Oct. 7, 1958 H. E. COBB ET AL 2,855,482

MAGNETIC SWITCH

Filed April 16, 1956 2 Sheets-Sheet 1

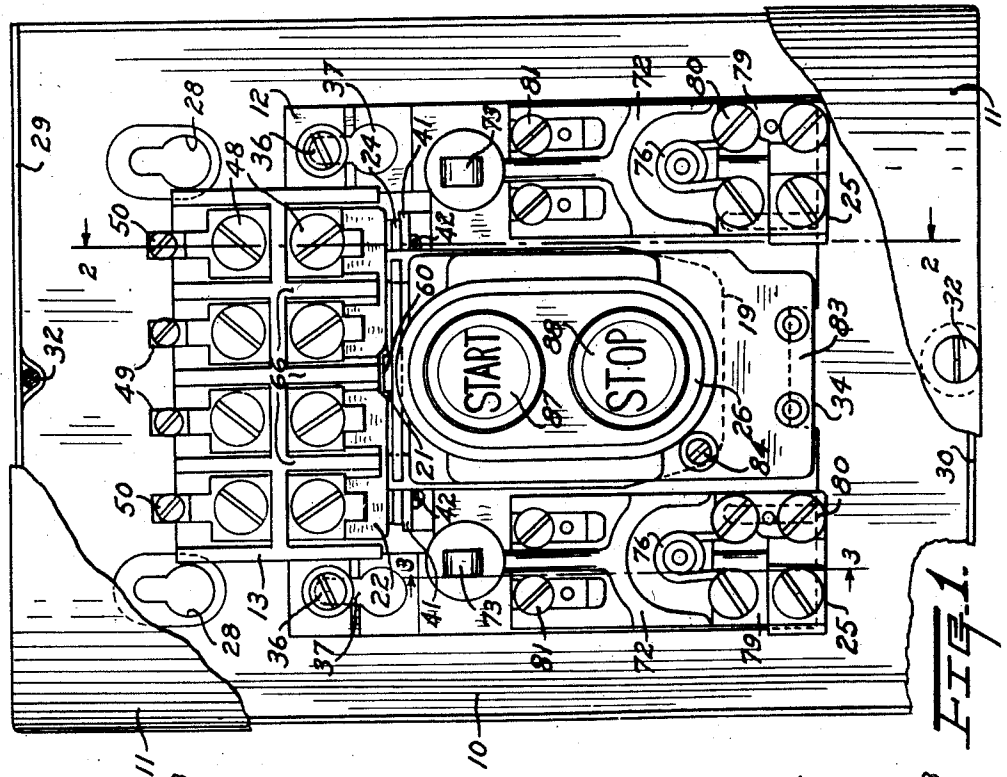


FIG. 1.

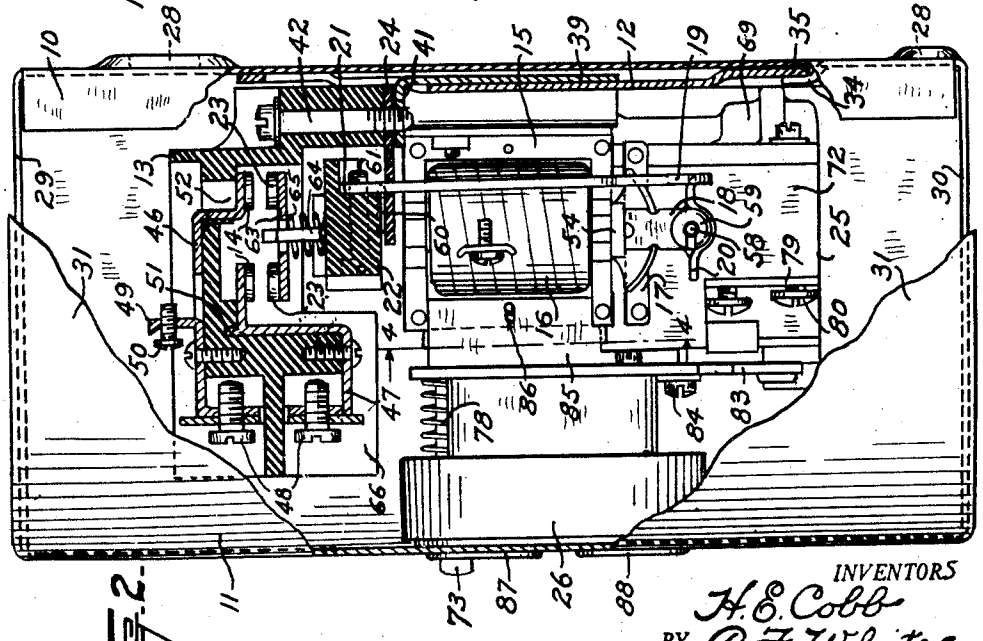


FIG. 2.

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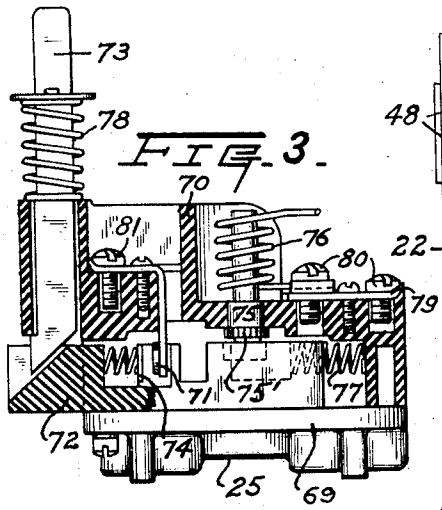


FIG. 3.

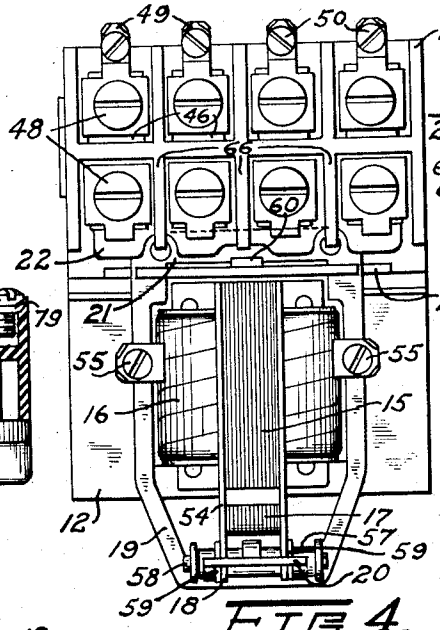


FIG. 4.

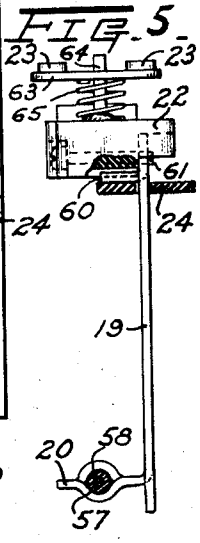


FIG. 5.

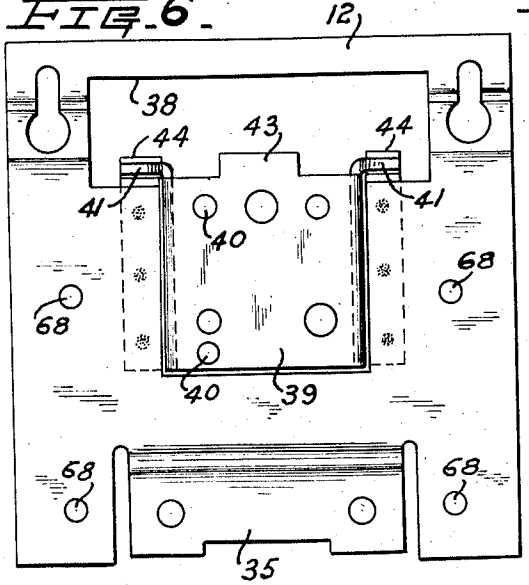


FIG. 6.

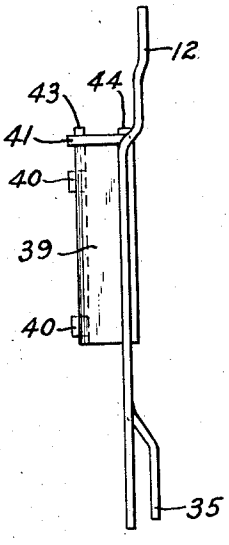


FIG. 7.

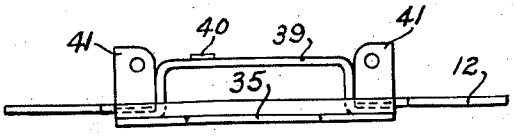


FIG. 8.

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MAGNETIC SWITCH

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Application April 16, 1956, Serial No. 578,288

7 Claims. (Cl. 200—104)

The present invention relates generally to improvements in magnetic switch assemblages, and it relates more particularly to improvements in the construction and operation of electro-magnetically actuated switches adapted to function in upright position.

The principal object of our invention is to provide various improvements in the construction of magnetically actuated switches whereby the efficiency and utility thereof is materially enhanced while the cost of construction is reduced to a minimum.

Some of the more important specific objects of the present invention are as follows:

To provide a sturdy magnetic switch which is simple but durable in construction and which is also exceptionally quiet and reliable in operation.

To provide an improved electro-magnetically actuated switch assemblage of the type wherein the circuits are closed by magneto-motive force and are opened by gravity acting upon a vertically reciprocable magnetic armature.

To provide an improved mounting and enclosure for a magnetic switch mechanism which is flexible in its cooperation with various types of electric control systems, and wherein all parts are normally well concealed and protected but are also conveniently accessible for inspection and wiring installation.

To provide an improved magnetic switch and thermal overload unit wherein the various parts are amply protected against damage due to excessive current but may be quickly reset to function normally when the dangerous condition has been eliminated.

To provide an improved coil and magnet assembly for a magnetic switch, which may be produced at moderate cost by utilizing relatively few standard parts effectively cooperating with simplified motion transfer elements for the movable contacts.

To provide improvements in the magnet and control switch supports of a magnetic switch, and in the mechanism for transferring the movement of the magnet armature to the switch contacts so as to eliminate noise and vibration.

To provide an improved stationary contact and terminal support for a poly-phase magnetic switch, and means for effectively insulating the various parts of such an assemblage.

To provide an improved magnetic switch and housing assemblage many elements of which may be readily constructed of sheet metal with the aid of punches and dies, and durably united with self locking fasteners to produce a sturdy final unit.

These and other more specific objects and advantages of our invention will be apparent from the following detailed description.

A clear conception of the various features constituting the present improvements, and of the construction and operation of a commercial magnetic switch embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification

wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a front elevation of a magnetic switch assemblage having a push-button control switch applied thereto but with the major portion of the casing cover broken away in order to reveal normally enclosed parts;

Fig. 2 is a vertical section through the magnetic switch unit of Fig. 1, taken along the line 2—2;

Fig. 3 is a central longitudinal section through one of the improved thermal overload devices associated with the switch assemblage of Figs. 1 and 2, the section having been taken along the line 3—3 of Fig. 1;

Fig. 4 is a front elevation of the magnet and contact portion of the same switch assemblage, but with the push button control switch omitted;

Fig. 5 is a fragmentary side view of a pair of the movable contacts and of the pusher and guide elements therefor;

Fig. 6 is an enlarged plan view of the upright magnet and arc box support;

Fig. 7 is a side view of the support shown in Fig. 6; and

Fig. 8 is an end view of the same support.

While the invention has been shown and described herein as having been embodied in a commercial magnetic switch having four cooperating sets of fixed and movable contact, two thermal overload devices, and a push button control switch all incorporated in the same switch assemblage, it is not intended to restrict the use of the improved features to such a unit; and it is also contemplated that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

Referring to the drawings, the electro-magnetically actuated switch disclosed therein comprises in general, a casing consisting of a rear mounting section **10** and a front closure section **11**; an upright main support **12** detachably suspended in the casing section **10**; an arc box or fixed contact housing board **13** secured to the upper end of the support **12** and having therein four sets of stationary contacts **14**; a magnetic field piece **15** secured to a lower portion of the support **12** and embracing an energizing coil **16**; a magnetic armature **17** reciprocable vertically within the magnet coil **16**, and having a lower end projection **18**; a pusher **19** surrounding the field piece **15** and having an end flange **20** pivotally attached to the armature projection **18**, while its upper end **21** spans the top of the field piece **15** and is connected to a transverse cross-bar **22** which carries four sets of movable contacts **23** adapted to cooperate with the stationary contacts **14**; a fixed guide plate **24** for the pusher **19** clamped between the support **12** and the arc box **13**; a thermal overload device **25** fastened to the support **12** on each side of the magnet assemblage; and a pushbutton control switch **26** secured to the front face of the field piece **15**, see Figs. 1 and 2.

The sections **10**, **11** of the main switch housing casing may be formed of sheet metal, and the mounting section **10** has a flat base provided with the usual suspension openings **28** and has upper and lower forwardly extending flanges **29**, **30**, while the closure section **11** has a flat front merging along curved portions into rearwardly extending opposite side flanges **31**. The two sections **10**, **11** may be firmly but detachably interconnected by screws **32**, and when these casing sections are separated they leave the opposite sides of the normally concealed switch assemblage unobstructed for free attachment of the conductor terminals, but when united the cooperating sections **10**, **11** thoroughly conceal and protect the mechanism.

The main magnet and arc box support **12** may also be formed of sheet metal, and is detachably attachable to the flat base of the casing section **10** by means of a tongue **34** formed integral with this section **10** and which

hooks over the lower medial edge portion 35 of the support 12, and also by screws 36 secured to the casing base and which coact with upper side openings 37 formed in the support, see Figs. 1, 2, 6, 7 and 8. The central portion of the support 12 is provided with a T-shaped opening 38 within which an auxiliary sheet metal supporting pad 39 is rigidly secured as by welding, and this pad 39 has several outwardly projecting integral lugs 40 for properly positioning the field piece 15, and is also provided with upper side flanges 41 to which the arc box 13 and the guide plate 24 are firmly attached by clamping screws 42, as shown in Fig. 2. The upper end of the pad 39 is moreover provided with a central projection 43 and with two side projections 44 as shown in Figs. 6, 7 and 8, which serve to accurately position the arc box 13 relative to the magnet assemblage.

The arc box or fixed contact housing 13 is formed of moulded insulation, and may be provided with either four or a lesser number of sets of fixed contacts 14 depending upon the purpose for which the switch assemblage is to be used. The contacts 14 are secured to upper and lower metal terminals 46, 47 respectively, each having a conductor attaching screw 48 applied thereto at the front of the box 13, and each of the upper terminals 46 may be provided with an integral upwardly projection 49 having an auxiliary conductor attaching screw 50 associated therewith, see Figs. 1 and 2. The lower terminal 47 may also be provided with an integral lug 51 adapted to be embedded in the arc box 13 as in Fig. 2 in order to firmly hold the adjacent contacts 14 in position, and the other contacts 14 are so held by passing the upper terminals 46 through slots 52 in the box.

The magnet unit comprising the field piece 15, coil 16, armature 17, guides 54, and conductor attaching screws 55, is of relatively standard commercial construction, and the field piece 15 and armature 17 are both formed of metal laminations, the armature 17 being elevated by energization of the coil 16 and descending by gravity when the coil is de-energized to thus close and open the electric circuit through the switch. However, the means for transmitting the reciprocation of the armature 17 to the movable contacts 15 in a quiet and positive manner, is an important feature of the present improvement, and this mechanism comprises the O-shaped sheet metal pusher 19 which loosely surrounds the field piece 15 and the coil 16 and has its lower end provided with the flange 20 pivotally attached to the lower armature end projection 18 while its upper horizontal end 21 bridges the top of the field piece 16.

The pusher 19 is formed as illustrated in Figs. 4 and 5, and the lower pusher flange 20 provides a loop within which an insulating bushing 57 embracing a pivot pin 58, is confined. The pivot pin coacts with the armature guides 54 and is held in place by insulating washers 59, so that the pusher 19 is thoroughly insulated from the armature 15. The pusher 19 moreover does not contact any portion of the field piece 15 but has its upper portion guided by the plate 24 which is formed of insulation and spans the interior of the pusher 19 above the field piece 15 and beneath the upper bridge portion 21, thus also thoroughly insulating the pusher 19 from the field piece 15 and coil 16. The center part of the pusher portion 21 is provided with an outwardly projecting integral lip 60 which is engageable with the guide plate 24 to limit the opening movement of the movable contacts 23, and the contact carrier bar 22 is secured to the pusher 19 by screws 61.

The guide plate 24 has opposite side grooves within which the opposite sides of the pusher 19 are rather snugly but freely slidably confined, and this plate 24 cooperates with the armature guides 54 to confine the armature 17, the pusher 19 and the contact carrier bar 24 to rectilinear motion. The bar 24 is formed of insulation and the movable contacts 23 are mounted upon cross-conductors 63 which are slidable along guide posts 64 and are constantly urged against lateral stops at the upper ends of these posts by helical compression springs 65 in a well known manner. Each set of cooperating fixed and movable contacts 14, 15 is housed within a cavity in the arc box 13 which is segregated from adjacent cavities by integral division walls 66 so as to positively prevent objectionable arcing.

The improved thermal overload devices 25 may be mounted upon the main support 12 on the opposite sides of the magnet assembly by means of screws coacting with openings 68 in the support and with the base plates 69 of the overload units, and these thermal overload devices are specially constructed to cooperate with the present improved upright magnetic switches. As shown in Fig. 3, each of the overload devices comprises a body 70 secured to the base 66 and having laterally spaced fixed contacts 71 mounted therein; a reset plunger 72 slidable within the body 70 by an actuator 73, and carrying movable contacts 74 cooperable with the adjacent fixed contacts 71; a solder pot 75 mounted centrally within the body 70 and cooperating with a ratchet 75' and with a heating element 76; and a spring 77 normally urging the plunger 72 toward the actuator 73.

The actuators 73 are disposed horizontally and are normally urged outwardly so as to protrude from the casing cover 11 as in Fig. 2, by springs 78, and they are slidable within the adjacent bodies 70 at right angles to the direction of sliding of the adjacent plungers 72. The adjacent ends of each actator 73 and plunger 72 are disposed at like angles relative to each other so that by depressing an actuator 73 it will move the adjacent plunger 72 inwardly against the spring 77 to actuate the corresponding ratchet 75' and reset the device 25. The opposite ends of each heating element 76 are connected to terminal plates 79 adapted to be applied to the electrical system by conductor attaching screws 80, and the fixed and movable contacts 71, 74 may be likewise applied by screws 81.

The starting and stopping switch 26 which is shown as being of the pushbutton type, may be of any other suitable type adapted to manually make and break the main electric circuit. This switch 26 is mounted upon a plate 83 secured by one or more screws 84 to a sheet metal bracket 85 which may be attached to the field piece 15 of the magnet by a cotter pin 86 or the like. The push buttons 87, 88 of the switch 26 are exposed for manual operation through another opening in the casing cover 11, but the switch 26 must be well insulated from the magnet assembly in order to avoid short circuiting of the electrical system. The improved magnetic switch assemblage may be installed in numerous types of electrical systems for diverse purposes well known to the users of such equipment, and the various attaching screws are preferably formed or provided with lock washers or the like so that they cannot become detached during normal operation.

When the improved magnetic switch and thermal overload unit has been properly constructed, assembled and installed in an electrical control system for a motor or the like, the system may be manually placed in operation by merely depressing the starting button 87 of the switch 26. The magnet coil 16 will then be energized to cause the field piece 15 to lift the armature 17, thereby elevating the pusher 19 and the cross bar 22 and engaging the movable contacts 23 with the fixed contacts 14 and closing the main circuit. This circuit will thereafter remain closed either until the stop button 88 is manually depressed, or in case of an overload. In either case the magnet coil 16 will then be de-energized and the armature 17 will promptly drop by gravity to lower the pusher 19 and the cross bar 22 and to thus move the contacts 23 out of engagement with the fixed contacts 14.

If the main circuit has been thus interrupted by an overload condition, the contacts 71, 74 of the overload devices 25 will have been separated by the springs 77 sliding the plungers 72 upwardly against the inclined inner

ends of the actuators 73; and after the solder pots 75 have cooled due to cooling off of the heating elements 76 which functioned to interrupt the circuit, the devices 25 must be reset. This may readily be done by depressing the actuators 73 to push the plungers 72 inwardly against the springs 77 sufficiently to cause the movable contacts 74 to again engage the fixed contacts 71, whereupon the ratchet 75' will function to retain the overload devices 25 in active condition until subsequent overloading of the main circuit occurs.

From the foregoing detailed description of the construction and operation of the typical magnetic switch it will be apparent that the present invention in fact provides a simple, compact and durable upright switch assemblage which is extremely reliable and positive in operation. All parts of the improved switch are well insulated and amply protected against short circuiting and dangerous arcing, and all of the conductor attaching portions of the assemblage as well as the more delicate mechanisms are conveniently accessible whenever desired by merely separating the housing sections 10, 11 with the aid of a screw driver. While the cover section 11 is thus readily removable for inspection and installation purposes, the mounting section 10 may also be conveniently removably attached to a support with the aid of screws applied to the openings 28.

The improved pusher 19 for transmitting movement of the armature 17 to the cross-bar 22 and movable contacts 23, not only insures positive and rapid actuation of the switch, but also does so quietly and with minimum shock. The forwardly projecting lug 60 on the upper transverse portion of the pusher positively arrests the opening movement of the contacts 23 and armature 17, and the guide plate 24 effectively cooperates with the guides 54 to most accurately produce true rectilinear movement of the armature 17 and of the movable contacts 23. The main support 12 with its mounting bracket 39 for the magnet, as well as the pusher 19 and casing sections 10, 11 may be readily fabricated from sheet metal with the aid of punches and dies, and the stop lugs 43 on the support 12 provide three point mounting pads for properly positioning the arc housing 13.

The improved thermal overload devices 25 are also especially adapted for use in conjunction with the improved upright magnetic switch, since these devices may be nested closely adjacent to the magnet and mounted upon the magnet support 12 with their actuators 73 horizontally disposed and protruding through the casing cover 11 for convenient manipulation. The actuators 73 are adapted to quickly and effectively reset the devices 25, and the entire switch assembly has proven highly satisfactory and successful in actual use and can be produced for various uses at very moderate cost.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation of the magnetic switch assemblage herein specifically shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

We claim:

1. In a magnetic switch, a support, a stationary contact secured to one end portion of said support, a magnetic field piece mounted upon the opposite end portion of said support, an energizing coil confined within said field piece, a magnetic armature cooperable with said field piece and having guides reciprocable within said coil, a unitary pusher surrounding but spaced from said field piece and said coil and having one end provided with an integral lateral flange pivotally secured to but insulated from said armature while its opposite end spans the field piece, a movable contact carried by said spanning pusher end and being cooperable with said stationary contact to make and break an electric circuit, and a guide plate coacting with said pusher beyond said field piece and closely adjacent to said contacts.

2. In a magnetic switch, a support, a stationary contact secured to one end portion of said support, a magnetic field piece mounted upon the opposite end portion of said support, an energizing coil confined within said field piece, a magnetic armature reciprocable toward and away from said contact and said field piece, a unitary annular pusher surrounding said field piece and said coil and having one end pivotally secured to the projecting end of said armature while its opposite end spans the field piece, a movable contact carried by said spanning pusher end and being cooperable with said stationary contact to make and break an electric circuit, and a guide plate for said pusher interposed between said field piece and said contacts closely adjacent to the latter, said spanning pusher end having thereon an integral laterally projecting stop cooperable with said guide plate to limit the contact opening movement of said armature.

3. In a magnetic switch, an upright support, a stationary contact secured to an upper portion of said support, a magnetic field piece mounted upon a lower portion of said support, an energizing coil confined within said field piece, a magnetic armature vertically reciprocable relative to the bottom of said field piece, a unitary annular pusher loosely surrounding said field piece and said coil and having its lower end secured to the corresponding end of said armature while its upper end spans the top of the field piece, a movable contact carried by said upper pusher end and being cooperable with said stationary contact to make and break an electric circuit, and an insulating pusher guide interposed between said field piece and said upper pusher end closely adjacent to said contacts, said upper pusher end having thereon an integral laterally projecting stop cooperable with said guide to arrest the downward travel of said movable contact.

4. In a magnetic switch, a support, a stationary contact carried by said support, a magnetic field piece mounted upon said support and having therein an energizing coil, a magnetic armature reciprocable relative to said field piece, a continuous sheet metal pusher surrounding but spaced from the opposite sides of said field piece and said coil and having one end pivotally secured to but insulated from said armature while its opposite end spans the field piece, and a movable contact carried by said spanning pusher end and being cooperable with said stationary contact to make and break an electric circuit.

5. In a magnetic switch, a support, a stationary contact carried by said support, a magnetic field piece mounted upon said support and having therein an energizing coil, a magnetic armature reciprocable relative to said field piece, a unitary resilient pusher surrounding but spaced from the opposite sides of said field piece and said coil and having one end pivotally secured to said armature while its opposite end spans the field piece, a movable contact carried by said opposite pusher end and being cooperable with said stationary contact to make and break an electric circuit, and a guide plate for said pusher interposed between said field piece and said contacts closely adjacent to the latter, said opposite pusher end having thereon a laterally projecting integral stop cooperable with said plate.

6. In a magnetic switch, an upright support, a stationary contact carried by said support, a magnetic field piece mounted upon said support and having therein an energizing coil, a magnetic armature vertically reciprocable beneath and relative to said coil, a unitary sheet metal pusher having flat upper and lower ends and opposite sides lying in a common plane and loosely surrounding said field piece and also having its lower end provided with an integral lateral flange secured to but insulated from the corresponding end of said armature while its upper end extends horizontally across the top of the field piece and is provided with an integral lateral stop, a movable contact carried by said upper pusher end and being cooperable with said stationary contact to make and break an electric circuit, and an insulating pusher guide

interposed between said field piece and said horizontal pusher end closely adjacent to said stop.

7. In a magnetic switch, an upright support, a stationary contact carried by an upper portion of said support, a magnetic field piece mounted upon a lower portion of said support and having therein an upright guideway, a magnetic armature having parallel central guides vertically reciprocable within said guideway, a unitary sheet metal pusher having flat upper and lower ends and opposite sides lying in a common plane and loosely surrounding said field piece and said coil and having its lower end provided with an integral lateral projection flange swingably attached to the corresponding end of said armature while its upper end spans the top of the field piece and is provided with an integral stop, a movable contact carried by said upper pusher end and being cooperable with said stationary contact to make and break

an electric circuit, and an insulating pusher guide secured to the upper end of said support and cooperating with said pusher sides closely adjacent to said contacts to confine said pusher to rectilinear movement.

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