

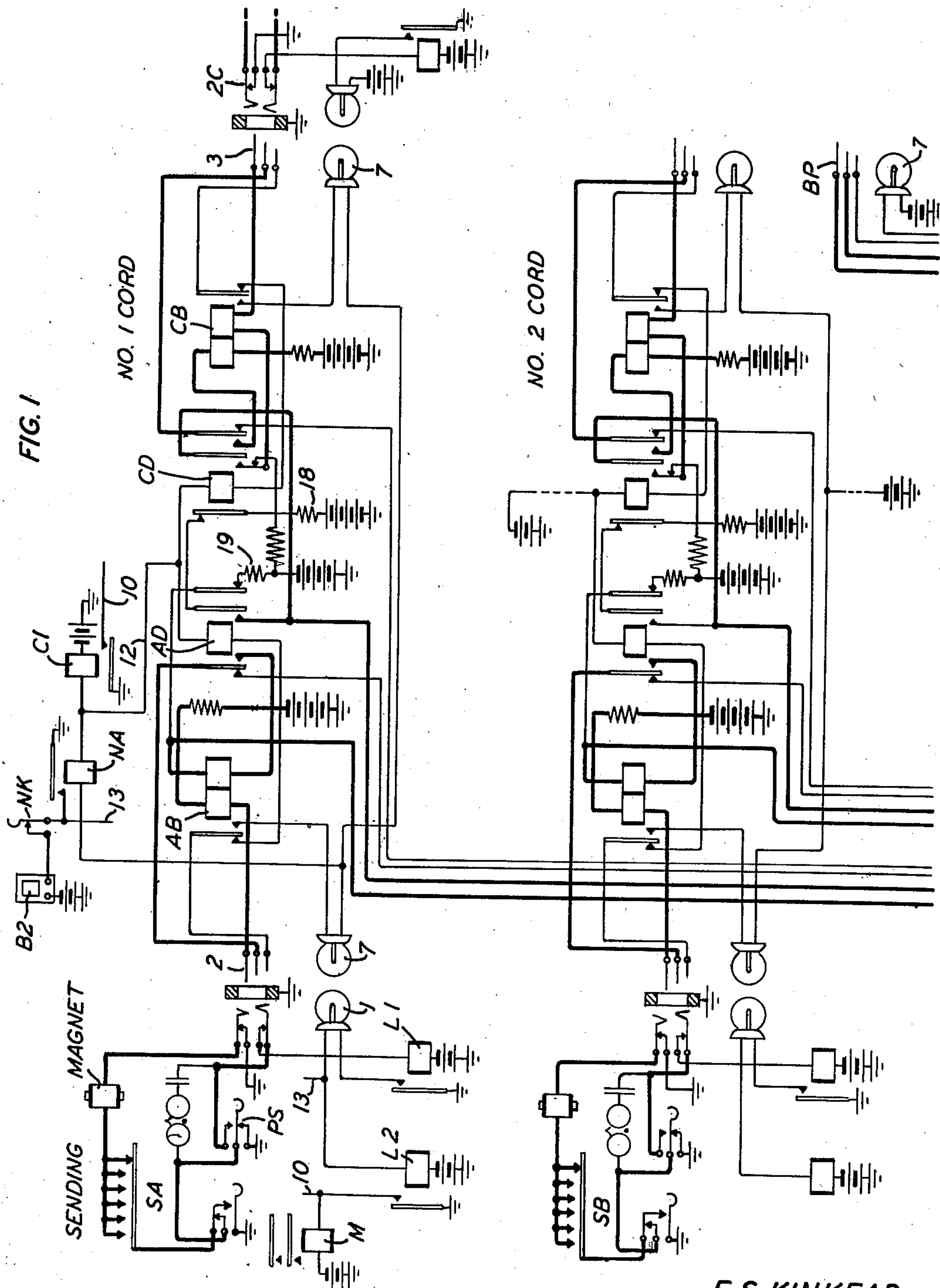
Sept. 19, 1939.

F. S. KINKEAD ET AL
TELEGRAPH EXCHANGE SYSTEM

2,173,335

Filed July 30, 1936

3 Sheets-Sheet 1



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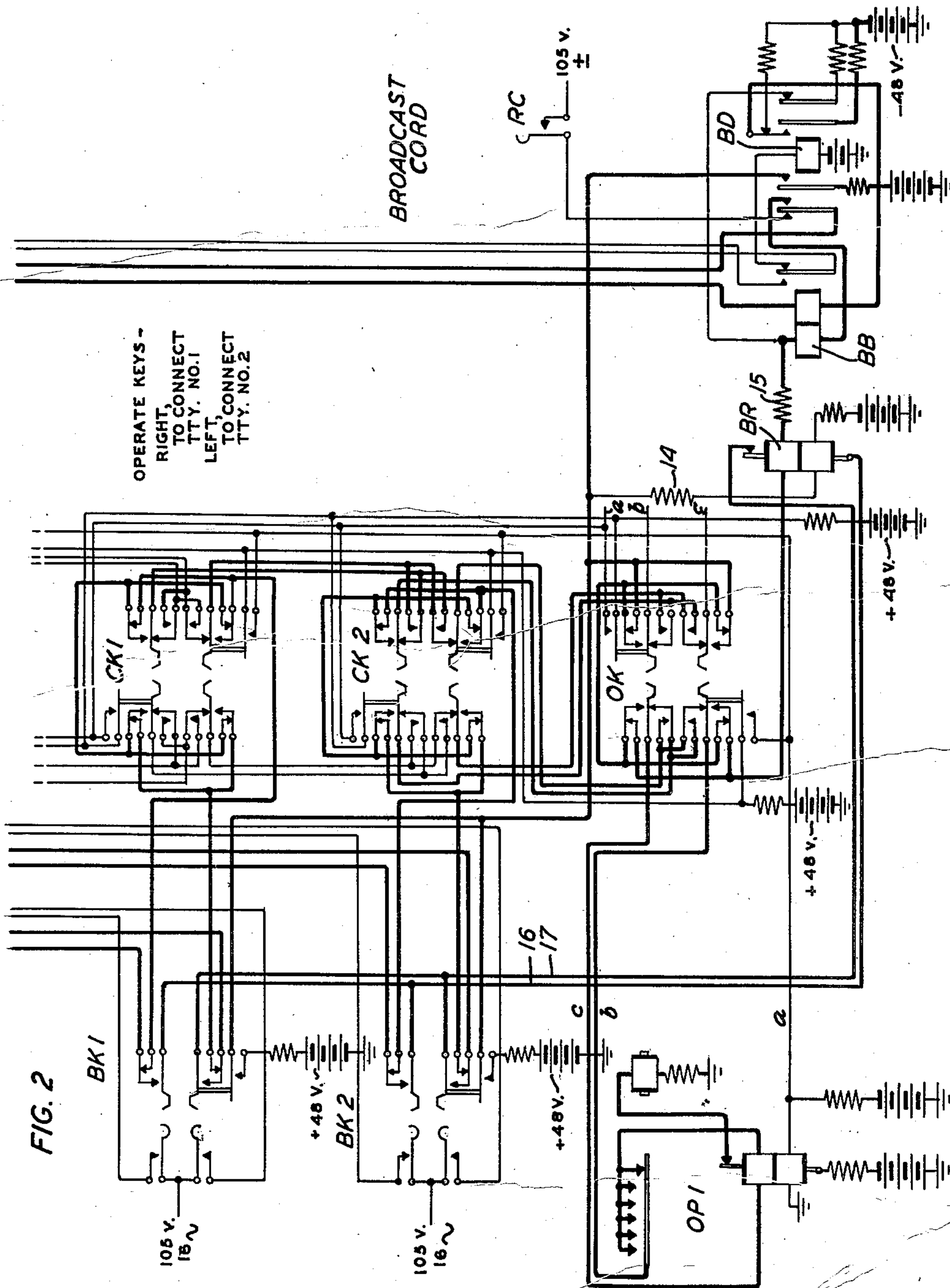
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3 Sheets-Sheet 2



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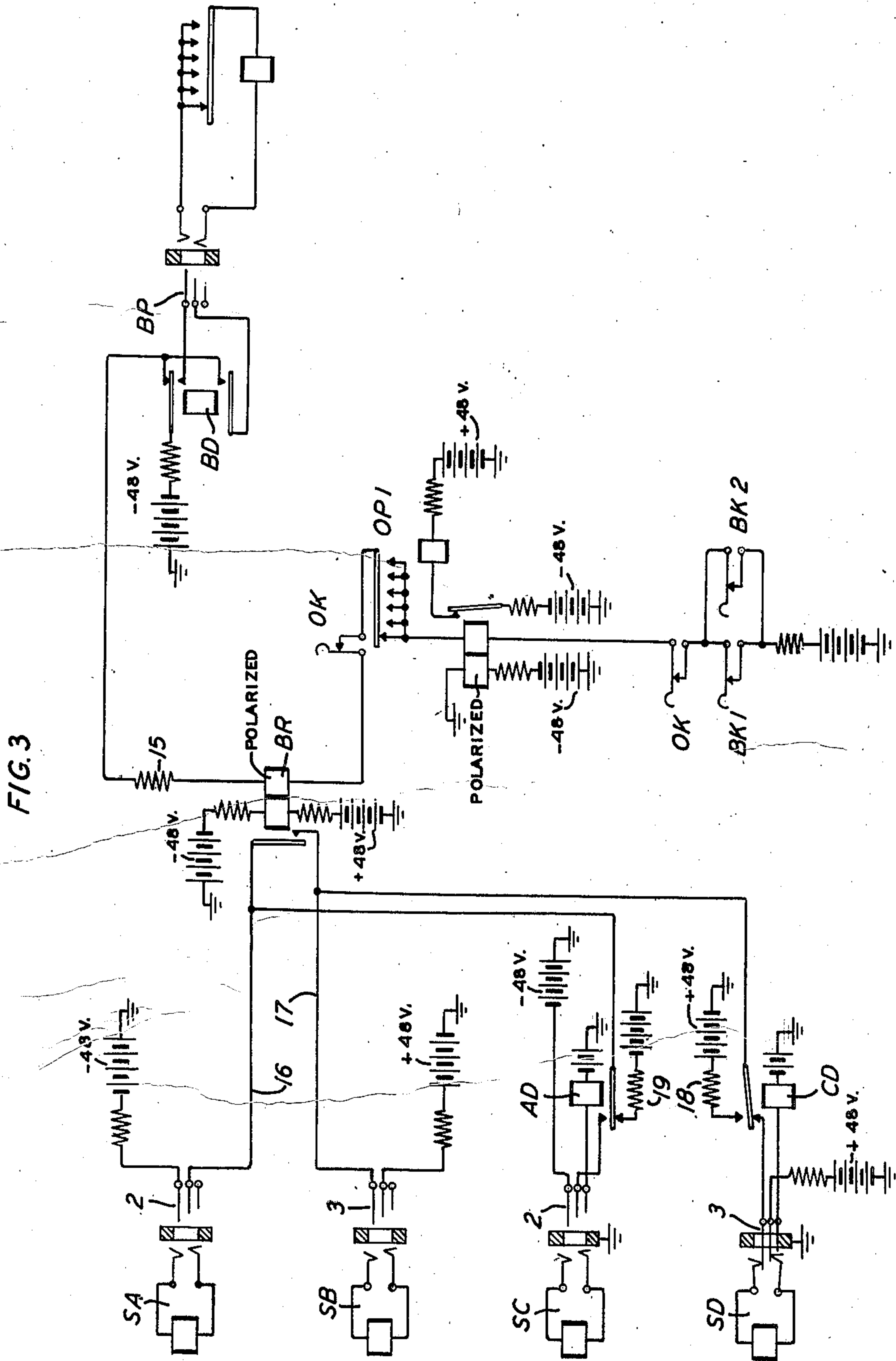
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2,173,335

TELEGRAPH EXCHANGE SYSTEM

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8 Claims. (Cl. 178—2)

The present invention relates to central office circuits including a broadcast arrangement, and trunk circuits for teletypewriter switching systems of the type adapted to give teletypewriter service to subscribers through exchanges.

A particular object of the invention is to simplify teletypewriter exchanges and to this end a typical embodiment of the invention includes a repeaterless cord circuit for interconnecting lines.

Another object is to provide arrangements whereby an exchange including said repeaterless cord circuits may connect one or more lines to a distant exchange over a long toll trunk and to this end a typical embodiment of the invention includes suitable line terminating equipment and arrangements whereby such trunk may be connected to the exchange having the repeaterless cord circuits through a repeater.

A feature of the invention is its ready adaptability to the setting up of a broadcast arrangement. For this purpose the teletypewriter operator's set at the central office may be simultaneously connected to a plurality of subscribers' lines.

A further feature consists of a broadcast cord by means of which any line terminating at the switchboard may be connected to broadcast to any reasonable number of other lines.

A feature of the broadcast operation is that all the necessary interconnection of lines and/or machines may be accomplished by plugging cords into line jacks and operating appropriate keys in proper directions.

A circuit arrangement embodying the invention is disclosed in the accompanying drawings in which:—

Figs. 1 and 2 taken together illustrate two subscribers' lines, two cord circuits adapted to interconnect subscribers' lines, a broadcast cord, and necessary keys and operators' sets and other equipment; and

Fig. 3 discloses in more diagrammatic form the relationship between a plurality of subscribers' lines and cord circuits associated with them during broadcasting.

Subscriber to subscriber connection

The apparatus will now be described in connection with the operation of setting up a communication circuit between two substations or subscribers' stations. Let it first be assumed that the equipment is in idle condition and the subscriber at subscriber's station SA wishes to make a call. The switch or key PS is operated which

closes the line from battery over the line relay L1 through the ring side of the line, the sending contacts of the subscriber's printer and the receiving magnet to ground. It will be understood that the switch PS may also start the motor of a subscriber's teletype machine by connecting it is to a suitable source of power. Relay L1 operates and energizes the line lamp 1 over an obvious circuit. The operator places the answering plug 2 of a cord circuit into the subscriber's line jack which deenergizes relay L1 and extinguishes lamp 1. Relays AD and C1 in the cord operate. A circuit is now closed from —48 V battery, through the winding of relay AB, to the tip of the line and back over the ring of the line to the inner left make contact of relay AD, through the other winding of relay AB, through the corresponding broadcast cord key BK1, contacts of cord key CK1 and inner right-hand contact of relay AD to +48 V battery on the left-hand armature of relay CD. By operating key CK1 to the right the operator's printer OP1 may be connected to the cord. By operating key CK1 to the left, another operator's printer, not shown, may be connected. The operator types an inquiry and the subscriber responds by giving information of the station desired. Let it be assumed that a subscriber connected to the jack 2C is the subscriber desired. The operator puts calling plug 3 into the jack 2C. This causes the operation of the relay CB. It will be noted that the relays AB and CB are differential relays. Relay AB remains released since the subscriber circuit SA is closed and the current flows through both windings in opposite directions. Relay AD remains operated and the transmission circuit between the operator's set OP1 and the subscriber station SA remains closed, as previously described. Relay CB operates from —48 V battery, through normally closed inner right-hand contact of relay CD, right-hand winding of relay CB, tip of plug 3, jack 2C to ground on contacts of key PS in the called station. The ring circuit is open at key PS in the station. A circuit is closed to the lamp 7 associated with the CB relay and the operator receives an indication that the station is in the normal idle condition.

To ring the called station the operator operates or depresses the left-hand portion of key BK1 repeatedly. Each time the key is depressed a source of ringing voltage will be applied through the contacts of key BK1, outer normally closed right-hand contacts of relay CD, ring of plug 3, jack 2C, ring conductor of the line to the ringer

and its associated condenser to ground in the station.

When the called subscriber answers by operating key PS, ground is removed from the tip circuit, the loop is closed and the ringer is short-circuited. Since no current flows in either winding of relay CB, it releases to extinguish the associated lamp and to operate relay CD. A communication circuit is now closed beginning —48 V battery, winding of relay AB, over the tip and ring of the line of the subscriber SA as before, back through the ring over the left inner make contact of relay AD, winding of relay AB, keys BK1 and CK1, right inner make contact of relay CD, right-hand winding of relay CB, tip of the line connected to the jack 2C, back through the ring of the jack 2C, right outer make contact of relay CD, left-hand winding of relay CB to +48 V battery. The subscribers are now connected and may communicate by teletypewriter over the circuit described.

Upon finishing communication either subscriber may give a disconnect signal by operating key PS to ground the tip of the line whereupon the corresponding relay AB or CB, as the case may be, operates due to the fact that only one winding thereof is energized which closes a circuit through the corresponding lamp 7 to call the operator's attention. The operator may pull down the plug which operation will extinguish the corresponding lamp 7.

Power supply and night alarm arrangements

If desired, a motor generator set may be employed as the source of all the positive and negative 48-volt battery supply indicated in the drawings. Such a motor generator set may be operated by a motor supplied with energy from public utility supply means or any other suitable source. The relay M may be connected to control the motor generator set in any acceptable manner, for example, as disclosed in the application of Singer Patent No. 2,170,038, granted Aug. 22 1939. It is desired that the relay M be energized whenever a subscriber makes a call by closing the key PS or whenever any cord plug is connected to a line jack. In order to secure this result the relay M is energized whenever the relay L2 is energized or whenever relay C1 is energized. To this end it may be assumed that the two conductors designated 10 are connected together. Whenever a line relay L1 is energized the motor generator set is started into operation. Moreover the connection of any answering plug to a jack energizes the circuit from negative battery through the relay C1, relay NA, lamp 7, make contact relay AB, if AB is energized to ground on the sleeve of plug 2. If, however, the relay AB is not energized then the path to ground will be over the conductor 12 through the winding of relay AD or CD as the case may be to ground upon the sleeve of jack 2 or any other jack of the office. Consequently, the relay M is energized and supplies positive and negative 48-volt potential to the exchange whenever the relay M or the relay C1 is energized and relay M is energized whenever a subscriber's station is in condition to communicate or whenever a cord plug is in any line jack.

In a similar manner a night alarm relay NA and the relay L2 control a night alarm circuit. For this purpose conductors 13 may be assumed to be connected together. Whenever relay L1 operates or whenever relay NA is energized and

operates, a ground is supplied to a circuit which extends from battery through the winding of buzzer relay BZ or a relay BZ which may control a buzzer through the night alarm key NK to ground. This night alarm is, therefore, effective both for calling and disconnect signals so that, if desired, the office may be attended at times of light business by an attendant primarily engaged in other duties.

Broadcasting

Provision is made whereby an operator may broadcast from her machine to several subscribers' lines simultaneously or whereby an operator at one subscriber's station may be connected to broadcast to several subscribers' stations simultaneously. It will be noticed in Fig. 2 that the circuit of one operator's machine OP1 is shown in full. There are three leads to this machine from key OK which are designated a, b, c. Three corresponding leads designated a, b, c, may extend to another operator's machine. By throwing key OK to the left or to the right either of these operators' machines may be connected to the circuit and when so connected may function in an identical manner. Let it be assumed that the operator wishes to broadcast to a plurality of subscribers' lines. A plug of a cord, such as is shown in Fig. 1, is connected to each such line and the subscriber is rung in the usual manner. As will be explained hereinafter, the broadcast may be made to either an even or odd number of subscribers. If the number is even, both ends of the cords utilized for the purpose are connected to subscribers' lines. This, however, is not necessary or essential as a single plug of the cord may be connected to the subscriber's line and the other plug of the cord left idle. Let it be assumed that the No. 1 and No. 2 cords shown in Fig. 1 are each connected to two subscribers' lines, making four in all, and that the operator wishes to broadcast from machine OP1. Keys BK1 and BK2 are operated to the right and key OK operated to the left. The operator's machine OP1 is now connected to the operating circuit of a broadcast relay BR. The circuit may be traced beginning at +48 V battery on key BK1 or BK2 through normally closed contacts on the right key OK, through the contacts on the left key OK, through lead c to operator's set OP1 back over lead b, over another operated contact on the left key OK, through the upper winding of relay BR and resistance 15 to —48 V battery on the right back contact of sleeve relay BD of the broadcast cord. As will be hereinafter more fully explained in connection with Fig. 3, every subscriber's line connected to the broadcast circuit is now brought to two common points, these common points being the two conductors 16 and 17, respectively.

Assume now that the operator does not wish to broadcast but that some particular subscriber wishes to broadcast. The lines of the subscribers to whom the broadcast is to be given are connected over the cord circuits to the common points represented by the conductors 16, 17 as before described. The broadcasting plug BP of a broadcast cord is connected to the line of the subscriber about to broadcast. This causes the sleeve relay BD to be operated over the sleeve of the broadcasting line and prepares the circuit so that the broadcasting subscriber may give a disconnect signal on the lamp 7 connected to the broadcast cord. Assuming that the subscriber's line is closed and that his teletypewriter machine is operating, a communication path is

closed from the tip of the line over the tip of the plug BP, a winding of relay BB to -48 V battery on a make contact of relay BD. From the ring of the plug the circuit is closed through the left outer make contact of relay BD and the other winding of relay BB, the operating winding of BR, contacts on key OK +48 V battery on the lower operated contact of any broadcasting key BK1, BK2, etc. It is to be understood that as many of these keys are operated as there are cord circuits to be connected to the broadcasting line.

It will be noticed that the ringing key RC is provided for ringing over a line of a subscriber to which the broadcast cord has been connected.

Reference to Fig. 3 will elucidate the principle of operation of the broadcast arrangement. As shown the simplified diagram of the circuit is as arranged for broadcasting from an operator's machine. The circuit from the operator's machine is traced from +48 V battery through the contacts of BK1, BK2 and OK keys diagrammatically indicated, sending contacts of operator's set OPI, and a contact of key OK diagrammatically indicated, the broadcast relay BR, contact of relay BD to -48 V battery. The actuation of the operator's machine operates the relay BR accordingly. The armature of the relay BR transmits the message to all lines which are connected to cord circuits similar to those of Fig. 1 with their broadcasting keys BK1, etc. operated. It will be seen that one-half of the lines, namely those connected to answering plugs 2, have -48 V battery connected to the tips, whereas those connected to the calling plugs have +48 V battery connected to the ring side. Four such subscribers' stations are shown designated SA, SB, SC and SD. We now discuss what happens in case an odd number of lines is connected to receive a broadcast and for this purpose let us consider the line of the subscriber's station SD. As set up the circuit extends from +48 V battery over the sleeve and back through the ring of the line to the common point 17. The sleeve relay CD is operated over its ground on the sleeve of the associated jack. If now the cord plug connected to the line of subscriber SD is withdrawn, the relay CD releases and upon such release it connects +48 V battery through resistance 18 directly to the common point 17 in place of the +48 V battery which was previously connected over the resistance of the subscriber's loop to such common point. The battery supply over resistance 18 thus takes the place of the battery supply over the subscriber's line and the resistance 18 replaces the resistance of the line.

On the other hand, if an answering plug is withdrawn from or left uninserted in a subscriber's line, then the relay AD is released and at its right-hand outer break contact connects -48 V battery directly through resistance 19 to the common point 16. In this way any number of lines either even or odd may be connected to receive simultaneously a message broadcast either from some particular line or from an operator's machine at the central office.

Alternative line connections

The switchboard circuits so far described are intended primarily for use in installations having a relatively small number of lines, such as exchanges in isolated places and private branch exchanges. In order to provide circuits for connecting the switchboard and its subscribers to a more general teletypewriter exchange system

through central offices, trunk circuits may be provided. Suitable trunk circuits are those illustrated in Figs. 4 and 6 of the application of Singer Serial No. 89,828, filed July 9, 1936. Either end of a double-ended cord, such as those terminated by plugs 2 and 3, may be connected to the line jack of one of those trunk circuits or the broadcasting plug BP may be connected thereto. The operation of the cord circuits will be generally the same as when connected to a subscriber's line; the operation of the trunk circuits is set forth in detail in the Singer application.

Furthermore, if one of the subscribers' lines is too long for a loop without repeaters, it may be connected to the central office by means of the circuit including a repeater as shown in Fig. 5 of the aforesaid Singer application.

Service to unattended subscriber's station

If one or more subscribers should desire to receive service upon their unattended teletypewriter instrument, this may be accomplished by utilizing at such subscriber's station the unattended station set shown in Fig. 3 of the aforesaid Singer application. The telephone portion of said unattended station set may be disregarded or the leads thereto disconnected, retaining only the ringer for calling the subscriber from the central office. The operation of said Fig. 3 will be fully understood from the disclosure of the said Singer application and aside from this will be well understood by those skilled in the art, since the telegraph portion of such subscribers' equipments are known and in common use.

General comments

It will be noted that the cord circuit equipment of the present application does not include a telegraph repeater. This is a desirable simplification for many installations where the lines are relatively short but obviously imposes certain limitations on the use of the equipment for interconnecting long subscribers' lines. The broadcasting arrangement provides an unusually convenient means for establishing circuits whereby several subscribers may be interconnected to receive messages from a single subscriber or from the operator.

What is claimed is:

1. A teletypewriter exchange system comprising a central office having a cord circuit having two current supply sources of opposite polarity, a plurality of lines extending from said office to subscribers' circuits, a plug at each end of said cord circuit for connecting said cord circuit to one of said lines, a key for each cord, connections whereby operation of said key brings such lines as are connected by plugs to said cord circuits to two common points, and a signal sending device connected to said points.

2. A combination according to claim 1, having an operator's teletypewriter and a key for connecting said operator's teletypewriter to operate said device.

3. In a combination, according to claim 1, a broadcasting cord having a plug for connection to one of said lines, and relays operative to render said line effective to operate said device.

4. In a telegraph exchange system, a plurality of lines, a plurality of cord circuits each having two plugs connectible to one of said lines for establishing through said cord circuit when the two plugs thereof are connected to two of said lines a two-way telegraphic communication path,

a key for each cord circuit normally isolating the communication paths of said cord circuits from each other and contacts upon said keys whereby operation thereof to a given position brings the communication paths of said cord circuits together at two common points.

5. In a combination, according to claim 4, contacts of a broadcasting telegraph impulse sending device connected across said common points.

10 6. In a combination, according to claim 4, operators' teletypewriters, and keys individual to said cord circuits for connecting one of said teletypewriters to the communication path of said cord circuits individually.

15 7. In a teletypewriter exchange system, a broadcast cord connectible to an incoming line by a plug and jack connection, a plurality of

other cords, and keys individual to said other cords for connecting them to common points controlled by signals from said broadcast cord.

8. In a telegraph exchange system, a plurality of cords terminating in plugs for connection to lines, keys for bringing two points in said cords to two common points, said points being at a definite potential from battery supplied over a plug and jack connection and a line when a plug of a cord is connected to a line, a relay having an armature movable by disconnection of a cord from a line effective to substitute for the battery connection to one of said points over a line another battery connection of similar polarity over a resistance.

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