

KELLOGG SWITCHBOARD AND SUPPLY COMPANY

SWITCHBOARDS FOR THE PRIVATE BRANCH EXCHANGE 1916

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BULLETIN NO. 86

Switchboards *for the* Private Branch Exchange

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Kellogg Switchboard & Supply Co.
MANUFACTURERS OF
STANDARD TELEPHONE EQUIPMENT
GENERAL OFFICES & FACTORY
Chicago, Ill.
SAN FRANCISCO, CAL. - KANSAS CITY, MO.

P.B.X.

INTRODUCTORY



THE question which quite often confronts a telephone company is how to increase its earnings.

Operating and maintenance charges are items which cannot always be lowered to any great degree, if the equipment is right. Therefore, a telephone company must look to by-products to increase its gross earnings. One of these by-products is the private branch exchange. Many companies are now furnishing a limited telephone service to department stores and manufacturing concerns which, to the customer, is not all that they wish. The breadth and flexibility of such service is limited to extensions and intercommunicating systems; and if the customer is approached and told the advantages of a private branch exchange, he can usually be convinced of its merits.

The service to be given a private branch exchange user with Kellogg Switchboard & Supply Company's type of equipment, properly installed, pleases the subscriber and brings increased earnings to the telephone company.

We are prepared, as manufacturers of high grade telephone equipment, to build apparatus to meet all conditions which may arise with your most exacting customer, and we solicit your inquiries for private branch exchanges.

Private Branch Exchange Switchboards

To meet all standard service conditions where Private Branch Exchanges are desired for hotels, department stores, manufacturing plants and commission houses, the Kellogg Company has developed a complete line of private branch exchange equipment.

Design and Construction

CABINETS:

The cabinets are designed for maximum equipment in the minimum amount of space, and at the same time, all equipment and apparatus is readily accessible for inspection.

CONSTRUCTION:

These boards are constructed of carefully selected and seasoned oak and birch. The woodwork is joined in a proper and substantial manner. It is then stained, filled, varnished and rubbed to present a durable and attractive finish, special precaution being taken in the selection of the finishing materials, so that the woodwork is thoroughly protected from moisture.

Two finishes in woodwork are carried in stock: No. 9, Golden Oak, and No. 11, Birch Mahogany. Where special finishes are desired to match certain woodwork, a sample must be furnished and sufficient time allowed for the process, to insure the durability of finish for which Kellogg switchboards are known.

The apparatus used in these P. B. X. cabinets is of the well-known Kellogg standard design and type that is used in their large common battery multiple switchboards. The line jacks, cord circuits and supervisory equipment are substantially and conveniently mounted in proper positions, where they are readily accessible.

All parts are properly designated and numbered in such a way that their particular functions can be readily identified.

For key to code numbers and letters see page 32.

Fifty Line Cabinet

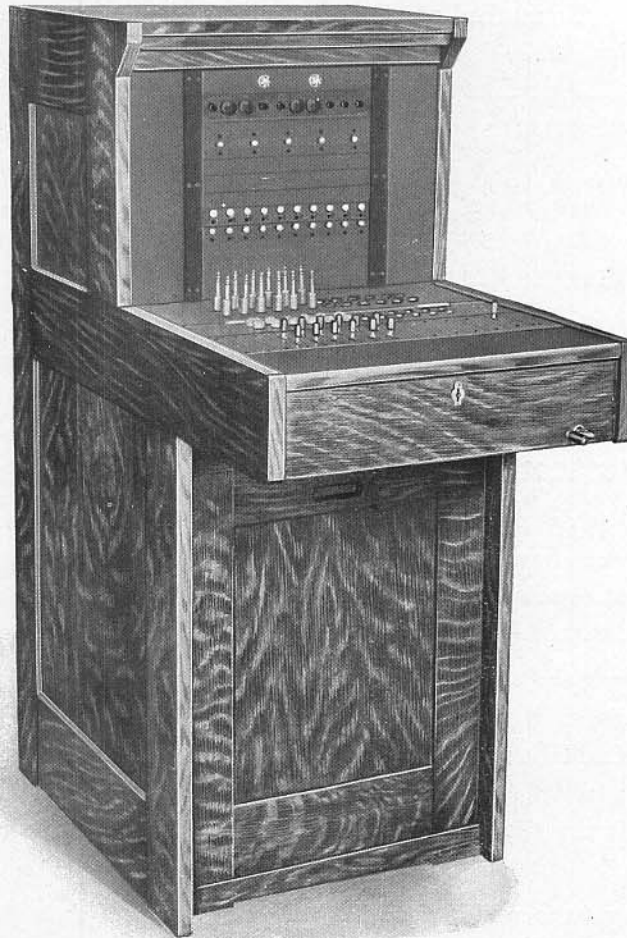


Fig. No. 8601—Code No. 100 Cabinet—10 to 50 line capacity

FEATURES:

A very durable cabinet which provides the maximum of equipment in the minimum of space.

Jacks rigidly mounted and arranged ten per strip to avoid cord congestion and to allow sufficient finger room for putting up and taking down connections.

Fifty Line Cabinet

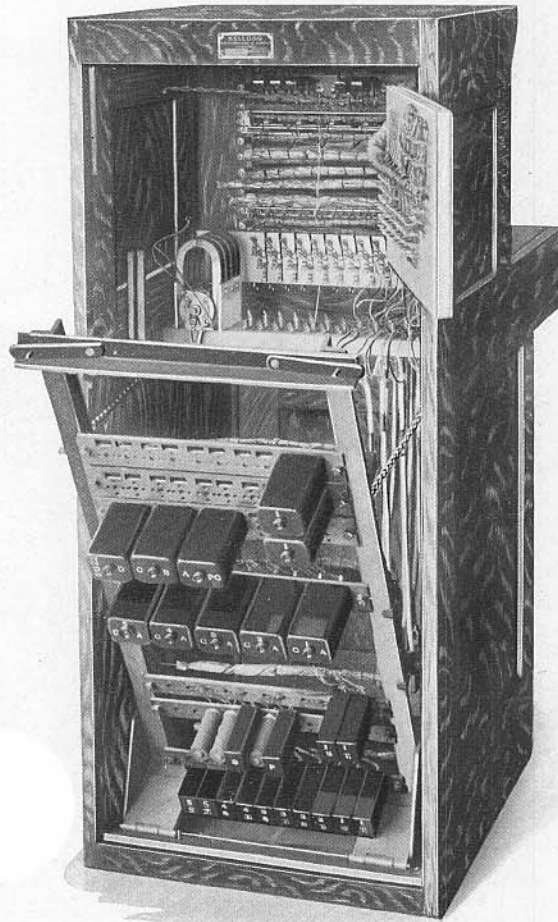


Fig. No. 8602—Code No. 100 Cabinet—from 10 to 50 lines
Rear view, showing relay rack open

ADVANTAGES:

Relays substantially and conveniently mounted on swinging rack, providing easy access to cords.

Connecting rack for terminating line and trunk cables hinged to allow ready access to lamp and jack mountings.

Cord racks arranged to prevent tangling of cords.

One Hundred Line Cabinet

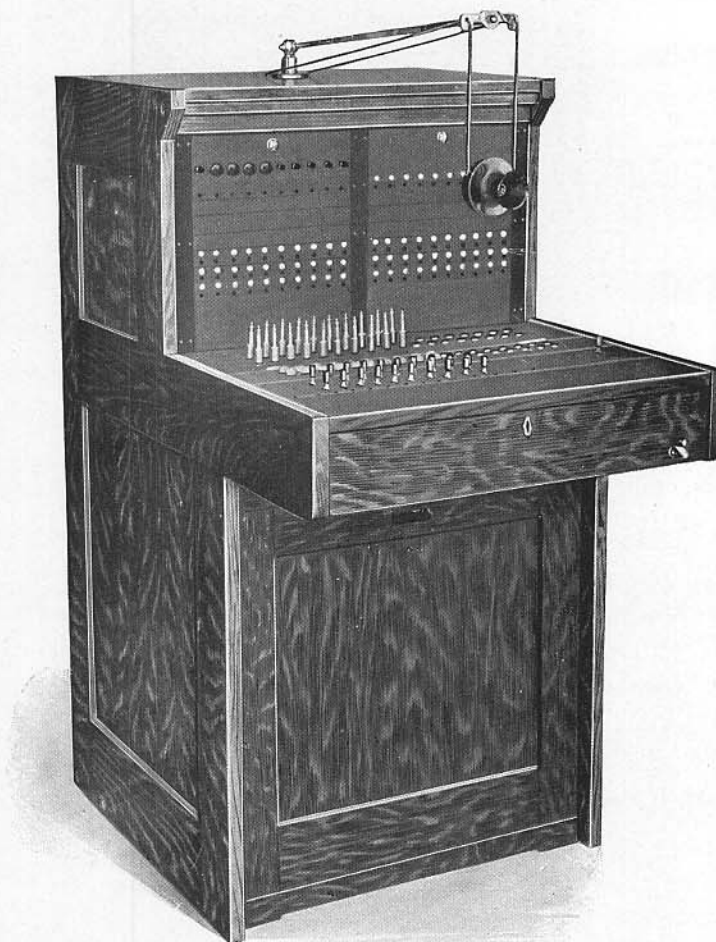


Fig. No. 8603—Code No. 101 Cabinet—from 10 to 100 lines

FEATURES:

Generous key shelf room allowing ample writing space. Transmitter conveniently adjusted to position by raising or lowering arm. No transmitter weights to wear out transmitter cords or injure wiring. Operator's jack mounted under key shelf, keeping receiver cord from being jammed against plug.

One Hundred Line Cabinet

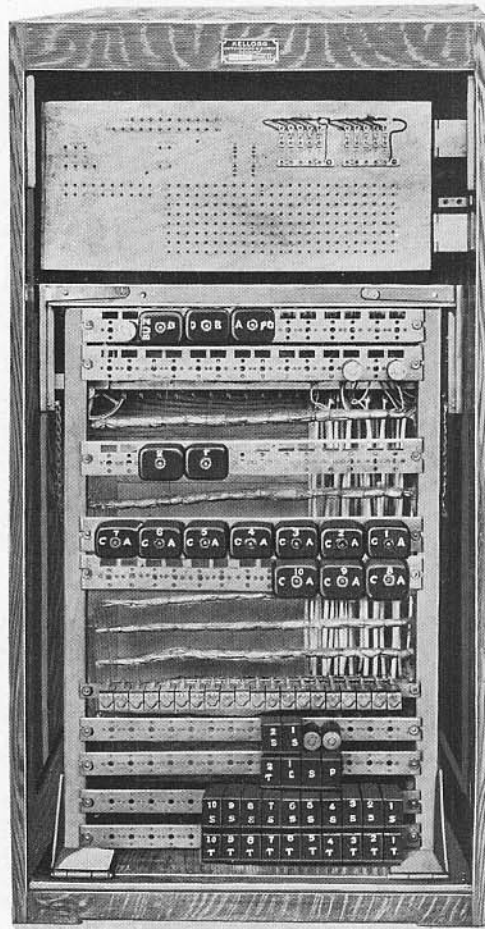


Fig. No. 8604—Code No. 101 Cabinet—from 10 to 100 lines
Rear view, showing relay rack closed

ADVANTAGES:

Apparatus is properly numbered and designated so that its particular function can be readily identified.

Relay rack and hinged heavy maple connecting rack securely locked in place when closed. In this position, they give added strength to the cabinet.

Heavy bus bars practically arranged for connecting and fusing the battery leads.

One Hundred Line Cabinet

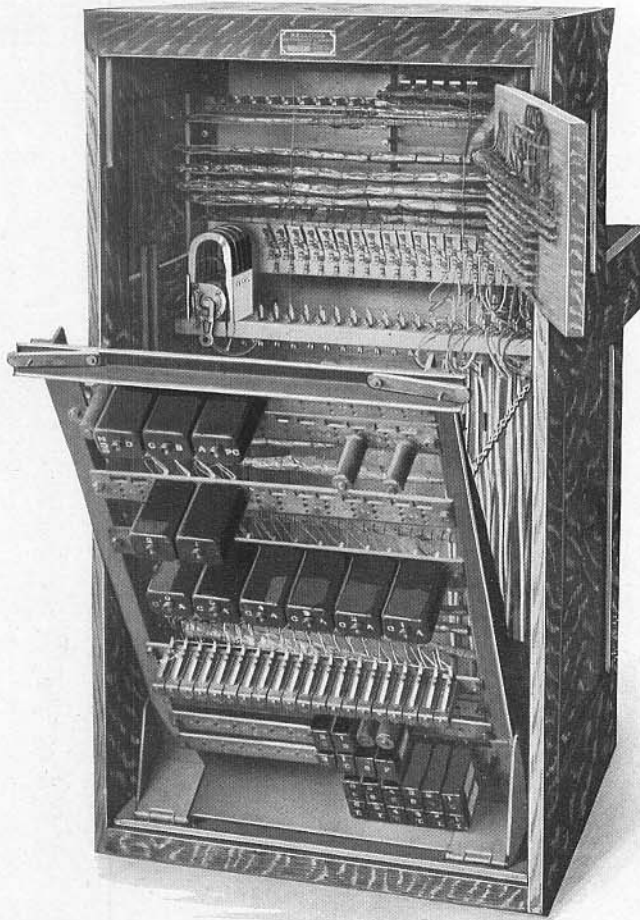


Fig. No. 8605—Code No. 101 Cabinet—from 10 to 100 lines. Relay rack open

FEATURES:

Relay rack, when open, securely held at an angle of 45 degrees by side chains which can be unlocked to allow lowering of rack to horizontal position, giving free access to all parts of interior of cabinet.

Heavy flange hinges constructed to keep relays and condensers from coming in contact with the floor, when rack is lowered.

Two Hundred Line Cabinet

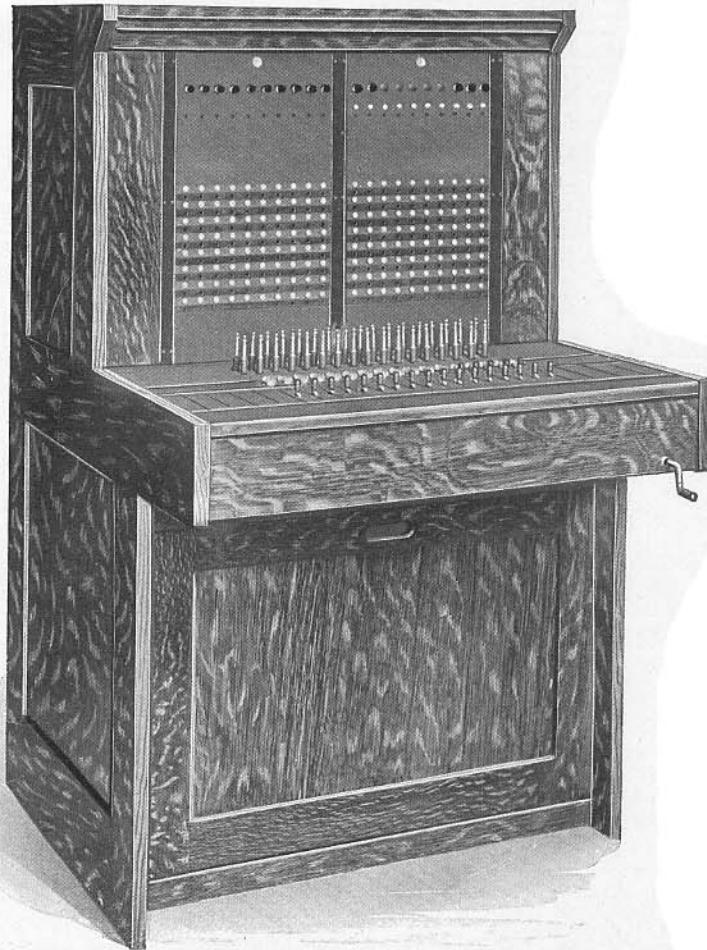


Fig. No. 8606—Code No. 102 Cabinet—ultimate capacity, 200 lines

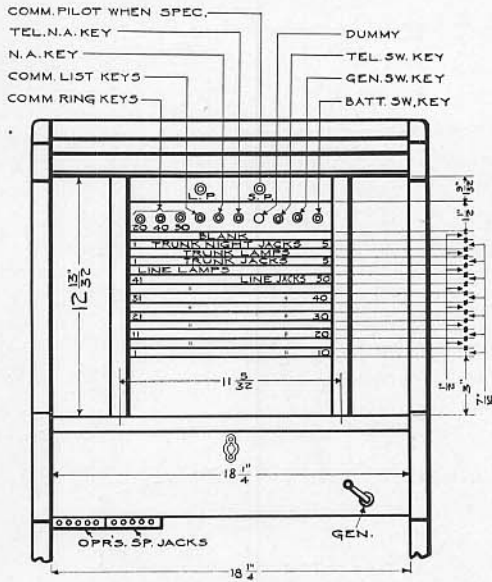
ADVANTAGES:

The height of the key shelf is such that ordinary office chairs are used with this board, an added saving and convenience.

Standard woodwork and finishes in keeping with regular designs in office furniture.

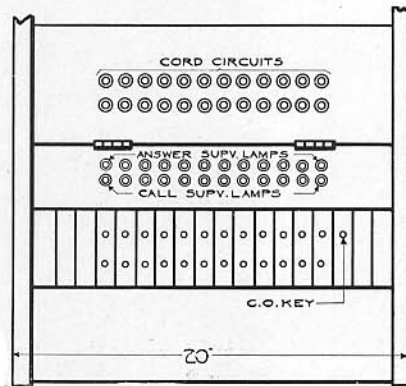
This is an ideal equipment where more than one hundred lines are needed.

Dimensional Drawing, Code No. 100, 50-Line Cabinet



Front view of face equipment showing lamps and jacks and front end of key shelf, with operator's jack.

Top view of key shelf showing keys, supervisory lamps and cord equipment.



Face Equipment, No. 1-A. Equipment, 10 to 50 lines, using Code No. 100 Cabinet

No. 1-A Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange.

Direct line lamp line circuits (without line relays). For lines of average length.

This cabinet has the following ultimate capacity:

- | | |
|--------------------------------------|-----------------------|
| 50 local line circuits, 10 per strip | 1 generator circuit |
| 5 jack trunk circuits, 5 per strip | 1 pilot circuit |
| 12 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

Equipment, 10 to 50 Lines

No. 1-AA Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange. Line relay line circuits.

This cabinet has the following ultimate capacity:

- 50 local line circuits, 10 per strip
- 5 jack trunk circuits, 5 per strip
- 12 cord circuits
- 1 operator's telephone circuit
- 1 generator circuit
- 1 pilot circuit
- 1 night alarm circuit
- 1 battery switch

No. 1-B Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange.

Direct line lamp line circuits (without line relay). For lines of average length.

Cabinet has the following ultimate capacity:

- | | |
|--------------------------------------|-----------------------|
| 50 local line circuits, 10 per strip | 1 generator circuit |
| 5 plug trunk circuits | 1 pilot circuit |
| 7 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

No. 1-BB Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange. Line relay line circuits.

Cabinet has the following ultimate capacity:

- | | |
|--------------------------------------|-----------------------|
| 50 local line circuits, 10 per strip | 1 generator circuit |
| 5 plug trunk circuits | 1 pilot circuit |
| 7 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

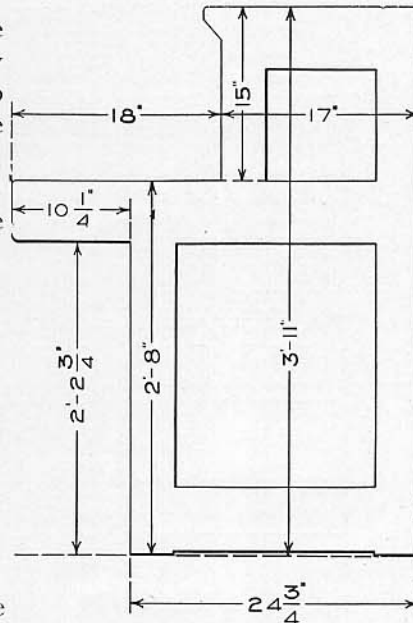


Fig. No. 8609
Side Elevation
Code No. 100 Cabinet

Dimensional Drawing, Code No. 101, 100-Line Cabinet

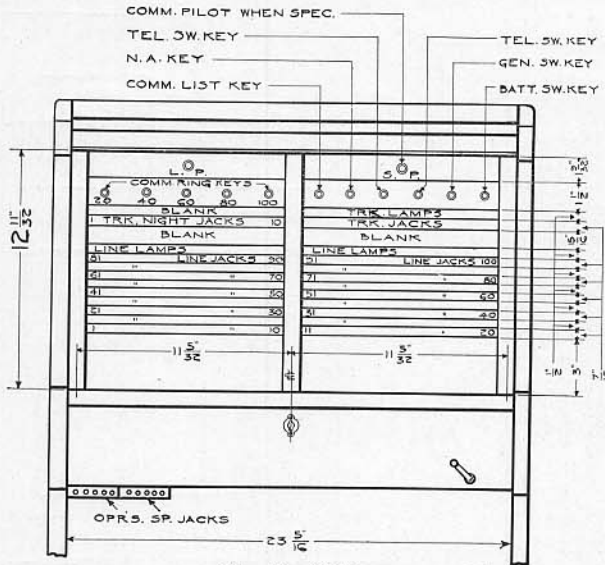


Fig. No. 8610

Front view of face equipment showing lamps and jacks and front end of key shelf, with operator's jacks.

Top view of key shelf showing keys, supervisory lamps and cord equipment.

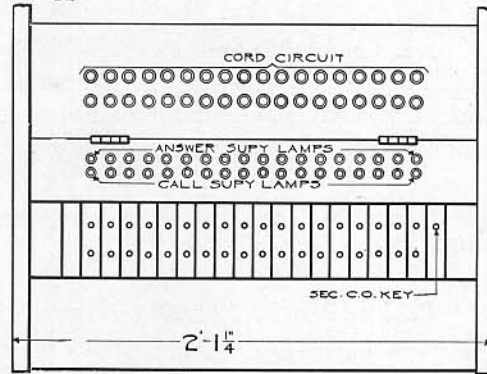


Fig. No. 8611

Face Equipment, No. 2-A. Equipment, 10 to 100 lines, using Code No. 101 Cabinet

No. 2-A Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange.

Direct line lamp line circuits (without line relays). For lines of average length.

This cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 100 local line circuits, 10 per strip | 1 generator circuit |
| 10 jack trunk circuits, 10 per strip | 1 pilot circuit |
| 18 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

Equipment, 10 to 100 Lines

No. 2-AA Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange. Line relay line circuits.

This cabinet has the following ultimate capacity:

- 100 local line circuits, 10 per strip
- 10 jack trunk circuits, 10 per strip
- 18 cord circuits
- 1 operator's telephone circuit
- 1 generator circuit
- 1 pilot circuit
- 1 night alarm circuit
- 1 battery switch

No. 2-B Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange.

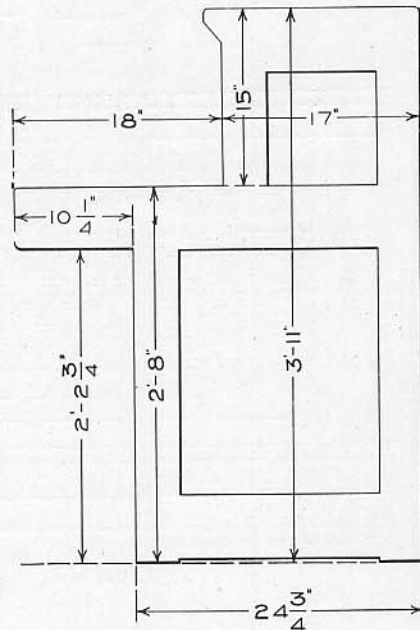


Fig. No. 8612
Side Elevation
Code No. 101 Cabinet

Direct line lamp line circuits (without line relay). For lines of average length.

Cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 100 local line circuits, 10 per strip | 1 generator circuit |
| 10 plug trunk circuits | 1 pilot circuit |
| 8 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

No. 2-BB Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange. Line relay line circuits.

Cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 100 local line circuits, 10 per strip | 1 generator circuit |
| 10 plug trunk circuits | 1 pilot circuit |
| 8 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

Dimensional Drawing, Code No. 102, 200-Line Cabinet

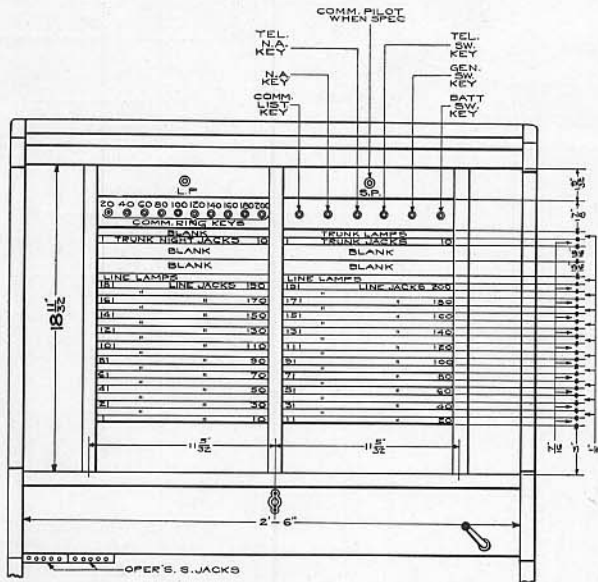


Fig. No. 8613

Front view of face equipment showing lamps and jacks and front end of key shelf, with operator's jacks.

Top view of key shelf showing keys, supervisory lamps and cord equipment.

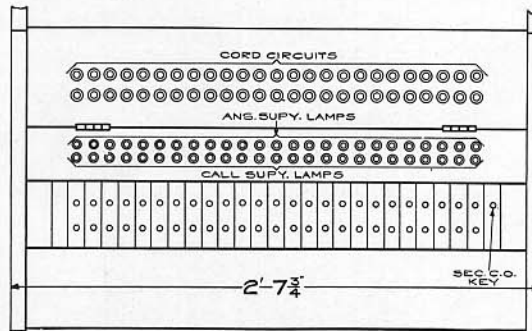


Fig. No. 8614

Face Equipment, No. 3-A. Equipment, ultimate capacity 200 lines, using Code No. 102 Cabinet

No. 3-A Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange.

Direct line lamp line circuits (without line relays). For lines of average length.

This cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 200 local line circuits, 10 per strip | 1 generator circuit |
| 10 jack trunk circuits, 10 per strip | 1 pilot circuit |
| 25 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

Equipment, Ultimate Capacity 200 Lines

No. 3-AA Private Branch Exchange Switchboard, one position, common battery with Universal jack-ended trunks to magneto or common battery city exchange. Line relay line circuits.

This cabinet has the following ultimate capacity:

- 200 local line circuits, 10 per strip
- 10 jack trunk circuits, 10 per strip
- 25 cord circuits
- 1 operator's telephone circuit
- 1 generator circuit
- 1 pilot circuit
- 1 night alarm circuit
- 1 battery switch

No. 3-B Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange.

Direct line lamp line circuits (without line relay). For lines of average length.

Cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 200 local line circuits, 10 per strip | 1 generator circuit |
| 10 plug trunk circuits | 1 pilot circuit |
| 15 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

No. 3-BB Private Branch Exchange Switchboard, one position, common battery with Universal plug-ended trunks to magneto or common battery city exchange. Line relay line circuits.

Cabinet has the following ultimate capacity:

- | | |
|---------------------------------------|-----------------------|
| 200 local line circuits, 10 per strip | 1 generator circuit |
| 10 plug trunk circuits | 1 pilot circuit |
| 15 cord circuits | 1 night alarm circuit |
| 1 operator's telephone circuit | 1 battery switch |

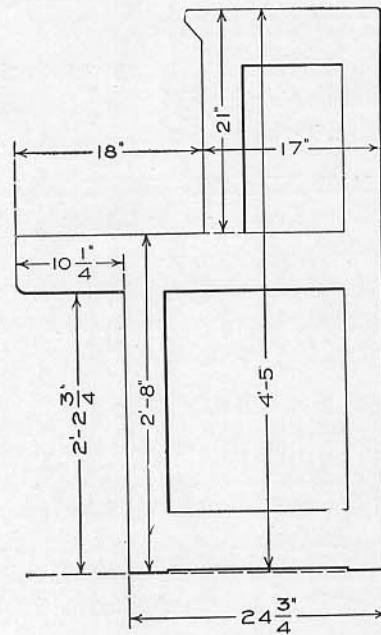


Fig. No. 8615
Side Elevation
Code No. 102 Cabinet

APPARATUS

Equipment Facilities

LINE CIRCUITS:

All line circuits are standard, ten per strip, and can be equipped with common ringing and listening, for fire alarm service on either the direct line lamp or line relay type circuit.

LINE RELAYS UNNECESSARY:

The direct line lamp circuits are generally used and the well known Kellogg switchboard lamps are designed to give a brilliant signal on the average line circuit. On exceptionally long lines, the line relay circuit is used, and it is sometimes customary to have most of the lines of the direct line lamp circuit and a few of the line relay circuit.

TRUNK CIRCUITS:

Jack-ended trunk circuits are furnished five and ten per strip. They are provided with a night jack. When requested, jack-ended trunks can be equipped with a flash button which, when pressed, will signal central without moving plug.

Plug-ended trunks have a line and disconnect lamp. This trunk is arranged so that no holding key is used, and the P. B. X. party can signal the main exchange operator at the same time as the P. B. X. operator.

CORD CIRCUITS:

The cord circuits provide for double lamp supervision.

OPERATOR'S CIRCUIT:

Operator's circuit can be furnished either with the suspended or breast-plate type transmitter, or both.

GENERATOR CIRCUIT:

Generator circuit is equipped with a four bar hand generator and a generator switching key to switch from power to hand generator.

BATTERY SWITCHING CIRCUIT:

This is in the main battery lead to open the circuit and cut off battery when the board is not in use.

CLERK'S EXTENSION DESK STAND:

This is used only with common listening equipment and is arranged so that local calls can be answered from this particular telephone when the operator is not at the switchboard.

NIGHT SERVICE:

Trunks are equipped with night jacks and any number of plugs can be furnished connected together to allow connecting as many lines to one trunk as desired.

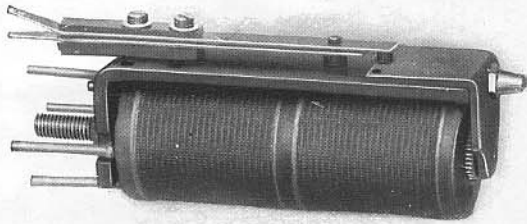


Fig. No. 8616—Code No. 2030 Cord Circuit Relay
are mounted so they are readily accessible. The line relay is of a similar construction and insures operation under all conditions.

LINE AND CORD CIRCUIT RELAYS:

These relays are of the well known angle armature type which insure a wide margin of operation. The armature is mounted so that it cannot move out of place. The springs are assembled with insulation of micarta and Bakelite and

TRUNK SIGNAL RELAYS:

This relay is designed to operate from alternating current from the central exchange and to be restored electrically by the insertion of a plug.

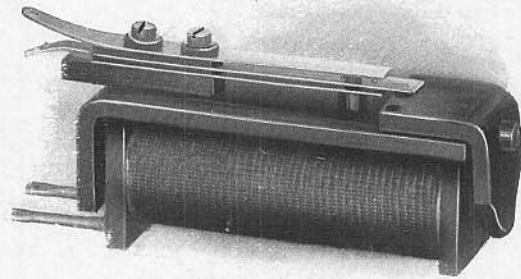


Fig. No. 8617—Code No. 26 Line Relay

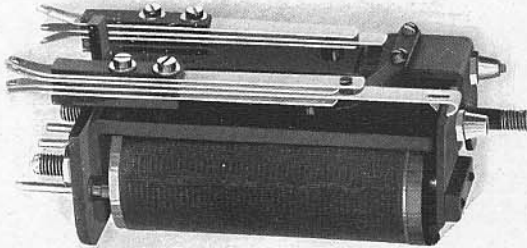


Fig. No. 8618
Code Nos. 2016 and 2011 Trip Restoring Relay

Heavy mounting plates and cover with adequate knurled and slotted nut secured to permanently riveted cover rod, insures absolute stability to both relay and cover, obviating any possible interference with relay action.

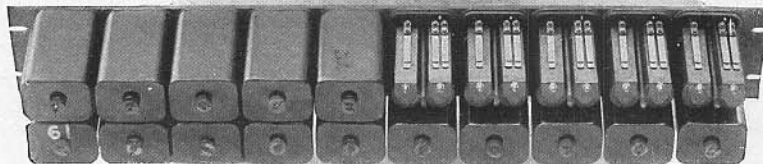


Fig. No. 8619—Strip of Standard Relays on Mounting Plate

RELAY BUZZER:

This relay buzzer has many advantages over the ordinary buzzer on account of its being made from a regular telephone relay which is known for its reliability of operation. The spring, arranged with a hammer piece, will vibrate against the metal cover, giving a distinctive alarm.

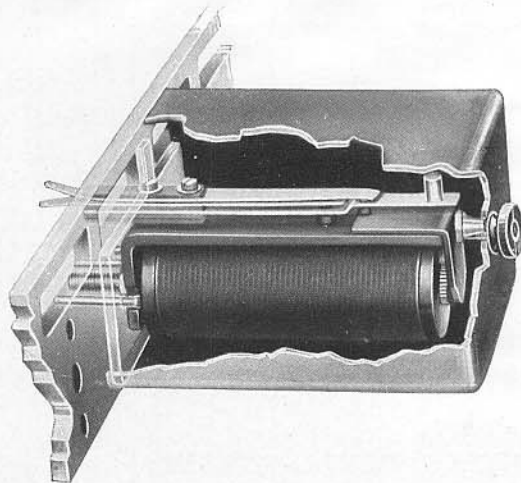


Fig. No. 8620—Code No. 2000 Relay

Operator's Equipment

ADJUSTABLE TRANSMITTER ARM:

A marked improvement over old styles. Does away with the cord weight bother. With this arm, position of transmitter can be instantly changed; brought forward or backward, moved sideways or raised and lowered. Holds transmitter conveniently for use in standing as well as sitting position.

This arm is especially valued at P. B. X. or magneto switchboards where operator attendant has other work to do and uses adjoining desk or counter.

OPERATOR'S SET:

The Kellogg operator's set, well known for its transmission efficiency, consists of the standard Kellogg transmitter, induction coil, head receiver, with band, hand generator and power to hand generator switching key.

The head receiver shell is made of Bakelite, the wonderful new unbreakable material used by the Kellogg Company, at no additional cost. It is of surpassing strength and endurance, is not brittle, will not chip, crack, or lose its shape, texture or color, under the most severe conditions.

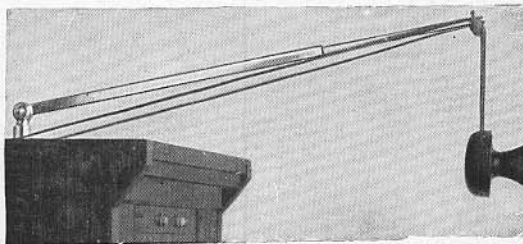


Fig. No. 8621—Code No. 45 Transmitter Arm

Durability is especially important in this receiver equipment, as many operators do not use the head band continuously. Being often engaged in clerical work, the frequent handling results in breakage in less durable shell materials.

Breast plate transmitters furnished when specified. They are of aluminum, light weight and very durable. The mouthpieces are correctly shaped and built for proper transmission.

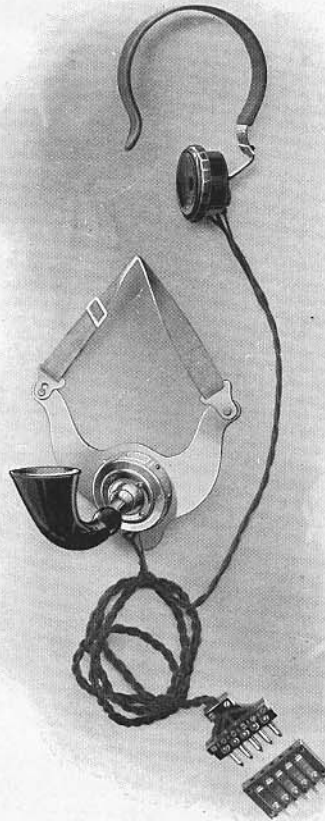


Fig. No. 8622

Operator's Equipment: No. 46-A receiver with No. 2 leather covered head band; No. 76-C breast plate transmitter; No. 131 plug; and No. 291 cut-in jack.

OPERATOR'S JACK AND PLUG EQUIPMENT:

Kellogg operator's jack and plug equipment for P. B. X. boards is exceptional, both in durable service qualities and in convenience. It must be seen and used to be appreciated. These plugs and jacks, if desired, allow the use interchangeably of either suspended or breast plate type transmitters or both at the same time.

HEAD BANDS:

Kellogg head bands are of three types, leather covered steel, black enameled steel and black enameled wire. Each of these has advantages of its own and is preferred under various conditions. All are extremely light, retain their shape and fit comfortably.

Kellogg Operators' Receivers and Head Bands



Fig. No. 8623
No. 46-A Receiver with
No. 5 Band with Cover

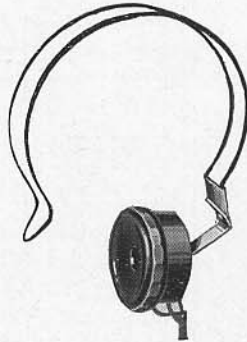


Fig. No. 8624
No. 46-A Receiver with
No. 6 Enamel Wire Band

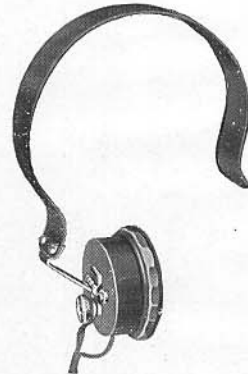


Fig. No. 8625
No. 46-A Receiver with
No. 4 Enamel Metal
Head Band

Kellogg standard operators' Bakelite shell receivers are listed as Code No. 46-A. Specify Kellogg Bakelite when ordering.

If leather covered band is desired, specify Code No. 2 head band with 46-A receiver.

If flat metal band is desired, specify Code No. 4 head band with 46-A receiver.

If swivel flat metal band is desired, specify Code No. 5 head band with 46-A receiver.

If swivel leather covered band is desired, specify Code No. 5 head band with cover, with 46-A receiver.

If swivel wire band is desired, specify Code No. 6 head band with No. 46-A receiver.

PLUGS:

Kellogg plugs are of heavy brass with durable fibre shell—ample insulations and accessible cord connections.

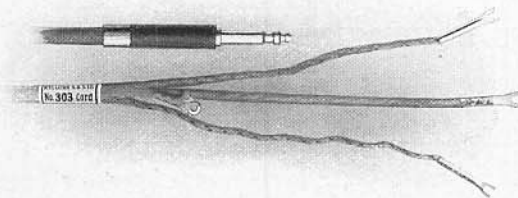


Fig. No. 8626—No. 106 Plug and 303 Cord

CORDS:

Kellogg cord manufacturing facilities are unsurpassed for the production of durable cords. High grade insulating material, ample tinsel and properly tested steel only, are used in our careful cord building to produce a finished product of highest quality—a cord free from humps or unevenness, of uniform flexibility, that will not twist or kink in use. Our cords, in addition, are tangentially stitched at plug end, resulting in vastly longer wear and freedom from cut-backs.

BATTERY SWITCHING KEY:

The battery switch is substantially built and arranged with special heavy contacts which insure a clean connection for the passage of the necessary amount of current to operate the switchboard. The springs are mounted in Bakelite and separated with micarta, forming an insulating medium of extremely high resistance.

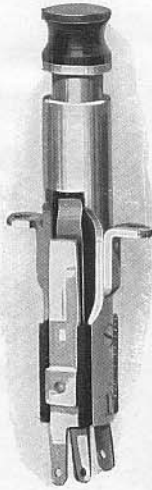


Fig. No. 8627
Code No. 300 Battery
Switching Key

CONDENSERS:

Kellogg condensers are thoroughly tested for capacity and breakdown, and are known to be absolutely reliable.



Fig. No. 8628—Code No. 64 Condenser

GENERATOR

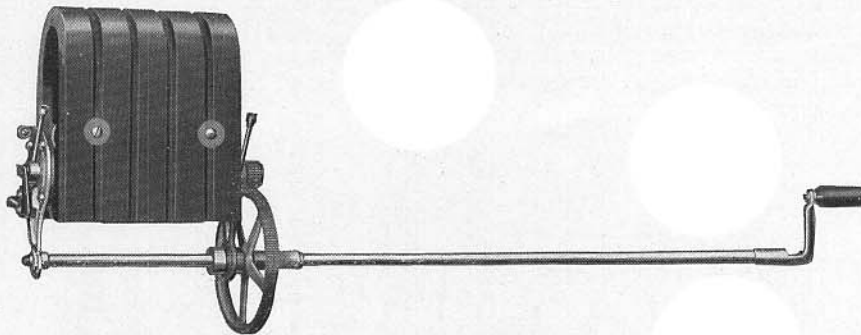


Fig. No. 8629—No. 63 Generator

This generator is substantial in design and as nearly perfect, electrically and mechanically, as it is possible to make it. It is very powerful on account of its armature construction having a shuttle shaped core, and the powerful magnets of special magnet steel.

Kellogg generators are given rigid tests to insure reliability under all conditions and freedom from trouble.

CHAIRS:

An advantage in Kellogg P. B. X.'s is that the top of the roomy keyshelves are standard desk height and ordinary office chairs can be used. If, however, a regular operator's chair is desired, the following code numbers describe a durable, comfortable and all around useful chair:

No. 1100. Cane Seat. No. 1100-W. Wood Seat. No. 1100-PL. Perforated Leather Seat.

Special finishes will require special prices the same as cabinets.

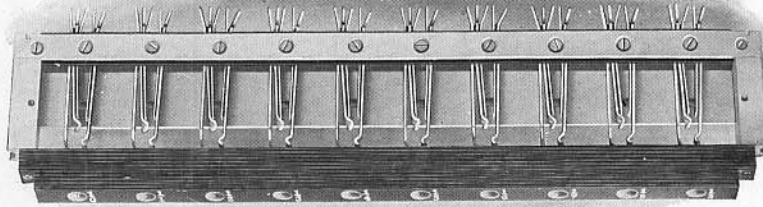


Fig. No. 8630—Code No. 267 Spring Jack

JACKS:

These jacks are constructed of the best materials and are assembled so as to form a substantial strip of ten jacks.

Springs are of heavy contact metal and insulations are of the best grade hard rubber, micarta and Bakelite.

They are arranged for mounting in the jack frame, so that they can be easily installed when additions are required. Thousands of Kellogg spring jacks are in service over ten years.

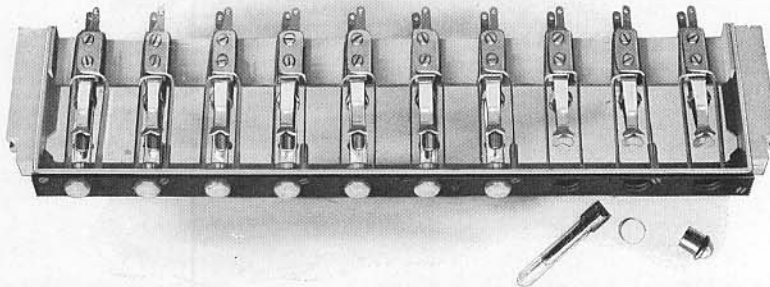


Fig. No. 8631—Code No. 34 Lamp Jack, and Separate Lamp and Cap

LAMP JACKS:

These lamp jacks are made of metal and are assembled with the proper insulating mediums in strips of ten. Strong springs engage the terminals of each lamp and hold it securely in correct position. The face strip is enameled and is provided with an improved form of removable lamp cap, so that lamps can be readily inserted. Substantial cross section springs separate the lamps in such a manner that each illumination shows only in the lamp cap of the lamp that is lighted, there being no reflection in any other opals. Repeated and long continued tests show Kellogg lamps superior to any on the market.

Principal Advantages of the Kellogg Cam Type Key

Some of which are omitted in all other makes

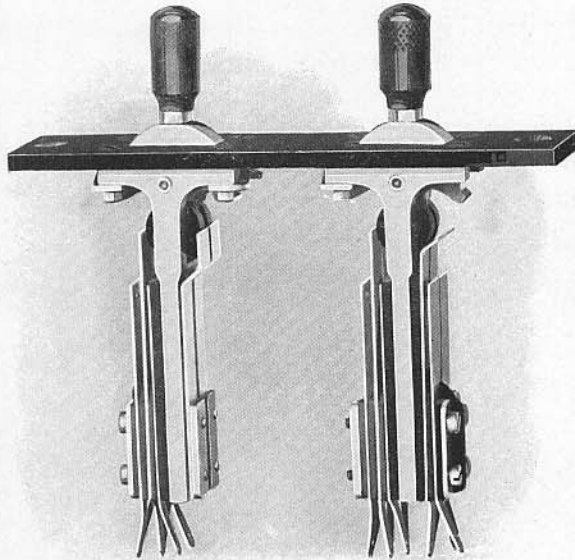


Fig. No. 8632—Code Nos. 1041 and 1033 Keys on
No. 1013 Escutcheon

1. Long flexible, durable contact metal springs of the proper thickness and tension with short action, which reduces spring breakage to a minimum and avoids excessive wear on the cam and rollers.
2. Kellogg Bakelite insulating material used throughout.
3. Tube bushings are of Kellogg Bakelite and of the headless type.
4. All screws are flush with escutcheon.
5. A projection has been cast on the main Bakelite insulator which rests between the springs and the key frame in such a manner as to always keep the spring assembly in perfect alignment.
6. Heavy metal clamps are used under the mounting screw heads, which permit rigid assembling.
7. The heavy brass "T" frame permits the contact springs to be mounted on both sides, thereby increasing possible spring combinations and at the same time balancing the strain under all conditions.
8. The cam is so designed that the extra heavy rollers are held in place without the use of screws or rivets.

9. Large bearings are provided for the rollers.
10. Extra wide, heavy steel bearings are provided for the cam, thereby eliminating side play.
11. A special stud is used to mount the cam handles which greatly increases the strength of this particular part.
12. The general construction of the cam type key is such that only one frame and one cam, together with the Universal stop, is necessary for any combination of key that is desired, making it possible to change this key to any combination by merely changing the springs and rearranging the stops.
13. The frame and cam are constructed of drawn brass.
14. The studs and screws are of steel.
15. The escutcheon is made of heavy steel with baked enamel finish.

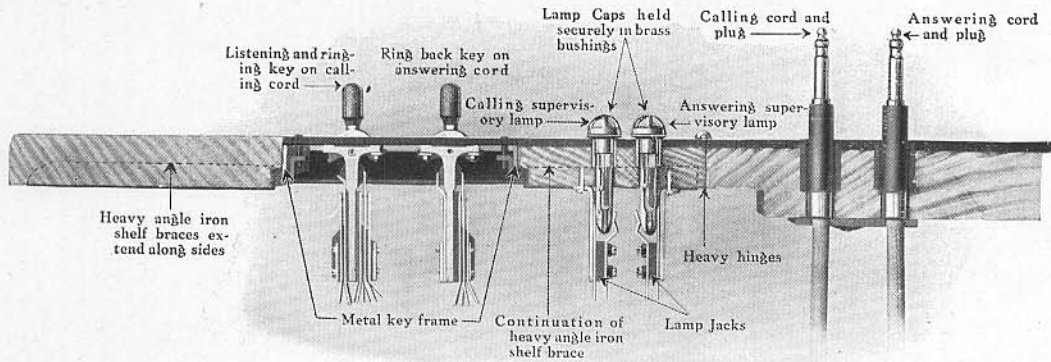


Fig. No. 8633—Cross Section of Plug and Key-Shelf

KEY-SHELF:

The key-shelf is reinforced by grooved metal key frames. Centered holes for mounting the keys are entirely done away with, the keys being securely held in place by a clevis, which is drawn up into the grooved key frame by means of screws through the escutcheon plate.

The plug shelf and lamp rail are covered with wear-resisting material which will not mar from the impact of the plugs.

The plug drillings are provided with bushings to prevent wear on cords and insure proper seating of plugs.

The supervisory lamp jacks securely hold the lamps for proper contact and the lamp drillings are equipped with brass bushings, giving lamp cap a snug fitting socket.

Heavy angle irons give added strength and durability to our key-shelves, preventing warping or splitting. Added shelf space aids in operating and general office work.

NO. 97 DESK TELEPHONE FOR CLERK'S USE:

In hotels and certain classes of private branch service, where the operator is away from switchboard, a standard telephone set is used, located where the operator works.

Information For Ordering

Code Number of P. B. X.....
Code Number of Finish for Woodwork.....	Number.....
Line Circuits, direct Line Lamp.....	Number { Equipped Wired only.....
Line Circuits, with Relays.....	Number { Equipped Wired only.....
Trunk Circuits, Jack-ended.....	Number { Equipped Wired only.....
Trunk Circuits, Plug-ended.....	Number { Equipped Wired only.....
Cord Circuits.....	Number { Equipped Wired only.....
Operator's Circuit.....
Generator Circuit.....
Battery Switching Circuit.....
Connections for Night Service.....
Description	Number.....

Operation

Various classes of service and operation can be furnished with the different types of private branch exchange equipment. The trunk circuits can be arranged to terminate at the private branch exchange in either jacks or plugs. The line circuits can be arranged to ring all telephones simultaneously, either as a fire alarm or for the purpose of calling a party to any telephone in case a shop superintendent, for instance, is to be located for a telephone call. Circuits are arranged so that any number of departments can be connected to switchboard for intercommunication. As many conversations can be carried on as there are pairs of cords or connecting circuits.

Telephones of the private branch system can be connected to the city exchange by means of trunk lines which are carried to the private switchboard and connected to a jack similar to the local telephones or in plugs and cords the same as used for connecting two telephones together at the P. B. X. It is recommended that the city line be terminated in what is known as jack-ended trunks on account of their simplicity in operation.

INTER-OFFICE CONNECTION

When a party at one of the telephones connected with the P. B. X. desires to call a party at one of the other telephones connected with the P. B. X., he removes his receiver from the hook-switch which causes the line lamp corresponding to this line to light and signal the operator. The operator answers and extinguishes the signal by inserting in the jack, which is located immediately under the lamp, the rear or answering plug of one of the cord circuits. The operation of the listening key enables her to speak to the calling subscriber and determine the connection that is desired, and then insert the corresponding calling plug into the line jack of the called telephone which lights the supervisory lamp associated with the calling cord. The listening key is then closed and the telephone signalled by operating the proper ringing key of the same cord circuit. The called telephone answers, extinguishing the supervisory lamp. After the conversation has been completed both parties return their receivers to the hook and both the calling and answering supervisory lamps are lighted, indicating to the operator that the connection should be taken down. Before the connection is removed, the supervisory lamps can be flashed to attract the operator's attention by moving the receiver-hook up and down. Should another call be desired, the connection can be completed in the original manner.

OFFICE TO CITY CONNECTION—JACK-ENDED TRUNK

The operator answers the call in the regular way and finds that the party desires a connection with the city exchange and makes this connection by inserting the calling plug in the jack of the trunk line. This causes the city operator to request the number in the same manner as from a regular city telephone except that the private branch exchange party cannot flash the city operator and must call the private branch exchange operator in when it is desired to again call the city operator on the same connection. When conversation is completed and the receiver is returned to the hook, the answering supervisory signal is displayed which notifies the P. B. X. operator to take down the connection. The P. B. X. operator must be governed entirely by the answering supervision on these connections as the calling supervisory signal is held out for the purpose of signalling the city exchange.

OFFICE TO CITY CONNECTION—PLUG-ENDED TRUNK

The operator answers in the regular manner; when she finds that a city connection is desired, she removes the answering plug and inserts the plug-ended city trunk in the jack of the line calling. The party already being on the line causes the city operator to request the number and the private branch party awaits his connection. When conversation is completed and the receiver returned to the hook, the disconnect signal is given at the city exchange and the supervisory signal is displayed at the private branch exchange which notifies the operator to remove the trunk connection.

CITY TO OFFICE CONNECTION—JACK-ENDED TRUNK

When a city subscriber calls a private branch exchange, a signal is displayed over the jack associated with the trunk. The operator answers and extinguishes this lamp by inserting the answering plug in the jack immediately beneath the signal; after determining the information desired, if necessary, connects to the proper private branch telephone by inserting the calling plug in the line jack of the line called, lighting the calling supervisory lamp and operating the ringing key. The calling supervisory lamp is extinguished when the receiver of the called telephone is lifted. When the conversation is completed, the calling supervisory lamp is lighted, thus notifying the operator that this connection is to be taken down.

FROM CITY TO OFFICE CONNECTION—PLUG-ENDED TRUNK

When a city subscriber calls a private branch, a signal is displayed in front of the plug-ended trunk and the operator answers and extinguishes the calling signal by throwing the listening key; after determining the information desired, if necessary inserts the trunk plug in the jack of the line called, lighting the supervisory signal. She then rings the called party. When the receiver is lifted, the supervisory signal is extinguished. After the conversation is completed and the receiver returned to the hook, the disconnect signal is given at the city exchange and the supervisory signal is displayed at the P. B. X. exchange, which notifies the private branch operator to remove the trunk connection.

NIGHT SERVICE AND OTHER FEATURES

When necessary to give certain telephones of the P. B. X. service on holidays and at night, an arrangement of plugs and cords is provided to connect as many stations as desired to any trunk line. This allows the party at the P. B. X. telephone to call the city exchange when the operator is off duty. When plug-ended trunks are used, this night service feature can be accomplished by providing extra plugs for the connection. The plug ended-trunk will allow the connecting of only one station unless other plugs are associated with it. The board is provided with a special key so that all battery can be cut off the switchboard and all lamps extinguished when the connections are up for night service; this saves the battery.

If operator is engaged in clerical work, operation of the night alarm key will cause an audible signal when the party calls, notifying the operator that attention is desired. Special equipment can be provided so that an operator can answer a call without the insertion of a plug. This is known as "Common Answering and Listening," and is particularly adapted to hotels, etc., where calls asking for information can be answered without the completion of a connection. Other equipment can be provided to simultaneously ring all the bells connected with the private branch exchange for a fire alarm signal. This is known as "Common Ringing," and is arranged to ring groups of twenty lines at one time. This can also be used for code ringing to call a superintendent or official of a firm when they may desire to locate him.

PRIVATE BRANCH EXCHANGE INSTALLATION

The installation of a private branch exchange is a very important feature for successful operation, and the best of material should be used and due consideration given to the method of running the cable and the wires for the interior telephones. This cable should be run from the switchboard to a suitable junction box and terminated for connection with the wires which radiate to the telephones. This provides means so that any particular line in the switchboard could be connected to any particular telephone line. Where lines are confined to factories and office buildings and not exposed to contact with foreign electrical wires, protection is not necessary. Where lines are exposed to foreign electrical wires, an approved type of protector should be used. The cables from the switchboard to the junction or terminal box should either be run in conduit or protected with a lead covering if there is any possible chance for moisture. The distributing wires to the telephone should be run in protected places and should have an approved covering of rubber and cotton.

Battery Supply for Private Branch Exchanges

I. BATTERY DIRECT FROM CENTRAL OFFICE:

To avoid the installation of a power plant at the exchange, battery is usually supplied from the central office over separate wires. Cable pairs are generally used for this purpose and a sufficient number of pairs to insure the proper current supply should be employed.

NUMBER OF CABLE PAIRS FOR BATTERY SUPPLY

No. 19 B. & S. Gauge Cable												No. 22 B. & S. Gauge Cable											
Cord Pairs in Use at the Same Time												Cord Pairs in Use at the Same Time											
Distance from Office												Distance from Office											
Feet.	4	5	6	7	8	9	10	11	12			Feet.	4	5	6	7	8	9	10	11	12		
500..	1	1	2	2	2	2	2	3	3			500..	2	2	3	3	3	4	4	4	5		
1000..	2	2	3	3	3	4	4	5	5			1000..	4	4	5	6	6	7	8	9	10		
1500..	3	3	4	4	5	6	6	7	7			1500..	5	6	7	8	9	11	12	13	14		
2000..	4	4	5	6	6	7	8	9	10			2000..	7	8	10	11	13	14	16	17	19		
2500..	4	5	6	7	8	9	10	11	12			2500..	8	10	12	14	16	18	20	21	23		
3000..	5	6	7	8	10	11	12	13	14			3000..	10	12	14	16	19	21	23	25	28		
3500..	6	7	8	10	11	12	14	15	16			3500..	11	14	16	19	22	24	27	29	32		
4000..	7	8	10	11	12	14	16	17	19			4000..	13	16	19	22	25	28	31	34	37		
4500..	7	9	11	12	14	16	18	19	21			4500..	14	18	21	25	28	32	35	38	42		
5000..	8	10	12	14	16	18	19	21	23			5000..	16	20	23	27	31	35	39	42	46		
5500..	9	11	13	15	17	19	21	23	25			5500..	17	22	26	30	34	38	43	46	51		
6000..	10	12	14	16	19	21	23	25	28			6000..	19	24	28	32	37	42	46	50	55		
6500..	10	13	15	18	19	23	25	28	30			6500..	20	25	30	34	39	44	49	53	58		
7000..	11	14	16	19	22	24	27	30	32			7000..	22	27	33	38	43	49	54	59	65		
7500..	12	15	18	20	22	26	29	32	35			7500..	24	29	35	40	46	52	58	63	69		

II. BATTERIES CHARGED FROM CENTRAL OFFICE:

When power is supplied from a local storage battery, which is charged from the central office over leads provided for this purpose, the cable pairs should be of sufficient number to carry the proper amperage for the normal charging rate of the batteries.

III. BATTERY CHARGED LOCALLY:

When the battery is fed from a local storage battery plant which is charged locally, it is sometimes necessary to provide power panels, charging machines and measuring instruments.

The Kellogg Company will be pleased to give this subject consideration from an engineering standpoint in regard to the necessary batteries and auxiliary apparatus required to operate the private branch.

Cordless Private Branch Exchange Equipment

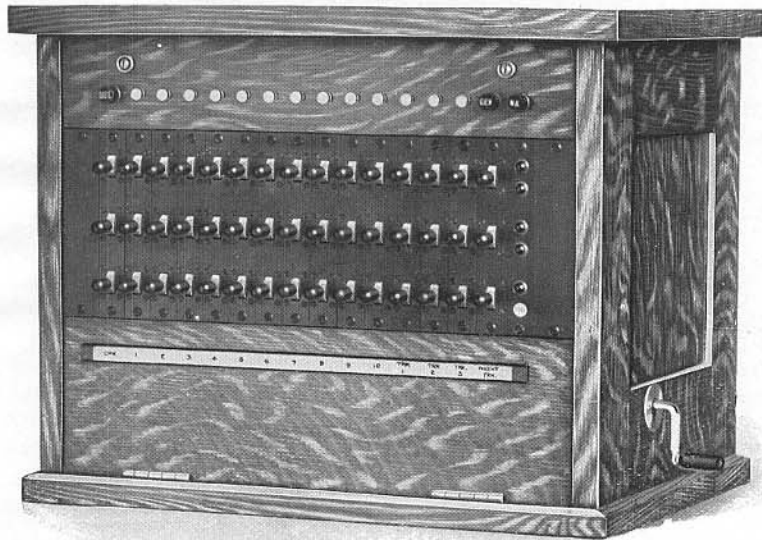


Fig. No. 8634

For business houses that do not require the interconnection of more than ten telephones and three city lines, the cordless private branch exchange has been developed.

This consists of connecting keys arranged in a small compact cabinet of the same durable construction and finish as the regular private branch exchange switchboard.

The construction and woodwork of this cabinet will match the regular office furniture, and when placed on a flat top desk will present the appearance of a regular turret. Its simplicity of operation makes it very desirable where the attendant is required to do clerical work when not answering calls.

The key arrangements provide five connecting circuits, and five conversations can be carried on at the same time without interference. Each line and trunk circuit is a unit of three keys with a signalling lamp above each unit. The operator's key unit consists of three keys at the left, and she can answer any call by throwing one of these keys and then throwing the line key under the signal in the corresponding row in the same direction.

The five connecting circuits are obtained as follows:

The first circuit on the upper row, by raising keys associated with the lines that are to be connected.

The second circuit, by lowering keys.

The third connecting circuit on the middle row of keys, by raising keys associated with the lines that are to be connected.

The fourth connecting circuit, by lowering keys.

The fifth connecting circuit, on the bottom row of keys, by raising keys associated with the lines that are to be connected.

By lowering any of the bottom row of keys, the line associated with the key lowered, will be signalled.

Cordless Private Branch Exchange Equipment

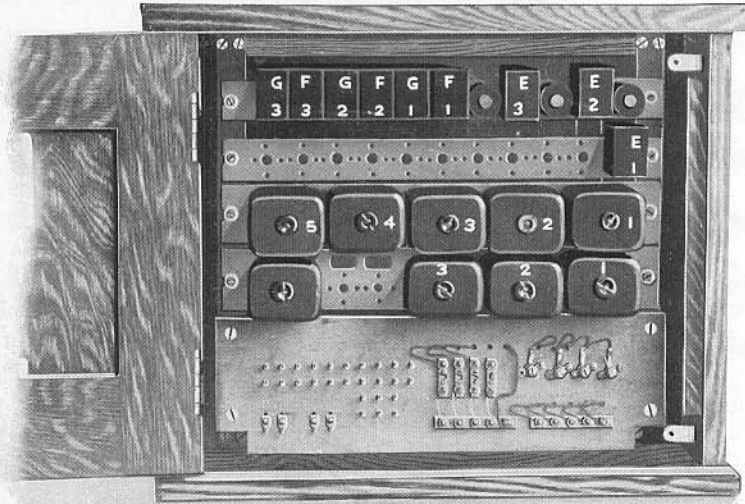


Fig. No. 8635

Each connecting circuit has a supervisory signal mounted in a unit at the extreme right and indicates the upper and lower circuit of each row of keys. If, in the upper row of keys, key No. 2 was raised and key No. 4 raised, lines No. 2 and No. 4 would be placed in a talking position and associated with the upper supervisory signal at the right; if, in this same row, keys No. 5 and No. 7 were lowered, lines No. 5 and No. 7 would be in a talking position and associated with the second upper supervisory signal at the right.

Two keys in the same row, operated in the same direction, would show that circuit to be in use. To answer and complete a second connection on any row, two keys must be operated in the opposite direction.

ANSWERING AND COMPLETING CONNECTIONS:

Should a calling signal appear above line No. 2, the operator will select a listening key in a row where it can be thrown in a direction not occupied by any other keys. She will then operate a key directly under the signal, in the same direction and row as selected by the listening key. This will enable her to answer and extinguish the signal, and after finding the party desires a connection with line No. 6, she will then operate a key on line No. 6 in the direction and row as on the answered line No. 2. She will then press down the lower key of line No. 6, which will ring this telephone bell.

The lines are now in the talking position and she can restore the listening key at the left. When conversation is completed and both parties return their receivers to the hook, the supervisory signal associated with these keys at the right will be displayed, and the operator notified to restore the keys to normal.

Should the party desire connection with the city exchange, a trunk key thrown in the same direction as the answering and listening key will connect this party to the city exchange when he can give the city operator the number desired. When conversation is completed and the party returns receiver to hook, supervisory signal at right of connecting circuit is displayed, notifying operator to restore key.

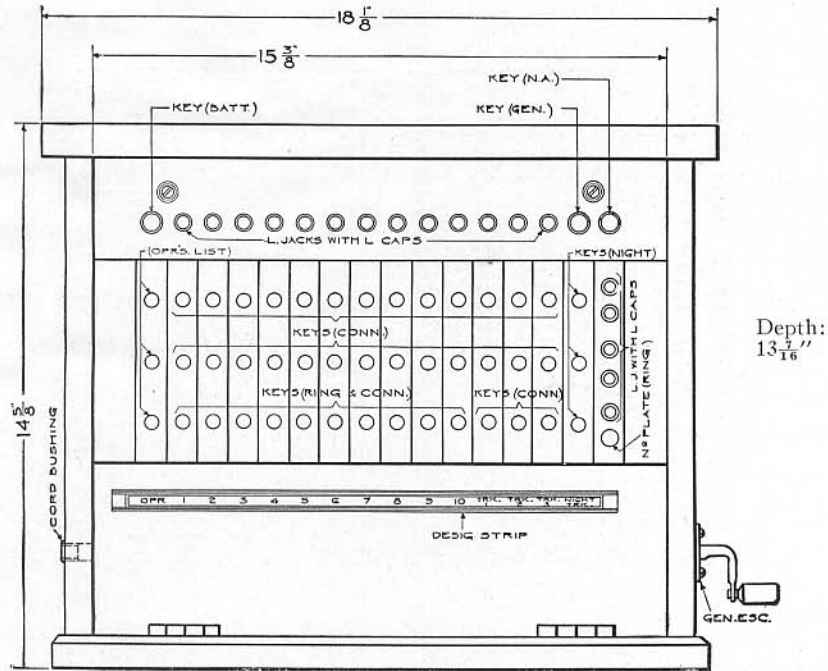


Fig. No. 8636 Cordless P. B. X., face equipment

When the city exchange calls the private branch exchange, a signal is displayed over the keys associated with the trunk and the operator answers and extinguishes the signal by throwing one of the trunk keys into one of the idle connecting circuits, and throws her listening key into the same circuit. After determining the information desired, if necessary, the operator presses one of the lower keys to ring the called party and then throws a key of this line into the same connecting circuit as held by the trunk key. When conversation is completed and the party returns receiver to hook, supervisory signal at right of connecting circuit is displayed, notifying operator to restore key.

NIGHT SERVICE:

The three keys at the extreme right, designated as night trunks, can be thrown onto a connecting circuit to allow a party at the P. B. X. telephone to call the city exchange when the operator is off duty.

Any number of telephones can be connected to a trunk for night service, as desired, the night key being thrown onto a connecting circuit and the lines that are to be connected to this trunk thrown into this same position. When lines are connected for night service, the battery switch should be thrown to disconnect battery from the lines.

When the operator is engaged in clerical work, the night alarm key should be thrown to obtain an audible signal to attract her attention when a party calls.

FIRE ALARM:

Fire alarm can be given on this system by the operator quickly pressing the lower row of keys and as fast as they are answered, giving the necessary information on the connecting circuit.