J. J. WOOD.

MAGNETIC SWITCH.

APPLICATION FILED SEPT. 29, 1905.

958,788.

Patented May 24, 1910.

2 SHEETS—SHEET 1.

FIG. 1.

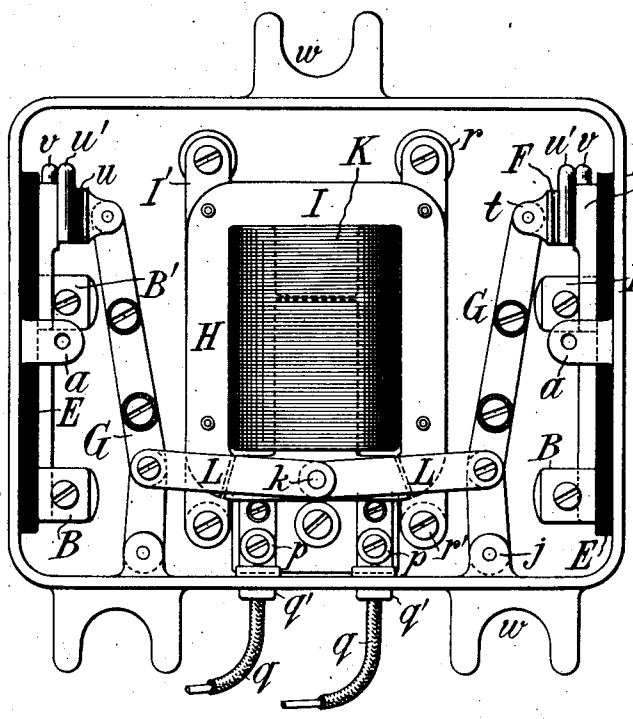


FIG. 2.

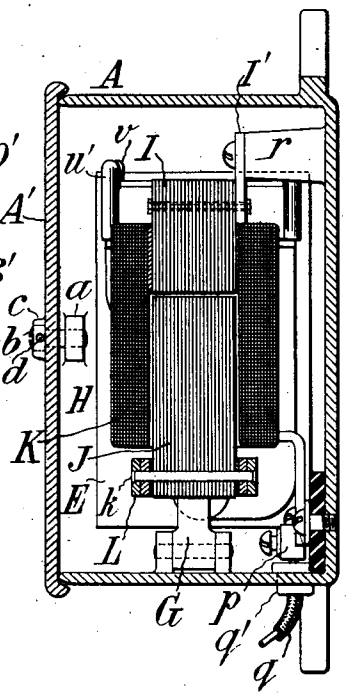


FIG. 4.

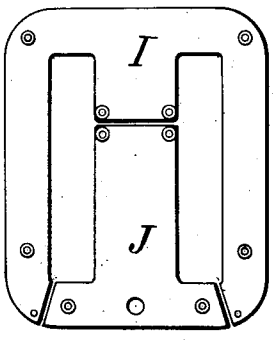
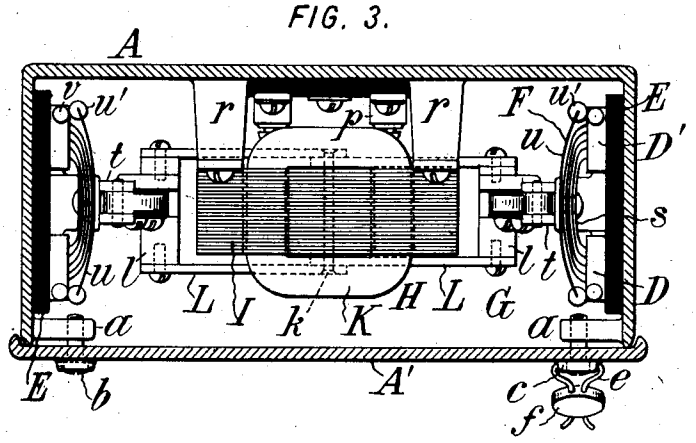


FIG. 3.



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2 SHEETS—SHEET 2.

FIG. 5.

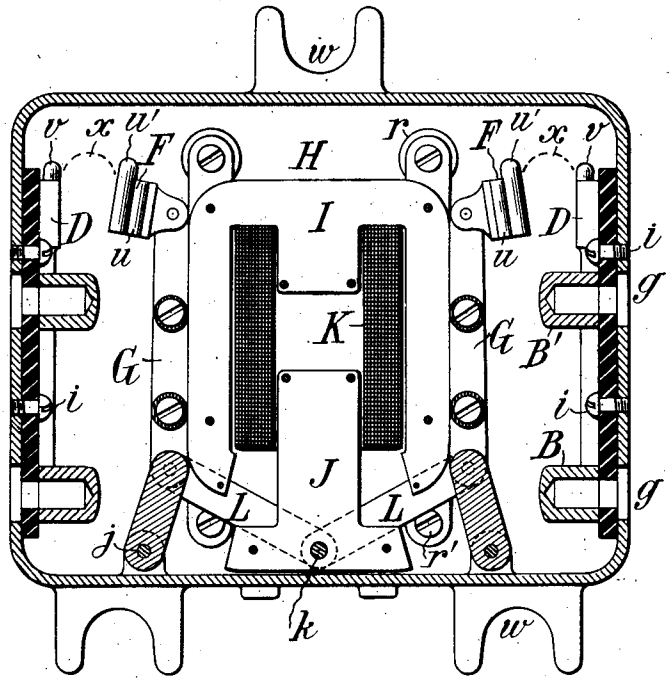


FIG. 6.

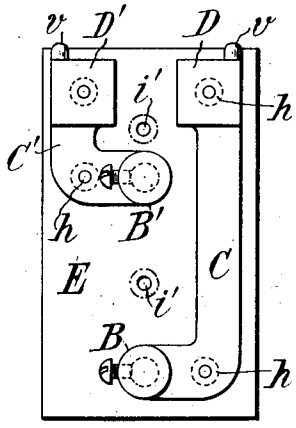


FIG. 7.

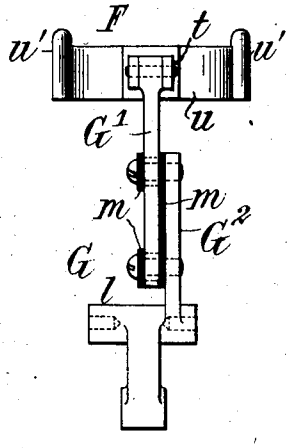
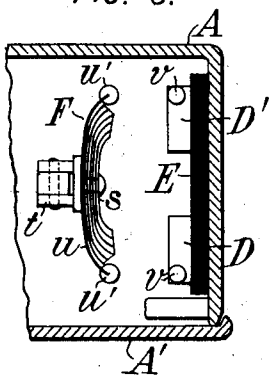


FIG. 8.



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MAGNETIC SWITCH.

958,788. Specification of Letters Patent. Patented May 24, 1910.

Application filed September 29, 1905. Serial No. 280,591.

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Magnetic Switches, of which the following is a specification.

This invention provides a magnetically operated switch adapted to be controlled from a remote point through an electric circuit.

The invention aims to provide a remote control switch which will operate with certainty, require the minimum expenditure of electric energy for its operation, and be capable of controlling a circuit of considerable capacity.

The accompanying drawings illustrate the preferred embodiment of my invention.

Figure 1 is a front elevation showing the front plate or cover of the inclosing casing removed and the switch closed; Fig. 2 is a vertical mid-section showing the cover applied; Fig. 3 is a horizontal section through the casing showing the switch in plan; Fig. 4 is an elevation of the magnet core and armature; Fig. 5 is a vertical mid-section showing the switch open; Fig. 6 is a side elevation of one pair of circuit terminals and binding posts with their insulating plate; Fig. 7 is an elevation of one of the switch levers; Fig. 8 is a plan of a fragment of the switch showing the open position thereof.

Referring to the drawings, let A designate any suitable inclosing case or box having a front plate or cover A′. These should be of fireproof material, as cast iron, and in order to inclose the working parts and protect them against tampering, the cover is fastened on by screws *b b* engaging lugs *a a*. The screw heads are embedded in a boss *c*, through which is drilled transversely a hole *d*. By turning the screwdriver nick in the screw so as to coincide with this hole, a seal wire *e* may be passed through and its ends joined by a seal *f*, as shown in Fig. 3, whereby the casing is sealed against any attempt to open it. Or any other means for locking of sealing the casing may be substituted.

The ends of the circuit wires are introduced through holes *g g*, preferably in the sides of the casing, and are fastened in binding posts B B′, as best shown in Figs. 5 and 6. These posts are formed as tubular sockets with set-screws in the usual manner, and are preferably made integral with connection plates C C′ (Fig. 6) which are also formed integrally with the terminal contact plates D D′ of the switch. The connection plates C C′ and their appurtenances are fastened to the inner side of the box, being insulated from its side wall by a plate E of insulating material to which the plates are fastened by screws or rivets *h h*, and which insulating plate is in turn fastened to the wall of the casing by screws *i i* (Fig. 5) passing through holes *i* (Fig. 6). Any other known and suitable means for mounting the terminal contacts D D′ and making electric connection between them and the circuit wires, may be adopted. For a double pole switch these contacts and binding posts, one set of which is shown in Fig. 6, are duplicated on opposite sides of the casing, as shown.

For closing the circuit, the contacts D D′ are bridged or connected by a conducting bridge or brush F, which is carried by a lever G pivoted at *j* to lugs in the casing. The lever G is duplicated for a double-pole switch, and the two levers G G are operated simultaneously and oppositely by means of a suitable electro-magnet H through any suitable mechanical connection. If it is desired that the excitation of the magnet shall close the switch, the parts are best arranged as shown.

The magnet H is designed to afford a short magnetic circuit with the minimum separation at the gap, so as to afford a powerful pull with the minimum expenditure of current in the exciting coil. The magnet core comprises a fixed part I and a movable part or armature J. These project partly within the exciting coil K, preferably so far that when the magnet is excited they form a practically continuous inner core, as shown in Fig. 2. The fixed part I has legs which extend down outside of the coil and terminate in polar ends, partly inturned, and with angular faces, as clearly shown in Figs. 4 and 5. The movable part or armature J has its external portion expanded laterally so as to nearly meet the polar ends of the fixed core, as best shown in Fig. 4. Both the fixed and movable cores are preferably laminated as shown. The magnet is arranged to draw the movable core or armature upward, so that upon the demagnetization the armature, which has considerable weight, falls by gravity. This arrangement of the magnet avoids the ne-

cessity of using a retracting spring, which would be required if the magnet were arranged in any other position.

The movable core or armature of the magnet is connected to the levers G G so as to move the latter simultaneously toward or from the respective pairs of fixed contacts D D′. This connection is made in a simple manner by toggle links L L, which are preferably duplicated at the front and back sides of the armature, as shown, being pivoted loosely thereto on a pin *k*. The thickness of the armature necessitates separating these links somewhat widely, and to provide for this the levers G G are formed with prolonged bosses *l l*.

The arrangement of the toggle links L L is such that the upward attraction of the armature J draws these links from their angular position shown in Fig. 5, to a position nearly in alinement as shown in Fig. 1, thereby forcing the levers G G apart, and consequently forcing the conducting bridges F F against the fixed contacts with a considerable degree of force, whereby a good electric contact is assured. The links L L, however, are not so nearly alined that they will afford any material resistance to the fall of the armature when demagnetized.

It is important that the conducting bridges F F be effectively insulated. This is best accomplished by constructing the levers G in two parts, the upper part G^1 which directly carries the conducting bridge being insulated from the lower part G^2 which is formed with the pivotal and link connections. This insulation is clearly shown in Fig. 7, where the two portions of the lever are fastened together by screws with intervening insulating plates and bushings *m m*.

The exciting coil K is fixed in place in any suitable manner with reference to the fixed core I, the ends of the coil being carried to binding posts *p p*, to which are fastened the ends of the wires *q q* of the circuit which is to control the switch, these wires passing into the casing through insulating bushings *q′*. The core I is shown as formed of laminæ united by screws or rivets to rear plates I′, which are fastened at top to posts *r r* within the casing, and at their bottom ends are bent back and fastened by screws *r′* to the back plate of the casing.

The conducting bridges F F are of peculiar construction. They are made up of leaves or brushes *s s* of resilient sheet metal, preferably copper, fastened at their middles to a yoke, *t*, which latter has ears embracing and pivoted to the upper end of the lever G. The laminæ *s* are bent or bowed and graduated in length so that their ends turn toward the fixed contact plates D D′, so that when the switch is closed they make end or edge contact therewith, as shown in Fig. 3. In the closing movement the laminæ first touch lightly against the contact plates, and then by the straightening out of the toggle links are forced more firmly against them, the bowed laminæ being thereby partly flattened, so that each leaf is pressed individually against the contact plates, and its ends make individual edge contact thereagainst, and during the flattening of the bowed laminæ their ends rub against the surfaces of the contact plates, whereby the respective contact surfaces are kept clean and bright. The laminæ are thin enough to give the requisite flexibility, and yet thick and stiff enough to firmly transmit the pressure to the contact faces, and they are sufficiently numerous to afford the requisite conductivity for carrying any required current. Thus the capacity of the switch may be varied between wide limits by varying the number of the laminæ constituting the conducting bridges F F. For the protection of these laminæ and of the fixed contacts from injury by arcing during the opening movement of the switch, they are backed by the leaf or lamina *u*, preferably of thicker and stiffer sheet metal, and which is given a greater curve, so that in the open position its ends extend beyond the ends of the laminæ *s s*, as shown in Fig. 8. In the closing movement of the switch the ends of this spring or leaf *u* touch the fixed contacts first, and as the conducting bridge is flattened by the circuit-breaking movement the laminæ tened to the greatest extent so that its ends are thrust apart as shown in Fig. 3. In the circuit-breaking movement the laminæ *s* first part contact with the fixed contact plates, so that in the receding movement of the bridge the ends of the leaf *u* alone remain in contact, and continue to remain in contact until the moving parts have acquired a considerable velocity due to the falling of the armature, so that when they finally separate from the fixed contacts, a quicker break is made. Whatever sparking or arcing accompanies the break in the circuit, follows the ends of the leaf *u*, so that the corrosion is confined to these ends, and the laminæ *s* are protected from corrosion and left clean and bright. The corrosion due to arcing is also limited to the extreme outer edges of the fixed contact plates, so that the remainder of their surface which coacts with the laminæ *s*, remains clean and bright. The leaf *u* being of heavier metal, is better adapted to carry the momentary arcs than the thinner laminæ *s*, and to still better adapt it for this purpose, its ends are thickened or increased in mass by the provision of enlargements *u′*. To carry this corrosion away from the normal contacting surfaces, the enlargements *u′* are prolonged upwardly as shown, and the fixed contacts

are provided with corresponding upward projections *v v*. Thus the arcs formed during the opening movement instantly travel to the upward projections *u' v*, and the subsequent corrosion occasioned by the arcs is wholly limited to these upward projections.

The switch casing may be provided with the usual lugs *w* for attaching it to a support, or it may in any other known way be fastened in place.

My invention is susceptible of considerable modification in structural details, and is not to be understood as limited to the precise features of construction set forth. Those features of my improved switch which are believed to be novel, are set forth in the claims. It is to be understood that certain features of my invention may be availed of without necessarily using the remaining features thereof.

As far as concerns the laminated bridge F, my invention is not limited to this part constituting strictly a bridge, since if one side alone be used making contact with only one of the plates D D', my invention will be to that extent utilized.

What I claim is:—

1. An electric switch comprising opposite fixed contacts, oppositely movable contacts, levers pivoted at their lower ends and carrying at their upper ends the respective movable contacts, an electromagnet between said levers comprising a coil, a fixed core exterior thereto serving as a stop to limit the movement of the levers, and a movable member, and toggle links connecting at their outer ends to said levers and at their intermediate joint to said movable member, and adapted upon the excitation of the magnet to approach alinement, and by forcing said levers apart to force the movable contacts against the respective fixed contacts, and on the demagnetization of the magnet and the retraction of said movable member to draw said levers together against the intervening magnet.

2. An electric switch comprising opposite fixed contacts, movable contacts mating therewith, one of each pair of contacts being laminated, an electro-magnet comprising a coil, a fixed core exterior thereto and a movable member entering partly within said coil and extended partly exterior thereto as an armature, and subject to a constant retracting force, and toggle links connecting at their outer ends to said movable contacts and at their middle joint to said movable member, and arranged with said middle joint below the ends in the retracted position of said movable member and in the open position of the switch, and adapted as the movable member is attracted to approach alinement, whereby during the free closing movement of the switch the magnet acts through the toggle with increasing mechanical advantage and during the final portion of the movement when the resistance is increased by the flexure of the laminae, both the mechanical advantage of the toggle and the magnetic attraction of the armature are at their maximum.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:
EDWARD A. BAXUES,
A. A. SERVA.