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CALL DISTRIBUTING TELEPHONE EXCHANGE DETAILS.

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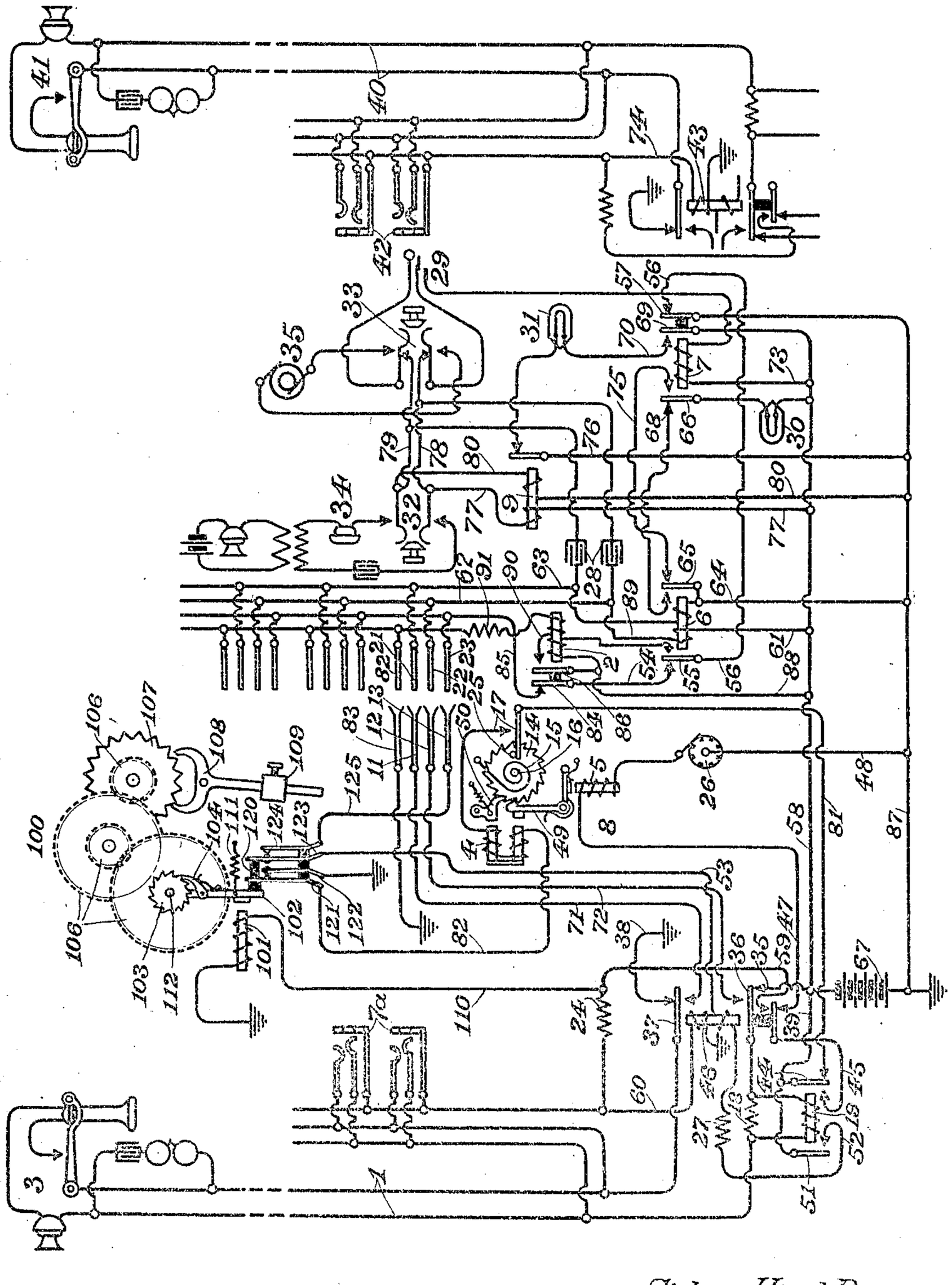
913,613. Patented Feb. 23, 1909



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UNITED STATES PATENT OFFICE.

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CALL-DISTRIBUTING TELEPHONE-EXCHANGE DETAILS.

No. 913,613. Specification of Letters Patent. Patented Feb. 23, 1909.

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To all whom it may concern:

Be it known that I, SIDNEY HAND BROWNE, a citizen of the United States of America, and resident of Pittsburg, county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Call-Distributing Telephone-Exchange Details, of which the following is a specification.

My invention pertains to telephone exchange systems of the class in which each line entering the central office is equipped with a switching device which is to some extent automatic in its action and to some extent under the control of the substation telephone on that line.

In this patent application, I shall describe and illustrate, as typical of the class indicated above, a system in which the distributing of all calls is accomplished mechanically by automatic switches, one of which is connected to each telephone line entering the central office, there being provided in addition to the automatic call-distributing switches a plurality of trunks leading from the automatic switches to calling equipments located before telephone operators, the function of the automatic switch associated with each telephone line being to select one of these trunks and to connect that telephone line with it, thereby extending that telephone line over the selected trunk to a calling equipment before a telephone operator, where the call may be answered by the telephone operator in the usual manner and the call completed by the insertion of a connecting plug associated with the selected trunk into a jack associated with the line called for, the trunk thus selected by the calling line being held throughout the ensuing connection as a part of the calling telephone line, and the called line being held by reason of the connection at one of its jacks and its automatic call-distributing switch being held inoperative by reason of he connection at the jack.

My invention provides, for a switch partly automatic in its action and partly under the control of the substation telephone upon the telephone line to which the switch belongs, an extension of the control of the substation telephone over the partly automatic switch, and has as its immediate object the delay of the disconnection of a switch designed to disconnect automatically when the substation receiver is hung upon the switch-hook. The necessity for such a provision in such a telephone equipment in the present state of the art is the custom of the present day to work the switch-hook slowly when the patron at the substation telephone desires to attract the attention of the central-office operator; in a system, such as I have indicated above, where connection with the operator is obtained through a partly automatic switch designed to disconnect the telephone line from the operator upon hanging up the receiver at the substation telephone, of course the customary working of the switch-hook slowly would disconnect the telephone patron from his operator upon the first movement of the switch-hook; it is desirable, therefore, in such a system, that the calling patron, having obtained a connection through a partly automatic switch, should be able to work his switch-hook slowly to attract the attention of his operator, or for any other purpose, without causing premature disconnection at said partly automatic switch, disconnection being dependent upon the permanent hanging of the receiver upon the switch-hook as may be indicated by an opening of the hook-switch for a period of, say, two seconds or more, continuously.

My invention provides for delaying a function of a partly automatic switch, and provides further a method of adjustment by which the period of delay may be set at any desired value.

One drawing accompanies this specification, in which I have shown the essential elements of such a system, and in which I have applied my function-delaying device for the purpose of delaying the disconnection of the call-distributing switch to permit the calling patron to work his hook to attract the attention of his operator without disconnection of his automatic switch.

A telephone line is shown at 1, connecting at one end with the substation telephone 3 and at the other end with the central office apparatus, which consists of two essentially separate equipments, viz., (first) an equipment for receiving calls for the substation telephone 3, comprising the multiple jacks 7^a, assumed to be located in a switchboard accessible to telephone operators, as the operator at equipment 34, and (second) an equipment for distributing calls from the substation telephone 3 to calling equipments

located before telephone operators, comprising an automatic switch designated as a whole 8, with associated relays 46 and 19, and resistances 18, 27 and 24; the constantly driven interrupter 26 and the battery 67 are common to a plurality of lines.

It is well known in the art of telephony, to construct a switch having a plurality of contacts arranged to project inwardly from a cylindrical surface, said surface being either a complete section of a cylinder or merely a segment of a cylinder, and to arrange, supported by an axis at the center of the cylinder determined by the cylindrical surface, movable electrical terminals adapted to make contact successively with the fixed points when the supporting axis is rotated; a familiar example is the Strowger automatic switch. In such a switch, the essential elements consist of a cylindrical surface, a rotary shaft occupying the position of the axis of the cylinder, terminals attached to said shaft and occupying the position of radii of the cylinder and adapted to connect with the fixed contacts in the cylindrical surface, a ratchet wheel attached to said shaft, a retractile spring attached to said shaft or ratchet wheel and holding the part against a stop or in its position of rest, a holding pawl engaging the teeth of said ratchet wheel, means for withdrawing said holding pawl from the teeth of said ratchet wheel, a driving pawl adapted to engage the teeth of said ratchet wheel when actuated, actuating means associated with said driving pawl and adapted to cause said driving pawl to drive said ratchet wheel and its attached shaft and radial electrical terminals at each actuation through an angular distance equivalent to the angular distance between contact points in said cylindrical surface. In such switches, the usual practice provides for a plurality of radial contacts and for fixed contacts arranged in groups or sets, so arranged and located that the movable radial contacts make connection respectively with the individual fixed contacts of a given group when the rotatable shaft is at a given position, and as the shaft rotates, the radial terminals move from set to set of the fixed contacts and effect electrical connection with the respective contacts of each set as progress is made from set to set.

In Fig. 1, I have shown a set of fixed contact points at 82, 21, 22, 23; a set of radial terminals is shown at 83, 11. 12, 13; the ratchet wheel is shown at 14; the shaft is shown at 16; the retractile spring is shown at 15; the holding pawl is shown as an armature to the upper core of magnet 4; means for withdrawing said holding pawl is shown in magnet 4; the driving pawl is shown pivotally attached to the armature of magnet 5; the actuating means for said driving pawl is shown in magnet 5 and its associated circuit and battery 67. It is customary also in such switches to include an operating part holding an electrical circuit open by the separation of a pair of electrical contacts during the period of time when the shaft remains in its position of rest, and to permit such contact pair to make electrical connection when the shaft makes its first step away from its position of rest. Such an electrical contact pair is called an off-normal switch and is shown at 17, being held open by the pin 25 attached to the ratchet 14. The mechanism involved in the switch designated as a whole 8 in Fig. 1, therefore, is of a general type which is well known in the art and one which may be constructed and used readily from a knowledge of the present state of the art and without further description here. The circuits by which the actuating means for the driving pawl is controlled and by which the releasing means is controlled are disclosed in the paragraphs following.

The three units of equipment, substation telephone equipment, call-receiving equipment and call-distributing equipment, together with the telephone line itself, form a complete line unit, and the equipment of all lines in a central office may be similar.

As a part of the call-distributing equipment, I have shown the function-delaying device designated as a whole 100, consisting of a magnet 101, an armature 102, a ratchet 103, a spring-pressed pawl 104, a set of contact-springs 121, 122, 123, 124, a gear train 106, a scape wheel 107, a pallet 108, and an adjustment weight 109. The winding of the magnet 101 has one terminal extending to ground, and the other terminal is connected through conductor 110 to conductor 59. The set of contact springs has a stiff spring 122, tending to remain rigid and yielding but slightly under pressure, and connected to ground; a flexible spring 121, having a spring tendency to move away from spring 122, but adapted to yield to pressure of armature 102 and to be forced into electrical connection with spring 122, as shown, the spring 121 being connected by conductor 82 to the winding of the release magnet 4; a stiff spring 124, tending to maintain its position and yielding but slightly when under pressure, and connected by conductor 125 to radial terminal or test wiper 13; and a flexible spring, 123, having a spring tendency to make electrical connection with contact-spring 122, but adapted to yield under pressure from armature 102 transmitted through insulating block 120 and adapted to be forced by such pressure against contact-spring 124, as shown, the spring 123 being connected by conductor, 53, with one winding of the relay 46; the set of contact-springs, 121, 122, 123, 124, therefore, has two positions,—a normal position

under pressure as shown, and a released position or alternative position in which springs 121 and 124 are isolated and an electrical connection is made between 122 and 123. The ratchet 103 and the first gear of the train 106 are both rigidly fixed to shaft 112 and therefore are rigidly fixed together, and the spring-pressed pawl 104 is adapted to engage the ratchet 103; the scape wheel 107 is rigidly fixed to the last gear of the train 106; pallet 108 engages the teeth of scape 107, and weight 109 is adjustable to regulate the speed of pallet 108, thus regulating adjustably the speed of the gear train 106 and consequently the speed of movement of armature 102 under tension of spring 111. It is the function of magnet 101 to attract armature 102 against the tension of spring 111 and thus to permit the set of contact-springs 121, 122, 123, 124, to shift to its released or alternative position; it is the function of the pawl, ratchet, gear train, scape, pallet and weight to retard the return of armature 102 when released by magnet 101 and thus to delay the operation of the contact-set 121, 122, 123, 124, by that armature after release, the period of delay being adjustable by the mass of the weight 109, by the distance from the center of oscillation of the weight 109, by the tension of the spring 111, and by the ratio of the gear train 106.

A trunk with calling equipment located before a telephone operator is shown consisting of fixed-contact set 82, 21, 22, 23, and a plurality of other similar sets which are located in other automatic switches, other than 8 but similar to it, belonging to other telephone lines similar to 1; relays 2, 6, 7 and 9; condensers 28; lamps 30 and 31; keys 32 and 33; and plug 29. The operator's equipment at 34 is common to a plurality of trunks, as is also the ringing generator 35.

Another telephone line is shown at 40, equipped with its three units of equipment, the substation telephone equipment 41, the call-receiving equipment 42, and the call-distributing equipment only a portion of which is shown.

The operation of the system is as follows: When a patron at substation telephone 3 takes his receiver from the hook, path is given for current from battery 67 through elements 35, 36, 19, (the larger portion of the current goes through resistance 18, the lesser portion through the winding of 19) 1, 3, 1, 37, 38 and ground, energizing relay 19 and attracting its armatures; by the attraction of the armatures of relay 19, path is given for current from battery 67 through elements 39, 44, 45, 47, 5, 26, 48, 87, energizing magnet 5 and causing actuation of the driving pawl 49 and consequent propulsion of the radial terminals or wipers, 83, 11, 12, 13, into electrical connection with the first set of fixed contact points or waiting contacts of the automatic switch 8; I will assume that the set of waiting contacts thus engaged is the set 82, 21, 22, 23, and that the trunk connected therewith is not busy at the time. Wiper 13 is thus in electrical contact with waiting contact 23 and path is given for current from battery 67 through elements 39, 51, 52, 27, lower winding of 46, 53, 123, 124, 125, 13, 23, 85, 84, 54, 55, 56, 57, 87, energizing relay 46 and attracting its armatures; by the attraction of the armatures of relay 46, connection is broken between elements 45 and 47, preventing further energization of magnet 5, and current flows from battery 67 through elements 39, 44, 45, 59, 24, 60, upper winding of 46 and to ground, continuing the energization of relay 46 and providing busy-test conditions upon the test rings of the jacks 7ª by placing upon them a potential above the earth equal to a portion of the potential of the battery 67; also by the attraction of the armatures of the relay 46, connection is broken between elements 35—36 and between elements 37—38, but current immediately flows through relay 19, without releasing that relay's armatures, from battery 67 over a path comprising elements 58, 61, left-hand winding of 6, 62, 22, 12, 72, 36, 19, 1, 3, 1, 37, 71, 11, 21, 63, right-hand winding of 6, 64, 87, thus energizing relay 6 and attracting its armatures; the attraction of the armature 65 of the relay 6 has permitted current to flow from battery 67 through elements 58, 30, 66, 68, 65, 64, 87, causing lamp 30 to glow as a calling signal before the operator at 34; the attraction of armature 55 of relay 6 has interrupted the circuit previously existing for current from battery 67 through elements 39, 51, 52, 27, lower winding of 46, 53, 123, 124, 125, 13, 23, 85, 84, 54, 55, 56, 57, 87, but the energization of relay 46 is continued by reason of current flowing from battery 67 through conductor 60 over the path comprising elements 39, 44, 45, 59, 24, 60, upper winding of 46 and ground; the breaking of the connection to ground by separation of elements 54—55 has placed the busy-test condition on test contact 23 and its multiples; the attraction of armature 55 of relay 6 also has closed its contact and permitted current to flow from battery 67 through elements 58, 88, left-hand winding of 2, 89, 55, 56, 57, 87, energizing relay 2, attracting its armatures and introducing another break in the conductor originally extending between test contact 23 and ground, by the separation of elements 84 and 85. The attraction of the armature of relay 2 results in the closing of connection between elements 86 and 90, giving path for current from battery 67 through elements 58, 88, 86, 90, right-hand winding of 2, resistance 91, 82, 83, and ground, the energization of relay 2 being thereafter continued by current flow-

ing over this path, regardless of the further operation of relay 6; thus the busy-test condition is continued upon the test-terminal 23 and its multiples regardless of the further operation of relay 6, until finally relay 2 may be released by the interruption of the circuit last described, such interruption being possible only through restoration of the automatic switch 8 and the breaking of connection between wiper 83 and waiting contact 82 incident to such restoration. The attraction of the armatures of the relay 46 also has given path for current from battery 67 through elements 39, 44, 45, 59, 110, 101, and ground, energizing magnet 101, attracting armature 102, and permitting contact-set 121, 122, 123, 124, to assume its released or alternative position; this condition remains constant until the operation of the telephone hook-switch, to be described later.

The telephone operator at 34 responds to the calling lamp 30 by using the key 32, thereby connecting her telephone outfit with the calling subscriber's telephone over the following path: from the upper movable contact of key 32, elements 79, 63 (including upper condenser 28), 21, 11, 71, 37, 1, 3, 1, 18, 36, 72, 12, 22, 62 (including lower condenser 28), 78, to the lower movable contact of key 32; one side of this connection is joined to one pole of the battery through element 77, and one winding of relay 9, and element 58, while the other side of said connection is joined to the other pole of the battery by element 80 and the other winding of relay 9, and element 87. Talking connections are thus established by which the central operator takes the calling patron's order by telephonic speech transmission, then tests a jack, as 42, of the line called for, and finding the line not busy inserts the trunk plug 29 in the jack 42 tested. This gives path for current from battery 67 through elements 58, 73, 7, 29, 42, 74, 43, and ground, energizing the relay 43 corresponding to relay 46 of line 1, thus rendering inoperative the call-distributing equipment of the selected line 40. Also, energization of the relay 7 by the action of its armatures has interrupted the current previously flowing through calling lamp 30 and has extinguished that signal: it has also closed a path for current from battery 67 through elements 58, 69, 70, 31, 76, 87 causing lamp 31 to glow as a signal to the operator that the receiver of substation 41 is on the hook. By manipulation of ringing key 33, ringing generator 35 is connected with the line 40 and the signal bell of substation telephone 41 is actuated in the usual manner. In response to the actuation of the signal bell, the patron at telephone 41 takes his telephone from the hook, closing the hook-switch at that telephone and giving path for current from battery 67 through elements 58, 77, left-hand winding of 9, 72, 29, 42, 40, 41, 40, 42, 29, 79, 80, right-hand winding of 9, 87, energizing relay 9 and interrupting current previously flowing through signal lamp 31. By the absence of both signals 30 and 31, the operator at 34 may know that no attention is required by the connection. The conversation circuit between the calling and the called subscribers may be traced by the following elements:—from calling subscriber's telephone 3, elements 1, 18, 36, 72, 12, 22, 62 and 28, contacts of 33, 29, 42, 40, through the telephone 41 of the called subscriber, 40, 42, 29, contacts of 33, 63 and 28 21, 11, 71, 37, 1 back to the telephone 3 of the calling subscriber. The sides of this connection are connected to the respective poles of common battery 67; from one pole of said battery by element 58 from which latter there are two paths, one path by element 61 and one winding of relay 6 to conductor 62 at one side of condenser 28, and the other path by element 77 and one winding of relay 9 and conductor 78 to conductor 62 at the other side of said condenser; from the other pole of said battery the connection extends by element 87 from which latter there are two paths, one by element 64 and winding of relay 6 to the conductor 63 at one side of condenser 28, and the other path by element 80 and winding of relay 9 and conductor 79 to conductor 63 at the other side of condenser 28.

Upon hanging up the telephone receiver at substation telephone 41, current through relay 9 is interrupted, and by the release of the armature of relay 9 current is permitted to flow through signal lamp 31; by the hanging up of the telephone receiver at telephone 3, current through relay 6 is interrupted and by the release of the armature 65 path is given for current from battery 67 through elements 58, 30, 66, 75, 65, 64, 87, illuminating signal lamp 30, the two lamps thus burning together as a disconnect signal to the operator at 34, who then may remove the plug 29 from the jack 42. Hanging up the receiver at substation telephone 3 also has interrupted current through relay 19. Relay 19 by the release of its armatures has interrupted current previously flowing from battery 67 through elements 39, 44, 45, 59, 24, 30, 46, and thus has released relay 46; also, release of relay 19 has interrupted current previously flowing from battery 67 through elements 39, 44, 45, 59, 110, 101, and ground, thus releasing relay 101 and its armature 102, by the release of which armature, the tension of the spring 111 is transmitted through pawl 104 and ratchet 103 to gear train 106 and its associated scape and pallet, and the gear train is propelled to permit the armature 102 to retire slowly from its position of attraction. By the release of the armatures of relay 19 also, armature 44 connects battery 67 through elements 39,

44, 81, 17, to the release magnet 4, whence the circuit extends by conductor 82 to the open contact-spring 121. If, now, the telephone receiver at the substation telephone 3 has been hung upon the switch-hook permanently, then the armature 102 will continue to move under the retarding influence of the gear train, scape and pallet until it engages and operates the contact-set 121, 122, 123, 124, thus completing the circuit from battery 67 through elements 39, 44, 81, 17, 4, 82, 121, 122, and ground, energizing release magnet 4 and permitting the automatic switch 8 to return to its position of rest and open the off-normal switch 17, interrupting the releasing circuit just described. All parts thus have been restored to their original positions of rest, assuming that it was the calling patron's desire to effect disconnection and restoration of his automatic equipment. If, however, the calling patron had desired merely to signal his operator, either prior or subsequent to the answering or hanging up of the called substation telephone 41, the result of his working his switch-hook would have been as follows: The adjusted period of return of armature 102 may be in excess of any probable delay between the breaking and the making of the electrical contact at the substation-telephone hook-switch when worked by the patron to attract the operator's attention, so that before the armature 102 had effected the closure of the contact-springs 121—122, the substation-telephone hook-switch would have been closed and path would have been given for current from battery 67 through elements 35, 36, 19, 1, 3, 1, 37, 38, and ground, energizing relay 19, attracting its armatures and establishing a circuit from battery 67 through elements 39, 51, 52, 27, lower winding of 46, 53, 123, 122, and ground, energizing relay 46, and that relay by the attraction of its armatures again establishes the circuit from battery 67 through elements 58, 61, left-hand winding of 6, 62, 22, 12, 72, 36, 19, 1, 3, 1, 37, 71, 11, 21, 63, right-hand winding of 6, 64, 87, energizing relay 6 and extinguishing lamp 30; thus the temporary operation of the substation-telephone hook-switch at telephone 3 has resulted in a correspondingly temporary flash of the lamp 30 before the operator handling the call, and as the reënergization of relays 19 and 46 has resulted in the reënergization of magnet 101 before armature 102 had closed contact-springs 121—122, such temporary conditions have not resulted in disconnection of the automatic switch 8; this flashing may be repeated as frequently as desired, the connection to the operator being maintained by reason of the function-delaying device 100.

If, when the call was made from substation-telephone 3, the first trunk tested had been found busy, the relay 2 would have been found energized and no circuit would have existed for current from battery 67 through elements 39, 51, 52, 27, 46, 53, 123, 124, 125, 13, 23, etc., so relay 46 would not have been energized; then the progress of interrupter 26 would have interrupted the current flowing through magnet 5, releasing the armature of magnet 5, and when in the further progress of interrupter 26 the circuit through magnet 5 was again closed, the wipers 11, 12, 13, 83, would be stepped forward into contact with the next set of waiting contacts, pertaining to the next trunk in order, and so repeating and progressing from trunk to trunk until a non-busy trunk was found, the non-busy condition being evidenced by the circuit existing between waiting contact 23 of that trunk and ground, by reason of relays 2, 6 and 7 all being in released condition, and the consequent circuit existing to ground from battery 67 through relay 46, etc., resulting in the energization of relay 46 and the consequent operations as already described. Thus it is seen that with the circuits here shown, any automatic switch conforming to the general requirements outlined for switch 8 will test successively the trunks available to it, passing the busy ones and selecting and connecting its associated telephone line to the first non-busy trunk, assuming that trunk as an extension to the associated telephone line and holding that trunk free from interruption throughout the duration of the ensuing connection.

The relay 19 may be named a line relay, because its winding is permanently and directly associated with a line conductor.

Magnet 101, armature 102, and contact-set 121, 122, 123, 124, in combination, constitute a relay; by reason of the pawl, ratchet, gears and escapement constituting an adjunct to that relay's armature 102, the whole device 100 may be referred to as a relay constructed to have a delaying function in addition to the usual relaying function.

While a gear train and escapement have been shown in the drawings as an illustration of delaying means for the armature 102 of the delay relay 100, it is obvious that any of the well known retarding devices, such as a dash-pot, fan wheel, brake wheel, or the like, may be substituted without in any way departing from the spirit of my invention.

I do not wish to limit myself to immaterial details set forth in this description, as I understand that many variations may be made in the use of these circuits and apparatus without departing from the scope and spirit of my invention.

What I claim as new and desire to protect by United States Letters Patent is:

1. In a telephone system, a telephone line having substation apparatus; an automatic

switch associated with said telephone line; a circuit for effecting restoration of said automatic switch to its normal position of rest; a function-delaying device adapted by operating for a predetermined period of time to render said restoring circuit effective; and means responsive to actuation of a part of said substation apparatus for effecting the starting of the operation of said function-delaying device, and also responsive to subsequent actuation of said part, at any time prior to the expiration of said predetermined period of time, to arrest the operation of said function-delaying device, substantially as described.

2. In a telephone system, a telephone line having substation apparatus including a hook-switch for the receiver; a plurality of trunks; an automatic switch associated with said telephone line and adapted, in response to movement of said hook-switch, to connect said telephone line with a disengaged trunk; a circuit for effecting restoration of said automatic switch to its normal position of rest; a function-delaying device adapted, by operating for a predetermined period of time, to render said restoring circuit effective; and means responsive to movement of said hook-switch for effecting the starting of said function-delaying device, and also responsive to subsequent movement of said hook-switch, at any time prior to the expiration of said predetermined period of time, to arrest the operation of said function-delaying device, substantially as described.

3. In a telephone system, the combination of a switch; a magnet adapted to restore said switch to its position of rest; a line relay; a delay relay; and a circuit including the winding of said restoring magnet, a source of electric energy, the contacts of said line relay and the contacts of said delay relay, substantially as described.

4. In a telephone system, the combination of a switch; a magnet adapted to restore said switch to its position of rest; a delay relay; and a circuit including the winding of said restoring magnet, a source of electric energy, and the contacts of said delay relay, substantially as described.

5. In a telephone system, the combination of a switch; a magnet controlling the restoration of said switch to its normal position of rest; a substation telephone; a line relay governed by said substation telephone; a delay relay; a circuit including a source of electric energy, said restoring magnet and the contacts of said delay relay; and another circuit including a source of electric energy, contacts of said line relay and the winding of said delay relay, substantially as described.

6. In a telephone system, the combination of a switch; a magnet controlling said switch; a relay controlled over a telephone line; a delay relay; a circuit including a source of electric energy, said controll magnet and the contacts of said delay relay; and a second circuit including a source of electric energy, contacts of said first relay and the winding of said delay relay, substantially as described.

7. In a telephone system, the combination of a switch; a magnet governing the movement of said switch; a relay; a delay relay; a circuit including a source of electric energy, said governing magnet and contacts of said delay relay; and another circuit including a source of electric energy, contacts of said first relay and a winding of said delay relay, substantially as described.

8. In a telephone system, the combination of a switch; an electromagnet governing the restoration of said switch to its position of rest; a substation telephone; a line relay controlled by said substation telephone; a second relay; a circuit including a source of electric energy, said restoration-governing electromagnet and contacts of said second relay; another circuit including a source of electric energy, contacts of said line relay and the winding of said second relay; and means associated with the armature of said second relay and adapted to retard the same in effecting the operation of its contacts consequent upon proper change of energization of the core of that relay, substantially as described.

9. In a telephone system, the combination of a switch; an electromagnet governing the restoration of said switch to its position of rest; a substation telephone; a line relay controlled by said substation telephone; a second relay the armature of which is adapted, upon deënergization of the relay, to return to a position of rest and thereby close contacts of said relay; a circuit including a source of electric energy, said restoration-governing electromagnet and said contacts of said second relay; another circuit including a source of electric current, contacts of said line relay and the winding of said second relay; and retarding means associated with the armature of said second relay and adapted to retard the same in returning to its position of rest and closing its contacts, substantially as described.

10. In a telephone system, the combination of a switch; an electromagnet governing the restoration of said switch to its position of rest; a substation telephone; a line relay controlled by said substation telephone; a second relay; a circuit including a source of electric energy, said restoration-governing electromagnet and contacts of said second relay; and means associated with the armature of said second relay whereby that armature may be retarded in its movement, substantially as described.

11. In a telephone system, the combination of a switch; a magnet controlling said

switch; a first relay controlled over a telephone line; a second relay; a circuit including a source of electric energy, said controlling magnet and contacts of said second relay; a second circuit including a source of electric energy, contacts of said first relay and a winding of said second relay; and means associated with the armature of said second relay and adapted to retard the same in effecting the operation of its contacts consequent upon proper change of energization of the core of said relay, substantially as described.

12. In a telephone system, the combination of a switch; a magnet controlling said switch; a first relay controlled over a telephone line; a second relay; a circuit including a source of electric energy, said controlling magnet and contacts of said second relay; a second circuit containing a source of electric energy, contacts of said first relay and a winding of said second relay; and means associated with the armature of said second relay and adapted to retard the same in its return to its position of rest to effect the operation of the contacts of that relay consequent upon the cessation of current through the winding thereof, substantially as described.

13. In a telephone system, the combination of a switch; a magnet controlling said switch; a first relay controlled over a telephone line; a second relay; a circuit including a source of electric energy, said controlling magnet and contacts of said second relay; a second circuit including a source of electric energy, contacts of said first relay and a winding of said second relay; and means associated with the armature of said second relay and adapted to retard the same in its movement, substantially as described.

14. In a telephone system, the combination of a switch; an electromagnet governing the movement of said switch; a first relay; a second relay; a circuit including a source of electric energy, said governing magnet and contacts of said second relay; another circuit including a source of electric energy, contacts of said first relay and a winding of said second relay; and means associated with the armature of said second relay and adapted to retard the same in closing its contacts, substantially as described.

15. In a telephone system, the combination of a switch; an electromagnet controlling the restoration of said switch to its position of rest; a substation telephone; line relay controlled by said substation telephone; a second relay; a circuit including a source of electric energy, said restoration-controlling electromagnet and contacts of said second relay; another circuit including a source of electric energy, contacts of said line relay and a winding of said second relay; and a ratchet, gear train, scape and pallet associated with the armature of said second relay and adapted to retard the motion of that armature, substantially as described.

16. In a telephone system, the combination of a switch; a magnet controlling said switch; a first relay controlled over a telephone line; a second relay; a circuit including a source of energy, said controlling magnet and contacts of said second relay; a second circuit containing a source of electric energy, contacts of said first relay and a winding of said second relay; and a ratchet, gear train, scape and pallet associated with the armature of said second relay and adapted to retard the motion of that armature, substantially as described.

17. In a telephone system, the combination of a switch; an electromagnet governing the movement of said switch; a first relay; a second relay; a circuit including a source of electric energy, said governing magnet and contacts of said second relay; a second circuit including a source of electric energy, contacts of said first relay and a winding of said second relay; and a ratchet, gear train, scape and pallet associated with the armature of said second relay and adapted to retard the motion of that relay, substantially as described.

18. In a telephone system, a telephone line having substation apparatus; an automatic switch associated with said telephone line; a circuit for effecting restoration of said automatic switch to its normal position of rest; a function-delaying device adapted by operating for a predetermined period of time to render said restoring circuit effective; means responsive to actuation of a part of said substation apparatus for effecting the starting of the operation of said function-delaying device, and also responsive to subsequent actuation of said part, at any time prior to the expiration of said predetermined period of time, to arrest the operation of said function-delaying device; and means associated with said function-delaying device adjustable to vary said predetermined period of time, substantially as described.

Signed by me at Cape May city, county of Cape May, State of New Jersey, in the presence of two witnesses.

SIDNEY HAND BROWNE.

Witnesses:

HENRY H. ELDREDGE,

HENRY C. THOMPSON.