

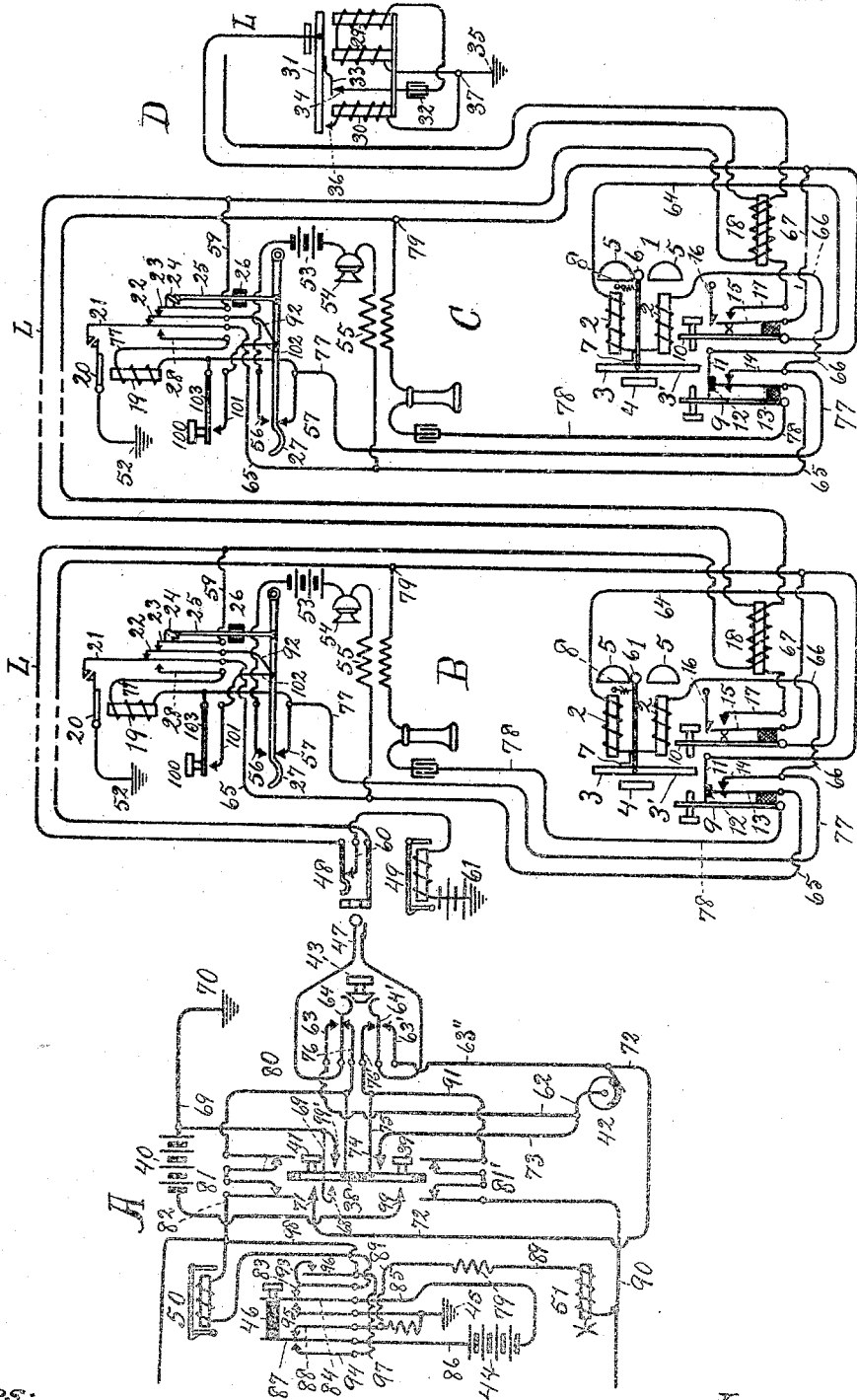
H. J. ROBERTS.
PARTY LINE TELEPHONE SYSTEM.
APPLICATION FILED MAY 1, 1905.

958,894.

Patented May 24, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
Harriet C. Chads?
Albert N. Mares

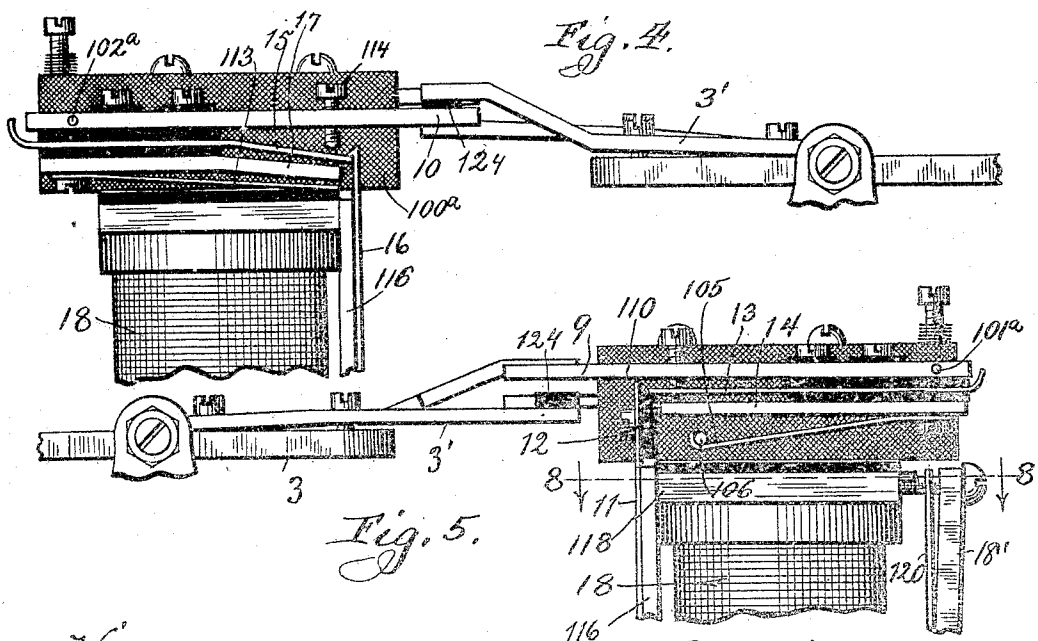
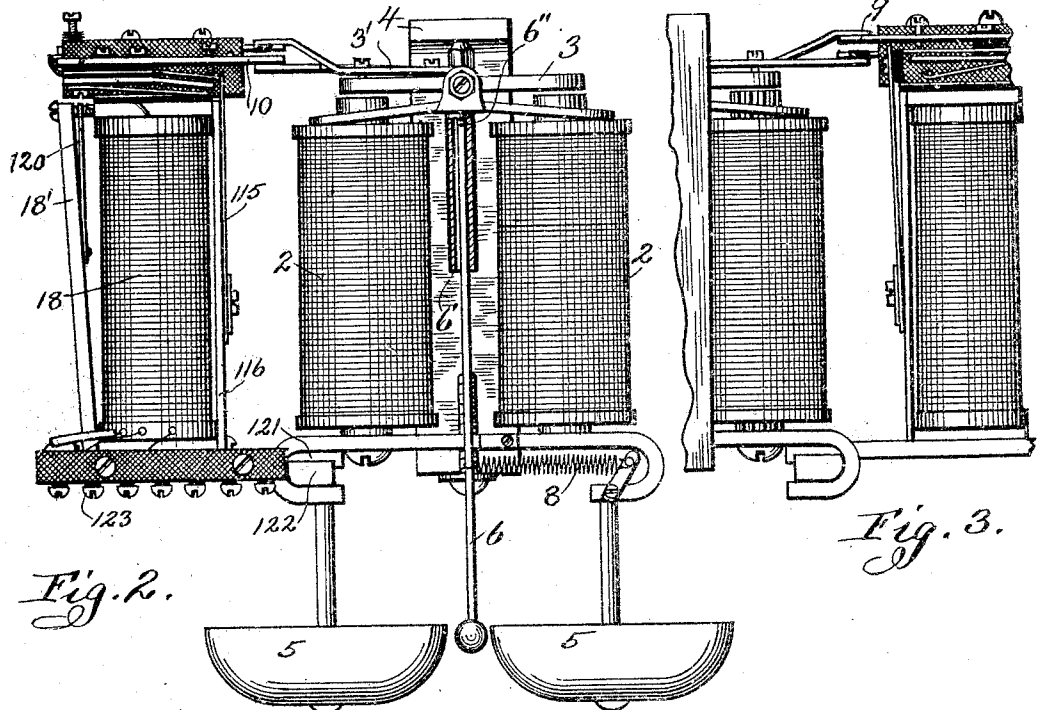
Inventor:
Homer J. Roberts

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PARTY LINE TELEPHONE SYSTEM.
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Patented May 24, 1910.

3 SHEETS—SHEET 2.



Witnesses:
Albert N. Graves.
E. L. Graves.

Inventor:
Homer J. Roberts

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APPLICATION FILED MAY 1, 1905.

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3 SHEETS—SHEET 3.

Fig. 6.

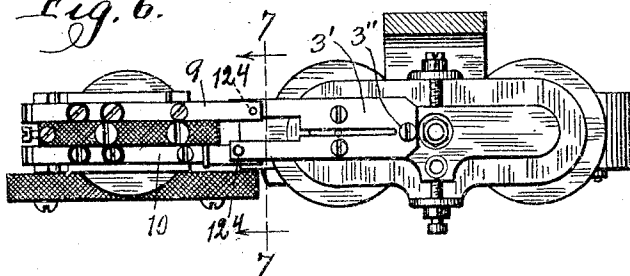


Fig. 7.

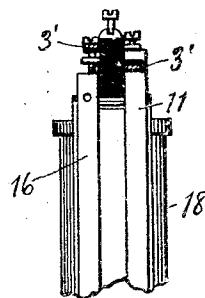


Fig. 8.

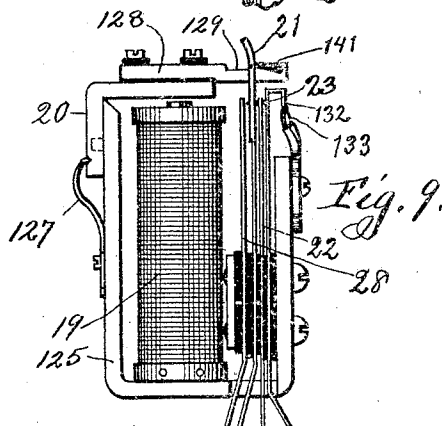
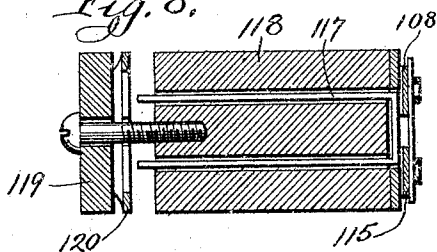


Fig. 9.

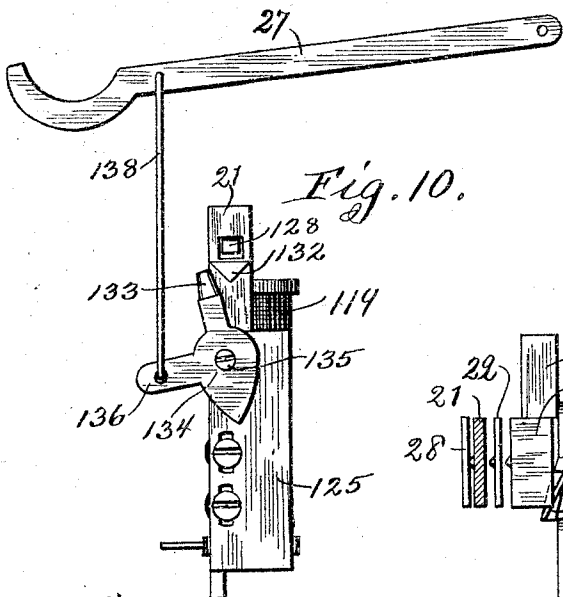


Fig. 10.

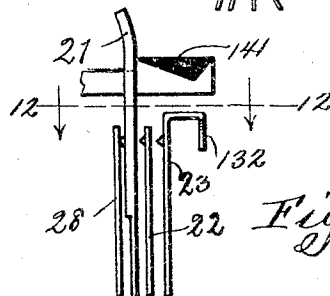


Fig. 11.

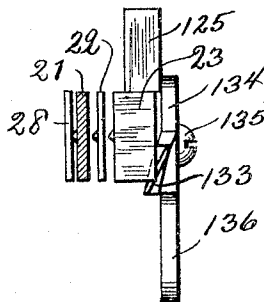


Fig. 12.

Witnesses:
Albert N. Graves
& L. Graves.

Inventor:
Homer J. Roberts

UNITED STATES PATENT OFFICE.

HOMER J. ROBERTS, OF EVANSTON, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
HOMER ROBERTS TELEPHONE CO., A CORPORATION OF WEST VIRGINIA.

PARTY-LINE TELEPHONE SYSTEM.

958,894.

Specification of Letters Patent.

Patented May 24, 1910.

Application filed May 1, 1905. Serial No. 258,192.

To all whom it may concern:

Be it known that I, HOMER J. ROBERTS, a citizen of the United States, residing at Evanston, in the county of Cook, in the State of Illinois, have invented certain new and useful Improvements in Party-Line Telephone Systems, of which the following is a specification.

This invention relates to improvements in party line telephone systems and among the salient objects of the invention are to provide a system which affords both selective signaling and "secrecy" or "lock-out" service; to provide a system which is at all times under absolute control of the exchange operator; to provide a system in which the changing of circuits whereby the selection of parties, signaling and restoring the line to normal condition, etc., are all accomplished by magnet relays as distinguished from those systems which employ "step by step," or analogous mechanisms; to provide a system wherein the instruments, the circuit connections, and the relations of the several sub-stations to "central" and to the main line, are alike, so that, within the limits of line resistance and practical considerations, the number of sub-stations which may be placed on a single line is unlimited; to provide a system wherein, under normal working conditions, but one sub-station at a time is connected in with the main line circuit, so that the full electrical energy impressed upon the line may be utilized and converted into mechanical energy at the particular sub-station selected; to provide a system wherein, during the operation of selecting, circuits are established from central through the first station in order of selection to the exclusion of all other sub-stations, then to the next sub-station in order of selection to the exclusion of all sub-stations, and so on until the desired station is selected; to provide a system in which two or more sub-stations on the same line can be thrown into talking connection with each other to the exclusion of all other stations on the line; to provide a system in which not only is interference by parties on the same line prevented but wherein the exchange operator can at will take the line from a party already connected in and transfer the connection to another party without let or hindrance; to provide a system wherein the appropriation of the line

to one subscriber does not interfere with or prevent other subscribers from signaling in for connections; to provide a system wherein the signaling in is accomplished over common battery or central energy circuits and is effected in the usual way *i. e.*, by simply lifting the receiver from the switch hook; to provide a system wherein the act of signaling in on the part of any subscriber sets his instrument in condition for selection by the exchange operator, without further effort on her part than simply throwing current on the line; to provide a means whereby the setting of his instrument for connection by a subscriber does not interfere or affect the line if already busy and whereby at the same time the set condition of the calling subscriber's instrument is not destroyed by the clearing or restoring to normal from the busy condition preparatory to giving this new connection; to provide in such a system means whereby the selection of a sub-station is automatically accompanied by an audible signal so that if a subscriber upon calling in finds the line busy he can leave his instrument set for connection and will be notified as soon as his turn is reached and a connection given; to provide a system in which full metallic circuits are provided for performing selections and for talking, free from ground connections, but in which at the same time ground to ground circuits may be used momentarily for clearing circuits, for locating a calling in subscriber and for preventing the blocking of the line by an intermediate subscriber; to provide means whereby the exchange operator is enabled to select any particular subscriber wanted without interference and regardless of the fact that an intermediate sub-station may at the same time be attempting to secure connection, and this without any necessity on the part of the exchange operator of taking cognizance of the fact that a subscriber is attempting to call in on the same line upon which a called subscriber is to be selected; to provide in such a system a clearing-signal system operating entirely independent of the calling in signal system; to provide a system which avoids, to all practical intents, marginal conditions of whatever kind or nature; to provide a system which is adapted for utilizing constantly supplied current from a generator or pole changer for effecting the

operations of selecting, ringing, etc.; to provide a system the line conditions of which are such that connections can be made at central between these party lines and other subscriber's lines of the usual kind, such as individual metallic circuit lines, individual grounded circuit lines and ordinary or non-selective party lines either metallic circuit or grounded lines, without interfering with the proper operation of the respective lines; to provide a system in which local battery may be employed for the talking energy, and in general, to provide a system conforming to a very great extent to what is considered the best conditions and requirements of modern telephone practice.

To the above ends the invention consists in the matters hereinafter described and more particularly pointed out in the appended claims.

The invention will be readily understood from the following description, reference being had to the accompanying drawings in which—

Figure 1, is a diagrammatic view of a practical embodiment of the invention. Fig. 2, is a plan view of a combined ringer and relay. Fig. 3, is a fragmentary view of the same as seen from the reverse side. Fig. 4, is an enlarged fragmentary detail of parts shown in Fig. 2. Fig. 5, is a view similar to Fig. 4, but looking at the reverse side. Fig. 6, is an end elevation of the same, the biasing bar being in section. Fig. 7, is a view taken on line 7—7 of Fig. 6 and looking in the direction of the arrows. Fig. 8, is a transverse sectional view taken on line 8—8 of Fig. 5 and looking in the direction of the arrows. Fig. 9, is a side elevation of a trip magnet. Fig. 10, is a front elevation of the same showing the method of connecting it with the switch hook. Fig. 11 is a detail showing upper end portion of the contact devices of the trip magnet greatly enlarged, and Fig. 12, is a view on line of 12—12 of Fig. 11 looking in the direction of the arrows.

Referring to the diagram A., designates as a whole the central station apparatus, B., and C., respectively sub-station equipments, and D., an instrument located at the end of the party line, for brevity hereinafter termed a "grounder." Of the exchange equipment, only so much is shown as is necessary to operate a single party line, it being understood that the operator's telephone set, the connecting-in cord and plug and usual other accessories of the exchange equipment may be arranged in any usual or preferred manner.

Describing first one of the sub-station equipments (all sub-stations being alike) there is located at each sub-station, in addition to the usual transmitter, receiver, talking coil and battery, a combined ringer

and selecting relay, and what for brevity will be termed a trip magnet. Describing these two latter instruments—1, designates the ringer, which is of the polarized type comprising the spools, 2, armature, 3, biasing magnet 4, gongs 5, and clapper 6. The stem of the clapper is loosely pivoted to the armature so that the latter may oscillate in one direction without ringing the bell, but said clapper is moved positively with the armature when the latter moves in the opposite direction, by means of a bracket 7 rigid with the armature and engaging one side of the clapper stem. The clapper is also held yieldingly in bearing with one gong by a spring 8.

One end of the armature, 3', is extended between two contact members 9 and 10 respectively, which are normally pressed toward the said extension 3'. The contact 9 engages and rests against the end of a latch contact 11 which carries upon its under side an insulating block 12 and in turn rests upon the upper end of a spring contact 13. Contact 13 is connected to move with contact 9 when the latter is oscillated by the armature. A back contact 14 normally engages contact 13. When the extension 3' of the armature engages the contact 9 and forces it outwardly the contact 13 moves from beneath block 12 and away from contact 14, latch contact 11 springs downwardly so as to bring the block 12 behind contact 13 and upon the return of the armature extension the return movement of the contact 9 carries it into engagement with contact point of spring 13 now held by the block 12. These movements, it will be seen, result in changing the circuits through contact 13 from 14 to 9 and at the same time open the circuit normally existing between 11 and 9.

The spring contact 10 is normally engaged by a spring contact 15 and with the upper end of the latter is arranged to cooperate a hook latch 16 which, when contact 10 is forced outwardly by the armature extension, engages the upper end of the spring 15 and as the contact 10 returns to its normal condition draws it over into bearing with a back contact spring 17. These movements, it will be seen, result in transferring the circuit through contact 15, from 10 to back contact 17.

18 designates a magnet which will be hereinafter termed the "restoring" magnet; an armature being actuated by this restoring magnet which lifts the two latch members 11 and 16 simultaneously when the magnet is energized thus releasing the two sets of springs described and permitting them to fly to their normal positions or that shown in the drawing.

Describing next the trip magnet and its operative connections, 19 designates the core thereof and 20 the armature which consti-

tutes a contact latch. 21 designates a spring latch contact with which are normally closed two other spring contacts 22 and 23. The latter carries a switch cam 24, which is engaged and actuated by a cam plunger 25 working through a guide 26 and operatively connected with switch hook 27. When the switch hook rises the cam plunger acting upon the outer incline of the cam forces the group of contacts forwardly and causes latch contact 21 to engage the armature latch 20. Upon the return movement of the switch hook the cam plunger engages the inner incline of cam 24 and oscillates the spring contact 23 backwardly; this movement being without electrical function. The latching of spring 21 to armature 20 opens the circuit between 23 and 22, between 22 and 21, and closes a circuit between 21 and 20 and between 21 and a forward contact 28 located in front of latch contact 21. The energizing of the trip magnet retracts the armature and permits the contact springs to fly back to their normal positions shown in the drawing.

The left main line L terminates in the grounder D hereinbefore referred to. This grounder comprises a highly wound polarized magnet the cores of which are designated 29, a low wound shunt magnet 30, a pivoted armature 31 common to both magnets and a condenser 32. The circuit from the left line through the grounder is normally to the armature 31, thence through a yieldable contact 33 carried by the armature to a fixed contact or anvil 34, from the latter to the condenser, from the condenser to and through the high winding of biased magnet and thence to ground at 35. Upon an impulse sent through the grounder in the right direction the longer end of armature 31 descends into bearing with an anvil contact 36 which is connected with the low shunt winding of magnet 30 and thence to the ground wire at 37. The obvious result of the operation of the grounder is to place a direct ground on the left main line and at the same time shunt the high resistance magnet as well as the condenser.

The central station apparatus shown comprises an oscillatory key 38 one end of which when depressed by its button 39 serves to place a battery 40 on the line and the other end of which when depressed by its button 41 serves to close a constantly running pulsating generator 42 upon the line. There is also provided a key 43 which when depressed closes the generator 42 upon the line (with its polarity reversed, however) and at the same time opens the main line as to a second battery 44 and ground 45 which are normally connected to line when the plug is in the jack. A third key 46 is provided which has the function of bringing into operation a grounded circuit over the left main line and through the several restoring magnets 18

and the grounder D, as will appear in connection with the description of the circuits. 47 designates the connecting plug, 48 the line jack, 49 the line drop, 50 an extension drop in the cord circuit and 51 is a self restoring drop, also in the cord circuit.

The operation, and the circuits involved, may now be described: Assuming the subscriber at sub-station C desires a connection he lifts his receiver from the switch hook, thereby through the cam mechanism described placing latch contact 21 in connection with armature latch 20 which latter is grounded as indicated at 52. A circuit is also closed from contact 21 to and through contact 28 which latter is connected in circuit with the trip magnet 19. The switch hook in rising also, as usual closes the local primary circuit through local battery 53, transmitter 54 and primary coil 55; this current being closed by the engagement of switch hook with top contact 56. At the same time the switch hook opens a circuit at a back contact 57 the function of which will hereinafter appear. A momentary or "flash" grounded drop circuit is thus established, from ground at 52 to and through latch contact 21, from the latter while the cam mechanism is still holding contacts 22 and 23 closed with 21 through the latter and to the left main line over conductor 59. The left main line is uninterrupted throughout its length and terminates in the tip spring of the jack 48 which normally is in bearing with a contact spring 60 connected to the line drop 49 and thence to ground at 61. The drop is therefore operated and central notified to take the order. Thereupon central plugs in and proceeds to establish talking connection with the subscriber as follows: As soon as the plug is inserted she presses key 43 whereupon pulsations from the generator 42 are thrown upon the line of that polarity which will move the armatures of the selecting or ringer relays into engagement with contacts 10, which movement it will be noted does not sound the bells. When key 43 is depressed and before the first impulse has passed it will be found that a metallic circuit exists to and through the first sub-station, but through no other station. This circuit may be traced from generator over conductor 62 to front contact 63 of key 43, thence to switch contact 64 of the key, thence to tip of the plug, over the left main line to the point where the latter joins conductor 59 of station B, thence over conductor 59 to and through the contacts 23, 22 and 21, from the latter over a conductor 65 to contacts 13 and 14, thence over a conductor 66 which leads to and through the windings of the bell and back to contact 10, from the latter to contact 15 and from that over a conductor 67 to the right main line and thence back to the sleeve side

of the plug, which latter is connected to the spring 64' of key 43. The switch spring 64' is at this time closed with the outer spring 63' with which is connected a conductor 63'' which leads to the opposite side of the generator thus completing the circuit.

Upon the first impulse from the generator the armature of the bell at station B will be oscillated into engagement with contact 10 thus throwing the spring 15 into engagement with the latch 16 and upon the dying away of this impulse changing the circuit through 15 to contact 17 as hereinbefore explained. The shifting of these latter contacts results in opening the circuit theretofore existing through the bell and extending the right main line through to station C. In other words, there will no longer exist a bridging circuit between the right and left main lines at station B and the closing of the circuit between contacts 15 and 17 will bring station C into precisely the same circuit relation with central that theretofore existed between station B and central.

It will be remembered that the subscriber at station C, in calling-in placed the latch contact 21 to ground and opened the left line between contacts 21 and 22. It will be obvious therefore that no metallic circuit exists through station C. And accordingly as soon as station B has been thrown from the line the further impulses from the generator while key 43 is depressed will be ineffective. Of course any number of stations located between the calling station and central would be thrown from the line by successive impulses precisely as was station B and the further running down the line automatically arrested upon the circuits being successively extended to that station which has called in. The operator therefore simply holds down the running key 43 long enough to insure reaching any station on the line and then immediately puts one or more reverse impulses from the generator 42 on the line. This she accomplishes by depressing the button 41 of the key 38. It will be noted that this act also grounds the tip side of the generator through a contact 68 which is connected by a conductor 69 to ground at 70. A ground to ground circuit is therefore established from 70 to the key 38, as described, thence to a contact 71 which is connected to the generator by a conductor 72, from the latter over conductor 62 and 73 to a contact 74 which is at this time in bearing with the opposite end of key 38, from the latter over a conductor 75 to the inner spring contact 76' of key 43 and thence over the right main line to contact 15 of station C. From contact 15 the circuit will be through contact 10 to and through the bell, thence to spring 14, from the latter to contact 13 and thence over conductor 65 to contact 21 and to ground. The

first grounded impulse from the generator will throw the armature of the bell at station C into engagement with contact 9 and thus open the circuit between contacts 13 and 14. The next impulse over the line will reach contact 14 as before, but from the latter point will pass over a conductor 77 to and through the windings of the trip magnet 19, thence to contact 28 and from the latter to contact 21 and to ground thus energizing the trip magnet and releasing the latch contact 21. Each of the two impulses last referred to were of the right polarity to ring the bell and if further impulses are sent over the line they will simply result in continuing the ringing of the bell at station C until key 38 is released.

The closing of the circuit between contacts 13 and 9 which occurred upon the first ringing stroke of the bell established a talking circuit at that station through a conductor 78 to the condenser, receiver and secondary connected therein and to the right hand main line at 79. The remainder of this talking circuit which is in fact a bridge from the right to the left main lines, is from contact 13 over conductor 65 to contact 21 from the latter through contacts 22 and 23, thence over conductor 59 to left. Accordingly as soon as the calling-in subscriber's bell ceases to ring, he gives his order to central and is given the proper connection in the usual manner.

It will be noted that the talking circuit is through a condenser and that is the only connection between the main lines while a subscriber has talking connection. This condition is taken advantage of to operate the self restoring signal 51 as a clearing signal. Referring to the diagram of the central exchange, it will be seen that there normally exists a metallic circuit through this restoring signal which includes the battery 44; the same circuit including also the extension drop 50, the restoring key 46 and a resistance 79. This circuit may be traced from the plug 47 as follows: From tip side to springs 64 and 76, thence over conductor 80 to the four springs of a break-off key 81, which coöperates with the key 38, thence over conductor 82 and through the extension drop and to spring 83 of the restoring key, from the latter to switch spring 84 thence over conductor 85 to battery 44 and back by conductor 86 to switch spring 87, thence to spring 88, from the latter over conductor 89 and through resistance 79 to the restoring relay, from the latter over conductor 90 to a second break-off key 81' which also coöperates with key 38, and thence to spring 76' of key 43 by conductor 91. Spring 76' is in contact with the sleeve side of the plug through switch spring 64'. It follows that while the subscriber has talking connection the restoring relay is deenergized.

gized. Whenever the subscriber hangs up his receiver, however, the switch hook descends and closes contact at 57 and this completes a metallic bridge circuit at his station between the right and left main lines, thus completing the circuit through the restoring relay and indicating to central that it is time to clear. The bridge circuit referred to is from left main line over conductor 59, contacts 23 and 22, thence by conductor 92 to the switch hook, from the latter to 57, thence over conductor 77 to contact 14, from the latter to and through the bell coils, to contacts 10 and 15 and thence over 67 back to the right hand side.

The restoring of the line to normal is accomplished by establishing a ground to ground circuit from central over the left main line to and through the grounder at the end of that line; it being noted that at each subscriber's station the left line includes the windings of the restoring relay 18. Upon depressing the restoring key 46 contacts 84, 87 and 93 engage back contacts 94, 95 and 96 respectively. This establishes a circuit from ground at 45 to and through contact 95, switch spring 84, conductor 85, battery 44, conductor 86, switch spring 87, contact 94, conductors 97 and 98, and thence over the tip side of the cord circuit as described in connection with the drop circuit and from the tip of the plug over the left main line and to and through the grounder to ground. It will be noted that the circuit thus traced shunts the extension drop 50 and the other resistances of the cord circuit thus throwing the full potential through the restoring magnets.

In order to prevent the clearing impulse from throwing the extension drop 50, the spring 96 and coöperating contact 93, carried by spring 83 are provided; these being so arranged that the drop will be short circuited before the line is grounded and upon the return movement of the key will remain short circuited until after the battery circuit is opened.

It will be noted that the right main line is at each subscriber's instrument arranged to include the restoring magnet 18. This is merely for the purpose of neutralizing the impedance effect of the restoring magnets; it being understood that the two windings of each restoring magnet are arranged so as to neutralize each other when simultaneously in circuit, as they are when the line is in talking condition.

Thus far those operations have been described which are involved in giving the line to a calling-in subscriber and restoring the line to normal. The operation of selecting a called subscriber will now be described: In case subscriber number one on the line is wanted it is, of course, only necessary for the exchange operator to throw

ringing impulses on the line which will result in ringing the bell at first station, thus calling the subscriber and will at the same time place his instrument in talking connection in the manner hereinbefore described. However, if any other sub-station than the first is wanted selective impulses must first be counted out and sent over the line until the desired station is reached and then the bell must be rung. In the present instance I have shown one end of the key 38 (that controlled by the button 39) as arranged to control the grounded battery 40. When the button 39 is depressed contacts 99 and 99' are engaged by the key controlling conductors leading to the two sides of the battery 40. A metallic circuit is thus established which is the same as that described in connection with the operation of key 43 when running down the line to locate a calling-in subscriber. It follows that each time the button 39 of key 38 is depressed and allowed to rise, a sub-station will be passed so that it is only necessary for the operator to count out the station wanted in this manner and then depress the opposite end of key 38 thereby throwing on ringing current and connecting in the wanted subscriber.

It will sometimes occur that the line may be set for a connection at an intermediate station at the time the exchange operator desires to call up a wanted subscriber. It is to prevent interference and confusion in such cases that the battery 40 is grounded at one side. If a subscriber's instrument be set for connection the metallic circuit through his instrument will be open between contacts 21 and 22, but at the same time contact 21 will be grounded through the armature of the trip magnet. Accordingly when the battery 40 is closed to line by the selecting key and such a set sub-station is encountered, current will flow from ground at 70 over the right main line to and through the bell at the sub-station in question, to contacts 14 and 13 and thence to ground over conductor 65, contact 21 and armature 20. This will, of course, move the armature of the bell and result in passing this instrument just as effectively as though the metallic circuit existed therethrough, and it is to be particularly noted that in so passing the station the trip magnet is not disturbed. Neither does the restoring of the line to normal by energizing the restoring magnets 18 disturb any trip magnet which may be set for connection, from all of which it follows that "central" can call a wanted subscriber, make the desired connection, clear the line and thereafter locate and give the line to a subscriber who had set his instrument for connection and operated the line drop before central received the order for another subscriber on the same line.

It often occurs that a subscriber in possession of the line desires to attract the attention of "central", it may be to secure another connection without giving up the line. This is provided for in the present system by reason of the peculiar circuit connections which exists at the subscriber's stations and their relation to the self restoring drop 51. It has been explained that when a subscriber has talking connection, it is through a bridging conductor 78 which includes the condenser, and that the metallic circuit is interrupted so that the deenergized position of drop 51 indicates that the line is busy. If, under such condition, the subscriber operates his switch hook he will in so doing establish a metallic circuit which will obviously operate the drop 51 and will at the same time throw current through his trip magnet 19 thereby holding down the armature 20 and preventing latch 21 from being engaged and held in position to open the circuit and destroy his talking connection. This holding circuit through the subscriber's instrument is from the left main line over conductor 59 to and through contacts 23, 22, 21 and 28 (during the moment the switch hook is rising and the cam is forcing the group of contacts over into engagement with contact 28), from 28 to and through the trip magnet, thence over conductor 77 to conductor 66, through the bell to contacts 10 and 15 and thence over conductor 67 to the right main line. The switch hook may thus be operated repeatedly, the rotary responding to each operation.

Occasionally it is necessary to place two or more subscribers on the same line in talking connection with each other. To accomplish this it is necessary that after central has responded and given the calling-in subscriber talking connections, that he perform an act which will enable central to pass by his station and select the additional station wanted. This the subscriber does by closing a metallic circuit at a push key 100 provided at his instrument. The circuit is then from the left main line over conductor 59 to contacts 23 and 22, thence to switch hook over conductor 92, thence to lower contact 101 of the push button over conductor 102, through upper contact 103 of the push button and to conductor 77, from which latter the circuit back to the right hand main line is the same as that last described. The selection of the additional subscriber is made by means of the selecting key 39, in case the wanted subscriber is more remote from central than the calling-in subscriber. If the reverse is the case the calling-in subscriber is asked to state his number on the line, central then restores or clears the line, selects the nearer subscriber called for, requests him to close his push button and then proceeds as before

to select the subscriber who first asked for the connection.

It will be noted that whenever the plug is inserted in the jack, the tip of the plug engages and lifts the tip spring thus opening the circuit through the line drop 49, but bringing into circuit the extension drop 50 in the cord. The cord circuit is normally grounded at 45, from which it follows that subscribers can signal in for connection at all times whether the line be busy or not. This is a feature of importance for the reason that central may at any time take the line away from a subscriber who is holding it unreasonably long, and should do so when her attention is called to the fact that other subscribers are waiting, by the repeated operation of the extension drop 50.

The combined ringer and relay forming one of the principal instruments comprises a polarized ringer of a usual type slightly modified in some of its details and a restoring magnet attached to and supported by the frame of the ringer. Describing this device in detail the parts referred to in the diagram are correspondingly designated in the instrument proper, it being noted that the clapper stem 6 instead of being pivoted direct to the armature, as shown in the diagram, is pivoted within a tube, as indicated at 6'' and the tube is rigidly seated in the armature 3 so as to vibrate with the latter. The tube is internally of slightly larger diameter than the clapper stem so that the armature can move in one direction without moving the clapper, but moves the latter positively when it oscillates in the opposite direction and thus rings the bell. The extension 3' is a forked plate of spring metal (see Fig. 6) having its end portion secured firmly to the armature as indicated at 3'' and its two arms bent outwardly to stand in slightly different planes and made adjustable relatively to the armature by means of adjusting screws inserted therethrough.

The two arms of extension 3' extend in overlapped relation to, and cooperate with the contact devices 9 and 10 described in the diagram. These two contact devices are in the form of rigid bars, pivotally mounted upon an insulating block 100^a, as indicated at 101^a and 102^a respectively; the block 100 being mounted on the free end of the magnet spool 18. The contact 9 has rigidly secured thereto spring contact strip 13, a back contact bar 14 and an actuating spring 105; the contact members being insulated from each other as shown clearly in Fig. 5. The spring 105 engages a stud 106 and draws the contact strip 13 into bearing with an insulating block 12 carried by a spring latch 11, when the parts are in one position, and draws the contact bar 9 into engagement with the extreme end 110 of said latch when the parts

are in their other position; this latter being the normal position of the contacts. In said latter position the latch is lifted so that the end of contact strip 13 underlies the block 12, and the resiliency of the spring strip holds the latter in bearing with contact device 14. Contact device 10 similarly carries a spring strip 15, a back contact bar 17 and an actuating spring 113, similarly insulated from each other; the spring 113, however, tending to force the group of contacts away from the head of the magnet or in the direction opposite that of spring 105. Normally spring 15 engages a contact screw 114, but when engaged with the hook latch 16, the tension of spring 113 overcomes that of spring 15 and thus brings the latter into bearing with back bar 17 shown in Fig. 4.

The two latch members 11 and 16 are mounted to lie in the same plane upon a frame strip 116 having its ends secured to the magnet frame. In order to lift these spring latches a "U" shaped plunger 17 (see Fig. 8) is arranged to extend through the head block 118 of the restoring magnet; one end of the plunger underlying the two spring latches and its opposite end projecting beyond the head block in position to be engaged and forced back by the armature 18' of the restoring magnet. A cushion spring 120 is interposed between the armature and head block to prevent possibility of the armature sticking to the head block under the influence of residual magnetism. The heel piece of the restoring magnet has an extension 121 which extends through a mortise in the heel piece of the ringer magnet and a key 122 inserted between the crook of the latter heel piece and the said extension, keys the two frames rigidly together.

For convenience of wiring the conductors leading to the several contact devices of the restoring magnet and to the windings of the latter are brought to and connected with a series of contact screws 123 mounted in an insulating strip 124 which is secured to the heel piece of said magnet. The mechanical engagement of the two arms of the extension 3' of the ringer armature with the corresponding contact bars 9 and 10 is effected through buttons of insulating material 124 carried by said arms.

Describing next the trip magnet the spool 19 thereof is mounted in a U shaped strap metal frame 125 (see Fig. 9) upon one arm of which is pivotally mounted an angular armature 20 which is normally held retracted by a spring 127. Secured to the armature is an extension 128 provided in its upper side with a notch 129; this portion of the extension being arranged to extend through a latch spring 21. Latch spring 21 forms one of a group of four spring strips secured parallel with each other upon the shorter arm of the magnet frame and

suitably insulated as shown clearly in Fig. 9. The outer spring 23 has a downturned hook portion 132 which constitutes one member of a switch cam; (see Fig. 10) the wiper member 133 being formed on the end of an angle lever 134 pivoted upon the magnet frame as indicated at 135. The other strip 28 and is free from contact with the switch hook 27 of the subscriber's instrument by means of a link 138; the construction of the cam mechanism being such that when the switch hook rises the group of contacts is forced forwardly and the latch member engages the notch of the extension 128 and is retained by the latter. Normally the spring latch 21 is in bearing with the intermediate spring 22 and forces the latter into engagement with contact 23, but when in latched engagement with the extension 128 contact strip 21 engages the innermost strip 28 and is free from contact with the others. The drawing down of the armature of the trip magnet releases spring latch 21 and permits the parts to fly back to their normal positions. An electrical contact is formed between spring latch 21 and the extension 128 when these parts are interengaged and to prevent the closing of this circuit until the engagement is complete an insulating block 141 is mounted on the upper side of the extension member outside of the notch thereof.

While I have herein shown and described a practical and preferred embodiment of the invention, yet it will be understood that modifications both in construction and arrangement may be made without departing from the invention, and particularly so with respect to the broader features of the invention. Moreover, it will be obvious to those skilled in this art that some of the features of improvement are capable of use independently of their associations in the specific form of system herein shown. Accordingly I do not limit myself to details, except in so far as they are made the subject of specific claims.

I claim as my invention:

1. In a party line telephone system, a main line extending uninterruptedly through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections, each section of which extends from the station of its origination to a succeeding station and is there normally connected to the intact main line, means operable from the central station for progressively disconnecting each section from the intact main line and connecting it to a succeeding section, electrically-actuated means at each sub-station for establishing a circuit through the talking coil and between the two main lines and means for restoring the line connections to normal.
2. In a party line telephone system, a main

line extending uninterruptedly through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections, each section of which extends from the station of its origination to a succeeding station and is there normally connected to the intact main line, means operable from the central station for progressively disconnecting each section from the intact main line and switching it into connection with the succeeding section, a relatively low wound magnet included in circuit with said intact main line at each sub-station and means actuated by the armatures of said low wound magnets for restoring the line connections to normal when said magnets are energized.

3. In a party line telephone system, a main line extending uninterruptedly through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections, each section of which extends from the station of its origination to a succeeding station and is there normally connected to the intact main line, a polarized magnet at each sub-station, connected in circuit normally with the terminal portion of the sectional line section, a switch controlled by said polarized magnet and operable to disconnect said section from the intact main line and connect it to the succeeding section and an annunciator, operable by said polarized magnet when current of the polarity opposite that required for operating said switch mechanism, is sent therethrough.

4. In a party line telephone system, a main line extending uninterruptedly through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections, each section of which extends from the station of its origination to a succeeding station and is there normally connected to the intact main line, magnet mechanism at each sub-station, responsive discriminatingly to two differentiated currents and normally connected in circuit with the terminal portion of the sectional line section, a switch controlled by said magnet mechanism and operable to disconnect said section from the intact main line and to connect it to the succeeding section, and an annunciator also controlled by said magnet mechanism, said switch being operated when current of one character is sent over the line and the annunciator being brought into action when current of different character is sent over the line.

5. In a party line telephone system, a continuous main line extending through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections each of which extends from the station of its origination to a succeeding station and is there normally connected to the continuous line, a polarized bell magnet at

each sub-station, included in that part of the circuit which is normally closed through the sub-station, a switch operable by the armature of each bell magnet for disconnecting the sectional line from the continuous line and connecting it to a succeeding station, a striker operable by the armature of each bell magnet when current of that polarity opposite that required to operate the switch mechanism is sent through the magnet and means for restoring the line connections to normal.

6. In a party line telephone system, a continuous main line extending through a series of sub-stations, a sectional main line comprising a series of normally disconnected sections, each of which extends from the station of its origination to a succeeding station and is there normally connected to the continuous line, a polarized bell magnet at each sub-station, included in that part of the circuit which is normally closed through the sub-station, a switch operable by the armature of each bell magnet for disconnecting the sectional line from the continuous line and connecting it to a succeeding station, a striker operable by the armature of each bell magnet when current of that polarity opposite that required to operate the switch mechanism is sent through the magnet and means for restoring the line connections to normal, comprising a restoring magnet connected in circuit with the continuous main line at each sub-station, means operable by the armatures of the said restoring magnets for restoring said switch mechanisms to normal and means for establishing a grounded circuit through said continuous line from ground at central to ground at the remote end of the line.

7. In a party line telephone system, the combination with a central station and a plurality of sub-stations, of electrically actuated selective mechanism at each sub-station, a main line extending from the central station through the series of sub-stations, a magnet at each sub-station in circuit with said main line and adapted to cooperate with said selective mechanism and means for establishing a circuit through said magnets comprising a condenser, a magnet having high and low windings, in circuit with said condenser, a shunt leading around the condenser and connected in circuit with said low windings, an armature common to the high and low wound portions of said magnet and a return circuit common to the circuit through the condenser and the shunt around the same, substantially as described.

8. In a party line telephone system, the combination with a central station and a plurality of sub-stations, of electrically actuated selective mechanism at each sub-station, a main line extending from the central station through the series of sub-stations, a

magnet at each sub-station in circuit with said main line and adapted to coöperate with said selective mechanism and means for establishing a circuit through said magnets comprising a condenser, a magnet having high and low windings, in circuit with said condenser, a shunt leading around the condenser and connected in circuit with said low windings, an armature common to the high and low wound portions of said magnet, a ground connection common to the circuit through the condenser and the shunt around the same, a ground connection at the central station, means for making and breaking the circuit at the central station and a source of energy connected with said main line.

9. In a party line telephone system, the combination with a central station and a plurality of sub-stations, of electrically actuated selective mechanism at each sub-station, a main line extending from the central station through the series of sub-stations, a magnet at each sub-station in circuit with said main line and adapted to coöperate with said selective mechanism and means for establishing a circuit through said magnets comprising a condenser, a double pole, relatively high wound polarized magnet in circuit with said condenser, a shunt leading around the condenser, a low wound magnet in circuit with said shunt, an armature pivoted between its ends and adapted to be moved in opposite directions by the respective poles of said polarized magnet, an extension of said armature adapted to coöperate with the pole of the relatively low wound magnet, a contact device in circuit with that part of the circuit which extends through the condenser and polarized magnet and arranged to be opened when the armature is moved in a direction away from the pole of the low wound magnet and a return circuit common to the circuit through the condenser and the shunt around the same.

10. In combination, a telephone ringer, comprising a double-pole, polarized magnet, an armature pivoted to oscillate in proximity to the poles of said magnet, one or more gongs, and a clapper connected to move positively with said armature in one direction but free to stand inactive when the armature moves in the opposite direction, an attachment to said ringer comprising a restoring magnet, a switch contact arranged to be actuated by the armature of the ringer magnet when it moves without actuating the clapper, a latch coöperating to hold said switch contact in shifted position and operative connections between the armature of said restoring magnet and said latch.

11. In combination, a telephone ringer, comprising a double-pole, polarized magnet, an armature pivoted to oscillate in prox-

imity to the poles of said magnet, one or more gongs, and a clapper connected to move positively with said armature in one direction but free to stand inactive when the armature moves in the opposite direction, an attachment to said ringer comprising a restoring magnet, two pairs of spring pressed contact switches arranged to extend in proximity to, and at opposite sides of a vibrating part of the armature of the ringer magnet, a pair of latch members, one for each pair of contact switch members, arranged to coöperate with the latter to hold the same in shifted positions, a trip member adapted to throw off said latch members and an armature arranged to coöperate with the restoring magnet to operate said trip member.

12. In a party line telephone system, the combination with a central station, a plurality of sub-stations and a main line connecting said stations, of means for locating a calling-in party, comprising selective mechanism at each sub-station, responsive discriminatingly to differentiated currents and operating responsively to one kind of current to extend circuit connections to a succeeding station and responsively to current of a different kind to direct current through a trip magnet, a trip magnet at each sub-station, contact devices controlled by said trip magnet, for arresting the progressive extending of the circuit, manually actuated means for setting said contact devices and means for impressing a succession of current impulses of either differentiated character upon said main line.

13. In a party line telephone system, the combination with a central station, a plurality of sub-stations and a main line connecting said stations, of means for locating a calling-in party, comprising selective mechanism at each sub-station, responsive discriminatingly to differentiated currents and operating responsively to one kind of current to extend circuit connections to a succeeding station and responsively to current of a different kind to direct current through a trip magnet, a trip magnet at each sub-station, contact devices controlled by said trip magnet, for arresting the progressive extending of the circuit, manually actuated means for setting said contact devices and means for impressing a succession of current impulses of either differentiated character upon said main line, comprising a constantly running direct-current pulsating generator and a reversing key controlling the current thereof.

14. In a party line telephone system, the combination with a central station, a plurality of sub-stations and a main line connecting said stations, of means for locating a calling-in party, comprising magnet mechanism responsive to current of different polarities at each sub-station, switch mech-

anism, controlled by said polarized magnet mechanism for extending circuit connections to succeeding stations, annunciator mechanism operable by said polarized mechanism when the latter responds to current of polarity opposite that by which the circuit is extended, contact devices arranged to control the return circuit from each sub-station to central, manually operable means for setting said contact devices, a trip magnet for restoring said contact devices to normal, circuit connections including said trip magnet and controlled by said polarized magnet mechanism and means for impressing series of impulses of currents of each polarity upon the main line.

15. In a telephone system, the combination with a subscriber's telephone set and the switch-hook thereof, of a trip mechanism comprising a magnet and cooperative armature, a set of contact devices, setting mechanism, operative connections between the setting mechanism and the switch-hook and operative connections between said setting mechanism and said armature.

16. In a telephone system, the combination with a subscriber's set having a manually operable member, of a trip mechanism comprising a magnet and armature, a set of contact devices, setting mechanism for moving said contact devices, operative connections between said setting mechanism and manually operable member and means operable by said armature for releasing said contact devices and restoring them to normal.

17. In a telephone system, the combination with a central station, a plurality of subscribers' sets arranged at a plurality of sub-stations and a line wire extending from station to station, of means for successively and progressively establishing return circuits from each sub-station to the central station to the exclusion of other sub-stations and means for arresting the progressive closing of said circuits at each sub-station, said means being under the control of the subscriber.

18. In a telephone system, the combination with a central station, a plurality of subscribers' sets arranged at a plurality of sub-stations and a line wire extending from station to station, of means for successively and progressively establishing return circuits from each sub-station to the central station to the exclusion of other sub-stations and means for arresting the progressive closing of said circuits at each sub-station, said means being under the control of the subscriber, comprising contact devices, setting mechanism for placing and holding said contact devices in circuit-arresting position and electrically-actuated means operating automatically to release said setting mechanism.

19. In a telephone system, the combination with right and left metallic main line wires and a plurality of sub-stations through which said line wires extend, of selective mechanism at each sub-station arranged in bridging relation between said main wires, means operable by said selective mechanism for progressively excluding or opening said bridging connections at the several sub-stations and manually operable means arranged in said bridging connections for arresting the progressive exclusion or opening of said bridging connections.

20. In a party line telephone system, the combination with a central station, a plurality of sub-stations, two main line conductors extending through the series of stations, bridging connections at each sub-station between the main lines and means for successively forming complete metallic circuits from the central station through the several sub-stations to the exclusion of all other stations, of manually operable means for opening the bridging part of the circuit at each sub-station, a ground connection and mechanism arranged to close said connection upon the opening of the bridging circuit, means for impressing successive impulses upon said main wires to effect the successive extension of the main line circuit and means for maintaining a ground on the line at central, whereby a ground to ground circuit is utilized to pass a sub-station at which the metallic bridging connection has been opened.

21. In a party line telephone system, the combination with a central station, a plurality of sub-stations, two main line conductors extending through the series of stations, bridging connections at each sub-station between said main lines, and means for selectively forming complete metallic circuits extending from the central station through the several sub-stations to the exclusion of all other stations, of manually operable contacts at each sub-station for opening its said metallic bridge connections, a detent for holding said circuit controlling contacts, a magnet connected in circuit with one of the main lines and operable to restore the manually operable contacts which open the bridging connections and circuit connections controlled by the subscriber's switch-hook for closing the circuit through said magnet when the main lines are energized and the switch-hook moved manually, whereby the detent is rendered functionally-inoperative at such times.

22. In a party line telephone system, the combination with a central station, a plurality of sub-stations, two main line conductors extending through the series of stations, bridging connections at each sub-station between said main lines and means for selectively forming complete metallic cir-

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cuits extending from the central station through the several sub-stations to the exclusion of all other stations, of means at each sub-station for opening the metallic bridge connections thereof comprising a magnet connected in bridge relation between its main lines, contact devices controlling said bridging circuit, a detent adapted to co-operate with said contact devices, operative connections between the detent and armature of the magnet, a setting mechanism operative connections between the switch-hook of the subscriber's instrument and said setting mechanism, and circuit connections through said trip magnet, controlled by contacts operable by said switch-hook for energizing the trip magnet and preventing the detent from holding the bridge-controlling contacts when the switch-hook is operated during the energized condition of the main lines.

23. In a party line telephone system, the combination with a central station and a plurality of sub-stations, of selective mechanism at each sub-station, a normally closed complete metallic local circuit including the subscriber's receiver at each sub-station and contact devices controlled by said selective mechanism whereby said local circuit is opened when the station is selected.

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24. In a party line telephone system, the combination with a central station and a series of sub-stations, of a main line wire extending normally uninterruptedly from the central station to and through the several sub-stations and terminating in a normally open-circuited grounding device and a restoring magnet connected in series with said main line at each sub-station.

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25. In a party line telephone system the combination with a central station and a series of sub-stations, of a main line wire extending from the central station to and through the several sub-stations, a restoring magnet connected in series with said main line at each sub-station, and a second main line wire extending from central extendible to and through the several sub-stations and likewise including each of said restoring magnets in series therewith, the windings of the respective main lines around each restoring magnet being inductively opposed to each other.

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26. In a party line telephone system the combination with a central station, a series of sub-stations and right and left main lines extending through said stations, of a polarized relay located at each sub-station, two sets of switching contacts, respectively controlled and operated by the movement of the armature of said relay in response to current of opposite polarity, a bridging connection including the windings of said relay and normally connected in bridged relation between the two limbs of the main line, said

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bridging connection being controlled by one of said sets of contacts, means controlled by the operation of the subscriber's switch hook for opening the said bridging connection, means for locking the contact devices controlled by the switch hook in shifted position, a ground connection arranged to be closed upon the opening of the bridging connection between the main lines, a trip magnet arranged to be brought into circuit with said grounded connection and an armature controlled by said trip magnet and adapted to restore said bridging connection between the main lines.

27. In combination, a trip magnet comprising a main frame, a group of spring contacts, a cam mechanism for flexing said contacts, a latch lever adapted to engage and hold one or more of said contacts in flexed position, operative connections between the armature of said magnet and said latch lever for operating the latter to release the contact or contacts and operative connections between the subscriber's switch hook and said cam mechanism.

28. A trip magnet, comprising a V-shaped main frame, a magnet spool mounted within and upon said frame, an armature pivotally mounted on one arm of said frame, a group of spring contacts mounted upon the other arm of said frame, a latch extension carried by said armature and adapted to co-operate with one or more of said spring contacts, a cam lever pivoted upon the main frame, and coöperative cam members upon said lever and one of the group of spring contacts, respectively.

29. In a circuit controlling magnet, the combination with the main frame, the magnet spool and the armature, of a plurality of contact springs, a latch adapted to hold one or more of said springs in flexed position, a switch cam arranged to flex the latch-controlled spring or springs during its movement in one direction and to return idly, and operative connections between said armature and latch, for tripping the latter.

30. A circuit controlling instrument comprising a polarized magnet, two groups of circuit switching contacts, each having operative connections with the armature of said magnet, but arranged in opposite relation to each other so as to be separately actuated in accordance with the polarity of the current sent through the magnet, each group of circuit-controlling contacts comprising two relatively rigid contact members, a spring strip interposed and adapted to vibrate between said relatively rigid members and a spring tending to shift the group of contact devices in one direction, a latch adapted to engage said intermediate spring strip of each group and hold it against movement under the action of said spring, a

restoring magnet and operative connections between the armature of said restoring magnet and said latches.

31. In combination with a polarized ringer-magnet and the main frame thereof, a restoring magnet spool mounted upon said main frame and arranged to extend substantially parallel with the spools of the ringer magnet, two groups of circuit controlling contacts mounted upon that end of the restoring magnet spool contiguous to the armature of the ringer magnet, each group having a relatively rigid main member pivotally supported and extending at its swinging end toward the contiguous end of the ringer magnet armature, operative connections between said armature and each of said pivoted main members, two spring latches respectively adapted to cooperate with said groups of circuit controlling contacts, an armature operatively connected with said restoring magnet and operative connections between said armature and said spring latches for disengaging the latter.

32. A circuit catching mechanism comprising an electric circuit and source of current supply, a condenser interposed in said circuit, a polarized magnet having an automatically returning armature, and arranged in circuit with the condenser, said magnet being provided with a main winding of high resistance and a retaining winding of a resistance substantially as low as is consistent with retaining the armature in closed position, and a normally opened shunt around said high resistance and said condenser, and controlled by said armature.

33. A circuit catching mechanism comprising an electric circuit and source of current supply, a condenser interposed in said circuit, a polarized magnet arranged in circuit with the condenser, said magnet being provided with a winding of high resistance, and a retaining winding of a resistance substantially as low as is consistent with retaining the armature reliably in closed position, and a normally opened shunt around said high resistance and said condenser and controlled by said armature.

34. A circuit catching mechanism comprising an electric circuit and a source of current supply, the condenser interposed in said circuit, a polarized magnet arranged in circuit with a condenser, contacts controlled by the armature of said magnet for closing a normally open circuit around said condenser and a portion of the windings of said magnet.

35. A circuit catching mechanism comprising an electric circuit and source of current supply, a condenser interposed in said

circuit, a polarized magnet arranged in circuit with the condenser, said magnet being provided with a main winding of high resistance, and a retaining winding of a resistance substantially as low as is consistent with retaining the armature reliably in closed position, and normally opened contacts controlled by the armature and adapted to close a direct circuit with said retaining winding.

36. A circuit catching mechanism comprising an electric circuit, and source of current supply, a normally charged condenser interposed in said circuit, a relay arranged in circuit with said condenser, means controlled by the armature of said relay for closing a shunt circuit around said condenser, and means for reversing the charge in said condenser to actuate the armature of said relay to close said shunted circuit.

37. A circuit catching mechanism comprising an electric circuit and source of current supply, a normally charged condenser interposed in said circuit, a relay having a high and low winding, a normally opened shunt circuit around said condenser and said high winding controlled by the armature of said relay, and means for reversing the charge in said condenser to actuate the armature of said relay.

38. A polarized ringer comprising an electromagnet having its two poles spaced apart and an armature pivotally mounted and arranged to extend from pole to pole, a permanent magnet having one of its poles associated with said magnets, a striker, one-way-operative-one-way-idle connections between said armature and said striker, circuit controlling contacts, and operative connections between said contacts and the armature of the ringer.

39. A polarized ringer, comprising an electromagnet having its two poles spaced apart and an armature pivotally mounted and arranged to extend from pole to pole, a permanent magnet associated with said electromagnet, a striker, a gong, a one-way-operative-one-way-idle connection between said armature and said striker, circuit controlling contacts, operative connections between the armature of the ringer and said contacts, a latch mechanism associated with the contacts and operating to hold the latter in a position into which they are shifted by the armature, a restoring relay, and operative connections between the armature of the latter and the latch for disengaging the latter.

HOMER J. ROBERTS.

Witnesses:

ALBERT H. GRAVES,
E. L. GRAVES.