Aug. 16, 1938. E. ZAHRADNIK 2,127,319

RECLOSABLE AUTOMATIC OVERLOAD CUT-OUT

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Fig. 1

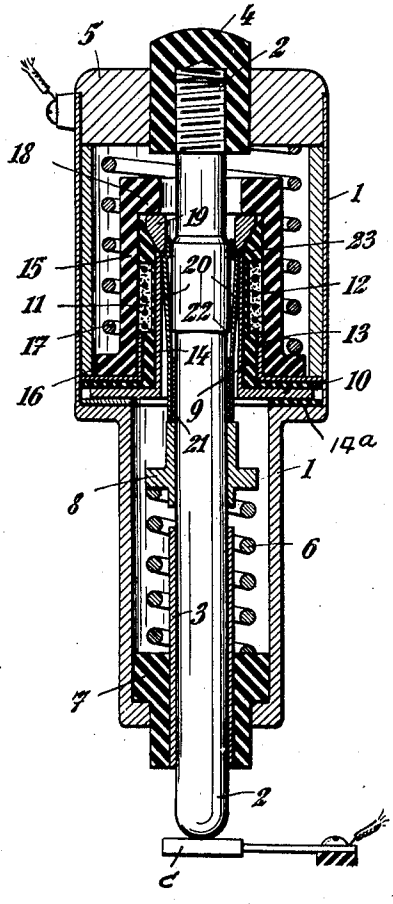
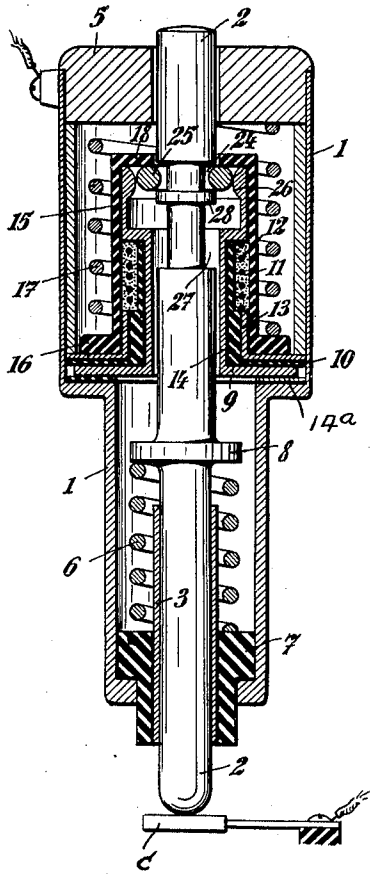


Fig. 2



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Fig. 1a

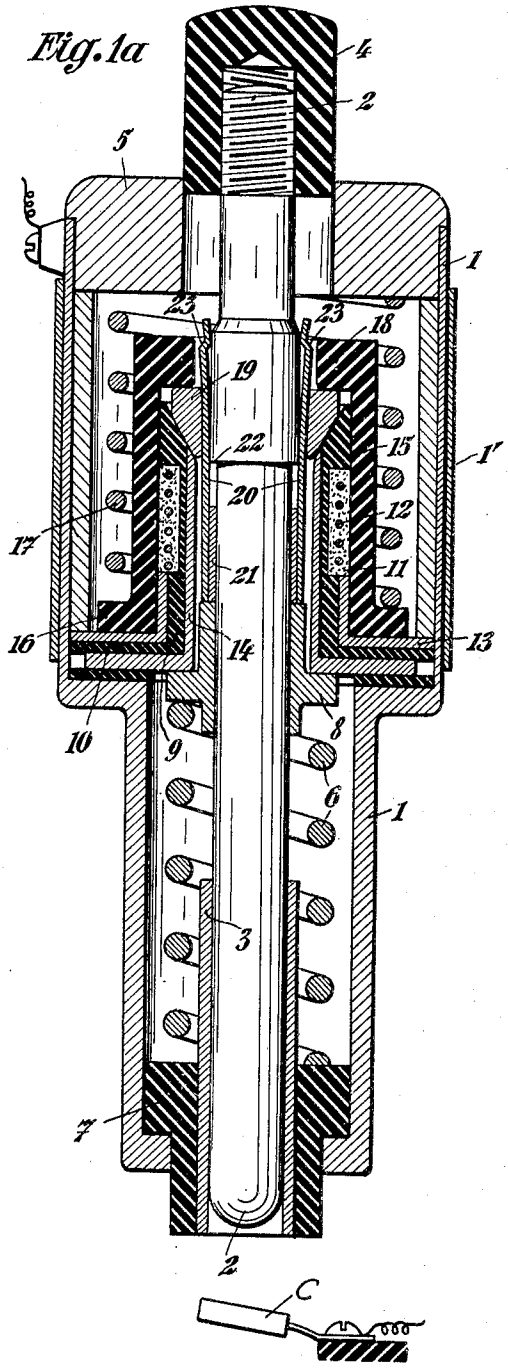
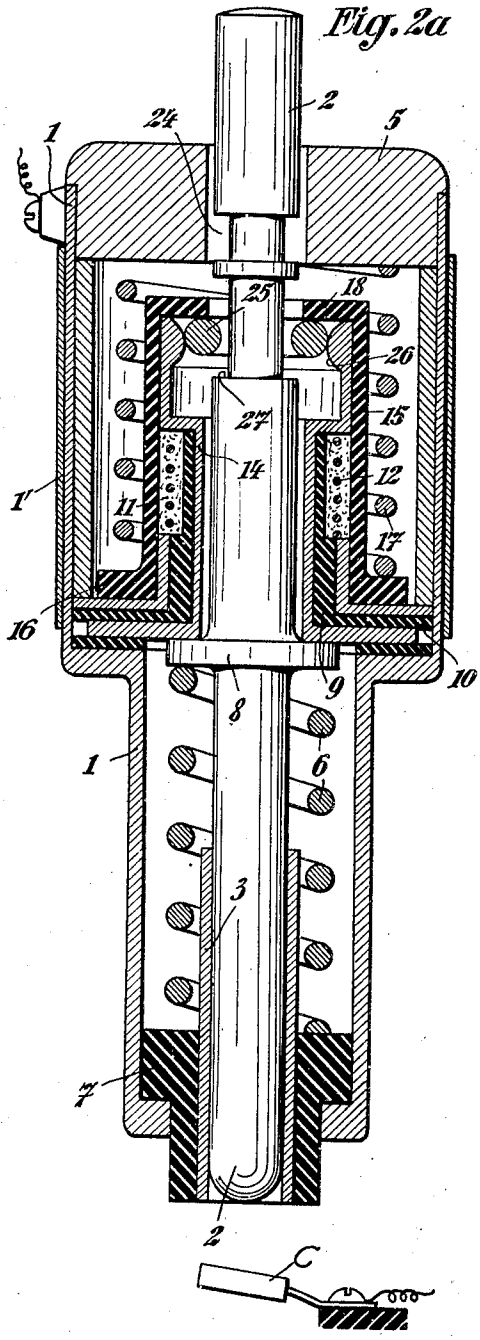


Fig. 2a



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RECLOSABLE AUTOMATIC OVERLOAD CUT-OUT

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Fig. 3

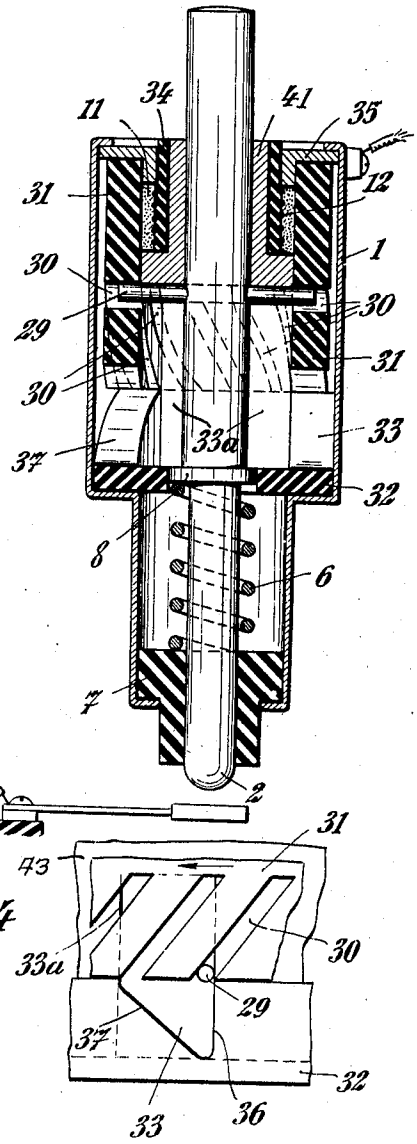


Fig. 4

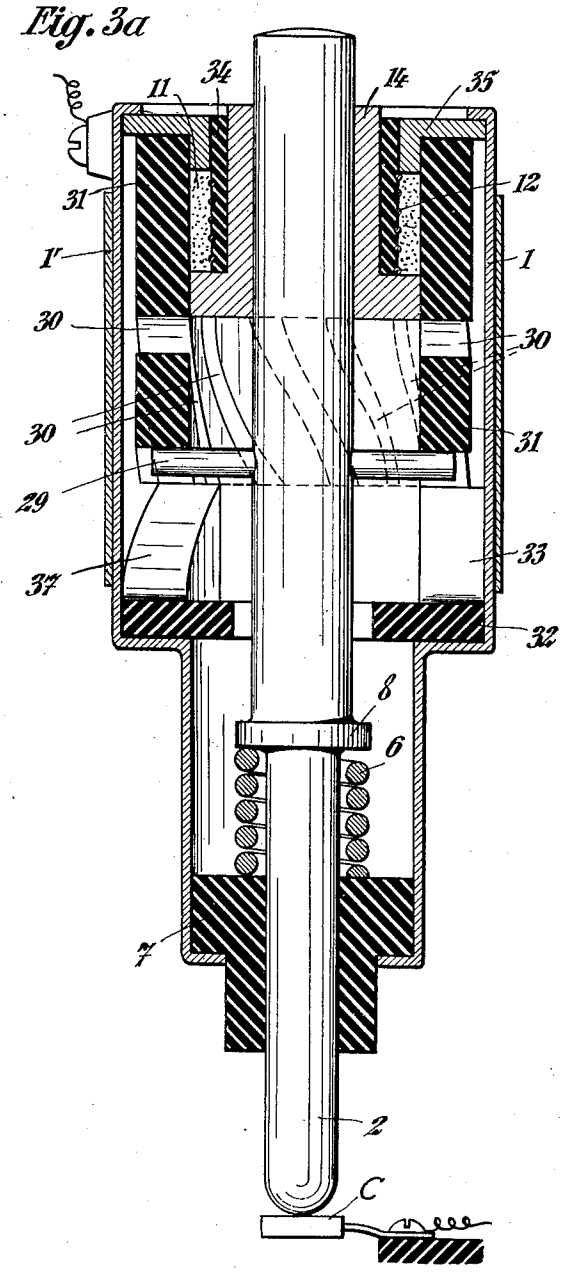
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RECLOSABLE AUTOMATIC OVERLOAD CUT-OUT

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Fig. 3a



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UNITED STATES PATENT OFFICE

2,127,319

RECLOSABLE AUTOMATIC OVERLOAD CUT-OUT

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Application February 4, 1937, Serial No. 123,995
In Austria February 5, 1936

8 Claims. (Cl. 200—124)

This invention relates to re-closable automatic overload switches of the type in which the movable contact member of the switch is detachably coupled with an interlocking member retained normally in its position of rest by a congealed fusible mass.

The invention consists essentially in establishing the disengageable connection between the movable contact member and the interlocking member by means of elements which are guided relatively to each other positively, with the aid of guide surfaces or the like, and which co-act with each other quite independently of any spring force, solely by virtue of the manner in which they are positively guided. This principle of construction has the advantage, as compared with the hitherto known types of switches controlled by a fusible mass in which the making and breaking of the contact between the moving contact and the interlocking contact is effected with the aid of spring parts, that there is no risk of essential parts deteriorating owing to fatiguing of the material or to removal of the spring temper by the heat, so that the new switches according to the present invention have a practically unlimited length of life.

The invention also relates to a number of advantageous forms of construction of the switch, with the view of simplifying the construction and mode of operation of the switch. One particular object is to enable the switch to be housed in a small cylindrical cartridge, for example in the shape of the known fuse cartridges of approximately 10 mm. diameter.

A form of construction embodying the invention is shown, by way of example, in the accompanying drawings, in which:

Figs. 1 and 2 are longitudinal sections of two modifications of the switch cartridge according to the invention, in both of which the contact member and the interlocking member carry out longitudinal movements during the switching operation.

Figs. 1*a* and 2*a* show respectively in larger scale the switch forms of Figs. 1 and 2 in open position.

Fig. 3 show in longitudinal section a modified form of construction employing a rotary interlocking member.

Fig. 3*a* shows the modified form of Fig. 3 in larger scale and in closed position, while

Fig. 4 shows a detail of Fig. 3, developed into a plane.

Referring to the drawings, and more particularly to Fig. 1, there is centrally disposed in a cylindrical cartridge casing 1 a metallic pin 2 which is longitudinally slidable in a guide 3 at one end of the cartridge. At the other end the pin 2 is furnished with a cap 4 of insulating material guided in the top 5 of the cartridge. The cylindrical walls of the carrier are likewise metallic. The guide sleeve 3 is insulated from the cartridge by a ferrule 7 of insulating material. The metal wall of the cartridge constitutes the one pole of the switch, while the second pole is formed of the pin 2 which effects contact making and breaking, or the switching on and off of current, with its end extending out of the cartridge through the guide sleeve 3. The pin 2 is controlled by a compression spring 6 which is supported at one end by ferrule 7, and bears with its other end against a collar 8 fixed to the pin 2. Within cartridge 1 is fitted a cylindrical insulating member 9 which is suitably secured in position by means of a flange 10. In a circumferential recess in the cylindrical member 9 there is embedded a mass 11 which is solid at normal temperature but readily fusible at a given higher temperature. In the fusible mass is embedded a heating wire 12 which is insulated with heat-proof material if the fusible mass is of a metallic nature, but in case of a non-conducting mass it may be bare. Outside and inside the insulating cylinder 9 is provided an electrically conductive sleeve 13 and 14, respectively, to which the ends of the heating wire 12 are respectively connected. Sleeve 13 is electrically connected with casing 1, and sleeve 14 insulated therefrom as shown at 14*a*. The fusible mass is confined on the outside by a cup-shaped insulating member 15 embracing the cylinder 9. As long as the fusible mass is set this cup-shaped member is held fast by it, but when the mass is softened the cup-shaped member is free to slide longitudinally upon the cylindrical member 9. Against the outwardly extending lower rim flange 16 of the cup-shaped member 15 bears a compression spring 17, the other end of which is supported against the cover 5 of the casing. This spring is somewhat weaker than the spring 6. The cup 15 is also provided with an upper, inwardly extending flange 18 overlapping the end of the cylinder 9. Between this flange and the inwardly conically bevelled end of the cylinder 9 is disposed a two- or multi-sectioned ring 19 having an outer delimiting surface tapered to fit the bevelling of the cylinder 9. The maximum outside diameter of the ring 19 is considerably smaller than the internal diameter of the cup 15. Against the ring 19 rest by offset ends 23 a set of spring tongues 20 arranged in a

circle. These tongues are attached at their lower ends to a common sleeve 21 slidably disposed on the pin 2. The range of movement between the pin 2 and the sleeve 21 is limited on the one hand by the collar 8 and on the other hand by a shoulder 22 on the pin 2. This shoulder serves at the same time at its upper end as a spreader and counter-support for inwardly offset ends 23 on the tongues 20, by which the tongues are held in supporting engagement with ring 19.

When in the switched-on condition shown in which pin 2 rests on circuit contact C, the switch constitutes a current-conducting bridge between the resilient pole element C connected to the casing wall 1 and the pole touching the end of the pin 2. The conducting connection is through the pin 2 and the sleeve 21 and spring tongues 20 mounted thereon, thence through the ring 19 and cylinder 14 to the heating wire 12, and thence through the cylinder 13 to the casing wall 1. As soon as an overload current, which it is desired to interrupt, occurs in the line, the fusible mass becomes liquid owing to the heat generated in the heating wire, with the result that the cup 15 is deprived of its retaining hold, and can be displaced along the cylinder 9. The spring 6 can therefore come into action to that effect in the following manner. The spring 6 in pressing pin 2 upwardly at collar 8 first opens the contact at C and thus interrupts the current. At the same time the collar 8 raises sleeve 21 and with it tongues 20 so that the upper offset portions 23 of tongues 20 take the multi-sectioned ring 19 and the cup 15 with them, against the tension of the spring 17, until the individual sections of the ring 19, which move outwardly against the oblique bearing surface of the cylinder 9 during their upward travel, come out of lifting engagement with the tongues 20. From this moment on the pin 2 travels on alone with the tongues 20, under the influence of the spring 6, until it reaches its upper end position, while the cup 15, being now freed from the control by pin 2 and in response to the pressure of the spring 17, returns to its normal position shown in Fig. 1, and in doing so also returns the ring 19 to its normal position. Since on the tripping of the switch the heating wire 12 becomes current-less, the fusible mass quickly sets and thereby holds the cup 15 again fast in its normal position. To re-set or re-close the switch the pin 2 is shifted against the force of the spring 6, by outside pressure exerted upon the cap 4, until contact at C is re-established. On this replacement of the pin the tongues 20 are kept back slightly by the ring 19, so that the lugs 23 slide beyond the collar 22 so that they can bend inwardly to clear ring 19. The lower shoulder of the collar 22 at that time engages the sleeve 21, and takes this latter and the spring tongues 20 downwards with it until the latter can engage with the lugs 23. When the outside pressure against pin 2 is released spring 6 returns it inwardly into the position shown in Fig. 1. It is assumed thereby that main circuit contact C is slightly downwardly yielding for this purpose.

In order to simplify the connection between the contact pin 2 and the cup-shaped interlocking member the following modification may with advantage be adopted. Referring to Fig. 2, which in general shows a construction similar to Fig. 1, there is disposed in a peripheral groove 24 provided in the pin 2 either a split ring or an elastically expansible ring 25 (formed for example by a few turns of a helical spring); when the switch is in the circuit-closing position shown in Fig. 1, this spring ring abuts against the flange 18 on the interlocking cup member 15, and is held contracted by a beading-shaped bearing surface 26 on the cylindrical contact member 14 firmly secured in the cartridge so that the ring is held in groove 24 of pin 2. Adjacent the groove 24 there is formed a wider peripheral groove 27 in the pin 2.

When the switch is in the circuit-closing position the course of the current from the end of the pin to the casing wall is similar to that occurring in the previously described form of construction, namely, from contact C through pin 2, ring 25 and the member 14, heating coil 12, sleeve 13 and casing 1. If an overload current flows through the switch the fusible mass is heated by the heating wire, the locking member 15 is released, and the contact pin 2 is free to be moved by the spring 6 so that current interruption is effected at the circuit contact C at the end of the pin 2. During the upward movement of the pin the ring 25, being pushed upwardly by collar 28, is gradually freed from its confinement between the flange 18 of the cup 15 and annular bead surface 26, and thereby gradually expands as it leaves bead 26. As soon as the ring has become expanded to such an extent that its inner diameter is larger than the diameter of collar 28, the latter slips through ring 25 and now pin 2 is free to move alone upwardly in the direction of circuit opening, while the cup-shaped locking member 15 is returned by the spring 17 into its normal position shown in Fig. 2. During this operation ring 25 becomes located in the groove 27 of pin 2 in which it can be contracted again when flange 18 forces the ring back into bead 26. The groove 27 is at least of such length, measured in an axial direction, that during this further opening movement of the pin 2 the locking member 15 can not be lifted a second time. To reclose the circuit it is merely necessary to push the pin 2 back by outside pressure. The collar 28 thereby first forces ring 25 below bead 26 so that the ring can expand and permit collar 28 to slip through the ring. This will relocate the ring into groove 24. If now the outside pressure is released, spring 6 slightly raises pin 2 and thereby forces ring 25 back into bead 26 and against flange 18 which at that time is unyielding since the fusible mass is set and holds locking member 15 in fixed position. Also, here it is assumed that circuit contact C is slightly downwardly yielding to permit the afore-described resetting.

If it is desired to reduce the over-all length of the cartridge containing the switch it is advisable not to make all the movable parts of the switch longitudinally displaceable, but to replace part of the longitudinal movements by rotary movements. Thus, for example, the locking member may with advantage take the form of a rotary cylinder.

A form of construction of this type is shown in section in Fig. 3 of the drawings which shows the switch in open position, while Fig. 4 is a partial elevation of the cylindrical locking member and of the movable switch member developed in a plane, showing the elements in switch closing position. In the casing 1 is again guided the movable switch member 2 which is upwardly pressed by the compression spring 6. In the movable contact member 2 is fixed a transverse pin 29 which engages in helical guide slots 30 in a rotatable locking member 31 consisting of in-

sulating material. These slots are disposed at regular intervals around the circumference of the locking member 31 of which a portion is shown in larger scale in Fig. 4. The locking member rests upon a stationary guide member 32 of insulating material which is fitted in the casing 1 and provided with diametrically opposed recesses 33 having inclined bottom edges 37 (Fig. 4). The movable contact member 2 is guided at its upper portion by means of a conducting sleeve or bushing 41 immovably fitted in the guide member 32, upon which bushing is mounted a coil holder 34 consisting of insulating material. This holder carries the heating wire 12 for the fusible mass 11 which in the solid condition prevents the locking member 31, surrounding it, from turning, the said heating wire being connected at one end to the bushing 41 and at the other end to a flanged ring 35 which closes the casing at the top. One circuit terminal is connected to casing 1 as shown, and the other, yielding terminal is at C, with which latter piece 2 cooperates. In the bushing 41 are provided two diametrically opposed rectangular gaps 33*a* (see Fig. 4) which extend down as far as the lower end surface of the bushing and allow the pin 29 to pass through unchecked in its movement.

In Fig. 4 of the drawings the relative position between the pin 29 fixed on the movable contact member 2 and the slots 30 in the locking member 31 in the switched-on position is shown, this pin being located normally at the lower end of one of the helical slots in the locking member as shown, when the switch is closed. If the strength of the current flowing through the switch exceeds a certain limit the fusible mass is melted by the heating wire 12 and releases the locking member. Then under the influence of the tensioned spring 6 the contact member 2 travels with its pin 29 along the right-hand side surface of the gap 33*a* in the bushing 41 upwards and opens the circuit contact at C as shown in Fig. 3. At the same time, in consequence of the engagement of the pin 29 in the inclined slots 30, the locking member is rotated in the direction of the arrow until the lower, open ends of two oppositely disposed slots containing the two ends of pin 29 coincide with the commencement of the oblique restoring edges 37 of the respectively adjoining recesses 31 in the guide member 32. In this switched-off position shown in Fig. 3 the body of fusible material 11 sets. The re-closing or resetting of the overload switch is effected by depressing the movable contact member 2 from outside whereby spring 6 is again tensioned. As the pin 29 travels downwards along the slot 30 it thereby rotates the movable contact member 2 through an angle equal to the width of slot 33*a*, and after pin 29 has reached the top of the restoring edge 37, it travels on further depression of member 2 along this latter edge until it reaches the lower end thereof, where it encounters the lower end of vertical guide surface 36. The main circuit is being closed at C by the movable contact member 2 when the pin 29 of the latter has arrived at the top of restoring edge 37. The just described further downward movement of pin 29 along edge 37 is possible because, as in Figs. 1 and 2, contact C is assumed to be yielding. When the outside pressure against member 2 is now released, the movable member slides axially upwards again under the influence of the spring 6, with contact C following, until its cross pin 29 enters the open end of the next of the slots 30, where it is arrested, since locking member 31 has become immovable through the setting of the fusible material. The reclosed switch is thus put in readiness for the next automatic current-interrupting operation.

The described overload switches have proved to be particularly well suited for the protecting of feeble current circuits, for example in telephone systems and the like, but may also be utilized for the automatic interruption of more powerful currents.

I claim:

1. A re-closable automatic overload switch comprising in combination a housing, an axially movable rigid contact member and a spring connected with said member tending to move it into contact opening position, a fixed guide body mounted in said housing and a rigid locking member movably disposed thereon and means connected with said contact member and said locking member and detachable from the latter for moving the locking member relatively to said fixed guide body when the contact member moves into contact opening position, and a body fusible at overload and disposed between said guide body and said locking member and adapted when set to hold the latter fixed on said guide body to prevent the contact member from moving into contact opening position.

2. A re-closable automatic overload switch comprising in combination a housing, an axially movable rigid contact member and a spring connected with said member tending to move it into contact opening position, a fixed guide body mounted in said housing and a rigid locking member movably disposed thereon and means connected with said contact member and said locking member and detachable from the latter for moving the locking member relatively to said fixed guide body when the contact member moves into contact opening position, a body fusible at overload and disposed between said guide body and said locking member and adapted when set to hold the latter fixed on said guide body to prevent the contact member from moving into contact opening position, and means for returning said locking member into its normal position after it has been moved by said contact member relatively to said guide body when the fusible body has melted to permit the fusible body to set with the locking member in its normal position relatively to said guide body which it has when the contact member is closed.

3. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing, and a spring connected to said contact member tending to open its contact, a movable locking member spring-loaded by a force smaller than that exerted by the spring force against said contact member and in a direction opposite that in which the said contact member is loaded, a fixed guide body mounted in said housing, a ring member of variable diameter arranged to couple together said locking member and said contact member whereby said contact member carries along said locking member in opening the contact, and a body fusible at overload and disposed between said locking member and said guide body and adapted to retain the said locking member in contact closing position when in the set condition.

4. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing and a spring connected to said contact member

tending to open its contact, a movable locking member spring-loaded by a force smaller than that exerted by the spring force against the contact member and opposite to it, a fixed guide body mounted in said housing, a ring member of variable diameter bearing in axial direction against said locking member and consisting of a plurality of annular sectors, spring tongues operatively connected with said contact member and bearing against the ring member, said ring member having a conical surface and normally resting against a correspondingly shaped surface on the said guide body when said contact member is in contact closing position, and a body fusible at overload and disposed between said locking member and said guide body and adapted to retain the said locking member in contact closing position when in the set condition.

5. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing and a spring connected to said member, tending to open its contact, a movable locking member spring-loaded by a force smaller than the force exerted by the spring force against said contact member and in the opposite direction to said force, a fixed guide body mounted in said housing, an elastic ring member of variable diameter arranged to couple together said locking member and said contact member whereby said contact member carries along said locking member in opening the contact, and a body fusible at overload and disposed between said locking member and said guide body and adapted to hold the said locking member in contact closing position when in the set condition.

6. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing and a spring connected to said member, tending to open its contact, a helically grooved rotatable locking member, a fixed guide body, a disengaging connecting element consisting of a pin radially projecting from the said movable contact member and adapted to enter the helical grooves in the said locking member, the said pin being guided along rigid guide surfaces on the said guide body, and a fusible body adapted to hold the said parts in position when in the set condition.

7. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing and a spring connected to said member, tending to open its contact, a fixed guide body mounted in said housing, a locking member rotatably supported on said guide body and having helical guide slots in its peripheral surface, a transverse pin fixed in said contact member and disposed to enter oppositely disposed slots in said locking member when the contact member moves into opening position, axially directed guide surfaces for said pin on said guide body along which said pin travels during the contact opening movement of said contact member whereby said locking member is rotated through a given angle, and a body fusible at overload and disposed between said guide body and said locking member to hold the latter in contact closing position with relation to said closing member when the fusible body is set.

8. A re-closable automatic overload switch comprising in combination a housing, an axially movable contact member guided in said housing and a spring connected to said member, tending to open its contact, a fixed guide body mounted in said housing, a locking member rotatably supported on said guide body and having helical guide slots in its peripheral surface, a transverse pin fixed in said contact member and disposed to enter oppositely disposed slots in said locking member when the contact member moves into opening position, axially directed guide surfaces for said pin on said guide body along which said pin travels during the contact opening movement of said contact member whereby said locking member is rotated through a given angle, a body fusible at overload and disposed between said guide body and said locking member to hold the latter in contact closing position with relation to said closing member when the fusible body is set, and a reverse guide surface on said guide body connecting with the terminals of the helical grooves containing the guide pin for guiding said pin and said contact member into their normal contact closing positions when the contact member is depressed from outside to reclose the contact.

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