March 21, 1944. W. T. POWELL 2,344,634

TELEPHONE INTERCEPT SYSTEM

Filed Jan. 8, 1942 2 Sheets-Sheet 1

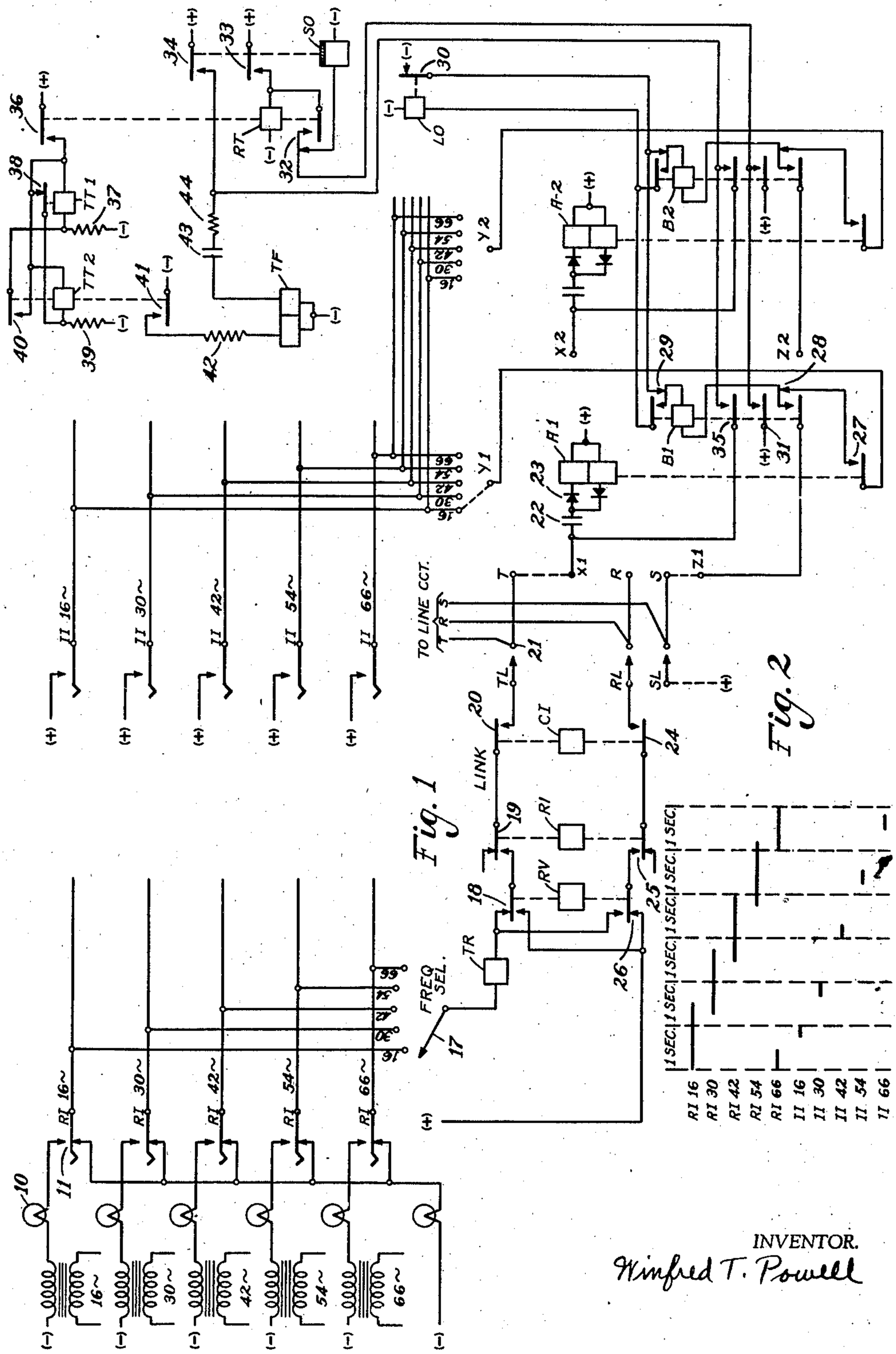

Fig. 1

Fig. 2

INVENTOR.
Winfred T. Powell

March 21, 1944. W. T. POWELL 2,344,634

TELEPHONE INTERCEPT SYSTEM

Filed Jan. 8, 1942 2 Sheets-Sheet 2

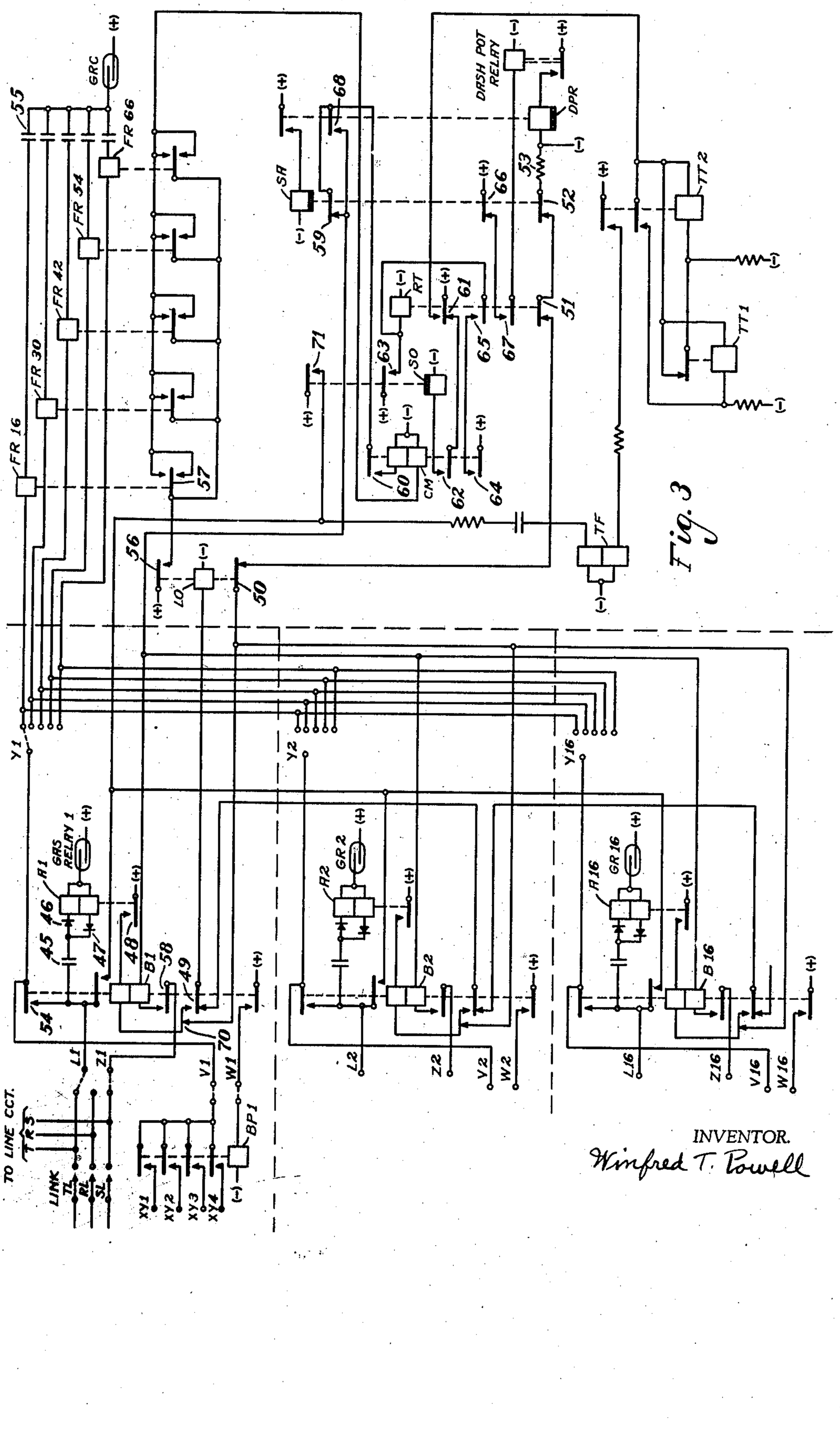

Fig. 3

INVENTOR.
Winfred T. Powell

Patented Mar. 21, 1944

2,344,634

UNITED STATES PATENT OFFICE

2,344,634

TELEPHONE INTERCEPT SYSTEM

Winfred T. Powell, Brighton, N. Y., assignor to The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., a corporation of New York

Application January 8, 1942, Serial No. 426,013

17 Claims. (Cl. 179—27)

This invention relates to telephone systems and more particularly to improvements in circuits for providing call intercept service in conjunction with the use of lines in an automatic telephone system.

It is one object of the present invention to provide improved circuits of the character described, which are simple and economical and which function in a positive and reliable manner to intercept calls to one or more predetermined substations on one or more lines of the system, to automatically connect the intercepted calls to a common intercept trunk and then to apply to the calling line a special tone or tick-tick signal to inform the calling party that the called station is out of service, or the like.

Another object of the invention is to provide circuit arrangements so that the control of the call intercepting apparatus is effected through operation of the common ringing interrupter equipment in conjunction with an intercept interrupter equipment, controlled in synchronism.

It is a further object of the invention to provide circuits of the character described, so arranged that the operation to intercept a call, by connecting the calling subscriber to the common intercept trunk, is effective to initiate a timing mechanism which functions to automatically release the calling connection from the common intercept trunk after a predetermined time interval.

Other objects, purposes and characteristic features of the present invention will be in part obvious from the accompanying drawings and in part pointed out as the description thereof progresses.

In describing the invention in detail, reference will be made to the accompanying drawings in which like characters designate corresponding parts and in which:

Figure 1 illustrates one modification of the intercept circuit arrangement, controlled in part by ringing interrupters and intercept interrupters operating as will be described.

Figure 2 is a timing chart illustrating the time intervals during which the various ringing interrupter contacts and the various intercept interrupter contacts may be closed to provide proper operation of the system.

Figure 3 illustrates an alternate circuit arrangement in which harmonic relays are used in place of the common intercept interrupters.

For the purpose of simplifying the illustrations and facilitating the explanation, the various parts and circuits constituting the embodiment of the invention have been shown diagrammatically and certain conventional illustrations have been employed, the drawings having been made more with the purpose of making it easy to understand the principles and mode of operation than with the idea of illustrating the specific construction and arrangement of parts that would be employed in practice. Thus, the various relays and their contacts are illustrated in a conventional manner, with all of the contacts associated with a particular relay being illustrated as attached to this relay by means of a dotted line. The negative side of the common exchange battery is indicated by a minus sign in parentheses and the positive side of the exchange battery, which is usually grounded, is indicated by a positive symbol in parentheses.

While certain features of the invention are applicable to and useable with any type of party line telephone system, the specific embodiment of the invention has been shown in a form adapted for use with an automatic telephone system.

Furthermore, it is assumed that the invention is applied to a party line telephone system in which five different ringing frequencies are employed for selectively ringing the bells on a selected party line. It is also assumed that the lines in the particular system to which this invention is applied are divided circuit ringing lines, with five stations selected by ringing over one side of the line to ground and with five additional stations selected by ringing over the other side of the line to ground.

It is believed that the invention will be best understood by explaining the operation when a connection is made to the line circuit illustrated in Figure 1, assuming first that 16 cycle ringing current is applied to this line and second that the station which responds to 16 cycle ringing current has been disconnected and consequently the call must be routed to the common intercept trunk and the calling subscriber must be given a signal to this effect.

The five different ringing frequencies are indicated, in the upper left-hand portion of the Figure 1 drawing, as being applied through separate transformers and separate ringing lamps to normally open contacts of separate common ringing interrupters. The back contacts of these common ringing interrupters are connected through a common lamp to negative battery and this is for the purpose of providing a return circuit for tripping the ring when a call is answered during a silent interval.

Associated with these five ringing interrupters and in line therewith are shown five intercept interrupters indicated II16, II30, II42, II54 and II66. These intercept interrupters are controlled by the same shaft that controls the ringing interrupter contacts, thus a cooperative relation between the operation of these ringing interrupters and intercept interrupter contacts can readily be obtained. For example, referring to Figure 2, it will be assumed that a 6 second cycle is used, with the ringing cur-

rent being applied for one and a half seconds, with a silent interval between rings of four and a half seconds. During each ringing interval of each ringing interrupter, the corresponding intercept interrupter is closed for a short interval, but it will be noted that there is no overlap from any intercept interrupter into a period during which a non-corresponding ringing interrupter is applying ringing current to the associated ringing commons.

A small portion of a link circuit is illustrated in Figure 1. It comprises a cut-in relay CI, a ringing relay RI, a reversing relay RV, a trip relay TR, a frequency selector and connecting terminals TL, RL and SL. It will be understood that the connection from the calling line to the called line is made through the link circuit, which may be a connector switch or the connecting mechanism of a relay type connector, by way of the tip line connector TL and the ring line connector RL, with the sleeve SL of the link applying positive battery to the sleeve terminal of the called line circuit for making this line busy and for operating the cut-off relay. After the called line is selected, it is usually the practice to dial a station selecting digit which operates the frequency selector for selecting the proper frequency for ringing the desired station. As illustrated, this frequency selector selects any one of the five frequencies indicated in response to dialing digits 1, 2, 3, 4 or 5. Furthermore, it is well known by those skilled in the art that a reversing relay RV, associated with the connector link, may be left in its normal position for ringing over the tip side of the line or it may be operated in response to a separate digit for ringing over the ring side of the line.

It is also well known by those skilled in the art how cut-in relay CI, is operated after the line is selected, how ringing relay RI is operated to ring the called line and how trip relay TR is operated for releasing relay RI to disconnect the called line from the ringing circuit and for connecting it through to the talking circuit, including the calling line.

It will now be assumed that the line circuit illustrated in Figure 1 is selected by the connector link and that 16 cycle ringing current is selected and that the station responsive to 16 cycle current on this line has been disconnected. When ringing interrupter RI 16 closes its front contact a circuit is closed from the right hand terminal of the secondary winding of the 16 cycle transformer, through lamp 10, front contact 11 of the 16 cycle ringing interrupter, terminal 16 and frequency selector wiper or contactor 17, winding of trip relay TR, back contact 18 of relay RV, front contact 19 of relay RI, front contact 20 of relay CI, tip side of the connecting link TL, terminal 21, intercept terminal T (to which intercept terminal X1 is cross connected as indicated by the dotted line), condenser 22, rectifier 23, upper winding of intercept line relay A1, positive side of battery and thence through the battery to the negative side and to the other terminal of the ringing transformer.

This current from the link connector terminal TL also passes out over the tip side of the called line, through the station ringers, ring side of the called line, connecting terminal RL, front contact 24 of relay CI, front contact 25 of relay RI, back contact 26 of relay RV, to positive battery and thence through the battery and to the other terminal of the ringing transformer. Since it is assumed that there is no 16 cycle ringer on the line, there will be no response and it becomes desirable to indicate to the calling subscriber that the receiver should be hung up and the information operator called for the desired information.

Ringing current through the upper winding of relay A1, as above described, is effective to operate this relay during the half cycles when the ringing impulses, over the above described circuit and through the upper winding of relay A1, are positive. During the other half cycles, when the ringing current impulses are negative, the current will flow through the lower winding of relay A1 and not through its upper winding. Consequently, because of the oppositely poled rectifier and the double wound coil of relay A1, the alternating current flowing over this circuit will hold relay A1 operated during the ringing interval without any chatter.

Recalling that intercept interrupter II16 is normally closed during the ringing period of the 16 cycle current, a circuit may be traced from the positive side of battery, contact of intercept interrupter II16, terminal 16 and cross connection to terminal Y1, front contact 27 of relay A1, back contact 28 of connecting relay B1, winding of relay B1, back contact 29 of relay B1 and back contact 30 of common lockout relay L0 to negative battery. Relay B1 is operated over this circuit and closes a locking circuit for itself which extends from positive battery now connected to the sleeve terminal S of the called line, cross connection to terminal Z1, front contact of make-before-break combination 28 of relay B1, winding of relay B1, front contact of make-before-break combination 29 of relay B1 and winding of relay L0 to negative battery. Relay L0 is thus inserted in series with the winding of relay B1, relay L0 operates and opens its back contact 30 which removes negative battery from the operating circuits of all of the connecting (B) relays. This lockout arrangement prevents the operation of more than one B relay at any one time.

The operation of relay B1 closes a circuit for operating slow to operate relay S0 which extends from positive battery, front contact 31 of relay B1, back contact 32 of the make-before-break combination or relay RT and winding of relay S0 to negative battery. The operation of relay S0 closes an obvious operating circuit, at its front contact 33, for operating ringing trip relay RT. The operation of relay RT opens up the circuit of relay S0 at back contact 32, which allows relay S0 to release and relay RT is now locked operated by way of its make-before-break front contact 32 to positive battery at front contact 31 of relay B1. This means that when relay B1 operates to connect the calling line to the common intercept trunk, relay S0 is operated and very shortly thereafter releases. During its operation, positive battery by way of its front contact 34 is connected through front contact 35 of relay B1 to terminal X1 and over the remainder of the previously described ringing circuit, which includes trip relay TR of the link. Consequently this momentary operation of relay S0 is sufficient to trip the ring but is not long enough to operate the usual battery feed relay provided in connector link circuits, which have reverse battery contacts for reversing the battery to the calling line.

With relay RT locked operated, a circuit is closed through its front contact 36 for operating

relay TT1 in series with resistance coil 37. It will be noted that relay TT2 is short-circuited at this time by back contact 38 of relay TT1. When relay TT1 operates, however, back contact 38 is opened and relay TT2 is operated in series with resistance coil 39. The operation of relay TT2 closes a circuit at its front contact 40 which short-circuits and releases relay TT1. The release of relay TT1 closes its contact 38 for short-circuiting and releasing relay TT2. This intermittent operation of relays TT1 and TT2 continues at a fairly rapid rate for intermittently energizing the left-hand winding of transformer coil TF over a circuit including front contact 41 and resistance coil 42. This sets up an inductive effect in the right hand winding of coil TF which is extended through condenser 43, resistance coil 44 and front contact 35 of relay B1 to the tip terminal TL of the connector link and thence to the calling line by way of front contact 20 and back contact 19, recalling that relay RI is released when the tripping operation is effected in the connector link.

The calling subscriber, hearing this tick-tick signal, releases the connection including the connector link. When this disconnection takes place, positive battery is removed from terminal S of the called line and the associated terminal Z1 of the intercept connecting circuit, which is effective to open the locking circuit and effect the release of relay B1. Since this locking circuit includes the winding of relay L0, this latter relay is released and negative battery is again connected to all of the connecting relays in readiness for another intercept circuit operation.

It will be apparent that, since relay A1 is not tuned to any particular frequency, it will be operated when the line to which it is connected has any of the five frequencies applied thereto. However, it requires correspondence between the frequency which is applied to the line and the closure of the associated intercept interrupter contact for the operation of the associated B relay. For example, if 30 cycle ringing current is applied to the line, over the above described connection, relay A1 will operate as before, but in this instance relay B1 will not operate because its operating circuit through front contact 27 of relay A1 extends by way of cross connection Y1 to intercept interrupter II16 and this interrupter is not closed in correspondence with ringing interrupter RI30. Furthermore, with the illustrated cross connection between terminal Y1 and the #16 intercept interrupter II16, ringing over this line with any other frequency will operate relay A1 but will not operate relay B1.

It will be understood that terminal X1 may be cross connected to the ring side of the line (terminal R) for operation when ringing current is applied to the ring side of the called line. A second intercept circuit, comprising relays A2 and B2 and its terminals X2, Y2 and Z2, is illustrated to indicate the interlock between these intercept circuits for preventing the operating of more than one at any one time. This interlock between intercept circuits is effected, as above described, by energizing lockout relay L0 in series with any B relay which is operated and by arranging the contacts of the common lockout relay so that it opens up the energizing circuits for all B relays. It will be understood that as many of these intercept circuits, comprising A and B relays, may be provided as is necessary to take care of the maximum number of intercept stations to be handled.

Since it is possible that two or more lines may be selected at the same time and the intercept stations thereon dialed, it will be understood that ringing current may be effective to operate two or more A relays at the same time, but only one calling line will be connected to the common intercept trunk at the same time. It is desirable to provide a time disconnect arrangement to automatically release a calling subscriber from the common intercept trunk so that it will not be tied up for an abnormal length of time, thus delaying its selection by other waiting calls. This time disconnect arrangement may be applied to the circuit of Figure 1 in the same way that it is applied to the circuit of Figure 3, the operation of which will now be explained.

Referrring to Figure 3, the connecting terminals of a connector link circuit are illustrated in the upper left-hand portion of this figure. These terminals comprise tip, ring and sleeve contacts TL, RL and SL and connect to the line circuit in the same manner as already explained in connection with Figure 1. Each intercept circuit comprises a line relay and a connecting relay, three sets of these intercept circuits being shown comprising relays A1 and B1 for circuit #1, A2 and B2 for circuit #2 and A16 and B16 for circuit #16. It will be assumed that 16 circuits may be accommodated by the common intercept trunk, that is, 16 substations may have their service disconnected and connected by way of these intercept circuits to the common intercept trunk at some time during the interval between directory issues.

The cross connections in this modification are made from the L terminals, such as terminal L1, to either the tip or the ring side of the line, depending upon the side of the line that the intercepted station was on. Terminal Z1 is cross connected to the sleeve terminal of the line circuit. It will be understood that terminals L2 and Z2 and other similar terminals, up to and including L16 and Z16, may be cross connected to other lines having intercepted stations thereon. In this modification, it is not necessary to use a separate relay combination, comprising an A relay and a B relay, when 2 or more stations on the same line are placed on intercept. It is only necessary to cross connect the terminals similar to V1 and W1 to a relay similar to BP1, as illustrated, and then connect terminal Y1 to the proper one of the five common leads leading to frequency relays FR16, FR30, FR42, FR54 and FR66. Now connect one or more of the terminals XY1, XY2, XY3, XY4 to separate ones of the five common leads. Since there are four extra Y terminals (XY1, XY2, XY3 and XY4) associated with relay BP1 and since this relay is a direct repeater of relay B1, five stations on the same line can be placed on intercept by the use of only one set of relays such as A1, B1 and BP1.

Although not illustrated in Figure 3, it will be understood that the common ringing interrupter arrangement and the frequency selector of the link for selecting the various frequencies are the same as disclosed in Figure 1. The intercept interrupters are not required in this modification.

It will now be assumed that terminal L1 of the first intercept circuit is cross connected to the tip side of the illustrated line, that terminal Z1 is cross connected to the sleeve terminal of this line and that terminal Y1 is cross connected to the common conductor leading to frequency relay FR16. It will be understood that these five frequency responsive relays are selectively responsive to the five different frequencies selected by

the frequency selector as illustrated in Figure 1.

Although it forms no part of the present invention, a gas relay is connected in series with each A relay of each intercept circuit, these gas relays being designated GR2, GR16, with the first one being labeled gas relay 1. A common gas relay GRC is connected in series with the five frequency responsive relays. The function of these gas relays is to simulate the condition of the party line which has substations connected thereto, with a gas relay in each ringer circuit. These gas relays serve the purpose of permitting sufficient current to flow to ring the associated bells and to offer a high impedance to noise currents for reducing noise in the telephone circuits due to grounded ringers.

With the above assumptions, when the illustrated line is called and 16 cycle generator is applied to the tip side of the line, generator current flows through the cross connection to terminal L1, through condenser 45, rectifier 46, upper winding of relay A1 and the gas relay to positive battery. This circuit is completed during the positive half cycles of the ringing current and during negative half cycles, the circuit is completed through lower winding of relay A1 and rectifier 47. Therefore, relay A1 is operated without chatter by the alternating ringing current flowing over this circuit. It will be apparent that this current also flows out over the called line but, since it is assumed that the 16 cycle station is out of service, no bell will ring and it becomes necessary to give the calling subscriber a signal to the effect that the station is out of service.

The operation of relay A1 closes a circuit for operating relay B1, which extends from positive battery, front contact 48 of relay A1, upper winding of relay B1, back contact of make-before-break combination 49, back contact 50 of relay L0, back contact 51 of relay RT, back contact 52 of relay SA and resistance 53 to negative battery. Relay B1 closes a first locking circuit for itself including the winding of relay L0, front contact 49 and upper winding of relay B1. The opening of back contact 70 disconnects the operating circuit of relay B1 and the closure of the front contact of this make-before-break combination effects the operation of relay L0 which, at back contact 50 opens up the common circuit to negative battery for all B relays, thus preventing the operation of more than one of these relays at any one time.

The operation of relay B1 extends the ringing circuit, by way of front contact 54 and cross connection Y1, to the winding of relay FR16, the ringing circuit being completed through condenser 55 and gas relay GRC, by way of positive battery and thence through the battery to the other side of the ringing source. Relay FR16 is operated in response to the 16 cycle ringing current which is being applied to the called line. It will be understood that, when this line is selected and some other frequency is applied, none of the frequency selecting relays of the common intercept trunk will operate because the only one that is connected to the ringing circuit is FR16 and it does not respond to any of the other selected frequencies.

The opening of the lower back contact 49 of relay B1 opens up the series circuit through all other B relays. This is to prevent any other B relay being maintained in its operated position in the event that two or more attempt to operate at exactly the same time. In other words, relay B1 has preference, with other B relays being next choice in operation by way of the series circuit extending from the #1 B relay to the #16 B relay.

With relay FR16 operated, a circuit is closed for operating common relay CM which extends from positive battery, front contact 56 of relay L0, contact 57 of relay FR16, and lower winding of relay CM to negative battery. Relay CM closes a locking circuit for itself extending from positive battery on the sleeve conductor of the called line circuit, cross connection Z1, front contact 58 of relay B1, lower winding of relay B1, back contact 59 of slow acting relay SA, front contact 60 and upper winding of relay CM to negative battery. This circuit locks relays B1 and CM to the sleeve conductor of the called line.

A circuit is now closed for operating slow to operate relay S0 which extends from positive battery, back contact 61 of relay RT, front contact 62 of relay CM and winding of relay S0 to negative battery. A circuit is now closed for operating relay RT which extends from positive battery through front contact 63 of relay S0. Relay RT closes a locking circuit for itself which extends from positive battery, front contact 64 of relay CM, front contact 65 and winding of relay RT to negative battery. Relay RT effects the release of relay S0 by opening its back contact 61. Thus, contact 71 of relay S0 is momentarily closed to trip the ring in the link.

The tick-tick relays TT1 and TT2 are now operated over a circuit which extends through front contact 61 of relay RT. The operation of these tick-tick relays is the same as already described in connection with Figure 1 and need not be repeated here. They function to intermittently apply positive battery to the transformer TF, through which a tick-tick signal is superimposed on the calling line.

When the calling subscriber hangs up the receiver, the release of the connector link opens up the sleeve circuit leading to terminal Z1, which effects the release of relay B1, which in turn restores the intercept circuit to normal so that another connection may now be made to the common intercept trunk.

From the above it will be apparent that the application of a ringing frequency to a called line which corresponds to the connection of jumper Y1 (or Y2 up to Y16, inclusive, of the other intercept circuits), effects the operation of the corresponding frequency responsive relay for completing the above described locking circuit for relays similar to B1 and CM. The application of any other frequency to this jumper connection is ineffective to operate a frequency responsive relay and consequently the intercept circuit connected to the called line does not function to seize the common intercept trunk.

A time release feature has been applied to the circuit shown in Figure 3 and comprises a dash-pot relay, a repeater of the dash-pot relay DPR and a slow acting relay SA. As above explained, relay RT operates when the common intercept trunk is seized. This closes a circuit for energizing the dash-pot relay which extends from positive battery, back contact 66 of relay SA, front contact 67 of relay RT and winding of the dash-pot relay to negative battery. The dash-pot relay is adjusted to complete its operation in a predetermined time, say 15 seconds. If the calling party, hearing the tick-tick tone, releases before this 15 second interval, the circuits func-

tion as previously described. In the event that the calling party does not release before this interval, the complete operation of the dash-pot relay closes an obvious circuit for operating relay DPR and relay DPR closes an obvious circuit for operating relay SA. The operation of relay SA opens up the energizing circuit of the dash-pot relay at back contact **66**, which effects the release of the dash-pot relay, followed by the sequential release of relays DPR and SA. With relay DPR released and before relay SA releases, the opening of front contact **68** while back contact **59** is open, opens up the holding circuit including relays CM and BI (or the like). This effects the release of the connection from the common intercept circuit, which renders this common circuit available for another call. It will be noted that when a connection is released from the common intercept trunk in this manner, this particular connection will not attempt to seize the intercept trunk again because the ringing has been tripped in the connector link which established the connection.

It should be noted that relay BPI is a direct repeater of relay BI and consequently the contacts of relay BPI can as well be placed on relay BI by providing a relay designed to carry this additional number of contacts.

It is also to be noted that, although the operation of one connecting relay, such as relay BI, locks out all others this does not prevent the operation of some other B relay associated with an intercept station, because the common generator frequencies are staggered as indicated in the timing chart of Figure 2.

Having described an intercept system as particularly adaptable for selective type communication service in party line ringing systems, it is desired to have it understood that this form is selected to facilitate in the disclosure of the invention rather than to limit the number of forms which it may assume; and it is to be further understood that various modifications, adaptions and alterations may be applied to the specific form shown to meet the requirements of practice, without in any manner departing from the spirit or scope of the present invention except as limited by the appended claims.

What I claim is:

1. In a telephone system, party lines, means for extending connections to said party lines, a common interrupter, means including said common interrupter for intermittently applying ringing currents of different character to connections extended to said party lines for selectively ringing stations thereon, means responsive to the application of said ringing currents to said lines effective in the event that the desired stations thereon are out of service for directing contemporaneous connections to a common intercept trunk, means for transferring one only of said contemporaneous connections to said common intercept trunk, and means for storing the other contemporaneous connections.

2. In an intercept system for telephone party lines, generator means for selectively signalling stations on said lines, a common intercept trunk, individual intercept control relay units interposed between a plurality of party lines and said intercept trunk one unit for each line, and generator controlled means associated with said intercept trunk and any one of said control relay units for connecting a call for any of a plurality of intercepted stations on the associated line to said intercept trunk.

3. In a telephone system; party lines, means for extending connections from a calling line to said party lines, means including a common ringing interrupter for selectively applying ringing currents of different characteristics to a connection to any one of said party lines for selectively signalling the desired station thereon, common testing means including said ringing interrupter for determining whether or not the desired station is out of service, means for extending a connection intended for a station out of service to a common intercept trunk, and means for applying a special intercept signal to the calling line connection extended to said intercept trunk.

4. In a telephone system, party lines, means for extending connections from a calling line to said party lines, means including a common ringing interrupter for selectively applying ringing currents of different characteristics to a connection to any one of said party lines for selectively signalling the desired station thereon, common testing means including said ringing interrupter for determining whether or not the desired station is out of service, means for extending a connection intended for a station out of service to a common intercept trunk, means for applying a special intercept signal to the calling line connection extended to said intercept trunk, and means for preventing the extension of more than one connection to said intercept trunk at any one time.

5. In a telephone system, party lines, means for extending connections to said party lines, means including a common ringing interrupter for selectively applying ringing currents of different characteristics to a connection to any one of said lines for selectively signalling the desired station thereon, common testing means including said ringing interrupter for determining whether or not the desired station is out of service, means for extending a connection intended for a station out of service to a common intercept trunk, means for applying a special intercept signal to the connection extended to said intercept trunk, means for preventing the extension of more than one connection to said intercept trunk at any one time, and means for automatically releasing an extended connection from said common intercept trunk after a predetermined time interval.

6. In an intercept system for telephone party lines, a common intercept trunk, a plurality of connecting units connected to said party lines, each of said connecting units comprising a line relay and a connecting relay, means responsive to the application of signalling current to a plurality of said party lines for operating a plurality of said line relays, means including said line relays for effecting the operation of one of said connecting relays, means controlled by the operation of one of said connecting relays for preventing the operation of any other of said connecting relays, and means controlled by the operation of one of said connecting relays for effecting a connection to said intercept trunk.

7. In an intercept system for telephone party lines, a common intercept trunk, a plurality of connecting relays connected to said party lines, means including a plurality of ringing interrupters operating at different time intervals for applying ringing current to said party lines and to the connecting relays connected thereto, a plurality of intercept interrupters operating at time

intervals corresponding at least in part to the time intervals of said ringing interrupters, and means responsive to correspondence between one of said ringing interrupters and one of said intercept interrupters for effecting a connection of one of said connecting relays to said intercept trunk.

8. In an intercept system for telephone party lines, a common intercept trunk, a plurality of connecting relays connected to said party lines, means including a plurality of ringing interrupters operating at different time intervals for applying ringing current to said party lines and to the connecting relays connected thereto, a plurality of intercept interrupters operating at time intervals corresponding at least in part to the time intervals of said ringing interrupters, means responsive to correspondence between one of said ringing interrupters and one of said intercept interrupters for effecting a connection of one of said connecting relays to said intercept trunk, and lock out means for preventing said correspondence effecting the connection of more than one connecting relay to said intercept trunk at any one time.

9. In an intercept system for telephone party lines, a common intercept trunk, a plurality of connecting relays connected to said party lines, means including a plurality of ringing interrupters operating at different time intervals for applying ringing current to said party lines and to the connecting relays connected thereto, a plurality of intercept interrupters operating at time intervals corresponding at least in part to the time intervals of said ringing interrupters, means responsive to correspondence between one of said ringing interrupters and one of said intercept interrupters for effecting a connection of one of said connecting relays to said intercept trunk, lock out means for preventing said correspondence effecting the connection of more than one connecting relay to said intercept trunk at any one time, and time control means for automatically releasing said one connecting relay from said intercept trunk whereby correspondence between said ringing and intercept interrupters is effective to connect another waiting connection to said intercept trunk.

10. In an intercept system for telephone party lines, a common intercept trunk, a separate pair of individual intercept relays connected to terminals of each line from which a plurality of stations have been been removed from service, means effective in case anyone of said plurality of stations is called for operating the associated pair of said intercept relays, means controlled by the operation of said pair of intercept relays for connecting the call for any one of said plurality of stations to said intercept trunk, and automatic means associated with said intercept trunk for applying a distinctive signal to a calling line connected to the intercept trunk whereby the calling party is signalled that the called station is out of service.

11. In a telephone system, a line, an intercept trunk, means for extending a call to said line and to said intercept trunk, locking means for maintaining said extended call in association with said intercept trunk, and time controlled means for automatically disassociating said extended call from said intercept trunk.

12. In a telephone system, a plurality of lines, an intercept trunk, means for extending calls to said lines and to said intercept trunk, locking means for maintaining an extended call in association with said intercept trunk, time controlled means for automatically disassociating said extended call from said intercept trunk, and means controlled by said locking means for preventing the extension of more than one call to said intercept trunk at any one time.

13. In a telephone system, a line adapted to have a plurality of substations associated therewith, means for routing calls to said line from other lines, means for selectively applying separately characterized ringing voltages to said line for selectively signalling said substations, call intercepting means, means responsive to any of said characterized ringing voltages for initiating operation of said call intercepting means, and means responsive to a particular characterized ringing voltage for completing the operation of said call intercepting means whereby the call is intercepted.

14. In a telephone system, a line adapted to have a plurality of substations associated therewith, means for routing calls to said line from other lines, means for selectively applying separately characterized ringing voltages to said line for selectively signalling said substations, call intercepting means comprising a circuit individual to said line and a circuit common to all of said lines, means responsive to any of said characterized ringing voltages for operating said individual circuit, and means responsive to a particular characterized ringing voltage for operating said common circuit to intercept the call to said line.

15. In a telephone system including a called line and ringing apparatus for impressing ringing voltage on the called line during any one of a plurality of time intervals, apparatus for routing a call from a calling line to a common intercept circuit only in the event ringing voltage is impressed upon said called line during a predetermined one of said time intervals, and means for applying a distinctive audible signal to said calling line only in the event that it is connected to said intercept circuit.

16. In a telephone system including a called line and ringing apparatus for impressing ringing voltage on the called line during any one of a plurality of time intervals, apparatus for routing a call from a calling line to a common intercept circuit only in the event ringing voltage is impressed upon said called line during a predetermined one of said time intervals, means for applying a distinctive audible signal to said calling line only in the event that it is connected to said intercept circuit, and time control means associated with said intercept circuit for automatically disconnecting said calling line from said intercept circuit.

17. In a telephone system, a calling line, a called party line, means for establishing a connection from said calling line to said called line and for transmitting any one of a plurality of distinctive ringing signals to said party line for calling any one of the parties thereon, an intercept trunk associated with said called party line, means responsive to a particular ringing signal transmitted to said party line and trunk for applying a special intercept signal to said calling line.

WINFRED T. POWELL.