J. L. RUE & C. F. BROWN.

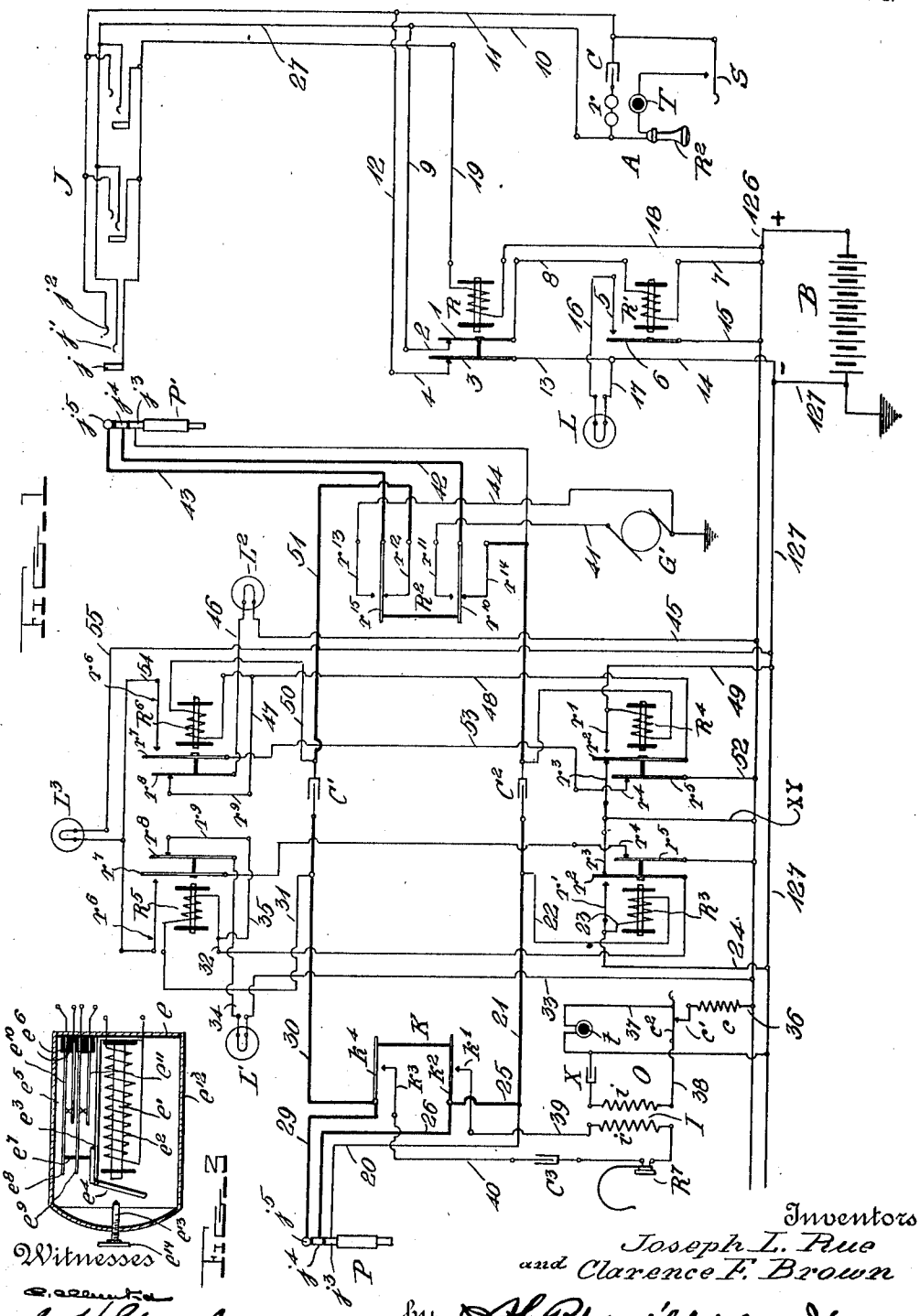
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 11, 1909.

1,019,992.

Patented Mar. 12, 1912.

2 SHEETS—SHEET 1.



Witnesses

C. H. Giesbauer.

E. Albrecht

Inventors

Joseph I. Rue

and Clarence F. Brown

by H. B. Williamson & Co

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

J. L. RUE & C. F. BROWN.

TELEPHONE SYSTEM.

APPLICATION FILED FEB. 11, 1909.

1,019,992.

Patented Mar. 12, 1912.

2 SHEETS—SHEET 2.

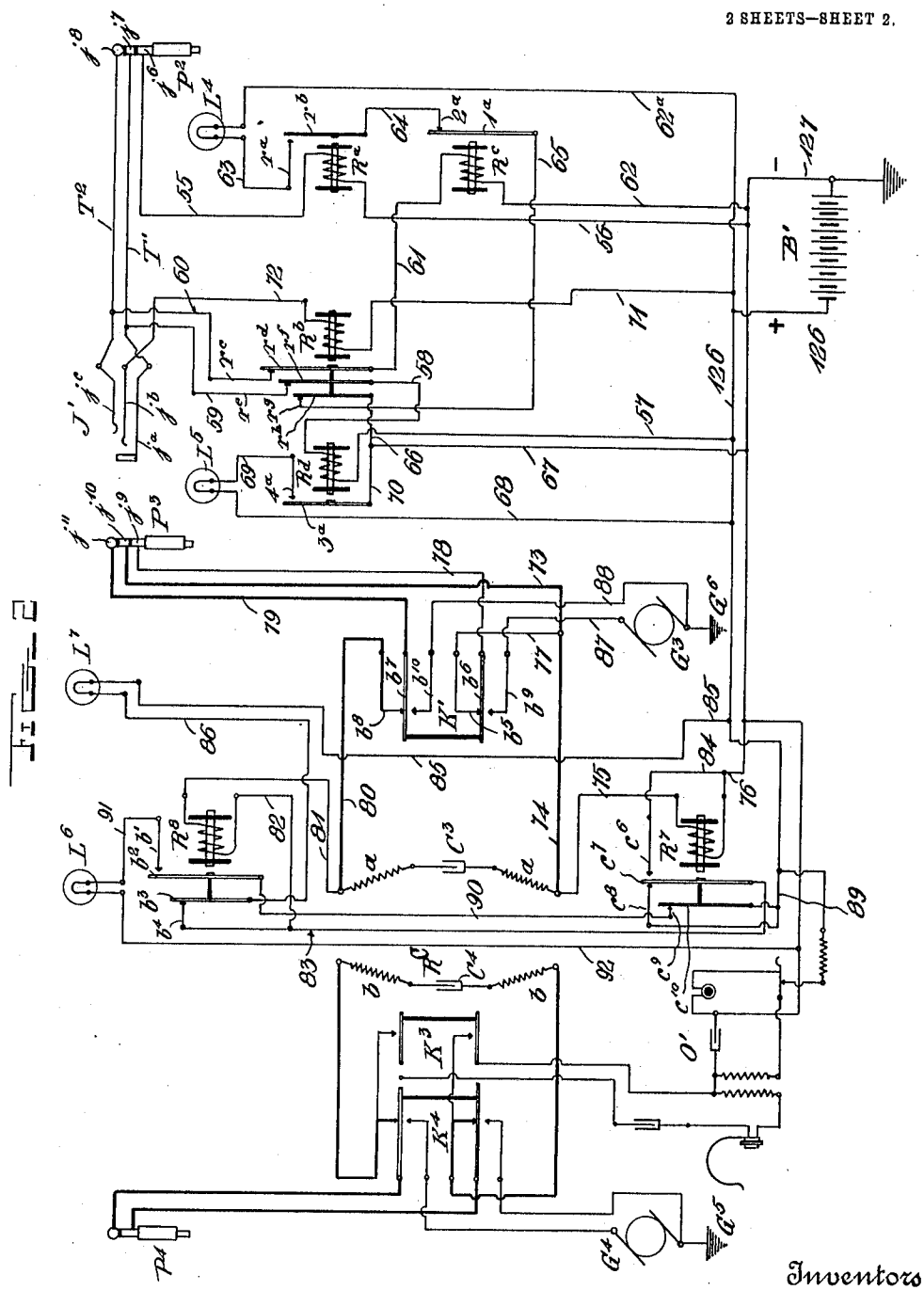


FIG. 2

Witnesses

C. H. Griesbauer.

Inventors

Joseph L. Rue

and Clarence F. Brown

by A. B. Wilson & Co

Attorneys

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOSEPH L. RUE AND CLARENCE F. BROWN, OF COSHOCTON, OHIO.

TELEPHONE SYSTEM.

1,019,992. Specification of Letters Patent. Patented Mar. 12, 1912.

Application filed February 11, 1909. Serial No. 477,316.

To all whom it may concern:

Be it known that we, JOSEPH L. RUE and CLARENCE F. BROWN, citizens of the United States, residing at Coshocton, in the county of Coshocton and State of Ohio, have invented certain new and useful Improvements in Telephone Systems; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to telephone systems and particularly to the cord and trunking circuits of manual systems.

The object of the invention is to provide a simple and easily installed system of the character described which will have a thorough and efficient busy test for the local operator, and which will also have an efficient busy test independent of the trunk for posting the trunking operator as to the condition of the lines.

A further object of the invention is the provision of retardation relays connected in the trunk and cord circuits which control other relays acting at certain times as busy test relays and at other times as retardation relays.

With these and other objects in view, the invention consists of certain novel features of construction, combination and arrangement of parts, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a diagrammatic illustration of the cord circuit and a subscriber's station; Fig. 2 is a similar view of the trunk and switching circuits; Fig. 3 is a sectional view of the top of cut-off relay employed.

Referring to the drawing and particularly to Fig. 1, J represents three switch board jacks which in this instance are wired in multiple, with the tip j^2 of each connected to one side of the subscriber's set at station A. The inner sleeve j' is connected by way of wire 27 to the opposite side of the set at station A and the sleeve j is connected directly to a cut-off feed relay R. The opposite side of the relay R is connected to positive battery B. The relay R is termed a cut-off feed relay, because it feeds talking current to the subscriber, when in operation and cuts out the line relay R′. It is provided with a pair of springs 1 and 3 and contacts therefor numbered 2 and 4, which are connected to the line wires 27 and 11, respectively. The spring 3 is connected to the negative side of battery B by wires 13 and 14 and the spring 1 is connected to the positive side of battery B by wires 7 and 8. These wires have included in their length the line relay R′ which is provided with a single spring 6 and contact 5 which are normally broken and while the contacts of the relay R are normally made when the relay is not in operation, the contact 5 of the relay R′ is connected by way of wire 16 to the line lamp L whose other terminal is connected to the negative side of the battery by way of wires 17 and 14.

The subscriber's station A is provided with the usual ringer r, condenser C, transmitter T, receiver R^2, and switch-hook S, and it will be noticed that one side of the station is connected to positive side of battery through the line relay R′. The other side of the station is connected to the negative battery through the contact 4 and spring 3 of the relay R. As springs 1 and 3 are normally closed on contacts 2 and 4, respectively, the sleeves j' and j^2 are supplied with current and both sides of the station A are complete to the battery. When the subscriber moves his receiver, the circuit of the line relay is completed so as to light the line lamp L.

Following the lighting of the line lamp, the switching circuit is put into operation. This circuit is composed of two three wire plugs P and P′, listening key K, ringing key R^2, answering supervisory lamp L′, calling supervisory lamp L^2, generator G′, condensers C′ and C^2, retardation relays R^3 and R^4, busy test and tip relays R^5 and R^6, operator's set O and busy lamp signal L^3. The retardation relays have one side connected to negative battery by way of wires 24 and 49 and the opposite side of these relays is connected to the sleeve side of the cord circuit on opposite sides of the condenser C^2, thus when the operator places his answering plug P in the jack, current passes through the cut-off relay R and disconnects the line lamp L and the line relay R′.

At this point we will explain the connections of retardation relay R^3 with the busy test relay R^5. The relay R^3 has two springs r^2 and r^5 which coöperate with the three contacts r', r^3 and r^4, for a purpose which will be hereinafter described. The contact point

r' is connected to negative battery by way of wire 24 and also connected to the winding of the relay R^3 by way of wire 23. The spring r^2 is connected to the winding of the relay R^5 by way of wire 32 and also to the contact r^9 on said relay. The contact r^8 is normally engaged by the spring r^2 and is connected directly to the wire 126 leading to positive battery. The contact r^4 is normally engaged by the spring r^5 and is connected to the spring r^7 on the relay R^5, while the spring r^5 is connected to positive battery so that current may be fed to the busy test lamp L^3 over the contacts r^6 and r^7 of the relay R^5 under certain conditions, which will be explained hereinafter. The relays R^3 and R^4 are constructed with the same number of springs and contacts and operate the same. The relay R^5 and the relay R^6 employ the same number of contacts and springs and operate identically. When the operator plugs-in in answer to the signal from the lamp L, as before described, the line relay and line lamp are cut-out and current travels over the line 18 relay R, 19, j, j^3, 20, 21, 22, R^3, 23, 24, and back to battery over 127. This energizes the relay R^3 and causes the contact spring r^2 to contact with the contact r'. As the subscriber is now on the line and as contact r^2 is connected directly with relay R^5, the latter is operated and the supervisory lamp L' cut out to indicate that there is subscriber on the line. After receiving the number wanted in the usual manner, the operator inserts his calling plug and then uses the ringing key R^2 to call the wanted subscriber, by the current from the generator G' which is bridged across the tip and sleeve of the calling plug by the operation of the ringing key R^2, when the subscriber comes in on the line, the circuit of the relay R^6 is completed and the supervisory lamp L^2 extinguished. When the subscribers hang up their receivers at the same time, the relays R^5 and R^6 are jointly released and the supervisory lamps L' and L^2 lighted which indicates that the subscribers are through talking and when the operator pulls the plugs P, P', the lamps are extinguished which indicates that the cord circuit is in normal order.

In view of the subscriber's station shown opposite the calling plug P', it is not deemed necessary to show such a station opposite the answering plug P, but it is to be understood that such a station is to be employed and wired the same as the one opposite the calling plug P' which shows the station in connection with the three jacks. The energizing circuit for the relay R^3, provided the operator plugs in the answering plug P' into the jack J, is from positive battery B, line 126, wire 18, cut-off feed relay R, conductor 19, sleeves j on jacks J, sleeve j^3 on answering plug P, wire 20, wire 21, wire 22, retardation relay R^3, wire 23, wire 24 to negative battery by the way of wire 127, operating cut-off feed relay R, breaking contact points 1, 2, 3 and 4, thus putting line relay R' and line lamp L out of commission. At the same time, positive battery would return at the listening key K by the way of wire 25, wire 26, sleeve j^4 of the calling plug P, inner sleeve j' of the jacks J, wires 27, line wire 10, subscriber's station A, back over line wire 11 and tips j^2 of the jacks J, tip j^5 of the answering plug P, wire 29 and wire 30, wire 31, relay R^5, wire 32, contact points r^2 and r', wire 24 to negative battery B by the way of wire 127. The circuit of the answering supervisory lamp in this case would be broken by reason of the separation of contacts r^9—r^8 of the relay R^5. This answering supervisory lamp L' will remain lighted just as long as relay R^5 is not in operation but when in operation contact points r^8 and r^9 will break, thus supervisory lamp L' would be out, indicating that there is subscriber on the line. On the other hand, the operator may place either plug P or P' in any one of the jacks shown in connection with the subscriber's station opposite the calling plug P'. As an illustration, suppose the calling plug P' be placed in one of the jacks of the subscriber's station opposite this plug P' and thus enable the operator to press the listening key and talk to the subscriber in connection with this plug P'. At the same time, the answering plug P may be inserted in a jack in connection with a subscriber's station, as already described, and both stations being on the line, the operator may talk to either one, or to both at the same time.

The circuit of the operator's set is of the usual type, the battery being led thereto over the wire 126, 36, retardation coil c and battery cut-off c', c^2. The local circuit of the operator's transmitter t includes the wires 37 and 38 and the primary i of the induction coil I.

The listening key K makes contact at k' and k^2, also at k^3 and k^4 thus a receiving circuit is established through the secondary i' of the induction coil I by the way of wire 39 and receiver R^7 and condenser C^3 and wire 40. The calling plug P' may then be placed in one of the jacks J, and the ringing key R^2 makes contact at r^{10} and r^{11}, contact is also made at r^{15} and r^{13} and breaks the talking circuit at contact r^{14} and r^{12} at this ringing key R^2, thus sending a current from positive side of power generator G' over wire 41 and contact r^{11} and r^{10} and wire 42, sleeve j^4 of calling plug P', sleeve j' of jacks J, wire 27, line wire 10, subscriber station A, through ringer r and condenser C, back over line wire 11 and tips j^2 of the jacks J, and tip j^5 of the calling plug P', wire 43, contacts r^{15} and r^{13} to negative side or ground of power

generator G′ by the way of wire 44. The circuit of the calling supervisory lamp L^2 would be from positive battery B to wire 126, wire 45 through lamp L^2, wire 46, contact points r^8 and r^9 on relay R^6, wire 47 and wire 48 over contact points r^2 and r', and wire 49 to negative battery B by the way of wire 127, thus supervisory lamp L^2 will remain lighted until relay R^6 is operated thus breaking contact points r^8 and r^9 and in this case supervisory lamp L^2 would be cut out, indicating a subscriber on the called line.

We will now explain the busy test on relays R^5 and R^6. It will be noticed that contact point r^6 is wired to one end of busy lamp L^3, and the other end of said lamp is wired to the negative side of battery B, and as r^2 and r^3, on both retardation relays R^3 and R^4 are normally in contact, contact points r^3, on relays R^3 and R^4 being wired to positive battery B, and as contact points r^2 are wired to one end of relays R^5 and R^6, the other ends of which are wired to the tips j^5 of their respective plugs, and as contact points r^4 on retardation relays R^3 and R^4 normally make, with contact points r^5 on said relays with contact points r^5 wired to positive battery B, and with contact points r^4 on relays R^3 and R^4 wired to contact points r^7 on relays R^5 and R^6, this would place positive battery to contact points r^7 on both relays and would also connect positive battery through the coils of relays R^5 and R^6 to tips j^5 of both plugs P and P′.

The busy test circuit operates when either the calling or the answering plug is placed in one of the three jacks J. For instance beginning with the answering plug P and placing it in one of the jacks J, positive battery would flow over wire 18, relay R, conductor 19 to sleeve j^3 of plug P, wires 20, 21, 22, relay R^3, wires 23 and 24 to wire 127, and to negative battery. This would pull up the relay R^3, and make contact points r' and r^2 of this relay, and by this operation positive battery would cease to flow through the coil of the relay R^5. Thus the relay R^5 would be terminated to negative battery by way of wire 127, and this half of the connection would then be in condition to form a talking connection with the first subscriber, should one be on the line. As the answering plug P is already inserted in one of the jacks J and relay R^3 has been pulled up thereby changing the position of its contact points and terminating the relay R^5 to the negative battery, positive battery then flows from the relay R to the relay R^3 to negative battery. This retardation relay R^3 is thus placed in connection with the sleeves of the jack J and by touching the tip of j^5 of the calling plug P′, to sleeve j of one of the jacks left unplugged, the busy relay R^6 will be operated over wire 43, contact points r^{15}, and r^{12}, wires 51 and 50, relay R^6, wire 48, contact points r^3 and r^2 of the relay R^4 to the positive battery 126, by way of the wire X Y. The busy relay R^6 will then pull up and close the contact points r^6 and r^7, and the circuit will be from positive battery over wires 126, 52, contact points r^4 and r^5 of the relay R^4 being made, and this relay not operated, over wire 53 contact points r^7, r^6, wire 54 to the busy lamp L^3 and the busy lamp L^3 being wired to the negative battery by means of the wire 55, would be immediately lighted and give the busy signal. This busy test may be obtained as long as there is a plug inserted in one of these jacks or in any other set of jacks.

Referring now to Fig. 2, we will explain the toll circuit which starts with the switchboard plug P^2. This plug is mounted on the local board and is the same type of plug as is used in Fig. 1 having sleeves j^6 and j^7 and tip j^8. The three way jack J′ is also the same type of jack as is shown in Fig. 1 with sleeves j^a and j^b and tip j^c. Tip j^c on the jack on the toll board is wired to tip j^8 on plug P^2 on local board. Sleeve j^a on the jack on the toll board is wired to sleeve j^7 of plug P^2 on local board, thus making a circuit from plug P^2 on local board to the jack on toll board. Sleeve j^6 of plug P^2 is wired to one end of retardation relay R^a. This relay has two contact points numbered r^a and r^b normally breaking when not in operation. Contact point r^a is wired to one end of supervisory lamp L^4, this lamp being placed on local board opposite the plug P^2 and having its other end wired to positive battery B′.

The cut-off feed relay R^b, is the same style relay as shown in Fig. 1, with the exception that it has six contact points normally making when not in operation. One end of this relay is wired to sleeve j^b on jack J′, the other end being connected to positive battery B′. The relay R^b has six contact points numbered r^e, r^d, r^c, r^f, r^g, and r^h, with contact point r^e running to tip j^c on the jack on the toll board. Contact point r^d runs to one end of retardation relay R^c, the other end of this relay is wired to negative battery B′. This relay R^c has two contact points 1^a and 2^a normally making when not in operation. Contact point 2^a on this same relay being wired to contact point r^b of relay R^a. Contact point 1^a is wired to contact point r^g on cut-off feed relay R^b. Contact point r^c on cut-off feed relay R^b is wired to sleeve j^a of the jack on toll board. Contact point r^f of cut-off feed relay R^b is wired to one end of relay R^d, the other end of this relay being wired to positive battery B′. This relay R^d has two contact points numbered 3^a and 4^a normally breaking when re-

lay is not in operation. Contact point 4^a on this relay is wired to one end of trunk lamp L^5 placed underneath the jack J′ on toll board, the other end of this lamp L^5 being wired to positive battery B′. Contact point 3^a is wired to negative battery B′, and is also tapped to contact point r^h on cut-off feed relay R^b. Relay R^c is normally made to connect with tip j^c on the jack of the toll board, and tip j^8 on the plug P^2 of the local board thus putting negative battery on the tips of plug and jack of this circuit, and relay R^d is normally made to feed positive battery to sleeve j^a of the toll board jack, and sleeve 57 of the plug P^2 on the local board. Should a subscriber on the local board as shown in Fig. 1 desire a connection with toll board, the operator would pick up the trunking plug P^2 and place it in the jack on her board. As sleeve j^6 of this trunking plug P^2 is wired to one end of retardation relay R^a and the other end of this relay being wired to negative battery B′, this would operate the cut-off feed relay R of Fig. 1 and relay R^a of Fig. 2 over the following path B, 126, 18, R, 19, j, j^6, 55, R^a, 56, 127 and back to ground at B′, thus putting the line relay R′, and the line lamp L out of commission. In the operation of relay R^a contact points r^b and r^a on relay R^a of the trunking circuit would be closed, and a subscriber being on the line of the trunking circuit, this would operate relays R^d and R^c thus putting out the trunking supervisory lamp L^4 mounted on the local board opposite the trunk plug P^2, over the following circuit B′, 126, 57, R^d, 58, r^f, r^e, 59, T′, j^7, j', 10, A, 11, j^2, j^8, T^2, 60, r^c, r^d, 61, R^c and back to battery over 62. Contact points 3^a and 4^a would close on relay R^d thus lighting trunk lamp L^5 underneath the jack on toll board. The subscriber has thus far signaled the toll board. It will thus be noted that as long as a subscriber's receiver is off the hook trunk line lamp L^5 is lighted, or would flash in and out should the hook work at station A thus attracting the toll operator's attention and causing the operator to ascertain immediately if the connection is for her, if not the operator would order the receiver to be hung up, giving a "disconnect" signal at lamp L^4 opposite trunk plug P^2 which is located at the local board shown in Fig. 1, or the toll operator may at once order the local operator to take the connection.

Should subscriber at station A place receiver on the hook, relay R^d would be de-energized and break contact points 3^a and 4^a and thus sever the circuit of the trunk line lamp L^5, at the same time contact points 1^a and 2^a would make on relay R^c thus lighting supervisory lamp L^4 opposite the trunk plug P^2 and by removing trunk plug P^2 from jack J of Fig. 1, contact points r^a and r^b on relay R^a would break and supervisory lamp L^4 would go out.

The next portion of the system to be considered is the toll operator's cord circuit and its connection with the cut off feed relay R^b. This circuit comprises a switch board circuit connecting with the three wire plug P^3 which is preferably the same style plug as that shown in Fig. 1, also the same as the trunking plug P^2 in this circuit having sleeves numbered j^9 and j^{10} and tip j^{11} which are wired to the ringing key K′ and at this point are made to connect with the talking circuit or ringing circuit or the power generator G^3. This talking circuit has an eight point repeating coil R^C with condenser C^3 and condenser C^4 wired in series with each coil. This it will be noticed will not permit battery current to flow through this talking circuit. Retardation relay R^7 is a five contact point relay being wired to one end of coil a on repeating coil R^C and also wired to sleeve j^{10} of plug P^3, being made to connect with sleeve j^9 on this same plug at the ringing key to K′, the other end of this retardation relay is tapped to contact point c^6 and wired to negative battery B′. Relay R^8 is a four contact point relay one end being wired to the other end of coil a of repeating coil R^C and is also wired to make connection at the ringing key K′ with the tip j^{11} of plug P^3, or answering plug of this circuit. The other end of this relay R^8 is tapped to contact point b^4 of this same relay, and also is wired to contact point c^7 on retardation relay R^7. When the toll operator places her answering plug P^3 in the jack of her trunking circuit, the circuit of the cutoff feed relay R^b is completed from positive battery over the following path B′, 71, R^b, 72, j^b, j^{10}, 73, 74, 75, R^7, 76, 127 and back to battery. This would place retardation relay R^7 in connection with the cut off feed relay R^b, thus breaking its contact points at the same time putting relay R^d and relay R^c and trunking lamp L^5 out of commission. It would also cause contact points c^6 and c^7 on relay R^7 to make, and as contact point c^7 is wired to contact point b^4 on relay R^8, and contact points b^3 and b^4 make on relay R^8, and contact point b^3 being wired to one end of supervisory lamp L^7, opposite answering plug P^3, the other end of this lamp wired to positive battery B′, this would cause contact points b^4 and b^3 on relay R^8 to break, the subscriber first removing his receiver from the hook; thus supervisory lamp L^7 would be out. Should subscriber place receiver on the hook, this would cause contact points b^4 and b^3 on relay R^8 to make, thus lighting supervisory lamp L^7. This lamp would remain lighted just as long as plug P^3 would remain in the trunk jack on the toll board, as it will be noted cut off feed relay R^b would be connected to relay R^7

and this relay connects with negative battery and being operated this would cause the supervisory lamp L^7 to remain lighted until relay R^8 is operated.

When listening key K^3 is closed, thus putting operator set O′ in circuit with coil b of repeating coil R^c, talking is through the coil a of repeating coil R^c by induction to ascertain the toll connection desired. In connection with this the operator would use plug P^4 which is an ordinary two way plug with a tip and a sleeve wired so as to connect with the talking circuit at ringing key K^4; also, as to make connection with power generator G^4 at ringing key K^4. Thus plug P^4 is simply placed in this circuit as an illustration to show how the connection is made through the switching circuit to the trunking circuit which constitutes the third operation. This switching current is as follows: Trunk line lamp L^5 is first lighted indicating a subscriber calling for a toll line connection. The plug having been placed in the jack and starting with positive battery B′, a circuit is closed as follows: wire 126, wire 71, cut off feed relay R^b, conductor 72, sleeve j^b of trunk jack J′, sleeve j^{10} of answering plug P^3, wire 73, wire 74, and 75 to relay R^7, wire 76 to negative battery by the way of wire 127 thus operating cut off feed relay R^b and breaking its contact points thus throwing relay R^d and relay R^c out of operation, also supervisory lamp L^4 and trunk line lamp L^5. Thus battery current would flow over wire 77 and contact b^5 and b^6 at ringing key K′ back over wire 78, a sleeve j^9 of answering plug P^3 and sleeve j^a of trunk jack J′, trunk line T′, sleeve j^7 of trunk plug P^2, sleeve j' of jack J as shown in Fig. 1, wire 27 and line wire 10, subscriber station A back over line wire 11, and tips j^2 of jack J, tip j^8 of trunk plug P^2 on Fig. 2, trunk line T^2, tip j^c on toll trunk jack J′, tip j^{11} on answering plug P^3, wire 79, contacts b^7 and b^8 on ringing key K′, wire 80 and 81, relay R^8, wire 82, and 83, contact points c^7 and c^6 on relay R^7, wire 84 to negative battery by the way of wire 127 thus through repeating coil R^c. This coil R^c has coil a and condenser c^3 in circuit with answering plug P^3 and coil b and condenser c^4 in circuit with the toll plug P^4. Thus the operator would close her listening key K^3 and put her operator set O′ in circuit with the repeating coil R^c to the subscriber's station A as shown in Fig. 1 or the subscriber would talk from station A through trunk connection through the repeating coil R^c by induction to the toll connection or plug P^4. The operator's set O′ in this circuit being explained in the description of the set O shown in Fig. 1.

The fourth and final operation of this connection from station A will be through the toll operator's supervisory lamp L^7. The circuit of this lamp is as follows: positive battery B′, wire 126, 85, supervisory lamp L^7, wire 86, contact points b^3 and b^4 on relay R^8, wire 83, contact points c^7 and c^6 on relay R^7, wire 84 to negative battery B′ by the way of wire 127. Thus the supervisory lamp L^7 in this case would be lighted until contact points b^3 and b^4 are broken on relay R^8 or should a subscriber place the receiver on the hook at station A as shown in Fig. 1 and being connected over the trunk line, relay R^8 would be released making contact points b^4 and b^3 on this same relay thus lighting supervisory lamp L^7 indicating that the subscriber is through talking.

The ringing circuit from Fig. 2 to Fig. 1 and station A is as follows: ringing generator G^3 in the toll operator's circuit wire 87, contacts b^9 and b^6 on ringing key k', wire 78 and sleeve j^9 of answering plug P^3, sleeve j^a of toll trunk jack J′, trunk line T′, sleeve j^7 of trunk plug P^2, sleeve j' of jack J as shown in Fig. 1, wire 27, line 10, subscriber station A through ringer r and condenser C back over line wire 11, tip j^2 of jack J, tip j^8 of the trunk plug P^2 as shown in Fig. 2, trunk line T^2, tip j^c of toll trunk jack J′, tip j^{11} of answering plug P^3, wire 79, contacts b^7 and b^{10} made on ringing key K′ back to negative generator G^3 by the way of wire 88.

Next we will endeavor to explain the busy test L^6. For instance, should the toll operator ask the local operator to place her trunking plug P^2 in any of the three jacks wired multiple on the local board, the busy lamp would glow. It will be noticed that the contact c^{10} on relay R^7 is connected directly to positive battery and that the contact c^9 normally in engagement therewith is connected to contact b^2 on relay R^8 adapted to engage contact b. It will also be noticed that one terminal of the busy lamp is connected to negative battery and the other terminal connected to contact b' on relay R^8. Now if the plug P^2 is in one of the jacks J and an operator at another position places a plug in one of the remaining jacks, a retardation relay would be placed in circuit with the sleeve j^a on the toll jack J′ and should toll operator touch the tip of her plug to the sleeve on the toll trunk jack this would operate relay R^8 and bring contacts b', b^2 together to complete the circuit of the lamp L^6 thus indicating that the line wanted is busy.

In Fig. 3 there is illustrated the preferred type of relay used and herein is shown the mechanism for manually operating the same so that when used as a cut-off feed relay a line relay circuit may be held opened. In this figure, e represents the base piece to which the core e' is attached. The winding e^2 is formed on the core as is usual and above the same and supported by the base e is the

return bar e^3 upon which the armature e^4 is pivoted at its forward end. The contact springs e^5 four in number in this instance are mounted as a unit upon the top of the return bar e^3 and are separated by strips of insulating material e^6. The rear end or lever end of the armature e^4 is provided with an operating stud e^7 which engages springs e^8 and e^9 of the set and when the armature is operated raises the springs from their cooperating springs e^{10} and e^{11}.

The relay is preferably incased with the usual dust shield e^{12} so as to keep the relay free from dust and thereby insure good working of the contacts. Screwed in the forward face of the casing is a contact screw e^{13} having a handle or operating button e^{14} by which its contacting end may be forced into engagement with the depending end of the bell crank armature e^4, thus raising its lever end and disconnecting springs e^8, e^9 from the springs e^{10} and e^{11}. With this type of relay used in lieu of the cut off R the circuit of the line relay R′ may be continuously held open. This is a very important feature, as such a condition is deemed eminently desirable in case of outside construction or during a heavy storm which causes many permanent signals on the switch-board. With this device, the operator is able to clear all signals caused in any manner as by storms or accidents.

From the foregoing description, taken in connection with the accompanying drawings, the construction and operation of the invention will be readily understood without requiring a more extended explanation.

Various changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention as defined in the appended claims.

Having thus described and ascertained the nature of our invention, what we claim as new and desire to secure by Letters-Patent, is:—

1. In a telephone system, a source of centralized energy, sub-station apparatus adapted to be connected therewith, a line relay, a line signal controlled by said line relay, a cut-off relay, a retardation relay and a three wire talking circuit connected to said retardation relay, and a ringing key connected to two of said wires, the third wire thereof adapted to conduct talking current through the cut-off relay continuously during connection.

2. In a telephone system, a source of current substation apparatus, a cord circuit, means for inter-connecting the same, a pair of retardation relays in the cord circuit, a pair of busy test relays, means operated by retardation relays for controlling the current from the source to said busy test relays, said busy test relays adapted to act as retardation relays when said retardation relays are inoperative, a busy signal for both ends of the cord circuit, and means controlled by said busy test relays for feeding circuit to the signal.

3. In a telephone system, a source of current, sub-station apparatus, a cord circuit, busy test relays connected to one side of the cord circuit, a signal adapted for both ends of the cord operated by said relays, and means connected to the opposite side of the cord circuit for controlling the current to said relays.

4. In a telephone system a source of current, a sub-station apparatus adapted to be connected therewith, a cord circuit for interconnecting said apparatus, a retardation relay in said cord circuit, a busy test relay, means operated by the retardation relay for controlling the current from the source of said busy test relay, said busy test relay adapted to act as a retardation relay when said retardation relay is inoperative, a three wire talking circuit, a line relay and a line signal, and a cut off relay therefor adapted to feed talking current to the line.

5. In a telephone system, a source of current, a sub-station apparatus adapted to be connected therewith, a cord circuit for interconnecting said apparatus comprising in part a three-wire talking circuit, a line relay and line signal, a cut-off relay therefor, and a ringing key connecting two of said wires, the third wire feeding talking current through the cut-off relay continuously during connection.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

JOSEPH L. RUE.
CLARENCE F. BROWN.

Witnesses:
AUSTIN RICHARD,
FRANK MOWREY.