June 24, 1930. W. W. SLOANE 1,765,546

EXPLOSIONPROOF FUSE

Filed June 25, 1927 2 Sheets-Sheet 1

Fig. 1

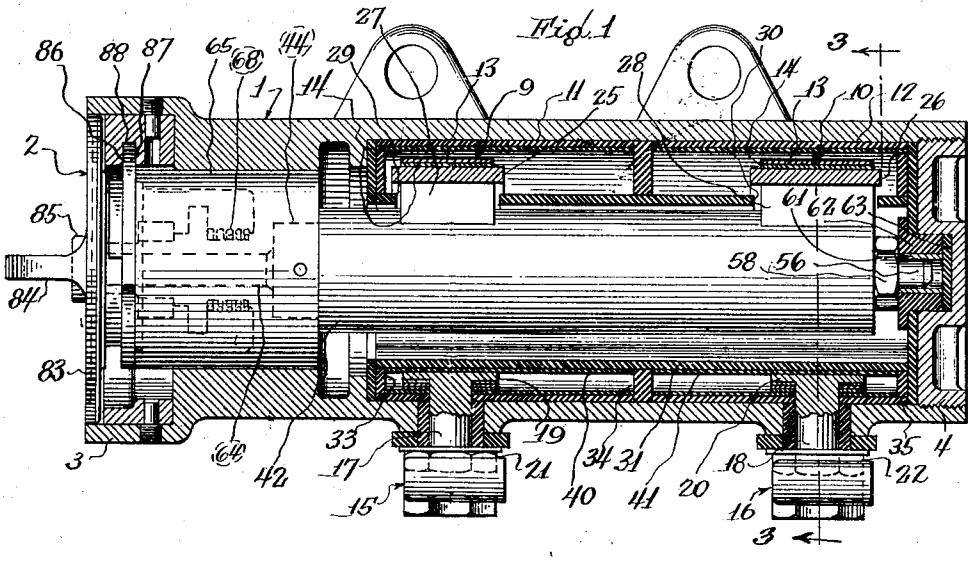


Fig. 2

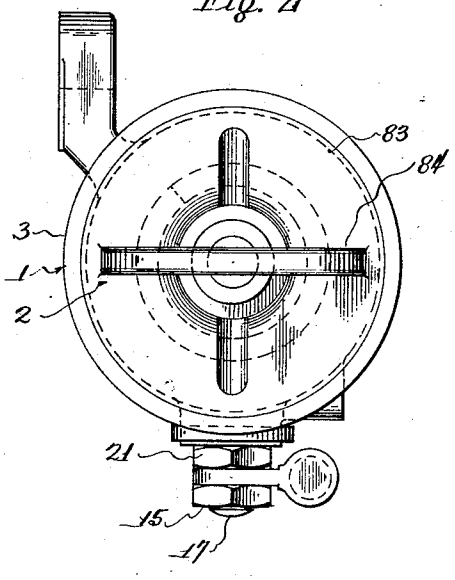
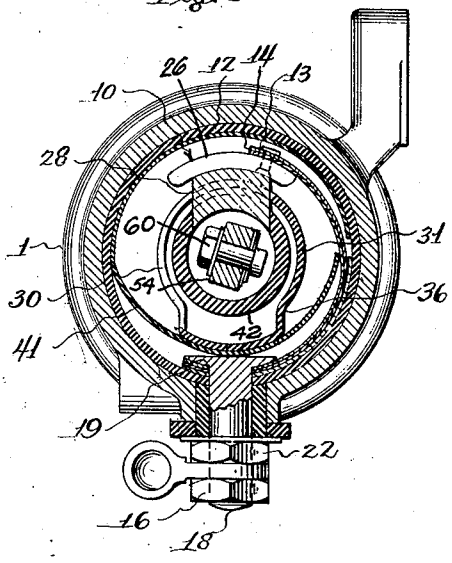


Fig. 3



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Fig. 4

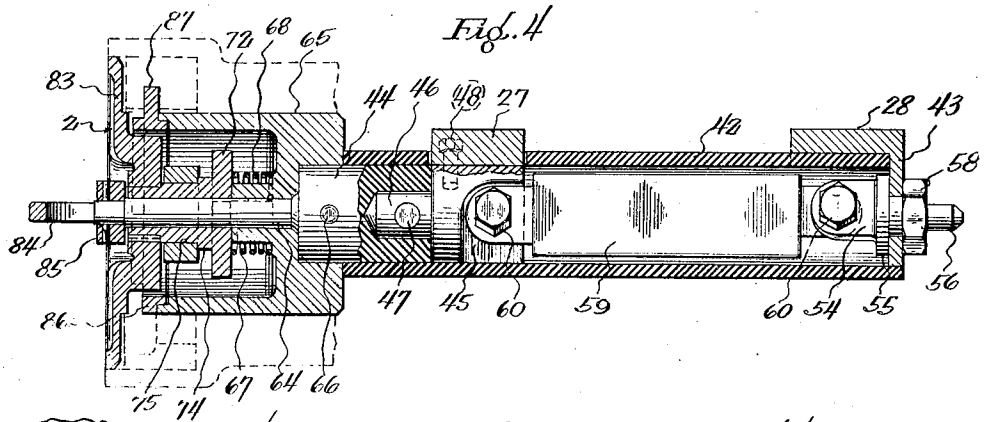


Fig. 5

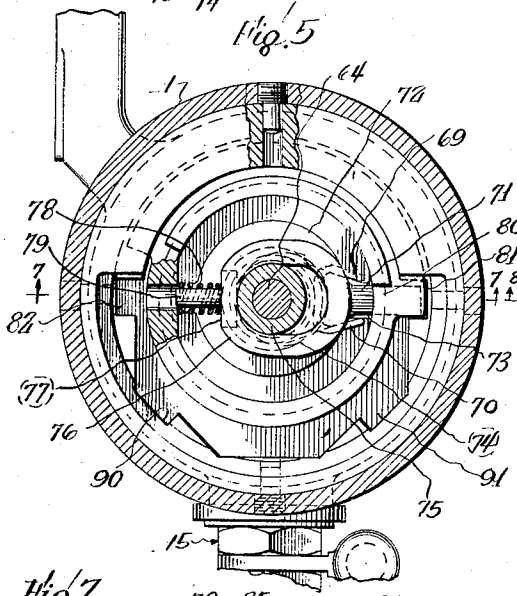


Fig. 6

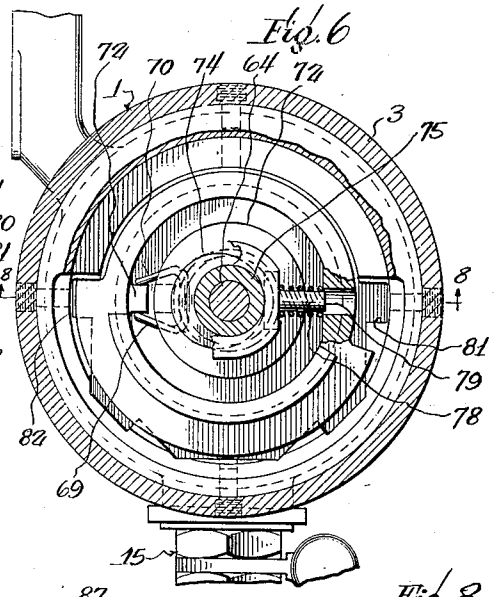


Fig. 7

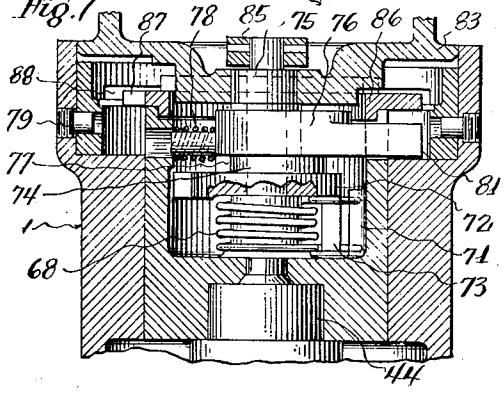
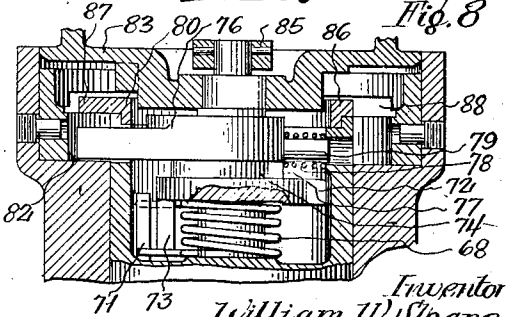


Fig. 8



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Patented June 24, 1930 1,765,546

UNITED STATES PATENT OFFICE

WILLIAM W. SLOANE, OF CHICAGO, ILLINOIS, ASSIGNOR TO GOODMAN MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

EXPLOSIONPROOF FUSE

Application filed June 25, 1927. Serial No. 201,403.

This invention relates to improvements in explosion proof electrical fuses or cutouts which are used in gaseous mines or under similar conditions in which explosions may be carried by the arcing exposed fuse connections, and has more particularly as its object to provide a safety fuse of this type with a new and improved means to prevent arcing or burning of the fuse contacts and thus lessen the danger of an explosion.

My prior Patent No. 1,619,640, discloses an explosion proof fuse similar to the fuse disclosed in the present application. The present invention however, is an improvement upon the above mentioned prior patent in that a new and novel means is provided to accelerate the making and breaking of the fuse contacts to prevent burning or arcing between these contacts.

Further objects will appear from the following description, reference being had to the accompanying drawings, wherein;

Figure 1 is a vertical cross-section of the device embodied in my invention;

Figure 2 is an end view of the device in Figure 1;

Figure 3 is a vertical cross-section taken on line 3—3 of Figure 1;

Figure 4 is a vertical cross-section of the fuse element removed from the casing;

Figure 5 is an end view of the device shown in Figure 1 with the top cover removed and the casing showing in section;

Figure 6 is an end view of the device shown in Figure 1 with parts removed and in section;

Figure 7 is a fragmentary vertical sectional view taken on line 7—7 of Figure 5; and

Figure 8 is a fragmentary vertical sectional view taken on line 8—8 of Figure 6.

Referring now to the details of construction, my device comprises two main elements, viz., an outer casing 1 and a removable fuse element 2, adapted to be inserted at one end of the casing 1, and to be locked therein, so as to provide a practically air-tight enclosure.

The outer casing 1 comprises a cylindrical body 3, preferably of metal, enclosed at one end by a threaded plug 4 and at the opposite end by the fuse element 2, already referred to. A pair of metallic connecting members 9 and 10 are separated from each other in the casing, and partially encircle the chamber adjacent the outer wall 3 of the casing, but are insulated therefrom by means of suitable insulation pieces 11 and 12 respectively. The connecting members 9 and 10 each comprise a spring member 13, and a contiguous conducting member or "shunt" 14. The spring member 13 is preferably of phosphor bronze, or other material suitable for use as a spring, while the conducting member, or "shunt" 14, is preferably made up of a plurality of thin copper plates of high relative conductivity, so as to carry most of the current. This arrangement is provided so that the tensional properties of the spring member 13 are not affected by heating. As shown in Figure 3, the connecting members 9 and 10 are preferably constructed in the form of a segment of a circle, and arranged eccentric with respect to the casing 1. They are connected to outside terminals 15 and 16 by means of studs 17 and 18 having heads 19 and 20 thereon. The studs are inserted through suitable holes in the connecting members 9 and 10, and secure said connecting members by threaded nuts 21 and 22 on the terminals. Contact shoes 25 and 26 are attached to the upper portion of the connecting members 9 and 10 respectively, and are adapted to provide contact with corresponding contact members 27 and 28 carried by the fuse element 2.

Inside of the connecting members 9 and 10 is inserted an insulating member 31 which extends practically the entire length of the casing, and is held in place by insulating discs 33, 34 and 35, supported by the casing wall 3. Said insulating member is so proportioned in cross-section as to receive the fuse element 2 therein, and includes a depending wall portion 36 extending the full length thereof which receives the contact members 27 and 28 when the fuse element is inserted in its inverted or off position. Two segmental slots 29 and 30 are provided in the insulating tube 31, which are adapted to register with the contact members 27 and 28, so that they may be turned from their downward or off position to a position indicated in Figures 1 and

3 where they engage with the contact shoes 25 and 26 respectively. Additional auxiliary insulating pieces 40 and 41 are provided which partially encircle the insulating pieces 11 and 12 and pass between the depending wall portion 36 of the insulating member 31 and the leads 19 and 20 of the terminals 15 and 16. The object of this insulation is to prevent arcing between the contact members 27 and 28 and the terminal leads 19 and 20 when said contact members are turned to an inverted or off position.

Referring now more particularly to the fuse element 2, I prefer to utilize a so-called "removable link" fuse in connection with my device, details of which are shown in Figure 4. An insulator tube 42 is provided for enclosing a fuse link 59. The contact member 28 of the fuse element 2 abuts the outer surface of the insulator tube 42 at the rearward end thereof and extends radially outward therefrom and is integral with a closure member 43 which fits within the rearward end of said insulating tube and is held therein by the fuse link 59 and threaded plug 4 in a manner which will hereinafter be described. The opposite or outer end of the tube 42 is enclosed by a plug 44 which projects substantially beyond the end of said tube. This plug is made of any suitable insulating material. A terminal 45 for the fuse link 59 abuts the inner end of said plug and is fastened thereto by a spindle 46 which is held in a suitable recess in said plug by a pin 47. The contact 27 is fixed to the terminal 45 by means of a machine screw 48. The opposite terminal of the fuse link comprises a terminal piece 54 having an enlarged flange 55 which abuts the inner face of the closure member 43 and a spindle 56 which extends through said closure member and provides an axis about which the fuse element 2 may rotate. The spindle 56 has a threaded portion adjacent the outer face of the end disc 43 and is provided with a nut 58 which clamps the terminal piece 54 to said disc. The fuse link 59 is detachably connected between the link terminals 45 and 54 in any suitable manner, as for instance by bolts 60, 60.

The end of the spindle 56 is adapted to fit in a recessed bushing 61, formed in the plug 4 but insulated therefrom by an insulating bushing 62 and insulating plug 63 to form a pivotal support for the forward portion of the fuse element 2 and to aid in holding the closure member 43 and contact 28 on the insulator tube 42 when said fuse element is inserted within the casing 1.

A spindle 64 projects outwardly from the plug 44 and is adapted to pass through a member 65 which acts as a closure for the casing 1. The plug 44 is also adapted to be received in said closure member and is held thereto by a pin 66 which passes through the spindle 64 and holds said spindle in said plug.

To assemble or disassemble the fuse element, it is simply necessary to remove the contact 27 from the terminal 45 by means of removing the set screw 48, and then punch out the pin 66 and remove the fuse elements from the insulating tube 42.

The closure member 65 is adapted to fit in the neck of the casing 1, and has a relatively long and fairly close-fitting bearing surface within the neck of the casing 1. This bearing surface provides an "explosion proof" joint, in which any flame from an arc, or from an explosion in the casing caused thereby, will be extinguished before it reaches the outer air. Said closure member is adapted to receive the actuating mechanism for making and breaking the fuse contacts, and has a boss 67 which projects outwardly from the central inner portion of said closure member, and surrounds the spindle 64 for a portion of the length of said spindle. A torsion spring 68 fits about the boss 67 and has ends 69 and 70 engageable with a projection 71 on the inner portion of the closure member 65. A disc 72 is rotatable on the spindle 64 and has an inwardly projecting lug 73 which also engages the ends 69 and 70 of the torsion spring 68. Abutting said disc and integral therewith is an eccentric 74. A sleeve 75 is integral with said eccentric and extends outwardly along the spindle 64. A plunger 76 fits on the sleeve 75 and is movable transversely to said sleeve. A projection 77 from the plunger 76 engages the eccentric 74. The projection 77 is forced against the eccentric 74 by means of a spring 78. Said spring fits on a pin 79 integral with the plunger 76 and bears against said plunger at one end, and against the inside wall of the closure chamber 65 at its other end. A suitable aperture is provided in the closure member 65 to receive the pin 79 to allow for movement of said plunger. The opposite end of the plunger 76 rides in a guide notch 80 in the member 65 and is engageable with locking notches 81 or 82 in the casing 1. It may therefore be seen that rotatable movement of the eccentric causes the plunger 76 to move transversely to the closure member 65 to engage with or disengage the locking notches 81 or 82 in the outer casing 1 to hold said closure member stationary with the casing 1 or allow said member to be free to rotate in said casing.

Abutting the plunger 76 and on the outer side thereof is a cover 83 having a handle 84 thereon keyed to the sleeve 75. A collar 85 is pinned to the outer end of the spindle 64 to hold the sleeve 75 in place on said spindle. Rotatable movement of the handle 84 causes movement of the sleeve 75, eccentric 74 and lug 73. Since the lug 73 engages one end of the torsion spring 68 and the opposite end of said spring engages the projection 71 in the chamber 65 which is held stationary in the casing 1 by the plunger 76 engaging

the locking notch 81, rotation of said lug will cause the torsion spring 68 to tighten. At the same time the spring 68 is being tightened the eccentric 74 is moving the plunger 76 transversely to the chamber 65 to disengage the end of said plunger from the locking notch 81. It may be seen that disengagement of the plunger 76 from the notch 81 will allow the member 65 to be rotatably moved in the casing. Therefore when handle 84 is turned to the point where the plunger 76 is disengaged from the notch 81, the spring 68 will unwind and rotate the member 65 which will in turn rotate the entire fuse elements 2 causing the contacts 27 and 28 to positively engage with the contacts 25 and 26. The plunger 76 will be forced in the notch 82 by the spring 78. In the same way turning the handle 84 in the opposite direction will positively disengage the contacts 27 and 28 from the contacts 25 and 26.

A safety collar 86 is fixed to the outer end of the closure member 65. Said collar has a segmental flanged portion 87 projecting therefrom engageable with a groove 88 in the casing 1. Therefore, when any part of the flange 87 is in engagement with the groove 88 it may be seen that the fuse element 2 cannot be removed from the casing 1 and that said flanged portion is in engagement with said groove at all times when the contacts 27 and 28 are in contact with the contacts 25 and 26 and said flange is not disengaged from said groove until the contacts 27 and 28 are in their farthest downward or off position. It should here be noted that the spring 68 does not throw the contacts 27 and 28 in their farthest downward or off position so the flange 87 is completely disengaged from the groove 88 so the fuse element 2 can be removed from the casing 1, but that the fuse element has to be turned a slight degree by hand to fully disconnect the flange 87 from the groove 88. This prevents a gas explosion in the casing 1 from blowing the fuse element 2 from said casing when the contacts are opened by the spring 68 to remove said fuse element, and makes it necessary to turn said elements by hand to remove it from the casing.

It may here be noted that auxiliary locking notches 90 and 91 are provided in the casing 1 to be engaged by the plunger 76 in case the speed of rotation of the fuse element 2 is not great enough to carry said plunger past these locking notches. The purpose of these auxiliary locking notches is to stop rotation of the fuse element 2 in case the spring 68 should become too weak from continual use to rotate the fuse element 2 at required speed or should only be able to rotate said element a portion of the required distance and cause arcing and burning of the contacts. The arrangement of these notches is such that the rotation of the fuse element 2 will be stopped while the contact members 25 and 26 are engaged by the contact members 27 and 28, and in the same manner, when attempting to engage the contact members 25 and 26 with the contact members 27 and 28, the rotation of said fuse element will be stopped before said contact members are engaged or are close enough to cause arcing or burning between said contacts.

From the preceding description it can be seen that my invention comprises an explosion proof fuse having a means to positively and quickly make or break the contact and connect or disconnect the fuse element with the source of power by means of a spring action which eliminates the arcing caused by the slower and uncertain making or breaking of said contacts by hand. This fuse element is entirely enclosed when connected to the outside source of electric power, and cannot be inserted into the casing which encloses it in any way that will make a contact with the outside source of power. The contact has to be made by the aforementioned spring means and when said contact is made the fuse element is locked in the casing which encloses it and cannot be removed therefrom until the contact is completely broken. The fuse element is also so arranged that it is practically impossible to insert a substitute for said fuse element due to the fact that it is practically impossible to reach the contact shoes 25 and 26 for the purpose of connecting these terminals with any substitute for the fuse element in the manner above suggested. While it may be possible to insert fuse wire or other substitutes for the fuse link 59, yet when this is done, the entire fuse element 2 must be inserted and locked before proper contact of the fuse device 2 can be made.

While I have shown and described one embodiment of my invention, it will be understood that the arrangement or construction of the various parts may be altered without departing from the spirit or scope thereof. Furthermore, I do not wish to be construed as limiting myself to the precise form illustrated, excepting as it may be limited in the appended claims.

I claim as my invention:

1. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts, and a spring actuated means independent of said contacts for locking said closure member in all positions of engagement between said contacts and contact members.

2. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse

element within said casing, contact members associated with said fuse element adapted to engage said contacts, and a spring actuated means independent of said contacts permitting insertion and removal of said fuse element only when said fuse contact members are out of engagement with said contacts.

3. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts, and a spring actuated and controlled means independent of said contacts for locking said closure in all positions of engagement between said contacts and contact members and for rotating said closure to engage or disengage said contacts and contact members.

4. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts, and a spring actuated and controlled means independent of said contacts for simultaneously locking said closure and engaging said contacts and contact members.

5. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts, and a spring actuated and controlled means independent of said contacts for disengaging said contacts from said contact members and unlocking said closure for longitudinal movement of said closure.

6. In a device of the class described, a cylindrical casing, a rotatable fuse element having an annular portion thereof to form a closure for said casing, electrical contacts for said fuse element within said casing, means permitting longitudinal movement of said fuse element within said casing when said fuse contacts are out of longitudinal alignment with said casing contacts, a spring controlled means permitting rotation of said fuse element in said casing only when said annular portion is in fully closed position in said casing.

7. In a device of the class described, a cylindrical casing, a rotatable fuse element having an annular portion thereof to form a closure for said casing, electrical contacts for said fuse element within said casing, means permitting longitudinal movement of said fuse element within said casing when said fuse contacts are out of longitudinal alignment with said casing contacts, and a spring controlled means for rotating said fuse element in said casing only when said annular portion is in a fully closed position in said casing.

8. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, a pair of contacts for said fuse element in said casing, contact members in said fuse element, spring actuated and controlled means permitting insertion and removal of said fuse contact members in one position with said fuse contact members removed from said casing contacts; spring actuated and controlled means for moving said fuse element in a second position with said fuse contact members in engagement with said casing contacts, and means operable to lock said closure against longitudinal movement in a position intermediate the first two mentioned positions of said fuse element.

9. In a device of the class described, a casing, a rotatable fuse element adapted to be inserted in said casing to form a closure therefor, said fuse element having a pair of laterally extending contact members and a lock, contacts in said casing for said fuse contact members, said casing having a passageway affording entrance of the fuse element in an axial direction with the respective fuse and casing contacts removed from each other, and a spring actuated and controlled means independent of said contacts for rotating said fuse element to lock said fuse element against axial movement, and to engage the respective fuse and casing contacts, said fuse element being locked at all times that said fuse and casing contacts are engaged.

10. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts and a spring actuated and controlled means independent of said contacts for locking said closure in all positions of engagement between said contacts and contact members and to rotate said fuse element to engage or disengage said contacts and contact members, comprising a spring member having one end connectible with said closure member and its other end connectible with a rotatable member having a suitable hand operated means at its outer end, a plunger for holding said closure member against rotation in said casing, and cam actuated means for releasing said plunger from said casing to allow said closure member to rotate in said casing.

11. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse

element within said casing, contact members associated with said fuse element adapted to engage said contacts and a spring actuated and controlled means independent of said contacts for locking said closure in all positions of engagement between said contacts and contact members and to rotate said fuse element to engage or disengage said contacts and contact members, comprising a spring member having one end connectible with said closure member and its other end connectible with a rotatable member having a suitable hand operated means at its outer end, a plunger for holding said closure member against rotation in said casing, and a cam actuated means for releasing said plunger from said casing on rotation of said hand operating means to allow said spring to rotate said closure member in said casing.

12. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts and a spring actuated and controlled means independent of said contacts for locking said closure in all positions of engagement between said contacts and contact members and to rotate said fuse element to engage or disengage said contacts and contact members, comprising a spring member having one end connectible with said closure member and its other end connectible with a rotatable member having a suitable hand operated means at its outer end, a plunger for holding said closure member against rotation in said casing, and a cam means, operated by said hand operating means connectible with said spring, for disengaging said plunger from suitable apertures in said casing, or allow said plunger to engage other apertures in said casing to allow said spring to rotate said closure member in said casing and stop rotation of said closure member at the desired point.

13. In a device of the class described, a casing, a removable fuse element having a portion thereof adapted to form a closure for said casing, electrical contacts for said fuse element within said casing, contact members associated with said fuse element adapted to engage said contacts and a spring actuated and controlled means independent of said contacts for locking said closure in all positions of engagement between said contacts and contact members and to rotate said fuse element to engage or disengage said contacts and contact members, comprising a spring member having one end connectible with said closure member and its other end connectible with a rotatable member having a suitable hand operated means at its outer end, locking notches in said casing to be engaged by said plunger to prevent rotation of said closure within said casing, a cam actuated means for releasing said plunger from said notches in said casing on rotation of said hand operating means connectible with said spring to allow said spring to rotate said closure member in said casing, and a plurality of intermediate auxiliary locking notches in said casing to be engaged by said plunger and stop rotation of said closure member in said casing whenever the speed of rotation of said closure member is slower than that required to prevent arcing between the contacts and contact members.

Signed at Chicago, in the county of Cook and State of Illinois, this 20th day of June, A. D. 1927.

WILLIAM W. SLOANE.