

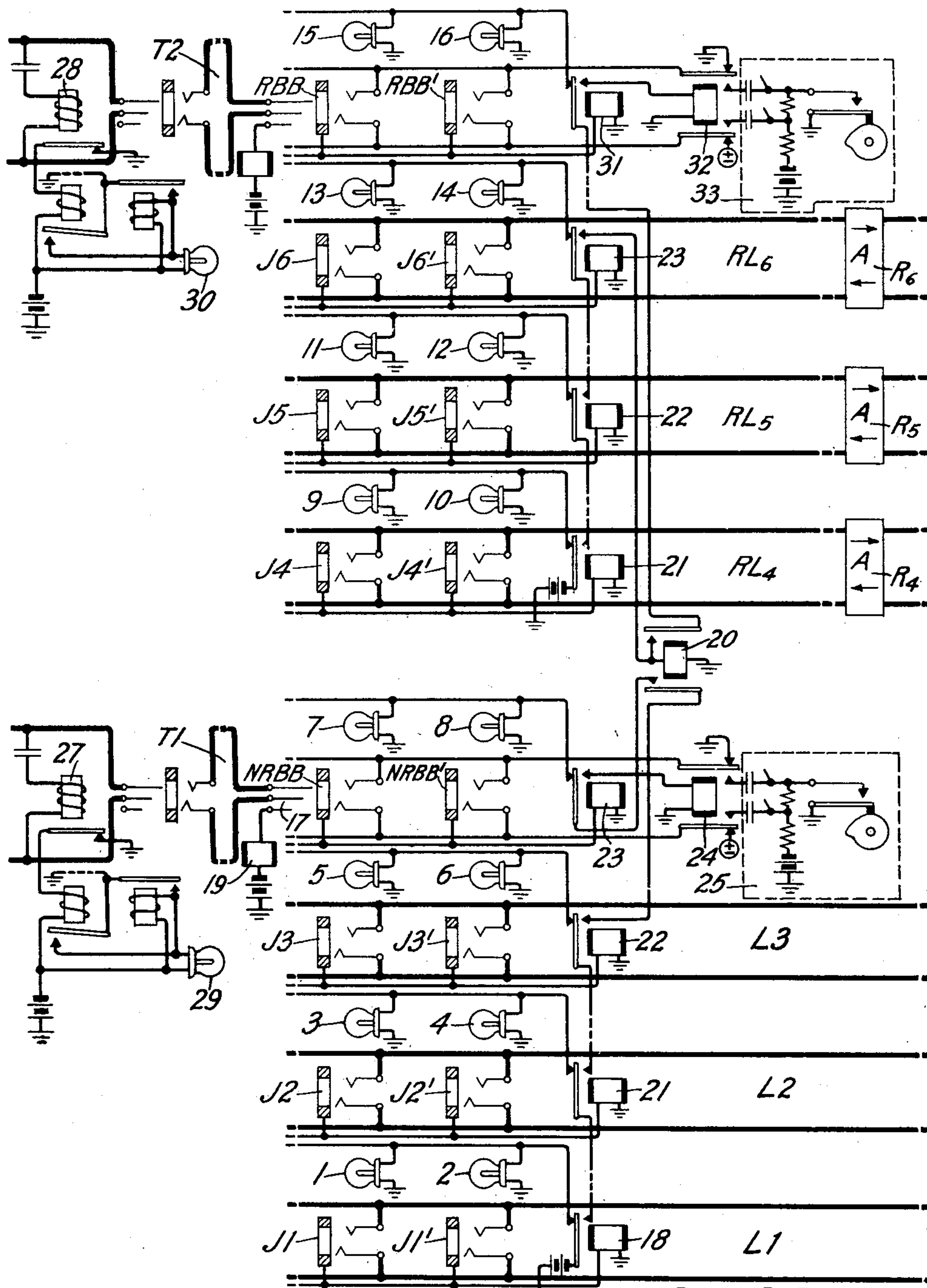
Aug. 20, 1929.

R. S. BAILEY ET AL

1,724,898

TELEPHONE SYSTEM

Filed April 10, 1928



INVENTORS: RAND S. BAILEY
LLOYD L. EAGON

By

g r f o r

ATTORNEY

UNITED STATES PATENT OFFICE.

RAND S. BAILEY, OF GLEN RIDGE, NEW JERSEY, AND LLOYD L. EAGON, OF NEW YORK, N. Y., ASSIGNORS TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

Application filed April 10, 1928. Serial No. 268,874.

This invention relates to toll systems, and more particularly to improvements in means for indicating the idle or busy condition of toll lines at their outgoing ends.

5 An object of the invention is to expedite the extension of a waiting toll call through a tandem office, which has been delayed by an all-lines busy condition thereat, when one of the busy lines becomes idle, whereby faster and more efficient toll service to calling subscribers is rendered.

10 More specifically the object is to automatically indicate to a waiting toll operator when an outgoing line from a tandem office becomes idle.

15 In systems wherein a number of toll offices are located within a single area, as, for example, in large cities such as New York and Chicago, it is sometimes advisable, for reasons of economy in wire facilities, to concentrate certain outgoing toll lines for the entire area at a conveniently situated central switchboard, commonly referred to as a tandem office, and effect connections between the various toll offices in the area and these toll lines by means of trunk lines, usually referred to as tandem trunks. As these outgoing lines from the tandem office are usually multiplied at two or more switchboard positions, it is desirable that some indication be given the tandem operators as to the idle or busy condition of the lines appearing in outgoing jacks at their respective positions. In Patent 1,632,826, dated June 21, 1927 to one of the present applicants there is disclosed a system in which a lamp signal is provided for each multiple jack of a group of outgoing lines and so arranged that all the multiple signals of the first idle line are lighted. When this line becomes engaged the corresponding signals are effaced and the multiple signals of the next line are lighted and so on throughout the group until all the lines are engaged, at which time no signal will be displayed thereby indicating to the operators that all the lines of the group are busy. At this time in case the operator receives a call over one of the trunk lines for a connection to a distant point served by the group of toll lines in question, she is usually instructed to plug the calling trunk line into what is known as a "busy back" jack, which thereupon supplies an audible tone to the calling trunk

as an indication to the outgoing toll operator that all the lines are busy.

The present invention attains the previously stated objects as follows:

The "busy back" jack hereinafter called the "overflow" jack is located at the end of the group of outgoing toll line jacks and a lamp signal is associated therewith in such a manner that the jack and lamp will appear as an additional line in the group. By a suitable circuit arrangement the overflow lamp is caused to light when the last lamp of the group of lines is extinguished and is itself extinguished when the tandem operator plugs the incoming end of the calling trunk into the overflow jack, at which time the plugged up trunk receives the usual busy back tone from the jack circuit, which tone persists as long as all the lines of the group are busy. As soon, however, as any one of the lines becomes idle, the circuits are so arranged that the busy back tone is disconnected from the trunk and means are actuated to light the supervisory lamp in the outward toll operator's cord circuit.

A specific embodiment of the invention resides in a toll system as previously described in which the group of outgoing toll lines from the tandem switchboard is divided into two sub-groups, one having amplifying or repeater apparatus associated therewith and referred to as "via" or "repeater lines" and the other group not having such repeater equipment and referred to as "non-repeater lines". In this arrangement the "overflow" jacks and signals are located at the end of each of the two sub-groups and the lamps of the individual lines function normally as though the two sub-groups were independent groups having no relation to each other. In case the connection to be finally established between the calling and called subscriber is to pass through still other tandem switching points the originating toll operator may indicate to the tandem operator that a "via" or "repeater toll line" is desired and the connection will be completed accordingly, but if no such requirement is indicated the tandem operator will establish the connection over an ordinary non-repeater line as long as an idle one is available. However, should all the non-repeater lines be indicated as busy the tandem operator is instructed to extend

the connection over a repeater circuit, if one is idle, and due to this requirement the circuit of the "overflow" lamps of the non-repeater group is so arranged that these lamps will not light so long as there is an idle repeater line available in the other sub-group, regardless of the fact that all the non-repeater lines are in use.

In the case of the repeater sub-group the conditions are obviously somewhat different and, therefore, when all the lines of that sub-group are busy the "overflow" lamp will light regardless of whether or not there are any idle lines in the non-repeater sub-group.

When all the toll lines of both sub-groups are busy the lamps associated with the "overflow" jacks of the non-repeater sub-group are lighted at the same time as the lamps of the "overflow" jacks in the repeater sub-group and the next calling trunk will be plugged into either a repeater or non-repeater overflow jack depending upon which type of outgoing toll line is required.

If we assume all lines of both sub-groups are busy and further that an incoming trunk is plugged into the overflow jack of the non-repeater group, then when either a non-repeater or a repeater line becomes idle the busy back tone will be disconnected from the incoming trunk and the outgoing operator's cord supervisory lamp signal will be displayed.

If, however, we assume all lines of both sub-groups busy and that an incoming trunk is plugged into the overflow jack of the repeater sub-group, then the tone will be disconnected and the supervisory lamp lighted only when a trunk of that sub-group (repeater) becomes idle and not when a trunk of the non-repeater sub-group becomes idle. The reason for this is obvious as the connection, to be established over the last mentioned calling trunk, requires a repeater and the originating operator is not interested in knowing that a line, not suitable for extending the connection, is idle.

The invention will be understood from the following description when read in connection with the accompanying drawing which shows the circuit arrangement required to practice the invention at a toll tandem switching position.

T^1 and T^2 are straightforward incoming tandem trunks from a distant toll exchange. L^1 , L^2 and L^3 are ordinary outgoing toll lines to another office and RL^4 , RL^5 and RL^6 are outgoing toll lines of the same main group as L^1 , etc. but equipped with repeaters R^4 , R^5 and R^6 , respectively.

Each of the lines L^1 to RL^6 are multiplied at different positions of the tandem switchboard in jacks such as J^1 , $J^{1'}$ etc.

Lines L^1 , L^2 and L^3 will hereinafter be referred to as the non-repeater sub-group

and RL^4 , RL^5 and RL^6 as the repeater sub-group.

Each sub-group has associated "overflow" jacks $NRBB$ and $NRBB'$ for the non-repeater sub-group and RBB and RBB' for the repeater sub-group.

It will now be assumed that all outgoing lines of both sub-groups are idle and therefore the idle lamps 1 and 2, and 9 and 10, associated with jacks J^1 and $J^{1'}$, and J^4 and $J^{4'}$, respectively, will be lighted over obvious circuits. It will be further assumed that a distant outward toll operator initiates a call over a straightforward tandem trunk such as T^1 . Upon receipt of this call therefore the tandem operator, not receiving any indication that a special type of outgoing line is required will insert the plug 17 of the trunk T^1 into the jack J^1 at her position, which is the first idle line of the non-repeater sub-group, as indicated by the lighted lamp 1. This action results in operation of relay 18 in a circuit which can be traced from battery, sleeve relay 19 of the incoming trunk, the sleeve conductors of the plug and jack, and winding of relay 18 to ground.

Relay 18 in operating opens the circuit of lamps 1 and 2 and closes the circuit for lamps 3 and 4 which immediately light to indicate that line L^2 is now the first idle line of the group. If jack J^2 is plugged up lamps 3 and 4 will be extinguished and lamps 5 and 6 lighted, and if jack J^3 is plugged up lamps 5 and 6 will be extinguished, but as L^3 is the last line of the non-repeater sub-group and it is being assumed that there are other idle lines in the repeater sub-group no further lamps such as 7 and 8, associated with the overflow jacks, will be lighted at this time for reasons which will be apparent later.

As all the lines of the non-repeater sub-group are now in use, if another call is received over a tandem trunk the tandem operator will pass over into the repeater sub-group and extend the connection over line RL^4 which will cause lamps 9 and 10 to be extinguished and lamps 11 and 12 to be lighted. This progressive lighting of the "idle line" lamps will continue until all of the lines of the repeater sub-groups are engaged, at which time relay 20 will be operated in a circuit which can be traced from battery, over the operated contacts of relays 21, 22 and 23 and winding of relay 20 to ground.

Relay 20 in operating closes at its upper contacts an obvious circuit to light lamps 15 and 16.

If none of the non-repeater lines have become idle in the meantime, relay 20 will also close at its lower contacts a circuit for lamps 7 and 8, which can be traced from battery, operated contacts of relays 18, 21, 22 and 20, the normal contacts of relay 23 and through lamps 7 and 8 in parallel to ground.

Lamps 7 and 8, and 15 and 16 are now lighted, and if we assume a further call for an outgoing line, if no repeater requirement is specified, the operator will plug the calling trunk into the overflow jack at her position associated with the non-repeater sub-group, for example NRBB, whereupon relay 23 will operate from battery on the sleeve of the calling trunk. Relay 23 in operating will extinguish lamps 7 and 8 and by closing its inner contacts will complete a circuit for the operation of relay 24, which closes its upper and lower inner contacts and connects an intermittent tone, from the source 25, to the talking conductors of the calling trunk, thereby indicating to the outward operator at the distant toll exchange that no outgoing lines are immediately available and that she may therefore release her telephone set from the trunk but leave the cord circuit plugged up in the outgoing jack.

As long as all the lines remain busy and the last mentioned trunk is connected to the overflow jack NRBB, the tone from source 25 will be transmitted back to the outward toll position, but as soon as any one of the outgoing toll lines of either sub-group becomes idle, by reason of its jacks being freed of trunk plugs, a change in the previously described condition will take place as follows.

Let it first be assumed that outgoing line L^2 of the non-repeater sub-group is freed by the removal of the plug from the jack J^2 . Under this new condition relay 21 will release and open the previously traced energizing circuit of relay 24 which relay then releases and connects alternating ringing current to the trunk plugged into the overflow jack NRBB in substitution for the tone current from source 25. This ringing current flowing back over the trunk causes a bridged ring-up relay, such as 27 of the outward operator's toll cord, to be energized, which locks up in the usual manner and lights the cord supervisory lamp 29, thereby indicating to the outward operator that an outgoing trunk from the tandem office is now idle and that she should disconnect, as a signal to the tandem operator to free the incoming end of the trunk from the overflow jack, and then recall the tandem office in the usual manner whereupon, if the idle toll line L^2 has not been re-seized in the meantime, the tandem operator will establish the desired toll line connection.

As the means for signaling the tandem operator over the tandem trunk forms no part of the present invention it has not been considered necessary to complicate the drawing by showing it.

Now, if we assume, as in the previous case, that both sub-groups are busy and a call for an outgoing toll line in the repeater instead of the non-repeater sub-group is received over one of the tandem trunks, the operator

will plug the calling trunk into the repeater overflow jack at her position, which we will assume is RBB, whereupon relay 31 will operate from battery on the sleeve of the calling trunk. Relay 31 in operating will extinguish lamps 15 and 16 and by closing its inner contacts will complete a circuit for the operation of relay 32 which closes its upper and lower inner contacts and connects intermittent tone from the source 33 to the talking conductors of the calling trunk, thereby indicating to the outward toll operator that no outgoing lines from the tandem office, having repeater equipment, are available and she is therefore expected to release her telephone set but leave the toll cord plugged up in the trunk.

It will be noted that relay 32 is under control of relays 20, 21, 22 and 23, all of which are in turn exclusively controlled from within the repeater sub-group and, therefore, the release of any or all of the toll lines in the non-repeater sub-group will have no effect on relay 32 and therefore this relay is not released to send back the recall signal until one of the lines in the repeater sub-group is released. The reason for this arrangement as previously pointed out is that the distant outward operator should not be signaled to initiate a recall until a line of the character desired (repeater) is idle and available.

What is claimed is:

1. In a telephone system, a group of outgoing lines and an associated busy back jack, a signal for said busy back jack, means for automatically actuating the signal of said busy back jack in response to seizure of all the lines of the group, an operator's link circuit adapted to be connected to said jack when all said lines are busy, a signal device associated with said link circuit, and means thereafter responsive to the release of any one of the lines to operate said link circuit signal device.

2. In a telephone system, a first operator's position, a second operator's position, a line extending from said first position to said second position, a group of lines outgoing from said second position, means for indicating at said first position an "all lines busy" condition of said group of lines, and means for automatically indicating at said first position when one of the lines of said group becomes idle.

3. In a telephone system, a first operator's position, a signal thereat, a second operator's position, a line extending from said first position to said second position, a group of lines outgoing from said second position accessible to said first line, means for transmitting an "all lines busy" signal over said first line, and means responsive to the release from a busy condition of any one of said lines for operating said signal.

4. In a telephone system, an operator's po-

sition, lines outgoing therefrom divided into first and second groups, a busy back jack associated with each group, an operator's link circuit connected to the first busy-back jack
5 when all the lines of both groups are busy, a supervisory signal device associated with said link circuit, and means responsive to release of a line of either group for actuating said signal device.
10 5. In a telephone system, an operator's position, lines outgoing therefrom and divided into first and second groups of different characteristics, a busy-back jack associated with each group, a signal for each busy-back jack,
15 means for automatically actuating the signal of the second busy-back jack in response to seizure of all the lines in the second group, and other means controlled by said first means and responsive to seizure of all the
20 lines in the first group for actuating the signal of the first jack.

6. In a telephone system, a first operator's position, a second operator's position, a trunk line extending therebetween, an operator's cord circuit at said first position adapted to
25 be connected to said trunk line, a supervisory signal associated with said cord circuit, a group of lines outgoing from said second position, means for transmitting a tone current over said trunk line from said second
30 to said first position when all the lines of said group are busy, and means for automatically transmitting ringing current over said trunk lines to display said cord circuit supervisory signal when one of the lines of
35 said group becomes idle.

In testimony whereof, we have signed our names to this specification this 9th day of April 1928.

RAND S. BAILEY.
LLOYD L. EAGON.