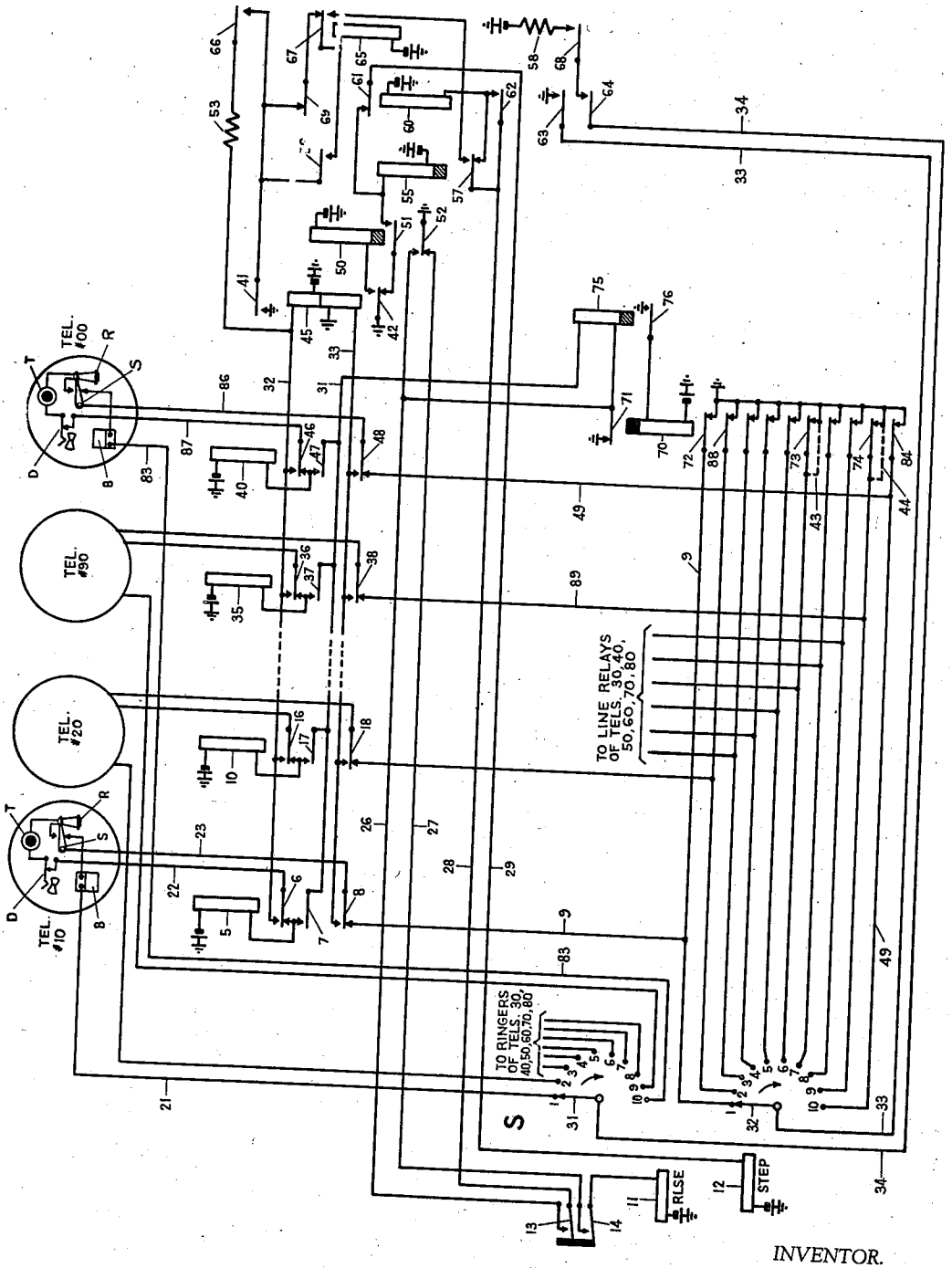
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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This invention relates in general to telephone systems but more particularly to small private automatic telephone systems, and the principal object of the invention is to design a small, efficient and economical telephone system for use in industrial organizations, schools, residences, and such.

A further object is to provide a small telephone system having a single common talking trunk, with the telephone connections arranged on a secret service basis. In accordance with the foregoing object, a particular feature of the invention is directed to the means whereby certain of the telephones may be arranged for right-of-way service so as to at any time connect with an already established connection.

Another object of the invention is to provide a system wherein a maximum of ten lines is provided and in which only a single conversation between any two lines at a time can be had. A particular feature concerns the means whereby a single individual line relay serves as a connecting link for each telephone, together with a single motion switch for selecting the called line. A further feature concerns an arrangement for indicating to a calling telephone the busy or idle condition of the common trunk.

The above objects and feature together with others not specifically enumerated will be pointed out more in detail hereinafter in connection with the accompanying drawing which shows by means of the usual circuit diagram a preferred embodiment of the invention.

Referring to the drawing, in the upper portion of the sheet four telephones are shown, No. 10, No. 20, No. 90, and No. 00, the remaining six telephones of the system not being shown. Each telephone has associated with it a line relay, for example, line relay 5 associated with telephone No. 10. At the right-hand side of the drawing a number of common relays are shown, while at the lower left-hand corner a rotary switch S is diagrammatically shown. The contacts of the upper bank are connected to wires extending to the call signals or ringers of each of the telephones while the bank contacts of the lower set are connected to leads extending to contacts of the common cut-off relay 70 and also the line relays. The switch S is mechanically constructed in well known manner and comprises essentially a stepping magnet 12, which upon each attraction of its armature engages a pawl with a ratchet which is on the shaft upon which the wipers 31 and 32 are supported so as to rotate these wipers step by step in a forward direction over their corresponding set of bank contacts. The operation of the release magnet 11 withdraws the pawl from the ratchet and under control of a tensioned spring the wipers are restored to normal position. A set of off-normal contacts 13 and 14 are actuated to close immediately that the switch wipers are stepped off-normal.

In describing the detailed operation of the system it will be assumed that the system as disclosed is installed in an industrial organization and that each of the ten telephones are scattered throughout the premises. All of the connection equipment including the relays and the switch S may be suitably mounted in a small cabinet at some centrally located position, and each of the telephones will have three wires extending from the equipment to the telephones, two of the line wires extending to the associated line relay while the third wire extends to the bank of the switch S.

Assume now that the telephone No. 10 desires to establish a connection with telephone No. 00. The removal of the receiver R from the switchhook S at telephone No. 10 establishes a circuit path extending from battery through the winding of line relay 5, back contact and armature 6 of the aforesaid relay, line conductor 22, normally closed contacts of the impulse sender or calling device D, transmitter T, receiver R contacts of the switchhook S, back over line conductor 23, armature 8 and its back contact, conductor 9, to ground on the back contact of armature 72 of the cut-off relay 70. Line relay 5 energizes over this circuit path and operates its armatures 6, 7 and 8. At the front contacts of armatures 6 and 8 the line conductors 22 and 23 are connected directly to the common trunk 32 and 33 extending to the windings of line relay 45 and battery and ground respectively. At the back contacts of armatures 6 and 8 the original energizing circuit of relay 5 is opened and a locking circuit for it is completed extending from battery through winding of line relay 5, front contact and armature 7, common locking conductor 31, through the winding of slow release relay 75, to armature 71 and its back contact to ground. The front contact of armature 7 closes first before the original energizing circuit for relay 5 is opened at the back contacts of armatures 6 and 8.

Relay 75 energizes in series with line relay 5 and at its front contact and armature 76 connects ground through the winding of slow-to-energize relay 70 to battery. This relay slowly energizes but does not immediately operate its armature.

Line relay 45 having its circuit closed through the upper and lower windings energizes and closes ground on armature 41 for a purpose which will be pointed out later on, while at the impulsing armature 42 it connects ground to the front contact and to the winding of slow-to-release relay 50 to battery. Relay 50, upon operating, at armature 52 and its back contact disconnects ground from conductor 27, while at the front contact of this armature ground is connected to conductor 26, a branch of which extends through the winding of relay 75. At front contact and armature 51 a circuit for relay 55 is prepared. During this time relay 70 has completely operated its armatures, and at armature 71 and its back contact disconnects the original energizing circuit of relay 75 which at this time, however, is connected to ground as just described on armature 52 to hold relay 75 and the line relay 5 energized in series.

As a further result of the operation of relay 70 it operates its remaining ten armatures including armatures 72, 73, 74 and 84 to disconnect ground from the back contacts of these armatures extending over leads 9, 89, 49, etc., to armatures 8, 18, intermediate similar armatures, armatures 38 and armature 48, so that this ground is disconnected from all the lines in the system and will prevent the associated line relays from operating in case their telephones attempt to initiate a call at the time relay 5 is operated in initiating a call from its associated telephone No. 10. It will be seen that as long as relay 70 is energized no other telephone can initiate a call or connect to the common trunk 32 and 33 except in certain instances which will hereinafter be pointed out.

As a further result of the energization of line relay 45 it closes ground from its front contact to its armature 41 over back contact and armature 69, back contact and armature 67, through the winding of ringing relay 65 to battery. Relay 65, upon energizing, first closes its front contact on armature 66 and completes a circuit extending from grounded front contact and armature 41, front contact and armature 66, high resistance 53, line conductor 32, through the upper winding of line relay 45 and battery. At the back contact of armature 67 the energizing circuit of relay 65 is opened and this relay retracts its armatures. As armature 41 in relay 45 is still operated the relay immediately energizes again. Relay 65, therefore, energizing and deenergizes rapidly in succession in the manner of a buzzer and rapidly opens and closes its contacts 66. This action generates a tone called the dial tone in the line conductor 32 which does not affect the operation of line relay 45, because of the high resistance of resistance 53. The tone generated is, however, transmitted over the line conductor 32 to the transmitter T and receiver R and informs the person at the calling telephone No. 10 that the common trunk is idle and not in use by other telephones. At armature 68 of relay 65 battery is connected to its front contact without effect at this time, however.

The person at telephone No. 10 hearing the dial tone generated by relay 65 and being aware that the common trunk 32 and 33 is not busy thereupon actuates his calling device to operate the impulse springs D at his telephone in accordance with the first digit of the called station's telephone, which in this instance is 0, corresponding to ten impulses. The line relay 45 deenergizes responsive to the first opening of the impulse springs D over the line circuit comprising conductors 22 and 23, 32 and 33. Relays 50 and 55, being rendered slow to release due to the copper slug on their heel ends remain energized throughout the series of impulses. A circuit is now closed when the line relay 45 falls back, from ground on armature 42 and its back contact, armature 51 and its front contact, through the winding of slow release relay 55 to battery. A branch of the energizing circuit of relay 55 extends by way of back contact and armature 61, conductor 29, through the winding of stepping magnet 12 to battery, of the switch S, thereby energizing this stepping magnet. The stepping magnet 12, upon energizing, operates its pawl to rotate the wipers 31 and 32 in a forward direction as indicated from the first to the second set of bank contacts. At the same time the wipers are rotated the off normal contacts 13 and 14 close.

As a further result of the energization of relay 55 it closes its front contact and armature 56 thereby extending ground from front contact and armature 41, through the winding of relay 65 to battery, thereby holding this relay energized so it will no longer vibrate its armature and front contact 66, and consequently disconnects the dial tone from the line conductor 32. At front contact of armature 57 relay 55 closes a further point and a locking circuit for relay 65 through its front contact and armature 67 through the relay to battery; and by way of conductor 28 closed off-normal contacts 13, to front contact and armature 52 and ground. This circuit therefore holds relay 65 operated independent of ground on armature 41 which is connected and disconnected by subsequent energizations and deenergizations of line relay 45 due to the impulses. At armature 68 relay 65 prepares a ringing circuit which will be later on pointed out.

After the first impulse from the calling device D at telephone No. 10 the remaining series of impulses operate line relay 45 to attract and retract its armatures rapidly in succession, relays 50 and 55 remaining energized for the duration of the impulses and each impulse being transmitted from the impulse contacts at armature 42 by way of armatures 51, 61 and conductor 29 to the stepping magnet 12, thereby rotating the wipers 31 and 32 across the bank contacts of the switch S.

After the first series of ten impulses have been transmitted by the calling device D relay 45 again remains energized when it comes to rest and armature 42 maintains relay 50 in the same position. At the back contact of armature 42, however, the circuit for relay 55 is permanently opened and after a short interval this relay deenergizes and releases its armatures. At armature 56 relay 55 opens the original holding circuit of relay 65, while at armature 57 it opens the locking circuit for this relay and relay 65 consequently deenergizes and retracts its armatures. At the back contact of armature 57 relay 55 completes a circuit for relay 60 extending from battery through the winding of this relay, back contact and armature 57, conductor 28, closed off-normal springs 13, conductor 26, front contact and armature 52 of relay 50 to ground. Relay 60 consequently energizes and at its front contact and armature 62 completes a locking circuit for itself independent of the back contact of armature 57, and at armature 61 and its back contact opens the circuit of the stepping magnet 12; at front contact and armature 64 it closes a point in the ringing circuit which, however, at this time is open by relay 65 at its armature 68; at front

contact and armature 63 it connects ground to conductor 33 which extends to wiper 32 and bank contact 10 upon which it is now resting, to conductor 49. This ground connection is in substitution for that which originally was disconnected from this conductor 49 at armature 84 by the operation of relay 70.

The second digit of the called telephone number 0 is now dialled. This digit 0, it will be noted, is the same for each of the telephones in the system, and constitutes the ringing digit; the first digit in each instance selecting the telephone which is being called. The operation of the calling device D at telephone No. 10 in accordance with the digit 0 transmits ten impulses over the line conductors 32 and 33 to energize and deenergize line relay 45 a corresponding number of times. At the first deenergization of line relay 45 responsive to the first impulse it completes a circuit again from grounded armature 42 and its back contact, armature 51 and its front contact, to relay 55 and battery. At the front contact and armature 56 it closes the circuit for relay 65 from ground on armature 41 responsive to the first impulse, so that this relay immediately energizes. At front contact of armature 57 relay 55 closes a locking circuit for relay 65 by way of its armature 67, so that it remains permanently energized during the series of impulses independent of the ground on armature 41 which vibrates in synchronism with the energization and deenergization of line relay 45. Relay 60 at this time being locked energized over armature and front contact 62, impulses no longer are transmitted over back contact and armature 61 to the stepping magnet 12 due to the opening of this armature.

Due to the energization of relay 65 battery is connected through the resistance 58, front contact and armature 68, front contact and armature 64, over conductor 34, wiper 31 and the tenth bank contact upon which it is now resting, ringing conductor 83 extending to telephone No. 00 through the ringer B, at telephone 00, normally closed switchhook contacts S, line conductor 86, armature 48 and its back contact, conductor 49, extending to bank contact No. 10, wiper 32 which is now resting on this bank contact, conductor 33, armature 63 and its front contact to ground. The circuit above pointed out actuates the ringer B to audibly signal the person at this telephone.

After the last impulse has been transmitted to relay 45 it again becomes permanently energized and holds relay 50 operated. At the back contact of armature 42 relay 55 has its circuit opened so that when it deenergizes it opens the original energizing circuit of relay 65, while at armature 57 it opens the locking circuit for this relay and relay 65 consequently deenergizes and retracts its armatures. Relay 60, however, remains locked energized over front contact and armature 62 to ground on armature 52 and its front contact, and at armature 69 prevents the energization of relay 65 again from armature 41. Should the person at telephone station No. 00 neglect to answer his telephone immediately, his ringing device B may again be actuated, by the person at telephone No. 10 again dialling the digit 0. This results in the energization of relays 45, 50, 55 and 65, as has been pointed out, to again actuate the ringing device. This dialling of the digit 0 may be repeated as many times as desirable or until the person at the called telephone answers and at the end of each series of impulses relays 45 and 50 remain energized while relays 55 and 65 are deenergized.

The removal of the receiver R from the switchhook S disconnects the ringing device B and prevents its further operation. At the same time the front contacts of the switchhook S close a loop circuit extending through the receiver R transmitter T, impulse springs D over line conductors 86 and 87, back contact of armature 46, through the winding of line relay 40 to battery and the ground connected to conductor 49 to back contact and armature 48. The line relay 40 energizes over this loop circuit and at its front contact and armature 47 completes a locking circuit for itself over conductor 31 through the winding of relay 75 to the front contact and armature 52 and ground. At the front contact of armatures 46 and 48 the line conductors 86 and 87 are connected directly to the common trunk 32 and 33 to which line conductors 22 and 23 of the telephone No. 10 are connected by armatures 6 and 8 of relay 5. The telephones No. 10 and No. 00 are both now connected directly to the common trunk 32 and 33 and both parties may now converse, battery current for talking purposes being furnished through the windings of the line relay 45.

Should it occur that during the time that telephones No. 10 and No. 00 are engaged in a connection that another telephone, for example, No. 20, desires to establish a call, the connection will be prevented from being made or the person from listening in on an existing connection due to the fact that the energizing circuit for line relay 10 of telephone No. 20 will be open due to the energization of relay 70, at armature 88. Relay 10, therefore, cannot energize and because of the absence of dial tone from relay 65 the person at telephone No. 20 will be aware that the common trunk 32 and 33 is in use and that he must wait until the trunk returns to normal before attempting to establish a connection with another telephone. From the foregoing it is seen that all conversations are on a secret service basis, as no other station can connect to the common trunk as long as it is in use, except as will hereinafter be pointed out.

In certain instances it may be desirable that certain telephones used by a supervisor or an executive, for example, be arranged so that they may at all times have access to the common trunks 32 and 33 and also that they may be enabled to cut in onto an established connection already existing on the common trunk between two other telephones. To provide for this right-of-way service certain of the telephones, for example telephone No. 60 and telephone No. 90 are arranged for this service. A strap 43 is connected around the contacts 73 of cut-off relay 70 for telephone No. 60 and the strap 44 around armature contacts 74 for telephone No. 90. With this arrangement should telephones No. 10 and No. 00 be engaged in a connection over common trunk 32 and 33 and telephone No. 90 desires to make a connection, the removal of the receiver R from the switchhook at telephone No. 90 completes the circuit for line relay 35 by way of conductor 89, the strap 44 around armature 74 and its back contact to ground. Therefore the line relay 35 will become energized to close its front contact onto armatures 36 and 38 and connect the telephone No. 90 direct to the common conductor 32 and 33. This circuit for relay 35 is rendered available as pointed out in spite of the fact that relay 70 is operated, and the armature 74 is open from its grounded back contact. The telephone No. 90 is therefore directly con-

nected onto the common trunk 32 and 33 and can inform the parties already engaged in a conversation that he desires the use of the common trunk or request them to hang up their receivers or listen in on the conversation. From the foregoing it is seen that any telephone desired may be equipped with the straps such as 43 and 44, it being a simple matter to provide these, or to disconnect them from any telephone in the system, thereby rendering this service extremely flexible. If the person at telephone No. 90 desires to have the common trunk line cleared, the telephones No. 10 and No. 00 must be restored to normal by the replacement of their receivers, as well as that of telephone No. 90, in order that all of the equipment may be in its normal position so that telephone No. 90 can establish the connection with the other desired telephone which it is to call.

After the telephones No. 10 and No. 00 have finished their conversation and the last one of them to hang up replaces the receiver R upon the switchhook S, the circuit extending over common trunk 32 and 33 to line relay 45 is interrupted at the front contact of the last switchhook. Line relay 45 consequently deenergizes and retracts its armature 42. Ground is thereby connected from the front contact of this armature from relay 50 and this relay upon slowly deenergizing finally restores its armatures 51 and 52. At the front contact and armature 52 ground is disconnected from conductor 26 extending through relay 75 to conductor 31. This ground, it will be recalled, extends over the conductor 31 to armature 47 and the front contact of line relay 40, and to armature 7 and its front contact on line relay 5. These line relays therefore deenergize and restore their respective armatures. Line relay 5 at armatures 6 and 8 disconnects the telephone No. 10 from the common trunk 32 and 33, while line relay 40 at armatures 46 and 48 disconnects the telephone No. 00 from this trunk. Slow release relay 75 after an interval disconnects ground from the front conductor and armature 76 to interrupt the circuit of relay 70. This relay after a short interval closes its ten armatures on to their back contacts and connects ground to all the conductors extending to the line relays, rendering the system available for other calls. As a further result of the retraction of armature 52 of relay 50 ground is disconnected from conductor 26 extending by way of off-normal contact 13 to conductor 28, armature 62 and its front contact, which maintains relay 60 energized. Relay 60 thereupon deenergizes and restores its armatures. At the back contact of armature 52 ground is connected to this armature and over conductor 27 through off-normal contacts 14, and through the winding of release magnet 11 to battery. Release magnet 11, upon energizing, withdraws the pawl holding wipers 31 and 32 on the bank contact No. 10 and under the action of a tensioned coil spring, the wipers are restored to normal position onto their first set of bank contacts. Shortly before these wipers reach this position the off normal contacts 13 and 14 are opened, resulting in contacts 14 opening the circuit of release magnet 11 which thereupon restores. All relays and apparatus of the system are now in their normal condition, ready to receive another call.

Having described the invention, what is new and is desired to be protected by Letters Patent will be set forth in the following claims.

What is claimed is:

1. In a telephone system, a plurality of lines, a line relay individual to each of said lines, means responsive to a call from any of said lines for operating its associated line relay, means responsive to the operation of said line relay for preventing the operation of all of said other line relays, a step-by-step switch connected to said line relays, and means controlled over the calling line for operating said step-by-step switch to select for operation only the line relay of the called line.

2. In a telephone system, a plurality of lines, a line relay individual to each of said lines, a cut-off relay controlling the energizing circuit of said line relays means responsive to a call from a line for operating its associated line relay and for operating said cut-off relay to disconnect the energizing circuits of all of said other line relays, a step-by-step switch, means controlled over said calling line for operating said step-by-step switch to connect with the line relay of the called line, and means for operating said called line relay through said step-by-step switch independent of said cut-off relay.

3. In a telephone system, a plurality of telephone lines each having an individual line relay associated with it, a cut-off relay controlling the circuits of all of said line relays, means responsive to the initiating of a call from any line for operating its associated line relay and for operating said common cut-off relay to disconnect the energizing circuit of all of said line relays including the line relay of the called line, a step-by-step switch operated over the calling line to select the line relay of the called line, and means for operating the called line relay over said switch over a circuit path independent of the control by said cut-off relay.

4. In a telephone system, telephone lines, a line relay individual to each of said telephone lines, a common cut-off relay controlling the circuits to each of said line relays, means responsive to a call from any line for operating its associated line relay and for operating said cut-off relay to disconnect all of said other line relays to prevent their operation, and means on said common cut-off relay for permitting the operation of only certain of said line relays.

5. In a telephone system, a plurality of telephone lines, a line relay individual to each of said telephone lines, a cut-off relay common to all of said line relays and controlling their energizing circuits, certain of said line relays controlled independent of said common cut-off relay, means responsive to the initiation of a call from any line for operating its associated line relay, and for operating said common cut-off relay to disconnect all energizing circuits from all the line relays except certain ones, means controlled over the calling line for operating the line relay of the called line over a circuit independent of said common cut-off relay to establish a connection between the calling and the called line, and means responsive to a call from any of said certain lines for operating its associated line relay to connect directly to said established connection independent of said common cut-off relay.

6. In a telephone system, a plurality of lines, a line relay for each of said lines, a common cut-off relay having a contact for controlling the circuit for each of said line relays, means responsive to a call from any line for operating its associated line relay and for operating said cut-off relay to operate its contacts to disconnect the circuits of all other of said line relays except the

calling line, and means on certain of said cut-off relay contacts for operating a line relay corresponding to the contact independent of said contact.

7. In a telephone system, a plurality of lines, a line relay individual to each of said lines, a common trunk connected to contacts of each of said line relays, means responsive to the initiation of a call from one of said lines to another of said lines for operating the line relays of the calling line and of the called line to connect said lines to said trunk over the contacts of the operated line relays, and other means responsive to said call for preventing the operation of all other of said line relays.

8. In a telephone system, a plurality of lines, a line relay individual to each of said lines, a common trunk line connected to contacts of each of said line relays, means responsive to the initiation of a call from any line to another line for operating the called and calling line relays to connect the common trunk line through their associated contacts to the calling and called lines, a common cut-off relay operated responsive to the initiation of a call, and contacts controlled by said common cut-off relay for disconnecting all other line relays from said trunk line except the calling and called line relays.

9. In a telephone system, a plurality of telephone lines, a line relay individual to each of said lines, a common talking trunk line connected to each of said line relays, a common cut-off relay controlling the circuits of said line relays, means responsive to the initiation of a call from any line for operating its associated line relay and for operating the common cut-off relay to disconnect all of said other line relays from operation, means responsive to the operation of said calling line relay for connecting the calling telephone to said common talking trunk, means controlled from said calling line for operating the line relay of the called line independent of said common cut-off relay, and connections on said common cut-off relay for permitting the operation of only certain of said line relays independent of said cut-off relays so that certain line relays can operate and connect their associated telephones directly to said common talking trunk at a time when said trunk is engaged in a connection between a calling and called line.

10. In a telephone system, a plurality of lines each having a telephone substation thereon including an automatic calling device, a step-by-step switch, means responsive to a digit dialled by a calling telephone for operating said step-by-step switch to connect with a called line, and means responsive to a second digit dialled by said calling telephone for signalling said called telephone over said switch.

11. In a telephone system, a plurality of substations each having a calling device thereat, a step-by-step switch including a pair of wipers, means responsive to a digit dialled by a calling substation for operating said step-by-step switch to connect one of its wipers with the called telephone, and means responsive to a second digit dialled by said calling telephone for signalling said called telephone over the other of said switch wipers.

12. In a telephone system, a plurality of substations each having a calling device, a step-by-step switch, means responsive to a digit dialled from a calling telephone for operating said step-by-step switch, said step-by-step switch having a pair of wipers, a first one of said wipers operated responsive to said digit to connect with the called telephone substation, the second one of said wipers operated to select the signalling device at the called station, means responsive to a second digit dialled from said calling substation for operating the signalling device at the called station over said second wiper, and said last means responsive to dialling additional digits to operate said called signalling device over said second wiper.

13. In a telephone system, a plurality of lines, a line relay individual to each of said lines, a common talking trunk connected to each of said line relays, means responsive to the initiation of a call from any line for operating its associated line relay and the line relay of the called line to connect said calling and called telephones through their associated line relays to said common talking trunk, a common cut-off relay operated responsive to the initiation of a call for disconnecting all other line relays from said common talking trunk, and means for connecting a tone to said common trunk to indicate to said calling line that said common trunk is not engaged in a connection.

14. In an automatic telephone system, telephone lines each having a substation connected thereto including a calling device, a line relay individual to each of said lines, a common talking trunk connected to all of said line relays, a cut-off relay common to all of said line relays and controlling the circuits thereof, a step-by-step switch having a pair of wipers, one of said wipers having its bank contacts connected to said line relays while the other wiper has its bank contacts connected to a signalling device at each substation, means responsive to the initiation of a call from any substation for operating its associated line relay and said common cut-off relay, means responsive to the operation of said cut-off relay for disconnecting said other line relays from operation, means responsive to a first digit dialled by said calling line for operating said step-by-step switch to rotate its wipers, the first of said wipers operated to a connection with a called line relay to operate the same independent of said common cut-off relay, said calling line relay and said called relay operating to connect said lines to said common talking trunk, the second of said wipers operated to connect with said signalling device at said called substation, and means responsive to the dialling of a second and subsequent digit for repeatedly operating the signalling device at said called substation.

15. In a telephone system, a plurality of lines, substations on each of said lines each having a signalling device, a step-by-step switch having a pair of wipers, a common cut-off relay for all of said lines, means responsive to the initiation of a call from any line for operating said cut-off relay to prevent any other line from initiating a call, means responsive to digits transmitted from said calling station for operating said step-by-step switch, the first wiper of said switch operated to select the called substation telephone and render it operative independent of said common cut-off relay, the second of said wipers operated to select the signalling device at the called telephone, and means responsive to a second digit dialled by said calling telephone for operating said signalling device over said wiper.

16. In a telephone system, a plurality of lines, a line relay individual to each of said lines, a common talking trunk common to and connected to each of said line relays, means responsive to

the initiation of a call from a calling telephone for operating its line relay to connect said line with said common talking trunk, a relay operated responsive to the seizure of said trunk by said line relay to transmit a tone over said trunk to said calling telephone to indicate that the trunk is in idle condition, means controlled from said calling telephone for preparing the establishment of a connection over said common talking trunk with a called line by selectively preparing only the called line relay for operation, and means controlled from said calling line for signalling said called line.

17. In a telephone system, a plurality of telephone lines, a trunk line common to all of said lines, means responsive to the initiation of a call from any of said lines for connecting said line to said trunk line, a relay, means responsive to the connection of the line with said trunk line for operating said relay to transmit a tone over said trunk line to said calling line to indicate the idle or busy condition of said trunk line, means controlled by said calling line over said trunk line for establishing a connection with another of said telephone lines, and means controlled from said calling telephone line for operating said relay to signal said called line over said common trunk.

18. In a telephone system, a plurality of lines, a common trunk line for all of said lines, a relay connected to said trunk line, means controlled from a calling station for operating said relay in one manner to indicate to the calling line that said common trunk is not busy, means controlled from said calling line in another manner to operate said relay in a different manner, and means responsive to the last operation of said relay for signaling the called line.

19. In a telephone system, a plurality of lines, a line relay individual to each line, a cut-off relay common to all said lines and operated in combination with any one of said line relays in response to the initiation of a call on any one of said lines, a contact on said cut-off relay for each line relay, an automatic switch operable from any one of said lines, an individual connection from said switch to each line, a first operating circuit for each line relay including its individual contact on said cut-off relay, and a second operating circuit for each line relay including the loop of its corresponding line and the corresponding individual switch connection.

20. In a telephone system, a plurality of lines, a line relay individual to each line, a cut-off relay common to all said lines, an individual contact on said cut-off relay for each line, an individual connection for each line connected in multiple with its corresponding cut-off relay contact, a first operating circuit for each line relay including its individual contact on said cut-off relay, and a second operating circuit for each line relay including the loop of its corresponding line and the corresponding individual connection.

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