signalling range is reduced somewhat by the link conversion.

Coin Box Lines

Two types of coin box service are given by this equipment:

(1) Post-pay with collection on local calls. No deposit is required to talk to an operator. A coin line auxiliary circuit sends a distinctive tone to the operator when she answers a call from one of these lines. The calling subscriber deposits the required coins on request of the operator when a toll call is completed. On local calls the called number is dialed without a deposit, but when the called party answers the auxiliary line splits the connection and sends a tone to the calling subscriber who then deposits a coin, causing the auxiliary line to cut through to permit conversation.

(2) Post-pay without collection on local calls. No deposit is required to talk to a local subscriber or an operator. The operator receives a distinctive tone from an auxiliary line circuit and requests deposits on toll calls as in the previous case.

Different types of auxiliary lines are required with the two types of coin box service. Each is arranged so that the operator may cause the tone to be repeated by re-plugging.

No segregation of coin box lines is required unless special numbering is desired to facilitate identification by operators.

Time Release and Line Lock-Out Features

The time release feature automatically releases a connection under the following conditions:

1. When a permanent signal or incompletely dialed condition exists for more than two to four minutes on a selector or connector.
2. If a call is not answered within two to four minutes after start of ringing.

3. If the calling party fails to release within two to four minutes after the called party hangs up or the operator disconnects.

After release of connections under these conditions, the released lines are held by the line circuits in the locked-out condition until hang up or the clearance of a trouble condition.

If the called party fails to hang up after the calling party has hung up, the connection is immediately released and the called line is locked-out.

Test Facilities

A simple line test circuit, with test keys on the power panel is provided as standard equipment for making tests of subscribers lines. The power circuit voltmeter is used. The connections to the subscribers lines are made at the protectors. "In" and "out" tests may be made. This circuit is also arranged for making equipment operation tests when connected to a dial station and a group of ringers furnished locally as indicated in the equipment section.

Tones

Conventional dial tone, busy back tone and ringing tone signals are used. When all line finders are busy the calling subscriber receives no tone. If all trunks in a group are busy, the busy tone is returned to subscribers calling that group.

Links

Links are furnished with the following features as specified:

Ten party or Twenty Party.
Metallic or universal. (See subsection on ground return lines.)

Reverting Calls

On reverting calls, the directory number of the called party is dialed. The calling party receives busy tone and hangs up and the link circuit then rings the called party. On divided ringing lines only the bells on one side of the line are rung. On bridged ringing lines all bells are rung. Upon answer of the called party, the connector restores to normal and the line circuit holds the line in the locked-out condition and supplies talking battery to both parties. When both parties hang up, the line circuit restores to normal.

Assignment of Links

The distributing relays are arranged so that idle selectors and connectors are assigned in rotation and successive calls have different paths. Another feature is the provision of different first choice outlets from lines with different units numbers. The service reaction which might result from a defective selector or connector is thus minimized. An automatic advance functions to assign a new circuit in case a line finder is unable to close a line through to an assigned selector or connector within a predetermined time interval.

Trunk Rotation Selecting Circuit

Each group of two or more trunks to other offices or P.B.X.'s must be equipped with one of these circuits. This equipment assigns idle trunks in rotation so that successive calls have different channels.

Trunks to Other Offices

Trunks to other offices have the usual features standard in community dial offices with the exception that the link does not cut through and talking battery on trunk calls is therefore the same as on regular calls.

Trunks to magneto, common battery manual, D.S.A. and toll boards may be provided, with signalling of either the D.C. automatic (reverse battery) or composite type. Standard Bell System circuits are provided at the manual or toll office, or D.S.A. board.

Two way dialing trunks to other offices of the CX type may be provided and each trunk requires a line circuit and trunk relay equipment at each end.

The trunk rotation selecting equipment described previously, is required for each group of trunks.

P.B.X. Trunks

No special equipment is required for P.B.X. trunks other than the rotation selecting equipment mentioned previously. The numbers available for P.B.X. trunks are shown under the numbering plan.

Traffic Registers

Traffic registers may be provided on specification to record:

- (1) Originating Calls.
- (2) Overflow Calls.

The traffic registers are mounted on the power panel. Only one of each type is furnished. On systems having more than one line and connector board the traffic registers are arranged so that they may readily be connected to any board.

The overflow meter operates and locks up on the first call attempt made in a group with an all links busy condition. Other attempts will not be recorded until after the register has been unlocked by a link becoming available.

Alarms and Alarm Checking Terminal

For local alarm supervision, alarm lamps are provided to indicate blown fuses, call blocked conditions, and power alarms (power failure, low voltage and blown power fuses). A local signal lamp is lighted when any line is in the locked-out condition to assist in locating permanent lines.

A common alarm bell is provided. Neither the bell nor lamps operate when the office is unattended as a cut-off key is then operated:

An alarm checking terminal feature is provided so that by dialing the number of the checking terminal the operator in a distant office will obtain indications as follows:

- a. Ringing tone - No trouble.
- b. Busy tone - Fuse blown, call blocked or power alarm.
- c. Dial tone - line lock-outs, either permanent signals or reverting calls.
- d. No tone - Tone, ringing or interrupter equipment trouble.

Terminal number 38 in the first hundred group is used for the alarm checking terminal, unless otherwise specified.

Radio Frequency Suppression

The spark suppressors provided at the more important sources of disturbances provide some radio frequency suppression but no general reduction is provided in the form of filters in line and trunk circuits. Such filters, made up of Bell System standard apparatus may, of course, be applied in the field if necessary.

Station Equipment

Standard dial station equipment, of suitable type as indicated by the Bell System Practices, should be used on non-coin lines. In the case of lines with not more than four bridged ringers, the type ordinarily used with individual lines may be used. The divided code type should be used in all other cases.

For coin box stations which collect on local calls the #163A coin collector should be used.

For coin box stations not arranged to collect on local calls a #162A coin collector equipped with a dial should be used.

Ranges

The maximum permissible line loop and minimum permissible line leak resistances have not been finally established. It is believed, however, that satisfactory service will be obtained with this equipment on lines operable with other types of community dial offices.

*See Handbook
for ranges*

Apparatus

The apparatus used in this type of dial office consists of relays, condensers, resistances, repeating coils and retard coils. This apparatus, with the exception of the relays, is similar in appearance to that now used in the Bell System.

The manufacturer recommends that in general no field adjustments of apparatus be made and that a relay which is out of adjustment or defective in

any other way be replaced and returned for repairs. An exception to this is the ringing vibrator, the contacts of which may wear out, and spare contact springs are accordingly furnished with each office.

Most of the distinctive features in the construction of the relays will be indicated in the following descriptions of a few of the different types.

All relays used in these offices have twin contacts throughout, some of gold alloy and others of base metal.

The 200-type relay is equipped with gold alloy contacts on bifurcated springs. The relay is mounted so that the planes of the springs are horizontal.

A number of other types of relays are similar to the 200 type with minor variations.

The relays used in the line circuits are of the 1300 and 1400 type which are similar to the 200 type with the exception that the contact springs are of phosphor bronze. The ends of one set are bifurcated and the ends of the other set are turned at right angles and pointed to form twin base metal contacts.

The 300 type relay is a multi-contact type with make contacts only. The contacts are made up of phosphor bronze reeds each moving into contact with two nickel-silver springs placed in an inverted Y arrangement. The contact between the reed and the springs is thus a twin base metal contact similar to that of a knife switch. A single coil and armature actuate all contacts. This type of relay with 33 contacts is used as a tens selection relay.

The 500 type relays, used as units selection relays, have contact arrangements similar to the 300 type, except that each mounting contains five coils and five armatures and the contacts are grouped into five sets of five each to form five separate relays. Two such groups provide the units selection relay equipment for each switching element.

EQUIPMENT ARRANGEMENTS

General

The CX-30, CX-60 and CX-100 systems each consist of a line and connector frame, a power frame, separately mounted storage batteries, and a main distributing frame. Auxiliary frames may be required in unusual cases. The auxiliary frames are in two forms: Supplementary line and connector frames, and auxiliary circuit frames for miscellaneous circuits.

The CX-200 system consists of a line and connector frame for the initial 100 lines and associated line finders and connectors and one or more supplementary line and connector frames with capacities of 30 or 50 lines to expand the system to 130, 150, or 200 lines. Auxiliary circuit and power frames, a separate storage battery and main frame complete the office.

The CX-1000 system consists of one line and connector frame per hundred line group, one or more selector frames, a power frame, separately mounted storage batteries, a separate main distributing frame, and auxiliary frames as described above.

The dimensions of the various frames are as follows:-

Frames	CX-30		CX-60		CX-100		CX-200		CX-1000	
	Height	Width	Height	Width	Height	Width	Height	Width	Height	Width
Line & Connector, Regular	54"	36"	80"	36"	80"	72"	80"	72"	80"	72"
Line & Connector, Supplementary Selector, 10 Selector Capacity			80"	36"	80"	36"	80"	36" & 72"	80"	36"
Selector, 20 Selector Capacity									80"	36"
Power	54"	14-1/2"	80"	14-1/2"	80"	14-1/2"	80"	14-1/2"	80"	14-1/2"
Auxiliary Circuit	"	"	"	"	"	"	"	"	"	"
" "	"	22"	"	22"	"	22"	"	22"	"	22"

NOTES All frames are 12" deep.
 Heights are for frames with casings including wiring trough. Wooden base consisting of 1-1/2" plank regularly furnished adds 1-1/2" height to all frames.

Line and Connector Frame

The line and connector frame consists of steel uprights to which are welded steel horizontal channels with universal drilling for mounting relays, coils, resistances, etc. Each frame contains the equipment for the specified number of line circuits, line finders and connectors and the necessary common equipment.

The equipment capacity is as follows:

	CX-30	CX-60	CX-100 & CX-200	CX-1000
Lines	30	60	100	100 per frame
Line finders and connectors	5	6	10	10 per frame
<i>normal trunks</i>	3	5	5	

The mounting plate arrangement does not permit the use of unit mounted circuits so that additions after the original installation must be made by mounting and wiring the required apparatus in the field. This should be kept in mind in providing the initial equipment.

In addition to wiring for the specified equipment the local color-coded form provided contains wiring for the full number of lines and their appearance before a full number of line finders and connectors. Connector wiring is provided only for those equipped but each connector is wired for the full number of lines.

CX-200 Frame Combinations

The following combinations of frames are used in the CX-200 office to obtain various maximum capacities:

Total Max. Capacity	Terms. Links	<u>Supplementary Frames</u>								
		Initial Frame			Second Unit			Third Unit		
		Width	Terms.	Links	Width	Terms.	Links	Width	Terms.	Links
100	10	72"	100	10		None				None
130	13	72"	100	10	36"	30	3			None
150	16	72"	100	10	72"	50	6			None
200	19	72"	100	10	72"	50	6	72"	50	3

Supplementary Line and Connector Frames - CX-60, CX-100 and CX-1000

Where the number of line finders and connectors required in the CX-60, CX-100 or CX-1000 systems exceeds the capacity of the regular frames the additional equipment is installed in these supplementary frames. The construction is similar to that of the regular frame. The capacity is six line finders and six connectors. Equipment and associated wiring is provided as specified. No wiring is included for growth.

Supplementary Line and Connector Frames - CX-200

These frames are used as the second and third units of the CX-200 (broadspan) system to expand the system above 100 lines. They are constructed like the regular line and link frame and are equipped as specified.

Two sizes are available. The first, 36" wide, has capacity for 30 line circuits and 3 links. The other, 72" wide, has capacity for 50 lines and 6 links if used as a second unit or for 50 lines and 3 links if used as a third unit.

These supplementary frames contain the extension wiring and equipment necessary to connect with the lines and links in the initial unit.

Wiring is provided only for equipment specified.

The supplementary frames for the CX-200 should be located in the same line-up and adjacent to the initial frames.

Selector Frames

The construction of this frame is similar to that of the line and connector frame. This type of frame is available in two sizes, one with a maximum capacity of 10 selectors, the other with a maximum capacity of 20 selectors.

Selectors are provided as specified. No wiring is provided for growth.

A selector frame should preferably be located adjacent to the line and connector frame with which it is associated. A twenty selector frame may frequently be adequate for two hundred lines and in such cases may be placed between the two associated line and connector frames if the line up length is not excessive for the space available.

Power Frame

On this frame are located:

A power panel equipped with ringing current resistance lamps, meters, switches, fuses, keys for the line test circuit, an overflow meter and a peg count meter.

A power rectifier and charging control equipment.

An all-relay ringing code interrupter,

A vibrating pole changer type of ringing current generator.

Space for a 12" x 13" relay cabinet for trunks and miscellaneous circuits.

Auxiliary Circuit Frame

This frame is required when the number of trunks or miscellaneous circuits exceeds the mounting capacity for miscellaneous circuits provided on the line and connector frame and the power frame. It is available in widths of 14-1/2" and 22".

Auxiliary circuit frames are arranged to mount 12" x 13" relay cabinet, each with capacity of about 45 relays, as follows:

Frame 54" high	-	4	cabinets
" 80"	"	-	6 "

These cabinets mount directly on the 14-1/2" frame and on the 22" frame with adapters.

The 22" frame is intended primarily for mounting composite trunk equipment or other Western Electric Company equipment using 19" mounting plates.

Frame Casings

All switch frames are equipped with aluminum finished frame casings. Relay cabinets, ringing interrupters and code interrupters mounted on power and auxiliary circuit frames have individual covers.

Mounting of Trunk & Misc. Circuits - Relay Cabinets

The CX-30 has spare space in the switch frame for mounting coin-box auxiliary lines only and 10 such 3-relay circuits may be accommodated. These circuits in all other systems are mounted in relay cabinets. In all systems, equipment for trunks, grounded line adapters, and other miscellaneous circuits must be mounted in relay cabinets on the power or auxiliary circuit frame.

Each relay cabinet, with a capacity of about 45 relays, provides space for mounting miscellaneous circuits such as the following:

- Trunks
- Coin Box auxiliary lines
- Grounded line adapters
- Alarm checking circuit

The relay cabinets have front and rear covers.

Cabling, Cable Racks, Cables & Wire

The cabling for all frames in the same line-up is carried in wiring troughs on the top of the frames and does not require lacing or clipping.

The cabling across aisles or between frames not in the same line-up is carried in wiring troughs or attached to conventional cable racks as most suitable for the particular case.

All cable racks, cable troughs, switchboard cable, miscellaneous wire, and power wire (except for service leads to power panel) required to install an office is furnished. Jumper wire should be supplied locally.

Ringin Current Generator and Code Interrupter

A ringing current generator of the vibrating pole changer type and a relay type code interrupter are normally provided. On systems of more than 200 lines a duplicate pole changer ringing generator with automatic transfer is provided. Ten or twenty party code interrupters are furnished as specified.

Charging Equipment

Self regulating copper-oxide type rectifiers operating on a floating basis are employed for charging the storage batteries. They are available in capacities of 1/2, 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15 and 20 amperes and are furnished as specified. The following are typical capacities required:

<u>CX-30</u>	<u>CX-60</u>	<u>CX-100</u>	<u>CX-200</u>	<u>CX-1000</u> (400 lines)
2 or 3 amps.	3-5 amps.	4-6 amps.	6 amps.	15 amps.

Storage Batteries

Suitable storage batteries and accessories should be ordered in accordance with Bell System specifications KS-5361 and KS-5378. Twenty-four cells are required.

For computing the capacity of the storage battery the following current drains may be used:

CX-1000	30 Amp. hrs. per 1000 Calls
All other systems	20 Amp. hrs. per 1000 Calls

These figures are based on 100" holding time.

Typical storage battery capacities in ampere-hours are as follows:-

<u>CX-30</u>	<u>CX-60</u>	<u>CX-100</u>	<u>CX-200</u>	<u>CX-1000</u> (400 lines)
50	50	100	100	200

Battery Racks

Two types of steel battery racks each in three lengths are available and will be furnished as specified.

The tier type has two tiers for storage batteries, one directly over the other. It is suitable for storage batteries per KS-5361.

The step type also has two tiers which are offset so that taller batteries may be used. It is suitable for batteries per KS-5361 and KS-5378.

The dimensions are as follows:

<u>Type</u>	<u>Available Lengths</u>	<u>Height</u> (See Note)	<u>Width</u>	<u>Support Rail Separation</u> (Outside Edges)
Tier	4', 5', 8'	33"	12"	6-1/2"
Step	4', 5', 8'	33"	24"	6-1/2"

Note: Height is to top of upper battery support rails.

Main Distributing Frame and Protectors

A floor type main distributing frame may be furnished for all sizes of offices. A bracket type of main distributing frame will be furnished on specification for the CX-30 and CX-60 systems. This type is attached to one side of the line and connector frame.

A specified number of Western Electric Co. protectors (#1269-A) are furnished. They should be specified in multiples of 20. Terminals for outside plant conductors are furnished as specified in multiples of 25.

A test cord and a #252-A and a #252-B (Western Electric Co.) plug suitable for connecting to subscribers lines at the protectors are provided for use with the line test circuit.

MAINTENANCE INFORMATION

Two sets of all circuit schematics, wiring diagrams, method of operation sheets, relay adjustment sheets, adjustment instructions and maintenance instructions applying to the office involved will be furnished with each office.

It will be noted that the drawings for this type of office are arranged so that in general apparatus code numbers and resistance values of relays are not shown on the circuit schematics. Relay code numbers and resistances for each circuit are shown on the corresponding relay adjustment sheet. Code numbers for other apparatus are shown on the wiring diagrams.

ORDERING INFORMATION

The following information should be given when ordering one of these offices:-

Ringling Code Interrupter

10 Party or 20 Party

Miscellaneous

Traffic Registers Req'd.

(Include floor plan drwg. if possible)

CX-1000

Type No.

Lines

Initial and Ultimate No.

Total Line Circuits Required (multiples of ten)

Coin Box Auxiliary Lines - Quantity & Type

Grounded Line Adapters - Quan.

Line Finder & Connector Frames

Quantity - Regular Frames

Quantity - Supplementary Frames

Hundreds Groups Nos. to Be Used

No. Line Ccts. each group (multiple of ten)

No. Line Finders each group

No. Connectors each group

10 Party or 20 Party Links

Selector Equipment

Frames - 10 sel. cap.

Frames - 20 sel. cap.

No. of Selectors (same as total line finders)

Trunks to Other Offices (for each group)

Code No. assigned

No. of trunks in group

▸ Distant office termination

Type of Signalling (for manual office terminations only)

Approx. Conductor Loop Resis. and make-up of Conductors

Trunks to PBX's (for each group of 2 or more)

Quantity

Directory No.

Auxiliary Circuit Frames

Quantity and Width

Power Equipment

Type and Length of Battery Rack
 Size of Rectifier (amps.)
 Storage Battery - Order per KS-5361 or KS-5378

Distributing Frame

No. of Western Electric Co.'s #1269-A protectors
 req'd. (20 per strip)
 No. of terminals to be provided for termination of
 outside plant (multiples of 25)

Ringing Code Interrupters

Ten Party or Twenty Party

Miscellaneous

Traffic Registers req'd.

(Include floor plan drwg. if possible)

Ordering Additions

When ordering additional equipment for existing offices it is important to indicate the office, the equipment frame and location within the frame in which the equipment is to be used in order that the proper wiring may be furnished.

SPARE PARTS

No spare parts other than a set of extra contacts for the ringing vibrator are furnished.

WEIGHTS OF EQUIPMENT

The approximate weights of the more important items of equipment are as follows:

<u>Item</u>	<u>Weight in Lbs.</u>
Fully Equipped CX-30	
Line & Connector Frame	350
Power Frame	200
Fully Equipped CX-60	
Line & Connector Frame	750
Power Frame	225
Fully Equipped CX-100	
Line & Connector Frame	1200
Power Frame	240
CX-1000	
Line & Connector Frame	1200
Selector Frame - 10 selectors	410
Relay Cabinet with 45 Relays	50
Aux. Cct. Frame (unequipped)	15
Storage Batteries	(See Specs.)

DRAWINGS FOR INFORMATION

The following is a list of typical drawings for reference. They are subject to change or replacement. They may be obtained from the Western Electric Co. on order.

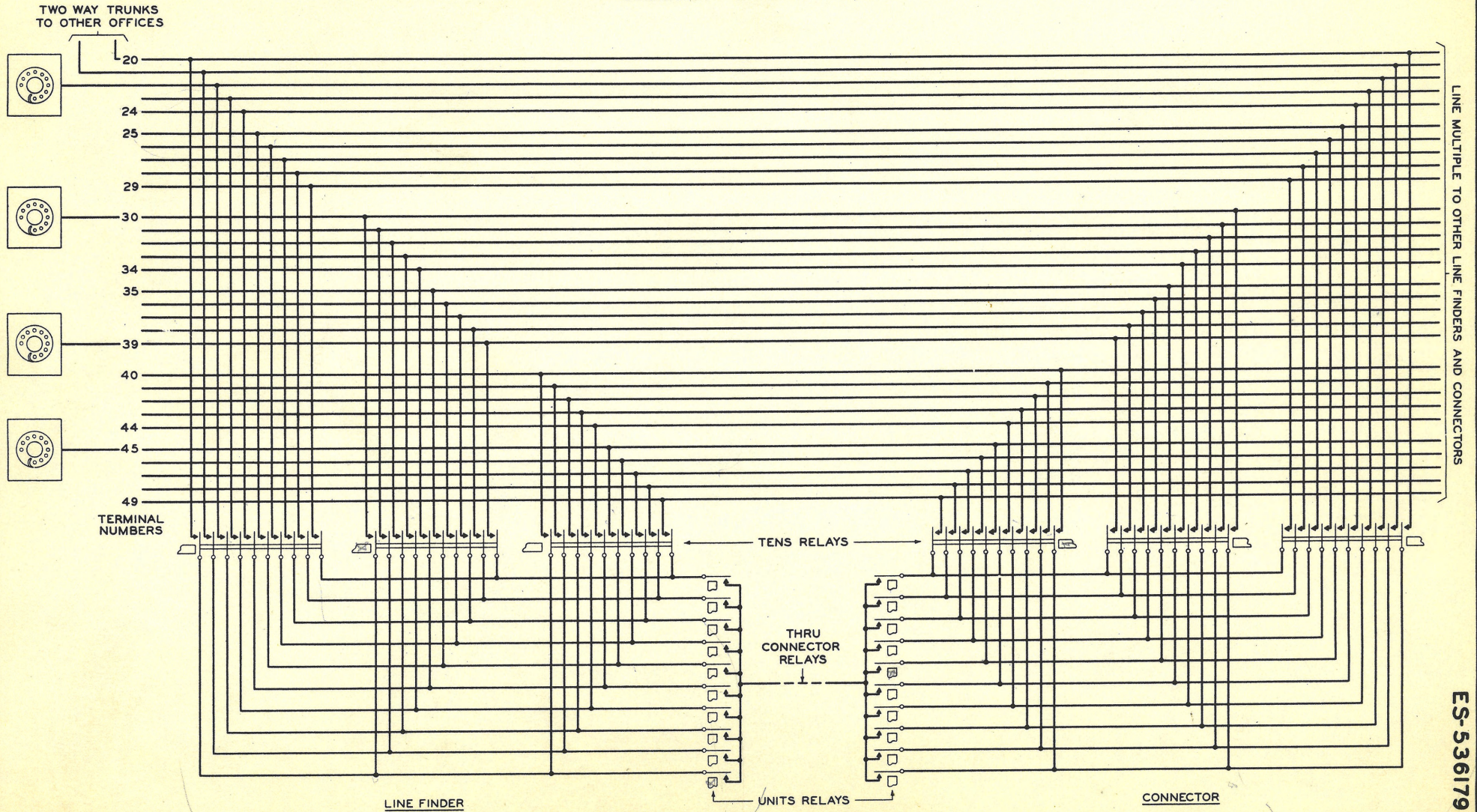
CIRCUIT DRAWINGS

	<u>Circuit Number</u>
CX-30, CX-60, CX-100, CX-1000, - Line finder - metallic	BC-3941
CX-30, CX-60, CX-100, - Line Finder - Universal	BC-3943
CX-30, CX-60, CX-100, CX-1000 - Connector - 10-party - metallic	BC-3942
CX-30, CX-60, CX-100 - Connector - 10-party, universal	BC-3944
CX-30, CX-60, CX-100, CX-1000 - Connector - 20-party metallic	BC-3945
CX-30, CX-60, CX-100 - Connector - 20-party - universal	BC-3946
CX-1000 - Selector	BC-3947
CX-200 - Line finder - metallic	BC-3948
CX-200 - Line finder - universal	BC-3950
CX-200 - Connector - 10-party - metallic	BC-3949
CX-200 - Connector - 10-party - universal	BC-3951
CX-200 - Connector - 20-party - metallic	BC-3952
CX-200 - Connector - 20-party - universal	BC-3953
10-party Code Interrupter and Ringing Converter	BC-4861
20-party Code Interrupter and Ringing Converter	BC-4862
All-Relay Timer	BC-4863
Long Line Repeater	BC-4867
Tone Circuit	BC-4864
Grounded Line adapter, repeat coil type, 1 line relay	BC-4865
Alarm Checking Terminal	BC-3956
Ringing change-over, automatic	BC-4866
Coin Line Auxiliary (collect on local calls)	BC-3955
Coin Line Auxiliary (non-collect on local calls)	BC-3966
Trunks to Manual Swbds. - D.C. Signalling:-	
Sel. Term. - Repeating Coil	BC-3960
Sel. Term. - Retard Coil & Condenser	BC-3961
Conn. Term. - Repeating Coil	BC-3954
Conn. Term. - Retard Coil & Condenser	BC-3959
Composite Signalling Trunks:-	
Sel. Term.	BC-3958
Conn. Term.	BC-3957
Two Way Dialing Trunks:-	
Conn. Term. - Retard Coil and Condenser	BC-3962
Sel. Term. - Retard Coil and Condenser	BC-3965
Sel. Term. - Repeating Coil	BC-3964

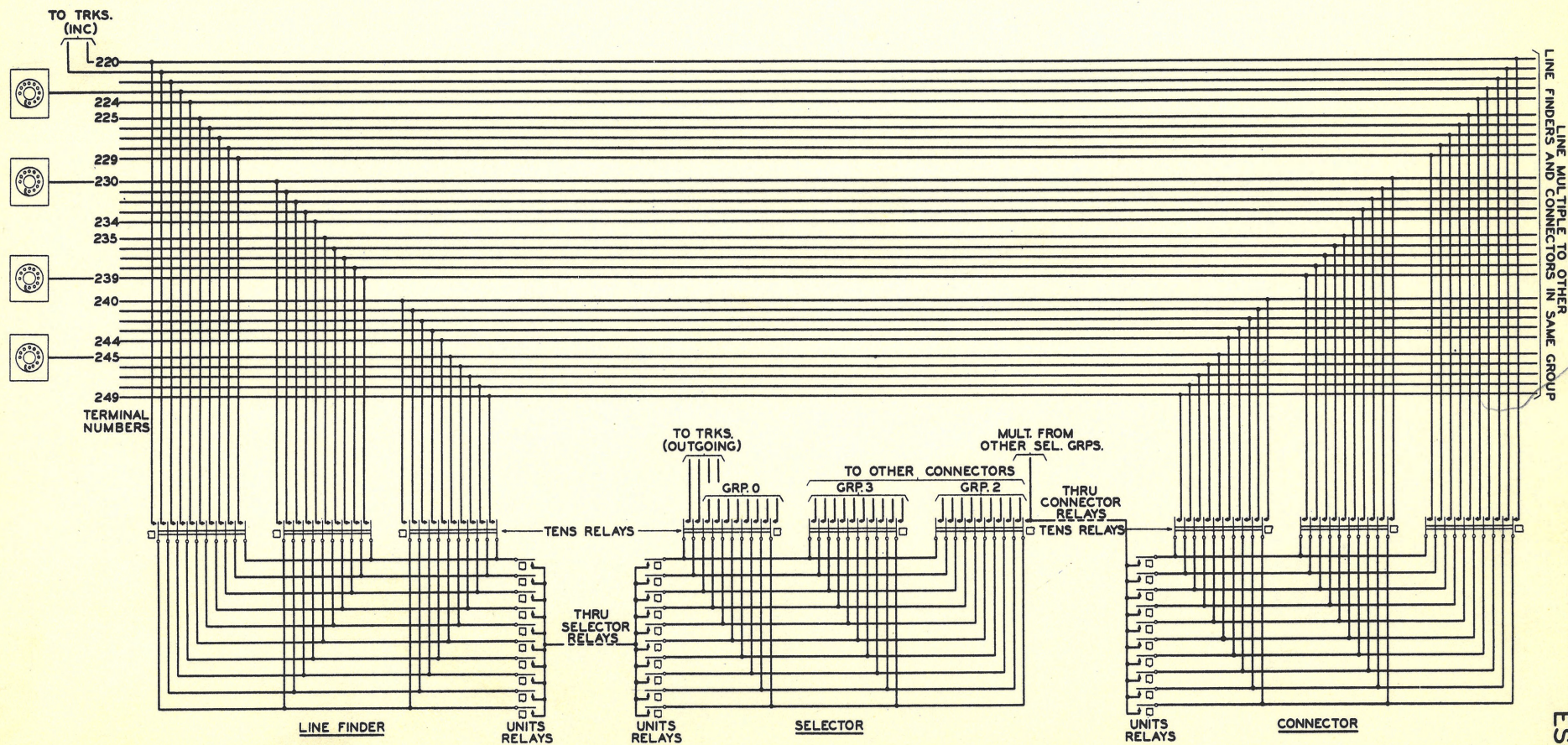
Equipment Drawings

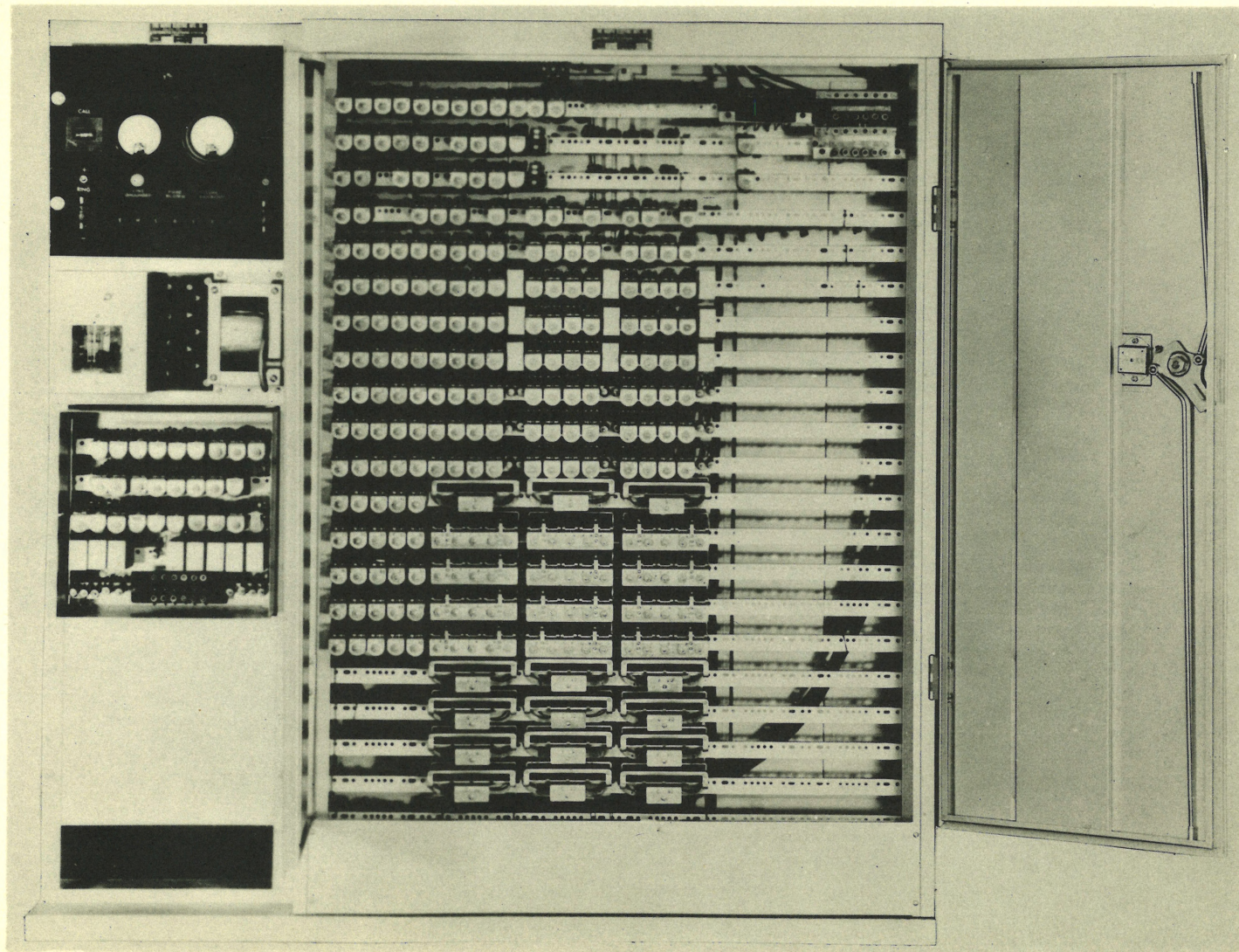
CX-30 Line and Connector Board	BA-4901
CX-60 Line and Connector Board	BA-4902
CX-100 Line and Connector Board	BA-4903
CX-200 Line and Connector Board	BA-4904
CX-60 Supplementary Frame	BA-4905
CX-100 Supplementary Frame	BA-4906
CX-100 Supplementary Frame	BA-4907
CX-200 Supplementary Frame (30 lines, 3 links)	BA-4908
CX-200 Supplementary Frame (50 lines, 6 links)	BA-4909
CX-200 Supplementary Frame (50 lines, 3 links)	BA-4910
CX-1000 Line and Connector Frame	BA-4911
CX-30 Power Frame Assembly	BA-4912
CX-60, CX-100 and CX-1000 Power Frame Assembly	BA-4913
CX-60, CX-100 and CX-1000 Power Panel	BA-4914
20 Cycle Converter for Power Frame	BA-4915
Auxiliary Relay Cabinet with Fuse Panel	BA-4916
CX-1000 Selector Frame (20 selectors capacity)	BA-4917
CX-1000 Selector Frame (10 selectors capacity)	BA-4918
2 Ampere Copper Oxide Rectifier	BA-4922
3 Ampere Copper Oxide Rectifier	BA-4923
5 Ampere Copper Oxide Rectifier	BA-4925
4 Ampere Copper Oxide Rectifier	BA-4924
6 Ampere Copper Oxide Rectifier	BA-4926
15 Ampere Copper Oxide Rectifier	BA-4929
CX-30 Auxiliary Circuit Frame, 14-1/2" wide	BA-4931 and BA-4932
CX-60 and CX-100 Auxiliary Circuit Frame, 14-1/2" wide	BA-4933 and BA-4934
Auxiliary Circuit Frame, 51" high (4 19" plates)	BA-4935
Auxiliary Circuit Frame, 74" high (4 19" plates)	BA-4936
MDF for Mounting on CX-30	BA-4941
MDF for Mounting on CX-60	BA-4942
MDF - Floor Type for 100 Lines	BA-4943
MDF - Floor Type for 200 Lines	BA-4944
Battery Rack - Step Type, 4 ft. long	BA-4945
Battery Rack - Step Type, 5 ft. long	BA-4946
Battery Rack - Step Type, 8 ft. long	BA-4947
Battery Rack - Tier Type, 4 ft. long	BA-4948
Battery Rack - Tier Type, 5 ft. long	BA-4949
Battery Rack - Tier Type, 8 ft. long	BA-4950

SWITCHING SCHEMATIC FOR TYPICAL CX-30, CX-60, CX-100, AND CX-200 COMMUNITY DIAL OFFICES

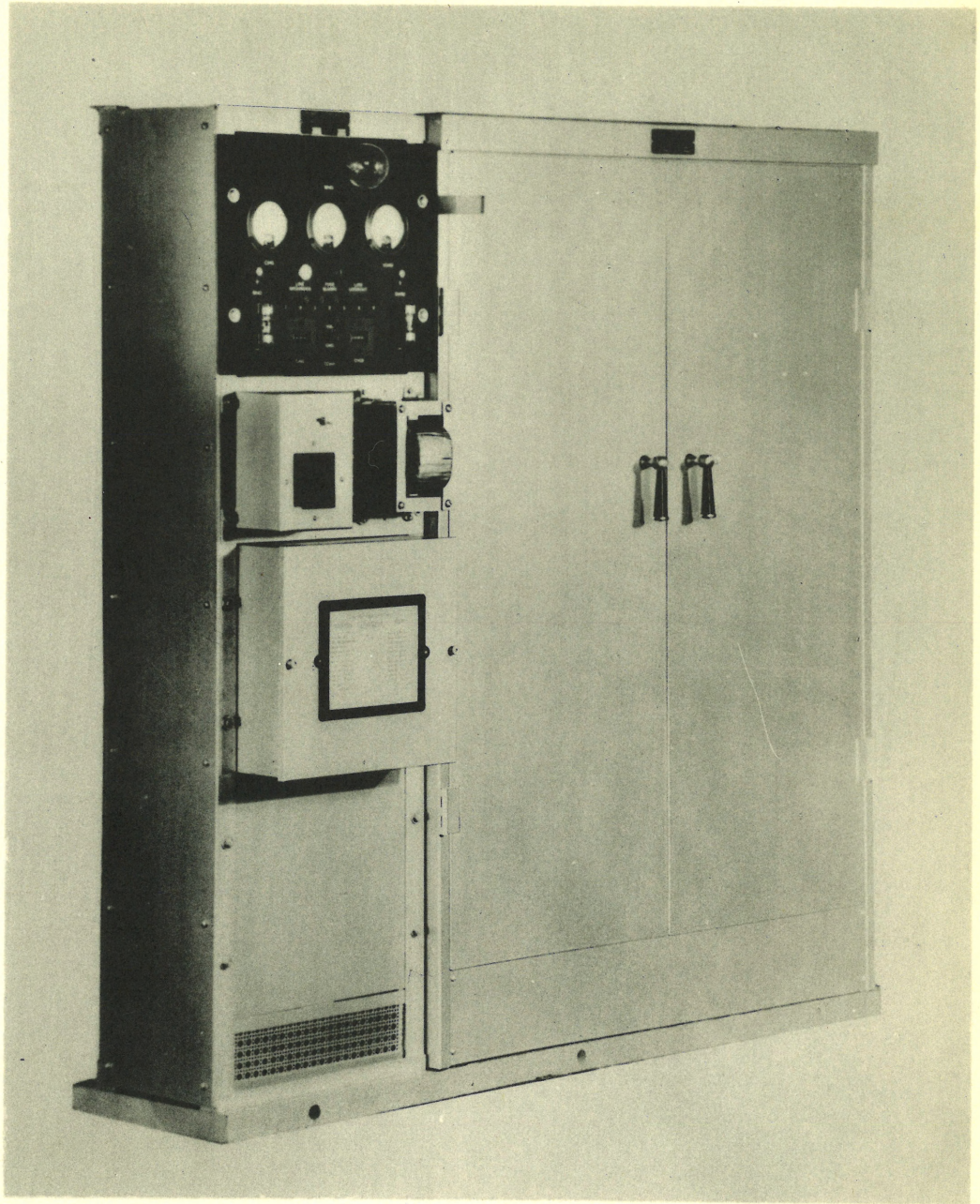


SWITCHING SCHEMATIC FOR TYPICAL CX-1000 COMMUNITY DIAL OFFICE

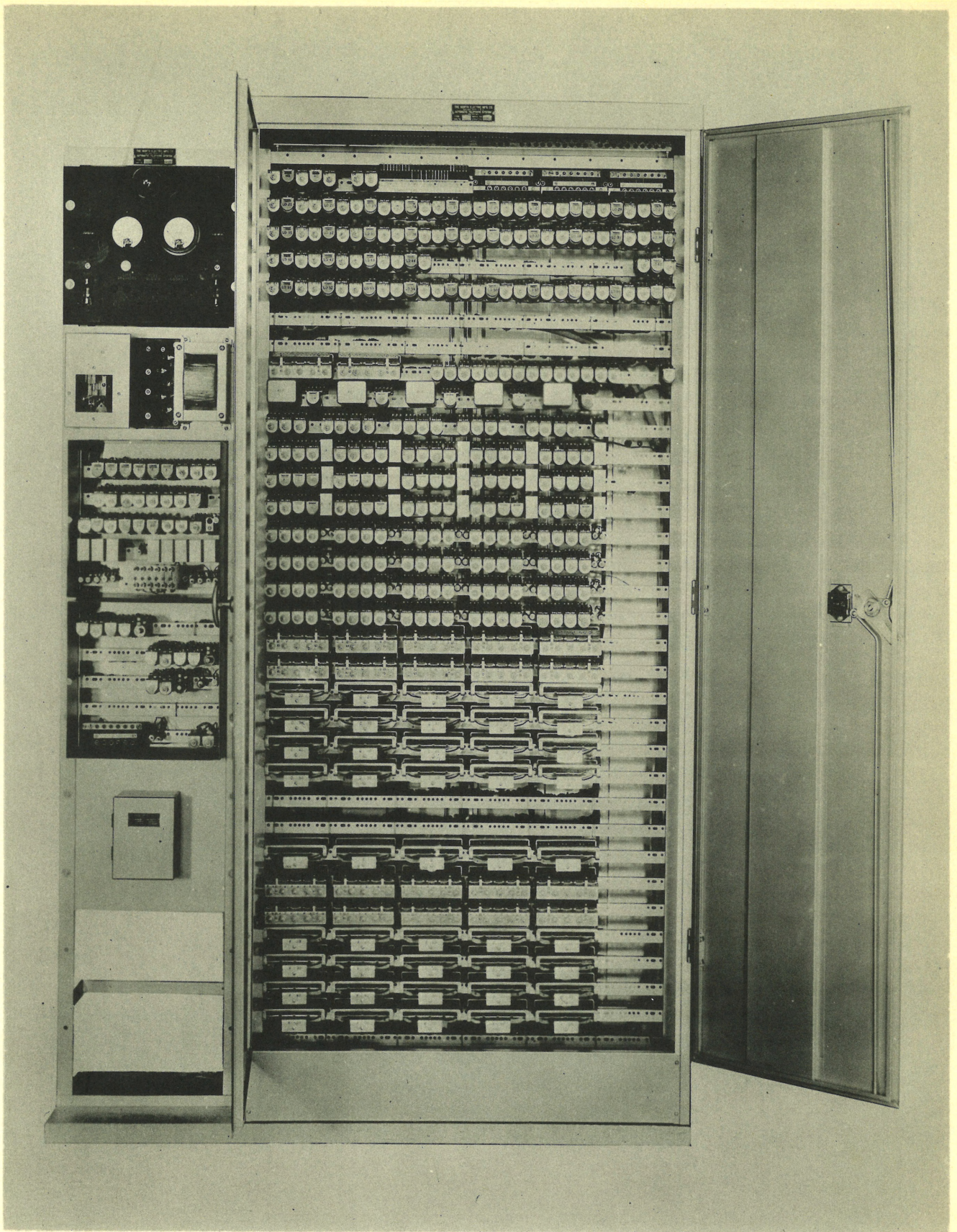




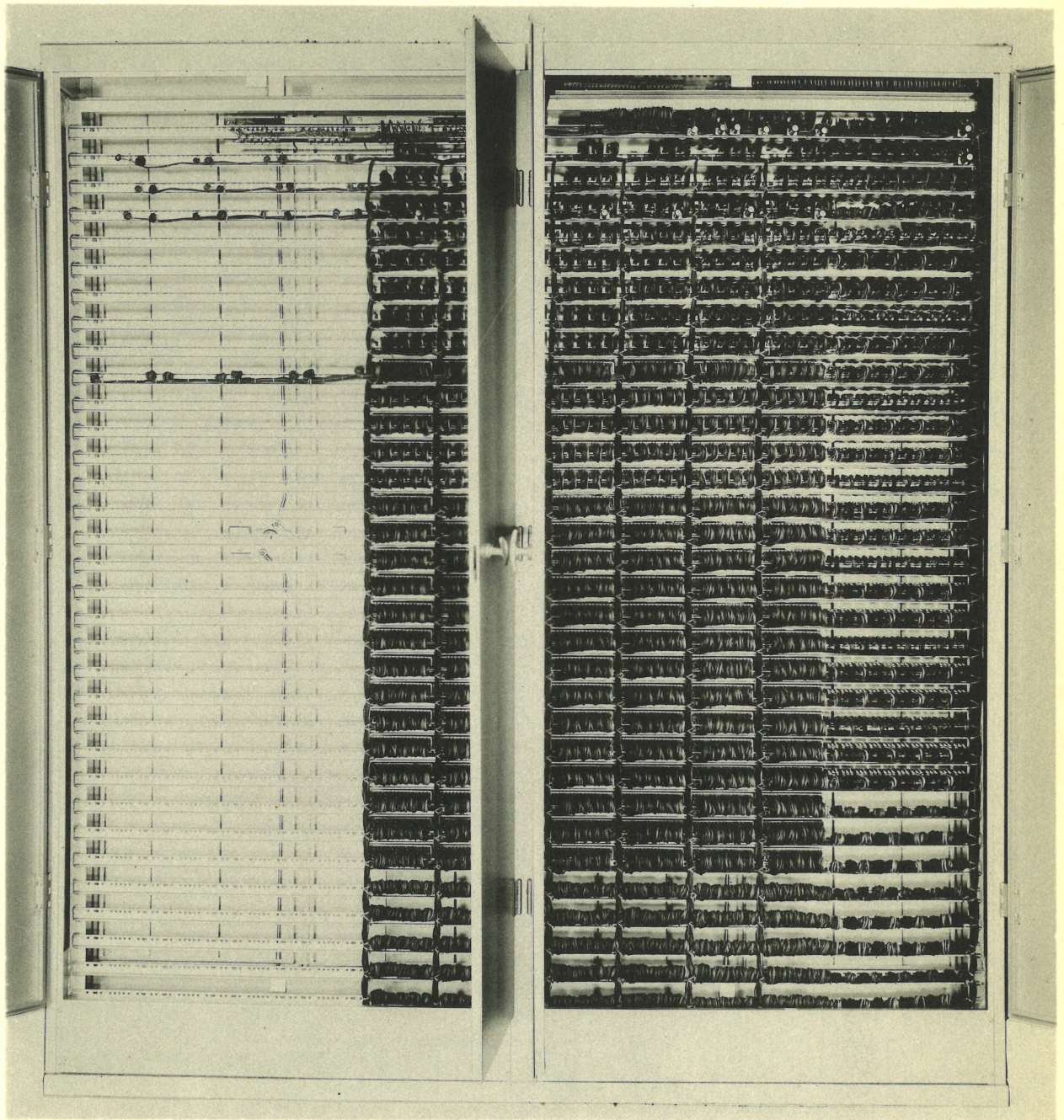
Typical CX-30 Dial Office Showing Line and Connector Frame and Power Frame. Equipped with 20 Lines, 3 Line Finders and 3 Connectors.



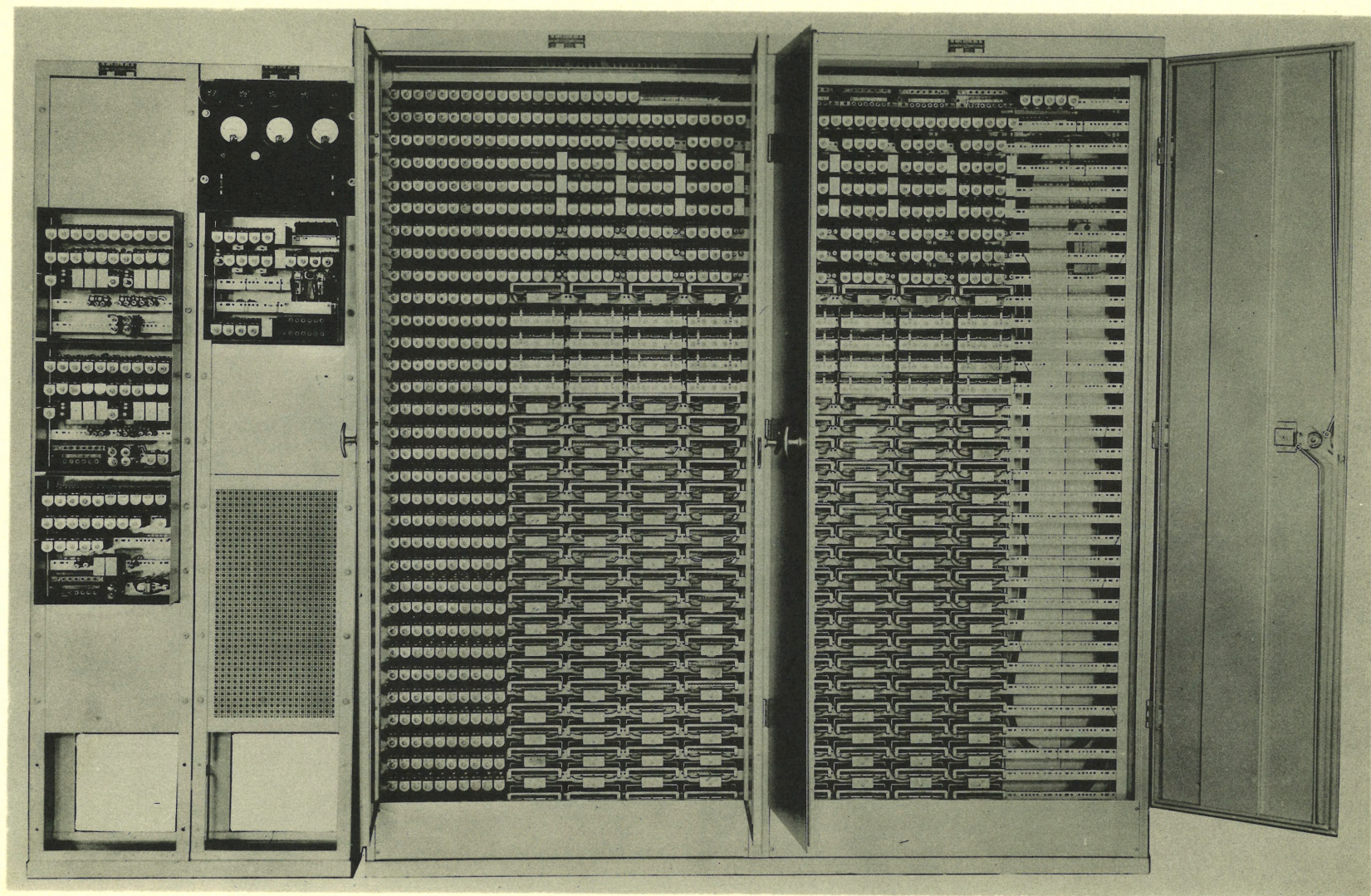
Typical CX-30 Dial Office Showing Casing and Miscellaneous Covers in Place.



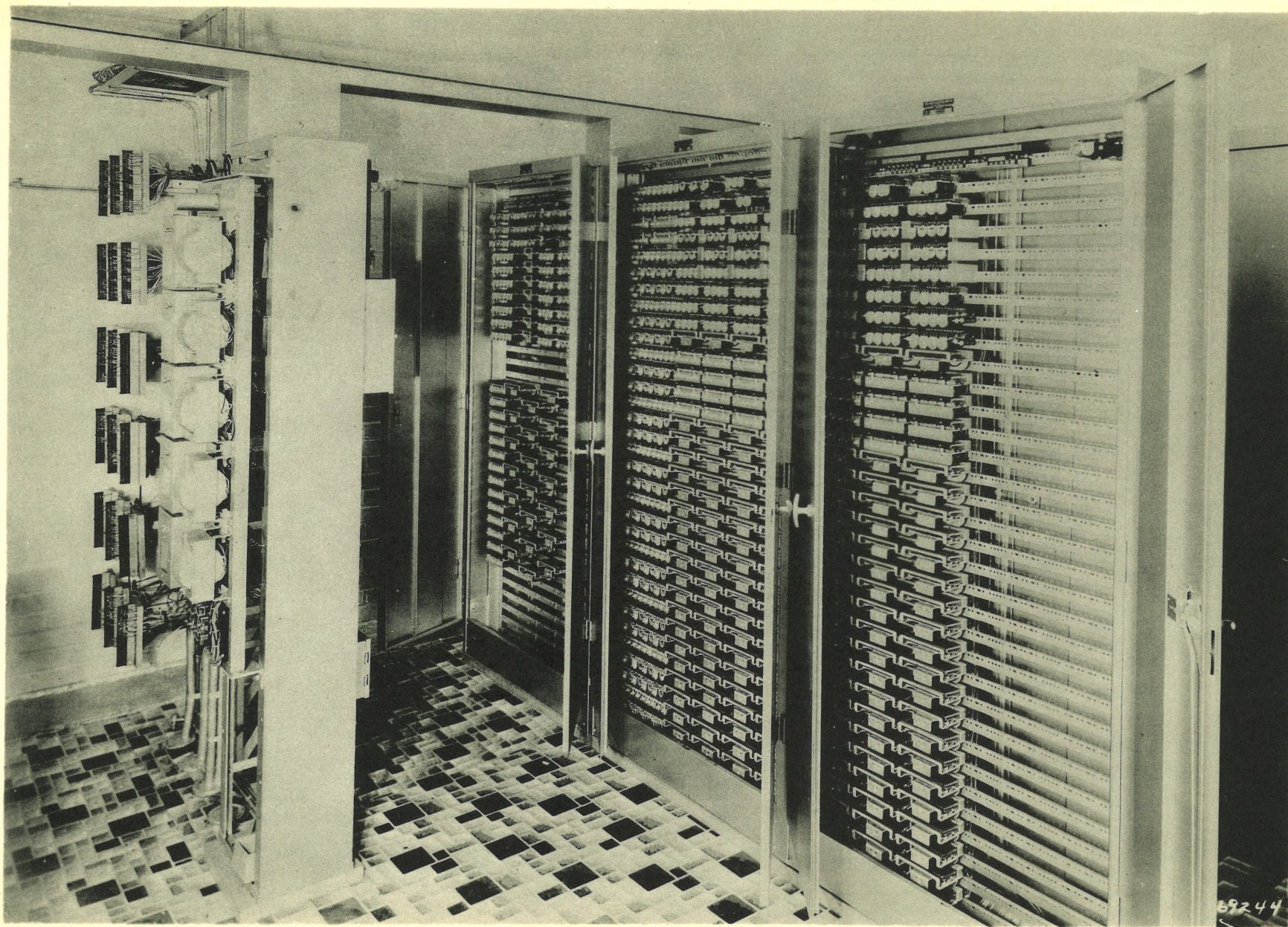
Typical CX-60 Dial Office Showing Line and Connector Frame and Power Frame. Equipped with 35 Lines, 5 line Finders and 5 Connectors.



Typical CX-100 - Showing Wiring Side



Typical CX-100 Dial Office Showing Line and Connector Frame,
Power Frame and Auxiliary Circuit Frame. Equipped with 100
Lines, 8 Line Finders and 8 Connectors.



Typical CX-1000 Office Showing a Line and Connector Frame,
a Selector Frame, Part of Main Distributing Frame and Power
Frame.