

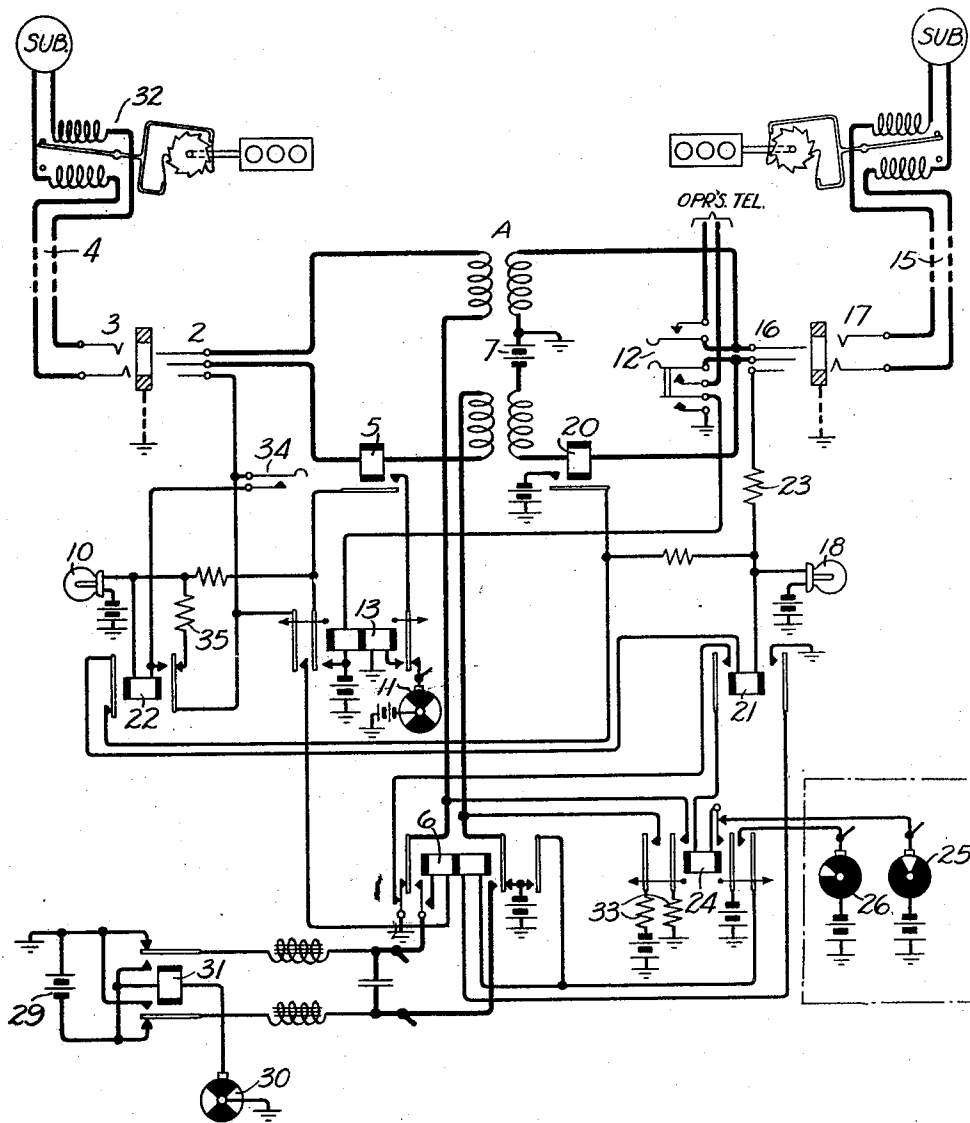
Dec. 1, 1931

C. B. FOWLER

1,834,393

TELEPHONE EXCHANGE SYSTEM

Filed Feb. 12, 1930



INVENTOR
C. B. FOWLER

BY
M. M. McFerry
ATTORNEY

UNITED STATES PATENT OFFICE

CLARENCE B. FOWLER, OF QUEENS VILLAGE, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEPHONE EXCHANGE SYSTEM

Application filed February 12, 1930. Serial No. 427,675.

This invention relates to telephone exchange systems and particularly to systems in which the service charge is based on the duration of conversation.

5 Its objects are to effect economy in the use of the central office equipment, to safeguard the subscriber against false charges and to otherwise improve the operation of telephone systems.

10 Service charging systems have been suggested in which a source of meter operating current, which is periodically reversed by a timing device, is connected at the central office to the subscriber's line during the con-
15 versational period to cause successive actuations of the meter. In order to safeguard the subscriber against false operation of his meter due to momentary openings of the line, it has been proposed to introduce a time
20 delay after the called subscriber answers and before the meter begins to operate. This delay is effected by means of interrupter driven contacts individual to the cord cir-
25 cuits.

5 According to my invention a considerable economy is effected and an improvement is secured over these prior systems by means of a time delay mechanism which is common to a large number of cords or connecting
0 circuits.

This invention has been shown in the accompanying drawing in which it has been incorporated in a cord circuit well known in the art. A calling subscriber's line and a
5 called subscriber's line have also been shown in diagrammatic form and equipped with service meters.

The description of a connection by means of this cord circuit from a calling subscriber to a called subscriber will now be made. When the operator inserts plug 2 of cord
10 circuit A into jack 3 of a calling subscriber's line 4, in response to an incoming call, a circuit for lighting lamp 10 is closed and the supervisory relay 5 is operated over a circuit from battery through the inner right-
15 hand armature and back contact of relay 6, lower left-hand winding of repeating coil 7, winding of relay 5, over the subscriber's loop, through the plug 2 and jack 3, upper left-

hand winding of repeating coil 7, left-hand armature and back contact of relay 6 to ground. The operation of relay 5 closes an
20 obvious shunt circuit for the supervisory lamp 10 to battery through a common in-
25 terrupter 11. This circuit is alternately closed and opened by the interrupter to cause lamp 10 to be intermittently lighted and ex-
30 tinguished. The operator in response to this signal actuates the talking key 12 for
35 the connection of her telephone set across the tip and ring conductors of the cord to ascertain the number of the desired sub-
40 scriber. The operation of key 12 also causes the operation of relay 13 over an obvious
45 circuit through the left-hand winding of this relay. Relay 13 provides a locking circuit for itself through its right-hand winding
50 under control of the supervisory relay 5 and disconnects the interrupter from the lamp
55 10 which is extinguished due to the shunt path to battery established at the inner left-
60 hand armature and front contact of relay 13.

When the operator receives the number of
65 the wanted subscriber she may complete the connection to this subscriber's line 15 by in-
70 serting plug 16 into jack 17. The supervisory lamp 18 is thereby lighted over the sleeve circuit established through plug 16 and jack 17.
75 The desired subscriber may now be rung in the usual manner through the operation of a
80 ringing key not shown and when this subscriber answers the call the supervisory relay 20 is operated through the subscriber's
85 loop in the usual manner. Relay 20 in operating establishes a shunt circuit for lamp 18, which is thereby extinguished and also closes
90 a circuit for the operation of relay 21 from battery, armature and front contact of relay 20, left-hand armature and back contact of
95 relay 22, winding of relay 21, resistance 23, sleeve terminals of plug 16 and jack 17 to ground.

Relay 21 in operating established a connection from ground at the outer contacts of the
100 left armature of relay 6, left-hand armature and front contact of relay 21 to one side of relay 24. Relay 24 will now operate as soon as the circuit through its make-before-break contacts is completed to battery over a com-

mon interrupting device 25. When relay 24 operates it provides a locking circuit for itself from battery, the inner right-hand armature and front contact to the ground connection controlled by relays 21 and 6. Relay 24 also connects another common interrupter 26 through its outer right-hand armature and front contact to one side of the right-hand winding of relay 6. The live segment of this interrupter is connected to the circuit of relay 6 two seconds after the connection from the live segment of the interrupter 25 is opened. The connection to battery through interrupter 26 causes relay 6 to operate over its right-hand winding as the ground connection for the other side of this winding is completed at the right-hand armature and front contact of relay 21. Relay 6 provides a locking circuit for itself under control of relay 21 independent of the interrupter 26 from battery through its outer right-hand armature and front contact. Relay 6 also opens the circuit for relay 24 so that it releases after relay 6 is operated, but relay 24 is made slow to release so as not to open the circuit from interrupter 26 too soon or before relay 6 has closed its locking circuit.

In case now, for example, relays 20 and 21 had been operated momentarily and released between the operation of relay 24 and the closure of the connection through interrupter 26 for the operation of relay 6, relay 24 would have released and consequently the operation of relay 6 during this cycle of interruptions by the interrupters 25 and 26 would have been prevented. Such a momentary operation of relays 20 and 21 may be caused by the called party momentarily operating his switchhook or by the cord being connected to a so-called "busy-back" circuit or for any other reason. False operations of relay 6 are thus prevented under these circumstances, without interference with the eventual operation of relay 6 when conditions are normal. The operation of relay 6 opens the circuit for relay 24 and disconnects the normal talking battery from the tip and ring conductors of the cord and connects these conductors to the meter operating and talking battery 29. The polarity of this battery is reversed at periodic intervals under control of interrupter 30 and relay 31 and will, as is well-known in the art, cause the periodic operation of the meter 32 of the calling subscriber's line. It should be noted that during the interval between break and make of the contacts on relay 6 to substitute batteries a connection to battery and ground through resistance 33 is maintained by relay 24 which is made slow to release for this purpose. In this manner a gradual change in the battery supply is caused and excessive click in the calling subscriber's receiver is thereby prevented.

When the called party disconnects, supervisory relay 20 is released causing the re-

lease of relay 21 which in turn causes the release of relay 6 if the called party has already replaced his receiver on the switchhook. In case, however, that the calling party still has his receiver off the hook, relay 6 will be held operated through its left-hand winding as long as timing battery is connected through this winding by the operation of relay 31. The circuit in this case will extend from battery, upper armature and front contact of relay 31, inner left-hand contacts, winding of relay 6, outer left hand armature and front contact of relay 13 to ground through the sleeve terminals of plug 2 and jack 3. When relay 31 releases and this connection is changed to ground, relay 6 will release. By insuring the release of relay 6 at this interval, a click in the calling subscriber's receiver is prevented and any operation of relay 21 by the called subscriber momentarily operating his switchhook cannot cause a false operation of the service meter 32. When the calling party hangs up his receiver, relays 5 and 13 are released, thus removing the shunt for lamp 10 which is now lighted through the sleeve circuit. In case the calling party should recall by operating his switchhook, relay 5 would be reoperated and cause the supervisory lamp 10 to be alternately lighted and extinguished. The operator would then answer this call by the operation of the talking key 12 and cause relay 13 to operate to again shunt the lamp 10 as previously described.

In case the desired subscriber's line is a free call line, the operator operates the no-charge key 34. The operation of this key causes the operation of relay 22 which locks under control of the sleeve circuit, the resistance of this winding replacing the resistance 35 in the sleeve circuit. The operation of relay 22 opens at the left-hand armature and back contact the circuit for relay 21, and thus prevents its operation when the called subscriber answers. As relay 21 is not operated, relay 6 cannot operate and the normal talking current supply cannot therefore be changed to the timing battery supply and no charge made on the meter 32 for this connection.

It should be understood that while the invention has been only illustrated in connection with one type of circuit it may readily be applied to other circuits without departure from the spirit thereof.

What is claimed is:

1. In a telephone system, calling lines and called lines, meters for said calling lines, a plurality of connecting circuits for interconnecting calling lines and called lines for conversation, a source of current for supplying the calling lines, means controlled by a called party for connecting said source to a calling line, means for changing the flow of current from said source to cause the operation of a

calling subscriber's meter, and contact means common to said connecting circuits for introducing a delay between the time the called subscriber answers and the time when the meter operating means is connected to the calling line.

2. In a telephone system, calling lines, called lines, meters for said lines, connecting circuits for interconnecting calling lines with called lines, means controlled by a called party for operating the meter of a calling party, and means common to a plurality of connecting circuits for introducing a delay between the time the called party answers the call and the meter operating means becomes effective.

3. In a telephone system, calling lines, called lines, meters for said lines, a plurality of connecting circuits for connecting calling lines with called lines, means controlled by a called party for operating the meter of the calling party, and a series of interrupters common to a plurality of connecting circuits for introducing a delay in the control by the called party of the meter operating means until a certain period has elapsed after the called party has answered the call.

4. In a telephone system, calling lines, called lines, meters for said lines, a plurality of connecting circuits for connecting calling lines with called lines, means for operating the meter of the called line when a connection is established, a relay responsive to the establishing of a connection, a second relay for controlling the meter operating means, and means responsive to the operation of the first relay for actuating the second relay when a predetermined period of time has elapsed after the actuation of the first relay.

5. In a telephone system, calling lines, called lines, meters for said lines, a plurality of connecting circuits for connecting calling lines with called lines, means for operating the meter of a calling line when a connection is established, a relay responsive to the establishing of a connection, a second relay for controlling the meter operating means, interrupters common to a plurality of connecting circuits, and means controlled by said interrupters and the first relay for actuating the second relay when a predetermined period of time has elapsed after the operation of said first relay if said relay has been maintained continuously operated during this period.

6. In a telephone system, calling lines, called lines, meters for said lines, connecting circuits for interconnecting calling lines with called lines, means for operating the meter of a calling line when a connection is established, a relay responsive to the establishing of a connection, a second relay for controlling the meter operating means, a third relay, means for operating said third mentioned relay in response to the operation of the first

mentioned relay, and means responsive to the operation of said third mentioned relay for operating said second mentioned relay a certain interval after the operation of said third mentioned relay.

7. In a telephone system, calling lines, called lines, meters for said lines, connecting circuits for interconnecting calling lines with called lines, means for operating the meter of a calling line when a connection is established, a relay responsive to the establishing of a connection, a second relay for controlling the meter operating means, a third relay, means for operating said third mentioned relay in response to the operation of said first mentioned relay, means responsive to the operation of said third mentioned relay for operating said second mentioned relay a certain interval after the operation of said third mentioned relay, and means for maintaining said second mentioned relay operated under control of said first mentioned relay.

In witness whereof, I hereunto subscribe my name this 10th day of February, 1930.

CLARENCE B. FOWLER.

70

75

80

85

90

95

100

105

110

115

120

125

130