July 3, 1945. C. S. RHOADS 2,379,456

TELEPHONE SYSTEM

Filed May 5, 1944 2 Sheets-Sheet 1

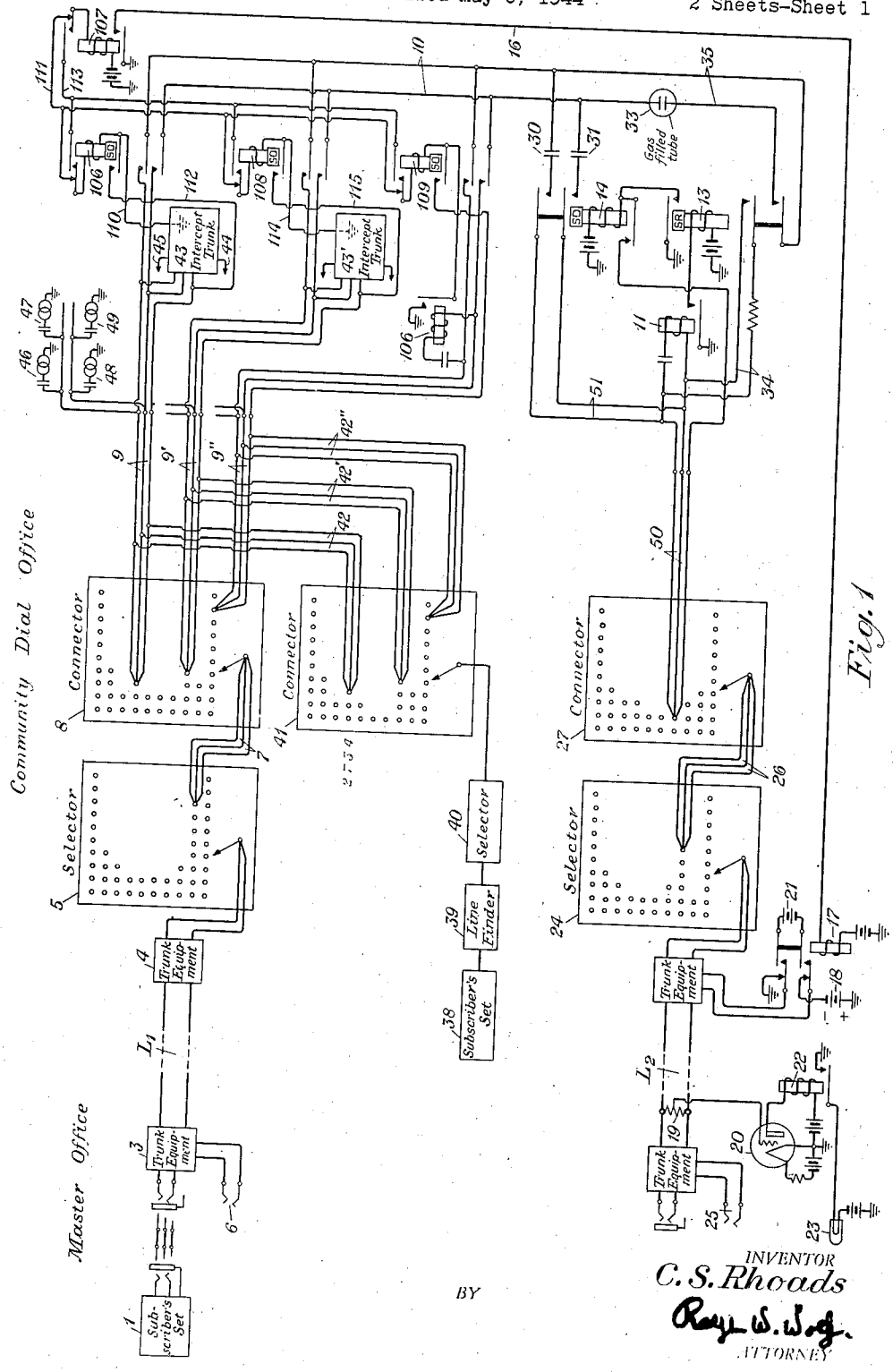


Fig. 1

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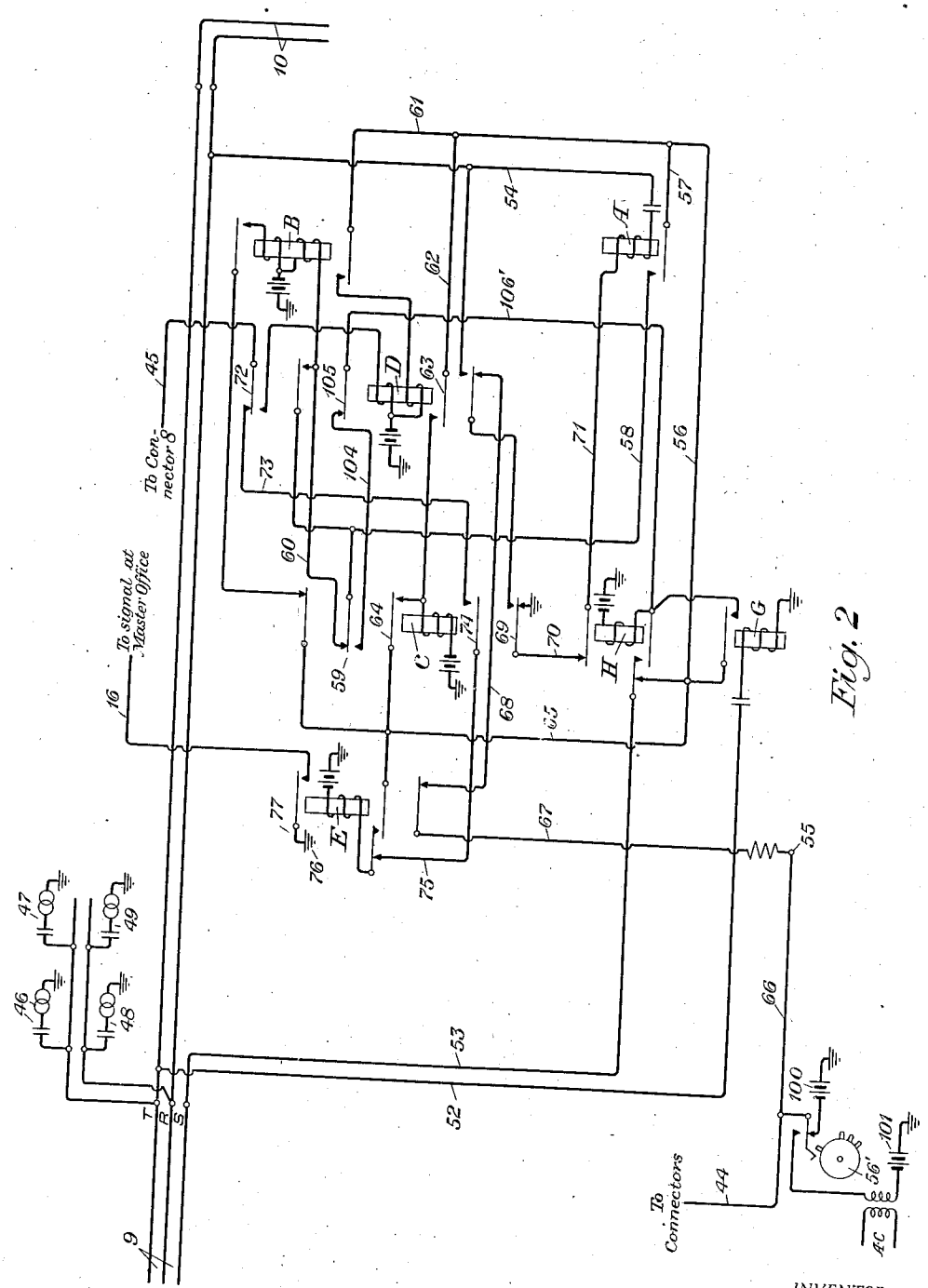


Fig. 2

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Patented July 3, 1945 2,379,456

UNITED STATES PATENT OFFICE

2,379,456

TELEPHONE SYSTEM

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Application May 5, 1944, Serial No. 534,273

5 Claims. (Cl. 179—27)

This invention relates to telephone systems and, more particularly, to telephone systems of the machine-switching type.

It often happens, due, for example, to directory errors, or to a subscriber moving away from a locality, that calls coming in for his former number must be intercepted by an operator so that the calling party can be informed that such a subscriber is not to be reached at such a number. It is one of the primary objects of this invention to provide arrangements for furnishing an intercept service of this type. The arrangements of the invention are particularly adapted for use at unattended exchanges utilizing machine-switching equipment which exchanges would be connected to an office having attendants. An example of an exchange of this type would be a community dial office which is usually an office serving a small community by means of step-by-step, panel or cross-bar machine-switching equipment and normally having no attendants. The community dial type of office would be connected with a so-called master office in another locality which would have attendants. With the arrangements of the invention, a call originating either at the master office or at the community dial office and intended for a number at the community dial office, may be intercepted by an attendant at the master office. In the community dial type of office the lines are usually multi-party lines having a number of subscribers connected thereto. It is one of the features of the arrangements of this invention, that a call intended for a particular one of the subscribers on a multi-party line may be intercepted without interference to the other subscribers on the line. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawings, in the Figures 1 and 2 of which the invention is illustrated. Figure 1 is a circuit diagram illustrating a preferred form of the invention. Fig. 2 is a circuit diagram showing in detail a part of the arrangements shown in Fig. 1. Similar reference characters have been used to denote like parts in both of the figures.

In the drawings are shown a number of trunks such as L_1 and L_2 which would connect a master office, which is the type of office which would have attendants, with an unattended office, such, for example, as a community dial office. At the master office is shown a subscriber's set 1. Let it be assumed that the subscriber having this set wishes to call a subscriber at the community dial office. At the community dial office is shown a telephone line 8 which is a multi-party line and would have a number of subscribers' sets connected thereto. Only the ringing apparatus such as 46, 47, 48 and 49 of these sets is illustrated. Let it be assumed that the subscriber at the master office wishes to call the set having the ringing apparatus 49. The subscriber at the master office would give the called subscriber's number to the operator at the master office. Let it be assumed that the number, for purposes of illustration, would be 2734. The operator at the master office through trunk equipment 3 would connect the subscriber to the trunk L_1, and trunk equipment 4 at the community dial office would connect this trunk to a selector 5. The selector 5 would return a dial tone to the operator at the master office and she would plug dialing equipment into the jack 6 and commence to dial the number 2734. The first group of two dial impulses would cause the switch of the step-by-step selector to move to its second level of terminals and hunt until an idle trunk such as 7 was found leading to the connector 8. The selector 5 and the connector 8 have, for purposes of illustration, been shown as of the step-by-step type, and are well-known in the art. The next group of seven impulses would cause the switching mechanism of the connector to move to the seventh level of terminals, and the succeding group of three impulses would cause it to move to the third terminal in that level, whereupon the subscriber would be connected to the circuit 9 which would normally lead through a main distributing frame to the subscriber's set having the ringing apparatus 49. The fourth group of dial impulses are used to operate ringing arrangements to be described later.

For the purposes of illustrating this invention, it will be assumed that the called subscriber's set having the ringing apparatus 49 is no longer in use and that calls for such a set are to be intercepted. To intercept such a call the circuit 9 will be connected to a circuit 10 and thence to a circuit 50 which leads to another connector 27. The circuit 9 will also be connected to an intercept trunk 43, the operation of which will be described in more detail hereinafter. When the circuit 9 is seized at the connector 8, the particular code signal for the subscriber having the ringing apparatus 49 will be transmitted to the intercept trunk 43 and wil cause a ground to be placed on conductor 110. This will complete the following circuit: from ground, conductor 110, winding of relay 106, armature and break contact of relay 106, conductor 111, winding of relay 107, to battery and ground. This will operate relays 106 and 107 and they will lock up over the following circuit: from ground applied to the sleeve of line 9, when it was seized by the connector, conductor 112, lower armature and make contact of relay 106, winding of relay 106, upper armature of relay 106, conductor 113, armature of relay 107, winding of relay 107 to battery and ground. The operation of relay 106 will connect

the tip and ring conductors of circuit 9 to the tip and ring conductors of circuit 10. The operation of relay 107 will place a ground on conductor 16. This will actuate the relay 17. Before the relay 17 is operated ground is applied to the ring side of the trunk L_2 and the negative pole of battery 18 is connected to the tip side of the trunk L_2. At the master office the midpoint of resistance 19 is connected to the grid of a vacuum tube 20. Due to the connection of battery 18 to the trunk, a negative bias will be applied by battery 18 to the grid of the vacuum tube 20 and it will be maintained in an inoperative condition. When relay 17 operates, however, ground and negative battery 18 are disconnected from the trunk L_2 and battery 21 is connected across the trunk L_2 in such a manner that the negative bias will be removed from the grid of the tube 20 and it will operate and cause the operation of relay 22. The operation of relay 22 will operate the signal lamp 23. This type of signaling circuit is more completely disclosed in a copending application S. N. 527,914, filed March 24, 1944, in the name of C. S. Rhoads. However, it is understood that any desirable arrangement for signaling over the trunk L_2, by means of the actuation of relay 17, may be utilized. When the signal lamp 23 operates an operator at the master office will know that a call has originated either at the master office or at the community dial office which must be intercepted because it is for a number not in active use. At the community dial office a certain unlisted number or numbers will be set aside for the intercept service. For example, let it be assumed that the unlisted number 3425 has been set aside for this service. Accordingly, when the lamp 23 lights the operator will plug into an idle trunk such as L_2 which will be connected at the community dial office with a selector 24. This will send dialing tone back to the operator at the master office and she will plug dialing equipment into the jack 25 and commence to dial the number 3425. The first group of three impulses will cause the switch of selector 24 to move to the third level of contacts and select an idle trunk, such as 26, leading to the connector 27. The next group of four dial impulses will cause the switching mechanism at the connector to move to the fourth level of contacts, and the succeeding group of two dial impulses will cause it to move to the second terminal thereof, whereupon a connection will be established with the circuit 50. The fourth group of five dial impulses will apply a ringing code to the circuit 50. This ringing code will actuate the relay 11 which in turn will actuate the relay 13. The actuation of relay 13 will close a circuit 35, including the gas-filled discharge tube 33, across the tip and ring conductors of the circuit 10 connected to the circuit 9. It will also close a circuit 34 across the circuit 50. These two circuits 34 and 35 will trip the ringing applied to circuits 50 and 9. The operation of relay 13 will cause the operation of relay 14 which will lock up over a connection to the sleeve of circuit 50 which has ground applied to it at connector 27. The operation of relay 14 will connect a circuit 51 connected to the tip and ring conductors of circuit 50 to the tip and ring conductors of circuit 10 which tip and ring conductors are connected to the tip and ring conductors of circuit 9. This will establish a talking connection between the operator at the master station and the subscriber having subscriber's set 1. The operator at the master office may now inform the subscriber at the set 1 that the called subscriber having number 2734 cannot be reached at that number and give him the reason therefor.

The arrangements of the invention may also be used to intercept a call originating in the community dial office for the number 2734. A subscriber at the community dial office having a subscriber's set 38 might dial the number 2734. In a well-known manner through the line finder 39 the selector 40 and the connector 41, a connection would be established between the subscriber having set 38 and the circuit 42. This circuit would be connected in multiple with the circuit 9, which as heretofore pointed out, is connected to the circuit 10. Accordingly, when such a connection is established in the same manner as heretofore pointed out, the signal lamp 23 at the master office would light and the operator would then again proceed to dial an unlisted number such as 3425. This would cause the operator to be connected to circuit 50 which in turn is connected to circuits 10 and 9. As circuit 9 is connected to circuit 42 the operator at the master office would then be connected to the subscriber having the set 38 and could inform him that the subscriber having the number 2734 could not be reached at that number.

The arrangements of the invention could also be used to intercept calls for other lines, such, for example, as lines 9' and 9''. These lines would be multipled by circuits 42' and 42'' to the connector 41 so that a call for either of these lines could be intercepted whether it originated at the master office or at the community dial office. If the line 9' was a party line and the calls to be intercepted were for a particular party on the line, it would be provided with an intercept trunk 43'. A call for a particular subscriber on line 9' would actuate mechanism in the intercept trunk 43' and put a ground on conductor 114. This would close the following circuit: from ground, conductor 114, winding of relay 108, break contact of relay 108, conductor 111, break contact of relay 107, winding of relay 107 to battery and ground. This would operate relays 108 and 107 and they would lock up over a circuit completed over conductor 115 to ground applied to the sleeve of line 9' when it was seized by the connector 8. It is pointed out that the previously traced circuit for operating relays 108 and 107 could not be closed if a call was being intercepted on line 9 because such an interception would have operated and locked up relay 107. Accordingly, if a call to be intercepted comes in for line 9' while a call is being intercepted on line 9 the intercept apparatus associated with line 9' will not function until after the operator has completed her interception of the call on line 9. As previously pointed out, the operation of relay 107 places a ground on conductor 16 to operate a signal at the master office. A call to be intercepted coming in for a line such as 9'', which is not a party line, would operate relay 106. This in turn would operate relays 109 and 107 to send a signal to the master office. However, if the operator was intercepting a call on either of lines 9 and 9' when the call came in for line 9'' relays 109 and 107 would not operate due to the fact that relay 107 had already been operated and locked up. Accordingly, the intercept apparatus associated with line 9'' would not function while the operator was intercepting another call.

In Fig. 2 are shown in detail the arrangements of the intercept trunk 43 which is connected to

the line to be intercepted in accordance with the arrangements of this invention. If, for example, a particular party on the multi-party line 9, such as the party having ringing apparatus 49, is to be intercepted, the intercept trunk 43 will be connected to the line 9 in a manner to be pointed out hereinafter, and line 9 will also be connected to the circuit 10. Lines running out of community dial offices usually are multi-party lines and the various parties are reached by using different ringing codes. One common scheme is to use five codes such as two short rings, three short rings, four short rings, one long ring or one long and one short ring. With such an arrangement, five parties could be rung from the tip side of the line and five parties could be rung from the ring side of the line. In most community dial offices, ringing is accomplished by a central ringing machine which has a rotating shaft on which are mounted code interrupters having various combinations of cams which close contacts that send out the different code ringing impulses and also the ground impulse that starts off the ringing at the proper time to make certain a ringing code will be sent out from the beginning thereof. If ringing should start at any instant a connector was seized, mutilated ringing codes would result as the connector might be seized at the instant that the ringing machine shaft was half way around in any revolution. The ground pulse which controls the apparatus so that the ringing code will start at its beginning is called in the art the "pick-up" ground. This "pick-up" ground is applied in Fig. 2 to conductor 45 which goes to the ringing machine at the connector where it gets this ground pulse every revolution of the ringing machine shaft at the start of each ringing cycle as will be pointed out in more detail hereinafter. The fourth group of impulses dialed operates mechanism at the connector which picks out the proper code ringing interrupter and connects it to the called line. The intercept trunk will also be connected to this code ringing interrupter in a manner to be pointed out hereinafter. The foregoing is well known in the art.

If calls for the subscriber having the ringing apparatus 49 connected to the ring side of line 9 are to be intercepted the intercept trunk 43 will be connected to line 9 in the following manner. A conductor 54 leading to relay A will be connected to the ring side of line 9. A conductor 52 will be connected to the tip side of line 9, and a conductor 53 will be connected to the sleeve of line 9. Conductor 45 to which will be applied the "pick-up" ground will be connected to the central ringing machine. The point 55 will be connected to the particular code interrupter 56' at the ringing machine assigned to the subscriber having ringing apparatus 49 whose incoming calls are to be intercepted. The dialing of the fourth group of impulses will connect to the line 9 this same code interrupter 56' and will cause the particular subscriber's code ring to be applied to the ring side of line 9.

The application of this ringing current to the ring side of line 9 will cause relay A, which is connected to the ring side of line 9 by conductor 54, to operate. When the line 9 was seized at the connector, ground was applied to the sleeve thereof. Accordingly, when relay A operates the following circuit will be closed: from ground connected to the sleeve of circuit 9, conductors 53, 56, 57, 58, armature 59 of relay C and its break contact, conductor 60, winding of relay B, to battery from ground. The closing of this circuit will operate relay B. The operation of relay B will connect the ground originally applied to the sleeve of circuit 9 and thence to conductors 56 and 61 to the winding of relay D and to battery and ground, thereby operating relay D. The operation of relay D will connect the ground, originally applied to the sleeve of circuit 9 and thence to conductor 61, to conductor 62, to its armature 63, to the winding of relay C, and to battery and ground. This will operate relay C. A locking circuit for relay C will be closed over its upper contact and armature 64 and thence over conductors 65 and 53 to ground connected to the sleeve of circuit 9. The operation of relay C will close a circuit from the ringing interrupter 56' as follows: over conductors 66, 67, 68, contact and armature 69 of relay C, conductors 70 and 71 to the relay A. As soon as this happens the relay A will not operate any more on the incoming ringing pulses because the code interrupter 56' will be applying identical pulses to the winding of relay A in opposite directions. In other words, a certain code combination of impulses will be applied to relay A over conductor 54 from the connector, and an identical set of pulses will be applied to the winding of relay A over conductor 71 by the code interrupter 56'. When the next "pick-up" pulse occurs to start a second set of ringing impulses, ground will be applied to conductor 45 and thence over the following circuit: armature 72 and contact of relay D, conductor 73, armature 74 and contact of relay C, conductor 75, winding of relay E to battery and ground, thereby operating relay E. The operation of relay E will connect the ground 76, which is connected to conductor 77, to the conductor 16 and thereby cause the relay 17 of Fig. 1 to operate to transmit a signal to the master office in a manner heretofore explained with respect to Fig. 1. In response to this signal, the operator at the master office will dial the unlisted number and the connector 27 of Fig. 1 will seize the circuit 50. In a manner explained with with respect to Fig. 1, the operator may now communicate with the calling subscriber over circuits 50, 10 and 9 to tell him the reason for intercepting his call.

From the foregoing it will be seen that a relay A in the intercept trunk will respond to the first impulses in the combination of impulses constituting the code ring for the subscriber to be intercepted. This will set other relay mechanism in operation so that when the next "pick-up" pulse is received at the intercept trunk a ground will be put on conductor 16 to operate a signal at the master office whereupon the operator thereat will dial the unlisted number set aside for intercepting calls. This will establish a connection at the community dial office with the operator and the line to which is connected the subscriber to be intercepted. The code interrupter at the connector which is also connected to the intercept trunk will be sending identical ringing pulses to the first-mentioned relay A in opposite directions and it will no longer operate after the first ringing pulse has ended.

For a call for one of the other parties on the line 9 which is not to be intercepted, the code ring received from the connector which seizes line 9 will not be the same as the code ring connected to point 55. Such a call may be either one that puts the ringing pulses out on the tip of line 9 or on the ring thereof. If the impulses are applied to the tip they will immediately operate relay G which is connected to the tip of the line by conductor 52. The operation of relay G will operate

the relay H by connecting its winding over conductor 53 to ground placed on the sleeve of circuit 9. This holds open the circuit for relay A. This cancels any further action and hence, there is no further interference and no interception.

If any other code combinations are transmitted out over the ring side of the line other than the one to be intercepted, the first of these pulses will operate the relay A. The operation of relay A will cause relay C to operate and lock up in the same manner as previously described. The operation of relay C closes a circuit from the ringing interrupter 56 as follows: conductors 66, 67, 68, make contact and armature 69 of relay C, conductors 70 and 71 to the winding of relay A. When the next impulse in the ringing code, which comes from some cam other than on interrupter 56', is applied to the ring side of the line, it will be transmitted through the winding of relay A and over said last-mentioned circuit to ground associated either with battery 100 or battery 101. Because the ringing codes do not match, this will cause relay A to operate on the second of the pulses of the code combination. When relay A operates a second time the following circuit will be completed: from ground connected to sleeve of line 9 and thence to conductor 57, over conductor 58, armature 59 and make contact of relay C, conductor 104, contact and armature 105 of relay D, conductor 106', winding of relay H to battery and ground. This will operate relay H which will lock up and open the operating circuit of relay A. Accordingly, relay A will not operate on succeeeding code impulses. This cancels any further action and hence there is no further interference and no interception of the other parties on the same side of the line.

While the arrangements of the intercepted trunk have been shown as adapted to intercept a party connected to the ring side of the line, they may be utilized to intercept a party connected to the tip side of the line by merely connecting conductor 54 to the tip side of the line and connecting conductor 52 to the ring side of the line.

While the arrangements of the invention have been disclosed as having been embodied in certain specific forms which are described, it is understood that they are capable of embodiment in many and widely varied forms without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. A telephone system including an unattended exchange having two connectors, a multi-party telephone line on which incoming calls for a particular one of the parties on the line are to be intercepted, means for connecting said line to a terminal in one of said connectors which terminal might be reached by dialing a designated number, means for connecting said line to a terminal in the other connector which terminal might be reached by dialing another designated number, and means connected to said telephone line and responsive only to the particular code signal for the party whose calls are to be intercepted for transmitting a signal to an attended exchange.

2. A telephone system including an unattended exchange having two connectors, a multi-party telephone line on which incoming calls for a particular one of the parties on the line are to be intercepted, means for connecting said line to a terminal in one of said connectors which terminal might be reached by dialing a designated number, means for connecting said line to a terminal in the other connector which terminal might be reached by dialing another designated number, an intercept trunk associated with said line, said intercept trunk including apparatus selectively responsive to the code signal individual to the particular party whose calls are to be intercepted, and means controlled by said apparatus for transmitting a signal to an attended exchange.

3. A telephone system including an unattended exchange having two connectors, a multi-party telephone line on which incoming calls for a particular one of the parties on the line are to be intercepted, means for connecting said line to a terminal in one of said connectors which terminal might be reached by dialing a designated number, means for connecting said line to a terminal in the other connector which terminal might be reached by dialing another designated number, an intercept trunk associated with said line, said intercept trunk including apparatus responsive when the code signal individual to the particular party whose calls are to be intercepted is applied to said line, signaling means controlled by said responsive apparatus for transmitting a signal to an attended exchange, said intercept trunk also including apparatus responsive when a code signal other than said first mentioned code signal is applied to said line, and means controlled by said last mentioned responsive apparatus for preventing said signaling means from operating.

4. A telephone system including an unattended exchange having two connectors, a telephone line on which incoming calls are to be intercepted, means for connecting said line to a terminal in one of said connectors which terminal might be reached by dialing a first number, a second telephone line on which incoming calls are to be intercepted, means for connecting said line to another terminal in said last mentioned connector which terminal might be reached by dialing a second number, means for connecting both of said lines to the same terminal in the other connector which terminal might be reached by dialing a third number, responsive means associated with said first line and operative when said first number is dialed for transmitting a signal to an attended exchange, responsive means associated with said second line and operative when said second number is dialed for transmitting a signal to an attended exchange, and means operative when said first mentioned responsive means is operated for preventing said second mentioned responsive means from operating to transmit said signal.

5. A telephone system including a plurality of lines at an exchange, a signaling circuit common to all of said lines for transmitting a signal to another exchange, a relay controlling said signaling circuit, relays individual to each of said lines and each being responsive to signals coming in over its associated line, and a plurality of operating and locking circuits for said first relay each completed over the contacts of different ones of said individual relays whereby when said first relay is operated and locked up by the operation of one of said individual relays it will be unaffected by the operation of another of said individual relays.

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