

Feb. 27, 1945.

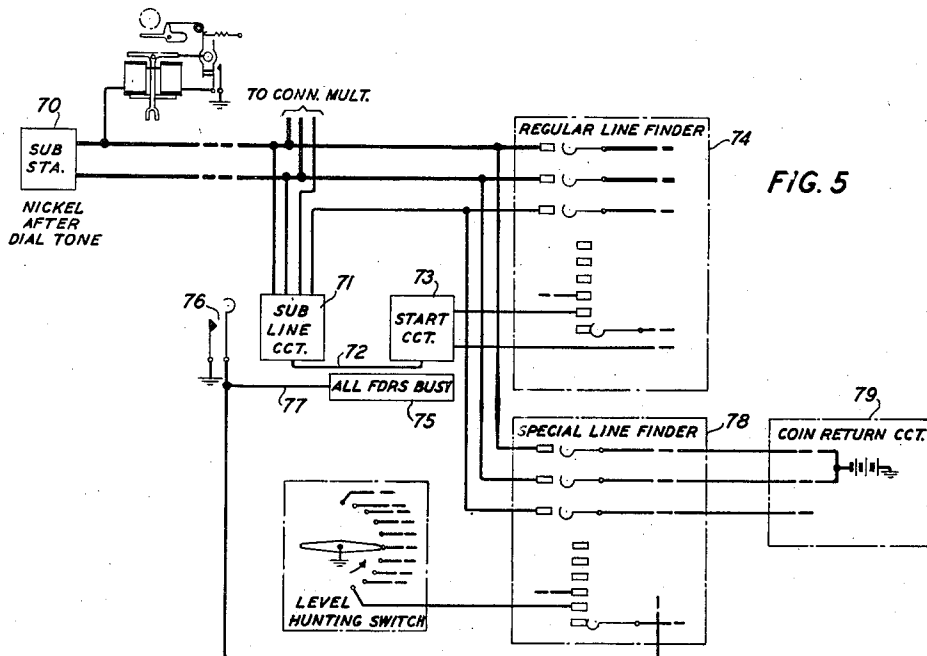
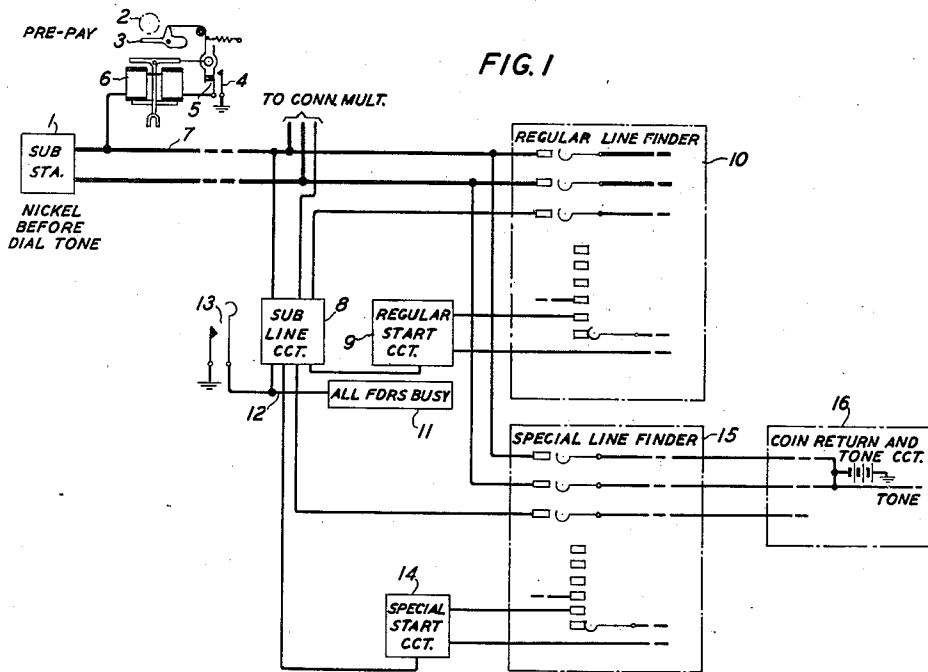
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2,370,239

SPECIAL SERVICE TELEPHONE SYSTEM

Filed Jan. 13, 1944

5 Sheets-Sheet 1



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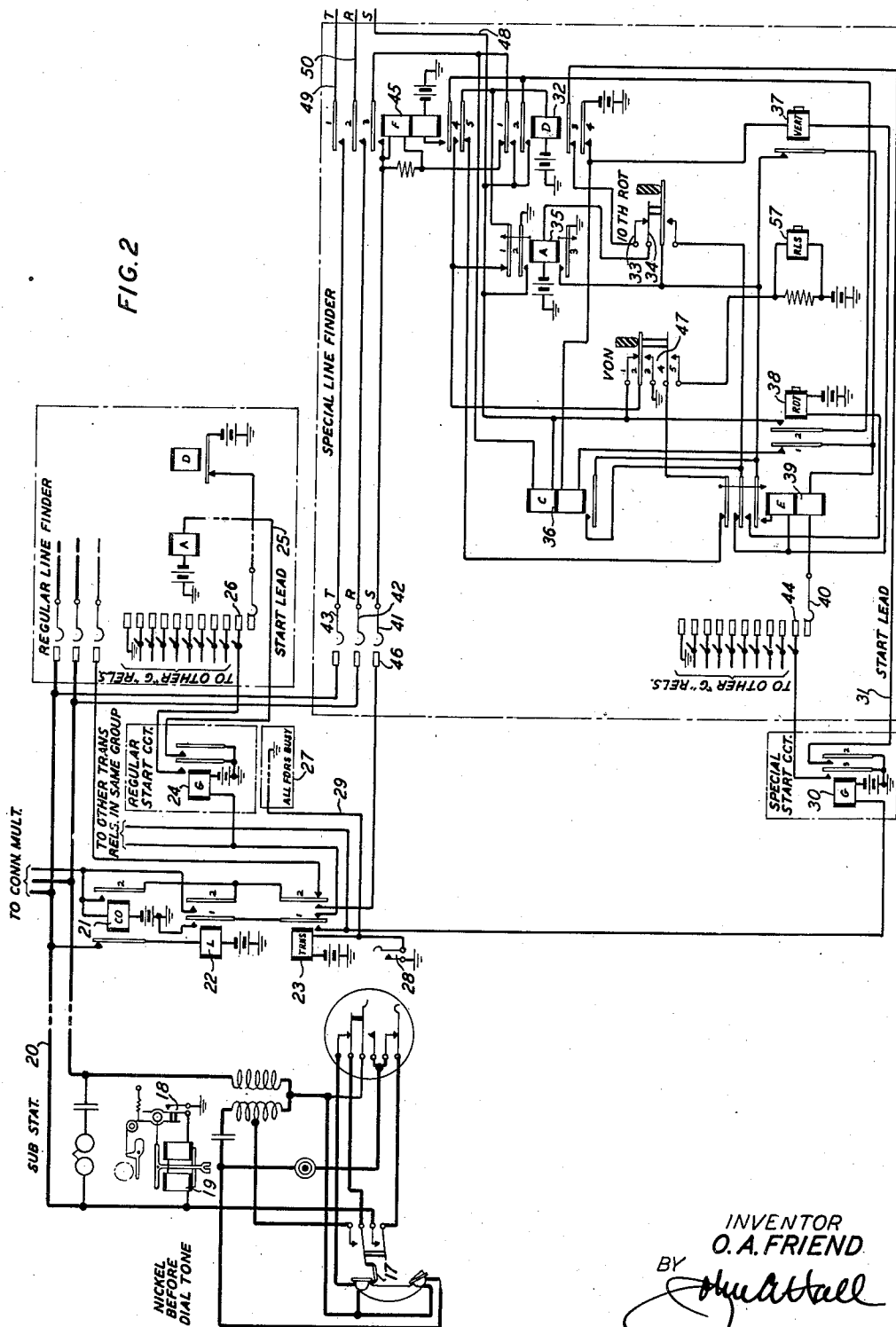
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5 Sheets-Sheet 2



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FIG. 3

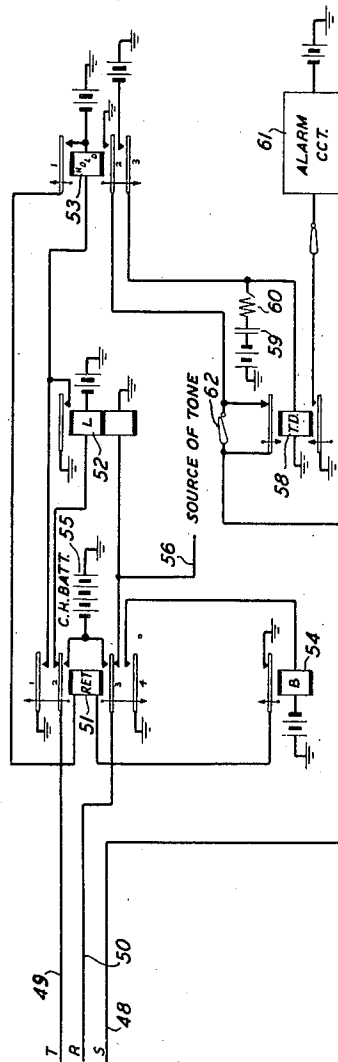


FIG. 4

FIG. 2
FIG. 3

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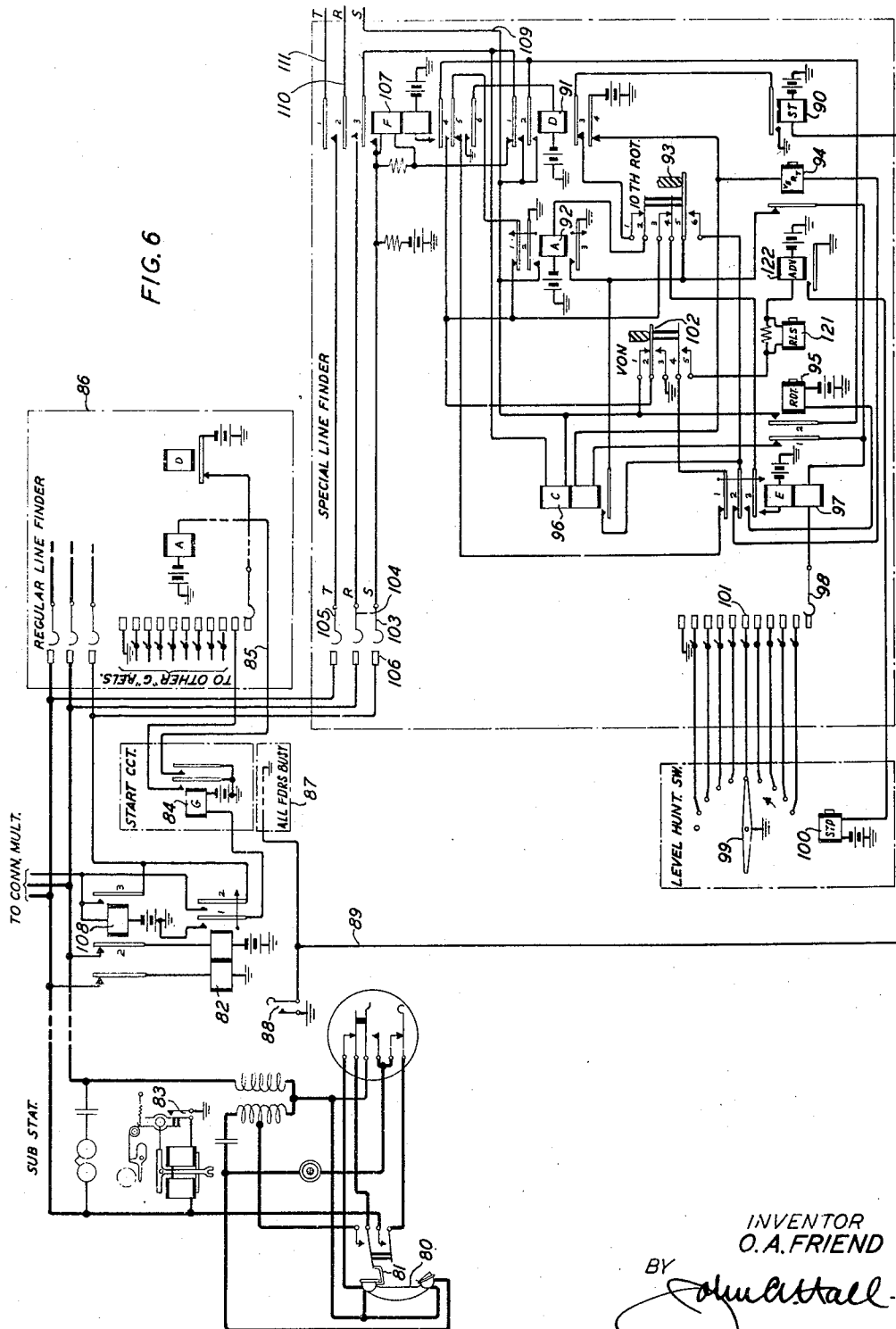
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SPECIAL SERVICE TELEPHONE SYSTEM

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5 Sheets-Sheet 4



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FIG. 7

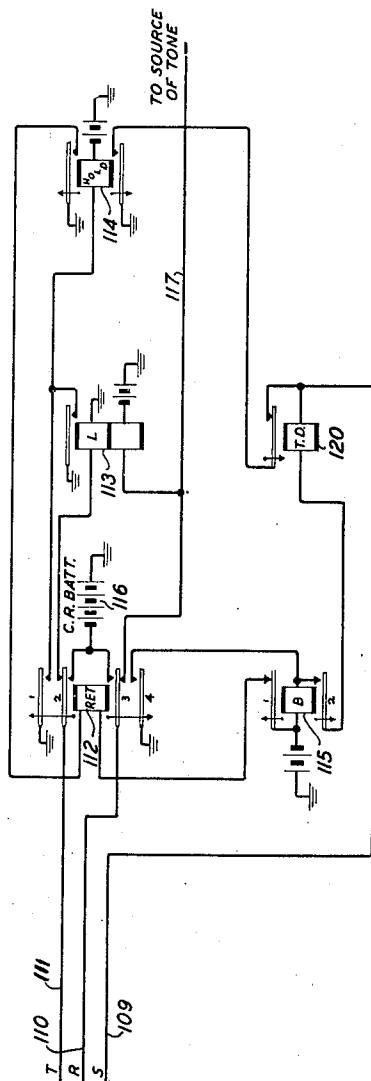


FIG. 8

FIG. 6 FIG. 7

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UNITED STATES PATENT OFFICE

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SPECIAL SERVICE TELEPHONE SYSTEM

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Application January 13, 1944, Serial No. 518,073

3 Claims. (Cl. 179—6.3)

This invention relates to telephone systems and particularly to special service arrangements for use under emergency conditions.

The object of the invention is to provide means to return coins deposited by subscribers under emergency conditions when the normal means for extending connections are all busy and therefore unavailable.

In accordance with this invention a special line finder or equivalent means is employed to make connection with a calling line for which no facilities are at the time available in order to apprise the calling subscriber of such temporary emergency condition and to return the deposited coin.

It will be recognized that this operation may be carried out in a great many ways and that numerous modifications of the specific means shown herein are contemplated as being within the scope of the present invention, due to the many types of telephone systems in use.

By way of example, where coin boxes are arranged so that the deposit of a coin operates the line relay the operation will be as follows. With all regular line finders of a group busy the normal line-finder start lead will be transferred to the special line finder. If a coin is then deposited to originate a call, the corresponding line relay will operate and cause the special line finder to find and cut through to the line in the same manner as a standard line finder. The associated coin return equipment will apply coin return battery for a short interval followed by a special tone for a short interval or the tone and coin return battery may be applied in the reverse order or even simultaneously. Each of these operations may be done by well-known means. After these operations are completed the line finder returns to normal and if other line relays are operated the finder will proceed as above set forth for each of the lines involved.

Again, by way of example, where coin boxes are arranged so that the line relay is operated whenever a receiver is off the hook regardless of whether or not there is a coin in the box a different specific arrangement would be provided. With this type of coin box a line relay would remain operated after coin return if the calling subscriber failed to hang up. As a result the special line finder must be prevented from repeatedly connecting to the same line to the exclusion of other lines. In order to meet this situation, a "cruising" line finder is employed which will have the previously described coin return and tone functions but will connect to lines with operated

line relays in definite sequence in the following manner. When first called into operation, the special equipment will first serve the nearest calling line on the lowest level. After completing its functions on this line as previously described, the finder will not release but will step to the next calling line on the same level. After all lines on this level have been served the finder will release. The level will be marked either by the operation of a marking relay or a recording switch. If calls are still waiting the finder will start again and will cut in on the next level. In this manner the finder will serve all levels by continuing to "cruise" as long as there is an operated line relay and applying coin return battery and tone to each line with an operated relay.

To avoid excessively frequent operation due to one or more lines with receivers off the hook (or permanent signals) the circuit may be arranged so that intervals between the restarting operation are not less than a predetermined amount, for instance, thirty seconds.

A feature of the invention is a means responsive to the lack of normal facilities for connecting with a line and performing a special operation thereover.

Another feature of the invention is a special line-finding arrangement for connecting with a line under temporary emergency conditions to return a deposited coin and to apprise the calling subscriber of the said temporary emergency condition.

Another feature of the invention is a special line finder which under temporary emergency conditions will cruise over the lines to which it may connect and to connect with different ones in turn to perform a special emergency operation thereover.

Other features will appear hereinafter.

The drawings consist of five sheets having eight figures, as follows:

Fig. 1 is a schematic circuit diagram helpful in explaining the principle of operation in connection with prepayment coin service systems;

Figs. 2 and 3, when placed as shown in Fig. 4, provide a more complete circuit diagram of the form of the invention shown in Fig. 1;

Fig. 5 is a schematic circuit diagram similar to that of Fig. 1 showing an alternative form of the invention; and

Figs. 6 and 7, when placed as shown in Fig. 8, provide a more complete circuit diagram of the form of the invention shown in Fig. 5.

In the arrangement shown in Fig. 1, the subscriber at station 1 cannot operate the central

office apparatus until he has deposited a coin 2. The weight of this coin on an arm 3 will close the contacts 4 and 5 of the coin disposal magnet. At the central office the subscriber's line circuit 8 will respond to a grounded tip, the start circuit 9 will be energized and a regular line finder indicated in the broken line rectangle 10 will respond and make a connection to the line in a manner well known.

Under emergency conditions, however, and either when the all finders busy circuit 11 grounds the conductor 12, or the line load control key 13 is operated by the proper authority, the special start circuit 14 will be operated, whereupon a special line finder indicated in the broken line rectangle 15 will make connection to the line and the circuit in the broken line rectangle 16 will apply coin return battery and tone to the line. Any coin in the coin chute will then be returned. If the subscriber is still on the line, the tone applied will notify him that his coin is being returned since an emergency condition exists. As soon as the subscriber hangs up the special line finder will be released. Details of this operation will be understood through the following description of Figs. 2 and 3.

The subscriber's circuit is conventional. The operation of the hook switch 17 will close through a talking circuit to the line wires but the line circuit at the central office will not respond until the tip wire is grounded by the deposit of a coin. When a coin has been deposited a circuit is established from ground, contacts 18, winding of coin disposal magnet 19, tip wire 20, back contact and armature 1 of cut-off relay 21, winding of line relay 22 to battery. Line relay 22 responds and closes a circuit from ground, front contact and armature 1 of relay 22, armature 1 and back contact of transfer relay 23, winding of group relay 24 to battery. Relay 24 grounds the start lead 25 and grounds a particular level contact 26 of the line finders which will respond to the ground on start lead 25. The operation of this apparatus is well known and will not be further described.

An all finders busy circuit is indicated in the broken line rectangle 27. When all the finders available are busy this circuit will place ground on conductor 29 in a manner well known. When conductor 29 is grounded either by the all finders busy circuit 27 or by the line load key 28 the transfer relay 23 will be operated. Under this condition if a call is made a connection is established from ground, front contact and armature 1 of relay 22, armature 1 and front contact of transfer relay 23 to the winding of start relay 30. Relay 30 becomes energized and through its armature 2 places a ground on start conductor 31 which may be traced through armature 3 and back contact of relay 32, contacts 33 and 34 of the set of contacts operated after the switch has taken ten rotary steps, the winding of relay 35 to battery. Relay 35 responds and closes a circuit for relay 36 from ground, armature 3 and front contact of relay 35, back contact and armature of vertical magnet 37, armature 1 and back contact of rotary magnet 38, lower winding of relay 36, back contact and armature 4 of relay 32 to battery. Relay 36 operates and closes a circuit for the vertical magnet 37 from ground, armature 3 and front contact of relay 35, armature 2 and front contact of relay 36, armature 2 and back contact of relay 39, winding of vertical magnet 37, back contact and armature 4 of relay 32 to battery. The vertical magnet 37 is thus placed in a self-operating circuit, for as magnet 37 operates

it opens the circuit of relay 36 and relay 36 in turn opens the circuit of magnet 37. Thereupon magnet 37 releases and closes the circuit for relay 36. Therefore, as long as there is no interference to this action magnet 37 and relay 36 will interact and magnet 37 will lift the brushes 40, 41, 42 and 43 step by step. When brush 40 finds a ground, as on segment 44, from relay 30, it will cause relay 39 to operate through its lower winding, armature 1 and back contact of rotary magnet 38, lower winding of relay 36, back contact and armature 4 of relay 32 to battery. This will hold relay 36 operated and when magnet 37 releases after the movement which placed brush 40 on segment 44 will close a circuit through the winding of vertical magnet 37 and the upper winding of relay 39, front contact and armature 3 of relay 39, front contact and armature 3 of relay 35 to ground. Magnets 37 and 38 do not energize in this circuit but relay 39 does energize. This will prevent further vertical stepping of the switch.

The rotary magnet 38 is now energized in a circuit from ground armature 3 and front contact of relay 35, armature and front contact of relay 36, armature 2 and front contact of relay 39, winding of rotary magnet 38 to battery. As rotary magnet 38 energizes relay 36 is deenergized, whereupon the circuit for rotary magnet 38 is opened. By this interaction the brushes 41, 42 and 43 are stepped around in a rotary direction until the brush 41 encounters a calling condition. When this is found a circuit may be traced from ground, armature 2 and front contact of relay 35, upper winding of relay 36, armature 1 and back contact of relay 32, upper winding of relay 45, brush 41, sleeve terminal 46, front contact and armature 2 of transfer relay 23, armature 2 and front contact of line relay 22, winding of cut-off relay 21 to battery.

Relay 45 responds and closes a locking circuit for itself from battery, front contact and armature 4 of relay 45, armature 2 and front contact of rotary stepping magnet 38 which is energized as the brush 41 comes into contact with the terminal 46, front contact and armature 2 of relay 35 to ground. Armature 3 of relay 45 now short-circuits the upper winding of relay 45 but this relay also closes a circuit for relay 32 which in turn opens the circuit through the upper winding of relay 45. The circuit for the energization of relay 32 may be traced from ground, springs 3 and 2 of the vertical off-normal contacts 47 operated on the first vertical step of the switch, front contact and armature 5 of relay 45, winding of relay 32 to battery. Relay 35 is now deenergized by the movement of armature 3 of relay 32 but being slow to release momentarily establishes a circuit from ground, armature 2 and front contact of relay 35, front contact and armature 1 of relay 32 (which short-circuits the upper winding of relay 36), armature 3 and front contact of relay 45 and thence over the circuit traced to the cut-off relay 21 which causes the energization of this relay and the consequent release of the line relay 22. The energization of the cut-off relay 21 provides a direct path from the armature 2 of transfer relay 23 when the line relay releases. Before relay 35 can open this ground connection to the sleeve wire 48 a substitute ground will be returned from the circuit of Fig. 3 as will be described hereinafter. It should be noted, however, that if now or later the ground on conductor 29 is removed as by the release of key 28 or the action of the all finders

busy circuit 27, relay 23 will release, the special finder will release and a regular finder will be called into service in the usual manner.

Relay 45 is now locked in to ground on sleeve conductor 48, through the front contact and armature 1 of relay 32, relay 32 is locked in to ground on spring 3 of the vertical off-normal contacts 47, front contact and armature 5 of relay 45, and when relay 35 releases in parallel therewith through the back contact and armature 1 of relay 35. Relays 36, 39 and the stepping magnets of the switch are released and the switch remains set with only relays 32 and 45 energized. Upon the release of the line relay 22 the group relay 30 is released.

Upon energization of relay 45, the tip and ring conductors of the line now connected to brushes 43 and 42, respectively, are extended by armatures 1 and 2 of relay 45 to the coin return and tone circuit of Fig. 7. Here a circuit may be traced from the tip conductor 49 over armature 2 and back contact of relay 51, the upper winding of line relay 52 to battery and from the ring conductor 50 over armature 3 and back contact of relay 51, the lower winding of line relay 52 to ground. Either a ground on the tip as from a deosited coin or a low resistance connection between the tip and ring as from the operation of the switchhook 17 will cause the energization of the line relay 52. This relay grounds the hold relay 53 and relay 53 in turn grounds the sleeve wire 48 through its armature 2 and operates relay 51 through its armature 1. The circuit for relay 51 extends through the armature and back contact of relay 54 to ground. Relay 51 in operating causes the energization of relay 54 and relay 54 in operating opens the circuit of relay 51. However, relays 51 and 54 are slow releasing so that relay 51 does remain operated for a short period. During this period the tip and ring conductors are disconnected from the line relay 52 and alternatively connected to coin return battery 55. Any coin at the substation will be returned. Now upon the release of relay 51 the ground on the tip has been removed and the line relay will fail to reoperate unless the subscriber has failed to hang up. A source of tone may be connected by conductor 56 to one winding of the line relay 52 so that such a tone will be connected intermittently to the subscriber's line to notify him that an emergency condition exists and that there is no apparatus available to extend his connection. If after the coin has been returned by the energization of relay 51 when relay 51 next releases the line relay fails to reoperate, the hold relay 53 will be released and since ground is now removed from sleeve conductor 48 the special finder will be released. The removal of ground from conductor 48 releases relays 45 and 32 and establishes a circuit for release magnet 57 from ground, springs 3 and 2 of off-normal contacts 47, back contact and armature 1 of relay 35, armature 5 and back contact of relay 45 back contact and armature 1 of relay 39, springs 4 and 5 of off-normal contacts 47 winding of release magnet 57 to battery.

In the coin return and tone circuit of Fig. 3 a timing device relay is operated from the hold relay 53. The relay 58 is rendered slow to operate so that under normal operating conditions for relay 53 the relay 58 will not respond. However, if the application of coin return battery to the tip does not result in the removal of ground from the tip or if the subscriber does not hang

up within a reasonable time or under any other emergency or trouble condition the line relay reoperates each time relay 51 releases, then relay 58 will operate and will energize an alarm circuit 61. A switch 62 is provided to short-circuit the upper armature and back contact of relay 58. With this switch closed the coin return and tone circuit will be held until an attendant responding to the alarm circuit clears the trouble. With this switch open, the operation of relay 58 removes ground from the sleeve and releases the special apparatus. The alarm circuit may in this case be arranged to record the trouble. If the trouble on the line persists the special finder will be repeatedly called into service. In order to prevent unduly frequent operation and to give the special finder opportunity to service other lines the condenser 59 and resistance 60 network may be provided to hold the relay 58 operated for any given period.

Another form of the invention is shown in Figs. 5, 6 and 7. In this case the coin does not have to be deposited until after the dial tone is received. Despite this subscribers sometimes deposit a coin before this time and hence the arrangement of Figs. 5, 6 and 7 is provided to return such coins erroneously deposited under emergency conditions. In accordance with the schematic of Fig. 5 a subscriber at station 70 may make a call by merely operating his switchhook. His line circuit 71 at the central office will respond and by grounding the start wire 72 will operate the start circuit 73 which in turn will cause a regular finder indicated by the broken line rectangle 74 to extend his line to the selective switches which he may then operate in a conventional manner. As in the arrangement shown in Fig. 1, if the all finders busy circuit 75 or the line load key 76 grounds the start wire 77 then a special finder indicated by the broken line rectangle 78 will operate to cause the coin return circuit indicated by the broken line rectangle 79 to apply coin return battery to the line. In this case a cruising line finder will be employed to go over all the lines in trouble in turn and not to repeatedly connect to one line to the exclusion of others. The action of this special finder will be explained in detail hereinafter.

Considering the more detailed circuits of Figs. 6 and 7, when the telephone 80 is removed from the switchhook 81, the line relay 82 at the central office will respond. The presence or the absence of a coin in the chute to operate the contacts 83 does not affect this operation in any way. In this case a third relay in the line circuit is not employed. Upon the operation of the line relay 82, a circuit is extended from ground, front contact and armature 1 of line relay 82, group relay 84 to battery. Relay 84 responds and grounds the start lead 85 whereupon the line finder indicated by the circuits in the broken line rectangle 86 operates in the conventional manner.

In case the all finders busy circuit 87 or the line load key 88 has been operated under emergency conditions to ground the start lead 89 the cruising finder in the lower right-hand portion of Fig. 6 will be started in operation. Ground on lead 89 will be used to operate the start relay 90. This will establish a connection from ground front contact and armature of relay 90, armature 3 and back contact of relay 91 contacts 1 and 2 of the spring combination 93 operated at the switch has taken ten rotary steps, winding

of relay 92 to battery. Relay 92 operates and establishes a circuit from ground armature 3 and front contact of relay 92 back contact and armature of vertical magnet 94, armature and back contact of rotary magnet 95 lower winding of relay 95, back contact and armature 4 of relay 91 to battery. Relay 96 operates and closes a circuit from ground armature and front contact of relay 92, armature and front contact of relay 96, armature 2 and back contact of relay 97, winding of vertical magnet 94, back contact and armature 4 of relay 91 to battery. Magnet 94 and relay 96 are in mutually controlling circuits whereby magnet 94 will step the brushes of the switch until stopped by a condition established by brush 98. This condition is one established under control of wiper 99 controlled by the stepping magnet 100. When brush 98 encounters a segment 101 which at the time is connected through the wiper 99 to ground a circuit through the lower winding of relay 97, armature 1 and back contact of rotary magnet 95, lower winding of relay 96, back contact and armature 4 of relay 91 is established, with the result that relay 97 is energized and relay 96 is prevented from releasing. Relay 97 now locks through its upper winding, front contact and armature 3 of relay 97 contacts 4 and 3 of spring combination 93, contacts 2 and 3 of the vertical off-normal spring combination 102 to ground. Thereupon a circuit is established for rotary magnet 95 from ground armature 3 and front contact of relay 92, armature and front contact of relay 96, armature and front contact of relay 97 winding of rotary magnet 95 to battery. Since magnet 95 controls the circuit of relay 96 by its armature 1 and since relay 96 controls the circuit of magnet 95 these two devices will interact until a calling line is encountered. Thus the brushes 103, 104 and 105 will be rotated step by step until brush 103 encounters terminal 106 whereupon a circuit is established from ground, armature 2 and front contact of relay 92 upper winding of relay 96, armature 1 and back contact of relay 91, upper winding of relay 107, brush 103, terminal 106, armature 2 and front contact of line relay 82, winding of cut-off relay 108 to battery. Relay 107 responds and operates relay 91 from ground, front contact and armature 6 of relay 107, winding of relay 91 to battery. Thereupon a temporary circuit, for the release time of relay 92 is established from ground, armature 2 and front contact of relay 92 sleeve wire 109, front contact and armature 1 of relay 91, armature and front contact of relay 107, brush 103, terminal 106, armature 2 and front contact of line relay 82, winding of cut-off relay 108 to battery. Cut-off relay 108 operates and locks its armature 3 and front contact independently of line relay 82 which now releases. The ground placed on sleeve wire 109 also locks relay 107 through its armature 4 and front contact and its lower winding. Also upon the operation of relay 107 its upper winding is first short-circuited through the back contact and armature 1 of relay 91 and then opened as relay 91 operates. The ground supplied to the sleeve conductor 109 by relay 92 is replaced by a ground from the coin return circuit of Fig. 7 as will appear hereinafter. At this stage with the brushes 103, 104 and 105 set on the terminals of a calling line relays 90, 91, 97 and 107 will be energized and all other relays and magnets will be released. It will be noted that unlike the previous case relay 97 is main-

tained energized so that further rotary movement may take place.

Upon the operation of relay 107 the tip and ring conductors of the calling line are extended through armatures 1 and 2 of relay 107 to tip and ring conductors 111 and 110 respectively. These may be traced through armatures 2 and 3 of relay 112 to the upper and lower windings of line relay 113 respectively whereupon this relay will operate. The operation of relay 113 results in the operation of relay 114 which closes a circuit through the winding of relay 112 to the back contact and armature of relay 115 to battery. Relay 112 operates and closes a circuit for relay 115 but both these relays being slow to release will cause the application of coin return battery 116 to the tip and ring conductors for a definite interval. If a coin is in the chute it will now be deposited. At the same time a tone will be applied to the calling line from a source of tone over conductor 117 connected to the lower winding of line relay 113.

The hold relay connects ground over the armature and back contact of slow to operate relay 120 to the sleeve conductor 109. This ground also extends through the winding of relay 120, armature 2 and front contact of relay 115, winding of relay 115 to battery to lock in this last relay so that in this case the coin return battery is applied to the calling line but once and then when relay 112 releases the tone is applied thereto until the slow operate relay 120 operates. When this happens the ground is removed from sleeve conductor 109 and the special finder is released.

It will be noted that upon the removal of ground from conductor 109, relays 91 and 107 will release. Thereupon a circuit is again established for relay 92, providing relay 90 is still energized. Hence the rotary magnet is again energized as before so that the brushes will rotate over the remainder of the level on which it has already been set. If another calling line is found on this level the action above described will be repeated. If no other calling line is found then the circuit of the A relay 92 is broken and the holding circuit of relay 97 is opened by the movement of spring combination 93 as the brushes move off their tenth set of contacts. With relay 92 released a circuit is established from ground, contacts 3 and 2 of spring combination 102, back contact and armature 1 of relay 92, armature 5 and back contact of relay 107, back contact and armature 1 of relay 97, contacts 4 and 5 of spring combination 102, winding of release magnet 121, and winding of advance relay 122 to battery. The release magnet 121 will release the switch to normal and relay 122 will transmit an impulse to stepping magnet 100 for advancing the wiper 99. If when the switch releases the start relay 90 is still operated, the switch will hunt for another calling line and will apply coin return battery and tone thereto and then release as before. This action will continue as long as the start wire 89 is grounded.

If the ground is removed from the start wire before the switch has reached a calling line, then the A relay 92 will be released and the switch will be halted and released without completing its hunting operation.

It will be readily apparent that other combinations coming within the scope of the present invention can be produced.

What is claimed is:

1. In a check controlled dial telephone system, apparatus for extending connections from a call-

ing line, a line finder responsive to an incoming call during the busy condition of all available said apparatus for establishing a circuit connection thereto, and means in said circuit connection for controlling the refunding of a deposited check.

2. In a check controlled dial telephone system, apparatus for extending connections from calling lines, a line finder responsive to one or more incoming calls during the busy condition of all available said apparatus for successively establishing a circuit connection to said calling lines, and means in said circuit connection for causing the return of all checks deposited in connection with said calling lines.

5 3. In a check controlled dial telephone system, apparatus for extending connections from calling lines, a line finder responsive to one or more incoming calls during the busy condition of all available said apparatus for successively establishing a circuit connection to said calling lines, a source of check return battery, and a source of tone in said circuit connection, and means for applying said sources to a calling line upon the establishment of a connection thereto by said line finder.

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