

G. D. WOLF.
 CONVERTIBLE RINGING CONTROL FOR TELEPHONE SYSTEMS.
 APPLICATION FILED SEPT. 20, 1913.

1,195,163.

Patented Aug. 15, 1916.

2 SHEETS—SHEET 1.

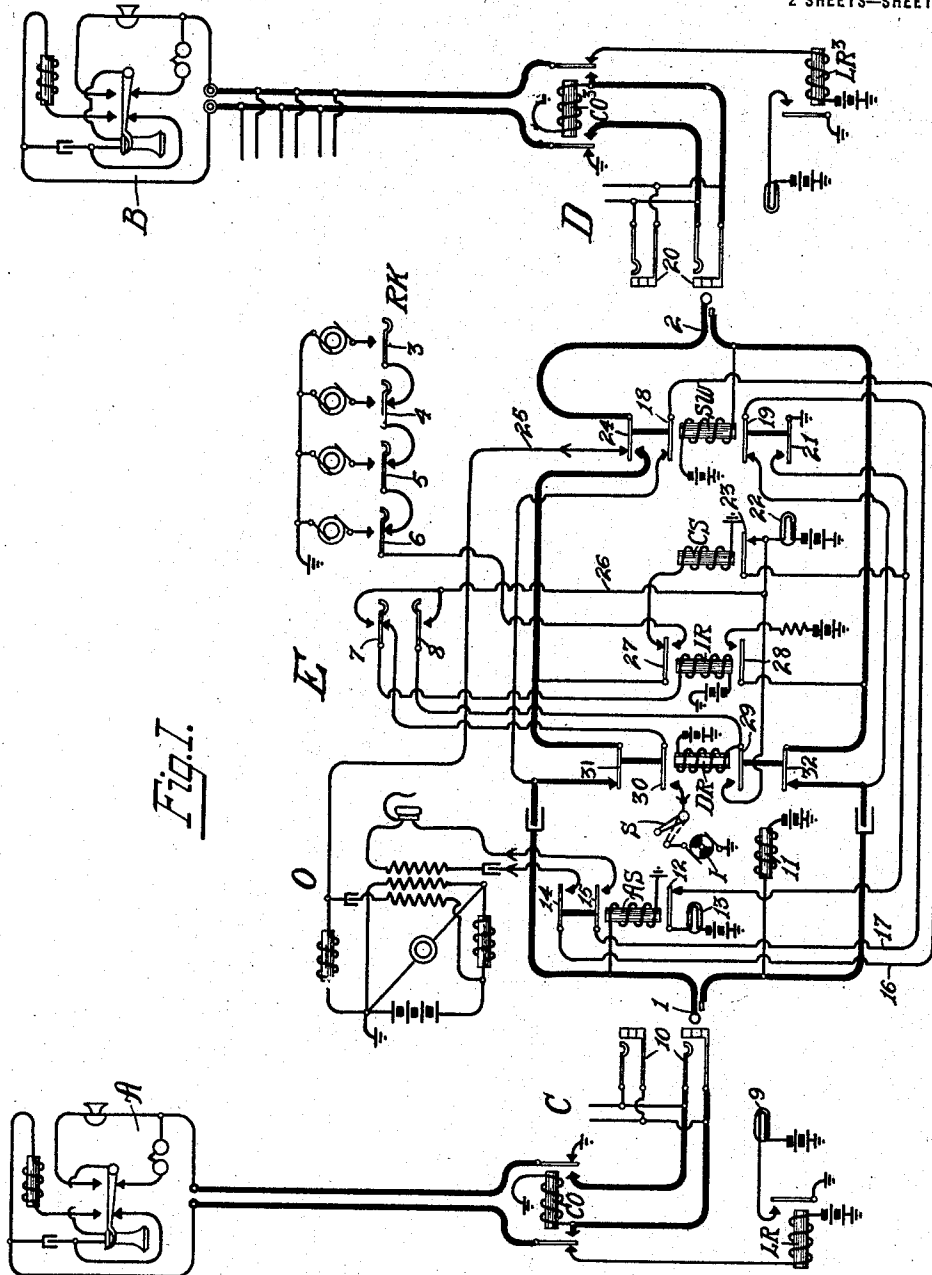


Fig. 1.

Witnesses:

George E. Mueller
 Wm. Berghahn

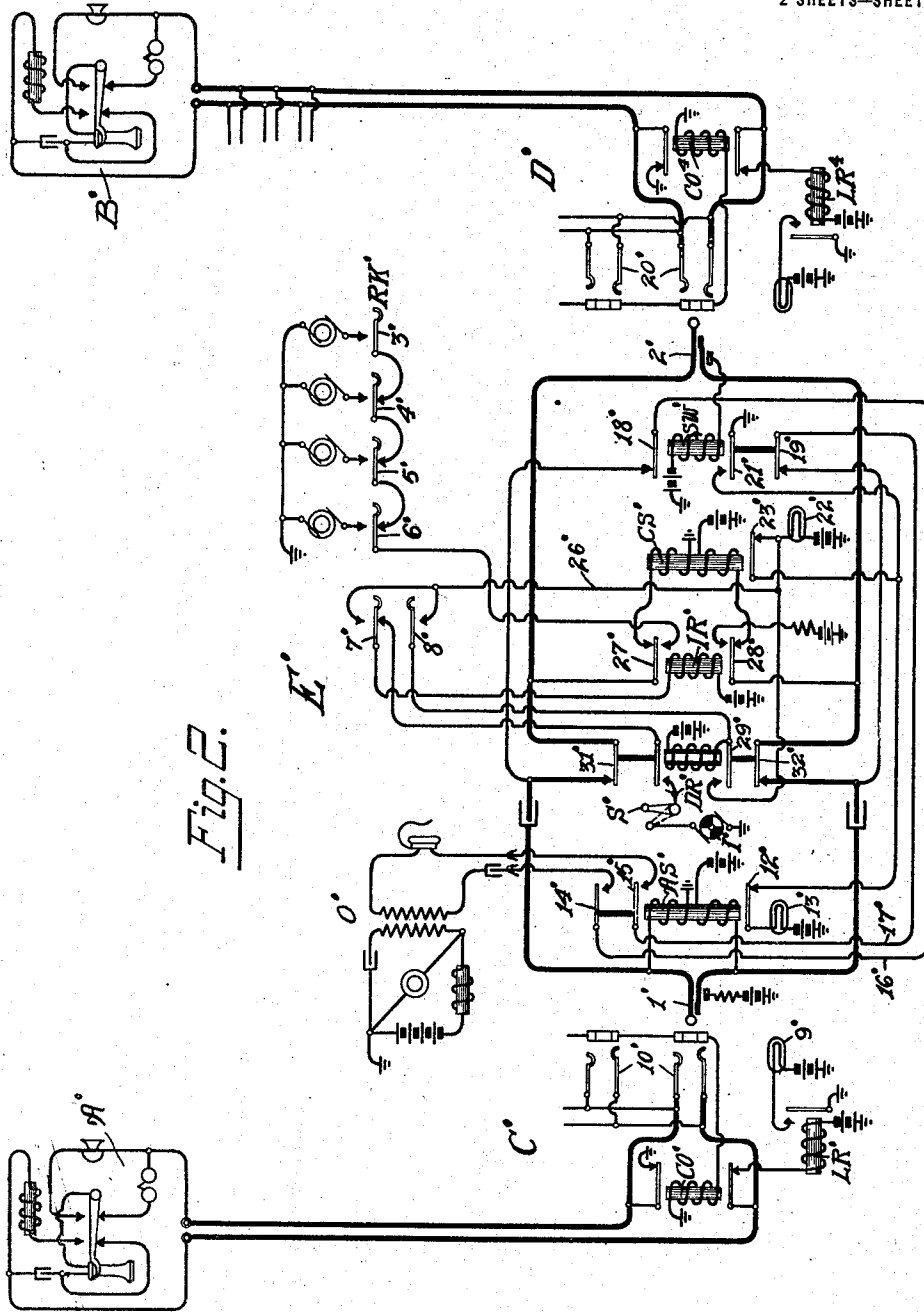
Inventor:

George D. Wolf
 By Curtis Klump
 Attorney.

G. D. WOLF.
 CONVERTIBLE RINGING CONTROL FOR TELEPHONE SYSTEMS.
 APPLICATION FILED SEPT. 20, 1913.

1,195,163.

Patented Aug. 15, 1916.
 2 SHEETS—SHEET 2.



Witnesses:

George E. Mueller
 Wm. Berghahn

Inventor:
 George D. Wolf.
 By Curtis K. Camp
 Attorney

UNITED STATES PATENT OFFICE.

GEORGE D. WOLF, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CONVERTIBLE RINGING CONTROL FOR TELEPHONE SYSTEMS.

1,195,163.

Specification of Letters Patent. Patented Aug. 15, 1916.

Application filed September 20, 1913. Serial No. 790,814.

To all whom it may concern:

Be it known that I, GEORGE D. WOLF, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Convertible Ringing Control for Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and is directed more particularly to alternative methods for controlling the application of ringing current. That is my invention looks more to a ringing system which may be readily converted from automatic to manual ringing, an object of my invention being to provide a simplified circuit arrangement of this character which is also positive and efficient in operation.

In telephone systems wherein automatic ringing is provided and wherein constantly operating mechanism is provided, such as an interrupter, although during the day service when a great many connections are being established such automatic ringing is an operating advantage, nevertheless during times when few connections are being established such as during the night, it has been found that the manual control of the ringing is desirable, and to this end I have provided a simplified combination of elements including a single contact manually operated switch whereby the ringing control may be converted from automatic to manual and vice versa.

In order to insure the immediate application of ringing current to called subscribers' lines, I have provided an improved cord circuit arrangement in which means are provided so that the moment a ringing key plunger is depressed (when the cord circuit is used for automatic ringing), ringing current is automatically connected to the calling end of the cord circuit, no matter in what position the interrupter mechanism may be in. The interrupter mechanism thereafter operates to intermittently apply ringing current to the said line. By so arranging the cord circuit, that is, by providing it with the above described so-called preliminary ring, I have saved a great deal of time in the average time that it takes from the moment that the ringing key plunger is depressed until the called subscriber's bell is first operated.

For a better understanding of my inven-

tion reference will be had to the accompanying drawings in which like reference characters indicate like parts and in which—

Figure 1 illustrates a telephone system having two-conductor line and cord circuits embodying my invention; and Fig. 2 illustrates a telephone system of the so-called three-conductor type, and which embodies my invention.

Referring now more particularly to the system illustrated in Fig. 1, it comprises a calling substation A and called substation B connected to line circuits C and D respectively. A cord circuit E for interconnecting said lines is provided, said line and cord circuits being of the two-conductor type. An answering supervisory relay AS is provided at the answering end of the cord circuit and is adapted, when the answering plug 1 is inserted into a jack of the calling line, to automatically connect an operator's telephone O in circuit with the cord.

In connection with the calling end of cord circuit E, I have provided a calling plug 2 and a so-called switching relay SW, which may also be called a supervisory control relay, said relay SW being adapted to be energized when the calling plug 2 is inserted into the jack of a called line whereby the operator's telephone O is operatively disconnected from the cord. A calling supervisory relay CS, sometimes referred to as a tip relay, is also provided being adapted to be energized when a response is secured from the called substation, to control the supervisory signal and the automatic ringing circuit.

A ringing key RK is also provided being preferably of the type having ringing and indicating positions and comprising a plurality of independently operable ringing contacts 3, 4, 5, 6, together with a set of common contacts 7, 8. When a plunger is depressed to its fullest extent, which is its ringing position, the corresponding ringing contacts 3, 4, 5, or 6 are actuated as are also the common contacts 7, 8. When the operator relieves the pressure upon the actuated plunger it returns to its middle or indicating position restoring the common contacts 7, 8, to their normal position but maintaining the ringing contacts in their alternate position. When a ringing plunger is depressed, the slow acting disconnect relay DR is energized and maintained energized whereby a circuit for interrupter re-

lay IR is established from the interrupter I. This effects an intermittent energization of the interrupter relay IR to periodically apply ringing current according to the actuated plunger. When the called subscriber responds, relay CS operates to interrupt the locking circuit for relay DR whereby the ringing current is disconnected. When it is desired to use the automatic ringing control, the switch S, which may be common to a plurality of cords, is moved into its dotted position but when the manual control is desired switch S is moved into its open position. Thus, when manual ringing is desired, switch S being in its open position, no circuit is established from the interrupter for the interrupter relay IR but each time a ringing plunger is fully depressed so as to actuate common contacts, 7, 8, relay IR operates to apply ringing current. When the subscriber answers, relay CS operates to restore the disconnect relay DR as before thereby establishing the continuity of the talking circuit, but of course in this instance it does not effect the interrupter relay IR. In connection with the ringing apparatus I preferably employ ringing generators of different frequencies using call bells at the substations corresponding to the ringing generators employed.

Referring now more in detail to the operation of the system of Fig. 1, upon the removal of the receiver at calling substation A, line relay LR is energized to light the calling signal 9 in the usual manner whereby the operator will insert an answering plug 1 into a jack 10 of the calling line. This connects the cut-off relay CO and impedance coil 11 in series to energize said relay CO. Therefore the calling line is connected in circuit with the answering end of the cord circuit E and a circuit for answering supervisory relay AS is established traced from battery through the winding of 11 over the calling line and returning through the winding of AS to ground. Relay AS therefore interrupts its normal contact 12 to open the circuit of signal 13 and upon the closing of alternate contacts 14, 15, of AS, the operator's telephone O is connected over conductors 16, 17, and through normal contacts 18, 19, to the cord circuit conductors.

The operator now ascertains the wants of the calling subscriber and finding that connection is desired with the line of substation B, a jack 20 of the called line is tested in the usual manner to determine its idle or busy condition, and finding that said line is idle the operator inserts the calling plug 2 into the jack. A circuit including switching relay SW and cut-off relay CO² is therefore established causing the energization of these relays whereby operation of CO² extends connection from the plug 2 to substation B and removes the nor-

mal control of its line relay LR³. Responsive to energization of SW, its alternate contact 21 is closed establishing a circuit for supervisory signal 22 over the normally closed contacts 23, while the interruption of normal contacts 18, 19, of SW disconnects the operator's telephone O from the cord. Furthermore the interruption of normal contact 24 of SW disconnects the test conductor 25 and by closing of alternate contact 24 establishing the continuity of the tip strand.

Assuming now that the automatic ringing control is in service and the switch S is in its closed or dotted position, upon the operator depressing the proper ringing key 3, 4, 5, or 6 to its fully actuated position, alternate contacts 7, 8, thereof are closed. The closing of alternate contact 8 establishes an energizing circuit for relay DR traced from battery through the winding thereof, alternate contact 8, conductor 26, normal contact 23, and alternate contact 21 to ground. At the same time alternate contact 7 is closed connecting the said grounded conductor 26 in circuit with the interrupter relay IR and whereby its alternate contacts 27, 28, are closed connecting ringing current to the called line. This connection of ringing current to operate the call bell of the called subscriber as just described may be termed a preliminary ring and is applied immediately upon the depression of a key plunger to a fully depressed position due to the momentary closure of the end spring 7. Should the operator hold the depressed plunger in its fully actuated position for a short time the call bell of the called subscriber would be continuously rung until the key plunger is allowed to restore to its indicating position at which time the interrupter mechanism is connected in circuit to bring about the intermittent application of ringing current to the call bell of the called subscriber as will now be described. Upon energization of DR, its alternate contact 29 is closed establishing a locking circuit for DR through normally closed contact 23 of the supervisory relay CS and the grounded alternate contact 21. Therefore, although the initial energizing circuit for DR is interrupted at alternate contact 7, when the operator removes the pressure upon the actuated key, relay DR remains energized and therefore an intermittent energization of interrupter relay IR is effected by current from battery through the winding of IR, normal contact 7, alternate contact 30, switch S and interrupter I to ground. Relay IR therefore is alternately energized and deenergized, alternately connecting ringing current and supervisory relay CS in bridge of the called line. During the application of ringing current, it will be noted that the talking conductors of the cord circuits are inter-

rupted at normal contact 31, 32 of DR so as to prevent ringing back over the calling line.

Due to the current charge of the called line which is caused by the periodic application of ringing current, relay CS receives the discharge from the line each time normal contact 27 of IR is closed. This will cause relay CS to kick up its armature and momentarily open the circuit of DR, but DR being a slow acting relay, it requires a prolonged interruption of its holding circuit to effect the restoration thereof.

Upon a response being secured from the called substation, and upon the following deenergization of IR, a circuit for relay CS is established from ground through the winding of CS, normal contact 27, alternate contact 24 over the called line returning through the winding of SW to battery. Relay CS therefore energizes, interrupting its normal contact 23 whereby supervisory signal 22 is effaced and the holding circuit for relay DR is interrupted. Relay DR therefore restores establishing the continuity of the talking conductors and also interrupting the operating circuit for relay IR.

After the subscribers have finished conversation they will replace their receivers upon their respective switch-hooks whereby the circuits for relays AS and CS are interrupted causing the restoration of these relays and lighting supervisory signals 13, 22. The operator therefore withdraws the plugs from the connected spring jacks 10, 20, and thereby brings about the restoration of the apparatus employed.

Assuming now that manual ringing is being employed and that the switch S is in its open position, when the operator depresses a ringing plunger alternate contacts 7, 8, close as before whereby relays DR and IR energize, relay DR remaining locked as already pointed out. But when the ringing plunger is restored, relay IR restores and remains inert until another actuation of the ringing key, because no operating circuit is provided for the interrupter I. Therefore it is necessary for the operator to continue to operate a ringing plunger each time she desires to apply ringing current to the called line. When the subscriber answers, relay CS energizes as before, followed by the restoration of DR. The disconnection of the apparatus in this instance is brought about in a manner as already described.

It will be apparent from the foregoing that in order to convert the system from one type of ringing to the other, it is only necessary to actuate the switch S.

Fig. 2.—Referring now to the embodiment of my invention as illustrated in Fig. 2, the principal difference in this system over that shown in Fig. 1 is that three conductors are employed at the jacks and plugs, while in

Fig. 1 but two conductors are employed.

Therefore the cut-off relays of the three conductor line circuits are connected to a third contact of the jack and a battery connection is provided for the third contact of the answering plug 1¹ while at the calling plug 2¹, the third contact is connected to the winding of switching relay SW¹, so that relays SW¹ and CO⁴ are connected in series to bring about their energization. Also I have provided a two winding answering supervisory relay AS¹ connected in bridge of the talking conductors of the cord, and a two winding calling supervisory relay CS¹ in bridge of the talking conductors at the calling end of the cord.

The corresponding parts of the systems of Figs. 1 and 2 are indicated by like reference characters, except in Fig. 2 the suffix prime is added.

Now as to the operation of the system of Fig. 2, when an answering plug 1¹ is inserted into a jack 10¹ of a calling line, the cut-off relay CO¹ is energized over a circuit including the third contacts of jack 10¹ and plug 1¹ and a circuit for supervisory relay AS¹ is established over the calling line. Relay AS¹ therefore connects the operator's telephone O¹ in circuit with the cord in a manner as before described while when the calling plug 2¹ is inserted into a jack 20¹ of a called line, relays SW¹ of CO⁴ are energized over a series circuit to bring about the disconnection of the operator's telephone O¹ and the lighting of supervisory signal 22¹. The actuation of the ringing apparatus of cord circuit E¹ is identical with the operation of the ringing apparatus of cord circuit E.

Upon a response being secured from the called substation B¹, the calling supervisory relay CS¹ is energized by current over the called line whereby its normal contact 23¹ is interrupted to bring about the supervisory and ringing control as described in connection with the cord circuit E.

When the subscribers at substations A¹ and B¹ have finished conversation, they will replace their receivers upon their respective switch-hooks whereby the circuits for supervisory relays AS¹ and CS¹ are interrupted to effect the operation of the supervisory signals 13¹, 22¹. Upon the operator withdrawing plugs 1¹ and 2¹ from the connected spring jacks, the apparatus used in establishing the connection is restored to normal in a manner as previously described.

In the several embodiments of my invention illustrated, well-known forms of line and substation circuits are shown together with well-known forms of supervisory apparatus and it is to be understood that I contemplate applying my invention in other ways than that shown and I aim to cover all such modifications as come within the spirit and scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A telephone system comprising a called telephone line, an operator's link circuit connected thereto, a ringing key, ringing control relays, a source of ringing current, circuit connections for said key and relays whereby when said key is operated an automatic and intermittent application of ringing current to the called line is effected, and a single pole manually controlled switch for changing said circuit connections whereby the automatic and intermittent control is removed and an application of ringing current to the said called line from said source of current is positively effected by each operation of said ringing key.

2. A telephone system comprising telephone lines, operator's link circuits for connection thereto, a ringing key for each of said circuits, ringing control relays for each of said circuits, a source of ringing current, circuit connections for each of said keys and associated relays whereby when a key is operated an automatic intermittent application of ringing current to a connected called line is established, and a single pole manually controlled switch common to said link circuits for changing said circuit connections whereby the automatic intermittent control is removed and an application of ringing current to a connected called line is positively effected by each operation of a key.

3. A telephone system comprising telephone lines, an operator's link circuit for connection thereto, a ringing key, ringing control relays, a source of ringing current, circuit connections for said key and relays whereby when said key is operated an automatic intermittent application of ringing current to a connected called line is established, and a single pole manually controlled switch for varying said circuit connections to remove said automatic intermittent control and whereby an application of ringing current is positively effected by each operation of said key.

4. A telephone system comprising telephone lines, operators' link circuits for connection thereto, a ringing key and ringing control relays for each of said link circuits, a source of ringing current, circuit connections for each key and associated relays whereby when one of said keys is operated an automatic intermittent application of ringing current to a connected called line is established, a single pole manually controlled switch common to said link circuits for varying said circuit connections to remove said automatic intermittent control and whereby an application of ringing current is positively effected by each operation of one of said keys.

5. A telephone system comprising a called telephone line, an operator's link circuit connected thereto, a ringing key, interrupter and disconnect relays, an interrupter adapted to be placed in circuit relation with the interrupter relay by an energization of said disconnect relay, circuit connections whereby an operation of said ringing key will energize said relays to periodically apply ringing current to the called line, and a manually operable switch for disconnecting said interrupter to place said relays under manual control of said ringing key.

6. A telephone system comprising a called telephone line, an operator's link circuit connected thereto, a ringing key, interrupter and disconnect relays, an interrupter adapted to be placed in circuit relation with the interrupter relay, a manually operable switching device adapted for disconnecting said interrupter, circuit connections whereby an operation of said ringing key will energize said relays and place said interrupter in circuit relation with said interrupter relay to apply ringing current to the called line, and means whereby when said interrupter is disconnected from the interrupter relay by said manual switch said relays are manually operative by said ringing key.

7. A telephone system comprising a called telephone line, an operator's link circuit connected thereto, a ringing key, ringing control relays, an interrupter adapted to be placed in circuit relation with one of said relays to effect intermittent operations thereof, a source of ringing current connected in circuit with the called line upon each such operation of said relay, circuit connections whereby an operation of said ringing key will cause operation of said relays to effect such periodic application of ringing current, and a single pole manually controlled switch for opening the circuit of said interrupter whereby said circuit connections are effective to place said relays under manual control of said key and remove said intermittent control.

8. A telephone system comprising a called telephone line, an operator's link circuit connected thereto, a ringing key, interrupter and disconnect relays, circuit connections whereby a single operation of said ringing key energizes said relays to automatically and periodically apply ringing current to the called line, an interrupter to effect such periodic applications, and a single pole manually operated switching device whereby said interrupter circuit is rendered ineffective and whereby ringing current is applied only while said key is held operated.

9. A telephone system comprising a subscriber's line, a link circuit for connection to said line, a ringing control relay for said link circuit, means for intermittently oper-

ating said relay, starting means for starting such intermittent operation, said starting means adapted to cause a preliminary operation of said control relay.

5 10. A telephone system comprising a subscriber's line, a substation thereon, a link circuit adapted to be connected to said line, automatic ringing means for said link circuit, a switching device for starting the operation of said ringing means whereby said
10 substation is intermittently signaled, and means controlled by said switching device for transmitting a preliminary signal to said substation.

15 11. A telephone system comprising a subscriber's line, a substation thereon, a manual link circuit provided with automatic ringing means adapted to be connected to said line, a ringing key plunger for causing the
20 operation of said automatic ringing means whereby said substation is intermittently signaled, and means controlled by said ringing plunger for insuring that said substation will be signaled the instant that said
25 ringing plunger is operated.

12. In a telephone system, the combination of a subscriber's substation and a link circuit connected thereto, automatic ringing means for said link circuit, a switching
30 device for starting the intermittent operation of said ringing means whereby said

substation is intermittently signaled, and means for insuring that the said substation will be signaled the moment that said switching means is operated.

35 13. A telephone system comprising a subscriber's line provided with a substation thereon, a link circuit for connection to said subscriber's line, a ringing relay for said link circuit, an interrupter device for intermittently operating said relay whereby said
40 substation may be intermittently signaled, and independent means for energizing said relay to cause a preliminary signaling operation at said substation.

45 14. A telephone system including a subscriber's telephone line, a link circuit for connection to said line, means for applying ringing current to said line, an interrupter device for intermittently operating
50 said means, and an electrical switch for first operating said means and for thereafter connecting said interrupter device in circuit with said means.

Signed by me at Chicago, county of Cook
and State of Illinois, in the presence of two
witnesses.

GEORGE D. WOLF.

Witnesses:

GEORGE E. MUELLER,
M. R. ROCHFORD.