

H. A. STEEN.
SWITCH.

APPLICATION FILED SEPT. 6, 1910.

1,309,822.

Patented July 15, 1919.

2 SHEETS—SHEET 1.

Fig. 1

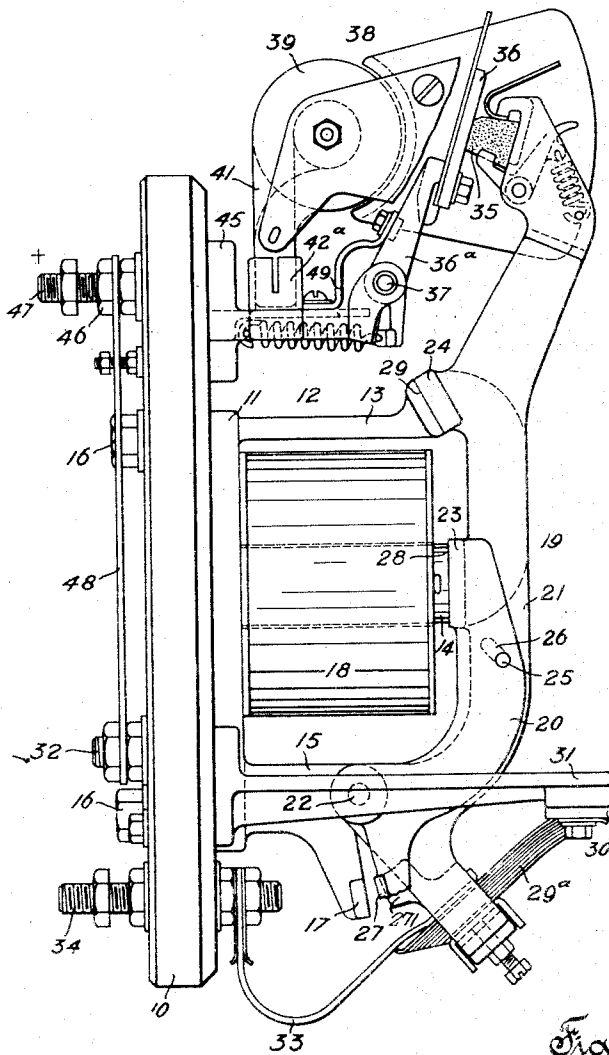


Fig. 2

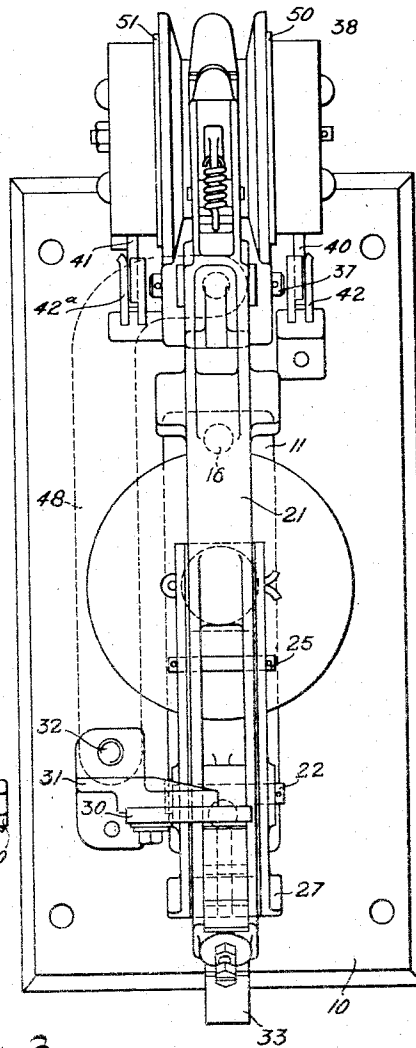


Fig. 3



Witnesses

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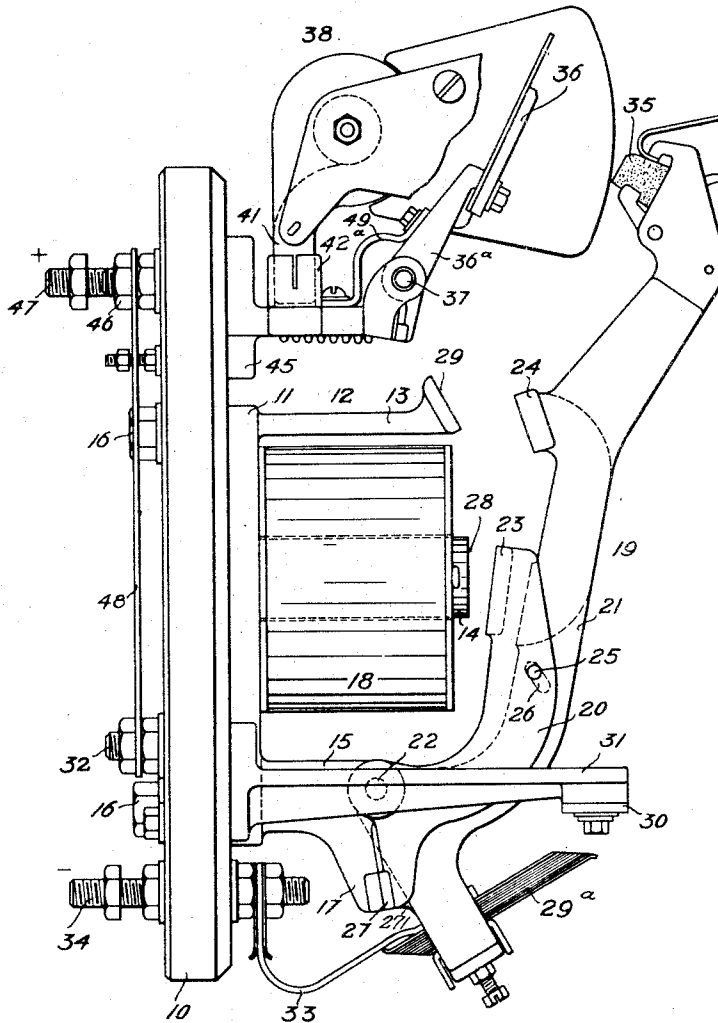
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2 SHEETS—SHEET 2.

Fig. 4



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UNITED STATES PATENT OFFICE.

HALFDAN A. STEEN, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO ALLIS-CHALMERS MANUFACTURING COMPANY, A CORPORATION OF DELAWARE.

SWITCH.

1,309,822.

Specification of Letters Patent.

Patented July 15, 1919.

Application filed September 6, 1910. Serial No. 580,532.

To all whom it may concern:

Be it known that I, HALFDAN A. STEEN, subject of the King of Norway, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Switches, of which the following is a full, clear, and exact specification.

This invention relates to electric switches 10 or circuit breakers and especially to automatically operated switches to be used in systems of remote control of motors or other translating devices.

The object of my invention is to provide 15 a simple and inexpensive switch of durable construction. The invention embodies novel features contributing to the effective operation of switches and including a novel type of operating magnet for the switch.

The various novel features of my invention will be described in the specification and particularly set forth in the appended claims.

This invention is illustrated on the accompanying sheets of drawings in which Figure 25 1 is a side elevation of a switch embodying my invention, the switch as here shown being in closed position;

Fig. 2 is a front elevation of the same;

Fig. 3 is a detail sectional view of a socket 30 for the reception of knife blade contacts of a blow-out magnet used in connection with the switch; and,

Fig. 4 is a side elevation of the same switch as shown in Fig. 1, the switch being in open 35 position.

Mounted upon any suitable base 10, is the frame 11 of magnetic material of a magnet 12. This frame, which has three legs 13, 14, and 15, is secured to the base by bolts 16, and 40 has a projection 17 which acts as a stop. The magnet 12 is provided with an actuating winding 18 which surrounds the middle leg or core 14 and is adapted to attract a switch actuating member 19. This switch 45 actuating member comprises two members 20 and 21, each of which is pivotally connected to the frame 11, as indicated at 22, and provided with armatures 23 and 24 respectively, these individual armatures or 50 armature portions being integral with the members on which they are mounted, as indicated in the drawings. The part 20 of the switch actuating member is provided with a pin 25, which slides in a slot 26 of the other 55 part 21 of the actuating member. The part

20 of the actuating member also has a projection 27, which is adapted to engage the projection 17 to limit the movement of said part. The part 21 of the actuating member likewise has a projection 271, which is adapted to engage the projection 17 to limit the 60 movement of said part. The two parts 20, 21 are relatively movable and when in open position with the projections 27, 271, against the stop projection 17, the pin 25 is slightly 65 spaced from the upper end of the slot 26. This switch actuating member is provided with these two relatively movable parts so that only a comparatively small or decreased 70 amount of current will be required to draw the armatures 23 and 24 of said switch actuating member into contact with their corresponding engaging faces or surfaces 28 and 29 respectively of the electromagnet. By 75 means of this arrangement the air gap between the armature 23 and its corresponding attracting member is materially decreased from that of the ordinary arrangement and a steady and gradual pull of the switch actuating member is thus obtained. This is ap- 80 parent from the drawings where it is seen that after the part 20 has been drawn toward the fixed part of the magnet a slight amount the pin 25 of said part engages the part 21 giving this part an initial start, decreasing 85 its air gap and making the pull of the magnet steady and gradual. That portion of the member 21 adjacent the armature portion 23 of the member 20 is preferably of such formation as to come into substantial engage- 90 ment throughout with the rear face of the armature portion 23 when both armature portions are in attracted position, as indicated in Fig. 1, the effect of which, in this latter condition of the parts, is to complete 95 a series magnetic circuit through the polar portion 28 of the core, armature portion 23, and, to some extent, the side pieces of the member 20 surrounding the adjacent portion of the member 21, and through member 21, 100 armature portion 24 and polar portion 29 of the core. It will be apparent that there may be a plurality of gaps in this magnetic circuit, and that the effect of movement of the armature portion 23 toward its cooperative polar 105 portion of the core is to decrease the reluctance of the series magnetic circuit and thus increase the attractive force exerted on each armature portion.

Mounted in the lower portion of the ac- 110

tuating member 19 is the main brush contact 29^a, preferably laminated, and adapted to engage a stationary contact 30, which is located at the end of support 31, the latter being secured to the base 10 by bolts 32. Clamped into contact with the brush 29^a is a conductor 33, which is connected to a stud 34, the latter forming one of the terminals of the switch. Located at the other end of the switch actuating member 19 is an auxiliary contact 35, which is adapted to engage, with a wiping action, a relatively stationary contact member 36. This contact member is secured to a spring pressed member 36^a, which is pivotally mounted, as shown at 37. The main contacts are arranged horizontally, breaking vertically, and the auxiliary contacts are arranged vertically, breaking horizontally. These contacts are placed at opposite ends of the switch actuating member 19, with the auxiliary contacts above the main contacts in order to prevent any damage, which might occur to the main contacts due to arcs formed when the auxiliary contacts are separated.

In order to destroy arcs formed at the auxiliary contacts when the circuit is broken, a blowout magnet 38 is employed. The coil of this magnet is wound on a spool 39 and its ends terminate in knife blade contacts 40 and 41 respectively, which are adapted to fit in contact sockets 42 and 42^a, as shown in cross section in Fig. 3. The contact sockets are suitably mounted, the socket 42^a being integral with or connected to a support 45, to which the contact carrying member 36^a is pivoted, and which is secured to the base 10 by a bolt 46, and the socket 42 being mounted separately or insulated from the support 45 and being suitably connected to the line terminal 47. By using a construction such as this, the blow-out magnet is efficiently supported in operative position and can be removed rapidly at any time simply by drawing out the same with its knife blade contacts from the contact sockets 42 and 42^a. It is thus seen that no screw connections are used and that the blowout magnet can be removed rapidly without the use of any instruments. This blow-out magnet is provided as usual with poles 50 and 51, which are so located that the flux between them is directly in the path of arcs formed when the circuit through the auxiliary contacts is broken.

The switch circuits will now be traced. Current enters at the plus terminal 47, and passes through contact socket 42, knife blade 40, blow-out coil, knife blade 41, and contact socket 42^a. At this point, the circuit divides, one branch including bolt 46, conductor 48, bolt 32, support 31, contact 30, brush 29^a, conductor 33, and the minus ter-

65 minal 34. The other branch includes conductor 49, contact carrying member 36^a, auxiliary contact members 36 and 35, part 21 of the actuating member 19, conductor 33 and minus terminal 34.

While, strictly speaking, each of the portions 23 and 24 constitutes an armature as to its cooperative polar portion of the core, it will be apparent that these armature portions along with the connection of magnetic material between the same may quite accurately be considered as the "armature" of the electromagnet as a whole, that is, considering the armature as the movable part which is actuated to attracted position through magnetic effects produced therein and completes the normal magnetic circuit of the electromagnet.

It is evident that several modifications of the precise form and arrangement herein shown and described may be made and in my claims I intend to cover the invention broadly.

What I claim as new is:

1. In combination, a switch, and an electromagnet for actuating said switch, said electromagnet comprising cooperative fixed and movable parts, the movable part of said electromagnet comprising two pivotally mounted and relatively movable armature portions movable about the same axis and engageable with separate spaced polar portions of the fixed part of said electromagnet, and said spaced polar portions being in series in the normal magnetic circuit of said electromagnet.

2. In combination in an electromagnetically-actuated switch, an operating electromagnet comprising fixed and movable parts of magnetic material, said fixed part comprising polar portions magnetically in series in the normal magnetic circuit of said electromagnet, and said movable part comprising a plurality of pivotally mounted and relatively movable armature portions of magnetic material cooperative with said polar portions of said fixed part and magnetically in series with each other in the normal magnetic circuit of said magnet, each of said armature portions being movable about its axis to attracted position, and one of said armature portions being more readily actuated to attracted position than a second armature portion and assisting in the actuation of said second armature portion to attracted position by decreasing the reluctance of the magnetic circuit of said electromagnet.

3. In a switch, a magnetic element and a winding therefor, a movable element comprising two pivotally mounted and relatively movable parts each having a portion of magnetic material forming an armature normally spaced from and cooperative with

a polar portion of said magnetic element, said armature portions in attracted position being magnetically in series and in unattracted position being spaced different distances from the cooperative polar portions of said magnetic element, and the armature portion nearest its cooperative polar portion being first moved to attracted position, and a connection between said relatively movable armature portions mechanically independent of said magnetic element whereby the armature portion nearest its cooperative polar portion assists the other armature portion in its movement to attracted position.

4. In a switch, a magnetic element and a winding therefor, said magnetic element having two polar portions, and a movable element comprising two relatively movable parts each having a portion of magnetic material forming an armature cooperative with one of said polar portions, said armature portions being magnetically in series when in engagement with the cooperative polar portions, and said relatively movable parts of said movable element being pivotally mounted on a common axis and being movable in the same plane of movement.

5. In a switch, relatively movable contacts, a magnet comprising frame and armature of magnetic material, said frame including two spaced polar portions, an energizing winding for said magnet, said armature being movable and associated with said relatively movable contacts for causing same to function, said armature having polar portions normally separated from and movable to a position directly in series with said polar portions of said frame to magnetically bridge same, and means for mounting said armature with one of its said polar portions at a distance from its corresponding frame polar portion different from that separating another of its said polar portions from its corresponding frame polar portion, said mounting permitting the exercise of the resulting magnetic bias tending to cause the engagement of the less spaced polar portions prior to that of the more separated polar portions.

6. In an electromagnetically operated device, an electromagnet comprising frame and armature, an energizing winding for said magnet, said frame having a plurality of spaced polar portions, said armature comprising two polar portions mounted for relative angular movement about a common axis and for engagement directly in series with said frame polar portions, and means for mounting said armature with its said polar portion nearest said axis spaced from its corresponding frame polar portion a distance less than that separating the remaining corresponding armature and frame polar portions, said mounting permitting

the exercise of the resulting magnetic bias tending to cause the engagement of the less spaced polar portions prior to that of the more separated polar portions.

7. In an electromagnetically-actuated controlling device, an electromagnet comprising a core having a plurality of polar portions magnetically in series in the normal magnetic circuit of the magnet, an energizing winding for said core, and a plurality of pivotally mounted and relatively movable armature portions each of which is movable about its axis of movement into engagement with one of the polar portions of said core on energization of said magnet, said armature portions being connected through magnetic material, and being in series in the normal magnetic circuit of said electromagnet, and one of said armature portions being more readily attracted to its cooperative polar portion of the core on energization of said magnet whereby the attraction of the other armature portion of its cooperative polar portion of the core is assisted through a decrease in the reluctance of the magnetic circuit of said magnet.

8. In an electromagnetically-actuated controlling device, an electromagnet comprising a core having a plurality of polar portions magnetically in series in the normal magnetic circuit of the magnet, an energizing winding for said core, and a plurality of relatively movable armature portions each of which is angularly movable about its axis of movement into engagement with one of the polar portions of said core on energization of said magnet, magnetic material outside of said core connecting said armature portions magnetically in series in the normal magnetic circuit of said electromagnet whereby approach of one of said armature portions toward its cooperative polar portion on the core has the effect of varying the attractive force exerted on the other armature portion through variation of the reluctance of the magnetic circuit of the electromagnet.

9. In an electromagnetically actuated circuit-controlling device, an operating electromagnet comprising a core having a plurality of polar portions magnetically in series in the normal magnetic circuit of the core, and a plurality of pivoted, relatively movable armature portions each of which cooperates with one of the polar portions of said core, a pair of contacts the circuit-controlling operation of which is effected by one of said armature portions, and a connection between said armature portions external of said core and of good magnetic conductivity and in series with said armature portions in the normal magnetic circuit of said electromagnet whereby approach of one of said armature portions toward its cooperative polar por-

tion on the core causes an increase in the attractive force exerted on the other armature portion.

10. In combination, a magnet having
5 spaced polar portions, an armature having a polar face of constant form during its cycle of operation and adapted to cooperate with one of said spaced polar portions and another polar face adapted to cooperate with
10 another of said spaced polar portions, said polar faces being magnetically in series and carrying substantially the entire effective flux produced by said magnet when the armature is in fully attracted position, and
15 means for causing one of said polar faces to engage its cooperating polar portion before the other polar face engages its cooperating polar portion.

11. In combination, a magnet having
20 spaced polar portions, an armature having a polar face of constant form during its cycle of operation for cooperating with one of said polar portions and another polar face for cooperating with another of said polar

portions, and means for causing one of said
25 polar faces to engage its cooperating polar portion before the other polar face engages its cooperating polar portion.

12. In combination, a magnet having
30 spaced polar portions, an armature having a polar face of constant form during its cycle of operation for cooperating with one of said polar portions and another polar face for cooperating with another of said polar portions, each polar face having substantially
35 the same area as its cooperating polar portion, and means for causing one of said polar faces to engage its cooperating polar portion before the other polar face engages its cooperating polar portion.

Milwaukee, Wisconsin, August 26, 1910.

In testimony whereof I affix my signature,
40 in the presence of two witnesses.

HALFDAN A. STEEN.

Witnesses:

CHAS. L. BYRON,
ROB. E. HALL.

Correction in Letters Patent No. 1,309,822.

It is hereby certified that in Letters Patent No. 1,309,822, granted July 15, 1919, upon the application of Halfdan A. Steen, of Milwaukee, Wisconsin, for an improvement in "Switches," an error appears in the printed specification requiring correction as follows: Page 3, line 87, claim 7, for the word "of" read *to*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of August, A. D., 1919.

[SEAL.]

Cl. 175—281.

J. T. NEWTON,
Commissioner of Patents.