July 22, 1941. S. W. ALLISON ET AL 2,250,173

COIN CONTROL CIRCUIT

Filed Sept. 29, 1939 3 Sheets-Sheet 1

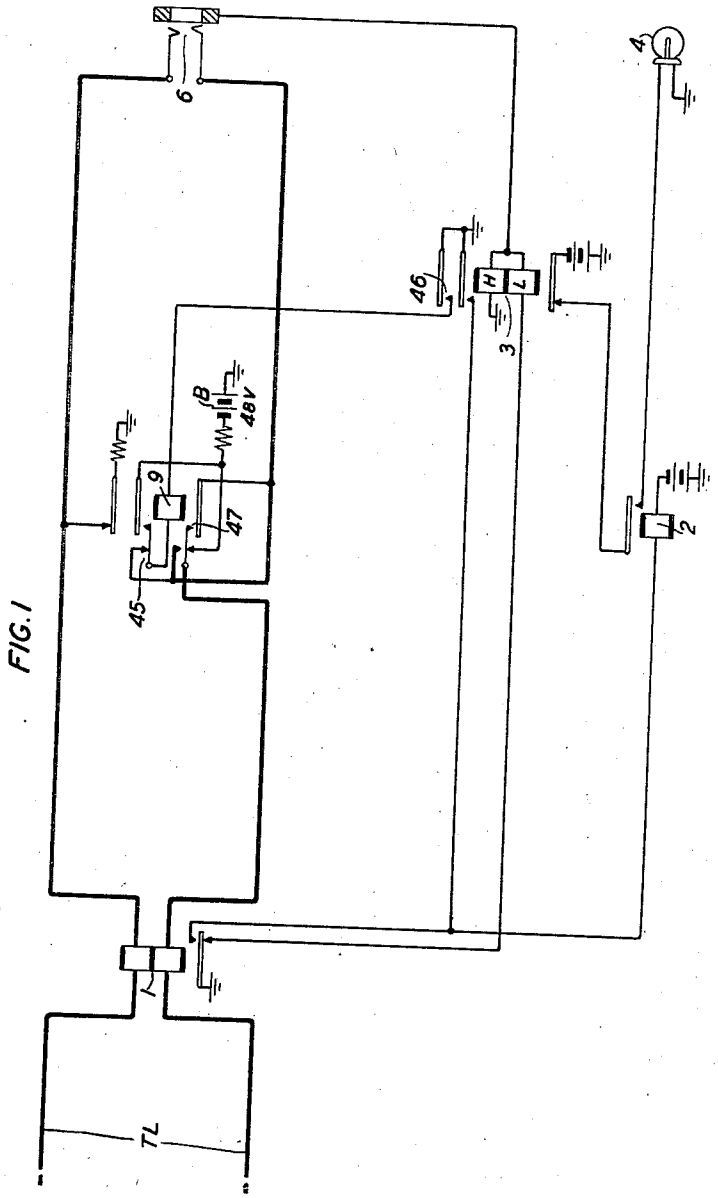

FIG. 1

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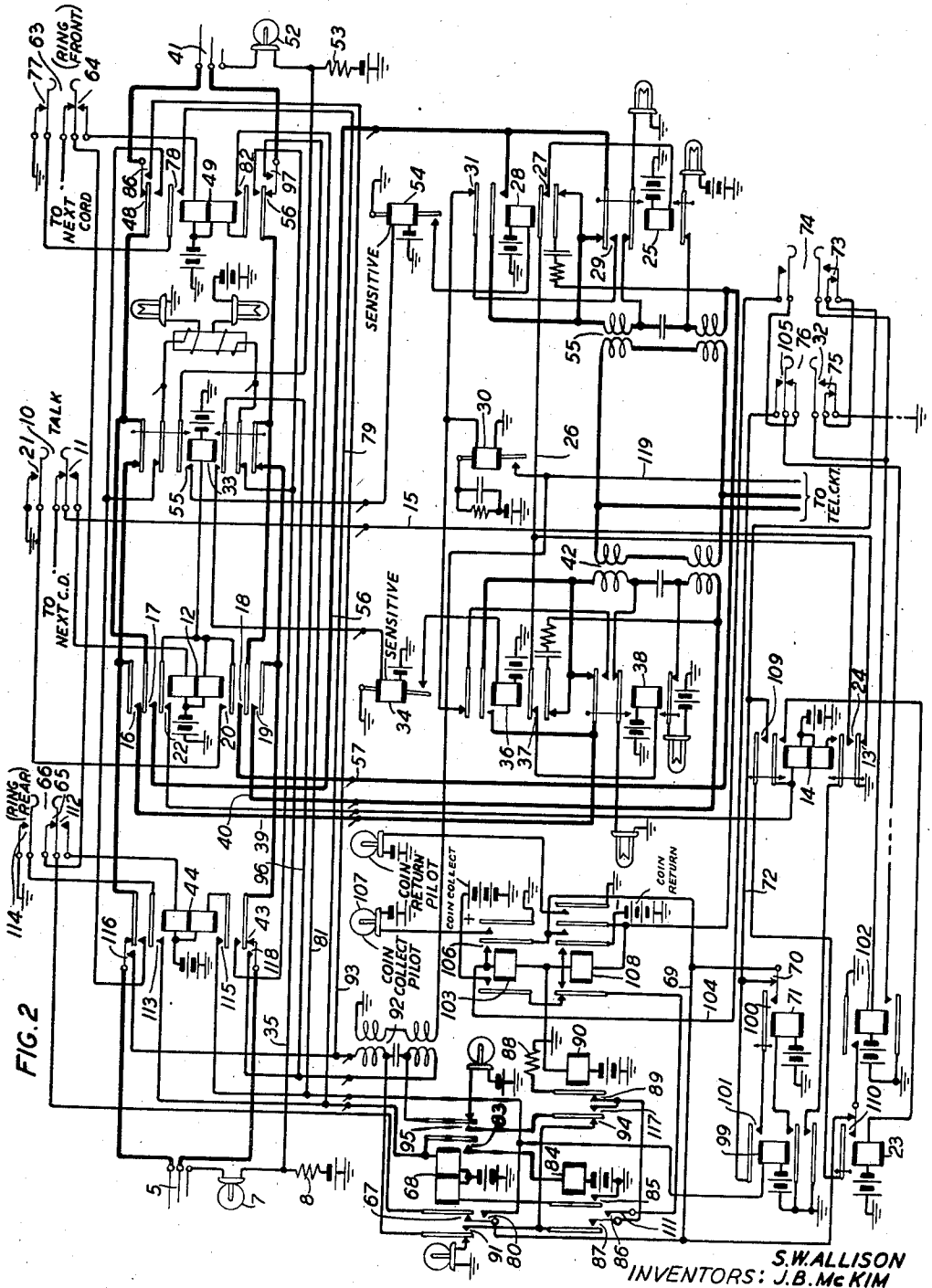

FIG. 2

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Filed Sept. 29, 1939 3 Sheets-Sheet 3

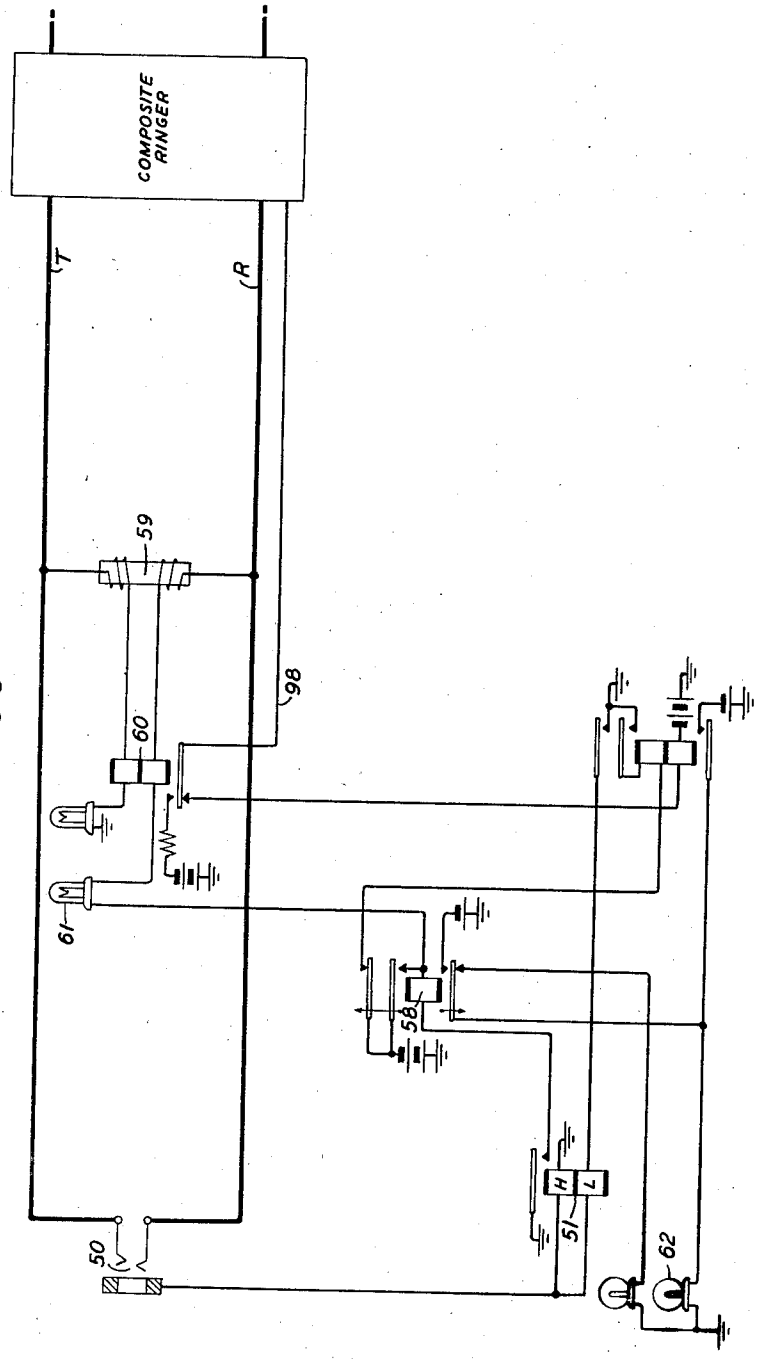

FIG. 3

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UNITED STATES PATENT OFFICE

2,250,173

COIN CONTROL CIRCUIT

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Application September 29, 1939, Serial No. 297,096

3 Claims. (Cl. 179—6.3)

This invention relates to telephone systems and more particularly to toll switching systems.

Circuit arrangements for telephone switchboard operators' positions are known which provide a common coin collect and refund key per position in substitution for individual coin disposal keys per trunk or cord circuit, which common coin disposal keys are selectively associated with any trunk or cord circuit at the position by the simultaneous operation therewith of a talk key individual to the desired trunk or cord. At switchboards so arranged, however, if the operator's telephone set is connected to a particular cord and she desires to dispose of a coin over a line with which another cord in her position is connected, it is necessary for her to first disconnect her telephone set from the cord to which it may be connected, after which she operates the common coin key and the listening or talk key of the cord over which she desires to exercise coin control. Such an arrangement, however, may at times be objectionable as the operator is either obliged to delay disposal of a desired coin or, on the other hand, interrupt a conversation with a subscriber or distant operator.

An object of the invention, therefore, is to provide an arrangement whereby a common coin control unit may be operatively associated with any cord at an operator's position and coin control potential transmitted thereover without interfering with the connection of the operator's telephone set to the same or any other cord or trunk circuit at the position.

A feature of the invention resides in a circuit arrangement for telephone switchboards, having a coin collect key and a coin return key common to all the cords at an operator's position and the usual talk and ringing keys individual to the several cords thereat, whereby a momentary operation of either coin key and the subsequent operation of any ringing key applies coin control potential, characteristic of the coin key operated, to the cord with which the operated ringing key is associated, regardless of the condition of any talk key at the position.

Other features of the invention will appear from the following description and appended claims.

The invention will be understood from the following description when read in connection with the accompanying drawings Fig. 1 of which shows an incoming trunk line over which a calling subscriber's line is extended;

Fig. 2 shows a cord and position circuit arranged in accordance with the present invention to collect coins on either end thereof; and

Fig. 3 represents a two-way ring-down toll line which is shown for the purpose of completing an operative disclosure of the cord circuit of Fig. 2.

Describing the operation of the circuit of the invention, it will be assumed that a loop closure is effected at a calling subscriber's station over line TL thereby causing the operation of relay 1. Relay 1 in operating closes an obvious circuit to operate relay 2 and by breaking its back contact, opens the low resistance winding of sleeve relay 3, thereby increasing the resistance of the sleeve circuit to a relatively high value. Relay 2 in operating closes an obvious circuit to light the line lamp 4.

Upon noting the lighted line lamp 4, the operator inserts plug 5 of the cord circuit in jack 6 of the calling line thereby operating sleeve relay 3 in a circuit which may be traced from ground, upper high resistance winding of relay 3, sleeve of jack 6, sleeve of plug 5, supervisory lamp 7, and resistance 8 to battery and ground. The operation of relay 3 opens its lower back contact to extinguish line lamp 4 and by closing its inner upper front contact provides a holding path for relay 2 whereby this relay is held operated as long as plug 5 remains in jack 6. Further, operation of relay 3 by closing its uppermost front contact prepares a circuit to operate relay 9 which circuit is completed when the ring spring of plug 5 meets the ring spring of jack 6, and the talking key of the cord circuit is operated, which circuit closure will be later described, it being assumed that the call was answered before the operator's talk key 10 was operated. When the operator actuates talk key 10, the following circuit operations take place. Closure of contacts 11 completes a circuit to operate relay 12 which can be traced from ground, contacts 13 of relay 14, conductor 15, contacts 11 of key 10 and upper winding of relay 12 to battery. Relay 12 in operating closes its contacts 16, 17, 18 and 19 thereby extending the tip and ring conductors of the cord into the position circuit. Contact 20 is also closed which provides a locking circuit for relay 12 which can be traced from contact 21 of key 10, contacts 20 of relay 12 and lower winding thereof to battery. Closure of contact 22 of relay 12 closes a path in parallel with the above traced locking circuit which extends to and operates relay 14. The operation of relay 14 extends its operating ground through the winding of relay 23 to battery which relay in operating performs no useful function at this time. Operation

of relay 14 by closing its contacts 24 causes the operation of relay 25 which circuit can be traced from ground, contacts 24, conductor 26, contacts 27 of relay 28 and winding of relay 25 to battery. Relay 25 in operating disconnects at its upper and lower contacts battery and ground from the tip and ring conductors of the cord and by closing its contacts 29 connects the busy test relay 30 to the tip conductor of the cord in a circuit which can be traced over contacts 31 of relay 28, contacts 29 of relay 25, conductor 56 and contacts 17 of relay 12 to the tip conductor of the cord. Returning now to the operation of relay 12, it will be noted that ground over contacts 21 of talk key 10, and contacts 20 of relay 12 also extends to the cord splitting relay 33 which relay in operating connects the sensitive relay 34 over conductor 35 to the sleeve of plug 5 which is now in contact with the sleeve of jack 6. Due to the sensitive characteristics of relay 34, this relay operates in series with the high resistance, upper winding, of relay 3, in the incoming trunk. Relay 34 in operating closes an obvious circuit to operate relay 36. Operation of relay 36 opens its contacts 37 thereby immediately releasing relay 38 in case this relay has started to operate in parallel with relay 25 from ground at contact 24 of relay 14. It will now be noted that battery and ground over the inner upper and lower contacts of relay 38 is extended to the tip and ring of the cord and thence to the incoming line of Fig. 1 over conductors 39 and 40 and contacts 16 and 19 of relay 12. Due to the operation of relay 12 the battery which is supplied to the incoming line causes the operation of the plug seat relay 9 which circuit can be traced from battery, lower contacts of relay 38, lower left winding of repeating coil 42, conductor 40, contacts 19 of relay 12, contacts 43 of relay 44, ring conductors of plug 5, and jack 6, contacts 45 of relay 9 in the trunk, the winding thereof and contacts 46 of relay 3. Relay 9 operates in this circuit and locks over a local circuit to 48-volt battery B. Operation of this relay (9) also removes battery and ground from the tip and ring of the line TL at this point and by closing its contacts 47 connects the ring conductor of the line through to the cord from which it receives battery supplied over the lower contacts of relay 36. Ground is also supplied to the tip conductor of the line over the inner upper contacts of relay 38.

Upon learning the details of the desired connection, the operator touches the tip of plug 41 to the jack sleeve of the desired line. If the called line is busy, the sleeve thereof will be at battery potential and the busy test relay 30 will operate over the circuit previously traced which includes contacts 31 of relay 28 and contacts 29 of relay 25, conductor 56, contacts 17 of relay 12, and contacts 48 of relay 49 to the tip of the plug.

If, however, the line is idle, busy test relay 30 will not operate and upon receiving no busy indication in her telephone, the operator will proceed to extend the connection by inserting plug 41 in jack 50, which we have assumed is the line called, whereupon sleeve relay 51 of the line operates from ground through its upper high resistance winding, sleeve of the jack 50 and plug 41 to battery in series with supervisory lamp 52 and resistance 53. Due to the fact that relay 33 is operated at this time, sensitive relay 54 is now connected over contacts 55 of relay 33 to the sleeve of the plug 41 and therefore this relay operates in series with the high resistance winding of relay 51 in the line. Relay 54 in operating completes an obvious circuit to operate relay 28 which relay in operating opens at its contacts 27 the circuit for relay 25 which thereupon releases and connects battery and ground over its inner upper and lower contacts through the upper and lower windings of repeating coil 55 and conductors 56 and 57 and contacts 17 and 18 of relay 12 and contacts 48 and 56 of relay 49 to the line (Fig. 3) whereby a circuit is closed to operate the plug seat relay 58 in the line which circuit can be traced from battery on the ring conductor of the cord and line, lower winding of retardation coil 59, lower winding of relay 60, resistance lamp 61, winding of relay 58 and upper contacts of relay 51 to ground. Relay 58 operates in this circuit and closes its upper inner contacts thereby completing a holding path for itself. Completion of this locking circuit also short-circuits the lower winding of relay 60 which therefore does not operate at this time. Closure of the lower front contacts of relay 58 lights the busy lamp 62.

Ringing on the called line is accomplished by operating ring key 63 whereupon relay 49 operates in the following circuit, battery, upper winding of relay 49, contacts 64 of key 63, contacts 65 of ringing key 66, contacts 67 of relay 68, conductor 69, contacts 70 of relay 71, conductor 72, contacts 73 of coin return key 74 and contacts 75 of coin collect key 76 to ground.

Operation of relay 49 operates relay 68 in the following circuit. Ground, contacts 77 of ringing key 63, contacts 78 of relay 49, conductor 79 and right-hand winding of relay 68 to battery. Relay 68 closes its contacts 80 and opens its contacts 67 thereby completing a locking circuit for relay 49 which can be traced from battery, lower winding of relay 49, contacts 82 thereof, conductor 81, contact 80 of relay 68, conductors 69, contacts 70 of relay 71, conductors 72, contacts 73 of coin return key 74 and contacts 75 of coin collect key 76 to ground. Relay 68 in operating also closes its contacts 83 to operate relay 84, the circuit for which can be traced from battery, winding of relay 84, contacts 83 of relay 68, conductors 79, contacts 78 of relay 49 and contacts 77 of ringing key 63 to ground. Relay 68 by opening contacts 67 removes the ground from the lower armature of all the ringing keys at the position, thus making operation of a second key ineffective to operate its associated relay such as 44 or 49.

Relay 84 in operating closes its contacts 85 to complete an obvious locking circuit for relay 68. Operation of relay 84 also closes its contacts 87 thereby connecting ground through resistance 88 to the tip and ring of the cord over contacts 89 of relay 90. From contacts 87 of relay 84 the path to the tip of the cord extends over contacts 91 of relay 68, upper left winding of repeating coil 92, conductor 93 and contact 86 of relay 49 to the tip of the plug 41 and line. The path to the ring of the line extends from contacts 87 of relay 84 over contacts 94 of relay 90, contacts 95 of relay 68, lower left winding of repeating coil 92, conductor 96 and contacts 97 of relay 49 to the ring of the cord and line which ground causes ringing relay 60 in the line to operate over its lower winding to battery at the inner upper contacts of relay 58. Relay 60 in operating closes its lower front contacts to connect battery to the signal lead 98 which controls well-known ringing equipment as indicated at the right-hand side of Fig. 3 which, however, forms no part of the

present invention and therefore is not described. Relay 68 in operating also causes the operation of relay 99, the circuit for which can be traced from battery, winding of relay 99, contact 80 of relay 68, conductor 69, contacts 70 of relay 71, conductor 72, contacts 73 of coin return key 74 and contacts 75 of coin collect key 76 to ground. Relay 99 in operating closes an obvious circuit to operate relay 71 which relay in operating opens its contacts 70, following the closure of its contacts 100, whereby the ground at coin collect key 76 over conductor 72 is maintained on conductor 69, the new circuit passing over contacts 101 of relay 99 and contacts 100 of relay 71. The operation of relay 99 also closes its lowermost front contact to hold relay 14 operated. Release of ring key 63 releases relays 84 and 68 in turn. Relay 68 in releasing, releases relays 49 and 99 which in turn releases relay 71. Release of relay 84 removes ground from the line thereby releasing relay 60 and disconnecting battery from the signal conductor 98.

Now that we have described how ringing on a line is controlled by the ringing key in a cord circuit, we will next describe how coin collect, or return, current can be applied to the line under control of the same ringing key. As we have assumed that the calling line of Fig. 1 is the extension of a coin subscriber's line and that the subscriber has deposited a coin in the box at his station, the operator of course desires either to collect the coin, i. e. deposit it in the coin receptacle or to return the coin to the subscriber. We will first describe the coin collect operation in the case where the operator has not released the talking key and therefore relays 12, 14, 23, 33, 34, 36, 54 and 28 in the cord are still operated and therefore the operator's telephone is connected through repeating coils 42 and 55 to both ends of the cord and their associated lines.

In the event that the operator desires to collect a coin over line TL, she will first operate coin collect key 76 thereby operating relay 102 in a circuit which can be traced from ground over contacts 32 of key 76. Relay 102 in operating closes a circuit to operate relays 103 and 90 in series which circuit can be traced from battery, winding of relays 90 and 103, conductor 104, contacts 105 of key 76 and the lower contacts of relay 102 to ground. Relay 103 in closing its contacts 106 locks itself and relay 90 to ground over contacts 70 of relay 71, contacts 109 of relay 14, contacts 110 of relay 23 and the upper contacts of relay 102 to ground which holding ground is effective until the coin collect key 76 is released. Key 76, may, however, be released immediately whereupon relay 102 is released and the holding ground for relays 103 and 90 just traced is supplied to lead 69 from contacts 75 of key 76. Further relay 103 closes its left-hand contacts thereby connecting positive 110-volt direct current over left back contacts of relay 108 to contact spring 111 of relay 84 in readiness to be extended to the line when relay 84 operates in response to a subsequent operation of a ringing key. Coin collect pilot lamp 107 is also lighted by closure of the outer right contact of relay 103. Operation of relay 90 opens its contacts 89 thereby disconnecting ringing ground and preventing ringing current from being connected to the line when a ringing key is subsequently operated as previously described. The cord position circuit is now in the coin control condition and ready for operation of a ringing key. As it is desired to collect a coin on line TL of Fig. 1, rear, or answering, cord ringing key 66 will next be operated, whereupon relay 44 operates in a circuit from ground at coin collect key 76 and contacts 75 thereof, contacts 73 of key 74, conductor 72, contacts 70 of relay 71, conductor 69, contacts 67 of relay 68, contacts 112 of key 66 and upper winding of relay 44 to battery. Relay 44 in operating closes its contacts 113 thereby completing a circuit to operate relay 68 which can be traced from ground, contacts 114 of key 66, contacts 113 of relay 44 and the right-hand winding of relay 68 to battery. Relay 68 closes its contacts 80 and opens its contacts 67 thereby completing a locking circuit for relay 44 which can be traced from battery, lower winding of relay 44, contacts 115 thereof and contacts 89 of relay 68 to ground at coin collect key 76 over conductor 69. Relay 68 in operating also closes its contacts 83 to operate relay 84, the circuit for which extends over contacts 83 of relay 68 and contacts 113 of relay 44 to ground at contacts 114 of ringing key 66. Relay 84 in operating closes its contacts 85 to complete an obvious locking circuit for relay 68 and by closing its contacts 86 and 87 extends the positive 110-volt direct current standing on contact spring 111, by virtue of operation of relay 103, to the tip and ring of the answering end of the cord circuit. The circuit for the tip conductor extending from positive 110-volt battery, left contact of relay 103, left back contact of relay 108, contacts 86 and 87 of relay 84, contacts 91 of relay 68, upper left winding of repeating coil 92, contacts 116 of relay 44 to the tip of the plug 5 and thence over the line TL to the subscriber's station, not shown, and the circuit to the ring conductor of the line extends from contact spring 111, over contacts 86 of relay 84, contacts 117 of relay 90, contacts 95 of relay 68, lower left winding of repeating coil 92 and contacts 118 of relay 44 to the line. Operation of relay 68 also operates relay 99 which in turn operates relay 71, relay 99 being energized over a circuit which includes contacts 80 of relay 68, conductor 69, contacts 70 of relay 71 and conductor 72 to ground at contacts 75 of collect key 76 now in its released condition. As long as key 66 is operated, relays 103, 90, 44, 68, 84, 99 and 71 remain operated and coin collect potential is applied to the line. When key 66 is released, relay 84 releases followed by relay 68 which in turn releases relays 44 and 99 which latter relay in releasing opens its contacts 101 thereby momentarily breaking the holding paths for relays 103 and 90 which immediately release. Relay 99 also releases relay 71 but this relay is slow to release and does not close its contacts 70 to reconnect ground to conductor 69 until relays 103 and 90 have released.

In case the operator desires to return a coin at the calling station, the key 74 instead of key 76 will be operated, thereby causing the operation of relays 108 and 90 instead of 103 and 90, thereby connecting negative 110-volt battery to the line when the key 66 is operated.

The transformer 92 is provided for the case where the line TL is a trunk which repeats coin potential toward the calling station and transmits a tone to the cord as an indication that the circuit is functioning properly. This tone is induced in the right-hand winding of the coil which is connected to the busy test conductor 119 which terminates, and is heard, in the operator's telephone.

In case the talk key is released at the time a coin is collected or returned, relays 12, 33, 14,

23, 34, 54, 36, 28, 25 and 38 are released and the operator's telephone is disconnected from the cord. When the coin collect key 76, for example, is operated, relays 102, 103 and 90 are operated as before and when the ring key 66 is operated, relays 44, 68, 84, 99 and 71 are operated. In this case and in view of the fact that relays 14 and 23 are not operated, the operation of 102 supplies ground at its upper contact over the normal contacts of relay 23 to hold relays 103 and 90 operated in case the ringing key 66 is operated before the key 76 is released.

It will be noted from the foregoing that operation of a ringing key, either 66 or 63, provided a coin key is not operated, causes ground to be connected to the tip and ring of a connected line to initiate ringing thereon, whereas if a coin key is first operated, the position circuit is set in condition for coin control instead of ringing, the ringing ground being disconnected (at contacts 89 of relay 90) and a subsequent operation of the ringing key causes coin potential instead of ground to be connected to the associated line.

What is claimed is:

1. In a telephone system, an operator's position, a plurality of cord circuits thereat, a ringing key individual to each cord circuit, a coin control key common to said cord circuits, a source of coin control current, and means responsive to operation of said coin control key and the subsequent operation of a ringing key to connect said source of coin control current to the cord with which the operated ringing key is associated.

2. In a telephone system, an operator's position, a plurality of cord circuits thereat, individual ringing keys for each cord, a coin control key common to all the cords at the position, a source of coin control current, a source of ringing potential, means responsive to the operation of a ringing key to connect said source of ringing potential to the cord circuit associated with the ringing key, and means responsive to the operation of said coin control key and the subsequent operation of a ringing key to connect said source of coin control current to the cord associated with the ringing key to the exclusion from said cord of said source of ringing potential.

3. In a telephone system, an operator's position, a plurality of cord circuits thereat, a source of ringing current, a ringing key individual to each cord circuit, relay means common to said position controlled by any of said ringing keys to connect said ringing potential to the cord with which the ringing key is associated and to disable all other ringing keys as long as the first key is operated, a source of coin control current, a coin control key common to said position, and means responsive to the operation of said coin control key and the subsequent operation of a ringing key to prevent connection of said source of ringing potential to any cord at the position and to connect said source of coin control current to the cord associated with the operated ringing key.

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