

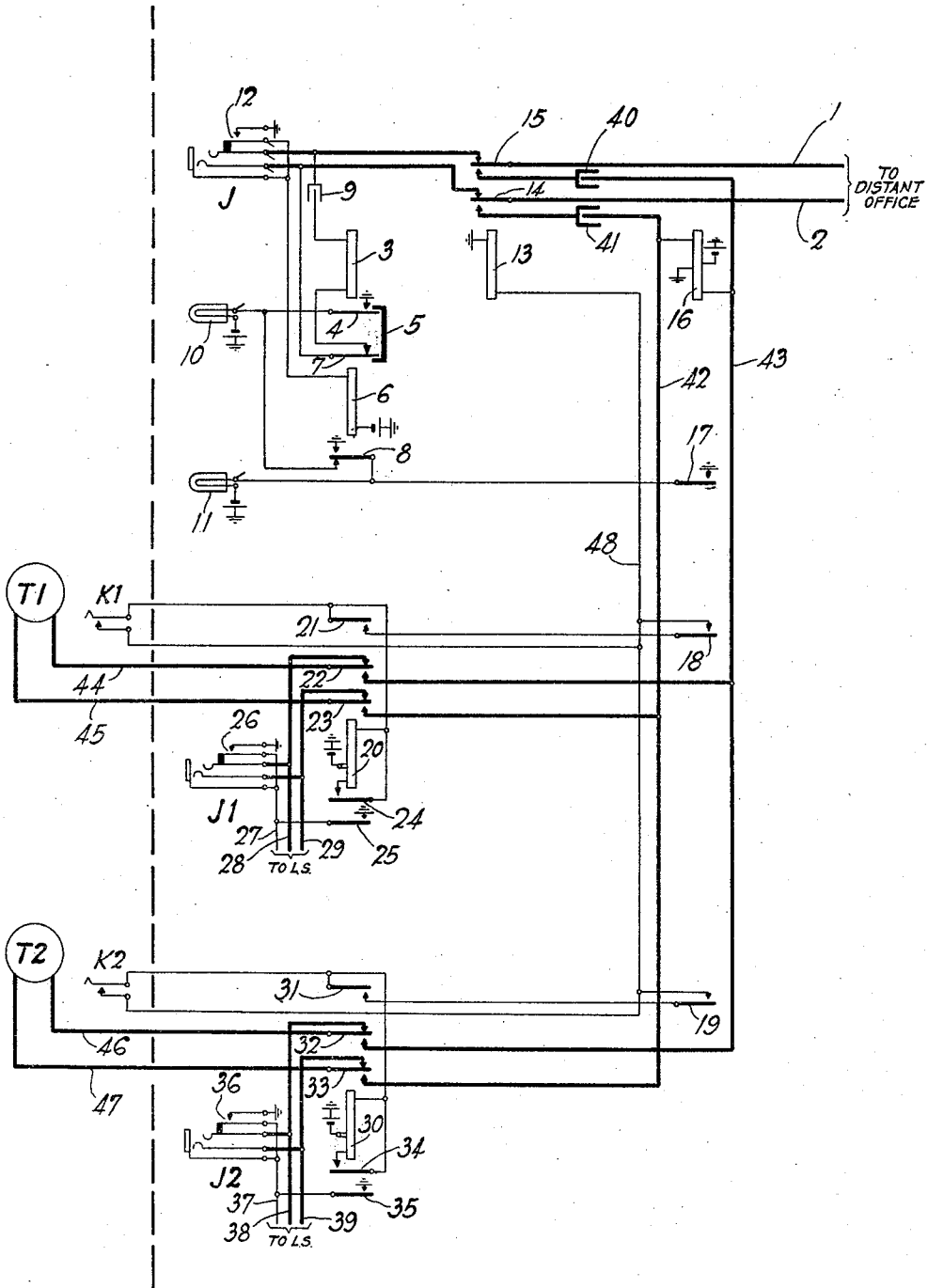
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TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

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The present invention relates in general to telephone systems, but is concerned more particularly with small automatic exchanges, commonly known as private automatic exchanges, of the type employing an attendant's cabinet for completing calls to and from distant exchanges. The main object of the invention is to provide an arrangement for giving secret service to a limited number of the subscribers in the private automatic exchange.

According to one feature of the invention, a special service trunk is provided to which the lines of subscribers entitled to secret service, and the incoming trunk line, over which the secret service facilities are to be provided, may be connected under control of the subscribers entitled to the service.

According to another feature of the invention, an incoming call over the trunk line is completed in the regular manner by the attendant by means of a cord circuit and, by the operation of a key at the subscriber's station, both the trunk line and the subscriber's line are disconnected from the jacks at the attendant's cabinet and connected to the special service trunk.

A still further feature of the invention lies in the arrangement which prevents a second privileged subscriber from connecting his line to the special secret service trunk while a connection is established thereover.

The above and other features of the invention not specifically mentioned at this time will be clearly understood from a perusal of the following description and explanation of the same when read in connection with the accompanying drawing comprising one finger only, which shows by means of the usual schematic diagram sufficient apparatus at a private automatic exchange to enable the invention to be understood.

The trunk line comprising conductors 1 and 2 connects the private automatic exchange with a second exchange and terminates in the P. A. X. in the jack J at the attendant's cabinet. The usual ring-up relay 3 with its mechanical locking arrangement, and the cut-off and busy relay 6 is provided on this trunk line. The subscribers' substations indicated as T1 and T2 are subscribers of the P. A. X. who are entitled to the secret service. The subscribers' lines 44 and 45, and 46 and 47 are normally connected to the line-multiple jacks J1 and J2 at the attendant's cabinet, and to the P. A. X. lineswitches and connector bank terminals over conductors 27, 28, and 29, and 37, 38, and 39, respectively.

A detailed description of the operation of the invention will now be given. For this purpose, it will be assumed that the trunk line comprising conductors 1 and 2 has been seized in a distant office by an operator or by an automatic switch having access thereto. The ringing current projected over the trunk line extends over armature 15 and its resting contact, condenser 9, winding of ring-up relay 3, resting contact of armature 7 and said armature, resting contact of armature 14 and said armature, to the other trunk conductor 2. Relay 3 responds to the ringing current and operates its armature 4 which is thereupon mechanically locked up by means of the well-known interlocking arrangement indicated diagrammatically at 5. The closing of armature 4 and its working contact connects ground to the line lamp 10 and, through the resting contact of armature 8 and said armature to the busy lamp 11. These two lamps light up to inform the operator that a call is waiting on the trunk line accessible at the attendant's cabinet over jack J.

The attendant, upon noting the lighted condition of the line lamp 10, inserts the answering plug of a cord circuit into jack J. The cord circuits at the attendant's cabinet may be of the well-known common battery type. Jack springs 12 are closed, thereby connecting ground through the winding of relay 6 to battery. Relay 6 operates and at armature 7 and its resting contact, opens the circuit to the ring-up relay 3, and at the same time releases the mechanical locking arrangement so that armature 4 of relay 3 restores to normal and extinguishes line lamp 10. At armature 8 and its resting contact, relay 6 opens the original circuit for the busy lamp 11 and at the working contact of this

armature it connects ground directly to the lamp to maintain this lamp lighted to mark the trunk busy.

The attendant now converses with the party who has originated the call over the trunk line and finds out to whom he wishes to speak. It will be assumed that the calling party desires to talk with the subscriber at substation T1. Accordingly, the attendant inserts the calling plug of the cord into the line-multiple jack J1 associated with the line extending to substation T1. She then rings the subscriber at substation T1 in the usual manner and when the subscriber answers the talking connection is completed over jacks J and J1 and the cord circuit at the attendant's cabinet.

In case the calling man and the subscriber at substation T1 wish to eliminate all possibility of any one overhearing their conversation, the subscriber at substation T1 momentarily operates the key K1. The closing of the contacts of this key completes a circuit from battery, upper winding of relay 20, contacts of key K1, conductor 48, winding of relay 13 to ground. Relays 13 and 20 operate in series in this circuit. At armature 21 and its working contact, relay 20 prepares a locking circuit for itself independent of the key K1. At armatures 22 and 23 and their resting contacts it disconnects the subscriber's line from the line-multiple jack J1 at the attendant's cabinet and from the subscriber's lineswitch and connector bank normals, and at the working contacts of these armatures connects the subscriber's line to the secret service trunk comprising conductors 42 and 43. At armature 25 and its working contact it connects ground to conductor 27 to make the line of the subscriber at substation T1 busy in the bank of connectors and to ground the sleeve of jack J1 so that the line will test busy at the attendant's cabinet. At armature 24 and its working contact relay 20 places its low resistance lower winding in multiple with the high resistance upper winding to act as a shunt to corresponding relays of other subscribers entitled to this service, thereby preventing any other subscriber, such as the one at substation T2, from connecting his line to the secret service trunk.

Relay 13, in operating, at armatures 14 and 15 and their resting contacts disconnects the incoming trunk line comprising conductors 1 and 2 from the jack J1 at the attendant's cabinet, and at the working contacts of these armatures connects the trunk line through condensers 40 and 41 to the secret service trunk comprising conductors 42 and 43. When the subscriber's line comprising conductors 44 and 45 is connected to the secret service trunk line, relay 16 operates in a circuit from ground, lower winding of relay 16, conductor 43, working contact of armature 22 and said armature, line conductor 44, through

the loop at substation T1, line conductor 45, armature 23 and its working contact, conductor 42, upper winding of relay 16, to battery. Relay 16 operates in this circuit and at armature 17 and its working contact connects ground to the busy lamp 11 to maintain this lamp lighted. At armature 18 and its working contact it completes the previously prepared locking circuit for relays 13 and 20. This locking circuit extends from ground, winding of relay 13, conductor 48, working contact of armature 21 and said armature, upper winding of relay 20 to battery, and in parallel thereto over armature 24 and its working contact, lower winding of relay 20 to battery. The key K1 at substation T1 may now be released.

As long as the conversation continues over the secret service trunk, the trunk line comprising conductors 1 and 2 will be made busy at the attendant's cabinet since ground is maintained on the busy lamp 11 at armature 17 and its working contact. This busy condition will be maintained even though the attendant withdraws the plugs of the cord circuit from jacks J and J1 when she learns that the connection is no longer completed over her cord circuit.

Should one of the other subscribers entitled to the secret service attempt to get in on the secret service trunk while the above-established conversation is going on, he is prevented from so doing by the low resistance lower winding of relay 20, which effectively shunts out all other relays such as 20 and 30. Assuming that the subscriber at substation T2 attempts to get in on the secret service trunk, he will operate his key K2, thereby completing a circuit from battery, upper winding of relay 30, contacts of key K2, conductor 48, winding of relay 13, to ground. However, the high resistance upper winding of relay 30 does not receive sufficient current to operate this relay since its winding is in multiple with the low resistance lower winding of relay 20. It is, therefore, seen that when one of the subscribers has connected his line to the secret service trunk, none of the other subscribers entitled to the secret service can interfere.

The subscriber in the P. A. X., such as the subscriber at substation T1 in the above-established connection, receives talking battery through the windings of relay 16. The subscriber in the distant office receives talking battery locally in the office.

When the conversation has been completed, the subscriber at substation T1 replaces his receiver, thereby opening the loop circuit and allowing relay 16 to release. In releasing, relay 16 at armature 17 and its working contact disconnects ground from the busy lamp 11 to inform the attendant that the trunk is again free. At armature 18 and its working contact it opens the locking circuit of re-

lays 13 and 20 and allows these relays to release. Relay 13 at armatures 14 and 15 again connects the incoming trunk-line conductors 1 and 2 to the jack J at the attendant's cabinet. Relay 20, in releasing, at armatures 22 and 23 disconnects the subscriber's line from the secret service trunk and again connects the line to the jack J1 at the attendant's cabinet and over conductors 28 and 29 to the line switch in the P. A. X. At armature 21 and its working contact it opens a point in the locking circuit, at armature 24 and its working contact it again opens a point in the circuit of the lower winding of the relay, and at armature 25 and its working contact it disconnects ground from conductor 27 to remove the busy condition at the jack J1 and in the banks of the connectors. All the apparatus used in the establishment of the original connection and over the secret service trunk has now been restored to normal.

The subscriber at substation T2 may connect his line to the secret service trunk by operating key K2 which brings about operations similar to those described above. In this case relay 30 operates in series with relay 13 to perform the switching operations.

Outgoing connections from the subscribers at substations such as T1 and T2 may be completed in any well known manner. For example, a subscriber, in desiring to make a call over the trunk line comprising conductors 1 and 2, might call the attendant over the automatic switch train. The attendant would answer by means of her cord circuit and upon learning that a call is to be extended over the trunk line would complete the connection by means of her cord. In this case also the subscriber could obtain secret service, the operation of the key at the calling station cutting off the subscriber's line from the automatic switch train and connecting it to the secret service trunk, and also disconnecting the trunk line from the manual board and connecting it to the secret service trunk.

From the foregoing explanation, it is seen that the invention provides a simple and inexpensive method of giving secret service to a number of subscribers in a P. A. X. This is especially useful in a case where the P. A. X. is located in a manufacturing plant or similar establishment and the trunk line extends to a distant exchange or to another P. A. X. located in the main offices of the company. In this case, the president of the company might have his office in the main office building and the subscribers at sub-stations T1 and T2 at the P. A. X. might be vice-presidents or other high officials. In such a case, it would prove quite expensive to equip all of the cords at the attendant's cabinet with secret service features or to provide other known systems of secret service since only two or possibly three of the lines in the P. A. X.

are to be given such service. The arrangement might also be applied to other systems and is not to be considered as limited to the particular arrangement shown.

What is claimed is:

1. In a telephone system, an incoming trunk line terminating in a manual board, a plurality of subscribers' lines terminating in said board, some of said lines being entitled to secret service, means at said manual board for completing connections between said trunk line and said subscribers' lines, and means controlled from a line entitled to said secret service and to which a connection has been established for establishing a talking connection between said line and said trunk line independent of said manual board.

2. In a telephone system, an incoming trunk line terminating in an attendant's cabinet, subscribers' lines terminating in said attendant's cabinet, means for interconnecting said trunk line and one of said subscribers' lines to complete a telephone connection, a secret service trunk, and means controlled from the station on the connected line for disconnecting said line and said trunk line from said attendant's cabinet and for connecting them to said secret service trunk.

3. In a telephone system, an incoming trunk line terminating in an attendant's cabinet, subscribers' lines also terminating in said attendant's cabinet, means at said attendant's cabinet for interconnecting said trunk line and one of said subscribers' lines to complete a telephone connection, a secret service trunk, means controlled from the station on the connected line for disconnecting said line and said trunk line from said attendant's cabinet and for connecting them to said secret service trunk, and means responsive to said last means for preventing the connection of any other subscriber's line to said secret service trunk.

4. In a telephone system, an incoming trunk line terminating in an attendant's cabinet, subscribers' lines each terminating in a jack at said attendant's cabinet and in an automatic switch, means at the attendant's cabinet for completing a connection from said trunk line to a desired called line over the associated jack, a special trunk, and means controlled from the called station for disconnecting the incoming trunk line and the called line from said attendant's cabinet and connecting them to said special trunk.

5. In a telephone system, an incoming trunk line normally terminating in a jack at an attendant's cabinet, subscribers' lines each normally terminating in an automatic switch and in a jack at the attendant's cabinet, means responsive to an incoming call over said trunk line for signalling the attendant, means for completing the connection to the desired subscriber's line over the associated line jack, a secret service trunk comprising two sec-

tions, and means controlled from the station on the called line for disconnecting said line from the line jack at the attendant's cabinet and connecting it to one section of said secret service trunk and for disconnecting said trunk line from the trunk jack at the attendant's cabinet and connecting it to the other section of said secret service trunk.

6. In a telephone system, an incoming trunk line terminating in an attendant's cabinet, subscribers' lines terminating in said attendant's cabinet, means at said attendant's cabinet for interconnecting said trunk line with one of said subscribers' lines to complete a telephone connection, a key at each subscriber's station, a secret service trunk, means responsive to the operation of the key at the station on the connected line for disconnecting said trunk line and said subscriber's line from said attendant's cabinet and connecting them to said secret service trunk, and means in said secret service trunk responsive to the connection of said subscriber's line thereto for maintaining said connection independently of said key.

7. In a telephone system, an incoming trunk line terminating in a manual board, subscribers' lines terminating in said board, means for interconnecting said trunk line and one of said subscribers' lines to establish a telephone connection, a key at the station on the connected line, a talking trunk, a first and a second relay, means responsive to the operation of said key for completing an energizing circuit for said two relays in series, contacts on said first relay for disconnecting said trunk line from said manual board and connecting it to one end of said talking trunk, and contacts on said second relay for disconnecting said subscriber's line from said manual board and for connecting it to the other end of said talking trunk.

8. In a telephone system, a trunk line terminating in a manual board, subscribers' lines terminating in said manual board, a secret service trunk, means controlled from the station on any one of said subscribers' lines for disconnecting such line and said trunk line from the manual board and for connecting them to said secret service trunk, means responsive to said last means for busying said line and said trunk line at the manual board, and means for preventing the connection of any other of said subscribers' lines to said secret service trunk while said first connection is maintained.

9. In a telephone system, a trunk line terminating in a manual board, subscribers' lines terminating in said board, means for completing a telephone connection between said trunk line and one of said subscribers' lines, a talking trunk comprising two sections, means controlled from the station on the connected line for disconnecting said line from the manual board and connecting it to the

first section of said talking trunk and for disconnecting said trunk line from said manual board and connecting it to the second section of said talking trunk, a battery feed relay in said first section, and means controlled by said relay for maintaining said connections until said subscriber's line is released and for marking said trunk line busy at the manual board.

In witness whereof, I hereunto subscribe my name this 25th day of February, A. D. 1932.

THOMAS F. CROCKER.

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