

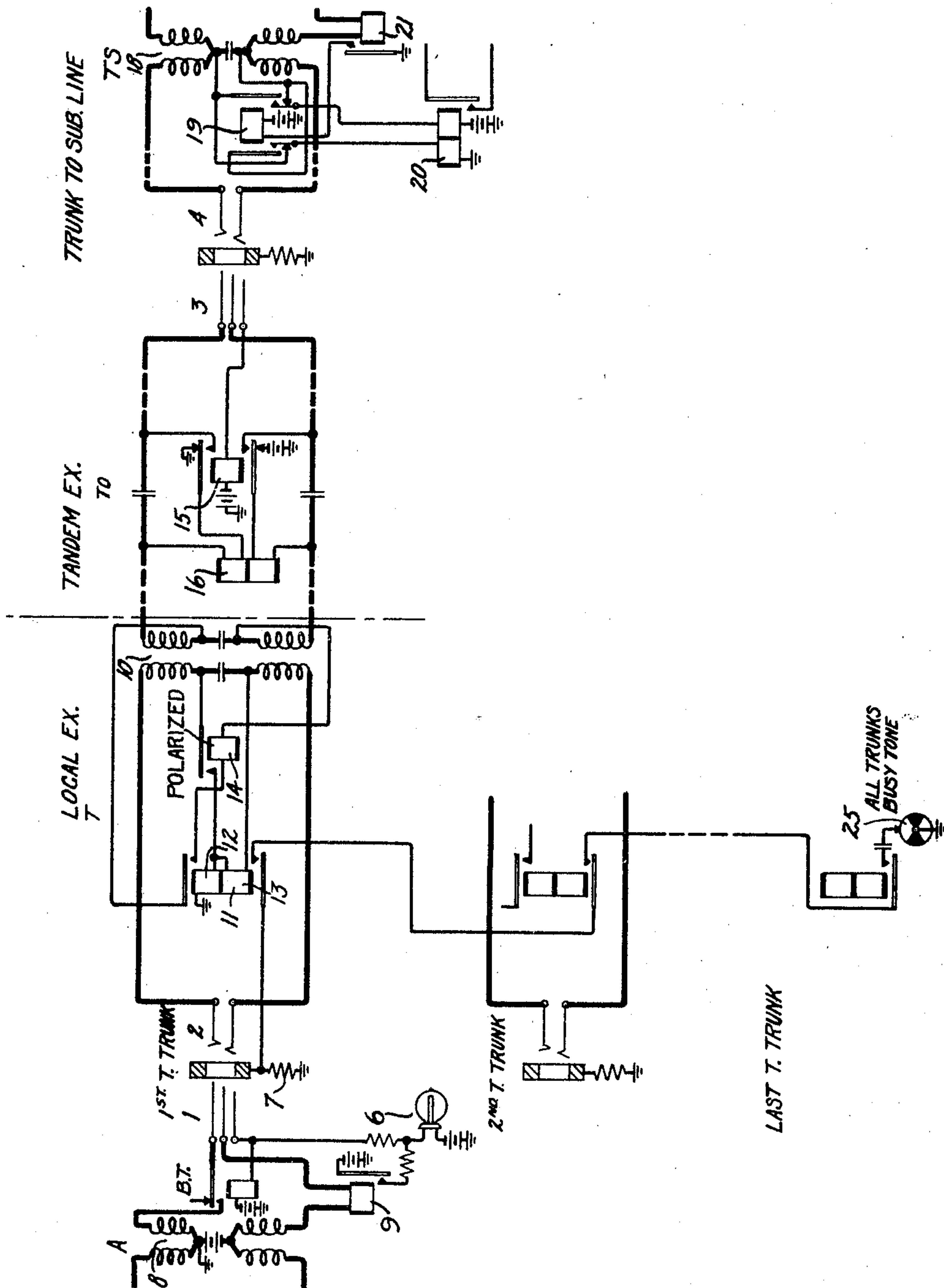
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TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

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This invention relates to telephone systems and particularly to improvements in the supervision of straightforward trunking connections established through tandem trunks.

5 In prior systems of this type where connections are established from a subscriber in a local exchange through an A operator's cord circuit, a tandem trunk terminating at a tandem exchange through an outgoing trunk to
10 a called subscriber's station, the A operator is notified by the extinguishing of the supervisory lamp when the called subscriber answers the call by removing his receiver from the hook. This indication is usually given
15 by the reversal of the battery over the tip and ring conductors of the tandem trunk, which reversal is translated into an increase of the resistance on the sleeve conductor of the A operator's cord, resulting in the extin-
20 guishing of the supervisory lamp.

An object of this invention is to provide a greatly improved arrangement in tandem trunk circuits, whereby this kind of supervision, which is ordinarily termed high-low
25 supervision, is effective over the talking conductors of the A operator's cord circuit instead of over the sleeve conductors as heretofore.

Another object of this invention is to provide that the application of the usual tandem trunk group busy tone is established by means of the above mentioned supervisory circuit arrangement without the aid of any additional apparatus.

30 To attain these and other objects of the invention, there is provided, in accordance with one feature thereof, a relay arrangement, the originating operations of which take place through the ring conductor of an
40 A cord and a tandem trunk when connected together without interfering with the usual lighting of the supervisory lamp and so arranged that when the called subscriber answers, this relay arrangement is responsive to
45 the reversal of the current on the line to extinguish the supervisory lamp, through the operation of the usual supervisory relay over the tip and ring conductors.

Another feature of the invention resides
50 in this, that the above relay arrangement is

also operative to apply a group busy tone on the sleeve of the first tandem trunk if all lines in a group of such trunks are busy.

The following detail description of the invention should be read in connection with the
55 accompanying drawing, in which the outgoing end of a tandem trunk, arranged in accordance with this invention, is shown in connection with a portion of an A operator's cord at a local exchange, while the incom-
60 ing end of this tandem trunk is shown schematically at a tandem operator's position in a distant tandem exchange where a portion of a standard trunk circuit leading to another local exchange is shown in sufficient detail to
65 enable the proper description of the invention.

Referring now to the drawing, in establishing a tandem connection, the A operator at a local exchange inserts the calling plug 1
70 of the cord circuit A into a jack 2 of the tandem trunk T; and the tandem operator TO at the tandem exchange, in answer to the usual signaling from the A position, inserts
75 plug 3 of this tandem trunk into a jack 4 of the trunk TS leading to another local exchange through which the wanted subscriber may be reached.

The insertion of plug 1 into jack 2 closes a circuit for the lighting of the supervisory
80 lamp 6 as follows: battery, lamp 6, sleeve terminals of plug 1 and jack 2 to ground through a resistance 7. Another circuit is also completed from the talking battery of the A cord through the lower right hand
85 winding of the repeating coil 8, the supervisory relay 9, the ring terminals of plug 1 and jack 2, lower left hand winding of repeating coil 10 of the tandem trunk, low resistance winding 11 and high resistance
90 winding 12 of relay 13 in series to ground. This circuit causes the operation of relay 13, but due to the high resistance winding 12 of this relay, the supervisory relay 9 is not operated at this time, thus permitting the su-
95 pervisory lamp 6 to remain lighted. The operation of relay 13 closes a circuit through the winding of the polarized relay 14 as follows: battery and lower armature and back contact of relay 15, lower winding of relay 16, 100

ring conductor of trunk T, right hand lower winding of a repeating coil 10, winding of relay 14, upper armature and front contact of relay 13, upper right hand winding of repeating coil 10, tip conductor of trunk T, upper winding of relay 16, upper armature and back contact of relay 15 to ground. Relay 14 is polarized so as not to operate on the current passing through its winding in this direction. However, relay 16 operates in the usual manner, not shown, to cause indications to be given to the tandem operator at TO that a through connection is desired.

In answer to this indication, the tandem operator at TO communicates with the A operator and on receiving the proper direction as to the extension of the connection inserts plug 3 into jack 4 of trunk TS leading to the desired local exchange. This results in the operation of relay 15 over the sleeve terminals of plug 3 and jack 4 over an obvious circuit. The operation of relay 15 extends the tip and ring leads through to the trunk TS as follows: from the upper armature and front contact of relay 15 through the tip terminals of plug 3 and jack 4, upper left hand winding of the repeating coil 18, left hand make-before-break contacts of relay 19, left hand winding of relay 20 to ground and from the lower armature and front contact of relay 15, over the ring terminals of plug 3 and jack 4, lower left hand winding of repeating coil 18, right hand make-before-break contacts of relay 19 and right hand winding of relay 20 to battery. Relay 20 is now operated and, as is well known in the art, indications are given at the distant local office, (not shown) that a connection with a subscriber at this office is wanted.

It is now assumed that the wanted subscriber is connected with and rung in the usual manner and that the subscriber answers the call by removing his receiver from the hook. This action on the part of the called subscriber will result in the operation of the supervisory relay 21. Relay 21 in operating closes an energizing circuit for relay 19 which now reverses the battery supply for polarized relay 14 by the operation of its armature in a manner which is believed to be obvious. Relay 14 operates on this reversal of current and thus shunts the high resistance winding 12 of relay 13, and bridges the low resistance winding 11 of this relay across the tip and ring conductors of the tandem trunk T. A circuit is thereby established from the talking battery at the cord A through the lower right hand winding of repeating coil 8, the supervisory relay 9, the ring terminals of plug 1 and jack 2, lower left hand winding of repeating coil 10, low resistance winding 11 of relay 13, armature and front contact of relay 14, upper left hand winding of repeating coil 10, tip terminals of jack 2 and plug 1, upper right hand

winding of repeating coil 8 to ground. It will be noted that the resistance in this circuit is now considerably decreased so that the supervisory relay 9 will operate and at its armature and front contact closing the shunt to battery for lamp 6 which is thereby extinguished to indicate to the A operator that the subscriber at the distance local exchange has answered the call.

It will be seen that, in accordance with this invention, the supervision as described above is effective through the talking conductors of a tandem trunk circuit and the cord circuit and not as is the usual practice through the sleeve conductors.

Another feature of the invention, which also is a step toward the simplification of the control of circuits of this type, is the application of group busy tone on the first trunk in a group of trunks. This is accomplished by means of an armature and front contact on relay 13 of the various tandem trunks in a group of trunks. For example, if all the relays 13 of these trunks are operated, a chain circuit will be completed as shown from the tone source 25 connected to the lower armature and front contact of the relay 13 of the last tandem trunk in the group through the corresponding contacts of the relays 13 of the intermediate tandem trunks to the corresponding armature and front contact of relay 13 on the first trunk. Therefore, if all the trunks in this group are busy and the operator at a particular position tests jack 2 in the usual manner by touching the tip of plug 1 to the sleeve of jack 2 she will receive a group busy tone from the source 25, and thus making it unnecessary to test any of the other trunks in the group. It will be seen that, while the application of trunk group busy tone is well known, the arrangement of this feature in connection with the supervisory relay arrangement in the manner described is exceedingly simple as no additional apparatus is required, except a single armature and contact on the relay 13 of the various tandem trunks.

What is claimed is:

1. In a telephone system, a cord circuit and a line circuit having respectively tip ring and sleeve conductors and a corresponding plug and jack, a signal and a circuit therefor including the sleeve conductors of said cord circuit and line for operating said signal on the insertion of the plug into the jack, a supervisory relay in said cord circuit for shunting the signaling circuit to release the signal on the operation of said supervisory relay, a relay in the line having a high and a low resistance winding, a circuit including the ring conductors and said high and low resistance windings for maintaining the supervisory relay in non-operated condition and for operating said second mentioned relay, a polarized relay and a circuit therefor ar-

ranged to be closed on the operation of the second mentioned relay, means for supplying battery to said last mentioned circuit for the operation of said polarized relay and a circuit controlled by said polarized relay to cause the operation of the supervisory relay over the tip and ring conductors by shunting the high resistance winding of the second mentioned relay.

10 2. In a telephone system, a cord circuit having tip, ring and sleeve conductors and a supervisory relay in said ring conductor responsive to a low resistance connection established from the said tip conductor to the
15 said ring conductor, a trunk line accessible to said cord circuit having a polarized relay and a second relay having high and low resistance windings, means for energizing said second relay upon the connection of said cord
20 circuit to said trunk in a circuit including said supervisory relay and both said windings of said second relay in series, and means controlled by said polarized relay for connecting the said low resistance winding of
25 said second relay across the tip and ring conductors of said cord circuit.

3. In a telephone system, a cord circuit having tip, ring and sleeve conductors and a supervisory relay in said ring conductor responsive to a low resistance connection established from the said tip conductor to the
30 said ring conductor, a group of trunk lines accessible to said cord circuit, each said trunk line having individual thereto a polarized relay and a second relay having high and
35 low resistance windings, means for energizing said second relay upon the connection of said cord circuit to said trunk in a circuit including said supervisory relay and both said
40 windings of said second relay in series, means controlled by said polarized relay for connecting the said low resistance winding of said second relay across the tip and ring conductors of said cord circuit, and means controlled by
45 all of said second relays of said group of trunks for establishing an all-trunks-busy condition.

4. In a telephone system, a cord circuit having tip, ring and sleeve conductors and a
50 supervisory relay in said ring conductor responsive to a low resistance connection established from the said tip conductor to the said ring conductor, a group of trunk lines accessible to said cord circuit, each
55 said trunk line having individual thereto a polarized relay and a second relay having high and low resistance windings, means for energizing said second relay upon connection of said cord circuit to said trunk
60 in a circuit including said supervisory relay and both said windings of said second relay in series, means controlled by said polarized relay for connecting the said low resistance winding of said second relay across the tip
65 and ring conductors of said cord circuit, a

source of tone, and means controlled by all of said second relays of said group of trunks for connecting said source of tone to the first of said group of trunks.

In witness whereof, I hereunto subscribe my name this 7 day of May, A. D., 1925. 70

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