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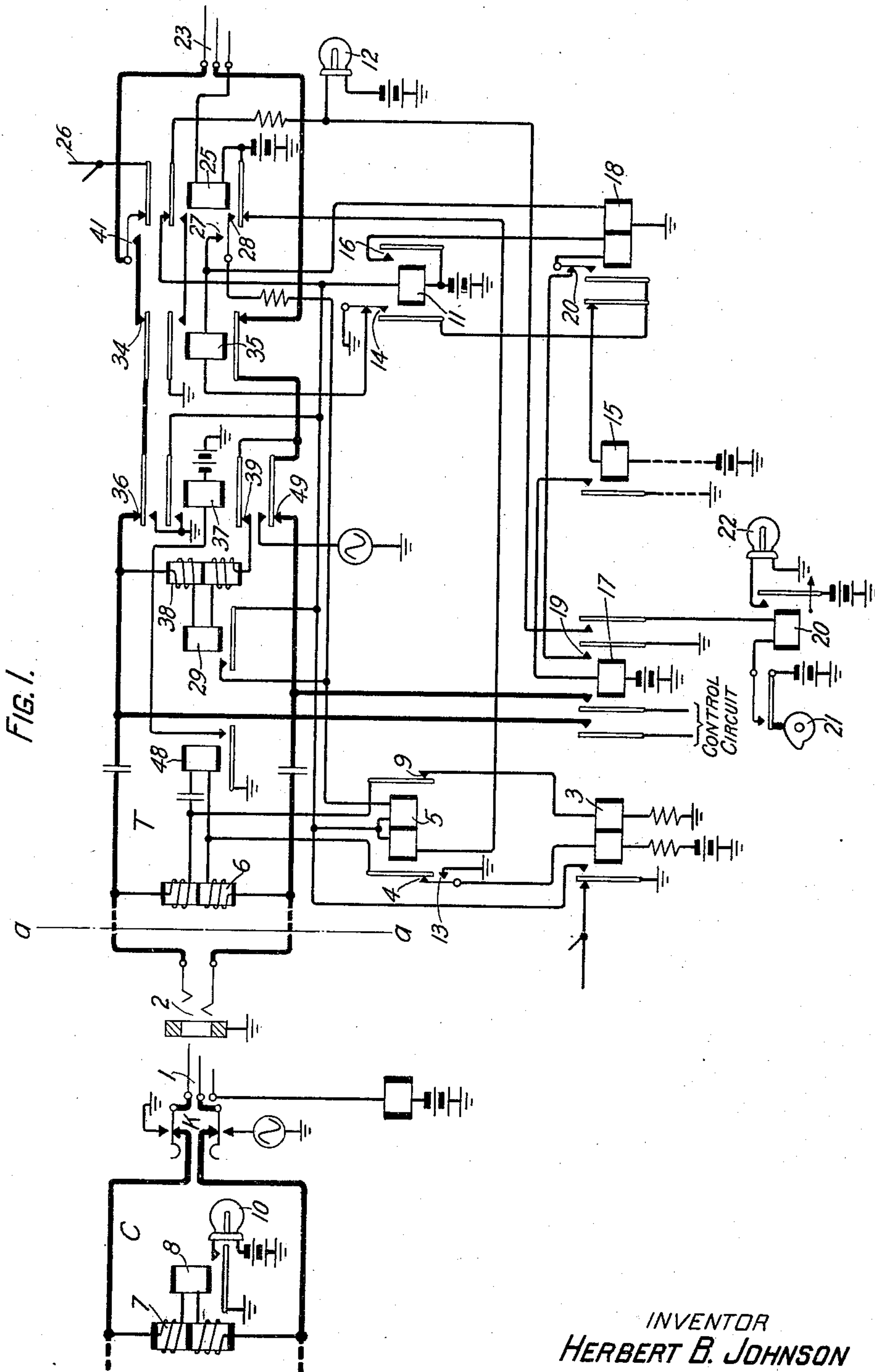
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TELEPHONE TRUNK CIRCUIT

Filed April 26, 1928

2 Sheets-Sheet 1



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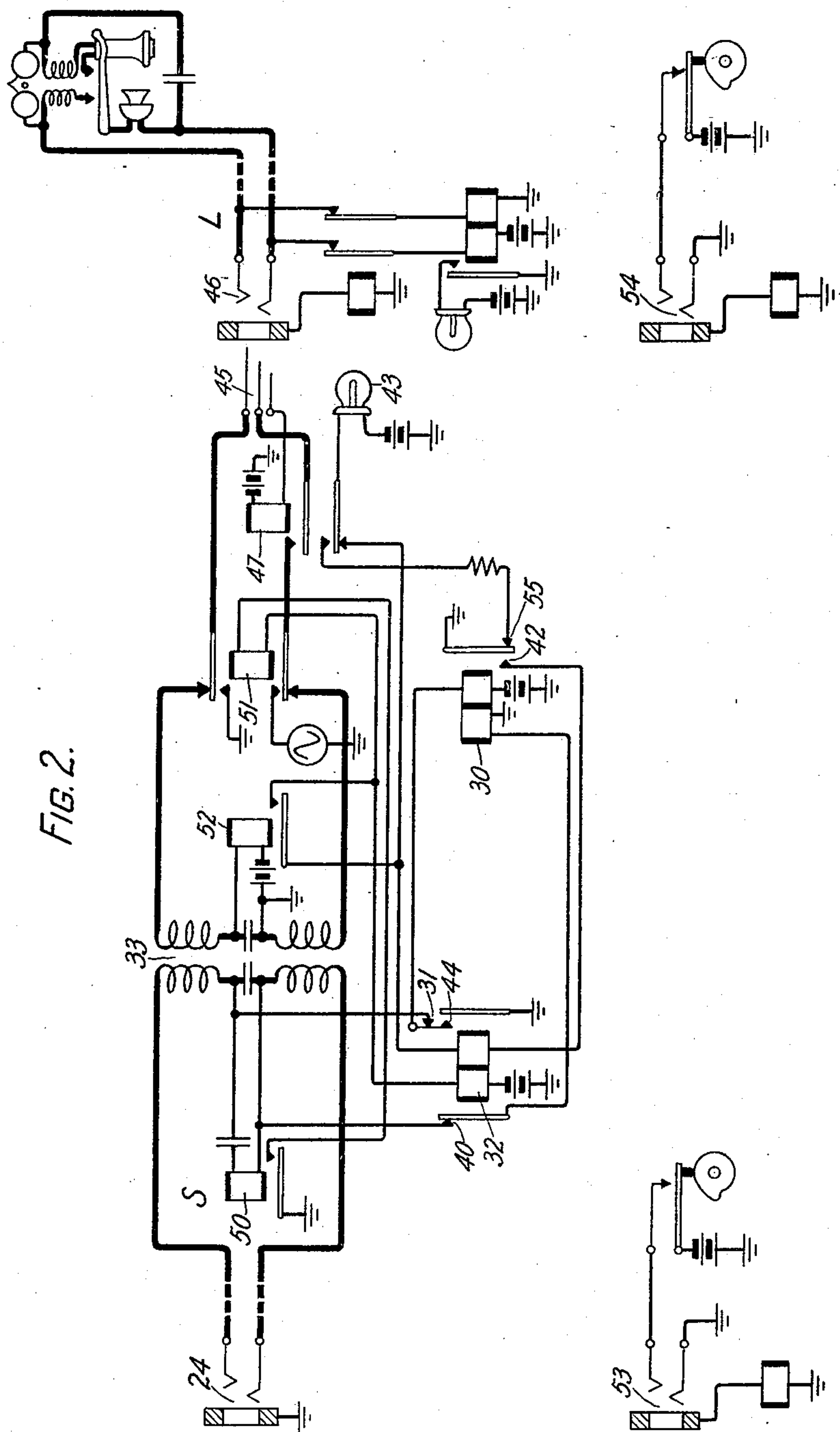
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UNITED STATES PATENT OFFICE

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TELEPHONE TRUNK CIRCUIT

Application filed April 26, 1928. Serial No. 272,898.

This invention relates to telephone trunking systems whereby connections are established between a calling and a called line through two trunk lines in tandem and more particularly to a tandem trunk circuit for establishing connections between a toll operator's cord circuit and the outgoing end of a toll switching trunk at a tandem operator's position.

It has been the practice for a number of years to complete toll connections to called subscribers' lines terminating at B or toll switching positions over what are known as toll switching trunks.

The method of operation of such a system, arranged to work on what is known as a straightforward basis, is for the toll operator to plug her cord circuit into a switching trunk to the desired exchange and, when the B or toll switching operator is connected to the trunk, request that the incoming end of the trunk be connected with the called subscriber's line. The B operator performs this function but does not ring the subscriber, this operation being left under control of the toll operator.

This method of operation requires that the toll operator have complete supervision of the connection. That is, the called supervisory lamp of the toll cord must light when the B operator connects the trunk to the subscriber's line, remain lighted until the subscriber answers at which time it will be extinguished and must again light when the called subscriber hangs up. Such a system of supervision between a B and a toll position is disclosed in U. S. Patent 1,312,773 to R. S. Wilbur.

In the present system, arranged to work on a straightforward basis, a single toll office serves a plurality of local exchanges over a single group of toll trunk lines extending from the toll office to a concentrating position, called a "tandem" position, from which point groups of toll switching trunks extend to the various local offices.

In its broadest aspect, the object of the invention is to effect economies in trunk facilities and in its attainment a specific object of the invention is to enable supervisory signals

to be transmitted from the toll switching trunk, through the tandem position and over the tandem trunk, to the toll operator's cord circuit.

In accordance with the foregoing objects, a feature of the present invention relates to an arrangement for tandem toll trunks such that supervisory signals, transmitted back over the toll switching trunk from the local exchange to the tandem office, are automatically repeated and retransmitted over the tandem trunk to control supervisory apparatus at the toll office.

Other features of the invention will appear from the following description.

The embodiment of the invention to be now described is shown by the accompanying drawing of which:

Fig. 1 represents a straightforward tandem trunk circuit extending from a toll operator's position to a tandem operator's position; and

Fig. 2 represents a standard toll switching trunk extending from the tandem position of Fig. 1 to a B or toll switching operator's position at which access to a called subscriber's line may be had. The switching trunk of Fig. 2 is similar to the trunk circuit D disclosed in the patent to Wilbur 1,312,773, dated August 12, 1919.

In systems of the character described, the toll operator, whose cord circuit C is shown at the left of Fig. 1, receives from a recording operator, or otherwise, a ticket giving the information as to the calling subscriber and the called subscriber's number or name or both. The toll operator then inserts the plug 1 of her cord circuit in the jack 2 of the tandem trunk circuit T extending from the toll office to a tandem office represented by the trunk equipment at the right of the vertical broken line *a—**a*, whereupon relay 3 operates in a circuit which may be traced from battery, left hand winding of relay 3, contacts 4 of relay 5, lower winding of retard coil 6, ring conductors of trunk T, ring spring and contact of jack 2 and plug 1, respectively, ring conductor of the cord circuit C, lower winding of retard coil 7, winding of relay 8, upper winding of retard coil 7, tip conduc-

tor of cord C and trunk T, upper winding of retard coil 6, contacts 9 of relay 5 and right hand winding of relay 3 to ground.

Relay 3 thereupon operates and completes energizing circuits for relays 5 and 11 and closes a circuit for steadily lighting guard and disconnect lamp 12. Although relay 8 may be immediately operated, thereby closing the circuit of the toll cord supervisory lamp 10, yet the immediate operation of relay 5 disconnects battery and ground from the trunk and causes the relay 8 to release at once, thereby opening the lamp circuit and preventing this lamp from being lighted at this time as a signal to the toll operator to start ringing. Relay 5 in operating, however, closes its contacts 13, thereby completing a holding circuit for relay 3, which relay therefore is not released at this time.

Relay 11, in operating, closes its contacts 14 thereby operating relay 15. Relay 15 operates and closes an obvious circuit for relay 17, which relay closes at its left hand contacts a connection from the trunk to the control circuit, not shown, and connects battery, supplied over contacts 16 of relay 11, through the left hand winding and contacts 20 of relay 18 and contacts 19 of relay 17, to the control circuit which thereupon functions and causes three short impulses of tone current, commonly referred to as "zips", to the trunk which are heard by the toll operator and understood by her as a signal to pass the exchange designation and number of the called line. Relay 18, however, does not operate at this time due to a high resistance in the control circuit.

After the order tone or "zips" have been transmitted relays in the control circuit function to connect the operator's telephone set, not shown, to the trunk over the left hand contacts of relay 17. Further, relay 17 in operating closes its outer right contacts and completes a circuit for flashing the guard and disconnect lamp 12 which, up to this time, has been burning steadily. This is accomplished by periodically shunting the lamp with the winding of the slow releasing relay 20 under control of a constantly operating circuit closing device 21. The flashing of lamp 12 indicates to the tandem operator that she is connected to trunk T.

Relay 20 operates following the first flash of lamp 12 and, being slow to release, holds up over subsequent flashing, thereby causing pilot lamp 22 to burn steadily. As soon as the tandem operator ascertains the office designation and number of the called subscriber's line, she selects a toll switching trunk extending to the desired office, which we will assume is the trunk S shown in Fig. 2 and then passes the information received from the toll operator to the B or switching operator in any desired manner which, as it forms

no part of the present invention, will not be further discussed.

When the tandem operator inserts the plug 23 in jack 24 of the switching trunk the sleeve relay 25 of the tandem trunk operates in an obvious circuit and transfers the tip of the plug 23 from the busy test lead 26 to the tip conductor of the trunk, opens the circuit of the lamp 12, thereby extinguishing it, operates relay 18 by closing contacts 27 and 28 and also completes, at its contacts 28, a holding circuit for relay 5, which can be traced from ground, left hand contacts of relay 3, right hand winding of relay 5 and contacts 28 of relay 25 to battery. The reason for holding relay 5 operated at this time is to prevent battery and ground, standing on the outer contacts of relay 5, from being connected to the trunk which would light lamp 10 in the toll cord and be taken by the toll operator as a signal to start ringing which is not desired at the present stage of the connection for the reason that the called subscriber's line has not yet been reached.

Relay 18 in operating locks up under control of relay 11 and releases relay 15, which in turn releases relay 17. Relay 17 in releasing disconnects the trunk from the operator's telephone set and disconnects the flashing circuit from lamp 12, which thereupon lights steadily again.

With plug 23 in jack 24, battery and ground is supplied over the switching trunk S to operate the line relay 30 at the switching position. This circuit can be traced from battery, right hand winding of relay 30, contacts 31, relay 32, upper left winding of repeating coil 33, tip conductor of trunk S and tip spring of jack 24, tip contact of plug 23, contacts 41 of relay 25, contacts 34 of relay 35, contacts 36 of relay 37, upper winding of retard coil 38, winding of relay 29, lower winding of retard coil 38, contacts 39 of relay 37, lower normal contacts of relay 35, ring contact of plug 23, ring spring of jack 24, ring conductor of trunk S, lower left hand winding of repeating coil 33, contacts 40 of relay 32 and left hand winding of relay 30 to ground. Relay 30 operates and closes its contacts 42, thereby operating relay 32 and lighting the guard and disconnect lamp 43. The operation of relay 32 immediately disconnects battery and ground from the trunk S in order not to operate relay 29 at the tandem office at this time, which, as before explained, would cause a ringing signal to be transmitted to the toll operator. Relay 32 in operating also closes its contacts 44, thereby completing an obvious holding circuit for relay 30, which must not release at this time.

When the switching operator completes the call to the desired subscriber's line L by inserting the plug 45 into the jack 46, sleeve relay 47 operates in an obvious circuit and connects the ring of the trunk through to the

repeating coil 33. The lower armature of relay 47, which is attracted when the winding of this relay is energized, opens the circuit through the right hand winding of relay 32 and lamp 43, thereby causing relay 32 to be released and lamp 43 to be extinguished.

The release of relay 32 reconnects battery and ground to the trunk S through the left hand windings of repeating coil 33, which now flows back over the trunk to the tandem office, as previously described and energizes relay 29. Relay 29 in operating short-circuits the right hand winding of relay 5 and causes this relay to release, which in turn reconnects battery and ground to the trunk T, which causes relay 8 in the toll cord circuit to attract its armature and light lamp 10. The toll operator recognizes this as a signal that the distant end of the switching trunk, to which the tandem trunk is connected, has been plugged into the called line and that she may now ring the subscriber by operating the ringing key K associated with the cord circuit in use.

Ringing current applied to the trunk T by the key K causes actuation of the relay 48 at the tandem end of the trunk, which in turn operates relay 37. Relay 37 splits the trunk by opening contacts 36 and 49 and connects locally supplied ringing current over its alternate contacts to the switching trunk S. When the trunk was split by the operation of relay 37 relay 29 released, thereby removing the short-circuit from relay 5, which relay thereupon reoperates.

Ringing current applied to the switching trunk at the tandem position causes relay 50 at the distant end of the switching trunk to operate, which closes a circuit from ground through the winding of relay 51 and the left hand winding of relay 52 to battery. Relay 51 operates and relays ringing current to the called line L to operate the called subscriber's bell. Relay 32 also reoperates which removes battery and ground from the switching trunk during the ringing interval and closes the holding circuit for relay 30. When the ringing key K is released, relays 48 and 37 release. Relay 37 in releasing disconnects ringing current from the switching trunk which permits relay 50 to release. This relay releases relay 51, which disconnects ringing current from the called line. Relay 50 also releases relay 32, which reconnects battery and ground to the trunk, which causes relay 29 to again operate, which once more short-circuits relay 5 and causes it to again release.

When the called subscriber answers relay 52 operates, which completes an energizing circuit for relay 32, which can be traced from battery through the left hand winding of relay 32, contacts of relay 52, right hand winding of relay 52 and contacts 42 of relay 30 to ground. Relay 32 operates and again disconnects battery and ground from the

trunk S, which releases relay 29, thereby operating relay 5 to disconnect battery and ground from the trunk, which causes the cord supervisory lamp 10 to be extinguished as a signal that the called subscriber has answered.

In case the outgoing switching trunks of any particular group at the tandem position are busy the tandem operator inserts plug 23 into the busy-jack 53, whereupon intermittent battery and ground is applied to the trunk and causes relay 29 to alternately operate and release, thereby intermittently releasing relay 5, which alternately connects and disconnects battery and ground to the trunk to flash lamp 10 in the toll cord circuit.

In case the subscriber's line is busy the switching operator will insert plug 45 into busy-jack 54, which alternately operates relay 52, which in turn causes relay 32 to intermittently apply battery and ground to the trunk S, leading back to the tandem position, where it causes relay 29 to flash the toll cord supervisory lamp 10 in the manner just described.

When the called subscriber hangs up, relay 52 releases, which in turn releases relay 32 and causes the lamp 10 in the toll cord to light as a disconnect signal. When the toll operator disconnects relay 3 is released, which in turn releases relay 11. Relay 11 released causes relay 35 to operate, which lights the guard and disconnect lamp 12 in an obvious circuit. The tandem operator noting this signal disconnects from the switching trunk, thereby opening the circuit of relay 30, which releases and closes its contacts 55, which thereupon causes lamp 43 to light as a disconnect signal to the switching operator.

When the tandem operator disconnects by removing plug 23 from jack 24, relay 25 releases, which releases relay 35 and extinguishes lamp 12, whereupon the circuit restores to normal.

What is claimed is:

1. In a telephone system, a toll operator's position, a cord circuit thereat, a tandem position, a tandem trunk line interconnecting said toll and tandem positions, a switching position, a switching trunk interconnecting said tandem and switching positions, means for interconnecting said trunks at said tandem position, called lines outgoing from said switching position, means for connecting said switching trunk with one of said called lines, a supervisory relay associated with said cord circuit, a first relay associated with said tandem trunk at the tandem position end thereof, a circuit including a source of current, a winding of said supervisory relay and contacts of said first trunk relay, a second relay associated with said tandem trunk adapted to disable said first relay, and a third relay associated with said switching

trunk and controlled by said called line for controlling said second relay.

2. In a telephone system, a cord circuit, a called line, a tandem trunk and a toll switching trunk for interconnecting said cord circuit and said called line, a supervisory relay associated with said cord circuit, a first relay associated with the incoming end only of said tandem trunk, an energizing circuit for said supervisory relay including contacts of said first relay, means at the incoming end of said tandem trunk for controlling said first relay, and means associated with said switching trunk, controlled by said called line, for controlling said first means.

In witness whereof, I hereunto subscribe my name this 23rd day of April, 1928.

HERBERT B. JOHNSON.