

Feb. 21, 1928.

1,659,627

D. C. CROWE

SELECTOR SWITCH

Filed Sept. 13, 1926

3 Sheets-Sheet 1

Fig. 1.

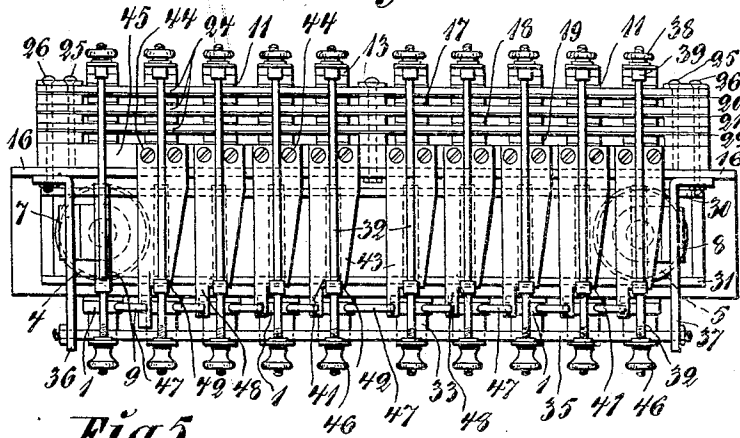


Fig. 5.

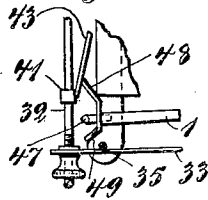
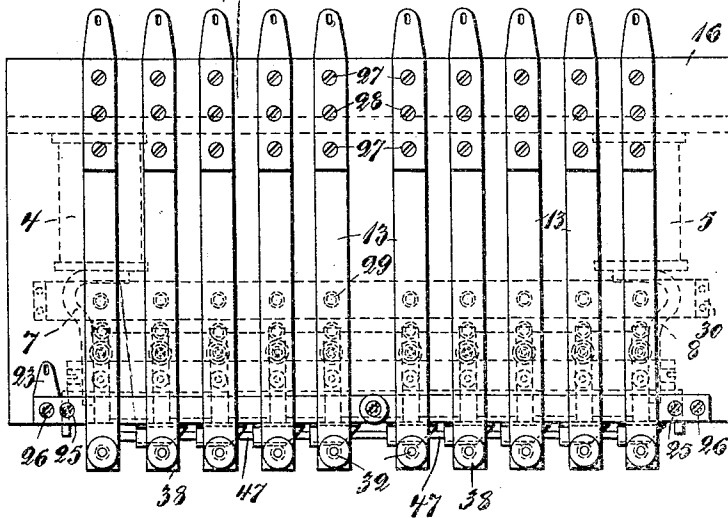


Fig. 2.



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Fig. 3.

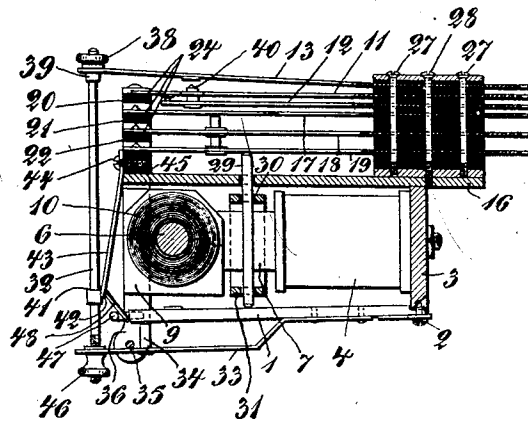
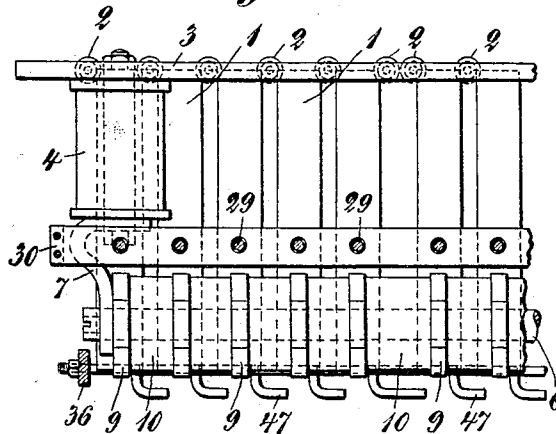


Fig. 4.



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Fig. 6.

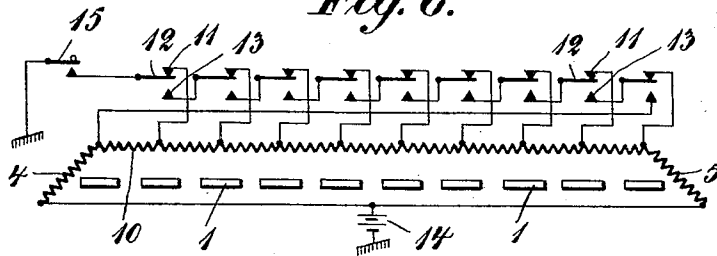


Fig. 7.

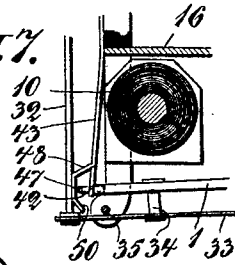


Fig. 8.

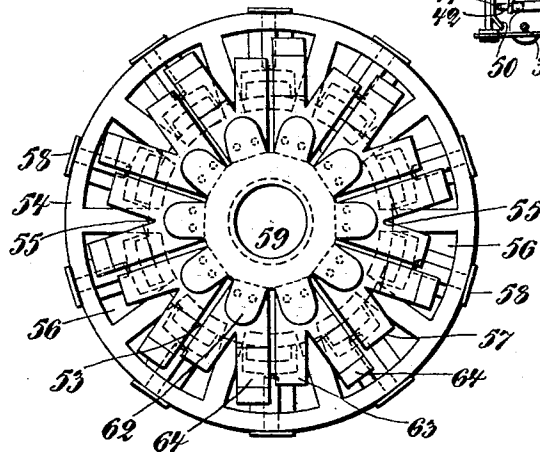
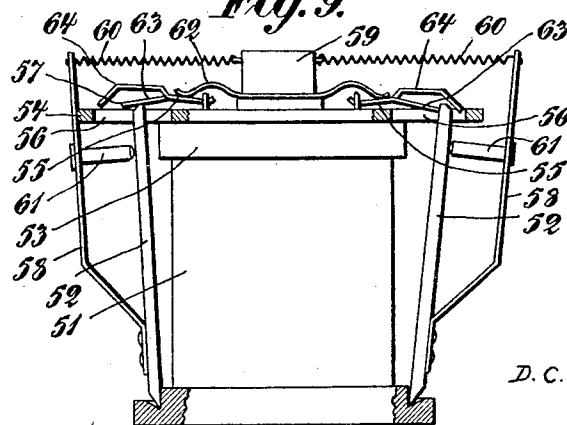


Fig. 9.



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UNITED STATES PATENT OFFICE.

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SELECTOR SWITCH.

Application filed September 13, 1926, Serial No. 135,255, and in Sweden October 12, 1925.

The present invention refers to selector switches, and particularly to switches of this type which are used in the art of automatic telephony, said switches being composed of a number of electromagnetic switching devices, for instance relays, adapted to be actuated by means of current impulses which are caused to actuate the different relays in succession. The successive operation of the relays has hitherto been effected by an electrical control of the impulse circuit the latter being successively shifted from one relay to the other either by means of the relays themselves or by means of special switching relays. The present invention chiefly has for its object to provide a mechanical control of the switching operation wholly or partly replacing the electrical control.

The invention will be more fully described with reference to the accompanying drawings which illustrate different embodiments of a selector switch of the type in question. Fig. 1 is a front view of a multiple relay of known type, the same being provided with switching means according to the invention. Fig. 2 shows the same multiple relay as viewed from above. Fig. 3 is a cross section thereof. Fig. 4 discloses the magnet system of the relay. Fig. 5 shows a detail of the switching device. Fig. 6 is a diagrammatic representation of the arrangement of the relay circuits. Fig. 7 shows a modification of the switching device. Figs. 8 and 9 show a multiple relay of a modified construction, Fig. 8 representing the said relay as viewed from above, and Fig. 9 the same as viewed from the side and partly in section.

The multiple relay shown in Figs. 1 to 5 is provided with a magnet system common to a plurality of relay armatures 1, the construction of said magnet system being most clearly illustrated in Fig. 4. The armatures 1 are swingably attached, by means of screws 2, to the lower edge of a longitudinal iron bar 3 forming part of the magnetic circuit. For the rest, the magnetic system comprises two electromagnets 4, 5 and a longitudinal electromagnet 6, the iron core of which is connected at the ends to the iron cores of the electromagnets 4, 5 by means of connecting pieces 7, 8 of iron. The longitudinal electromagnet 6 is provided with a number of pole-pieces 9 arranged

opposite the various armatures 1. In the example shown, the relay is provided with ten armatures. Between the different pole pieces 9, there are provided windings 10 wound in the same direction and connected in series with one another and with the windings 4, 5 in the manner shown in Fig. 6. From the connecting points between the different windings outtakes are branched off to switching contacts 11, 12, 13, which may be connected to the one pole of a battery 14, Fig. 6, over an impulse sender 15. The other pole of said battery 14 is connected to the free ends of the windings 4, 5.

If a current impulse be sent through the relay, the position of the contacts being as shown in Fig. 6, the current will pass through the connecting point between the first two windings 10, and is thus divided so that part of the same will pass through the first winding 10 and the winding 4, whereas another part of the current will pass through the other windings. Thus there are produced two opposed magnetic fluxes resulting in a marked pole on the pole piece situated between the first two windings 10. The opposite pole will be situated on the longitudinal bar 3. By reason of this the armature 1 situated opposite the said pole-piece will be attracted while the other armatures remain unactuated. Obviously, it is possible in this manner to actuate any one of the armatures by sending the current through the connecting point between those windings which are situated on both sides of the corresponding pole-piece.

The contact springs of the relay are arranged on a supporting plate 16 attached to the upper edge of the bar 3. In the example shown, each armature 1 is adapted to actuate two groups of contact springs, first, one group 11, 12, 13 corresponding to the contacts in Fig. 6 designated by the same numerals and, second, a group 17, 18, 19. The first group is intended for the switching of the impulse circuit from one winding 10 to the other, and the other group is intended for the connecting up of the lines allotted to the relay. The contact springs 17, 18, 19 are adapted to co-operate with a corresponding number of longitudinal contact strips 20, 21, 22, which are connected with the line wires by means of soldering lugs 23, Fig. 2. Arranged between the different contact strips 20, 21, 22 are in-

insulating strips 24, forming an abutment for the free ends of the contact springs 17, 18, 19 in their normal position. The contact strips 20, 21, 22 are held together at the ends by means of screws 25 and interposed insulating washers, and are attached to the fore edge of the supporting plate 16 by means of screws 26. The springs 11, 12, 13, 17, 18, 19 are held together by means of screws 27 and interposed insulating washers, and are attached to the rear edge of the plate 16 by means of screws 28. The springs 17, 18, 19 may be actuated from the appertaining armatures by means of insulating pins 29 which are passed through holes in two longitudinal bars 30, 31 attached to the plate 16.

Each armature is suspended at its fore end from the upper contact spring 13 through the medium of a vertical rod 32 and a resilient arm 33 attached to the armature, the armature then abutting against a stud 34 attached to the arm 33. Through the action of the spring 13 the resilient arm 33 is kept bearing against a longitudinal rod 35 carried by two arms 36, 37 secured to the plate 16. By means of nuts 38, 39 the position of the contact spring 13 may be adjusted relatively to the contact spring 12 with which it is adapted to make contact by means of a contact pin 40 attached to said contact spring 12, said contact pin 40 extending through a hole in the spring 11.

The vertical suspension rods 32 are provided with an abutment 41 adapted to co-operate with the lower edge 42 of a resilient locking member 43 provided behind the rod, said locking member 43 consisting of a plate spring attached by means of a screw 44 to a longitudinal insulating bar 45 attached to the fore edge of the plate 16. The locking member 43 is resilient in such a manner that the lower edge 42 thereof falls in over the abutment 41 when the rod 32 is moved downwards. This takes place when the armature is released from its attracted position, the armature then striking against the stud 34 and moving, by reason of its inertia, past the position shown in Fig. 3, against the action of the spring 13. As the armature is released, the rod 32 will, consequently, be locked in a depressed position, the spring 13 then making contact with the spring 12, whereas the contact between springs 11 and 12 is broken. By means of a nut 46, the position of the abutment 41 may be adjusted with respect to the locking member or plate 43.

In order to disengage the rod 32 from the locked position, each armature excepting the last one is provided with a pin 47 projecting laterally (to the right in Fig. 1), said pin 47 being arranged to co-operate with an extension 48 of the locking plate 43 adjacent thereto on the right hand side.

When the armature is attracted, the adjacent locking plate will thus be actuated by the pin 47 abutting against the extension 48, so that the appertaining suspension rod 32 is disengaged, the said rod being then raised, together with its armature, by the spring 13, until the resilient arm 33 has been brought to bear against the rod 35. The said extension 48 is formed, in the resilient locking plate belonging to the second armature, in a manner different from that of the other locking plates, and more particularly it is formed in the manner shown in Fig. 5, so that the disengagement of the appertaining suspension rod takes place only when the first armature is released, the pin 47 then acting against a forwardly slanting portion 49 of the extension 48, so that the locking plate is disengaged from the abutment 41. On the other hand, the disengagement of the other connecting rods takes place when the preceding armature is attracted. The first armature has no such locking device, and the suspension rod together with the appertaining group of contact springs 11, 12, 13 may be omitted.

Before the apparatus is taken in use, all armatures 1, suspension rods 32 and groups of springs 11, 12, 13 may be assumed to occupy the position shown in Fig. 3. Now, if a connection is desired, for example, with a line connected to the fourth group of contact springs 17, 18, 19, the apparatus is brought into operation in the following manner. The impulse circuit is closed at the impulse sender 15, Fig. 6, whereupon the circuit is broken twice. When the impulse circuit is closed the first time, the second relay armature is actuated, as hereinbefore described, the said armature being thus attracted toward its pole-piece. This, however, will not alter the position of the suspension rod 32 and the springs 11, 12, 13, because the resilient arm 33 is retained against the rod 35. In this case, the striking of the pin 47 against the portion 48 of the adjacent locking plate is of no consequence, inasmuch as the suspension rod 32 already occupies its disengaged position. When the current is broken the first time, the said armature is released and is now moved downwards under the influence of its own weight and the resiliency of the contact springs 17, 18, 19. Its outer end then hits the stud 34, whereby the suspension rod 32 will be depressed and locked by the locking plate 43 allotted thereto. At the same time the contacts 11, 12, 13 have been switched, so that the current, upon the circuit being then again closed, will pass over to the connecting point between the next pair of windings 10, as illustrated in Fig. 6. Thus the third armature is attracted, without any other result than that the contact springs 17, 18, 19 are raised into contact

with the contact strips 20, 21, 22. When the circuit is broken the second time, the suspension rod allotted to the third armature is actuated in the manner previously described so as to be locked in a depressed position while the appertaining contact springs 11, 12, 13 are shifted. When the circuit is then reclosed, the current will pass through the connecting point between the next pair of windings 10, with the result that the fourth armature is attracted. In this position, connection is thus established with the desired line through the fourth group of contacts 17, 18, 19.

If the apparatus is to operate as a numerical selector, it is necessary, through a subsequent series of current impulses to bring the apparatus into a certain normal position from which the apparatus is started every time it is taken in use. If the apparatus is used as a non-numerical selector, it may remain in the position into which it has been brought by the last operation, and from this position the apparatus will thus be started when taken into use the next time. Upon the last armature being actuated, the impulse circuit will be switched over to the connecting point between the winding 4 and the first winding 10, as will appear from Fig. 6. The first armature will thus be attracted, without, however, influencing the adjacent locking plate, the upper portion of the extension 48 of the second locking plate, Fig. 5, being out of reach of the pin 47. Only when the armature is released the second suspension rod will be disengaged by the pin 47 actuating the portion 49 of the adjacent locking plate, as will be seen from Fig. 5. Consequently, the next closing of the circuit will actuate the second armature which, when attracted, actuates the extension 48 of the next locking plate, the corresponding suspension rod being then disengaged. Thus the next impulse circuit is prepared by reason of the fact that the contacts 11, 12, 13 are simultaneously shifted. When the second armature is released, the suspension rod allotted thereto will be locked in the manner hereinbefore described, the corresponding contact springs 11, 12, 13 being then shifted so that the current will next time actuate the third armature. This latter, in turn, will now effect disengagement of the fourth suspension rod, another circuit being then prepared for the fourth armature, which circuit is completed at the contact springs 11, 12, 13 of the third armature, when the third armature is released and the suspension rod allotted thereto is locked. In this manner, the switching operation is continued while successive disengagement of a subsequent suspension rod and locking of a preceding connecting rod is taking place simultaneously with a successive switching of the impulse circuit.

The locking device of the suspension rods 32 may be modified as shown in Fig. 7. According to this arrangement, the resilient locking plate 43 is adapted to co-operate with the armature direct, so that the latter is locked in retracted position. The disengagement of the next connecting rod will then be effected through the influence of the pin 47 on the portion 50 of the extension 48 of the next locking plate, when the armature is in its lowermost position. In this embodiment, the extensions 48 are shaped similarly on all locking plates. This arrangement will thus act in the following manner. It is assumed that all suspension rods are in the locked position. The first current impulse will then produce a pole in front of the first armature, which is the only armature that is not locked. When the armature is attracted, nothing else will take place than the group of springs 17, 18, 19 being raised into operative position. When the armature is then released, the pin 47 will, when the armature reaches its lowermost position, actuate the locking plate 43 allotted to the second armature, in the manner set forth, so that the last mentioned armature is released and occupies the position shown in Fig. 7. The shifting of the group of springs 11, 12, 13 is then taking place so that the next current impulse will actuate the second armature. When the latter is again released it will be locked in retracted position by the locking plate 43 allotted thereto while at the same time releasing the next armature which is then attracted through the third current impulse and so forth.

The multiple relay shown in Figs. 8 and 9 is distinguished by the fact that it has only one magnet winding 51 and only one magnetic circuit common to all armatures 52. The armatures are arranged about a circular pole-piece 53, on the upper side of which is provided a plate 54 carrying a number of locking devices in the form of metal plates 55 which are adapted to co-operate with the ends of the armatures 52 projecting through openings 56 in the plate 54. All armatures excepting one are normally locked in retracted position against the edge 57 of the locking member 55 allotted thereto. In Fig. 9, the left armature is shown to occupy a non-locked or released position, the armature being then kept at a certain distance from the pole-piece 53 through a resilient arm 58 attached to the armature, said arm 58 abutting against the outer edge of the plate 54 under the influence of a spring 60 attached to a central upright 59, and abutting with a pin 61 against the outer end of the armature 52. The locking plates 55, which are actuated each by a lap of a centrally disposed star-shaped leaf spring 62, are provided with two laps 63, 64 adapted to

co-operate each with one of two adjacent armatures, and of which laps one 63 serves as a locking member for the appertaining armature, whereas the other 64 serves as a
5 disengaging member for the adjacent armature.

When a current impulse is sent through the magnet winding 51, the armature which for the time being is unlocked, will be attracted against the pole-piece 53, a group
10 of contact springs (not shown in the drawing) allotted thereto being then actuated. When a current impulse ceases, the armature will be thrown back, the same being then
15 locked by the lap 63 of the locking plate allotted thereto. At the same time the lap 64 of the adjacent locking plate will be actuated so that the next armature is released. Consequently, the next current impulse will
20 actuate the last-mentioned armature which, in turn, disengages the next armature while locking itself in retracted position. In this arrangement, consequently, no switching whatever of the impulse circuit is taking
25 place.

I claim:

1. A selector switch comprising in combination a number of sets of contacts, a number of switching members for actuating said
30 sets of contacts, electromagnetic means for operating said switching members in succession, means for locking the switching members mechanically in shifted positions, and means associated with the switching members and adapted to cause said members to be disengaged successively each by the operation of an adjacent switching member.

2. A selector switch as claimed in claim 1, characterized by the switching members being locked normally and adapted to be disengaged successively by the operation of a preceding switching member.

3. A selector switch as claimed in claim 1, characterized by the switching members being locked in a deenergized position and adapted to be disengaged by the energizing of an adjacent switching member.

4. A selector switch as claimed in claim 1, characterized by the switching members being locked in a de-energized position and adapted to be disengaged by the deenergizing of an adjacent switching member.

5. A selector switch comprising in combination a number of sets of contacts, a number

of switching members for actuating
55 said sets of contacts, a number of magnetizing windings adapted upon energizing to operate said switching members, means under the control of the switching members for connecting said windings successively
60 into circuit, means for locking the switching members mechanically in shifted positions, and means associated with the switching members and adapted to cause said members to be disengaged successively each by the operation of an adjacent switching member.

6. A selector switch as claimed in claim 5, characterized by the shifting of the impulse circuit of said windings being effected by the de-energizing of the switching members.

7. A selector switch as claimed in claim 5, characterized by the fact that the impulse circuit of a switching member is adapted to be prepared by said switching member being
75 disengaged and to be completed by the operation of an adjacent switching member.

8. A selector switch as claimed in claim 1, characterized by the switching members being pivoted co-axially.

9. A selector switch as claimed in claim 1, characterized by the switching members being arranged to be actuated successively in a circle.

10. A selector switch comprising in combination a number of sets of contacts, a number of magnetic switching members for actuating said sets of contacts, a magnetic circuit arranged in common for said switching members, electromagnetic means
90 for operating the switching members in succession, means for locking the switching members mechanically in shifted positions, and means associated with the switching members and adapted to cause said members
95 to be disengaged successively each by the operation of an adjacent switching member.

11. A selector switch as claimed in claim 10, characterized by all switching members except one being normally locked in an
100 operative position.

12. A selector switch as claimed in claim 10, characterized by the switching members being normally locked in a retracted position.

In testimony whereof I affix my signature.

DOUGLAS CORMACK CROWE.