

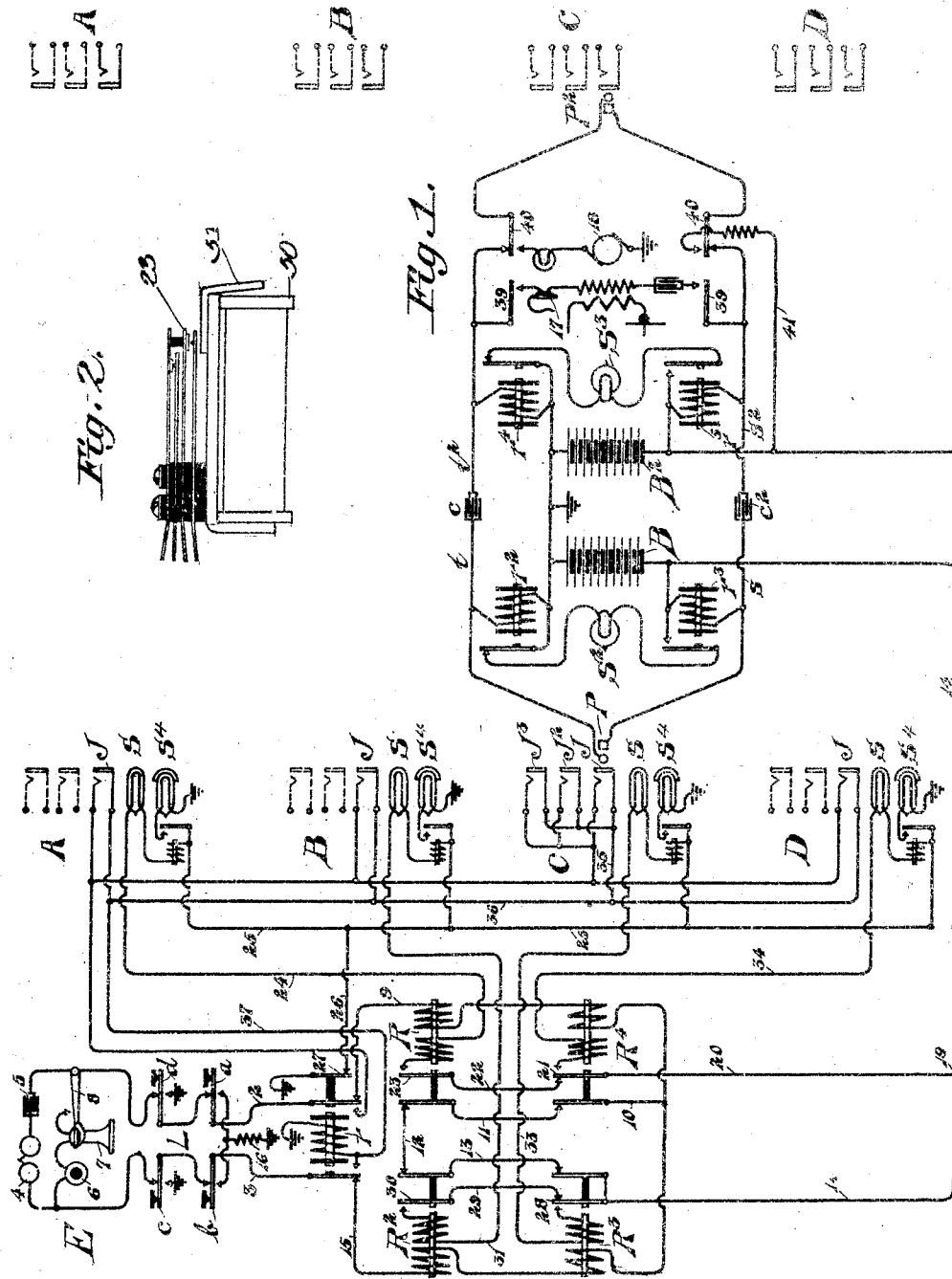
No. 883,093.

PATENTED MAR. 24, 1908.

W. W. DEAN.

DIVIDED CENTRAL TELEPHONE SYSTEM.

APPLICATION FILED JUNE 16, 1903.



Witnesses.

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DIVIDED-CENTRAL TELEPHONE SYSTEM.

No. 883,093.

Specification of Letters Patent.

Patented March 24, 1908.

Application filed June 15, 1903. Serial No. 161,531.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and resident of Chicago, county of Cook, and State of Illinois, have invented a certain new and useful Improvement in Divided-Central Telephone Systems, of which the following is a specification.

My invention relates to telephone systems of the divided central type. In this class of systems, the lines are each provided with signals upon different divisions of the switchboard and the subscriber is furnished with means for selectively operating the said signals. By thus being able to call the different sections of the switchboard, the multiple jacks for each line need be placed upon one only of said sections, whereby a considerable reduction in the multiple installation over that of the straight multiple board is secured.

My invention has for its objects to provide a system of this type which shall be comparatively simple and which operates wholly by current from a central office and in which the call responsive devices in the several sections of the board for each line are operated by means of signaling currents of different strengths and controlled from a subscriber's station.

My invention is illustrated by the aid of the accompanying drawing in which

Figure 1 is a diagram of a telephone system embodying my improvements. Fig. 2 shows one way of arranging the contacts of the line relays of my invention.

L indicates a subscriber's telephone line extending in two limbs 2 and 3 from the substation E to the central office. At the substation an ordinary bell 4 and a condenser 5 are included as usual in the permanent bridge of the line conductors while a transmitter 6 and receiver 7 are located in a bridge of said conductors, whose normal discontinuity is maintained by the switch hook 8 and the receiver held thereby. This apparatus is adapted for use in connection with the common source of current located at the central office and typifies any desired subscriber's outfit.

At the central office the line is provided upon the four divisions of the switchboard with answering jacks J, line signals S and a suitable pilot signal S². Upon one of the

divisions of the switchboard, division C in the case of line L shown in the drawing, multiple jacks J² and J³, in any number, are provided. Each line is also provided with four line relays R, R², R³ and R⁴, and a cut-off relay *r* which, when operated, serves to sever the relays and signaling apparatus from the external line circuit and to connect the spring jacks of the switchboard with said external line circuit for conversational purposes. In the normal extension 9 of the line conductor 2 are located the line relays R and R⁴, the former having an actuating winding of greater resistance than the latter, 200 and 100 ohms respectively having been found satisfactory, said conductor being connected by conductor 10 through normal contacts of the relay R⁴ thence by conductor 11 through normal contacts of relay R and likewise by conductors 12 and 13 through normal contacts of the relays R² and R³ from whence a lead 14 extends to the live pole of battery B connected with the central office cord circuit. Similarly the line conductor 3 is normally joined to a wire 15 including the high and low resistance actuating windings of line relays R² and R³ and which wire is likewise joined by conductors 10, 11, 12, 13 and 14 with said battery. The said line relays are suitably provided with locking windings to maintain the same actuated after once being energized. At the substation four keys, *a*, *b*, *c*, and *d* are provided, the keys *a* and *b* being adapted to close the opposite line conductors through a high resistance 16 to ground, while the keys *c* and *d* close the said conductors through low resistance or directly to ground.

The cord circuit for establishing connections with the lines, and with which each operator at the several sections is provided in any number desired, each includes an answering plug P and a calling plug P² having tip and sleeve contacts adapted to register with the like contacts of the jacks of the telephone lines, the tip contacts of said plugs being connected by the strands *t* and *t*² and the interposed condenser *c*, while the sleeve contacts are similarly connected by the strands *s* and *s*² and the interposed condenser *c*². Across the answering end of the cord circuit supervisory relays *r*³ and *r*² together with the common battery B are connected, said relays controlling through their

contacts the local circuit of a supervisory lamp S^2 . The similar supervisory signal S^3 has its circuit controlled by the supervisory relays r^4 and r^5 and similarly connected across the calling end of the cord circuit with the battery B^2 . The operator's receiver 17 together with the associated apparatus is adapted to be connected across the cord circuit by means of any suitable listening key, while the ringing generator is adapted to be connected with the cord circuit for ringing the wanted subscriber.

Assuming that the subscriber E wishes to call a subscriber whose multiple jacks are located upon the division A, he presses the key a at his station, thus completing a path for current from the battery B at the central office, over conductors 14, 13, 12, 11, 10, 9 and 2, and thence through the high resistance 16 to ground. Owing to the presence of the high resistance 16 in this path, the current is sufficient to operate only the high resistance relay R, the low resistance relay R^4 remaining unoperated. The operation of relay R closes a local circuit from the battery B over conductor 14 to junction point 19, thence over conductor 20, spring 21 and normal contact of relay R^4 , conductor 22, spring 23 and forward contact of relay R, thence through the locking winding of relay R and over conductor 24 through the line lamp S and the pilot relay for the operator's position, and thence by way of conductors 25 and 26 and through the normal contact 35 and spring 27 of cut-off relay r to ground. The line lamp and the pilot relay are actuated over this circuit and the line relay R is locked so that it is not deenergized when the subscriber releases his push button. The local circuit at spring 23 of relay R must obviously be completed before the circuit through the outer spring is opened, as shown in Fig. 2. Said figure shows a form of line relay having the superposed contacts mounted thereon, arranged so that the forward set of contacts will be made before the back set of contacts is broken. The relay coils are wound upon the spool 50 which carries an angle armature 51 adapted to rock upon the edge of the magnetic structure as shown. When the lower projecting end of the armature is attracted it will be noted that the contact springs will be actuated by the other end of said armature as described with reference to the line relays shown in Fig. 1. The same is true of all the other line relays.

If the subscriber whose multiple jacks are located upon the B section of the switchboard is wanted, the subscriber pushes key b with the result that line relay R^2 which is of high resistance is operated in the manner just described with reference to the relay R connected with the other side of the line, the low resistance relay R^3 remaining inoperative. The path for current in this instance

is the same as that traced for the relays over the other side of the line except that it is over the other line conductor. The actuation of this line relay closes a local circuit over the conductor 14, through spring 28 of relay R^3 and its back contact, conductor 29, spring 30 and forward contact of relay R, the locking winding of said relay, conductor 31 and thence through the line lamp S located upon the B division of the switchboard, through the pilot relay, and by way of conductors 25 and 26 to ground as before. The relay R^2 is thus locked and the signal located upon the B division of the switchboard is operated. In a similar manner the depression of key c at the substation serves to close the line conductor 3 through a low resistance path to central with the result that both relays R^2 and R^3 in that line conductor are actuated, the current flowing the same as before traced except that instead of passing through the high resistance in the substation it is now directed through the low resistance path. The operation of the relay R^3 closes a local circuit from the conductor 14 through spring 28 of said relay and its forward contact, the locking winding of the said relay, conductor 33 to the lamp S located upon the C division of the switchboard and thence by way of common conductors 25 and 26 to ground. In the same manner the operation of key d at the substation operates the low resistance relay R^4 over the line conductor 2, the local circuit for the lamp in this instance including the conductor 20, the locking winding of said relay and conductor 34 leading to the line lamp located upon the D division of the switchboard.

Assuming that the signal upon the C division has been operated, the operator inserts the calling plug P of her cord circuit, thereby permitting current to flow from the battery B over the sleeve strand of the cord circuit and the sleeve conductors 35, 36 and 37 of the switchboard section of the line and through the winding of the cut-off relay r to ground. This operates the cut-off relay which severs the connection with conductors 9, 10 and 15 and connects the line conductors 2 and 3 with the said switchboard section. Likewise the local circuits for the lamps are opened at the said cut-off relay to render them inoperative. Owing to the fact that the subscriber has taken up his telephone the tip relay r^2 is actuated by current flowing over the metallic line so that the supervisory signal S^2 has its circuit opened at the said relay and is therefore inert. The operator connects her instrument with the cord circuit by means of the usual listening key indicated diagrammatically by the springs 39, 39 and receives the order for the connection. The wanted line is tested in the usual manner by touching the tip of the calling plug to the ring of one of the multiple jacks. If the line

is idle, said ring is connected with ground through the cut-off relay, and since the tip of the said plug is likewise grounded no flow of current results and no click is received.

5 When the line is busy, however, said test rings are connected with the live pole of one of the central batteries so that when the testing plug is brought into engagement therewith a current flows over the tip strand and a
10 surge of current takes place through the operator's receiver. Assuming that the line is found idle, the plug is inserted in one of the multiple jacks of the called subscriber's line and the ringing key springs 40, 40 depressed.
15 The generator 18 sends ringing current out over the telephone line, the return path for which is completed through the central battery B², the auxiliary path 41 being completed around the supervisory relay r⁵ by the
20 sleeve spring of the ringing key. The current from the battery B² serves to maintain the cut-off relay of the called line actuated during ringing.

After the subscriber has been called but
25 before his response, the relay r⁵ is actuated to close the local circuit of a supervisory signal S³, which is lighted to indicate that the subscriber has not yet responded. Upon
his response the tip supervisory relay r⁴ is
30 actuated and serves to open said supervisory signal circuit which renders the same inert during conversation. The batteries B and B² furnish current to the connected lines for conversation, and for the operation of the
35 various relays and signals associated therewith. At the termination of the conversation, the return of the subscribers' receivers to their hooks deenergizes the tip supervisory relays r² and r⁴ which closes the local
40 circuits of lamps S² and S³ which are lighted to indicate to the operator that the conversation has terminated. Upon observing this the operator takes down the connections and returns all parts to normal position.

45 I claim:—

1. In a telephone system, the combination with a telephone line having a plurality of connection terminals located upon the
50 different divisions of a divided central switchboard, of a signal for the line upon each division of said switchboard, cord circuits at each of the divisions of the switchboard to establish connections with the line through the medium of said connection terminals for
55 conversational purposes, a common source of current at the central office adapted to be connected with the telephone line by means of said cord circuits to furnish current over the line for talking, and means controlled
60 from the substation for causing currents of different strengths to flow from said source over the telephone line to selectively operate said signals upon the various divisions of the switchboard, substantially as described.

65 2. In a telephone system, the combina-

tion with a telephone line having a plurality of connection terminals located upon the different divisions of a divided central switchboard, of a signal for the line upon each
70 division of said switchboard, cord circuits at each of the divisions of the switchboard to establish connections with the line through the medium of said connection terminals for conversational purposes, a common source
75 of current at the central office adapted to be connected with the telephone line by means of said cord circuits to furnish current over the line for talking, and means at the substation for closing high resistance and
80 low resistance paths for current over the telephone line from said common source to selectively operate said signals upon the various divisions of the switchboard, substantially as described.

3. In a four-division, divided central tele-
85 phone circuit, the combination with a telephone line, having a connection terminal upon each of the four divisions of the switchboard at the central office, a signal for the
90 line in each of said divisions of the switchboard, cord circuits at each division of the switchboard to establish connections with the telephone line through the medium of said connection terminals for conversational
95 purposes, a common source of current at the central office associated with said cord circuits adapted when a connection exists at any of said divisions to furnish current over the line for talking, two of said signals being
100 connected with each line conductor of the telephone line, and means at the substation to cause current of different strengths to flow from said source over either of said line conductors to selectively operate the signals
105 connected therewith, substantially as described.

4. In a telephone system, the combination with a telephone line terminating in
110 connection terminals upon the various divisions of a divided central switchboard, of a plurality of signals for the line—one upon each of said divisions, a central common
115 source of current, a resistance at the substation of the line, and means under the control of the subscriber to close circuits from said central source over the telephone line and to at will include or exclude said resistance to thereby selectively operate said signals, substantially as described.

5. In a telephone system, the combina-
120 tion with a telephone line, of a plurality of signals therefor located upon the different divisions of a divided central switchboard, a central common source of current, a relay at the central office connected with the line
125 for each of said signals, and serving to control the same, said relays being responsive to currents of different strengths, and means at the substation for causing currents of different strengths to flow over the line from 130

said source and selectively operate said relays and thereby the said signals, substantially as described.

6. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a switchboard, a central source of current, means at the substation of the line for closing different paths of different resistance over the telephone line from said source, and means to cause said signals to selectively respond to the currents over said different paths, substantially as described.

7. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a switchboard, a central source of current, means at the substation for closing different paths for current and of different resistances over the telephone line, means to cause said signals to selectively respond to such different currents, and a cut-off relay for the line actuated when connection is established therewith, at any of said divisions to render said signals inoperative, substantially as described.

8. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a divided central switchboard, a central common source of current, a relay at the central office connected with the line for each of said signals and serving to control the same, each of said relays having two windings, one of said windings of each of said relays being responsive to currents of different strengths and being adapted to energize said relays when a subscriber calls central, the other winding of each of said relays being in the circuit of the corresponding signal, and constituting a locking winding for said relays, and means at the substation for causing currents of different strengths to flow through said first mentioned windings from said source to selectively operate said relays, substantially as described.

9. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a divided central switchboard, a central common source of current, a pair of relays at the central office connected with each line conductor and adapted to control the circuit of said signals, the relays associated with each line conductor being responsive to

currents of different strengths, a resistance at the substation, and means for including or excluding said resistance from the circuit of the relays associated with either of said line conductors, whereby said relays are selectively energized by current from said source and the corresponding signal selectively controlled, substantially as described.

10. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a divided central switchboard, a central common source of current, a plurality of relays at the central office connected with the line for selectively controlling said signals, each of said relays having two windings, one of said windings of each relay being responsive to currents of different strengths, means at the substation for sending currents of different strengths over the line to selectively energize said windings, normally-closed contacts for said relays in the path of current through said winding, the other winding of each relay constituting a locking winding therefor, normally-open contacts for each relay in the path of current through said locking windings, and means for making said last mentioned contacts before said first mentioned contacts are broken, whereby said locking winding maintains said relay energized after the selective calling current is broken and the corresponding signal remains exposed, substantially as described.

11. In a telephone system, the combination with a telephone line, of a plurality of signals therefor located upon the different divisions of a switchboard, relays at the central office associated with said signals, a central source of current, means at the substation of the line for closing different paths of different resistances over the telephone line and through the windings of a plurality of said relays in series from said source, and means to cause said signals to selectively respond to the currents over said different paths, substantially as described.

Signed by me at Chicago, county of Cook and State of Illinois, this 12th day of June 1903.

WILLIAM W. DEAN.

Witnesses:

EVA A. GARLOCK,
ROBERT LEWIS AMES.