A. H. DYSON.

TELEPHONE SYSTEM.

APPLICATION FILED MAR. 31, 1914.

1,167,053.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

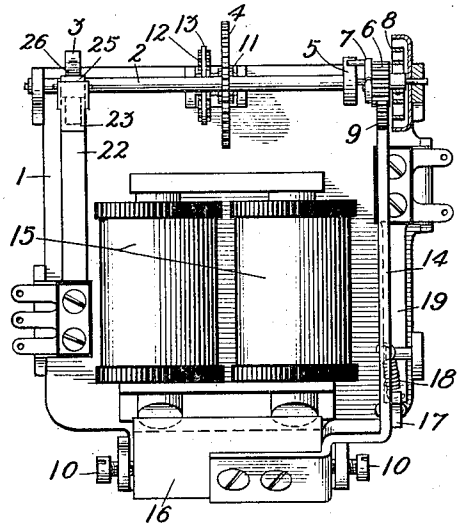


Fig. 2.

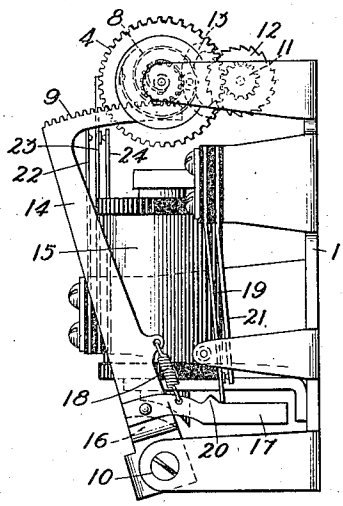


Fig. 3.

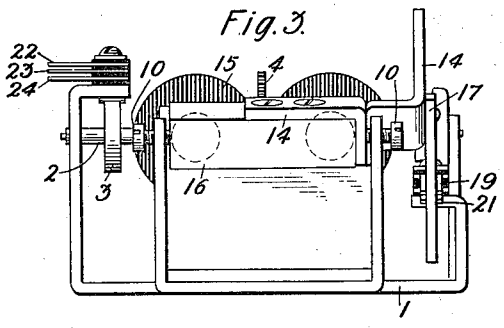
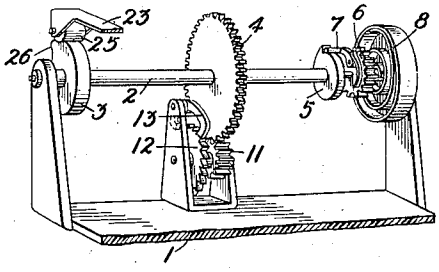


Fig. 4.



Witnesses:

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2 SHEETS—SHEET 2.

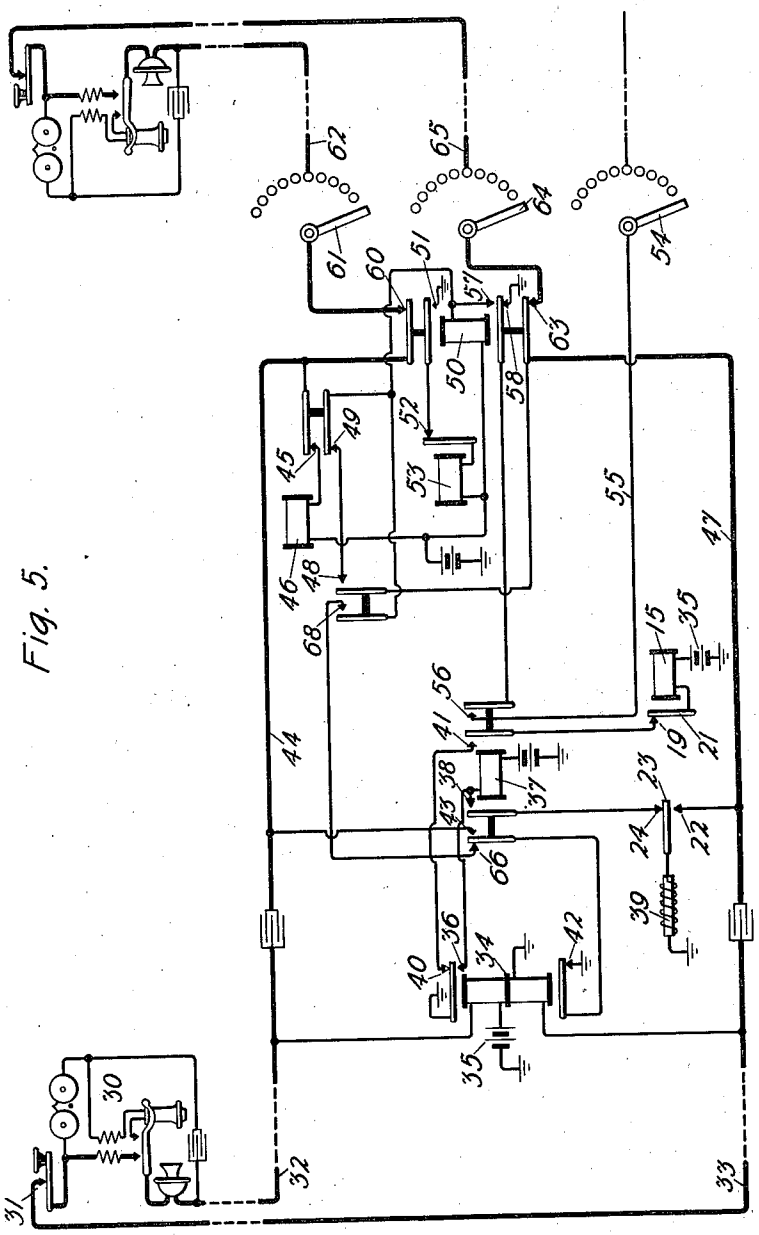

Fig. 5.

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UNITED STATES PATENT OFFICE.

ALFRED H. DYSON, OF MONTCLAIR, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTERN ELECTRIC COMPANY, INCORPORATED, A CORPORATION OF NEW YORK.

TELEPHONE SYSTEM.

1,167,053. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed March 31, 1914. Serial No. 828,585.

To all whom it may concern:

Be it known that I, ALFRED HARTWELL DYSON, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Telephone Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to automatic telephone systems.

The invention is applied to a system in which automatic connecting switches located at a central office are controlled over two line wires leading to a subscriber's station without the aid of a third conductor.

The object of this invention is to provide means for variously controlling the switches of the system over these two line conductors. The particular classes of control here provided for are the movement of the contacts of a switch to a desired position, the maintenance of the switch in this desired position during the control of other switches and the return of the switch to its normal position. The means by which the foregoing controls are accomplished is a timed switching device which serves to alter circuit conditions after the lapse of a predetermined interval, which interval is of sufficient duration to permit the sending of the greatest number of directive impulses which is required for moving any switch to its last position. The apparatus for accomplishing this control comprises an escapement mechanism which is electrically set and timed to the desired interval by the selection of parts of the proper dimensions and inertia.

The invention is illustrated in the accompanying drawings in which—

Figure 1 is a plan of the mechanism for obtaining the desired time interval; Fig. 2 is a right hand elevation of this mechanism; Fig. 3 is a front elevation of this mechanism; Fig. 4 is a perspective view of part of this mechanism; and Fig. 5 is a circuit diagram showing the portion of a telephone system in which this mechanism is used.

The mechanism of Figs. 1, 2, 3 and 4 comprises a base plate 1, which has a plurality of supporting projections formed thereof and bent so as to extend outwardly at right angles to the main plate. Between two of these supports the shaft 2, carrying the cam 3, gear wheel 4 and ratchet wheel 5, is pivoted. Loosely mounted upon the shaft 2 is a pinion gear 6, which carries a dog 7 adapted to engage the single tooth in the ratchet wheel 5. Connected between the pinion gear 6 and the frame of the device is a coil spring 8 tending to rotate said pinion gear 6 in a clockwise direction. Meshing with the pinion wheel 6 is a rack 9 supported upon an arm 14, which is pivoted at 10 between a pair of supports extending outwardly from the plate 1. This rack is of sufficient length that in its movement about its pivotal point 10, the pinion gear 6 is given slightly over one complete revolution. Upon the return of the rack and pinion wheel under the influence of spring 8, the dog 7 engages the single projection upon ratchet 5 and thus carries the shaft 2 one revolution in a clockwise direction. Meshing with the gear wheel 4 is a pinion 11 carried upon a shaft upon which is also carried the scape wheel 12, which is engaged by the pallet 13 to cause a slow return movement of shaft 2 under the influence of spring 8.

An electromagnet 15 is arranged to act upon an armature 16 which is attached to the pivoted arm 14 carrying rack 9, the arrangement being such that the pull of the magnet upon its armature moves the arm 14 in a clockwise direction about the pivot 10.

Attached to the rack supporting lever 14 is a pivoted member 17, which, by means of spring 18, is pressed against the forward end of contact spring 19. The member 17 has a projection 20 formed thereon which has inclined faces engaging the end of contact spring 19. In the clockwise movement of the lever 14, the contact spring 19 is held against its mate 21, but at the completion of the stroke of the lever 14, the peak of the projection 20 is pushed past the end of the contact spring 19, whereupon the spring is forced away from its mate 21 until the lever 14 has returned to its normal position. At this time the peak of the projection 20 again passes the end of spring 19 and that spring is again forced into contact with its mate 21. This action results in the contact 19 being closed with its mate during the entire approaching movement of the armature 16, whereas it is opened from its

mate during the entire receding movement of said armature.

A set of springs 22, 23 and 24 is controlled by the cam 3, the movable spring 23 being provided at its end with a roller 25 which rests upon the surface of the cam. The cam 3 is provided with a single lifting projection 26 which passes under the roller 25 just before the shaft 2 has completed its revolution under the influence of spring 8, and at this time the normal contact between contact springs 23 and 24 is severed and a momentary contact between springs 23 and 22 is completed.

In Fig. 5, of the parts just described, appear those designated by the numerals 15, 19, 21, 22, 23 and 24. In this figure the calling subscriber's station 30 is provided with the usual transmitter and receiver and with a controlling device having contacts 31 arranged to open the circuit of the line conductors 32 and 33 in the transmission of a signal. This line is connected through suitable switch contacts with the conductors of a selector switch circuit wherein the line conductor 32 extends through one winding of relay 34 to the live pole of central battery 35, and line conductor 33 extends through another winding of relay 34 to the ground pole of said battery. The preliminary closure of the line at the subscriber's station by the removal of the subscriber's receiver from its hook, energizes relay 34, causing the closure of its front contacts 36 and the consequent energization of relay 37. The energization of relay 37 completes a local circuit for itself through its front contact 38 and the normal contacts between springs 23 and 24, this circuit including the impedance 39.

A series of short interruptions is now produced by means of the circuit breaker 31 at the subscriber's station 30, the number of interruptions depending upon the number of the desired subscriber's telephone, and being in all events equal in number to one of the digits of the desired subscriber's number. At the first interruption the relay 34 releases its armatures. The first release completes a circuit through back contacts 40 of relay 34, front contacts 41 of relay 37, contacts 19 and 21 and the coil of electromagnet 15, this circuit including the battery 35. Electromagnet 15 thereupon pulls in its armature 16, moving the arm 14 and rack 9 in a clockwise direction, and finally opening contacts 19 and 21 at the extreme position of the rack. The shaft 2 immediately starts in its revolution under the influence of spring 8. At each deënergization of relay 34, the back contacts 42 of that relay complete a circuit through front contacts 43 of relay 37, conductor 44, contacts 45 and the coil of preliminary stepping magnet 46 to battery. Current in this path energizes the stepping magnet 46 once for each time that the circuit is interrupted at subscriber's station 30. The switch controlled in its primary movement by stepping magnet 46 is of a type in which each deënergization and deënergization of the primary magnet 46 moves a set of contact wipers in front of a group or a row of contacts; thus one energization of the primary magnet 46 places the wipers in front of one group of the contacts, two energizations and deënergizations in front of another and so on, the number of groups usually being ten.

The pallet 13 is so constructed that the time required for the shaft 2 to revolve to a point at which contacts 23 and 24 are broken and contacts 23 and 22 are closed, is sufficient for the maximum number of impulses or steps to move the wipers to the last group of contacts. When this predetermined time has lapsed and the projection 26 on cam 3 comes under the roller of the spring 23, the circuit between springs 23 and 24 is severed and a circuit is completed between springs 22 and 23. The interruption between 23 and 24 has no effect upon relay 37 because at this time the relay 34 is actuated by reason of the circuit being closed at the subscriber's station, but a circuit is completed through the impedance coil 39, contacts 23 and 22, conductor 47, contacts 48 of the primary off-normal set of springs, which are arranged to close upon the first energization of magnet 46, through contacts 49 of the secondary off-normal set of springs and the coil of relay 50 to battery, thus actuating the relay 50. The actuation of relay 50 completes a circuit through its front contacts 51, interrupter contacts 52 and secondary stepping magnet 53 to battery. The magnet 53 is adapted to move the contact wipers over the contacts of the group which has been picked out by the previous actuation of magnet 46, the circuit 53 being made and broken by its own contacts 52 so long as the relay 50 remains in its actuated condition.

Upon the first actuation of secondary magnet 53, the wipers 54 were moved into contact with the first of the series of contacts in the particular group which had been picked out by directive actuation of primary magnet 46. These contacts are connected with trunk lines extending to other switches and, as will be hereafter explained, the contacts connecting with busy trunklines will have a guarding potential thereon to indicate the busy condition.

Considering that the first few contacts to be reached by the private wiper 54 are thus guarded by a ground potential, a circuit is completed through conductor 55, front contacts 56 of relay 37, front contacts 57 and coil of relay 50 to battery. Current in this path maintains the actuation of relay 50, which maintains the circuit through the secondary stepping magnet 53 until the private

wiper 54 arrives upon a non-grounded trunk contact, whereupon the circuit in the path just described is interrupted and the relay 50 resumes its normal position, opening the circuit of the secondary stepping magnet 53 and closing its own back contacts 58, thus putting ground potential upon wiper 54 and the contact of the trunk just selected to guard this trunk against its selection by other switches. It may be stated here that the secondary off-normal contacts 45 and 49 were interrupted upon the first actuation of secondary stepping magnet 53.

The next series of interruptions which are made by the controller 31 at the subscriber's station in designating the second digit of the desired number similarly deënergizes the relay 34 but this time, instead of controlling the circuit of the selector switch shown in the drawing, the circuit of the next switch in the series will be controlled. Primary magnet 46 and secondary magnet 53 are not actuated because their respective circuits are broken through the opening of secondary off-normal contacts 45 and 49 as described above. As before, the electromagnet 15 will be energized by the first deënergization of relay 34, and at each deënergization of relay 34 a circuit will be completed through the back contacts 42, front contacts 43 of relay 37, conductor 44, back contacts 60 of relay 50, wiper 61, conductor 62 and a magnet of the next switch in the series. At the lapse of a predetermined interval as before described, contact 23 is moved from its normal connection with 24 and makes a momentary connection with contact 22, which completes a circuit through impedance 39, contacts 23 and 22, conductor 47, back contacts 63 of relay 50, wiper 64, conductor 65 and a relay or electromagnet of the next switch in the series to be controlled. This succeeding switch may be of the type disclosed in a patent to me, No. 975,608, of November 15, 1910.

In order to return the switch to its normal position, the circuit at the subscriber's station is opened by replacing receiver upon the hook, thus producing what may be termed a long interruption. Relay 34 then releases its armatures, which fall away, closing the back contacts 40 and 42. Electromagnet 15 is, therefore, actuated as before described. At the end of a predetermined interval as provided by the action of the pallet 13, the circuit between contacts 23 and 24 is interrupted. This breaks the locking circuit for relay 37 and permits that relay to return to normal, closing its back contacts 66. A circuit is thus established through back contacts 42 of relay 34, back contacts 66 of relay 37, primary off-normal contacts 68 and coil of relay 50 to battery. The actuation of relay 50 again brings the secondary stepping magnet 53 into circuit, which, through its pawl, continues the movement of wipers 54, 61 and 64 over the contacts until the switch has been moved to its extreme secondary position beyond the last contacts in the group. At this point the primary retaining pawl is tripped, permitting the switch to return to its normal position so far as its primary movement is concerned. At the end of this primary movement, the secondary retaining pawl is tripped, permitting the switch to return to its normal position so far as the secondary movement is concerned. The interruption of contacts 56 of relay 37, removed the guard potential from private wiper 54, and caused the release of the next succeeding switch in the series. Even before the release of the switch is accomplished, the shaft 2 has fully completed its revolution and returned its contacts 22, 23 and 24 to their normal conditions. All of the apparatus is then returned to its normal position and is in readiness for a second call.

It is to be understood that the apparatus of Figs. 1, 2, 3 and 4 may be applied to many other types of system than that shown in Fig. 5, and that modifications may be made in the apparatus itself without departing from the spirit or scope of this invention.

What is claimed is:

1. In a telephone system, the combination with a telephone line, of an interrupter mechanism at the subscriber's station of said line, a switch at the central office, a controlling relay for said switch under the control of said substation interrupter and a circuit changing device acting at a predetermined lapse of time after the first deënergization of said controlling relay to change the circuit controlled by said relay.

2. In a telephone system, the combination with a telephone line, of an interrupter mechanism at the subscriber's station of said line, a switch at the central office, a primary controlling magnet, a secondary controlling magnet for said switch, a controlling relay for said magnets under the control of said substation interrupter and a circuit changing device acting at a predetermined time after the first deënergization of said controlling relay to switch the circuit controlled by said relay from one of said controlling magnets to the other.

3. In a telephone system, the combination with a selector switch, a set of movable contacts for said switch and a plurality of sets of stationary contacts, an electromagnet for causing the step-by-step movement of the movable contacts to various sets of stationary contacts, a relay for controlling said electromagnet, and a circuit changer including an escapement mechanism also controlled by said relay and adapted to remove said electromagnet from the control of said relay at a predetermined time after the first control of said magnet by said relay.

4. In an automatic telephone system, the combination with a selector switch, of a primary controlling magnet and a secondary controlling magnet for said switch, a relay for controlling said primary magnet, a circuit changing device for bringing the secondary magnet into action at a predetermined time after the first action of the primary magnet.

5. In an automatic telephone system, the combination with a selector switch, of a primary controlling magnet and a releasing magnet for said switch, a relay initially causing the completion of the circuit of the primary magnet each time it releases its armatures, and a switching device acting after a predetermined time from the first release of the armatures of said relay to place the releasing magnet under the control of said relay so as to return the selector switch to its normal position if said relay is at that time in its unactuated condition.

6. In an automatic telephone system, the combination with a central office switch, of circuit changing contacts for said switch, a controlling device, an electromagnet to set said device, spring actuated means for returning said device to normal, a controlling relay for said magnet, a circuit for said magnet closed upon the first deënergization of said relay, means for delaying the return movement of said device, said contacts being moved from and returned to normal during the return movement of said device.

In witness whereof, I hereunto subscribe my name this 28 day of March A. D., 1914.

ALFRED H. DYSON.

Witnesses:

E. EDLER,

NANON E. TUTHILL.