E. GENGENBACH.

SOLENOID SWITCH.

APPLICATION FILED JUNE 7, 1913. RENEWED MAR. 22, 1916.

1,180,914.

Patented Apr. 25, 1916.

2 SHEETS—SHEET 1.

Fig. 1

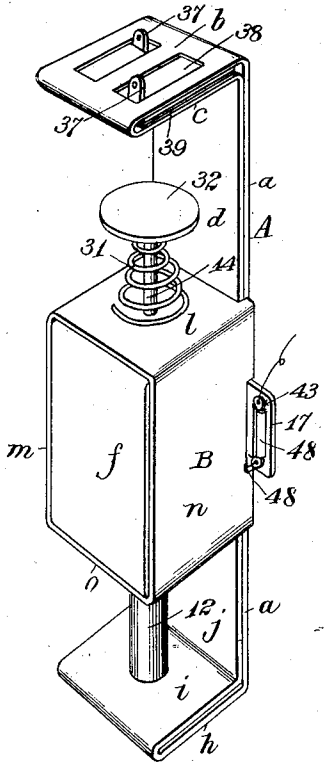


Fig. 2

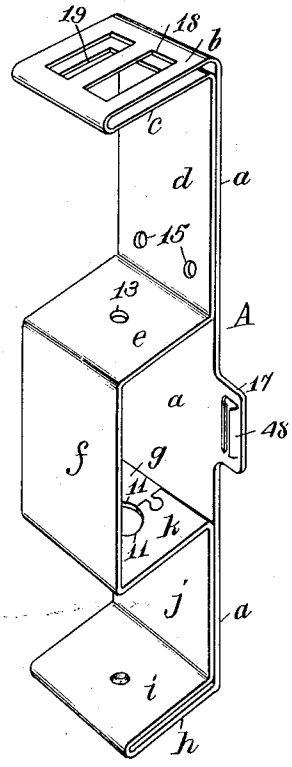


Fig. 5

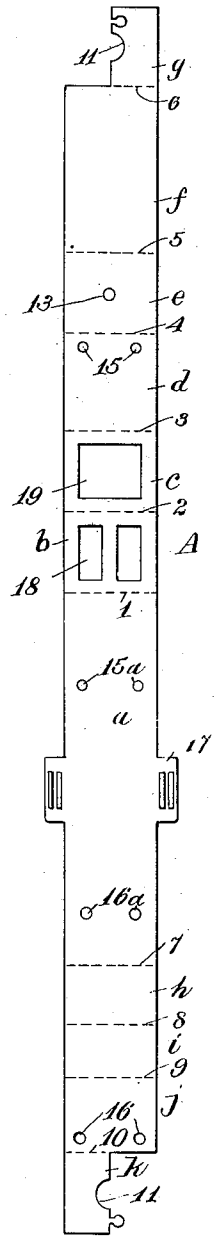


Fig. 4

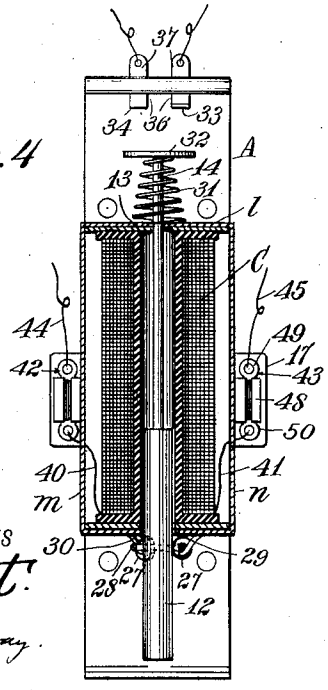
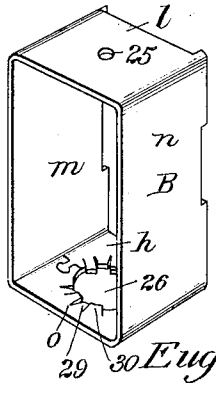


Fig. 3



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 7

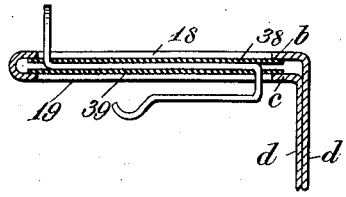


Fig. 6

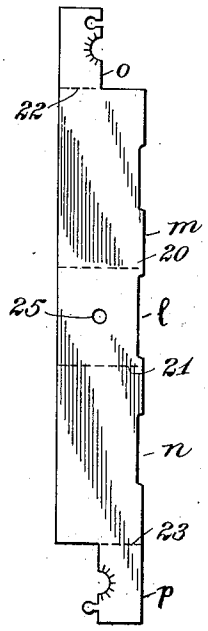


Fig. 8

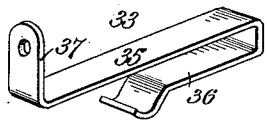


Fig. 9

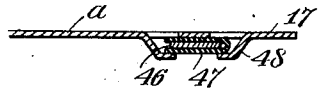
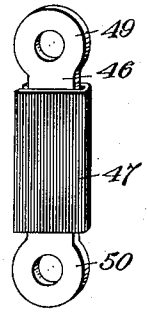


Fig. 10



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UNITED STATES PATENT OFFICE.

EUGENE GENGENBACH, OF NEW YORK, N. Y.

SOLENOID-SWITCH.

1,180,914. Specification of Letters Patent. Patented Apr. 25, 1916.

Application filed June 7, 1913, Serial No. 772,369. Renewed March 22, 1916. Serial No. 85,971.

To all whom it may concern:

Be it known that I, EUGENE GENGENBACH, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Solenoid-Switch, of which the following is a full, clear, and exact description.

This invention relates to an electro-magnetically operated switch, and more particularly to solenoids of the iron-clad type.

The invention has for its general objects to improve and simplify the construction and operation of devices of the character referred to so as to be comparatively simple and inexpensive to manufacture, reliable and efficient in use, composed of comparatively few parts and so designed that the housing in which the solenoid is mounted may be made of sheet metal.

Another object of the invention is the provision of a combined housing and support for the solenoid or magnet, which housing is made up of detachable sections each consisting of sheet metal bent or shaped into the desired form.

Another object of the invention is the provision of a novel arrangement of switch contacts in combination with the solenoid core which carries the movable contact and gravitates to open circuit position when the solenoid is deënergized, the movement of the core being limited by a stop formed on the frame of the solenoid.

With these objects in view, and others as will appear as the description proceeds, the invention comprises various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, and wherein similar reference characters are employed to designate corresponding parts throughout the several views, Figure 1 is a perspective view of a solenoid switch; Fig. 2 is a perspective view of the frame or base section of the device; Fig. 3 is a perspective view of the closing section of the housing for the solenoid; Fig. 4 is a front elevation of the solenoid switch with the solenoid and housing in section; Fig. 5 is a plan view of the blank from which the base section of the housing is formed; Fig. 6 is a similar view of the closing section of the housing; Fig. 7 is a detail sectional view of the upper portion of the device, showing the manner of mounting the fixed contacts of the switch; Fig. 8 is a perspective view of one of the fixed contacts; Fig. 9 is a detail sectional view on the line 9—9 of Fig. 1 of one of the devices for connecting the solenoid in circuit; and Fig. 10 is a perspective view of one of the said connecting devices removed.

Referring to the drawing, A designates the frame or base section of the apparatus and B the casing or closing section that is attached to the frame section A and cooperates with the latter for forming a complete housing for the solenoid or magnet C. The two sections A and B are preferably made from sheet metal, the blanks of which are shown in Figs. 5 and 6, respectively.

The blank shown in Fig. 5 comprises a part *a* which forms a back plate, and connected with one end of this are the parts *b*, *c*, *d*, *e*, *f* and *g*, while connected with the other end are the parts *h*, *i*, *j*, and *k*, the said various parts forming a strip of metal which is bent on transverse lines between the adjacent parts so as to form the structure shown in Fig. 2; that is to say, the part *b* is bent forwardly on the line 1, the part *c* bent downwardly and backwardly on the line 2; the part *d* is bent downwardly on the line 3 to overlie the upper portion of the back plate *a;* the part *e* is bent forwardly on the line 4 at right-angles to the back plate *a* to form the top of the housing that incloses the solenoid; the part *f* is bent downwardly on the line 5 in parallel relation to the back plate *a* to form the front of the solenoid housing, and the part *g* is bent backwardly on the line 6 into right-angular relation to the back plate *a* to form part of the bottom of the solenoid housing. The part *h* of the other end of the back plate is bent forwardly on the line 7 at right-angles to the back plate *a*. The part *i* is bent backwardly on the line 8 to lie flat against the part *h;* the part *j* is bent upwardly on the line 9 to lie flat against the lower portion of the back plate *a*, and the part *k* is bent outwardly on the line 10 to lie in the same plane with the part *g* to form

the bottom of the solenoid housing. With the blank bent in the manner described the structure shown in Fig. 2 results. The parts *g* and *k* have semi-circular recesses 11 which form an opening through which the core 12, Figs. 1 and 4, of the solenoid passes, and in the part *e* is an opening 13 through which the stem 14 of the solenoid extends. In order to attach the frame section A to a support the part *d* has screw-receiving openings 15 which register with corresponding openings 15ª in the upper portion of the back plate *a*, and the part *j* has screw-receiving openings 16 that are adapted to register with corresponding openings 16ª in the lower portion of the back plate *a*. On the back plate *a* are laterally projecting lugs 17 for carrying devices for connecting the solenoid with an external circuit, and the part *b* has openings 18 and the part *c* has an opening 19 for accommodating the fixed contacts of the switch.

It will be observed that the frame section A constructed as described comprises a chamber for receiving the solenoid, such chamber consisting of the back plate *a* and the parts *e*, *f*, *g*, and *k* of the blank. The section A is formed, and the doubled portion of the blank formed by the parts *b* and *c* constitutes an upper shelf that carries the fixed contacts of the switch. While the doubled portion formed by the parts *i* and *j* of the blank constitutes a lower shelf which serves as a stop for limiting the downward movement of the solenoid.

The closing section B of the solenoid housing is made from the blank shown in Fig. 5, which blank comprises a top part *l*, side parts *m* and *n* and parts *o* and *p*, which together form the bottom of the section B. The parts *m* and *n* are bent respectively on the lines 20 and 21 in parallel relation with each other and at right-angles to the part *l*, and the parts *o* and *p* are bent on the lines 22 and 23, respectively, so as to lie opposite each other in the same plane. The rectangular body thus formed is of such size as to fit over the portion of the solenoid housing formed by the section A, so as to close the open sides of the housing. The top *l* of the section B has an opening 25 through which the stem 14 of the solenoid core passes, and the bottom of the section B has an opening 26 formed by recesses in the adjacent edges of the parts *o* and *p*, said opening 26 serving to permit the solenoid core 12 to pass therethrough. No special fastenings are required to hold the section B in place, as the core 12 and its stem 14 answer as retaining means. The core 12 and stem 14 are assembled in the magnet housing before the upper and lower portions of the frame sections are bent laterally into their final form.

To guide the movement of the core the section B carries a plurality of rollers 27 that are mounted on a ring 28, which ring encircles the core 12 and is supported by lugs 29 stamped out from the bottom of the section B, the ring 28 resting on the lugs as shown in Fig. 4. Additional lugs 30 are stamped out from the bottom of the section B to engage over the ring 28 so as to hold the same in place.

The solenoid C is of any suitable construction and being arranged within the sections A and B is entirely clad by magnetic material so as to increase its attractive powers by minimizing stray lines of force. It is so wound or connected in circuit that when energized it produces an upward pull on the core 12, and when deënergized the core drops, there being a spring 31 interposed between the top of the solenoid housing and the bridging contact 32 on the upper end of the core stem 14, whereby the spring cushions the downward movement or drop of the core. When the core rests on the lower support or shelf the spring is under a tension which enables the core to be lifted by a weaker magnetic pull than would otherwise be necessary.

The switch feature of the apparatus comprises a bridging contact 32 soldered or otherwise fastened on the upper end of the stem 14 and fixed contacts 33 and 34, each of which fixed contacts is constructed as shown in Fig. 8, and comprises a strip of metal formed into a body portion 35 having at one end a spring contact portion 36 and at its opposite end a terminal lug 37. The contacts are mounted between the upper and lower sheets 38 and 39 of insulation, which sheets together with the contacts are clamped between the parts *b* and *c* of the frame or base section A, the lugs 37 of the fixed contacts extending upwardly through the openings 18 and the spring contact arms or members 36 extending downwardly through the opening 19. In this manner the contact members 36 are disposed under the shelf at the top of the section A and can be engaged by the bridging contact 32 carried by the solenoid, so as to close a light, heat or power circuit.

The terminals 40 and 41 of the solenoid winding are connected with devices 42 and 43, respectively, which are in turn connected with wires 44 and 45 of a controlling circuit. The devices 42 and 43, which are constructed as shown in Fig. 10, consist of a strip 46 of copper or other suitable metal and set in a doubled piece of insulation 47 as shown in Fig. 10, and the parts are then positioned against the lug 17 and held in place on the latter by bent-out ears 48. The ends 49 and 50 of the metal piece 46 form terminals which project beyond the insula-

tion 47 and serve to connect the solenoid and circuit wires thereto.

From the foregoing description taken in connection with the accompanying drawings, the advantages of the method of operation and of the apparatus shown will be readily understood by those skilled in the art to which the invention appertains, and while I have described the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A device of the class described comprising a solenoid, a core and a magnetic housing inclosing the solenoid, said housing consisting of two rectangular sections each open at opposite sides held together by said core, and the sections being so arranged that the closed sides of one section close the open sides of the other section, both sections being made of a single strip of sheet metal having recessed ends coöperating to form an opening through which the core is slidable.

2. A device of the class described comprising a magnetic spool and a magnetic housing therefor, said housing consisting of a frame section formed into a back plate and a chamber having opposite sides open, and a rectangular closing section fitted on the frame section to close the open sides of the chamber thereof, said chamber and closing section having registering openings and the said movable element extending through the openings for holding the closing sections in place.

3. A device of the class described comprising a frame section consisting of a strip of metal doubled at both ends on itself and having its doubled portions bent forwardly to form shelves and having one of the doubled extremities shaped to coöperate with the middle portion in forming a chamber, the bottom of the chamber having an opening, a solenoid in the chamber, a solenoid core normally resting on the lower shelf and slidable through the opening in the bottom of the chamber, switch contacts on the upper shelf, and a circuit closing contact carried by the core to engage the switch contacts.

4. A device of the class described comprising a frame made of a single strip of metal having each extremity doubled on itself and a portion of each doubled extremity bent forwardly to form upper and lower shelves, the portions of the strip between the shelves being shaped to form a chamber open at two sides, a solenoid in the said chamber, a rectangular closing section fitted over the chambered portion of the frame to close the open sides of the chamber in the latter, a core slidable into the chamber and normally resting on the lower shelf, a bridging contact carried by the upper end of the core, and fixed contacts carried by the upper shelf and adapted to be engaged by the bridging contact.

5. A device of the class described comprising a frame section consisting of a single strip of metal having its extremities doubled back on itself, one doubled extremity being longer than the other, the longer doubled extremity being bent to form with the intermediate portion of the strip a chamber open at two sides, a closing section consisting of a strip of metal bent into rectangular form and assembled on the frame section to close the open sides of the said chamber, and a magnetic coil in the said chamber.

6. A device of the class described comprising a frame section consisting of a single strip of metal having its extremities doubled back on itself, one doubled extremity being longer than the other, the longer doubled extremity being bent to form with the intermediate portion of the strip a chamber open at two sides, a closing section consisting of a strip of metal bent into rectangular form and assembled on the frame section to close the open sides of the said chamber, a magnetic coil in the said chamber, lugs formed in the side edges of the strip, and devices insulated from the lugs and forming means for connecting the terminals of the coil to a circuit.

7. An iron-clad solenoid comprising a frame section having a chamber provided with open sides, a closing section for closing the open sides of the chamber, a coil in the chamber, and a core movable in the coil and forming means for holding the closing section on the frame section.

8. An iron-clad solenoid comprising a frame section formed with a chamber partly open, a closing section for closing the said chamber, a solenoid in the chamber, said chamber and closing section having registering openings, and a core passing through the said opening and serving to hold the sections together.

9. A device of the class described comprising a frame section having a chamber with open sides, a closing section mounted on the frame section to close the sides of the chamber thereof, a solenoid in the said chamber, said sections having registering openings, a core extending into the solenoid and passing through the openings, additional registering openings in said section, and a stem on the core passing through the last mentioned openings, said core and stem forming means for holding the closing section on the frame section.

10. A device of the class described comprising a frame having a doubled portion, plates of insulation within the doubled portion, contacts between said plates, and a solenoid-actuated contact mounted on the frame to engage the first mentioned contacts.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EUGENE GENGENBACH.

Witnesses:

CHARLOTTE BRADWAY,

GEORGE H. EMSLIE.