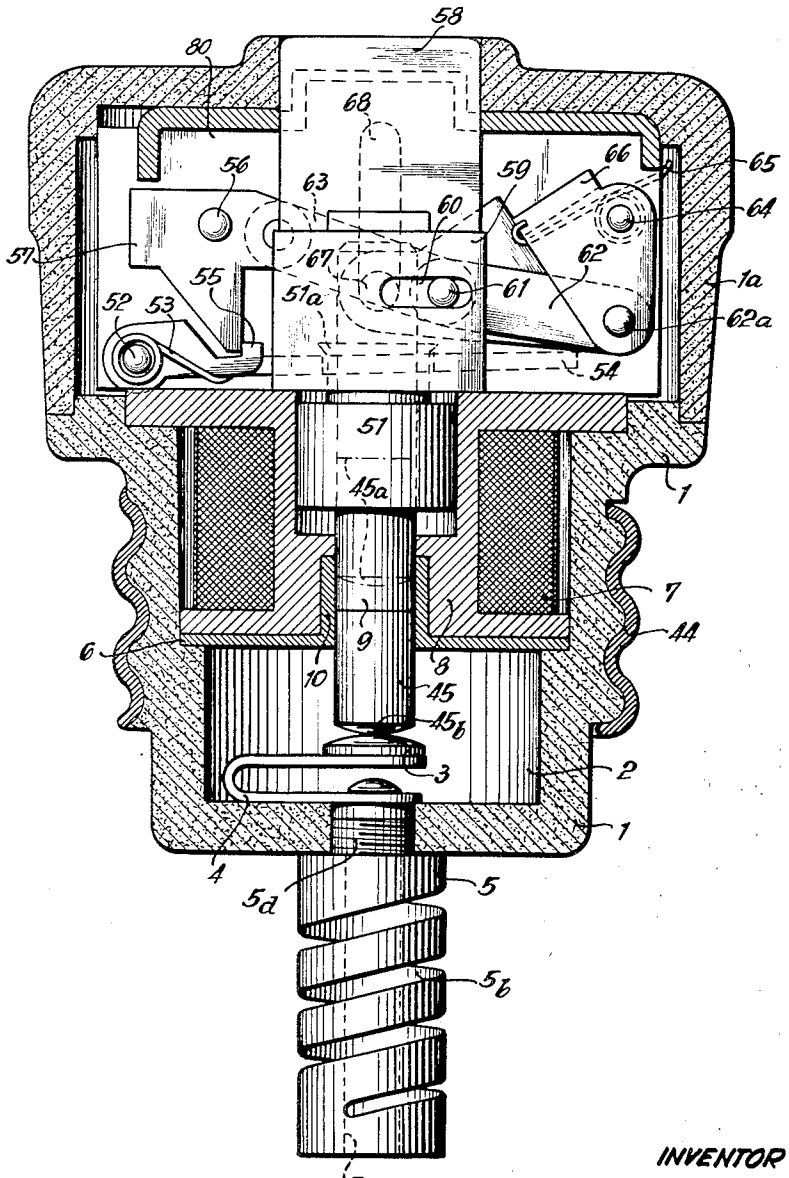
Dec. 18, 1956 W. LEYHAUSEN 2,774,840

AUTOMATIC SWITCHES

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3 Sheets-Sheet 1

FIG. 1



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FIG. 2

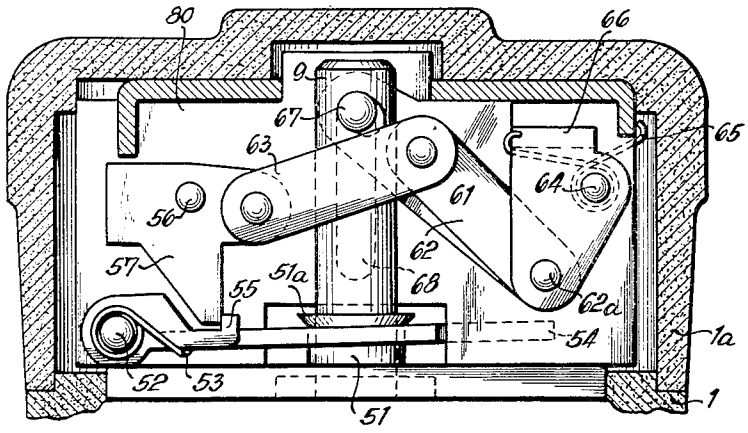
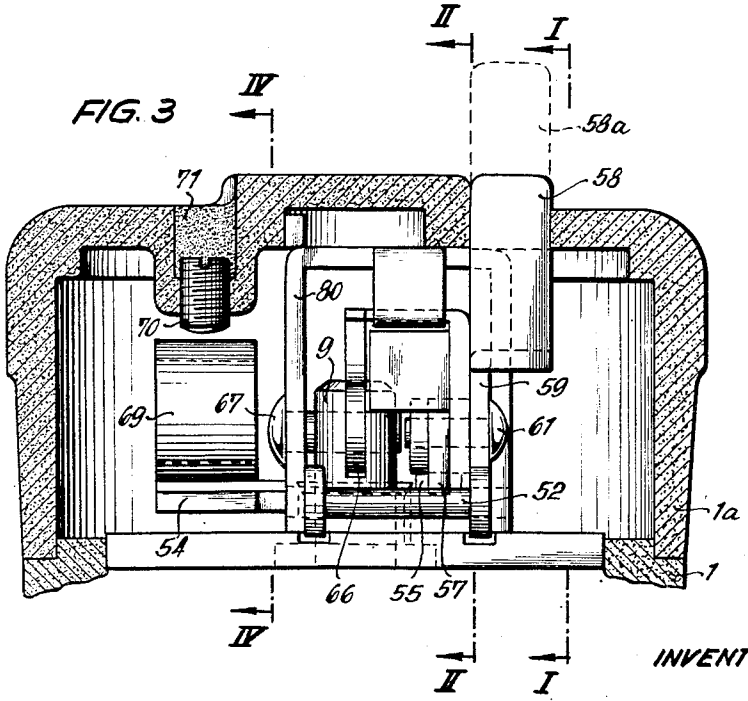


FIG. 3



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FIG. 4

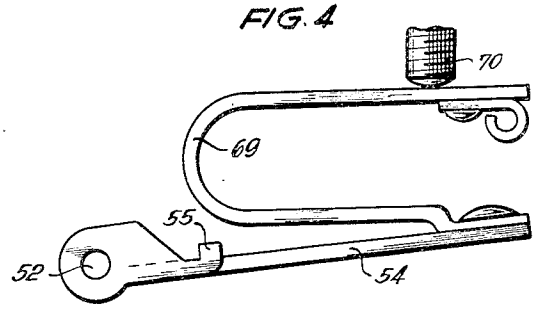


FIG. 5

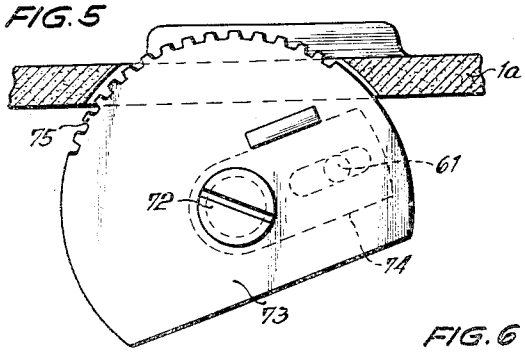


FIG. 6

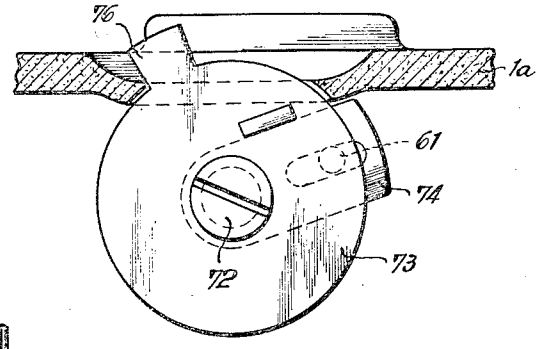


FIG. 7

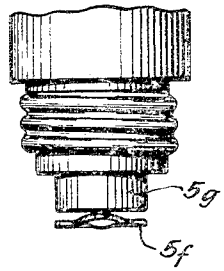
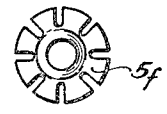


FIG. 8



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United States Patent Office

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AUTOMATIC SWITCHES

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Application April 6, 1953, Serial No. 347,090

Claims priority, application Germany September 1, 1952

3 Claims. (Cl. 200—87)

This invention relates to electric switches of the type in which the switch operating mechanism is manually operable to close and open the circuit and is automatically operable to open the circuit upon the occurrence of overload conditions.

The dimensions of such switches have to be kept as small as possible, more especially if they are to be employed as a substitute for wire fuse plug cartridges which are screwed into sockets provided in fuse boards or panels, where the fuse holder sockets, more particularly when a large number of fuses are provided on one panel, are so close together that there is only sufficient clearance between the adjacent cartridges to enable them to be inserted into and removed from the sockets on the panel. In order to enable automatic electric switches for use instead of fuse cartridges to be made as compact as possible, it has been proposed to locate the switch contacts in a contact chamber provided in the bottom of the switch casing and to arrange an overload release magnet coil above the said contact chamber in such a manner that it is traversed axially by a contact rod forming the movable contact of the switch and operated by switch operating mechanism arranged above the magnet coil, the said contact rod being depressed into circuit closing position when the switch operating mechanism is actuated by hand to close the circuit and being retained in the depressed position by a locking member against the action of a spring which raises the contact rod when the locking member is actuated to release it as the result of an overload. Such an arrangement has been employed in the case of a switch of the screw plug type in which the movable contact member bears directly on a contact in the base of the switch casing and the contact chamber and magnet coil lie in the lower part of the plug casing which is surrounded by the screwed ring of the fuse holder.

The invention relates to an electric automatic switch of the type referred to and which is of small dimensions, but is not limited to such switches in the form of a plug.

The invention consists in such an arrangement and such dimensions of spark chamber, magnet coil and switch rod that when the switch rod is in the circuit breaking position, its contact point is located within the magnet coil. The air gap between the fixed and the movable contact thus lies partly within the core of the coil. Thereby, not only is the height of the switch reduced, but also the capacity of the switch in the case of a short-circuit is substantially increased by the increased electric blow-out action of the coil. Moreover, the burning of the movable contact is thereby reduced.

These advantages have been ascertained by means of tests which have been carried out. A further object of the invention is to so construct the other parts of the switch that they can be accommodated within the small constructional height of the switch, which height mainly comprises only the length of the switch rod plus the extent of its displacement. Thus, the switches according to the invention can be made smaller than those hitherto known without loss in their capacity.

The invention also relates to further features which facilitate and reduce the price of manufacture of switches according to the invention.

The accompanying drawings illustrate by way of example a construction according to the invention together with several details.

Figure 1 shows an automatic switch of the screw plug type in the switched-on position partly in section about the line I—I of Figure 3;

Figure 2 shows the switch gear of the same switch in the switched-off position partly in section about the line II—II of Figure 3;

Figure 3 is a left-hand side view of the switch gear according to Figure 1;

Figure 4 shows the armature and bi-metal of the switch along the line IV—IV of Figure 3;

Figures 5 and 6 each show a modified construction for the switching-on by hand of the switch according to Figures 1 to 3;

Figure 7 is a modified construction of the foot contacts according to Figure 1; and

Figure 8 is a view of the said foot contact as seen from below.

In the form of construction according to Figures 1 to 4 there is provided in the lower part **1** of the switch casing a contact chamber **2** and the stationary contact **3**, which is connected by means of the spring **4** with the external contact pin **5**. Over the contact chamber, separated therefrom by a partition member **6**, lies the magnet coil **7** with the fixed iron core **8** and a movable iron core **51** having a tubular extension **51***a*, which extends freely through a latch member **54**, mounted at **52** and subjected to the force of a spring **53**. The partition member **6** is provided with a bearing sleeve **10** which extends into the iron core **8**, while surrounding the switch contact rod **9**. The latch member **54** is provided with a projection **55** which holds in the locking position a triangular locking member **57** pivotally mounted at **56**. The switch rod **9** is longitudinally displaceable through the movable core **51** and its extension **51***a* and co-operates with a switch slide consisting of an insulating part **58** and a metal part **59** which when pressed down, it depresses into the locking position beyond the dead centre, the pivot pin **61** which connects together the arms **62, 63** of a toggle, the said pivot pin being slidable in the slot **60** provided in the metal part **59**, whereby the switch lever **66** mounted at **64**, and under the pressure of a spring **65**, is rocked downwardly and its arm moves the switch rod **9** downwards onto the fixed contact **3**. The device is now in the switched-on position.

In the case of a short-circuit, the movable core **51** is drawn towards the middle of the coil **7**, that is to say, slightly downwards, whereby the outwardly flanged upper end of the member **51***a* presses the latch member **54** downwards, so that its projection **55** is disengaged from the locking member **57** so that, under the action of the spring **65**, the locking member **57** turns anti-clockwise. At the same time, a spring, which is not shown and which may, for instance, be mounted on the pin **62***a*, rocks the arm **62** clockwise around the pin **62***a*, whereby the pin **6** slides in the slot **60**, and raises the slide **58**, whilst the switch lever **66** moves with the switch rod **9** into the switched-off position (Figure 2). The switch rod being guided by a transverse pin **67** in a vertical slot **68** (Figure 2), provided in the stationary plate **80**. A spring (not shown) then turns the locking member **57** back into the position shown in Figure 2.

Figure 3 is a view of the switch operating mechanism according to Figure 1 in the circuit-closing position as viewed from the left-hand side. One limb of a U-shaped bi-metal spring **69** is attached to the latch member **54** to act as a thermal overload release in the case of a

persistent smaller excess current, as shown in Figure 4. When the switch casing is closed, the bi-metal spring 69 can be adjusted by means of a screw 70 in the casing part 1*a*, which is thereupon sealed with cement 71 after the adjustment. The latch member may also be made of iron to serve as a magnet armature, thereby assisting the plunger 51. The casing of the switch is preferably of pressed insulating material. By the arrangement of the magnet coil 7 and of the contacts 3 and 9 in the part 1 of the casing, and by the accompanying heating up of the parts surrounding them, there is a danger that the part 1 of the casing may shrink, and that the connection of the switch screwed into the fuse socket may become loose. In order to prevent this, the contact pin 5 (Figure 1) is made resilient by providing it over part of its length with a longitudinal bore 5*a* and cutting a helix 5*b* in the tubular part of the pin. When the automatic switch is screwed into a fuse socket, the helix is pressed together and forms a positive connection with the stationary bus bar (not shown) of the fuse element, even if through shrinking of the material of the casing 1, or for some other reason, loosening of the connection between the contact pin and the contact rail of the fuse element would occur if the pin 5 were not resilient, so that in all circumstances, owing to the resiliency of the helix a reliable contact is always ensured and burning of the contact point is prevented.

The magnetic lines of force penetrate the contact chamber 2 and extinguish the arc produced during switching-off this being especially important in the case of a switch of small dimensions. Therefore, the screw-threaded ring 44 for engagement with the fuse socket is made of magnetic material, for instance of copper-plated or rust-proof iron, whereby the magnetic flux from pole to pole is substantially increased. For the same purpose, and more particularly in order to accelerate the interruption, a portion 45 of the switch contact rod 9 is made of magnetic material at the end thereof nearest the fixed contact 3, the length of the said magnetic portion being such that in the switched-off position the magnetic portion 45 lies in the middle of the coil (see the dot and dash line position 45*a*).

58*a* in Figure 3 shows the positions of the slide 58 in the circuit-breaking position. It may be of advantage as regards the incorporation of the switch in distribution boxes, to provide a switching-on device which does not project beyond the casing of the switch in the circuit-breaking position. Such constructions are shown in Figures 5 and 6. In this case the slide 58 is replaced by a disc 73 of insulating material mounted at 72 and coacting with a lever 74 which engages the pivot 61 of the toggle 62, 63. In Figure 5, the disc 73 is provided at the point where it projects through the casing part 1*a* with grooves 75 whilst in Figure 6 the disc 73 has a short projection 76.

It is to be understood that a hand release may be provided in the usual way, for instance in the form of a vertical rod, which can be pressed down onto the bar 54 by means of a pressure knob provided on the upper side of the cover 1*a* of the casing. Figures 7 and 8 show a modified construction of the resilient contact pin 5. The contact pin 5*g* is provided in this case with a star-like plate spring 5*f*. When screwed on, the individual segments of the plate spring bear resiliently, each independently of the other, against the contact of the socket so that even when a fixed contact is uneven and lies aslant, a number of contact points are provided, whereby the passage of current is ensured.

I claim:

1. In an automatic electric switch comprising a casing, a magnet coil in said casing spaced from the bottom thereof to define a contact chamber below it, and a fixed contact in said contact chamber intersected by the axis

of the magnet coil, the combination of a contact rod having a contact thereon for co-operation with said fixed contact and displaceable axially within the magnet coil from a circuit closing position in which the contact on the contact rod bears against said fixed contact, into a circuit breaking position in which the contact rod is retracted from the fixed contact with the contact on said rod located within the interior of the magnet coil, so that the switch air gap between said contacts, in the circuit breaking position, is located partly within the magnet coil, with switch operating mechanism in said casing above the magnet coil and comprising a switch lever articulated to said contact rod for displacing said rod axially of the magnet, a spring biasing said switch lever to urge the contact rod to circuit breaking position, a manually operable switch slide displaceable vertically in the switch casing and having a horizontal slot therein, a horizontal toggle comprising a pair of toggle members with a connecting pin slidable in said horizontal slot, one of said toggle members articulated to said switch lever, a locking member pivoted in the switch casing and articulated to the other toggle member, a latch member biased to normally engage said locking member and means on the movable core for displacing said latch member to release the locking member on the core being drawn into the magnet under the action of an overload current.

2. In an automatic electric switch comprising a casing, a magnet coil in said casing spaced from the bottom thereof to define a contact chamber below it, and a fixed contact in said contact chamber intersected by the axis of the magnet coil, the combination of a contact rod having a contact thereon for co-operation with said fixed contact and displaceable axially within the magnet coil from a circuit closing position in which the contact on the contact rod bears against said fixed contact, into a circuit breaking position in which the contact rod is retracted from the fixed contact with the contact on said rod located within the interior of the magnet coil, so that the switch air gap between said contacts, in the circuit breaking position, is located partly within the magnet coil, with switch operating mechanism in said casing above the magnet coil and comprising a switch lever articulated to said contact rod for displacing said rod axially of the magnet, a spring biasing said switch lever to urge the contact rod to circuit breaking position, a manually operable switch slide, a toggle comprising a pair of toggle members, one of said toggle members articulated to said switch lever, a locking member pivoted in the switch casing and pivoted to the other toggle member, a latch member biased to normally engage said locking member, means on the movable core for displacing said latch member to release the locking member on the core being drawn into the magnet under the action of an overload current, and a screw-threaded ring of magnetic material surrounding the magnetic coil and serving to effect magnetic blow-out when the contacts are separated.

3. An automatic electric switch as claimed in claim 2, characterized in that the contact of the contact rod which is engageable with the fixed contact is made of magnetic material.

References Cited in the file of this patent

UNITED STATES PATENTS

2,170,412	Jennings	Aug. 22, 1939
2,217,462	Willmann	Oct. 8, 1940

FOREIGN PATENTS

51,392	France (1st addition of No. 846,872)	Feb. 5, 1942
646,238	Germany	June 11, 1937
788,639	France	July 29, 1935
870,490	France	Dec. 12, 1941