



Central Battery Private Exchange Switchboard No. 1801 Sectional Unit Type

INFORMATION BULLETIN

NOVEMBER 1, 1912



Fig. 1—No. 1801 Sectional Unit Type Private Exchange Switchboard. System B.

Consists of:

- 1—No. G-1 Top Unit.
- 1—No. HA-4 Simultaneous Ringing and Listening Unit.
- 1—No. HD-1 Line Unit.
- 1—No. JA-2 Cord Unit.
- 1—No. K-1 Supporting Unit.

INTRODUCTION

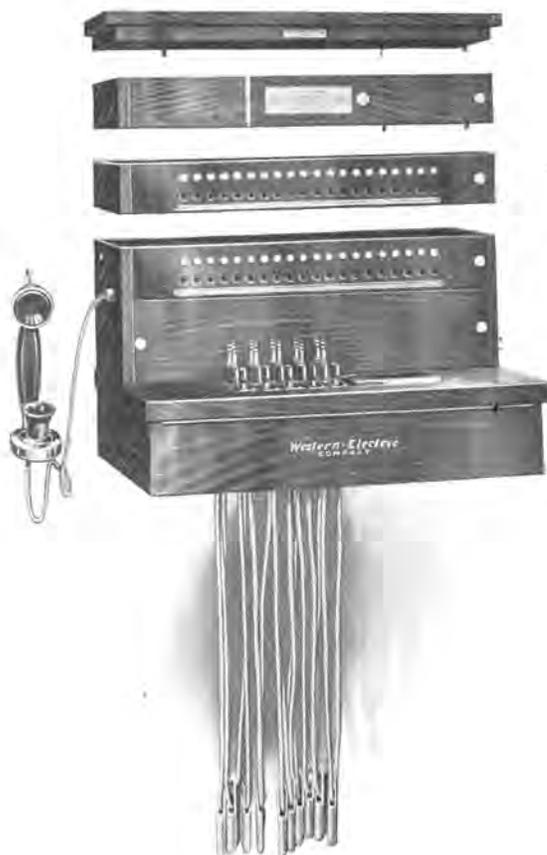


Fig. 2—No. 1801 Switchboard, Showing Flexibility of Unit System and Ease with which Different Units can be Assembled to meet a variety of operating conditions.

THIS Bulletin covers a new type of Central Battery Private Exchange equipment which is offered to meet a demand for a thoroughly reliable yet inexpensive private telephone system.

This system is especially adaptable to establishments too large or otherwise not suitable for our "Interphone" systems.

Several novel and distinctive features not to be found in other systems are incorporated in this type of switchboard and are as follows:

1. The switchboard affords a wide range of application, being composed of various types of units, all of which are interchangeable.

2. The unit system is simple and economical, as you buy at one time only as much switchboard as you need.

3. Its capacity can be increased at any time with the least possible amount of expense and difficulty.

4. The switchboard is arranged so that all telephones or stations can be rung and talked to simultaneously when desired. This feature alone is

a valuable asset, constituting as it does an efficient and reliable fire or general alarm system.

5. It is equipped with a transfer switching key, so that when desired, all incoming calls can be received at some one of the outlying stations, instead of from the switchboard. This is a particularly desirable feature in hotels where there is no regular switchboard attendant at night. The hotel clerk's telephone set can be arranged in this case to receive all calls. Other applications of this will be found in various lines of business.

Applications and Advantages

Hotels The Telephone is rapidly replacing the antiquated annunciator systems used in hotels, as it establishes direct communication between the guest and hotel office, and saves time and labor over the push button call system. Communication between all rooms and departments of the hotel is possible, as well as

service outside the hotel over trunk lines between the hotel switchboard and the local telephone central office.

Bell Boy expense can be reduced, as many calls to the office are for information and do not require a trip by the boy. Other calls requiring service cut the labor in half as the boy does not have to make two trips, one to learn the guest's wishes and the other to perform the service.

The feature of having all incoming calls received at the clerk's telephone during the night or when no switchboard attendant is necessary, is particularly desirable for hotels.

The simultaneous ringing and talking feature is a decided advantage for hotels, in case of fire or other emergency, as the switchboard attendant can notify all guests immediately by simply operating one key.

Apartments No modern and up-to-date apartment house is complete without a telephone system, providing direct communication between apartments, janitor and vestibule.

Speaking tubes are unsanitary and inflexible and are not to be classed with the telephone for this service.

The No. 1801 Switchboard is particularly well adapted for apartment house service.

The switchboard can be installed in the janitor's quarters where it can be attended by some member of his family, taking but a small portion of their time. By this arrangement, the tenants are often saved the annoyance of unnecessary calls from persons they do not care to speak with, by instructing the switchboard attendant to ascertain the name and errand of all persons calling from the vestibule.

Schools and Factories In addition to the regular telephone service which enables the principal or superintendent to keep in touch with all teachers or departments, the simultaneous ringing feature of the No. 1801 switchboard is especially desirable.

Most states and cities have laws which require that schools and factories be equipped with reliable fire alarm systems. In many instances, the simultaneous ringing and talking feature provided with the No. 1801 switchboard meets the requirements and makes any other fire alarm arrangement unnecessary.

Prisons and Asylums Institutions such as prisons and asylums require a rigid system of supervision and close watch over the inmates, and for accomplishing this a telephone system provides the most efficient and reliable method. The superintendent can keep in direct touch with his subordinates by means of the telephone on his desk and instructions can be issued and executed without delay. Guard stations throughout the institution can be equipped with a telephone, whereby each guard can report to headquarters at specified intervals.



Fig. 3—No. 1801 Switchboard System "B."
 Consisting of:
 1—G-1 Top Unit.
 1—HA-4 Simultaneous Talking and Ringing Unit.
 1—HD-1 Line Unit.
 1—JA-2 Cord Unit.
 1—K-2 Supporting Unit.

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The simultaneous ringing and talking feature of the No. 1801 switchboard is a decided advantage in these installations in case a prisoner or inmate attempts to escape. All stations and guards can be notified immediately and simultaneously, and instructions issued for the prompt guarding of the various avenues of escape or for his recapture.

General Description

The No. 1801 switchboard is a unit type, central battery lamp signal switchboard. It is also adapted for branch exchange service from a telephone central office, trunks to either central battery or magneto offices being furnished if desired.

It is designed for systems having not more than 100 lines, but cases will arise, however, where this type of switchboard can be used to accommodate a greater number of lines, such as for hotels and similar institutions in which there is little call for intercommunication between stations.

To meet the different classes of service encountered by a switchboard of this type, four different systems are provided which for convenience, we will call "A," "B," "C," and "D."

System "A": This system provides for communication between the switchboard and the outlying stations or telephone sets only. It is not possible for a party at one station to converse with a party at another station and there are no trunk connections to a telephone central office. It is a three wire system, a third wire common to all telephone sets being required in addition to the regular two wires individual to each station.



Fig. 4—No. 1801 Switchboard System "A."

- Consisting of:
 1—G-2 Top Unit.
 1—HD-1 Line Unit.
 1—JB-1 Cord Unit.
 1—K-1 Supporting Unit.

Figure 19, and is described in detail in a later paragraph.

System "B": This system embodies all of the features of System "A" and in addition is arranged for intercommunication between the sta-

Batteries are used for ringing the telephone bells as well as for operating the switchboard, the telephone sets being equipped with direct current vibrating bells. This system can be arranged for simultaneous ringing and talking to all stations as mentioned on page 2, by the addition of units HA-3 or HA-4.

The circuit of this system is shown in



Fig. 5—No. 1801 Switchboard System "A."

- Consisting of:
 1—G-1 Top Unit.
 1—HA-4 Simultaneous Ringing and Talking Unit.
 1—HD-1—Line Unit.
 1—JA-1 Cord Unit.
 1—K-1 Supporting Unit.

tions. Five pairs of connecting cords with ringing and listening keys are provided for this purpose.

The telephone sets and wiring to the sets are the same as for System "A." See Figure 20 for general arrangements of circuits.

System "C": This system embodies all of the features of systems "A" and "B," and in addition, provision is made for connections to either central battery or magneto central office lines. Two plug ended trunk cords with ringing and listening keys are provided for this purpose.

The general arrangement and wiring of the circuits is shown in Figures 20, 23 and 24, and is the same as for System "B" except that trunk circuits to a central office are added and an induction coil is employed in the operator's circuit to increase the transmission on trunk connections. The telephone sets used with this system are also equipped with an induction coil. Units HA-3 for simultaneous ringing or HA-5 for simultaneous ringing, talking and listening can be used with this system.

System "D": This system is arranged for intercommunication between the stations and trunk connections to a telephone central office. Five

pairs of connecting cords and two plug ended trunk cords to either central battery or magneto central office are furnished. It employs the regular two wire line circuit, and alternating current for ringing the telephone set bells.

The telephone sets for use with System "D" are the regular central battery sets used with central office systems.

The units for simultaneous ringing and talking, HA-3, HA-4 or HA-5, are not adapted for use with System "D" on account of the



Fig. 6—No. 1801 Switchboard, Systems "B" or "D."



Fig 7.—No. 1801 Switchboard System "D." Consisting of:
1—G-2 Top Unit.
1—HD-1 Line Unit.
1—JB-4 Cord Unit.
1—K-3 Supporting Unit.

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complications arising in providing for ringing a large number of stations at the same time on a two wire system. Cord units can be furnished with this system, wired but not equipped for trunk circuits, the holes for trunk circuit apparatus being covered with apparatus blanks.

The general arrangement of the subscribers' line and cord circuits is shown in Figure 21. The trunk circuits are similar to those shown in Figures 23 and 24, the ringing key part of the circuit, however, being modified for System "D" as per Figure 25.

Construction of Units

Framework All lumber used in the construction of these switchboard units is thoroughly seasoned and kiln dried, which prevents any warping or cracking.

Keyshelf and Plugshelf The keyshelf and plugshelf on those cord units equipped with keys are hinged by means of a piano hinge which extends the full length of the shelf. That portion of the shelf around the plugs is covered with 1/8" specially prepared and selected sole leather, which affords protection against the impact of the falling plugs and prevents undue noise, when the operator pulls down a connection.

Accessibility for Inspection The rear of all units is permanently closed, as the switchboard is designed to be placed against the wall when desired. The front panels of all the units are provided with thumb screw locks and are hinged to permit inspection of the wiring, terminals and apparatus, if necessary. The terminals are arranged for screw connection and are accessible from the front and top of the units.

Finish of Switchboard Units The exterior surface of all units is given a rich, deep mahogany finish (Code No. 104-K). This finish presents a very pleasing appearance. The outer coat of varnish is handrubbed and of such character as to not scratch easily or show ordinary wear. The interior of all cabinets is stained to match the outside finish and is given a shellac finish which fills the pores of the wood and effectively prevents warping or decay.

Batteries for Operating No. 1801 Switchboard

The No. 1801 switchboard is designed primarily for operation from batteries consisting of dry cells, for the reason that dry cell batteries are the simplest to install and maintain under the conditions where the majority of private exchange switchboards of this type are used. We recommend the Blue Bell Dry Battery as best adapted to this class of service.



Blue Bell Battery

Systems "A" "B" & "C" The design of the circuits for these systems is such that at least two separate batteries (talking and line lamp battery, and ringing battery), are required, and it is recommended that three be used; one for talking current, one for line lamp current and one for ringing current.

A storage battery in many cases will be found less economical than dry cells, especially for systems "A," "B" and "C," where direct current ringing is employed, as it is necessary on account of the fundamental design of the circuits to provide a separate battery of dry cells for ringing. The storage battery and separate ringing

battery will be most economical, however, where there are a large number of lines and a high calling rate.

System "D" When dry cells are used for system "D," two batteries only are recommended, one for talking current and one for line lamp current. A storage battery can be used to good advantage with system "D," as no ringing battery is required.

NUMBER OF DRY CELLS REQUIRED.

More than one string of cells may be required for a certain battery when dry cells are used in order not to necessitate too frequent renewals. The number of cells in series per string does not change but is constant for the various batteries and systems.

The following table gives the number of cells per string for the different batteries and systems.

System	Number of Cells per String.		
	Line Lamp Batt.	Talking Batt.	Ringing Batt.
A	26	6	20
B	26	6	20
C	22	6	20
D	22	6	None required

We suggest the use of our No. 1440 Type Battery Cabinet to protect the cells from dust and mechanical injury.

Storage Battery Plants

For information on storage battery power plants refer to our Bulletin No. 1008. Any of the 22-volt power plants will operate the No. 1801 Switchboard, except when a ringing battery is required, in which case an extra set of cells is required, as previously explained.

Battery Cabinets

These cabinets are substantially built of oak with removable shelves for dry cells and are furnished with a golden oak finish unless otherwise specified.

Code No.	No. of Dry Cells
1440	72
1441	140



Fig. 8—No. 1441 Battery Cabinet.

Ringling Equipment



Fig. 9—No. 62-A Interrupter.

No. 62-A Interrupter In system "D" if it is desired to avoid using the hand generator provided with the switchboard, for ringing the telephone bells, which require alternating current, we recommend our No. 62-A interrupter shown in Figure 9. This interrupter operates from 5 dry cells and is arranged to interrupt direct current through a small transformer and thereby deliver alternating ringing current of a proper voltage for ringing the telephone set bells. This interrupter operates and consumes current only when a ringing key is operated, the current being controlled by local contacts on the ringing keys. The No. 62-A interrupter is not adapted for use with systems "A," "B" and "C."



Fig. 10—Bell Ringing Transformer.

Bell Ringing Transformer If 110 volt alternating current be available in the building in which the private exchange is installed, our bell ringing transformer, List No. 101177, Western Electric Company catalog, and shown in Figure 10, may be used to advantage in place of a dry cell ringing battery for systems "A," "B" and "C." This transformer is *not adapted for use with system "D," and cannot be used to furnish talking current.*

Protective Apparatus

It is sometimes necessary to protect certain lines against lightning and crosses with electric light or power circuits. Protective apparatus is ordinarily not required on lines which are entirely within the building, but quite often a private exchange installation requires a certain number of lines run outside to some distant building or to the nearest telephone central office.

For such cases we are prepared to furnish the following protective apparatus:

Where only a very few lines or trunks are to be protected, a very economical arrangement is the use of our No. 58-A protector as shown in Figure 11.

No. 4-C protectors, Fig. 12, in strips of 10, 20, 30, 40 or 60 lines, as specified. Provides protection against Lightning, High Potential and Sneak Currents.

No. 7-D protectors, Fig. 13, in strips of 10, 20 or 30 lines, as specified. Provides protection against Abnormal Currents, such as crosses with Electric Light and Power circuits.

The method of installing the No. 4-C and No. 7-D protectors is clearly shown in Figure 16.

No. 61-A protectors, Fig. 14, in strips of 10, 20 or 30 lines, as specified. Provides protection against Lightning and Abnormal currents.

No. 1431-A Distributing Frame, Fig. 15. A 20 line distributing frame designed for mounting on the wall. Equipped with the No. 4 and 7 Type Protectors.



Fig. 11—No. 58-A Protector.



Fig. 12—No. 4-C Protectors on Mounting.



Fig. 13—No. 7-D Protectors on Mounting.



Fig. 14—No. 61-A Protectors on Mounting.

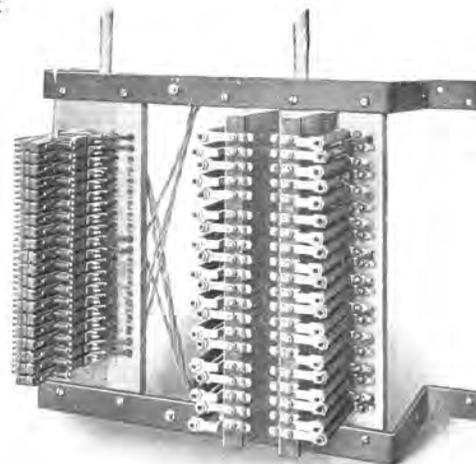
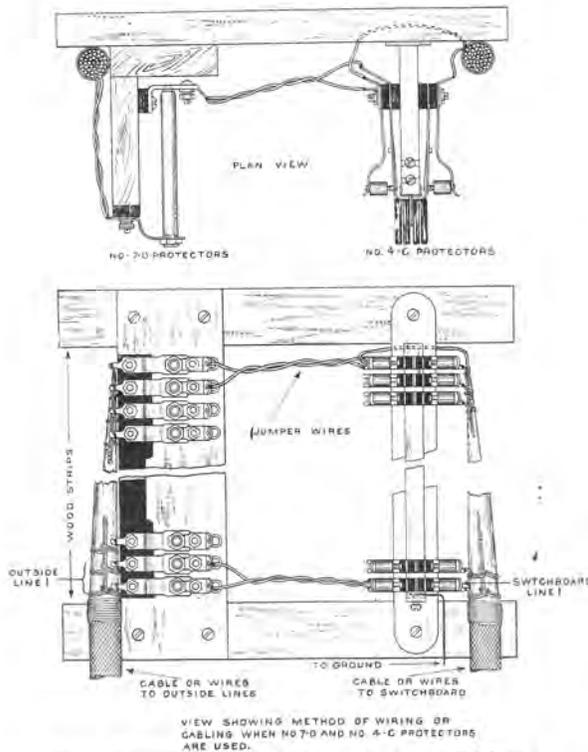


Fig. 15—No. 1431-A 20 Line Distributing Frame.



View Showing Method of Wiring or Cabling When No. 7-D and No. 4-C Protectors are Used. Fig. 16.

Lead Covered Cable

Type "G" Special We recommend for general interior construction and short exterior spans, such as between buildings, our Special Type "G" lead covered cable. This cable is made up of No. 22 B. & S. tinned copper wire insulated with two wrappings of silk and one of cotton, twisted together in pairs and thoroughly saturated with a beeswax compound.

The sheath is composed of 97 per cent. lead and 3 per cent. tin.

A standard color scheme is used throughout so that each wire can be easily traced. See page 11 for standard color code.

Enter order as follows: — ft.
— pair type "G" Special beeswaxed core cable.

This cable can be furnished in any of the following sizes:



Type "G" Lead Cable.

Code No.	No. of Pairs	Outside Dimension
G-5	5	3/8"
G-10	10	7/16"
G-15	15	1/2"
G-20	20	9/16"
G-25	25	19/32"
G-30	30	5/8"
G-35	35	11/16"
G-40	40	23/32"
G-50	50	13/16"
G-60	60	7/8"
G-75	75	15/16"
G-100	100	1 1/16"
G-120	120	1 5/32"
G-150	150	1 7/32"
G-200	200	1 17/32"

Braid Covered Cable

We recommend for interior construction in dry places, our standard beeswaxed core switchboard cable. This cable is made up of No. 22 B & S gauge twisted pair tinned copper wire, insulated with two wrappings of pure silk and one wrapping of cotton. The entire cable is then given a wrapping of heavy paper laid on spirally

and a heavy braiding of cotton. The conductors are insulated with different colored insulation, arranged according to a standard color code, to facilitate locating of particular pairs.

The cable can be obtained in any of the following sizes:

Code No.	No. of Pairs	Outside Dimension
143	20	11/16" x 11/32" oval
144	30	25/32" x 7/16" oval
147	40	7/8" x 15/32" oval
145	50	3/4" diameter
146	100	1 1/8" diameter

Spares in Cables

All cables furnished by the Western Electric Company have two extra or spare conductors, which are available for the common return or third conductor which is necessary in Systems "A," "B" and "C." The best method is to connect these two conductors in multiple and thus secure a conductor of double the conductivity of the individual wires.



Braid Covered Cable.

Cable Color Code

Pair No.	Colors	Pair No.	Colors
1	White Paired with Blue	31	Red Paired with Orange, White
2	White " Orange	32	Red " Orange, Green
3	White " Green	33	Red " Orange, Brown
4	White " Brown	34	Red " Orange, Slate
5	White " Slate	35	Red " Green, White
6	White " Blue, White	36	Red " Green, Brown
7	White " Blue, Orange	37	Red " Green, Slate
8	White " Blue, Green	38	Red " Brown, White
9	White " Blue, Brown	39	Red " Brown, Slate
10	White " Blue, Slate	40	Red " Slate, White
11	White " Orange, White	41	Black " Blue
12	White " Orange, Green	42	Black " Orange
13	White " Orange, Brown	43	Black " Green
14	White " Orange, Slate	44	Black " Brown
15	White " Green, White	45	Black " Slate
16	White " Green, Brown	46	Black " Blue, White
17	White " Green, Slate	47	Black " Blue, Orange
18	White " Brown, White	48	Black " Blue, Green
19	White " Brown, Slate	49	Black " Blue, Brown
20	White " Slate, White	50	Black " Blue, Slate
21	Red " Blue	51	Black " Orange, White
22	Red " Orange	52	Black " Orange, Green
23	Red " Green	53	Black " Orange, Brown
24	Red " Brown	54	Black " Orange, Slate
25	Red " Slate	55	Black " Green, White
26	Red " Blue, White	56	Black " Green, Brown
27	Red " Blue, Orange	57	Black " Green, Slate
28	Red " Blue, Green	58	Black " Brown, White
29	Red " Blue, Brown	59	Black " Brown, Slate
30	Red " Blue, Slate	60	Black " Slate, White

Wiring to Telephone Sets

We recommend for interior wiring to the telephone sets our No. 19 B & S gauge twisted pair or triple, braided rubber covered wire, list No. 105207, Western Electric Company Catalog.

Where floor terminals are used, the triple conductor will be found very convenient for the three wire systems "A," "B" and "C." For system "D" a paired conductor only is necessary.



Fig. 17.

One wire of the paired conductor and two of the triple conductor are arranged with a tracer for the purpose of distinguishing the different wires.

Each terminal contains two strips on which are mounted an equal number of terminal punchings. On one strip can be terminated the wires or cable running to the switchboard, and on the other the wires running to the telephone stations. Short flexible wires or jumpers can then be cross-connected between the two strips, connecting any switchboard line with any telephone station. When the number of stations on different floors of a building is constantly changing, as they are in office and similar buildings, the changes can be made much more economically and conveniently by changing the jumpers in the building terminal than by changing the actual wires which run to the various stations.

Terminals

Building Terminals

We are prepared to furnish building terminals for use in private exchange construction of the type shown in Figure 17.

This terminal is intended for use at some central point of an installation to facilitate distribution and to make the system flexible. Each terminal contains two strips on which are mounted an equal number of terminal punchings. On one strip can be terminated the wires or cable running to the switchboard, and on the other the

These building terminals can be furnished in two sizes, as follows:

List No.	Line Capacity
120272	80
120273	100

The exterior surface of the cabinet of these building terminals is furnished with a mahogany finish unless otherwise specified.

Floor Terminals We are prepared to furnish floor terminals as shown in Figure 18. This terminal is intended for use in distributing the line wires leading from the riser cables running



Fig. 18—No. 19 Type Floor Terminal.

from the building terminal to the various floors. It can be furnished in two sizes, as follows:

Code No.	Number of Single Terminals	Outside Dimensions
19-A	28	8" x 5 1/8" x 2 1/2"
19-B	52	14" x 5 1/8" x 2 1/2"

The exterior surface of the metal cover of the floor terminal is finished in black japan.

Varying conditions will make different methods of installation desirable on different installations. For example, it is sometimes convenient to have the same lines in a cable available at several different floors so that a telephone instrument may be changed from one floor to another, with no more work than is entailed in running the necessary wires from the new location to the floor terminal box on the same floor.

Circuits

For all short lines having a resistance of less than 25 ohms, which is the equivalent of about 800 feet of No. 22 B. & S. gauge or 1600 feet of No. 19 B. & S. gauge twisted pair wire, the Regular Line Circuit shown in Figure 19 and described below is recommended.

Regular Line Circuit Figure 19

This circuit is also shown as a part of circuits in Figures 20 and 21. The third wire or common ringing lead to all stations is not considered a part of the line circuit. When a subscriber removes the receiver from the hook of his telephone set, the circuit through the telephone set is closed and current flows through the line and the telephone set, thus lighting the lamp. When the operator plugs into the line jack associated with the lighted lamp, the inside contacts of the jack are opened, current ceases to flow and consequently the lamp goes out. As previously stated, the line lamp also acts as the supervisory lamp, but this operation will be considered under cord circuits. Line Units HA-1, HB-1, HC-1, HD-1, and HA-2, described on page 21, are equipped with this circuit.

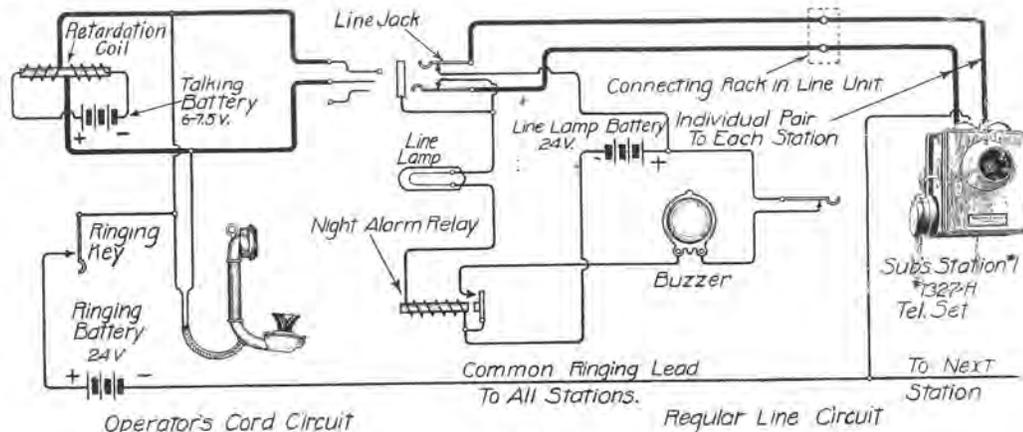


Fig. 19.

For all lines having a resistance greater than 25 ohms, which is the equivalent of about 800 feet of No. 22 or 1600 feet of No. 19 B & S gauge twisted pair copper wire, and up to those lines having a resistance of 750 ohms or the equivalent of 23,000 feet of No. 22 or 46,000 feet of No. 19 B & S gauge twisted pair copper wire (which is the limit usually calculated for central battery lines), the Long Line Circuit shown in Figures 20 and 21 and described below, is recommended.

Long Line Circuit

This circuit is shown in Figures 20 and 21. When a subscriber removes the receiver from the hook of his telephone set, the circuit through the telephone set is closed and current from the line lamp battery flows through the line relay, the contacts of the line jack, the line and the telephone set, thus pulling up the armature of the line relay. The line lamp which is in series with the line relay armature contact and the battery, then lights and remains lighted until the operator inserts one of the cord circuit plugs into the associated line jack. The act of plugging into the line jack opens the jack contacts, current ceases to flow through the line relay, the armature is released and consequently the lamp is extinguished.

The supervisory function of the line lamps is the same as in the regular line circuit and will be considered under cord circuits. Line Unit HA-2 described on page 21 is equipped for five Long Lines.

Cord Circuit System "A"

This circuit is shown in Figure 19. When the plug is inserted into a line jack, talking battery current is fed through the two windings of the retardation coil over the "tip" and "ring" of the line circuit to the telephone set. Talking battery current for the operator's set is also fed through the retardation coil and continues to flow as long as the hand set or receiver of the desk stand, as the case may be, is off the hook. Current for ringing the telephone set bells is carried over the tip of the cord and line circuits, through the ringer coils and back over the third wire or "common ringing lead to all stations" when the ringing key is operated. Since the operator is a party to all conversations, no supervision is required for system "A."

Cord Circuit System "B"

This is a connecting cord circuit for providing inter-communication between stations and is shown in Figure 20. The telephone set bells may be rung over either end of the cord circuit, the path of the ringing current being the same as in system "A." The function of the listening key is to connect the operator's telephone set to the two sides of the cord circuit.

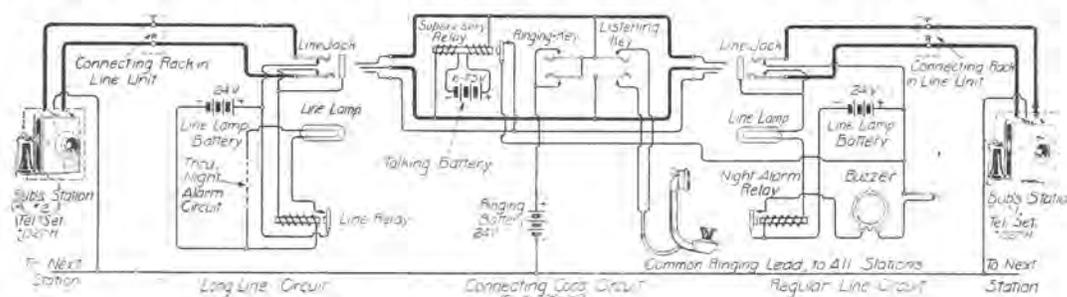


Fig. 20.

Talking battery for both the operator and the telephone sets is fed through the two windings of the No. 114-B "supervisory relay." As soon as a plug is inserted into a line jack, the lamp associated with that jack becomes a supervisory lamp and is controlled by the supervisory relay through the "sleeve" of the cord and line circuits. As long as current is flowing through the supervisory relay, the armature remains pulled up and the lamps do not light. As soon as current ceases to flow, which is the case when both parties to a conversation hang up their receivers, the armature releases and

closes the circuit over the "sleeve" of the cord and line circuits, thus lighting both lamps. The lamps are extinguished upon the removal of the plug from the line jack.

Cord Circuit System "C" The operation and performance of this circuit is the same in every detail as that of the cord circuit of system "B."

Cord Circuit System "D" The operation of this circuit is the same as that for the cord circuit of system "B," except that the telephone set bells are rung with alternating current from a hand generator or interrupter installed in connection with the private exchange switchboard. The arrangement of this circuit is shown in Figure 21. When the ringing key is operated, ringing current is placed on the calling plug (nearest the operator) of the cord circuit and the other portion of the circuit is cut off. There is also a local contact on the ringing key for closing

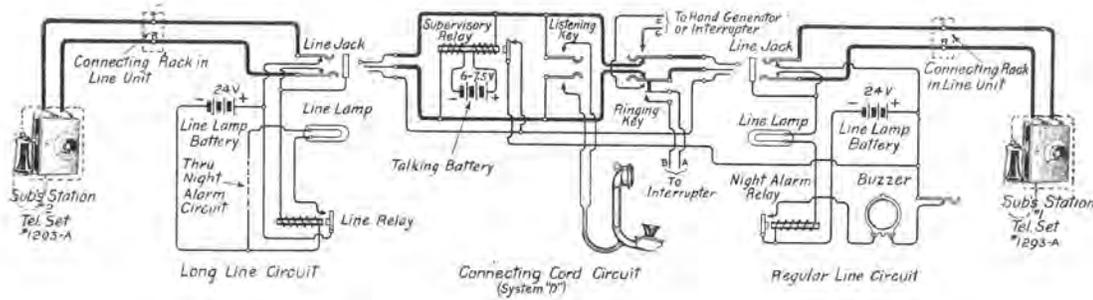


Fig. 21.

the primary circuit of the interrupter (when used) when the ringing key is operated.

Operator's Telephone Circuits As the operation of the operator's telephone circuits is closely associated with that of the cord and trunk circuits, the wiring is shown together. As the choice of operators' telephone equipment is a matter of personal convenience and opinion, Cord Units are provided for each system, and described on pages 21-24, equipped with either a Standard Desk Telephone and Hand Receiver, Fig. 22-b, or a Hand Set, Fig. 22-a.

In System "A," no listening key is used, the transmitter and receiver being bridged in series directly across the cord circuit. Talking battery current is controlled by the hook switch in the hand set or desk stand as described under the operation of the cord circuit for System "A."

In System "B," the operation is the same as for System "A," except the transmitter and receiver are bridged across the cord circuit by the operation of the listening key of the cord circuit.

In Systems "C" and "D," an induction coil and condenser are used (in addition to the receiver and transmitter) the function of which is to improve the transmission for long distance connections. The listening key connects the hand set or desk stand across the circuit the same as for System "B."



Fig. 22-a—No. 1002 Operator's Hand Set.



Fig. 22-b—No. 1020 Operator's Desk Stand.

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Ringing Circuit

In the three wire systems, "A," "B" and "C," the operation of the ringing key in the cord circuit causes battery current to flow over the "tip" side of the line and the third wire or "common ringing lead to all stations," to the vibrating bells in the telephone sets. In System "D," the operation of the ringing key causes alternating current from the hand generator or interrupter to flow over the "tip" and "ring" sides of the line to the ringers in the telephone sets.

Night Alarm Circuit

The function of the *night alarm* is to provide an audible signal whenever a line, trunk or supervisory lamp lights. The desired result is obtained by connecting the winding of the night alarm relay in series with the common battery lead to all lamps. When a lamp lights the relay armature pulls up and closes the contact in series with the buzzer and night alarm key, thus operating the buzzer when the key is closed.

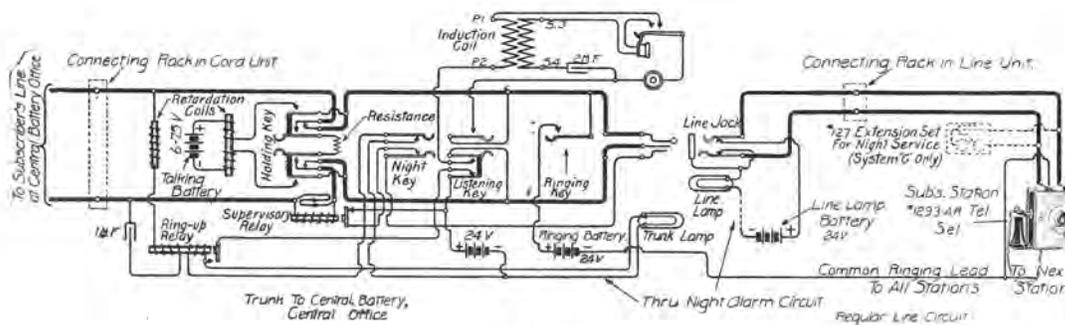


Fig. 23.

Trunk Circuit To Central Battery Central Office System "C," Figure 23

The central office end of this trunk circuit is a regular subscriber's line. To signal the private exchange operator, the central office operator rings out on the line the same as if ringing a regular subscriber. Ringing current from the central office passes through the winding of the ring-up relay, bridged across the trunk circuit in series with a retardation coil and condenser. The armature of the ring-up relay pulls up and locks up, and allows current to flow through the trunk lamp which lights and remains lighted until the listening key is operated. The operation of the listening key opens the circuit through the locking winding of the ring-up relay and the armature releases thus putting out the trunk lamp. Talking battery current for the telephone sets is obtained from the central office (except when the holding key is operated) and flows out over the line circuit to the telephone sets in the usual manner, when a trunk plug is inserted in a line jack.

The supervisory relay is controlled by the talking current from the central office while the telephone set receiver is off the hook, which pulls up the armature of this relay. As soon as the telephone set receiver is hung up, the armature releases, closing the circuit through the line lamp now used as a supervisory lamp, which lights and remains lighted until the trunk plug is removed from the line jack.

The operation of the holding key divides the trunk circuit into two parts, bridges a 50-ohm resistance across that part connected to the central office (to prevent the supervisory lamp at the central office from lighting) and connects talking battery current through the double wound retardation coil to that part of the circuit connected to the trunk plug so that the operator may converse with the person at the telephone set. The ringing key in this circuit, when operated, rings the telephone set bells, the same as in the cord circuit for System "B."

The operation of the night key disconnects battery current from the lamp and the locking winding of the ringing relay, thus preventing the trunk and supervisory lamps from remaining lighted on night or through connections.

Trunk Circuit to Magneto Central Office System "C," Figure 24

To signal the private exchange operator the central office operator rings out on the line the same as if ringing a regular subscriber. The ring-up relay is rung up and locked up, thus lighting the trunk lamp. The lamp is extinguished by operating the listening key. Talking battery current cannot be obtained from the central office but is fed through the two windings of the supervisory relay, as in the cord circuits for Systems "B" and "C."

Supervision is obtained in the same manner as in the cord circuits for Systems "B" and "C," the armature being pulled up during conversation and released when

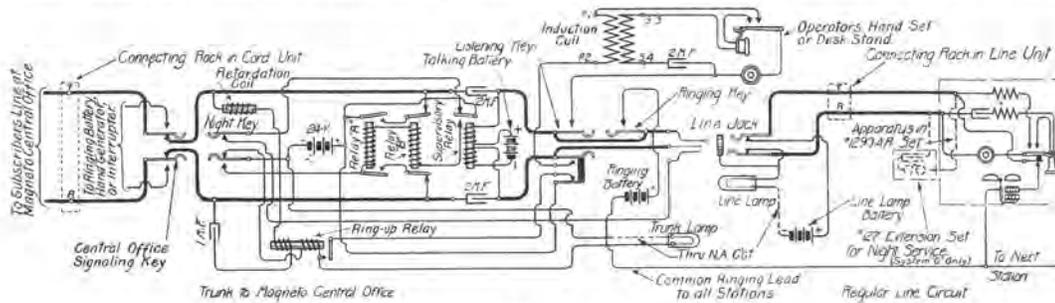


Fig. 24.

the receiver of the telephone set is hung up, thus lighting the line lamp used as a supervisory. The telephone set bells are rung by operating the ringing key which sends ringing battery current over the "tip" side of the line and the third wire or "common ringing lead to all stations."

The "key to ring central office" is used both for signaling the central office operator when a connection is desired and for giving a disconnect signal to central office; in the former case the line drop is rung down and in the latter case the supervisory drop or clearing-out signal.

The listening key performs the usual function of bridging the operator's telephone set across the trunk circuit, talking current being obtained through the supervisory relay.

The operation of the night key disconnects battery current from the trunk and supervisory lamps to prevent them from remaining lighted on through or night connections. It also brings into play relays "A" and "B" which are used only on night or through connections and which operate to give either a line or disconnect signal to the central office, as follows: A subscriber on a night connection wishing to get a central office connection, removes his receiver from the hook. Current immediately flows through the windings of the supervisory relay, pulling up the armature which in turn sends current through relays "A" and "B." Relay "A" operates much quicker than relay "B," thus sending battery current out over the trunk to the central office and operating or "kicking down" the line drop. Relay "B" now operates and cuts off relay "A" from the trunk which is left clear for conversation. When the subscriber hangs up his receiver, the armature of the supervisory relay releases, thus in turn releasing relays "A" and "B." Relay "B" releases quicker than "A" and current is again sent over the trunk to central office, thus operating or "kicking down" the central office supervisory drop or clearing-out signal. Relay "A" then releases and the trunk circuit resumes its normal condition.

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No. 127 Type Extension Bell.

Audible Trunk Signal

Any telephone set of private exchange system "C," to be given night or through service, during periods when the operator is off duty, must be equipped with a No. 127-A extension bell (which includes a No. 21-D condenser), connected across the "tip" and "ring" sides of the line, so that the central office operator can signal this station by ringing in the usual way.

Trunk Circuit to Central Battery Central Office System "D" (Fig. 23 Modified by Fig. 25)

The operation of this circuit is the same as that for the Trunk Circuit to Central Battery Central Office, System "C," Fig. 23, except for the ringing key, the wiring for which is shown in Fig. 25. Alternating current from a hand generator or interrupter is used for ringing. The operation of this ringing key cuts off the rear portion of the trunk circuit during the ringing interval and sends alternating current over the "tip" and "ring" sides of the line, ringing the telephone bells. The No. 127-A extension bell is not required for night or through connections under System "D."

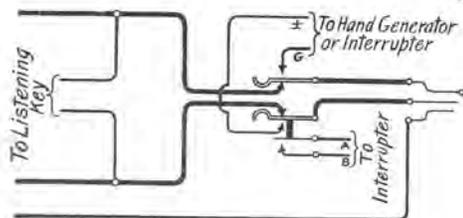


Fig. 25—Modifying Figs. 23 and 24.

Trunk Circuit to Magneto Central Office System "D" (Fig. 24 Modified by Fig. 25)

The operation of this circuit is the same as that for the Trunk Circuit to Magneto Central Office system "C,"

Fig. 24, except for the ringing key which is wired as shown in Fig. 25 and arranged for alternating current ringing as described

in the preceding paragraph. The No. 127-A extension bell is not required for night or through connections under System "D."

SIMULTANEOUS RINGING AND TALKING CIRCUITS.

Provided By Units No. HA-3, HA-4 and HA-5

The operation of these circuits is considered separately for the different functions performed.

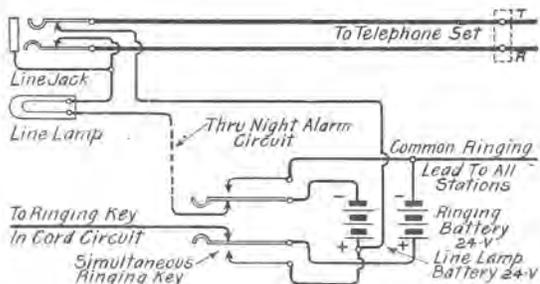


Fig. 26.

Ringling Fig. 26

The Line Lamp and Ringing Battery Leads are wired through the contacts of the simultaneous ringing key in such a manner that the line lamp and ringing batteries are switched together in parallel when the key is operated, in order to provide the necessary battery current supply for ringing all of the stations. The operation of this key also causes current for ringing the telephone

set bells to flow over the tip sides of all the lines and the third wire or common ringing lead to all stations. The circuit shown in Figure 26 is applicable to systems "A," "B" and "C."

Talking Systems "A" & "B," Fig. 27

The function of this circuit is to connect the operator's transmitter in such a manner that the voice currents will be of sufficient volume to be distinctly received and understood at all of the telephone sets. This is accomplished by separating the operator's transmitter and receiver, and connecting a condenser in series with the receiver as shown in Fig. 27.

The voice currents from the operator's transmitter are induced in the secondary of the induction coil and carried to the telephone sets through the line lamps and line lamp battery over the line wire.

Talking System "C" Fig. 28

The same result is accomplished with this circuit as with systems "A" and "B," Fig. 27. A slight difference in the connections necessitated by the difference in operator's telephone sets, may be noted, but this has no effect on the operation of the circuit.

Listening System "A" & "B," Fig. 29

In order to increase the operator's receiving or listening efficiency on simultaneous connections, the transmitter is removed entirely from the circuit, as shown in Fig. 29, when the listening key is operated. The incoming voice currents from the telephone sets take the same path as described under "Talking."

Listening System "C," Fig. 30

This is the same circuit as for systems "A" and "B" except the condenser in the regular operator's telephone circuit is connected in series with the receiver when the listening key is thrown.

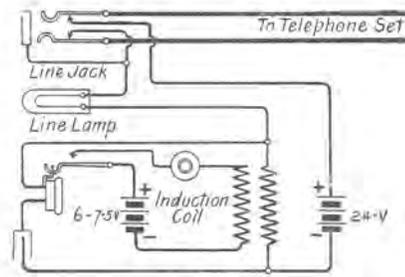


Fig. 27.

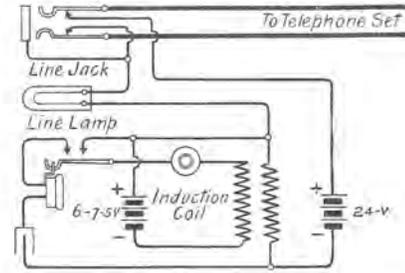


Fig. 28.

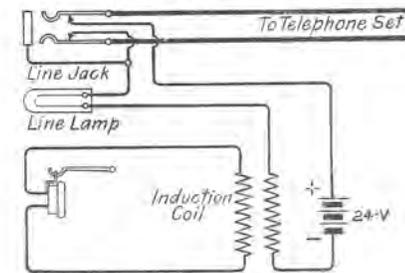


Fig. 29.

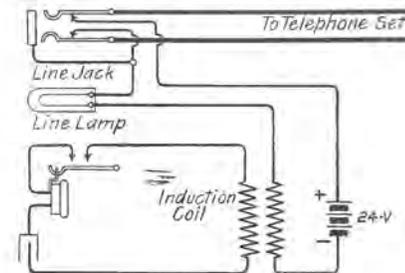


Fig. 30.

**INCOMING CALL TRANSFER CIRCUIT.
Provided By Unit HA-6**

The line circuit of the telephone set designated to receive all incoming calls is wired to the switching key in such a manner that when the key is in its normal position it is connected and handled the same as any regular line circuit. Fig. 31. When the key is operated the leads to the common receiving telephone set are connected with the common battery supply leads to the line lamps and jacks. The third wire or common ringing lead is also switched to the contact of the night alarm relay. Upon the removal of the receiver from the hook of any telephone set the line lamp of the associated line lights and consequently the night alarm relay pulls up.

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thus sending battery current over the "tip" side of the line and the third wire to the bell of the common receiving telephone set. This bell continues to ring until the receiver is removed from the hook. Conversation is carried on in the usual manner, talking battery for the common receiving telephone set being supplied through the

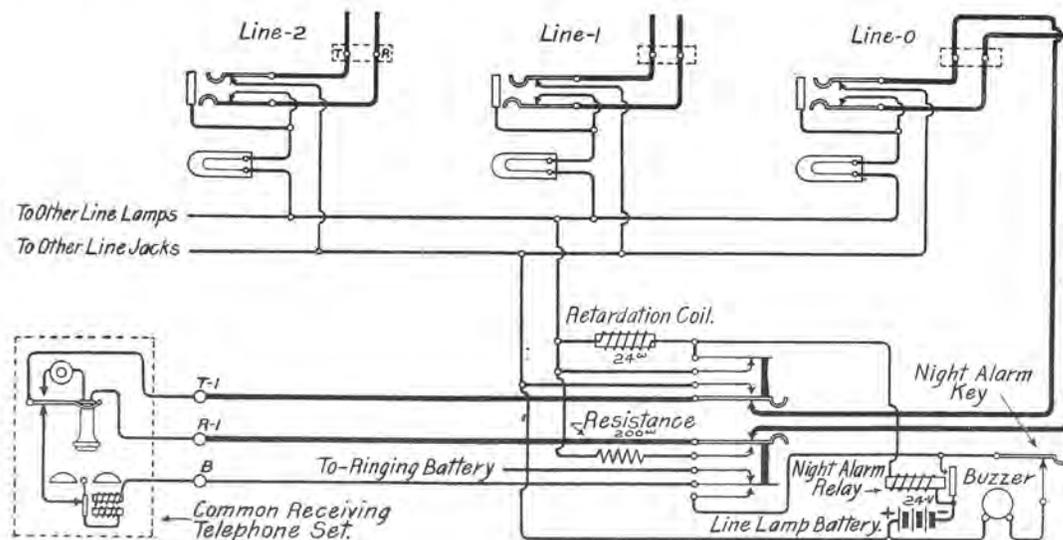


Fig. 31.

retardation coil and resistance and for the other telephone sets, through the retardation coil and line lamp.

The retardation coil is also bridged across the talking circuit in series with the battery and on account of its high impedance, serves to prevent loss in transmission which would result if the battery alone were bridged across. The resistance serves to prevent an excess of current through the common receiving telephone set.

No. 1801 Switchboard Units

A complete No. 1801 switchboard consists of at least three or more units or sections, as follows:

- (a) One Supporting unit.
- (b) One Cord unit.
- (c) One Top unit, and

NOTE: The Cord unit always contains 20 line circuits.

As many line units as are necessary to increase capacity of switchboard from 20 to the desired number of lines.

The following table lists standard units. These units are carried in stock packed in individual boxes. It is necessary, to avoid expense and delay, that standard units be ordered exactly as listed.

Care should be taken to select units which are designed to be used together.

The following tables give information as to the proper units to order for any class of service:

TOP UNITS

- | <i>Code No.</i> | <i>Description</i> |
|-----------------|--|
| G-1 | Equipped with a hook for supporting operator's hand set. Used with all line units and JA-1, JA-2, JA 3, JA-4, JA-5, JA-6, JA-7 Cord Units. |
| G-2 | Not equipped with hand set hook. Used with all line units and JB-1, JB-2, JB-3, JB-4, JB-5, JB-6, JB-7 Cord Units. |



No. G-2 Top Unit.

LINE UNITS

- | | |
|------|---|
| HA-1 | Wired for twenty line circuits, and equipped for five. The remaining fifteen spaces blanked. Used with all Cord and Top units. |
| HB-1 | Wired for twenty line circuits and equipped for ten. The remaining ten spaces blanked. Used with all Cord and Top units. |
| HC-1 | Wired for twenty line circuits and equipped for fifteen. The remaining five spaces blanked. Used with all Cord and Top units. |
| HD-1 | Wired and equipped for twenty line circuits. Used with all Cord and Top units. |
| HA-2 | Wired and equipped with five relays for long line service. That is, where lines over 800 feet in length are to be operated. Used with all Cord and Top units. |



No. HD-1 Line Unit.

SIMULTANEOUS RINGING UNITS

- | | |
|-------|--|
| HA-3* | Equipped with a key, for ringing all the bells simultaneously. Used with Systems "A," "B," and "C" Cord units and all Top units. |
|-------|--|

SIMULTANEOUS RINGING AND TALKING UNITS

- | | |
|-------|---|
| HA-4* | Equipped with keys for simultaneous ringing, talking and listening. Used with Systems "A" and "B" Cord units and all Top units. |
| HA-5* | Equipped with a key for simultaneous ringing, talking and listening. Used with System "C" Cord units and all Top units. |
| HA-6* | Equipped with key for answering all incoming local calls at any designated station. |

* Only one of these units required per installation.



No. HA-5 Simultaneous Ringing and Talking Unit, Open.



No. HA-5 Simultaneous Ringing and Talking Unit, Closed.

CORD UNITS

System "A"

- | | |
|------|--|
| JA-1 | Equipped with Hand set for operator's use, one night alarm circuit, and twenty regular line circuits (5 wired for long line service). [*] Provides facilities for communication between the operator and the stations only. No communication between stations possible. Used with G-1 Top units, all Line units and all Simultaneous Ringing and Talking units except HA-5. |
|------|--|



No. JA-1 Cord Unit.

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No. JB-1 Cord Unit.

JB-1 Equipped with Desk stand for operator's use, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and stations only. No communication between stations possible. Used with G-2 Top units, all Line units and all Simultaneous Ringing and Talking units except HA-5.

System "B"

JA-2 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).*



No. JA-2 Cord Unit.

Provides facilities for communication between the operator and stations and also for five simultaneous conversations between the stations. Used with G-1 Top units, all Line units and all Simultaneous Ringing and Talking units except HA-5.

JB-2 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).*

Provides facilities for communication between the operator and stations and also for five simultaneous conversations between the stations. Used with G-2 Top units, all Line units and all Simultaneous Ringing and Talking units except HA-5.

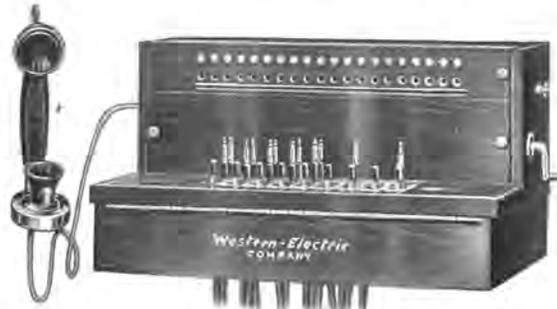
System "C"

JA-3 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a central battery telephone exchange, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and stations and also for five simultaneous conversations between stations, as well as two trunk connections to a central battery telephone exchange. Used with G-1 Top unit, all Line units and all Simultaneous Ringing and Talking units except HA-4.

- JB-3 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a central battery telephone exchange, one night alarm circuit and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between stations, as well as two trunk connections to a central battery telephone exchange. Used with G-2 Top unit, all Line units and all Simultaneous Ringing and Talking units except HA-4.
- JA-5 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connections to a magneto telephone exchange, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between stations, as well as two trunk connections to a magneto telephone exchange. Used with G-1 Top unit, all Line units and all Simultaneous Ringing and Talking units except HA-4.
- JB-5 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a magneto telephone exchange, one night alarm circuit, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations, as well as two trunk connections to a magneto telephone exchange. Used with G-2 Top unit, all Line units and all Simultaneous Ringing and Talking units except HA-4.

System "D"

- JA-4 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a central battery telephone exchange, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also for five simultaneous conversations between the stations, as well as two trunk connections to a central battery telephone exchange. Used with G-1 Top unit and all Line units.



No. JA-4 Cord Unit.

- JB-4 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a central battery telephone exchange, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations, as well as two trunk connections to a central battery telephone exchange. Used with G-2 Top unit and all Line units.

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- JA-6 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a magneto telephone exchange, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations, as well as two trunk connections to a magneto telephone exchange. Used with G-1 Top unit and all Line units.
- JB-6 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, two plug-ended trunk cords for connection to a magneto telephone exchange, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations, as well as two trunk connections to a magneto telephone exchange. Used with G-2 Top unit and all Line units.
- JA-7 Equipped with Hand set for operator's use, five pairs of connecting cords with ringing and listening keys, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations. Used with G-1 Top unit and all Line units.
- JB-7 Equipped with Desk stand for operator's use, five pairs of connecting cords with ringing and listening keys, one night alarm circuit, one hand generator, and twenty regular line circuits (5 wired for long line service).* Provides facilities for communication between the operator and the stations and also five simultaneous conversations between the stations. Used with G-2 Top unit and all Line units.

* It will be necessary to order one HA-2 Line unit, which is equipped with relays, if long lines are to be served.

SUPPORTING UNITS

- K-1 Consists of two japanned iron brackets for supporting the switchboard against a wall. Used with JA-1 and JB-1 Cord units.

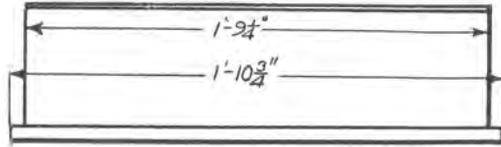


No. K-2 Supporting Unit.

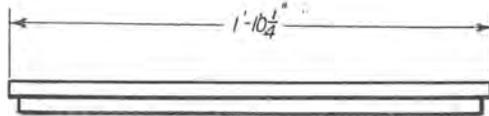
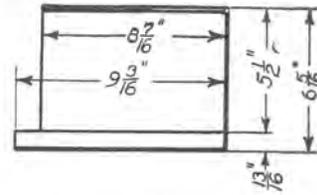
- K-2 Consists of a shelf supported by two brackets and a wooden casing for enclosing the cords. Adapted for use where the switchboard is mounted on a wall. Used with JA-2, JB-2, JA-3, JB-3, JA-4, JB-4, JA-5, JB-5, JA-6, JB-6, JA-7, and JB-7 Cord units.

- K-3 Consists of a flat top desk, equipped with one tier of drawers, having a hole cut in the top in which the base of the cord unit is placed. The desk is so arranged that the cords are hidden back of a removable panel which protects them from interference. Used with the same Cord units as the K-2 Supporting Unit.

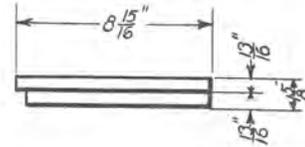
Dimensions No. 1801 Switchboard Units



Cord Units
JA-1, JB-1



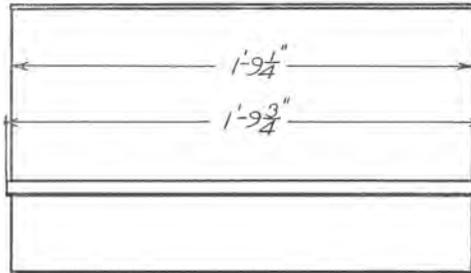
Top Units
G-1, G-2



Simultaneous Ringing & Talking Units
HA-3, HA-4, HA-5

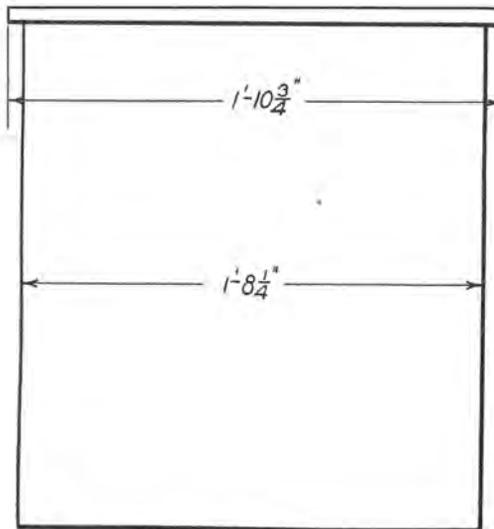
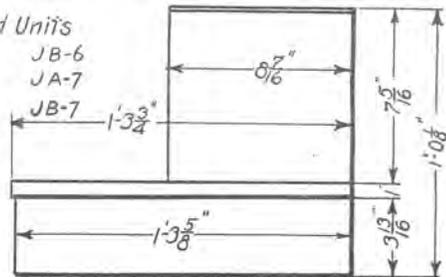


Line Units
HA-1, HB-1, HC-1, HD-1, HA-2,

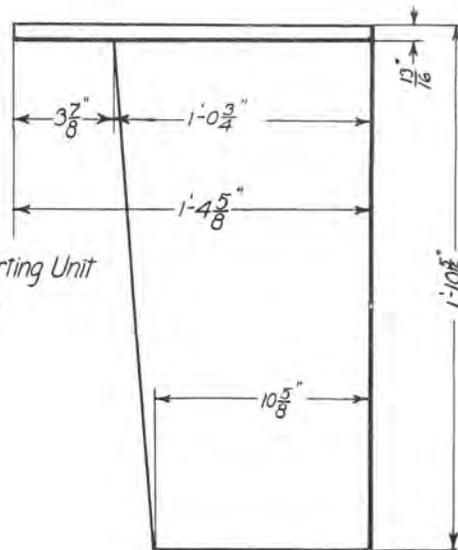


Cord Units

- JA-2 JB-6
- JB-2 JA-7
- JA-3 JB-7
- JB-3
- JA-5
- JB-5
- JA-4
- JB-4
- JA-6



Supporting Unit
K-2



Telephones for Use with No. 1801 Switchboard

SYSTEMS "A" AND "B"

Wall Telephones



No. 1327-H.

Code No.	Description	List Price
1327-H	Compact, non-flush wooden wall telephone with direct current vibrating bell. Golden oak finish.....	\$6.70
1339-N	Compact, flush metal wall telephone with direct current vibrating bell. Brush brass finish.....	7.40



No. 1339-N.

Desk Telephones

6034-AE	Nickel plated desk stand equipped with direct current vibrating buzzer mounted in the base.....	9.00
6034-AD	Nickel plated desk stand with a separately mounted direct current vibrating bell. No mounting for bell is furnished.....	9.00

SYSTEM "C"

Wall Telephones—Induction Coil Type



No. 6034-AE.

1293-AR	Compact, wooden wall telephone with direct current vibrating bell. Golden oak finish.....	9.00
1333-S	Compact, metal wall telephone with direct current vibrating bell. Black Japan finish.....	12.20
1357-B	Compact, semi-flush metal wall telephone with direct current vibrating bell with black Japan finish.....	11.85



No. 1293-AE.
No. 1293-A.



No. 1333-S.
No. 1333-AY.
No. 1333-A.



No. 1357-B.
No. 1357-D.
No. 1357-A.

SYSTEM "C" (Continued)

Desk Telephones—Induction Coil Type

<i>Code No.</i>	<i>Description</i>	<i>List Price</i>
6000-AE	Nickel plated desk stand and wooden desk set box, equipped with direct current vibrating bell. Golden oak finish	11.95
6035-B	Nickel plated desk stand and flush metal desk set box, equipped with direct current vibrating bell. Black Japan finish	16.00



No. 6035-B.

Wall Telephones—Series Type

1333-AY	Compact, metal wall telephone with direct current vibrating bell. Black Japan finish	10.70
1357-D	Compact, semi-flush metal wall telephone with direct current vibrating bell. Black Japan finish On request	



No. 6015-K.
No. 6015-D.

Desk Telephones—Series Type

6015-K	Nickel plated desk stand and wooden desk set box, equipped with direct current vibrating bell. Golden oak finish	10.30
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SYSTEM "D"

NOTE: Any standard central battery telephone listed and described on pages 4-7 of Catalog Bulletin No. 4 can be used with System "D." A few of the most representative types are listed herewith.

Wall Telephones—Induction Coil Type

1293-A	Compact, wooden wall telephone with 1000 ohm alternating current ringer. Oak. Equipped with No. 143-W receiver	9.70
1333-A	Compact, metal wall telephone with 1000 ohm alternating current ringer. Black Japan finish. Equipped with No. 143-W receiver	9.70
1357-A	Semi-flush metal wall telephone with 2500 ohm alternating current ringer. Black Japan finish. Equipped with No. 143-W receiver	12.65

SYSTEM "D" (Continued)

Desk Telephones—Induction Coil Type



No. 6000-A.
No. 6000-AE.

<i>Code No.</i>	<i>Description</i>	<i>List Price</i>
6000-A	Nickel desk stand and wooden desk set box equipped with 1000 ohm alternating current ringer. Oak. Equipped with No. 143-W receiver	\$11.40



No. 6032-Y.

6032-Y	Nickel plated desk stand and metal desk set box, equipped with 1000 ohm alternating current ringer. Black Japan finish. Equipped with No. 143-W receiver	11.40
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No. 6035-C.

6035-C	Nickel plated desk stand and semi-flush metal desk set box. Equipped with 2500 ohm alternating current ringer. Black Japan finish. Equipped with No. 143-W receiver	14.00
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