

Feb. 19, 1924.

J. F. TOOMEY

TELEPHONE SYSTEM

Filed Nov. 8, 1921

1,483,956

2 Sheets-Sheet 1

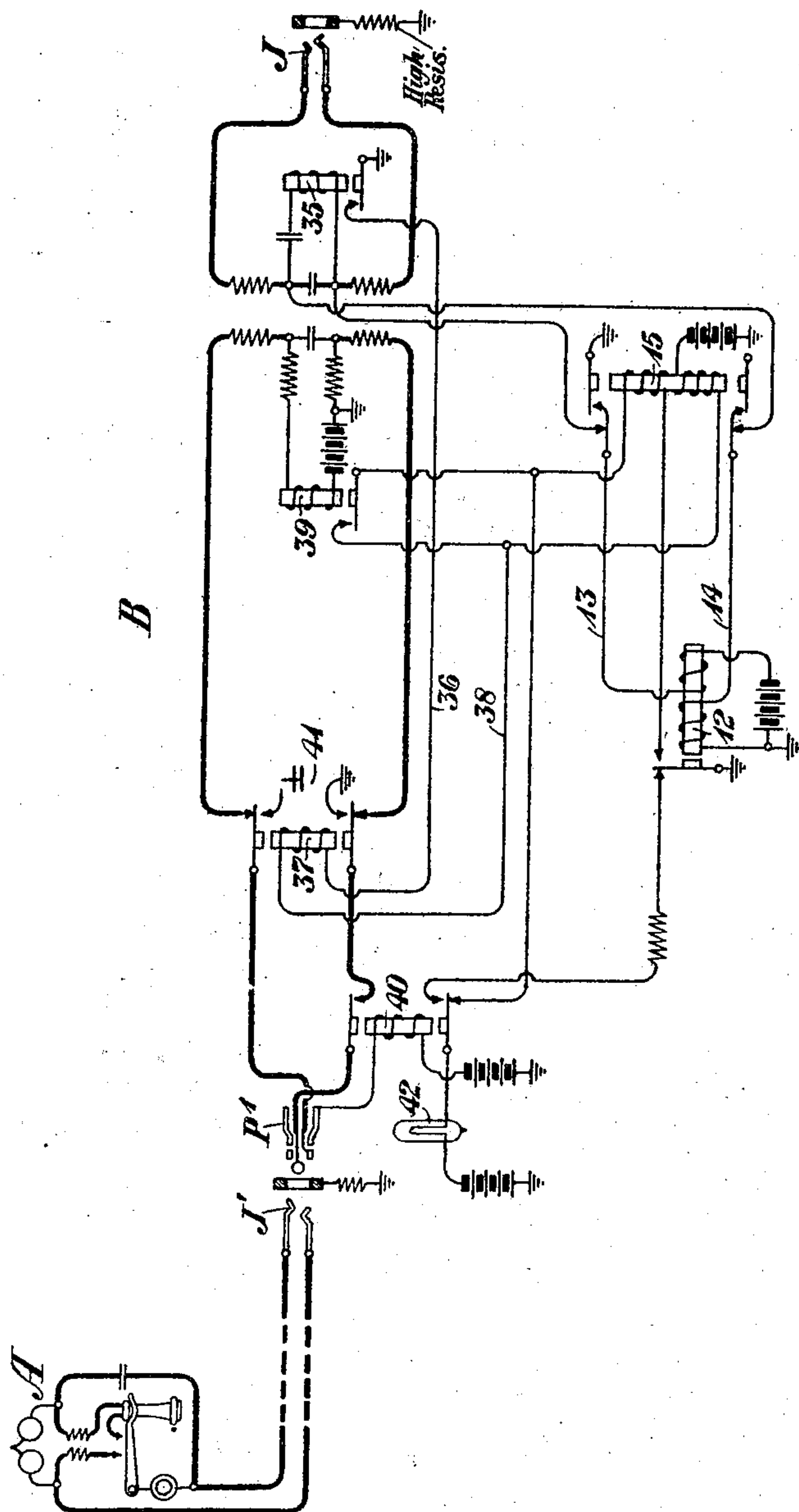


Fig. 1

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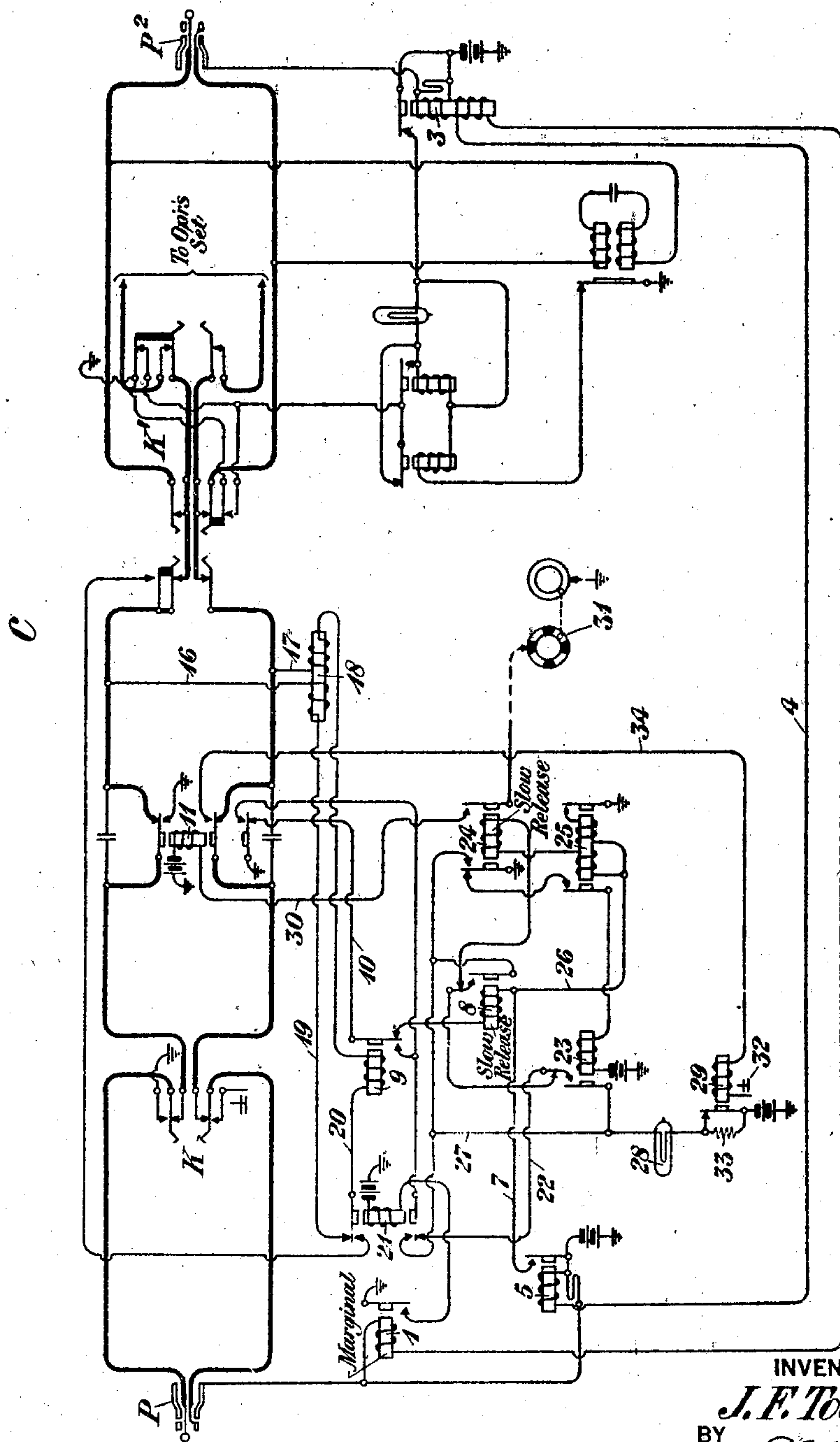


Fig. 2

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UNITED STATES PATENT OFFICE.

JOHN F. TOOMEY, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

Application filed November 8, 1921. Serial No. 513,701.

To all whom it may concern:

Be it known that I, JOHN F. TOOMEY, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Telephone Systems, of which the following is a specification.

This invention relates to telephone exchange systems, and more particularly to such systems in which telephone lines terminating at different telephone exchanges may be interconnected by means of a link or connecting circuit.

The object of this invention is the production of a link circuit by means of which the work of establishing connections between telephone lines may be greatly simplified.

In accordance with one feature of the invention, ringing current is applied to the called subscriber's station when connection is established therewith and at predetermined intervals thereafter.

In accordance with another feature of the invention, ringing current is automatically disconnected when the subscriber's station answers.

In accordance with a further feature of the invention, supervisory signaling apparatus is provided in the improved link circuit whereby the operator is informed as to the progress of ringing current in a connected link circuit.

For a more complete understanding of this invention, reference should be had to the following description, taken in connection with the drawings, wherein

Figure 1 shows a telephone line and a trunk circuit; and Fig. 2 shows a link or cord circuit, which embodies certain features of the invention, and which is adapted to operate with the trunk circuit indicated in Fig. 1.

Referring to the drawings, there is shown at A a telephone station connected with a telephone line which terminates at a central office. At B is shown a trunk circuit which may be used to connect with a telephone line extending to a telephone station, such as A. C represents a link or cord circuit which may be used to interconnect telephone stations through the medium of a trunk circuit such as that indicated at B.

Assuming that after a connection has been established between two central offices, in the usual manner, as for instance, by in-

serting plug P of link circuit C in jack J of trunk B, it being understood that the opposite plug P² of the link circuit has been inserted into a toll trunk of the customary type, and plug P¹ of trunk B into jack J¹ of the line leading to the subscriber's station A, the following circuit will be closed: from ground, sleeve contacts of jack J and plug P, winding of relay 1, conductor 2, lower winding of relay 3, conductor 4, winding of relay 5 to battery. The closing of this circuit causes the energization of relay 5. Relay 1 being marginal does not operate at this time. The operation of relay 5 closes a circuit through its make contact from battery, conductor 7, winding of relay 8, normal contact of relay 9, conductor 10, lower normal contact of relay 11 to ground. The closing of this circuit operates relay 8 momentarily and prevents premature ringing.

The connection of plug P and jack J also closes a circuit from ground and battery through the windings of relay 12 of trunk B, conductors 13 and 14, upper and lower normal contacts of relay 15, respectively, tip and ring conductors of trunk B, tip and ring contacts of jack J and plug P, normal contacts of key K, back contacts of relay 11, conductors 16 and 17, windings of coil 18, conductors 19 and 20, including winding of relay 9. The closing of this circuit operates relays 12 and 9. The operation of relay 9 closes a circuit from ground, lower normal contact of relay 11, conductor 10, make contact of relay 9, lower normal contact of relay 21, conductor 22, normal contacts of relays 23 and 8, this relay being now deenergized, winding of slow release relay 24, left-hand winding of relay 25, conductors 26 and 7, closed contact of relay 5, to battery. The closing of this circuit operates relays 24 and 25, and the operation of the latter relay closes a locking circuit through its right-hand make contact and winding from ground, conductors 26 and 7, closed contact of relay 5 to battery. The operation of relay 24 closes a circuit through its left-hand make contact from ground, conductor 27, filament of lamp 28, back contact of relay 29, to battery, thereby causing the lighting of supervisory lamp 28. The operation of relay 24 also closes a circuit from battery, winding of relay 11, conductor 30, right-hand closed contact of relay 24,

through interrupter 31 to ground. The closing of this circuit operates relay 11 intermittently under the control of interrupter 31. Each time the relay 11 operates, ringing current is transmitted from source 32, through winding of relay 29, conductor 34, lower make contact of relay 11, lower normal contact of key K, ring conductor of cord A, ring contacts of plug P and jack J, winding of relay 35, tip contacts of jack J and plug P, upper normal contact of key K to ground, through the upper closed contact of relay 11, thereby operating relay 35. The closure of this circuit causes relay 29 to operate intermittently under control of relay 11. Each time relay 29 operates, the resistance 33 is included in series with the supervisory lamp 28, dimming it at regular intervals. The flickering of this lamp indicates to the operator at C that ringing is in progress on that particular cord. During the ringing interval relay 15 of trunk B operates, as will appear later, and the circuit whereby relay 9 was energized is broken and this relay releases, but relay 24 remains operated during the ringing period and the silent period. During the ringing period relay 24 will be operated over a circuit from ground, lower make contact of relay 11, lower normal contact of relay 21, conductor 22, normal contacts of relays 23 and 8, winding of relay 24, left-hand winding of relay 25, conductors 26 and 7, make contact of relay 5 to battery. During the silent period relay 24 will be operated by a circuit through the make contact of relay 9 previously described.

The intermittent operation of relay 35 of trunk B under control of relay 11 of cord C closes a circuit through its make contact from ground, conductor 36, winding of relay 37, conductor 38, lower winding of relay 15 to battery. The closing of this circuit operates relays 37 and 15, and as relay 40 was operated upon the connection of plug P¹ and jack J¹ by a circuit from ground through the sleeve contacts of said jack and plug, winding of relay 40 to battery, ringing current will be impressed upon the line from source 41, over the ring contacts of said plug and jack, through the ringer at station A and return by way of the tip contacts of said jack and plug to ground, through the lower closed contact of relay 37. The station A will be thus signaled automatically at predetermined intervals until it answers or until the operator abandons the call.

When the subscriber at station A responds to said signal by removing the receiver from its hook, ringing current will be automatically disconnected in the following manner: Relays 39 will be operated by a circuit through its winding from ground and battery over the tip and ring conductors of trunk B, including like contacts of plug P¹

and jack J¹, over the line and through the switch-hook at station A in a well understood manner. The operation of relay 39 closes a circuit from battery, lower winding of relay 15, make contact of relay 39, upper winding of relay 15, make contact of relay 12 to ground. The closing of this circuit causes the operation of relay 15 which opens the circuit previously traced whereby relay 9 of link circuit C was operated, causing this relay to release permanently. The release of relay 9 closes a circuit from ground, lower back contact of relay 11, winding of relay 8, conductor 7, make contact of relay 5 to battery. The closing of this circuit causes the operation of relay 8, thereby opening the circuit by which relay 24 was energized causing it to release. The release of relay 24 closes a circuit through its back contact from ground left-hand make contact of relay 25, this relay being maintained operated by means of the locking circuit previously described, winding of relay 23 to battery thereby operating relay 23. The release of relay 24 disconnects the ground through interrupter 31 from relay 11, thereby preventing further energization thereof. The release of relay 11 disconnects ringing current from source 32 through relay 29 thereby releasing the latter relay. The release of relay 11 causes the release of relay 35 of trunk B, which, in turn, provides for the release of relay 37. The release of 24 also opens the circuit by which supervisory lamp 28 was lighted, and the extinguishing of this lamp indicates to the operator at C that the called station A has answered.

If the called subscriber at station A, after answering the call, desires to signal the operator, and moves the switch-hook up and down, relay 39 of trunk B will operate and release, thereby opening and closing the energizing circuit previously described in connection with relay 9, causing this relay to operate and release. Each time relay 9 operates, a circuit will be closed from ground, conductor 10, make contact of relay 9, normal contact of relay 21, conductor 22, make contact of relay 23, filament of lamp 28, contact of relay 29 to battery. The intermittent opening and closing of this circuit causes supervisory lamp 28 to flash, and the operator C by operating key K' may establish a talking connection with station A in a well-known manner.

When the subscriber at station A restores the receiver to its hook, relay 39 will be deenergized and in turn will deenergize relay 15. The release of relay 15 will cause the operation of relay 9 over the circuit previously outlined. The operation of relay 9 will close a circuit from ground, lower normal contact of relay 11, conductor 10, make contact of relay 9, normal contact of relay 21, conductor 22, make contact of relay 23,

filament of lamp 28, normal contact of relay 29 to battery. The closing of this circuit will light the lamp 28 as a disconnect signal, whereupon the operator will remove plug P from jack J and the entire circuit will be restored to normal.

If, instead of disconnecting, the operator at C desires to re-ring the called subscriber at station A, after said station has once answered and then hung up, the operator can do so by removing plug P from jack J and then re-inserting said plug in said jack. This starts the whole ringing cycle, previously explained, over again.

The link circuit C is also adapted for use in through toll connections. In such connections marginal relay 1 will also operate, in addition to the operation of relay 5 previously referred to, owing to the low resistance connected with the jack sleeve of the toll line (not shown). The operation of relay 1 will close the circuit through its make contact from ground, winding of relay 21 to battery, thereby operating relay 21. The operation of relay 21 disconnects the energizing circuit of relay 9 from across the tip and ring conductors of the link circuit and removes the machine ringing equipment from the control of relay 9, giving that relay direct control over the supervisory lamp 28 instead. The link circuit C is provided with the ordinary manual ringing keys such as that indicated at K for ringing on such connections.

Although the improved link circuit is herein shown and described as connected with a trunk circuit by way of illustration, it will be understood that in practice intermediate circuits may be employed in addition to said link circuit and said trunk circuit.

What is claimed is:

1. In a telephone system, a subscriber's line terminating in a line jack at a central office, a link circuit, a trunk circuit for interconnecting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit adapted to be impressed upon said subscriber's line, signaling means associated with said link circuit operable in a characteristic manner by the application of ringing current to said subscriber's line, and means associated with said link circuit responsive to the closure of said subscriber's line for disconnecting ringing current from said line and extinguishing said signaling means.

2. In a telephone system, a subscriber's line terminating in a line jack at a central office, a link circuit, a trunk circuit for interconnecting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit adapted to be impressed upon said subscriber's line, signaling means associated with said link circuit operable in a characteristic manner by the ap-

plication of ringing current to said subscriber's line, a relay bridged across said link circuit, a second relay in said trunk circuit for controlling said first mentioned relay, and a third relay controlled by the first relay whereby upon the closure of said subscriber's line the ringing current will be disconnected from said line and said signaling means will be extinguished.

3. In a telephone system, a subscriber's line terminating in a jack at a central office, a link circuit, a trunk circuit for interconnecting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit, signaling means associated with said link circuit, a relay bridged across said link circuit responsive to the connection of said link circuit and said trunk circuit, a second relay controlled by said first mentioned relay, a third relay in series with said second relay for controlling the application of ringing current to said trunk circuit, means in said trunk circuit controlled by the application of said ringing current for impressing ringing current from said trunk circuit on said subscriber's line, and means in said link circuit including said second relay responsive to the closure of said subscriber's line for disconnecting ringing current therefrom and extinguishing said signaling means.

4. In a telephone system, a subscriber's line terminating in a line jack at a central office, a link circuit, a trunk circuit for interconnecting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit adapted to be impressed upon said subscriber's line, a relay associated with said link circuit for controlling the application of ringing current to said line, signaling means associated with said link circuit controlled by said relay operable in a characteristic manner by the application of ringing current to said subscriber's line, a relay bridged across said link circuit, and a third relay in series with said first relay and controlled by said bridged relay whereby upon the closure of said subscriber's line ringing current will be disconnected from said line and said signaling means will be extinguished.

5. In a telephone system, a subscriber's line terminating in a line jack at a central office, a link circuit, a trunk circuit for interconnecting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit adapted to be impressed upon said subscriber's line, an interrupter, a relay associated with said link circuit for connecting said interrupter with said link circuit, means responsive to the connection of said interrupter for impressing ringing current on said line, signaling means associated with said link circuit operable by the application of ringing current

to said line, a second relay serially connected with said first relay whereby upon the closure of said subscriber's line ringing current will be disconnected from said
5 line and said signaling means will be extinguished.

6. In a telephone system, a subscriber's line terminating in a jack at a central office, a link circuit, a trunk circuit for intercon-
10 necting the subscriber's line and link circuit, a source of ringing current associated with the trunk circuit, an interrupter, a relay associated with said link circuit for connecting said interrupter to said link cir-
15 cuit, means responsive to the connection of said interrupter for impressing ringing current on said line, signaling means associated

with said link circuit operable in a characteristic manner by the application of ring-
ing current to said line, a second relay seri- 20
ally connected with said first mentioned relay whereby upon the closure of said subscriber's line ringing current will be disconnected from said line and said signaling
means will be extinguished, and a relay 25
bridged across said link circuit whereby upon the opening of said station line said signaling means will operate as a disconnect signal.

In testimony whereof, I have signed my
name to this specification this 5th day of
November, 1921. 30

JOHN F. TOOMEY.