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TOLL TELEPHONE DIVERSION SYSTEM

Filed Nov. 7, 1944

2 Sheets-Sheet 1

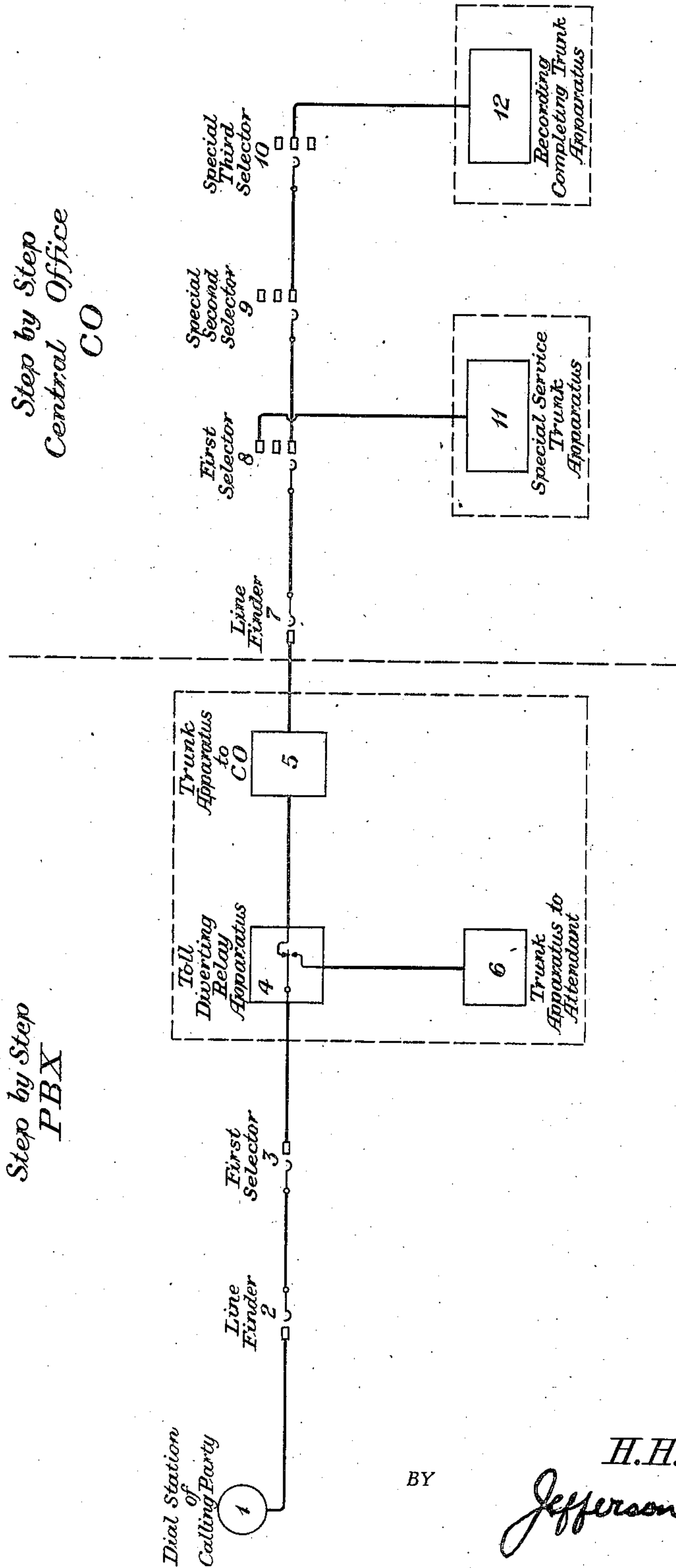


Fig. 1

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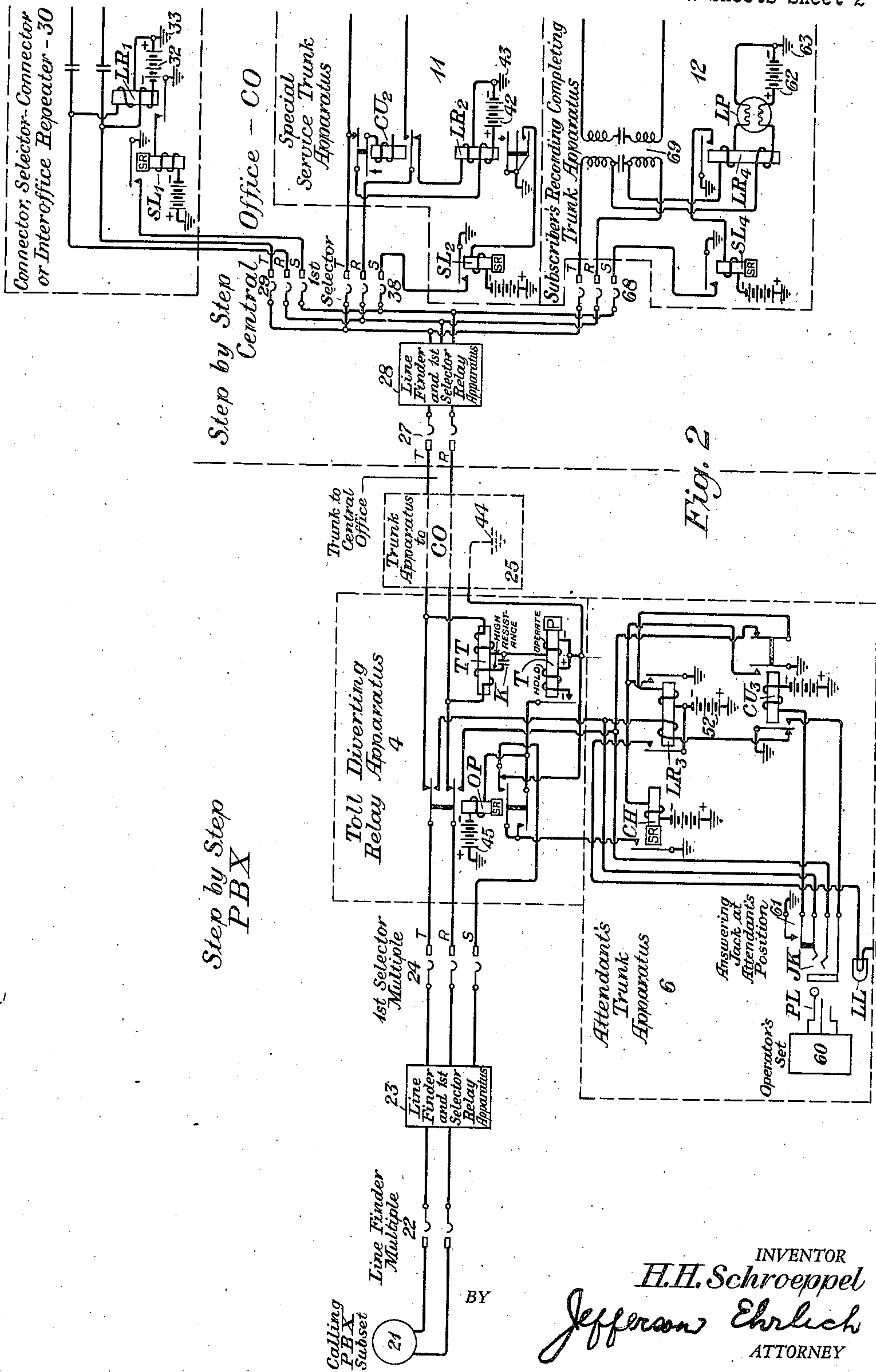
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TOLL TELEPHONE DIVERSION SYSTEM

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5 Claims. (Cl. 179-27)

1

This invention relates to telephone systems, and especially to step-by-step telephone systems in which private branch exchange apparatus, otherwise known as PBX, is employed to connect one or more calling stations to a central office. More particularly, this invention relates to apparatus in step-by-step telephone systems for automatically diverting certain types of calls, such as toll calls, to an attendant at the PBX.

Telephone companies offering a dial type of PBX service have heretofore made available to their subscribers a special arrangement of apparatus by which the calling stations within the PBX area may dial local calls unrestrictedly outside the PBX area, but other calls would be diverted to the PBX attendant. The local calls may be completed through the PBX equipment and through the equipment of the associated central office without requiring the attention of the PBX attendant. Although a calling station within the PBX area may dial local numbers without restriction, the arrangement was nevertheless set up so as to automatically divert calls involving toll charges from the central office to the PBX attendant so that such toll calls may be completed only by the PBX attendant. However, the equipment required for this kind of service is so expensive in step-by-step telephone systems as to be practically prohibitive.

Accordingly, it is an object of this invention to provide simple and inexpensive equipment in step-by-step dial telephone systems to automatically divert to the PBX attendant certain types of calls, such as toll calls, while permitting other types of calls, such as local calls, to be made unrestrictedly.

In present step-by-step systems, the central office battery has its positive terminal grounded, but the polarity of the battery is reversed to operate the calling party's message register when a call is completed. In accordance with the present invention, two polarities of batteries are employed at the central office, one for use in completing local calls and the other for diverting toll calls to an attendant. The battery used for completing local calls may be one having its positive terminal grounded and the other battery may be one having its negative terminal grounded. A relay operated by the negatively grounded battery and non-operated by the positively grounded battery will be employed for the call diverting operations.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawings in which Figure 1 illustrates sche-

2

matically the general features of a step-by-step telephone system employing the principles of the invention, and Fig. 2 shows a more detailed diagram of the apparatus required to practice the invention.

Referring to Fig. 1 of the drawings, the PBX office and the central office CO are shown connected to each other in a step-by-step telephone system. The calling station designated 1, which is of the dial type, is connected through a line finder 2 and, after dialing the central office code, is then connected through a first selector 3 to toll diverting relay apparatus 4 and trunk apparatus 5, the latter apparatus providing a path over cable conductors to the central office CO. When the calling station 1 is thus connected to the central office, line finder 7 is caused to find the calling trunk and dial tone is returned from the associated selector 3. When the calling station 1 dials number 0, for example, it will be connected to the central office CO over the equipment already described, then through first selector 8 to the special service trunk apparatus 11. On the other hand, when the calling station 1 dials No. 112, for example, it will be connected to the central office CO over the equipment already described, then through the first selector 8, the special second selector 9 and the special third selector 10 to the recording completing trunk apparatus 12. The calling station may dial number 0, for example, to reach the special apparatus 11 so that the central office operator may then complete a short haul toll call. Number 112 may be dialed by the calling station 1 to reach the central office recording completing apparatus 12 so that the central office operator may then complete a long distance call to another city, for example. However, according to the present invention, the dialing of numbers 0 or 112 will actuate the apparatus 11 or 12 so as to automatically switch the calling party's line at the PBX toll diverting apparatus 4 to the attendant's trunk apparatus 6. By this arrangement the toll or long distance calls will be controlled by the PBX attendant so that only those calls that are authorized by the attendant will be completed by the attendant through the central office CO. The toll diverting apparatus will remain unoperated by ordinary local calls from the calling station so that such calls may be completed through the central office CO in the usual manner. But the toll diverting feature will come into play only in response to predetermined dialed codes emanating from the calling station 1 to prevent the completion of certain types of calls,

such as toll or long distance calls, unless sanctioned by the PBX attendant.

The essential equipment in use at present in step-by-step offices may be understood by considering the arrangement of Fig. 2 when the calling station 21 dials a code to complete a local call. The apparatus labeled 4, 6, 11 and 12 in Fig. 1 is shown in greater detail in Fig. 2. When the calling station 21 dials a local number, the calling station 21 will be connected to the tip and ring conductors T and R of a trunk leading to the central office CO, through equipment of the PBX office, the PBX equipment including a line finder 22, line finder and first selector relay apparatus 23, a first selector 24, the upper armature of a relay such as OP and the back contacts of these armatures, and trunk equipment 25 which controls the trunk having tip and ring conductors T and R extending to the central Office CO. At the central office CO, the connection of the calling station 21 continues over a line finder 27, line finder and first selector relay apparatus 28, a first selector 29, and then through second and third selectors if required (not shown) to a connector, selector-connector or interoffice repeater 30. In the device 30, the circuit continues over the windings of relay LR₁ to battery 32 and ground 33. The line relay LR₁ will then operate and in turn operate relay SL₁ to ground the sleeve terminal S so as to hold the connection. Relays LR₁ and SL₁ also perform other functions, such as to control the establishment of the connection to the called station. It is important to note that battery 32 is the usual central office battery which has its positive terminal grounded in step-by-step systems and that, after the called station has answered, this battery is connected to the tip conductor T of the trunk while the ground 33 is connected to the ring conductor R of the trunk.

Suppose that the calling station 21 dialed number 0 instead of the number of a local station. In response to the number 0, a path through the PBX station as already outlined will be traversed to connect the calling station 21 to the trunk conductors T and R. At the central office CO the path will be continued through the line finder 27, the line finder and first selector relay apparatus 28, then through the first selector 38, the armatures of cut-off relay CU₂ and their back contacts, the windings of line relay LR₂ to battery 42 and ground 43. It is noted that battery 42 is poled in a direction which is opposite to that of battery 32, the negative pole of battery 42 being grounded at 43. The function of battery 42 will be explained presently. The operation of line relay LR₂ will occur upon the completion of the circuit just traced and it in turn will cause relay SL₂ to operate over an obvious path provided by the armature and make contact of the line relay LR₂. Relay SL₂ will connect ground to the sleeve terminal of the first selector 38 and the line finder and first selector relay apparatus 28.

As soon as the trunk apparatus 25 at the PBX office is seized by the calling party's line, ground 44 will be connected to the sleeve terminal S of the first selector 24 over a circuit which includes the make-before-break contacts associated with the lower inner armature of relay OP. Moreover, as soon as the first selector 38 at the central office CO is seized, a circuit will be completed to the operating winding of polar relay T. The latter circuit may be traced to include ground 43, battery 42, the lower winding of line

relay LR₂, the upper armature and back contact of cut-off relay CU₂, the tip terminal of first selector 38, then through the line finder and first selector relay apparatus 28, the tip terminal of line finder 27, then over the tip conductor T of the trunk, then through the trunk apparatus 25 at the PBX office, the right winding of choke TT, the right or operating winding of relay T to ground 44. The current flowing from battery 42 is in a direction that will cause relay T to become operated. Relay T will then be locked in its operated position over a circuit which includes ground 44, the left or holding winding of relay T and its make contact and armature, the winding of relay OP, battery 45 and ground. Inasmuch as the winding of relay OP is included in the locking circuit of relay T, relay OP will be operated at the same time that relay T becomes locked.

In response to the operation of relay OP, the previously described path between the first selector 24 and the trunk conductors T and R will be opened at the back contacts of the upper armatures of relay OP. The path to the calling station 21 will now be transferred to the PBX attendant's trunk apparatus 6. This diversion of the calling station 21 will cause the line relay LR₃ of the PBX attendant's trunk apparatus 6 to become operated, the operating circuit including battery 52, the right winding of relay LR₃, the right outer armature and back contact of cut-off relay CU₃, the inner upper make contact and armature of relay OP, the ring terminal of first selector 24, through apparatus 23, the ring terminal of line finder 22, calling station 21, the tip terminal of line finder 22, the apparatus 23, the tip terminal of first selector 24, the upper outer armature and make contact of relay OP, the left winding of line relay LR₃, the left back contact and armature of cut-off relay CU₃ and ground. The operation of line relay LR₃ in turn operates relay CH over an obvious path completed through the right make contact and armature of line relay LR₃. The closure of the make contact of relay CH connects ground through the lower inner armature and make contact of relay OP to the sleeve terminal of first selector 24 to hold the first selector 24 in its present position. The closure of the make contact of relay CH will also provide a holding path for relay OP through the lower outer make contact and armature of relay OP. The operation of line relay LR₃ also completes an obvious path over its left armature and make contact to illuminate the PBX attendant's lamp LL. This will signal the PBX attendant and the attendant may then obtain the necessary information from the calling station to complete the desired call. The attendant's set 60 may be connected to the calling station 21 merely by inserting plug PL into jack JK. When this happens the cut-off relay CU₃ will become operated over an obvious path completed through the ground contact 61 of jack JK. Relay LR₃ will release in response to the operation of relay CU₃. The release of relay LR₃ will extinguish lamp LL, but ground at the inner right armature of relay CU₃ will hold relay CH operated. The PBX attendant may then connect the calling station to the central office CO, but the details of the interconnecting circuit are not shown. The latter circuit to the central office CO may be completed through jack JK or through a similar jack multiplied thereto.

It will be clear that upon the operation of relay OP as already described hereinabove, the trunk

5

equipment 25 at the PBX station will be released so as to be available for another call. At the same time line relay LR₂ will be released and relay LR₂ will in turn release relay SL₂. The equipment at the central office CO will therefore also be available for another call. The release of the trunk equipment 25 will also disconnect ground 44 from the operating winding of relay T, whereupon relay T will release. Although relay T releases, relay OP and the first selector 24 will be held operated by ground provided by the armature of relay CH. Relay OP will be held operated until the calling station 21 has completed the call. When the PBX attendant removes the plug from jack JK or its multiple, relay CU₃ will release, thereby releasing relay CH as well as relay OP. The equipment at the PBX station will be returned to normal and will now be ready for another call.

The relay T will be operated when it is connected to battery 42 but will remain unoperated when it is connected to battery 32. This is due to the fact that relay T is of the polar type and will readily distinguish between oppositely poled batteries such as 32 and 42. Hence local calls of the usual type will fail to operate the toll diverting relay equipment 4 at the PBX station, but other calls will operate the toll diverting equipment 4 and thereby call in the PBX attendant. It is noted that the operation of the toll diverting equipment 4 will promptly break the circuit between the calling station 21 and the central office CO.

Likewise, when the calling station 21 dials number 112, the connection to the central office CO will be completed by the same path as already considered for the case when number 0 is dialed. At the central office CO the path will then include the line finder 27, the line finder and first selector relay apparatus 28 and the first selector 68 to the recording completing trunk apparatus 12. The path through the latter apparatus 12 will include the primary windings of repeating coil 69, the windings of line relay LR₄, the filaments of lamp LP, battery 62 and ground 63. The line relay LR₄ will become operated, in turn operating relay SL₄. Relay SL₄ will then extend ground to the first selectors 24 and 68. It will be observed that battery 62 is of the same polarity as battery 42 and hence relay T of the toll diverting relay apparatus 4 will be operated as soon as battery 62 is connected to the tip conductor T. The connection of the calling station 21 to the central office CO will therefore be broken, but will be diverted to the PBX attendant's trunk circuit 6, in the manner already described hereinabove.

Both batteries 42 and 62 are shown connected to the tip side T of the trunk interposed between the PBX station and the central office CO. This is important for the connection of either battery 42 or 62 will not operate the subscriber's message register (not shown) on calls completed by the PBX attendant. The reversal of battery 32 cannot be used for toll diversion because such a reversal would operate the message register falsely and would, moreover, cause the equipment to respond falsely to local calls. Consequently a separate battery, such as 42 or 62, of a polarity which is opposite to that of battery 32, is important in the practice of this invention.

It will be observed that the choke coils TT are bridged across the trunk conductors T and R in series with a condenser K. This bridging circuit will present a large impedance to talking cur-

6

rents so that such currents will not be absorbed by the bridging elements. The condenser K will also act to block the flow of direct currents between the left coil of impedance device TT and the operating winding of relay T.

With the above-described arrangement the local calls by the calling station 21 will reach the central office CO through the PBX equipment and may be completed without attracting the attention of the PBX operator. Other calls, such as toll calls, will reach the central office CO but they will be automatically diverted to the PBX attendant before they are completed by the central office operator.

While this invention has been shown and described in certain embodiments merely for illustrative purposes, the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. In a step-by-step telephone system, the combination of a dial telephone subset, a line to which said dial subset may be connected, a polar relay connected to said line, two oppositely poled grounded batteries, means responsive to a first predetermined code dialed by said subset to connect the positively grounded battery to said line, said positively grounded battery being unable to transmit current through the winding of said polar relay to operate said polar relay, means responsive to a second predetermined code dialed by said subset to connect the negatively grounded battery to said line so as to operate said polar relay, and means responsive to the operation of said polar relay to break the connection between said subset and said line.

2. In a step-by-step telephone system, the combination of a PBX serving one or more dial telephone stations within its area, a central office which may be connected to said PBX, a positively grounded battery and a negatively grounded battery at said central office, a polar relay at said PBX, means responsive to a first predetermined code received by said PBX from a dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the positively grounded battery to said circuit, said polar relay being connected to said positively grounded battery but remaining unoperated, means responsive to a second predetermined code received by said PBX from a dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the negatively grounded battery to said circuit so as to operate said polar relay, and means responsive to the operation of said polar relay to break the circuit between said PBX and said central office.

3. In a step-by-step telephone system, the combination of a PBX serving one or more dial telephone stations within its area, a central office which may be connected to said PBX, a positively grounded battery and a negatively grounded battery at said central office, a polar relay at said PBX, means responsive to a first predetermined code received by said PBX from a dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the positively grounded battery to said circuit, said polar relay being connected to said positively grounded battery but remaining unoperated, means responsive to a second predetermined code received by said PBX from a

7

dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the negatively grounded battery to said circuit so as to operate said polar relay, and means responsive to the operation of said polar relay to signal the PBX and to prevent the completion of any call from said dial station through said central office.

4. In a step-by-step telephone system, the combination of a PBX serving one or more dial telephone stations within its area, a central office which may be connected to said PBX, a positively grounded battery and a negatively grounded battery at said central office, a polar relay at said PBX, means responsive to a first predetermined code received by said PBX from a dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the positively grounded battery to said circuit, said polar relay being connected to said positively grounded battery but remaining unoperated, means responsive to a second predetermined code received by said PBX from a dial station within its area to establish a circuit from said dial station through said PBX to said central office and to connect the negatively grounded battery to said circuit so as to operate said polar relay, and means responsive to the

8

operation of said polar relay to break the circuit between the PBX and said central office and simultaneously to signal the PBX.

5. In a step-by-step telephone system, the combination of a calling station of the dial type, a PBX to which the calling station is connected, a central office, a line having tip and ring conductors interposed between the PBX and the central office, a positively grounded battery and a negatively grounded battery at the central office, a polar relay connected to the tip conductor at the PBX, means responsive to a predetermined code dialed by said calling station to seize said line and connect the positively grounded battery to said tip conductor, the polar relay remaining unoperated when the positively grounded battery is connected to said tip conductor, means responsive to another predetermined code dialed by said calling station to seize said line and connect the negatively grounded battery to the tip conductor, the polar relay being operated when the negatively grounded battery is connected to said tip conductor, and means responsive to the operation of said polar relay to disconnect the calling station from said line and to simultaneously signal the PBX.

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