E. R. HOBBS.

TELEPHONE SYSTEM.

APPLICATION FILED MAY 15, 1909.

1,045,845.

Patented Dec. 3, 1912.

2 SHEETS—SHEET 1.

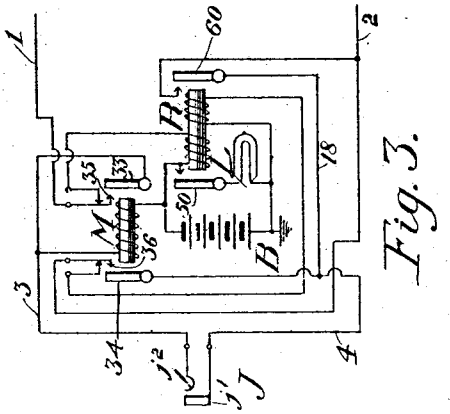

Fig. 3.

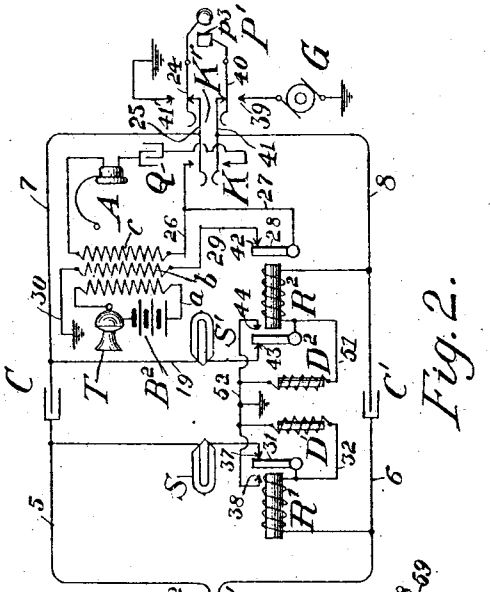

Fig. 2.

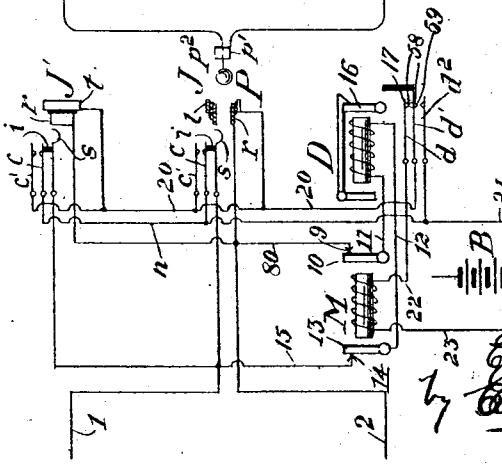

Fig. 1.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 6.

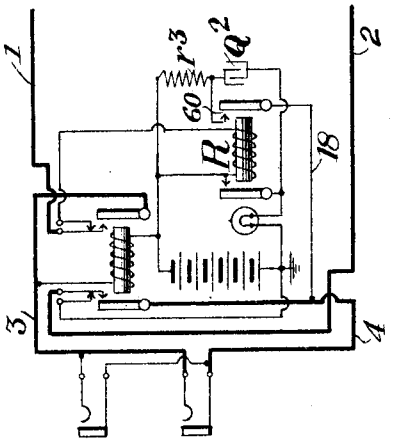


Fig. 5.

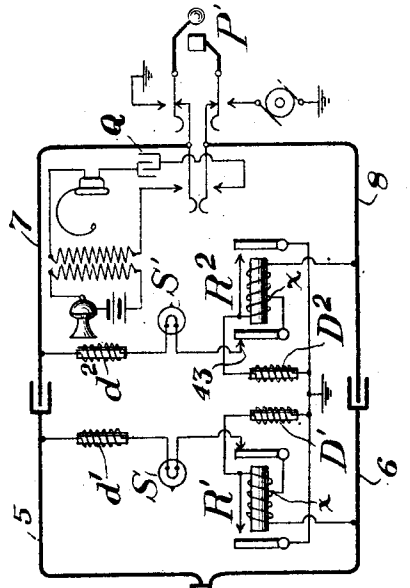
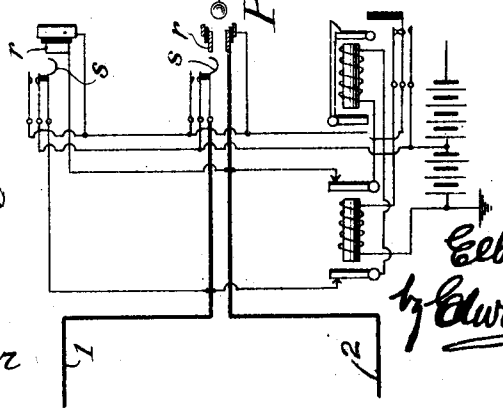


Fig. 4.



Witnesses

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TELEPHONE SYSTEM.

1,045,845. Specification of Letters Patent. Patented Dec. 3, 1912.

Application filed May 15, 1909. Serial No. 496,127.

To all whom it may concern:

Be it known that I, ELBERT R. HOBBS, a citizen of the United States, residing at Buhl, in the county of Twin Falls and State of Idaho, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to telephone systems, and has for its object the provision of a novel means for effecting connections at a central station betwen magneto and common battery line circuits.

A further object of my invention is to provide the subscribers' line terminal apparatus in a magneto circuit with means for affording an immediate busy test.

In a co-pending application No. 464,860 filed November 28, 1908, I have shown and described a device for putting the subscribers' line terminals in a common battery system in condition for an immediate busy test and while I show and describe herein a test for a common battery circuit, this invention relates particularly to the provision of means for accomplishing the same purpose in a magneto circuit. To that end I have arranged an additional test sleeve on the answering and multiple jacks associated with the magneto line circuit, and have provided the drop signal with contact springs arranged to place said test sleeve in immediate condition for a busy test.

Other objects and advantages will appear in the detailed description of the system as hereinafter set forth.

My invention is illustrated in the accompanying drawings in which:

Figure 1 shows a subscriber's magneto line terminal apparatus and multiple jacks for use with the operator's cord-circuit shown in Fig. 2. Fig. 2 shows an operator's cord-circuit. Fig. 3 shows a subscriber's common battery line terminal apparatus. Fig. 4 is identical with Fig. 1. Fig. 5 is a modification of operator's cord circuit. Fig. 6 is a modified form of subscriber's terminal apparatus.

In Fig. 1 the subscriber's lines 1 and 2 are shown leading from the subscriber's substation (not shown) both of said lines terminating in contacts of the cut-off relay M. Connected with these contacts is the magneto drop signal D which may be of any approved type, either manually or mechanically self-restoring. The terminals of the lines are multiplied to the jacks J and J'. Each jack consists of the sleeve ring r and the tip spring s. Secured to the under side of the tip spring is the insulating member i arranged to close the contacts c and c' when the plug is inserted in the jack. A novel feature of this jack consists in an additional ring t which is provided for testing purposes only. This ring or sleeve is made considerably larger than the sleeve r so that when the plug is inserted it will not come in contact with the larger ring. This additional sleeve may entirely or only partly encircle the line sleeve r or, to economize space it may be only an exposed piece of metal, as its use is merely for testing. The test rings of the jacks are all connected to a common conductor 20 connected with the spring c' and with the spring d' associated with the magneto drop D. The spring d' is extended and the end is disposed in such a position that when the magneto D is energized the shutter will engage the end of the spring thereby breaking the contacts between the springs d and d' and closing the contacts between d' and d^2.

The operator's cord-circuit is provided with the usual plugs P and P' connected on the tip side by the conductors 5 and 7 and on the sleeve side by the conductors 6 and 8. The condensers C and C' are interposed on the tip and sleeve sides of the cord-circuit respectively, to permit the passage of voice currents while cutting off battery current. The answering supervisory relay R' controls the supervisory lamp S, while the relay R^2 on the calling end of the cord-circuit controls the lamp S'. One end of the windings of the relays R' and R^2 is connected to the sleeve side of the cord, the other end being normally grounded through the choking coils D' and D^2 respectively.

The operator's set consists of the usual parts and includes the transmitter T in circuit with the battery B^2 and the secondary winding a of an induction coil. The receiver A is in circuit with the primary winding c of the induction coil, together with a condenser Q. A tertiary winding b is provided on the induction coil for test purposes. One end of this coil is connected directly to ground and the other terminates in a contact of the calling supervisory relay R^2. A listening key K is provided by means of which the operator can listen in to get the

number wanted when a connection is desired, the operation of this key serving to connect the test coil *b* with the tip side of the cord and the receiver A with the tip and sleeve sides of the cord through the coil *c* and the condenser Q respectively. The ringing generator G is connected on one side to the ground and on the other to a contact arranged to be closed by the ringing key K^r.

The apparatus shown in Fig. 3 is especially arranged to coöperate with the cord-circuit in Fig. 2. I have shown therein the line wires 1 and 2 leading from a subscriber's station (not shown) both of said lines terminating in contacts of the relay M, which are of the make before break type, as will be seen from the drawing. The line relay R controls the circuit of the signal lamp L, the pulling up of its armature 50 completing the lamp circuit from the battery B. The pulling up of its other armature 60 serves to connect the line wire 2 with its extension 4 leading to the jack J. The line relay R is double wound, one end of each winding being connected to the opposite sides of the battery and the other ends terminating in contacts of the cut-off relay M. The energization of the cut-off relay M puts the line wires 1 and 2 onto their respective extensions 3 and 4 leading to the jack J.

Fig. 4 is identical with Fig. 1 and its operation is therefore the same.

In Fig. 5 there is no extra test winding to the operator's set as the lamp S′ keeps the tip side of the operator's receiver at the potential of ground, so that when the tip of plug P′ touches a jack sleeve on which the potential has been raised, a charge flows into the condenser Q, giving the operator a busy test. The supervisory lamp is connected to ground through a circuit that includes a few windings of the supervisory relay, this scheme admitting of the following advantages: first it provides against any possibility of the supervisory relay R^2 operating on the test current of a second operator, as this current divides at *x* and traverses the windings in opposite directions, the neutralizing effect of the smaller winding being sufficient to prevent the relay from operating; second, it insures supervision on long lines or lines whose resistance has been slightly raised as the current flowing from supervisory lamp would insure the positive operation of supervisory relay; third, it cuts down the resistance between the lamp and sleeve side of cord circuit, thus providing a stronger busy test for a second operator after the first operator has plugged in. The operation of the supervisory relay connects one terminal of its full winding to ground.

Fig. 6 is somewhat similar to Fig. 3. However it makes use of a single winding on the line relay R instead of a double winding, and a condenser Q^2 which is kept charged to the potential of battery through the resistance r^3 thus providing an immediate busy test on the pulling up of the line relay R, the charge flowing through contact 60, 18, 4 and to sleeve of jack.

The operation of the system will be readily understood from the foregoing explanation of the apparatus used.

Referring now to Fig. 1, when a subscriber desires a connection he operates his ringer, current flowing over line 2, through 80, 9, 10, 11, D, 12, 13, 14, 15, and back upon the line 1. Thereupon the armature 16 of the drop signal D is released and comes into engagement with the terminal 17 of the spring *d′* breaking the contact of the latter with the spring *d* at 58 and closing the contact with the spring d^2 at 59. This serves to increase the potential of the multiple jacks J, J′ since they are now connected through the conductor 20 and springs *d′* and d^2 to the battery B. The multiple jacks are thus in condition to test busy at once. On seeing the drop signal displayed the operator answers the call by placing the answering plug P in the jack J. If however before she has had time to insert the plug in its jack another subscriber should desire to communicate with the calling subscriber, a second operator before whom the line of the second subscriber terminates, on testing the first subscriber's line in the ordinary way, will find it busy even before the first operator has plugged in. The second operator will get a click in the ear due to a momentary current induced in the coil *c* caused by a flow of current from the ring of the calling subscriber's multiple jack through the tip side of the cord plug (the cord of the second operator), 24, 25, 26, 27, 28, 29, *b*, 30 and ground. A portion of the current from the ring of the multiple jack will flow over the tip side 7 of the cord and to ground through the supervisory lamp S′ and the choking coil D^2. This current, however, is small, due to the presence of the coil D^2, most of the current being forced through the test coil *b*. It will be noted that the drop D must be restored before the cut-off relay can be energized. This restoring can be accomplished in any ordinary and desired manner, either manually or automatically, means for this purpose being common and well known. The simplest method however is for the operator to poke up the drop with the tip of the plug just as she inserts the latter into the jack. This would be the method followed with simple apparatus such as that shown in Fig. 1.

When the first operator plugs into the answering jack the cut-off relay M is energized the energizing current being from B,

21, c, c', 20, 58, 22, M, 23 to ground. The actuation of the cut-off relay M cuts out the drop signal D through the breaking of the circuit at the contacts 9—10 and 13—14. After plugging in to answer the call the operator presses her listening key K and inquires the number wanted. Having learned the number she tests the wanted line by touching the tip of the calling plug P′ to the ring of the jack. If the wanted subscriber is busy the potential of his jack is raised in the manner described and current will flow through the test coil b and a click will be heard. If the line is not busy the plug is inserted into the jack of the wanted subscriber. When the plug P′ is inserted in the jack the cut-off relay M of the called subscriber's line is energized current flowing from battery, through the cut-off relay, 3, tip side of jack, j^2, tip side of plug, 24, 7, 19, S′, 43, 51, D^2, 52 and ground. Thereupon the supervisory lamp S′ lights up. Ringing current is now supplied to the line on the manipulation of the ringing key Kr. Current then flows from the generator through 39, 40, p^3, over the sleeve side of the subscriber's line, through the subscriber's ringer, back upon the tip side of the subscriber's line, through 24, 41′ and to ground. When the subscriber answers he closes the line circuit and provides another path for the current through his cut-off relay, this current flowing through the cut-off relay over the line wire 1, through the telephone, back upon the line wire 2, through the sleeve side of the cord plug, conductor 40, 41, 8, R^2, 51, D^2, and ground. Thereupon the supervisory relay R^2 is energized, the test circuit is broken at 42, the circuit of the supervisory lamp S′ is broken at 43 and a direct path to ground is provided by the closure of the contacts at 44. Battery current for the called subscriber is supplied through his cut-off relay, through his instrument, back on the sleeve side 2 of the line and through the relay R^2.

With the arrangement described above the clearing-out signal would be operated by the called subscriber hanging up his receiver. When the operator withdraws the plugs from their jacks the system is restored to its normal condition.

Having thus described my invention what I claim and desire to secure by Letters Patent is—

1. In a telephone exchange system, subscribers' lines comprising magneto circuits and common battery lines, an operator's cord circuit, line controlled means for placing the line terminals of a calling subscriber on either the magneto or common battery lines in immediate condition for a busy test, means operable upon use of said cord circuit with any of the lines interchangeable, for maintaining a busy test potential, said means acting automatically through the cord to disable the line controlled means of common battery lines and to maintain a busy test on said common battery lines and separate means adapted to be actuated by the operator for disabling the line controlled means of magneto lines.

2. In a telephone exchange system, subscribers' lines comprising magneto and common battery circuits, signals therefor, and means operated by the signal of the magneto circuit for placing the terminals in immediate condition for a busy test.

3. In a telephone exchange system, a magneto line circuit, a drop signal therefor, answering and multiple jacks therefor and means actuated when the signal is displayed for placing said answering and multiple jacks in immediate condition for a busy test.

4. In a telephone exchange system, a magneto line circuit provided with a drop signal, answering and multiple jacks provided with test contacts and means adapted to be engaged on the actuation of said drop signals to raise the potential of said test contacts thereby providing for an immediate busy test.

5. In a telephone exchange system, a magneto line circuit provided with a drop signal, answering and multiple jacks provided with sleeve and tip contacts, an additional test sleeve associated with each jack and means arranged to be actuated on the display of the drop signal for raising the potential of said test sleeve thereby providing for an immediate busy test.

6. In a telephone exchange system, a magneto line circuit, a drop signal associated therewith, answering and multiple jacks provided with sleeve and tip contacts, an additional test sleeve associated with each jack, contact springs adapted to be actuated on the display of said drop signal and arranged to raise the potential of said test sleeve thereby providing an immediate busy test.

In testimony whereof I affix my signature in presence of two witnesses.

ELBERT R. HOBBS.

Witnesses:
JOHN W. FARIS,
WALTER G. BISHOP.