Feb. 6, 1951 T. R. WELCH 2,540,466

ELECTROMAGNETIC SWITCH AND THERMALLY RELEASED SHORTING SWITCH

Original Filed Dec. 28, 1945

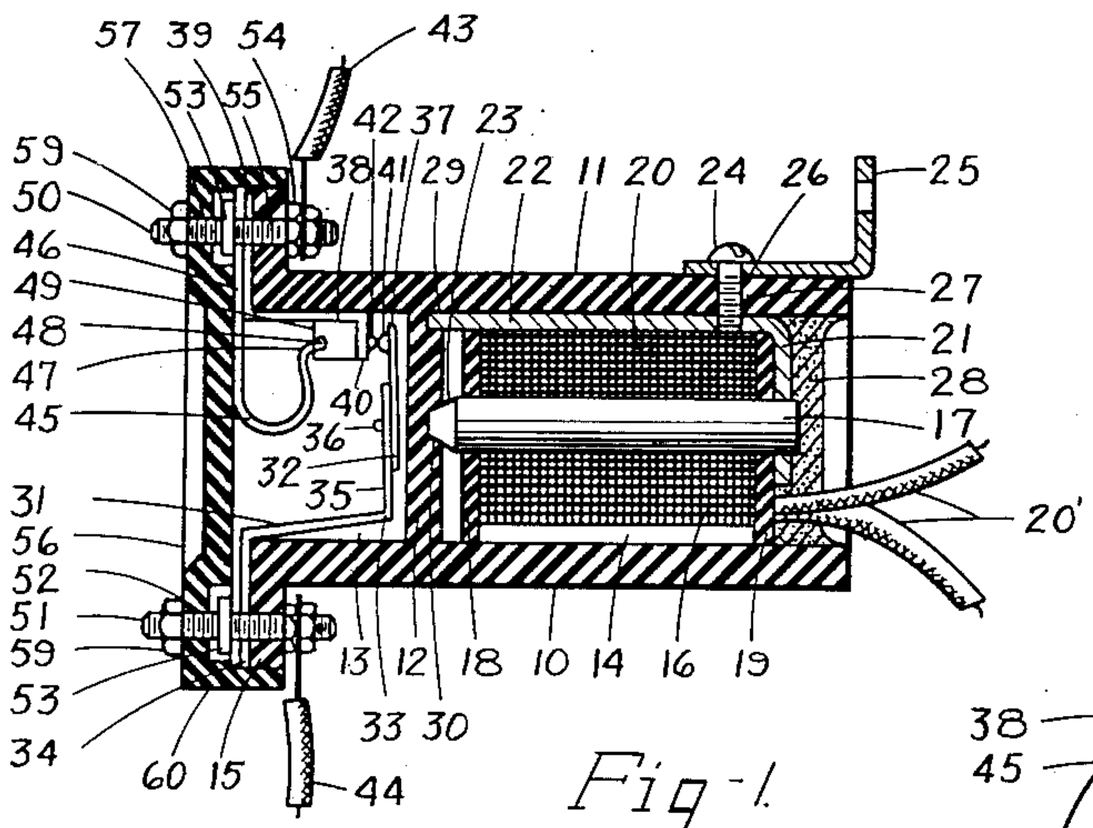

Fig-1.

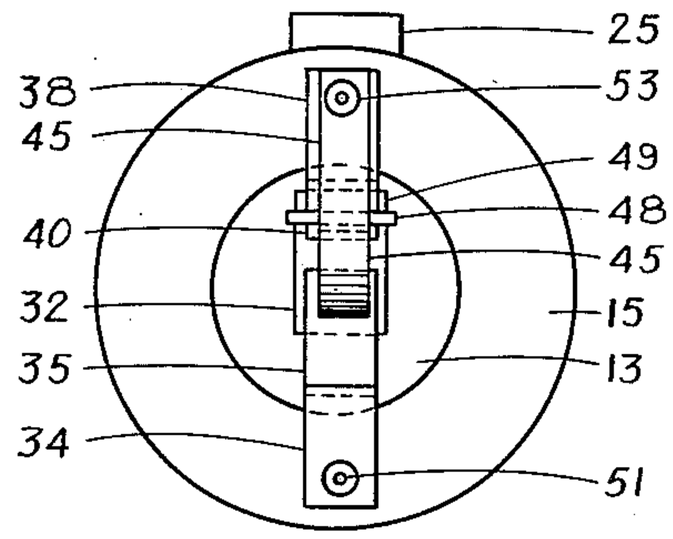

Fig-2.

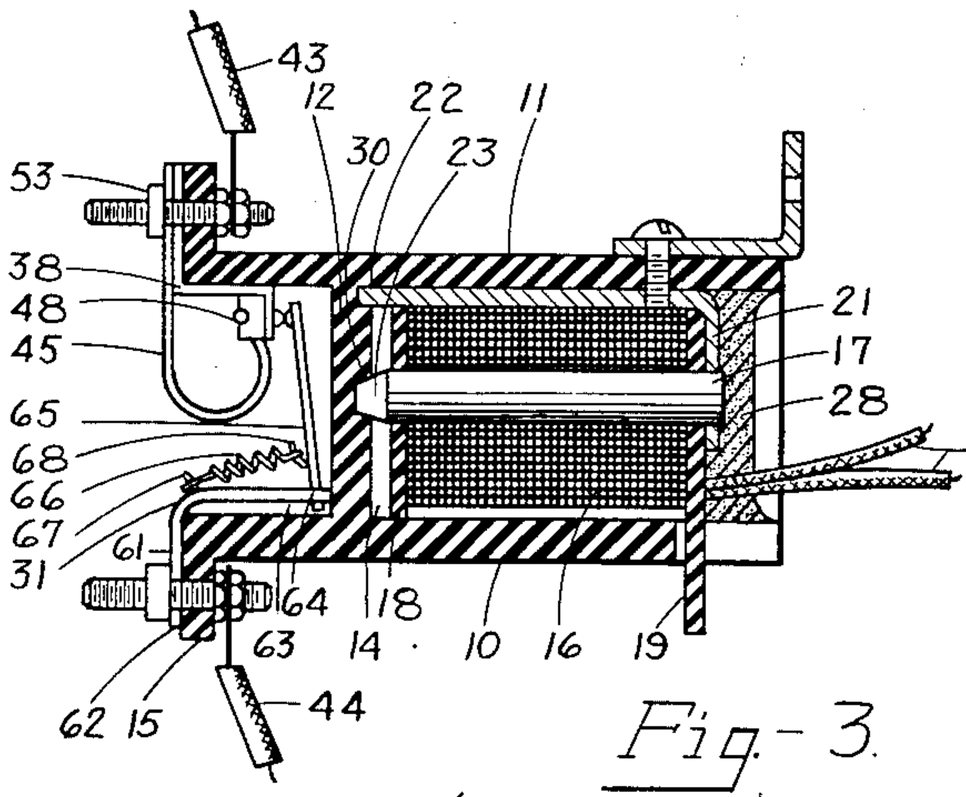

Fig.-3.

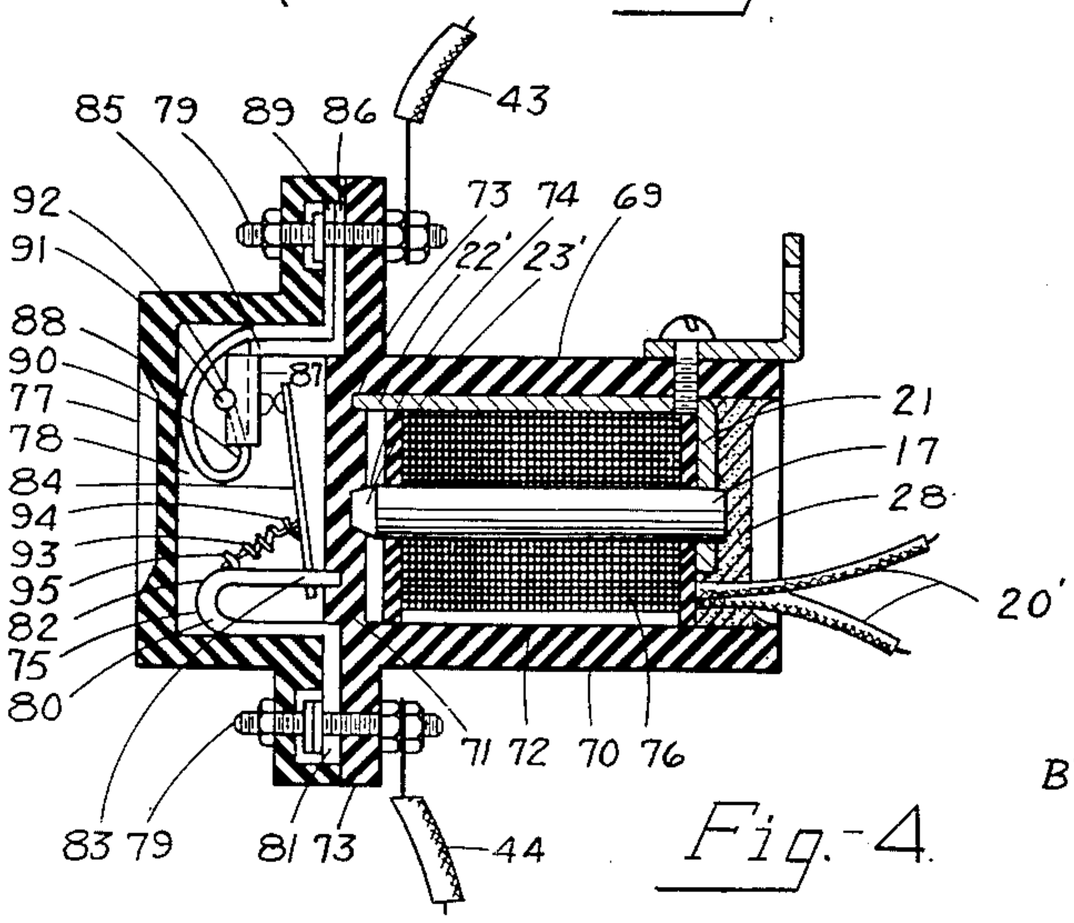

Fig.-4.

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ELECTROMAGNETIC SWITCH AND THERMALLY RELEASED SHORTING SWITCH

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Original application December 28, 1945, Serial No. 637,711, now Patent No. 2,490,182, dated December 6, 1949. Divided and this application March 13, 1947, Serial No. 734,448

13 Claims. (Cl. 200—88)

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My invention relates to a new and useful electromagnetic switch and thermally released shorting switch, of which the following specification is a division of my co-pending application Serial No. 637,711, filed December 28, 1945, now Patent No. 2,490,182, December 6, 1949, entitled Electric Sign.

This invention relates to a circuit controlling device and particularly to a control device of the type in which a low voltage circuit is employed to actuate the switching mechanism of a high voltage circuit.

The present invention, as well as that set forth in Patent No. 2,490,182 is particularly directed to an invention for use with an electric sign, such as set out in Letters Patent of the United States, Number 2,290,261 granted to me July 21, 1942.

It is the general object of the present invention to provide an electromagnetically actuated switch mechanism adapted to be operated in a novel manner, making it possible to control a high voltage circuit in response to the energization of a low voltage circuit.

A further object of my invention is to provide a simple switch mechanism wherein the high voltage terminals are spaced sufficiently that the danger of high voltage arcing is minimized.

A further object of my invention is to provide a switching mechanism, including a hollow body of insulating material, having a dividing wall so as to form isolated chambers, one to contain an electromagnet with the poles thereof in close proximity to one side of the dividing wall and a switch mechanism having an armature in close proximity to the other side of the dividing wall so that upon energization of the electromagnet, the armature will be caused to move whereby the switch mechanism is actuated.

A further object of my invention is to provide a simple electromagnetic switch mechanism having spaced terminals for connection to a high voltage circuit with a simple safety means for operation between the terminals when excessive high potentials are encountered which may otherwise injure the contacts of the switch mechanism.

These and other objects of the invention will become apparent in the specification with reference to the accompanying drawings that illustrate preferred embodiments thereof, in which

Fig. 1 is a longitudinal sectional view of one embodiment of my invention.

Fig. 2 is a view of the left end of Fig. 1 with the cover removed.

Fig. 3 is a longitudinal sectional view of another form of my invention.

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Fig. 4 is a longitudinal sectional view of still another form of my invention.

In Fig. 1 I have shown a circuit control device 10 comprising a shell having a tubular wall 11 of insulating material supporting a transverse wall 12 disposed intermediate the ends of the wall 11 so that two chambers 13 and 14 are formed in the shell. The shell may be molded or otherwise formed from a suitable insulating material with one end thereof provided with a radial flange 15. The one chamber 14 is shown as having a greater axial length than the other chamber 13 and receives an electromagnet 16. The electromagnet 16 comprises a core 17 with end pieces 18 and 19 forming a spool to carry a winding 20.

Positioned at the rear end of the core 17 a flat metal field piece 21 is secured, this field piece 21 being bent so as to lie along one side of the electromagnet and is provided with a magnetic pole 22 adjacent the pole 23 formed by the front end of the core 17.

The electromagnet 16 may be secured in the chamber 14 by means of a screw 24 which passes through a bracket 25, an opening 26 in the wall 11 and threaded at 27 into the field piece 21. The electromagnet 16 may be sealed in the chamber 14 by pouring body 28 of pitch material or compound into the rear end of the chamber 14 so as to cover the rear end of the electromagnet 16. The poles 22 and 23 of the electromagnet 16 preferably rest in depressions 29 and 30 formed in the transverse wall 12 facing the chamber 14.

The chamber 13 of the control device 10 contains a magnetically actuated switch mechanism 31 comprising an armature 32 which may be a rectangular piece of flat soft iron disposed in spaced relation to the transverse wall 12 and so positioned that when the electromagnet 16 is energized through the leads 20', the magnetic flux will attract the armature 32 towards the poles 22 and 23 and against the transverse wall 12. The armature 32 is supported by a resilient member 33 preferably made from a flat strip of hard brass or bronze, bent to a Z-shaped form, so that one end 34 thereof will lie across the outer face of the flange 15 and its inner end 35 will project into the chamber 13 and secured as by means of rivets 36 to the armature 32. The free end 37 of the armature 32 has a contact 41 mounted thereon to cooperate with a contact member 42, which is supported on a supporting member 38 formed from a flat strip of conducting metal, bent to a reverse Z-shaped form so that one end 39 thereof will lie across the outer face of the flange 15, in a position substantially diametrically opposite to the outer portion 34 of the mem-

ber 33, and the inner end 40 of the supporting member 38 will project into the chamber 13 for cooperation with the armature 32.

As shown in Fig. 1 the support member 33 normally holds the armature 32 in a position that the contact member 41 on the armature 32 will be held with pressure against the contact member 42 on the support member 38. When the electromagnet 16 is energized the armature 32 will be moved toward the transverse wall 12 to carry the contacts 41 and 42 out of engagement with one another. The actuation of the switch 31 may be considered either the closing movement or the opening movement or both as it may be desired.

The control switch 10 is provided with a safety device 45 to bridge through the actuated switch 31 if the contacts 41 and 42 should be burned out resulting from arcing by excessive current passing through the leads 43 and 44. This safety device 45 as shown in Fig. 1, comprises a spring member 45' having one end 46 connected with the contact member 38 against the flange 15 and bowed so that its free end 47 may be held by a fuse element 48 in a recess 49 provided on the end portion 40 of the support 38. The operation of the safety device is as follows, if excessive current is temporarily passed through the leads 43 and 44 to burn out the contacts 41 and 42 the heat generated by the arcing is sufficient to melt the fuse element 48 allowing the free end 47 of the spring element 45' to move into contact with the member 33 thus bridging the section between and thereby closing the circuit from terminal 50 to terminal 51 and restoring the circuit to an operating condition.

The terminals 50 and 51 besides serving as connectors for the leads 43 and 44 also serve as fastening means for securing the spring member 45 and support member 38 and the support member 33 of the switch mechanism 31 to the face of the flange 15. The terminals 50 and 51 comprise screw means 52 having a head or nut 53 intermediate the ends thereof, to bear against the end portions 39 and 46, and 34, to clamp such end portions against the face of the flange member 15 when nuts 54 are applied to the ends of the screw means 52 which project through openings 55 in the flange 15. The terminals 50 and 51 also serve as fastening means for a cover or seal 56 that may enclose the switch mechanism 31, by mounting the cover 56 on the outer portion 58 of the screw means 52 through the openings 57 and securing the cover in place by nuts 59 applied to the ends of the screw means 52. The cover 56 may have a cylindrical lip 60 to extend around the edge of the face of the flange member 15.

In Fig. 2 I have shown a view of the right end of Fig. 1 with the cover removed showing the relative positions of the switching mechanism parts and the method of securing the members in their respective positions.

In Fig. 3 I have shown an alternative form of my control device with the cover removed. The use of a cover being optional. This form is substantially the same as that shown in Fig. 1, with the variation in the switching mechanism 31'. In this form of my invention the magnetically operated switch 31' comprises a rigid flat conductive metal support member 61 bent to an L-shaped form so that one end 62 will lie across the outer face of the flange member 15 and the other end portion 63 will project into the chamber 13. The end portion 63 has a cut out section to provide an opening 64 for the reception of an armature 65

which is held in place against the support member 61 by a coil spring 66 which has one end connected to a clip 67 formed on the support member 61 and its other end connected to a clip 68 formed on the armature 65. The free end of the armature 65 is held with pressure against a stationary contact member 38 positioned diametrically opposite the member 62. The safety device means 45 is mounted similarly to that shown in Fig. 1.

In Fig. 4 I have shown an alternative form of my control device eliminating the use of two chambers in the shell, the shell comprising a tubular wall 70 and a transverse wall 71 cooperating to form a single chamber 72 to receive the electromagnet 76. The pole pieces 22' and 23' extend into cavities or recesses 73 and 74 respectively in the transverse wall 71 facing the chamber 72, thereby providing a thin wall section in the wall 71 adjacent the end of the pole pieces 22' and 23'.

In this form of my invention the flange 73 of the shell 69 lies substantially in the same plane as the transverse wall 71 and the magnetically operated switch 75 may be disposed in a chamber 78 formed within a cover 77 of cup-shaped form which is secured to the outer face of the flange 73 by screw means 79.

The magnetically operated switch 75 comprises a rigid flat conductive metal support member 80 having one portion 81 secured to the outer face of the flange member 73 by means of one of the screw means 79. The free end of the support member 80 is bent outward and inward to form substantially a U portion 82 the end of which lies adjacent to the transverse wall 71. The end portion of the support member 80 has a cut out section to provide an opening 83 for the reception of an armature 84 which is held in place against the support member 80 by a coil spring 93 which has one end connected to a clip 94 formed on the armature 84 and its other end connected to a clip 95 formed on the support member 80. The armature 84 is disposed adjacent the wall 71 for movement towards the pole pieces 22' and 23' when the electromagnet 76 is energized but is normally in contact with a stationary contact member 85 biased by the coil spring 93.

The stationary contact member 85 comprises a rigid flat conductive metal support member 85 bent to substantially a Z-shaped form and having one portion 86 secured to the flange member 73 by means of one of the screw means 79, diametrically opposite to the outer portion 81 of the support means 80. The other end 86 of the support means 85 extends parallel to the transverse wall 71 but spaced therefrom so as to cooperate with the armature 84.

A safety device 88 is provided to bridge the actuated switch 75 for the high voltage current if the contacts of the switching mechanism are burned out by excessive high current passing through the leads 43 and 44. This safety device 88 is shown to comprise of a spring member 88 having one end portion 89 seated on the flange member 73 and held in place by screw means 79. The free end 90 of the spring member 88 is bowed and held by a fuse member 91 in a recess 92 formed in the end portion 87 of the support member 85. Excessive current passing through the leads 43 and 44 that is sufficient to burn out the contacts, will generate sufficient heat to melt the fuse element 91 so as to allow the free end 90 of the spring member 88 to move into contact

with the armature 84 to close a circuit between the leads 43 and 44.

The screw means 79 besides serving as a fastening means for switch parts by retaining them against the face of the flange 73 also serve as terminals for the leads 43 and 44 and as a fastening means for the cover 77 against the face of the flange 73.

From the foregoing description and the several forms illustrated it will be seen that I have provided an electromagnetically actuated switch mechanism which may be economically manufactured, is efficient and durable in operation and capable of modification and rearrangement without departing from the spirit and scope thereof.

I claim as my invention:

1. In a switch device of the character described: a tubular shell of insulating material, said shell having a transverse wall of insulating material intermediate its ends which forms an insulating barrier in said shell so as to form in said shell an inner chamber and an outer chamber; an electromagnet disposed in said inner chamber adjacent said transverse wall; an armature in said outer chamber adjacent said transverse wall, said armature being readily movable in response to the magnetic flux of said electromagnet; a strip of metal suitably mounted in said outer chamber to movably support said armature and conduct electrical energy thereto; a switch contact member suitably mounted in said outer chamber and positioned to be engaged by said armature when said armature is in one of its operative positions; a flexible member having one end thereof permanently associated with said switch contact and having its free end held against said switch contact by a fuse element and said free end being adapted when released by said fuse element to move into engagement with said strip of metal; a cover for said outer chamber; means for connecting conductors to said metal strip and said switch contact; and means for connecting the inner end of said tubular shell to a support.

2. In a switch device of the character described, the combination of: a hollow shell of insulating material, said shell having a barrier of insulating material intermediate its ends so as to form in said shell an inner chamber and an outer chamber; an electromagnet disposed in said inner chamber adjacent said barrier; an armature in said outer chamber adjacent said barrier, said armature being adapted to be moved by said electromagnet; a strip of metal suitably mounted in said outer chamber to movably support said armature and conduct electric energy thereto; a switch contact member suitably mounted in said outer chamber diametrically opposite said strip of metal and formed to be engaged by said armature when said armature is in one of its operative positions; a flexible metal strip having one end thereof fixed to said switch contact and having its free end held against said switch contact by a fuse element, said free end being adapted when released by said fuse element to move into engagement with said strip of metal; and means for connecting conductors to said metal strip and said switch contact.

3. In a switch device of the character described, the combination of: a tubular shell of insulating material, said shell having a transverse barrier of insulating material intermediate its ends so as to form an inner chamber and an outer chamber; an electromagnet disposed in said inner chamber adjacent said transverse barrier; an armature in said outer chamber adjacent said barrier, said armature being adapted to be moved by said electromagnet; a strip of metal suitably mounted in said outer chamber to movably support said armature and conduct electrical energy thereto; a switch contact member suitably mounted in said outer chamber diametrically opposite said metal strip and formed so as to be engaged by said armature when said armature is in one of its operative positions; a flexible metal contact having one end secured to said switch contact and formed in a bow by holding its free end in engagement with said switch contact by means of a fuse element, said free end being adapted to move sufficiently far to engage said metal strip when released by said fuse element for closing the gap between said switch contact and said metal strip if said switch contact is burned out by high voltage current; and means for connecting conductors to said switch contact and said metal strip.

4. In a switch device of the character described: a tubular shell of insulating material having a barrier of insulating material intermediate its ends so as to form in said shell an inner chamber and an outer chamber, said shell having adjacent the outer chamber a radially extending flange; an electromagnet disposed in said inner chamber adjacent said barrier; an armature in said outer chamber adjacent said barrier, said armature comprising an electro-conductive material; a strip of metal extending from said flange into said outer chamber to movably support said armature and conduct electrical energy thereto; and a stationary switch contact member extending from said flange into said outer chamber to a position whereby said contact member will be engaged by said armature when the latter is in one of its operative positions.

5. In a switch device of the character described, the combination: a tubular shell of insulating material having a transverse barrier of insulating material adjacent one end thereof to form a chamber within the shell, said shell having a radially extending flange adjacent the outer end thereof; an electromagnet disposed in said chamber on one side of said transverse barrier; an armature adjacent the other side of said transverse barrier; a support member connected to said flange and movably supporting said armature; a stationary switch contact element supported on said flange in spaced relation to said support member and positioned whereby said contact element and said armature will be in engagement when said armature is in one of its operative positions; spring means biased between said support member and said armature whereby pressure is exerted against said stationary contact element; and means for connecting conductors to said support member and said contact element.

6. In a switch device of the character described: a hollow casing of insulating material having a radial flange adjacent one end thereof, said housing having a barrier therein of insulating material so as to form a chamber therein; an electromagnet disposed in said chamber adjacent one face of said barrier; an armature disposed adjacent the other face of said barrier, said armature comprising an electro-conductive material; a metal support extending from said flange to said barrier to movably support said armature and conduct electrical energy thereto; a switch contact element extending from said

flange in spaced relation to said metal support and laying across said barrier but spaced therefrom whereby it engages said armature when said armature is in one of its operative positions; and a spring biasing said armature whereby pressure is exerted by said armature against said contact element.

7. In a switch device of the character described, the combination of: a tubular shell of insulating material having a transverse barrier of insulating material intermediate its ends so as to form in said shell an inner chamber and an outer chamber, and having an outward extending radial flange at the outer end thereof; an electromagnet disposed in said inner chamber adjacent said transverse barrier; an armature in said outer chamber adjacent said transverse barrier, said armature comprising an electro-conductive material; a strip of metal forming a support for said armature, said strip of metal having an outer portion overlaying the outer face of said flange; a switch contact member overlaying the outer face of said flange and diametrically opposite to said strip of metal, and extending into said outer chamber to a position for engagement with said armature when said armature is in one of its operative positions; fastening means extending through said flange and through said strip of metal and said contact member whereby said strip of metal and contact member are retained on said flange; and conductor means connected to said fastening means.

8. In a switch device of the character described, the combination of: a tubular shell of insulating material having a transverse barrier wall of insulating material intermediate its ends so as to form in said shell an inner chamber and an outer chamber, and having an outwardly extending radial flange formed at the outer end thereof; an electromagnet disposed in said inner chamber adjacent said transverse wall; an armature in said outer chamber adjacent said transverse wall, said armature comprising an electro-conductive material; a strip of metal forming a support for said armature, said strip of metal having a portion overlaying the outer face of said flange; a switch contact member in spaced relation to said strip of metal and having an outer portion overlaying the outer face of said flange, and extending into said outer chamber to a position for engagement with said armature when said armature is in one of its operative positions; a cover overlaying the outer face of said flange so as to close said outer chamber; and fastening means through said flange and said cover for retaining said strip of metal and said contact means in position and serving as an attachment for conductor means.

9. In a switch device of the character described, the combination of: a tubular shell having a transverse electrically insulating barrier and an outwardly projecting radial flange, there being a chamber in said shell adjacent the inner face of said transverse barrier; an electromagnet in said chamber adjacent said inner face of said transverse barrier; an armature lying adjacent the outer face of said transverse barrier in position to be attracted when said electromagnet is energized; a spring element for supporting said armature in spaced relation to the outer face of said transverse barrier, the outer end of said spring element extending across the outer face of said flange; a movable contact carried by said armature; and a stationary contact element positioned so as to be engaged by said movable contact, said stationary contact element having an outer portion extending across the outer face of said flange in spaced relation to the outer portion of said spring element.

10. In a switch device of the character described, the combination of: a tubular shell having an outward projecting radial flange and a transverse wall providing an electrical barrier and forming a chamber in said shell adjacent one face of said transverse wall; an armature lying adjacent the other face of said transverse wall in a position to be attracted when said electromagnet is energized; a spring element for supporting said armature in spaced relation to the face of said transverse wall, the outer portion of said spring element extending across the outer face of said flange; a movable contact carried by said armature; a stationary contact element positioned so as to be engaged by said movable contact, said stationary contact element having a portion extending across the outer face of said flange in spaced relation to the outer portion of said spring element; screw means for securing said spring element and said stationary contact element to said flange and whereby connection may be made by conductors to said spring element and said stationary contact element; and a cover overlaying the outer face of said flange so as to conceal said armature and held in place by said screw means.

11. In a switch device of the character described, the combination of: a transverse wall of insulating material; an electromagnet disposed adjacent one side of said transverse wall; a movable armature operatively disposed adjacent the other side of said transverse wall whereby said armature may be operated by said electromagnet when said electromagnet is energized; primary switch means associated with said armature so as to be actuated thereby, said primary switch means including switch contacts; a pair of terminals for connecting high voltage conductors to said primary switch means; and a secondary switch means having two end portions, one end portion being connected to one of said terminals and the other end being releasably held to said primary switch means by a fuse element in heat exchange relation with the contacts of said primary switch means and being adapted, upon release by said fuse element, to bridge said primary switch contacts when said primary switch means encounters high potentials sufficient to injure said primary switch means.

12. In a switch device of the character described: a transverse wall of insulating material; an electromagnet disposed adjacent one side of said transverse wall; a movable armature operably disposed adjacent the other side of said transverse wall whereby said armature may be operated by said electromagnet when the latter is energized; primary switch means associated with said armature so as to be actuated thereby, said primary switch means including switch contacts; means for connecting electrical conductors to said primary switch means; and secondary switch means having two end portions, one end portion being fixed and the other end portion being releasably held by a fuse element in heat exchange relationship with the primary switch contacts, said secondary switch means bridging the primary switch contacts upon release by said fuse element.

13. In a switch device of the character described: a transverse wall of insulating material; an electromagnet disposed adjacent one side of

said transverse wall; a movable armature operably disposed adjacent the other side of said transverse wall whereby said armature may be operated by said electromagnet when the latter is energized; primary switch means associated with said armature so as to be actuated thereby, said primary switch means including switch contacts; means for operably connecting high voltage conductors to said primary switch means; secondary switch means having end portions, one of said end portions being fixed; and a fuse element in heat exchange relation to the primary switch contacts, said fuse element releasably holding the other end portion of said secondary switch means in an open position, said secondary switch means, upon release by said fuse element, bridging the primary switch contacts.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
586,888	Williams	July 20, 1897
1,282,426	Hynes	Oct. 22, 1918
1,345,537	Eastman	July 6, 1920
1,442,489	Mallory	Jan. 16, 1923
1,628,802	Perrem	May 17, 1927
1,654,646	Hartwig	Jan. 3, 1928
1,728,038	Burstyn	Sept. 10, 1929
2,009,892	Leece	July 30, 1935
2,379,772	Scotia	July 3, 1945