Sept. 8, 1953 S. I. LINDELL 2,651,694

ELECTRIC FUSE SWITCH CONSTRUCTION

Filed April 26, 1950 4 Sheets-Sheet 1

Fig. 1

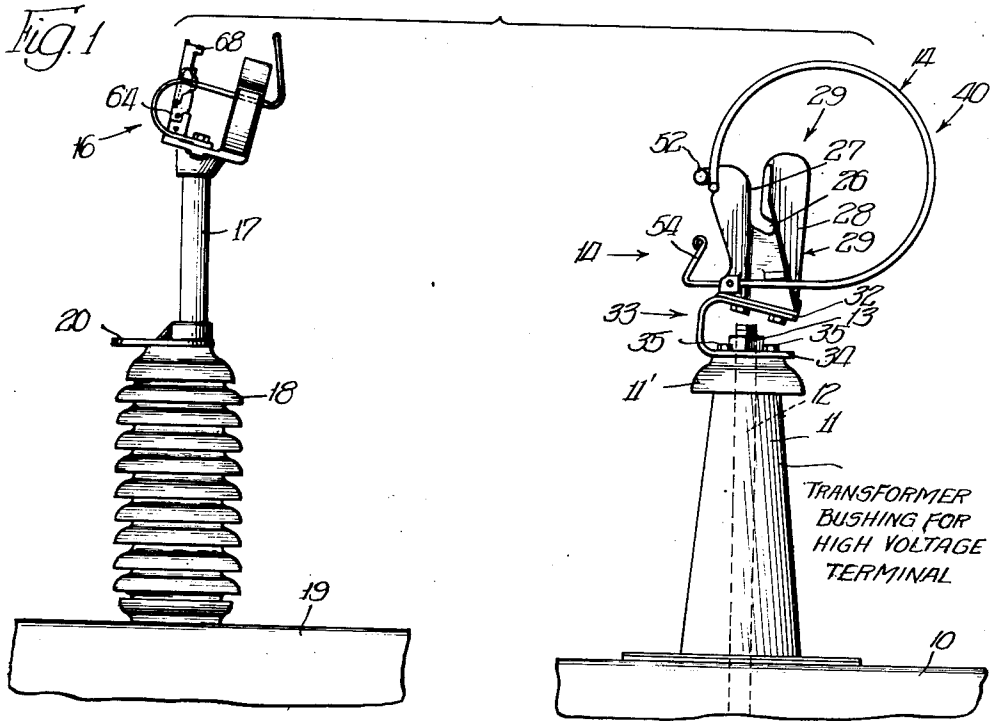
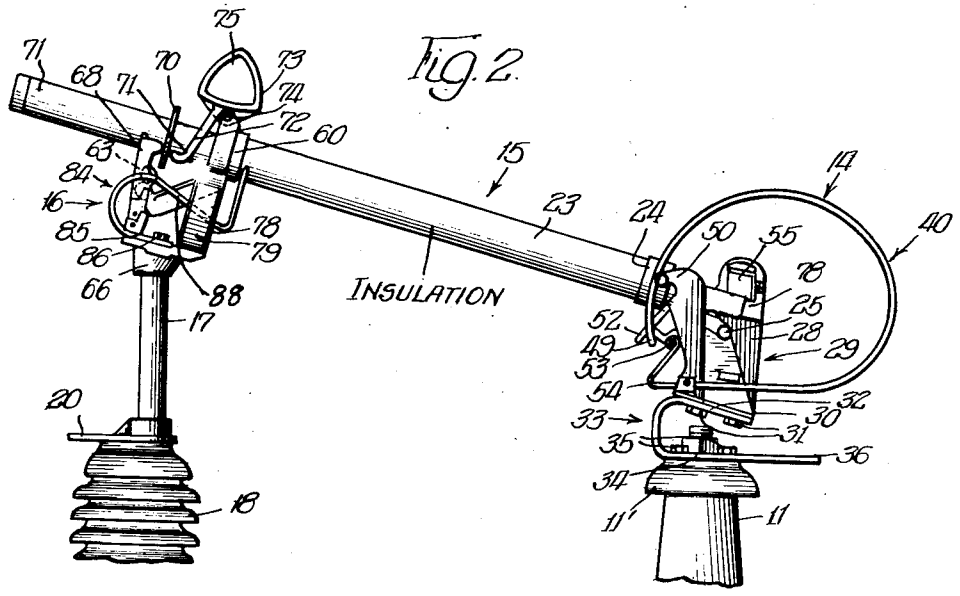


Fig. 2



INVENTOR.
Sigurd I. Lindell,
BY
Robert R. Lockwood
Atty.

Sept. 8, 1953 S. I. LINDELL 2,651,694

ELECTRIC FUSE SWITCH CONSTRUCTION

Filed April 26, 1950 4 Sheets-Sheet 2

Fig. 3.

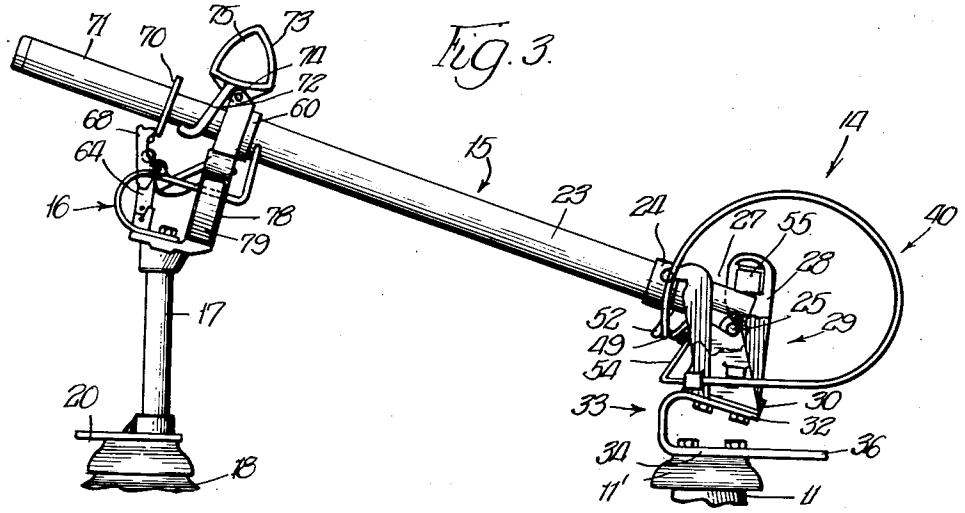


Fig. 4

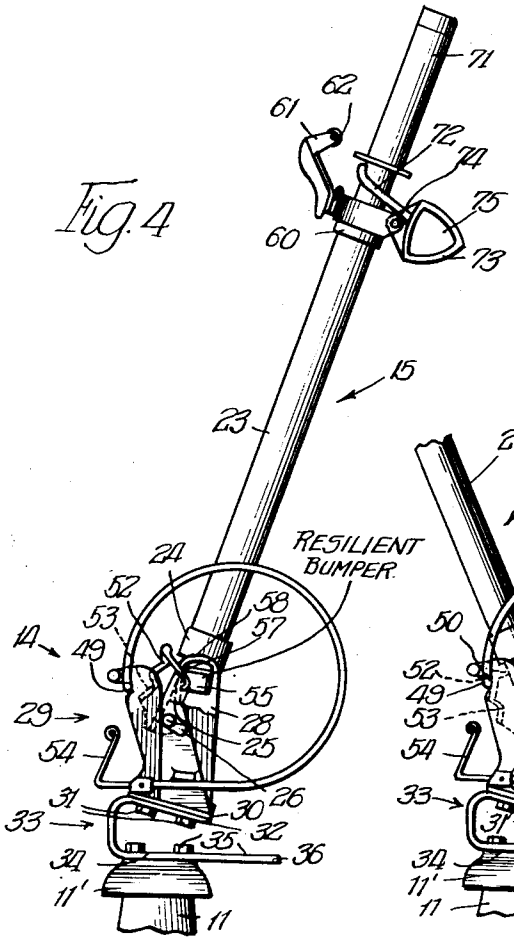
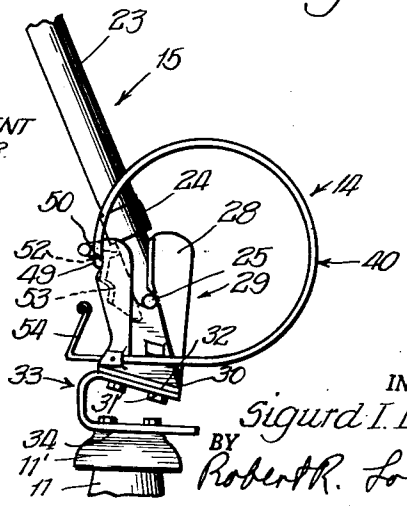


Fig. 5



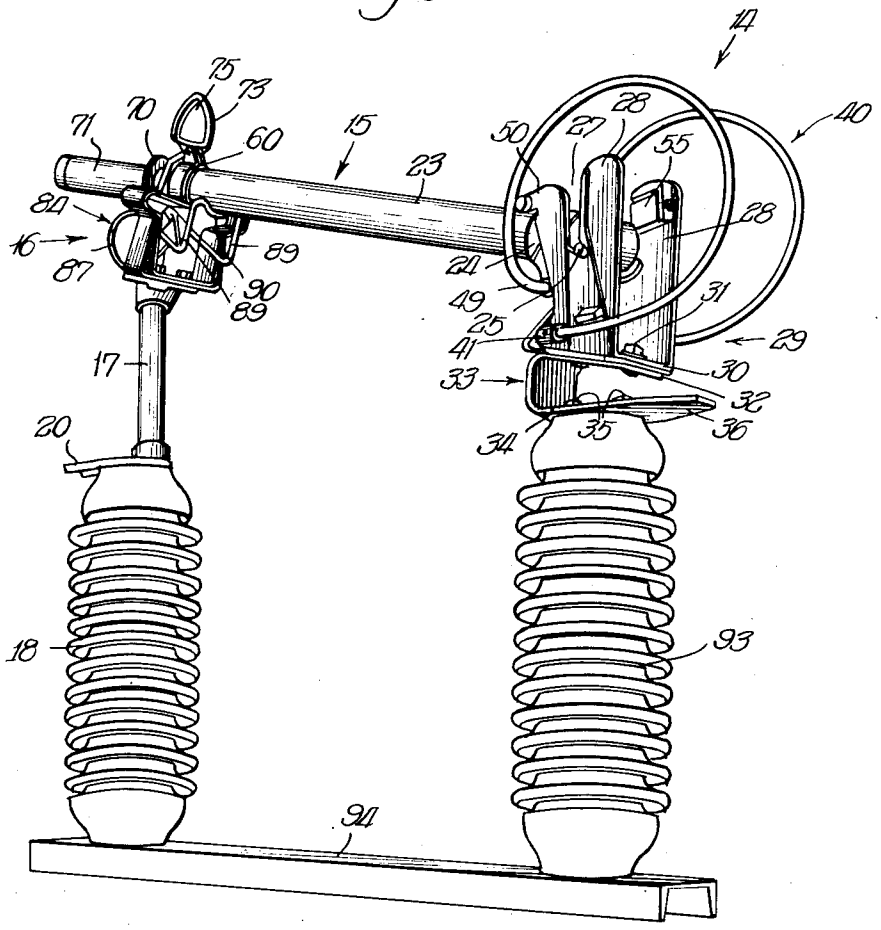
INVENTOR.
Sigurd I. Lindell,
BY
Robert R. Lockwood
Atty.

Sept. 8, 1953 S. I. LINDELL 2,651,694

ELECTRIC FUSE SWITCH CONSTRUCTION

Filed April 26, 1950 4 Sheets-Sheet 3

Fig. 6



INVENTOR.
Sigurd I. Lindell.
BY
Robert R. Lockwood
Atty

Sept. 8, 1953 S. I. LINDELL 2,651,694

ELECTRIC FUSE SWITCH CONSTRUCTION

Filed April 26, 1950 4 Sheets-Sheet 4

Fig. 7

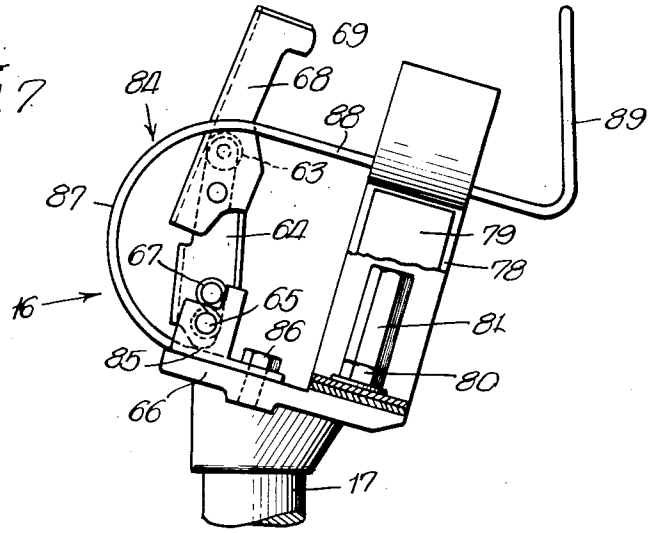
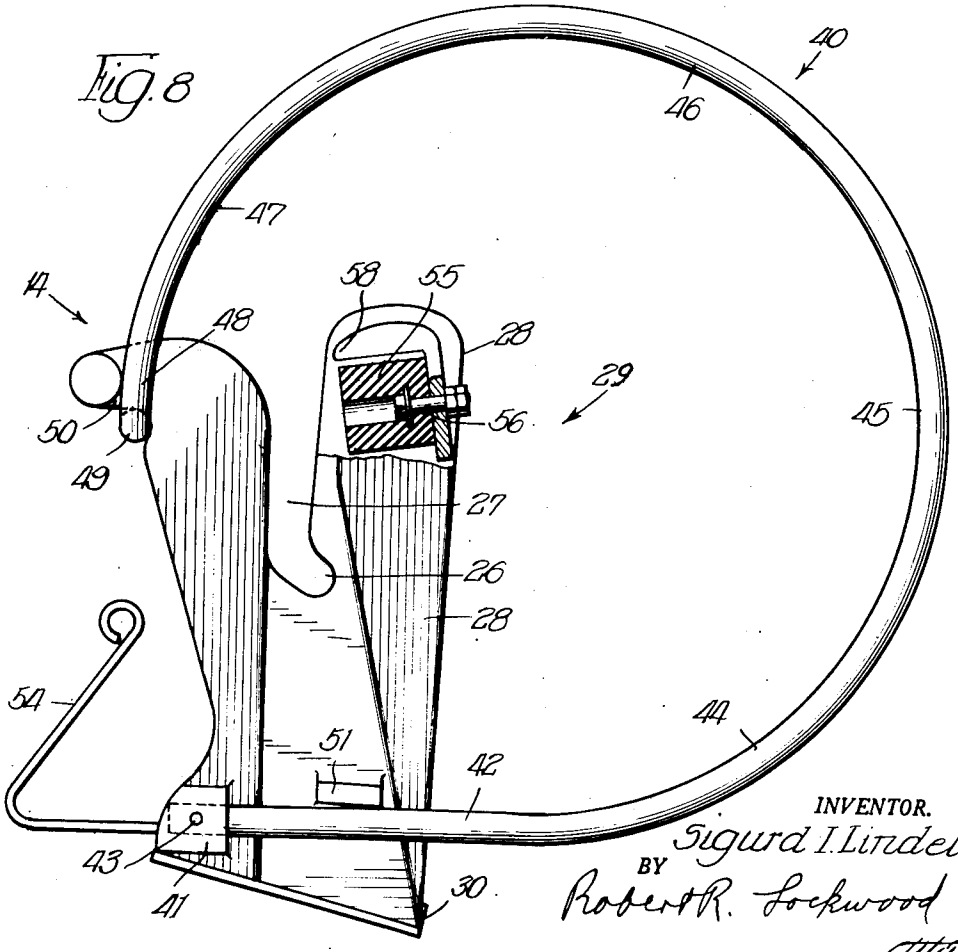


Fig. 8



INVENTOR.
Sigurd I. Lindell,
BY
Robert R. Lockwood
atty.

Patented Sept. 8, 1953

2,651,694

UNITED STATES PATENT OFFICE

2,651,694

ELECTRIC FUSE SWITCH CONSTRUCTION

Sigurd I. Lindell, Chicago, Ill., assignor to S & C Electric Company, Chicago, Ill., a corporation of Delaware

Application April 26, 1950, Serial No. 158,264

17 Claims. (Cl. 200—114)

1

This invention relates, generally, to automatically disconnecting high voltage high interrupting capacity electric fuse switches and it has particular relation to such devices having relatively great size and weight arranged for mounting on an insulator bushing whose strength is relatively slight, such as the bushing of a transformer containing a high voltage terminal, although its application is not so limited.

Among the objects of this invention are: To flexibly and pivotally mount on the high voltage terminal insulator bushing of a transformer an automatically disconnecting high voltage high interrupting capacity fuse; to arrange the fuse so as to be spring biased from a generally horizontal closed position to a generally vertical open position; to limit the impact incident to arresting the fuse in the open position to a practically attainable minimum; to accomplish this in part by arresting it in a substantially vertical position; to bias the fuse as aforesaid by a spring having a non-linear torque characteristic generally corresponding to the torque characteristic of gravity acting on the fuse to bias it toward the closed position as it moves therefrom to the open position; to construct the biasing mechanism so that it is capable of breaking loose from ice that might otherwise interfere with or prevent opening of the fuse switch; to apply the principal biasing torque for opening the fuse switch at its pivot end by a main spring; to pretension the main spring; to provide a biasing action at the other end of the fuse switch by an auxiliary or kicker spring to assist in initiating its opening movement and in overcoming the force of gravity; to pivotally mount the fuse switch on a hinge member and provide interengageable shoulders thereon for limiting the opening movement of the former; to resiliently mount the hinge member on the end of the bushing; to interpose a resilient stop between the fuse and the hinge member; to latch the fuse switch in the closed position by latch means on the end opposite the pivot end; and to elevate the latch end slightly above the pivot end.

Other objects of this invention will, in part, be obvious and in part appear hereinafter.

This invention is disclosed in the embodiment thereof shown in the accompanying drawings and it comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

2

For a more complete understanding of the nature and scope of this invention reference may be had to the following detailed description, taken together with the accompanying drawings, in which:

Figure 1 is a view, in side elevation, of a transformer bushing mounted on top of a transformer tank in horizontal spaced relation to another insulator or support, which might be a lightening arrester, and both arranged to carry at their upper ends a fuse switch;

Figure 2 is a view, similar to Figure 1, illustrating only the upper ends of the insulator bushing and insulator support and showing how a fuse which forms a part of the fuse switch is mounted thereon, the fuse switch being shown closed;

Figure 3 is a view similar to Figure 2 but showing the fuse in the position which it occupies immediately after it is unlatched from the closed position and starts to swing to the open position;

Figure 4 is a view, in side elevation, of the fuse in the position to which it is swung in the opening movement, the position here shown being at the extreme limit of travel permitted in the opening direction, about 20° past the vertical position;

Figure 5 is a view, similar to Figure 4, showing the fuse in the open position and at rest after recoil;

Figure 6 is a perspective view of the fuse switch construction in which the present invention is embodied mounted on a pair of vertically extending insulators which are spaced horizontally so that the fuse in its closed position lies in a generally horizontal position;

Figure 7 is a view in side elevation, at an enlarged scale, showing in more detail the construction of the latch terminal, certain parts being broken away; and

Figure 8 is a view, at an enlarged scale, showing the details of construction of the hinge terminal and operating assembly, certain parts being broken away.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 10 designates a portion of a transformer tank from which a vertical insulator bushing or support member 11 extends upwardly. Within the insulator bushing 11 there is provided a high voltage terminal 12 which may be in the form of a rod or in the form of a flexible conductor. It extends into the transformer tank 10 for connection to one of the high voltage terminals of the transformer as will be understood

readily. The terminal 12 extends through the upper end of the bushing 11 and is threaded for receiving a nut 13 which serves, in part, to clamp a hinge terminal and operating assembly, shown generally at 14, in place on the upper end of the threaded bushing 11.

In Figure 2 a fuse is illustrated, generally, at 15 that is arranged to be pivotally mounted on the hinge terminal and operating assembly 14. At its other end the fuse 15 is carried by a latch terminal and auxiliary operating assembly that is indicated, generally, at 16. A tubular conductor 17 is provided for carrying the latch terminal and auxiliary operating assembly 16 at its upper end. At its lower end the tubular conductor 17 is carried by a vertical porcelain insulator or support member 18 which, as illustrated, is spaced horizontally from the bushing 11. The tubular conductor 17 is employed to elevate the end of the fuse 15 carried thereby slightly with respect to the other end so that it will be more weatherproof. Generally, however, the fuse 15 is mounted in what is considered to be a horizontal position although, as illustrated in Figure 2 and described above, the fuse 15 in the closed position is inclined slightly to the horizontal.

Any suitable means such as a mounting frame 19 may be employed for supporting the lower end of the vertical insulator 18. A terminal pad 20 is located at the lower end of the tubular conductor 17 to permit connection of a line conductor thereto.

The fuse 15 together with the hinged terminal and operating assembly 14 and the latch terminal and auxiliary operating assembly 16 together constitute a fuse switch which, as shown in Figure 1, is arranged to close and open the circuit to one terminal of the high voltage winding of a transformer. The details of construction of the fuse 15 form no part of the present invention. For illustrative purposes the fuse construction disclosed in application Serial No. 663,834, filed April 22, 1946, now U. S. Patent No. 2,599,186, dated June 3, 1952, and assigned to the assignee of this application may be used. However, it will be understood that other fuse constructions can be employed if desired. Any suitable contact construction can be used. For example, the contact construction disclosed in application Serial No. 57,346, filed October 29, 1948, now U. S. Patent No. 2,578,255, dated December 11, 1951, and assigned to the assignee of this application may be used. It will be understood also that other types of contact construction can be employed as may be desired.

The fuse 15 includes a fuse tube 23 of insulating material having a terminal 24 at its lower end which is provided with trunnions 25 that are arranged to interfit with the lower end portion 26, Figure 8, of longitudinally extending slots 27 in upwardly extending arms 28 of a generally U-shaped hinge member, shown generally at 29. The hinge member 29 is formed preferably of good electrical conducting material such as red brass. Its lower central portion 30 is secured by bolts 31 to an upper arm 32 of a generally U-shaped resilient mounting adapter that is indicated, generally, at 33. Preferably the mounting adapter 33 is formed of a resilient conducting material such as Phosphor bronze or hard drawn copper. Its lower arm 34 may be secured by bolts 35 to the upper end of the insulator bushing 11 where a metallic cap 11' is provided for this purpose. In addition, as shown in Figure 1, the nut 13 on the threaded upper end of the terminal 12 also serves to hold the lower arm 34 in position on the cap 11'.

Where the insulator bushing 11 is merely another insulator, such as shown in Figure 6, the high voltage terminal 12 would be omitted. In such case the lower arm 34 may have an extension in the form of a terminal pad 36 to permit connection of another conductor thereto.

The provision and resilient construction of the mounting adapter 33 are important. It will be noted that the upper and lower arms 32 and 34 extend generally horizontally with the intermediate portion providing a flexible section therebetween. This flexible construction cushions to a considerable extent the shock that is incident to the stopping of the fuse 15 in the open position as shown in Figure 4. Insulator bushings 11 of the type shown in Figure 1 have different allowable cantilever loads which they are capable of withstanding. These are in the neighborhood of 75 to 100 pounds. For a fuse 15 designed for use in a circuit energized at a voltage of 69,000 volts the fuse 15 may weigh from 18 to 20 pounds with the terminals and fittings mounted thereon. This weight may be increased as much as 25 per cent where the fuse is coated with ice. While provision must be made for swinging the fuse 15 from the position shown in Figure 2 to the position shown in Figure 4, so that it will be operated alone or in the iced condition, it will be appreciated that a considerable amount of kinetic energy must be dissipated when the fuse is stopped in the generally vertical position. By employing the resilient mounting adapter 33, some of this energy is absorbed in further flexing it and thus the force to which the upper end of the insulator bushing 11 is subjected is reduced to within allowable limits.

Another factor that must be taken into consideration in swinging a fuse 15 from the generally horizontal position shown in Figure 2 to the generally vertical position shown in Figure 4 is the change in torque applied thereto by gravity which varies as the fuse 15 approaches the vertical position. Specifically the torque applied by gravity varies as the cosine of the angle between the fuse 15 and the horizontal from a maximum at zero degrees to a minimum at 90°. In order to avoid overshooting of the fuse 15 much beyond the vertical position, it is desirable that the biasing means which swings it to this position have a non-linear characteristic which approaches that applied by gravity to the fuse 15 in opposing its movement from the horizontal to the vertical position.

In accordance with this invention a non-linear U-shaped main spring 40 is employed for this purpose. It may be formed of Phosphor bronze wire and for use with fuses 15 having a rating of 69,000 volts it may have a diameter of $\frac{7}{16}$ inch. Apertured bosses 41, Figure 8, are provided on opposite sides of the hinge member 29 for receiving the free straight end portions 42 of the main spring 40. These end portions 42 may be secured in the bosses 41 by suitable pins 43. As shown more clearly in Figure 8 of the drawings, the main spring 40 is curved outwardly and upwardly on the side of the hinge member 29 away from the insulator or support member 18. In order to provide the non-linear characteristic, the general center of curvature of the spring 40 is offset from the axis of rotation of the fuse 15 through the trunnions 25. Further, intermediate portions of the arms of the U-shaped main spring 40 are curved on different radii. For example in

the spring construction referred to above the portion indicated at 44 may have a radius of $6\frac{3}{32}$ inches when the main spring 40 is completely unstressed. The portions 45, 46 and 47 have radii respectively as follows: $7\frac{3}{16}$ inches, $5\frac{13}{32}$, and $4\frac{13}{16}$ inches. The joined end portions 48 of the U-shaped main spring 40 are interconnected by a central portion 49 which extends underneath stop shoulders 50 that are formed integrally with the upwardly extending arms 28 of the hinge member 29 on the side toward the vertical insulator or support member 18. In the position of the main spring 40, as shown in Figure 8, where the central portion 49 is in engagement with the stop shoulders 50, the spring 40 is in a prestressed condition. That is, if the stop shoulders 50 were removed, the central portion 49 would occupy a position substantially higher and to the right of the position shown in Figure 8. By prestressing the main spring 40 it is possible to employ it in a region where the torque exerted thereby is at a maximum for initiating the movement of the fuse 15 from the generally horizontal position while requiring a minimum of movement of the central portion 49 and flexing of the main spring 40 to store energy for effecting this operation.

By providing the main spring 40 with a relatively large free length, the breaking loose under icing conditions is facilitated. When ice collects on the arms of the main spring 40, as soon as it begins to flex for swinging the fuse 15 to the open position, the ice thereon is cracked and falls away. Thus there is substantially no interference in the operation of the fuse 15 under icing conditions when the main spring 40 of the character and construction described herein is employed. Abutments in the form of bosses 51 are located on the outer sides of the upwardly extending arms 28 and bear against the straight end portions 42 of the main spring 40 for holding them in position. The bosses 51 are formed integrally with the hinge member 29.

As shown in Figure 4 an abutment 52 is formed on the terminal 24 and, as shown in Figure 2, is arranged to engage the central portion 49 of the main spring 40. It is through the abutment 52 that the main spring 40 transmits its operating torque to the fuse 15. In the open position, as shown in Figure 5, the abutment 52 engages the central portion 49 which, in this position, is restrained by the stop shoulders 50 in the prestressed condition of the spring 40. When the fuse 15 is swung from the open position, shown in Figure 5, to the closed position, shown in Figure 2, the central portion 49 of the spring 50 is picked up by the abutment 52 and is carried downwardly to further tension the main spring 40.

Adjacent the abutment 52 there is provided a convex contact engaging portion 53 on the terminal 24 that is arranged to be engaged by a contact finger 54 which is carried by the hinge member 29. The construction of these contact members is set forth in more detail in the application referred to above.

As a further means of decreasing the shock incident to the stopping of the fuse 15 in the position shown in Figure 4, a rubber bumper 55, Figure 8, is provided on each of the upwardly extending arms 28 on the inner side thereof. Each rubber bumper 55 is held in position by a bolt 56. It will be understood that, when the fuse 15 is swung to the position shown in Figure 4, it engages the bumpers 55 which act as shock absorbers. Since they are carried by the relatively rigid and heavy hinge member 29 that in turn is resiliently mounted on the resilient mounting adapter 33, the shock absorbing action of the mounting is further enhanced.

With a view to preventing the fuse 15 from being thrown out of the hinge member 29 when it is stopped in the position shown in Figure 4, shoulders 57, Figure 4, are provided on opposite sides of the terminal 24 and they are arranged to engage shoulders 58, Figure 8, which extend inwardly from the upper ends of the arms 28 of the hinge member 29. In the position shown in Figure 4, the shoulders 57 are in engagement with the shoulders 58 and the trunnions 25 have been moved out of the lower end portions 26 of the slots 27. However, the construction is such that the trunnions 25 bear against the left hand side of the slots 27, as viewed in the drawings, and they, together with the interengaging shoulders 57 and 58, prevent the fuse 15 from being thrown out of the hinge member 29. As described hereinbefore, the shock, incident to the stopping of the fuse 15 in the position shown in Figure 4 is absorbed partly by the rubber bumpers 55, partly by the resilient mounting adapter 33 and the balance is absorbed by the insulator bushing 11 or its equivalent insulator, such as that shown in Figure 6.

Provision is made at the upper end of the fuse 15 for latching it to the latch terminal and auxiliary operating assembly 16. For this purpose a terminal 60 is positioned at the upper end of the fuse tube 23. Extending from the terminal 60, as shown in Figure 4, is a latch hook 61 which carries a roller 62 at its outer end. The roller 62 is arranged to engage behind a roller 63, Figures 2 and 7, that is carried by a latch lever 64 which is pivoted at 65 on a base member 66. As shown in Figure 7 the base member 66 is positioned on the upper end of the tubular conductor 17. A spring 67 cooperates with the latch lever 64 to bias the roller 63 so that it will engage the roller 62 and latch the fuse 23 in the closed position shown in Figure 2.

In order to move the roller 63 out of locking engagement with the roller 62 a pry out lever 68 is pivoted on the latch lever 64 near its forward end and it has nose portions 69 that are arranged to be engaged by a flange 70 for lifting the pry out lever 68 and thereby the latch lever 64. The flange 70 extends radially outwardly from a latch tube 71 that is slidably mounted on the upper end of the fuse 15. As described in more detail in U. S. Patent No. 2,599,186, referred to above, provision is made within the fuse 15 for causing the latch tube 71 to move from the position shown in Figure 2 to the position shown in Figure 3 on the occurrence of a predetermined overload for swinging the pry out lever 68 and the latch lever 64 to the unlatched position. This operation may be accomplished manually by means of a fork 72 which is arranged to engage the underside of the flange 70. The fork 72 constitutes a part of a hook stick release member 73 that is pivoted at 74 on the terminal 60. The hook stick release member 73 has an eye 75 for receiving the prong of a hook stick which permits the member 73 to be swung in a clockwise direction, as viewed in Figure 2, to cause the ends of the fork 72 to engage the underside of the flange 70 and move the latch tube 71 to the unlatching position.

Any suitable means can be employed for making good electrical contact between the base member 66 and the terminal 60. For this pur-

pose a U-shaped contact member 78 may be employed having a U-shaped reinforcing spring 79 as described in U. S. Patent No. 2,578,255, referred to hereinbefore. The U-shaped contact member 78 and correspondingly shaped reinforcing spring 79 may be secured to the upper side of the base member 66 by bolts 80, Figure 7. In addition a stop pin 81 is employed for determining the closed position of the fuse 15.

While the main spring 40 may be provided and arranged so that, when the fuse 15 is unlatched from the latch terminal and auxiliary operating assembly 16, it can by itself swing the fuse 15 to the open position shown in Figure 4, it is preferable to provide additional mechanism for assisting it in initiating the movement of the fuse 15 to the open position. Such assistance may be required when the mechanism is covered with ice and must be broken loose. For this purpose a generally U-shaped auxiliary or kicker spring, shown generally at 84, Figure 2, can be used. The free ends 85 of the spring 84 are secured by bolts 86 to the upper side of the base member 66. The intermediate portions 87, Figure 7, of the arms forming the spring 84 are curved outwardly and upwardly on the side of the latch terminal and auxiliary operating assembly 16 away from the insulator bushing 15. These intermediate portions 87 have straight portions 88 extending therefrom which terminate in end portions 89 that are joined by a central curved portion 90. As shown more clearly in Figure 6, the central curved portion 90 bears against the underside of the fuse tube 23 adjacent the terminal 60. When the fuse 15 is closed, as shown in Figure 2, the straight portions 88 of the spring 84 are inclined downwardly toward the free ends 85. In the open position of the fuse 15, the straight portions 88 are generally parallel to the free ends 85 as shown in Figure 7. For illustrative purposes it is pointed out that the auxiliary or kicker spring 84 may be formed of Number 4 Phosphor bronze wire. The intermediate portion 87 in the unstressed condition may have a radius of $1\frac{11}{16}$ inches. The straight portions 88 are about $4\frac{3}{8}$ inches long. The inclined end portions 89 are about $2\frac{3}{4}$ inches long. The arms of the U-shaped auxiliary or kicker spring 84 may be spaced about 4 inches apart.

In Figure 6 of the drawings, the alternate construction referred to hereinbefore is illustrated. A second insulator 93 is employed which may be a duplicate of the vertical insulator 18. As shown the insulators 18 and 93 may be mounted on a channel base 94. Of course, it is possible to have the insulator 18 in Figure 6 longer than the insulator 93 and to then dispense with the tubular conductor 17 which is employed to locate the fuse 15 in the inclined position. However, since the insulator 93 must be long enough to withstand the rated line voltage, the additional insulation provided by the longer insulator 18 is unnecessary and is more expensive than it is to provide the tubular conductor 17.

Since certain further changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter shown in the accompanying drawings and described hereinbefore shall be considered as illustrative and not in a limiting sense.

What is claimed as new is:

1. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position, comprising, in combination, horizontally spaced insulating support members, a fuse pivotally mounted on one support member to swing upwardly and latched to the other support member, and spring means reacting between said one support member and said fuse to swing it upwardly on unlatching of the same from said other support member, said spring means being characterized by applying to said fuse a diminishing torque corresponding generally to and opposing the torque applied to said fuse by gravity and acting principally in a vertical direction on said fuse to swing it from closed to open position whereby the torque exerted by said spring means in opening said fuse decreases generally in the same proportion that the torque exerted by gravity biasing said fuse closed decreases.

2. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position comprising, in combination, horizontally spaced insulating support members, a fuse pivotally mounted on one support member to swing upwardly and latched to the other support member, generally C-shaped spring means reacting between said one support member and said fuse to swing it upwardly on unlatching of the same from said other support member, the effective center of curvature of said C-shaped spring means being offset from the pivot axis of said fuse so that the torque applied thereby to said fuse corresponds generally to and opposes the torque applied to said fuse by gravity and acts principally in a vertical direction on said fuse to swing it from closed to open position whereby the torque exerted by said C-shaped spring means in opening said fuse decreases generally in the same proportion that the torque exerted by gravity biasing said fuse closed decreases, and additional spring means reacting between said other support member and said fuse and acting to swing the same upwardly on unlatching thereof to provide a thrust thereon in addition to that applied by said C-shaped spring means for breaking said fuse loose under all operating conditions.

3. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position comprising, in combination, horizontally spaced insulating support members, a fuse pivotally mounted on one support member to swing upwardly and latched to the other support member, spring means reacting between said one support member and said fuse to swing it upwardly on unlatching of the same from said other support member, said spring means being characterized by having more energy stored therein than is necessary to swing said fuse past its vertical position, and stop means cooperating with said spring means to limit the movement thereof and cause the same to disengage said fuse in advance of its reaching the vertical position thereof and before said energy stored in said spring means has been released completely whereby said fuse thereafter continues to swing substantially only under the influence of the momentum previously acquired from said spring means.

4. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position comprising, in combination, horizontally spaced insulating support members, a fuse pivotally mounted on one support member to swing upwardly and latched to the other support member, spring means re-

acting between said one support member and said fuse to swing it upwardly on unlatching of the same from said other support member, said spring means being characterized by having more energy stored therein than is necessary to swing said fuse past its vertical position, stop means cooperating with said spring means to limit the movement thereof and cause the same to disengage said fuse in advance of its reaching the vertical position thereof and before said energy stored in said spring means has been released completely whereby said fuse thereafter continues to swing substantially only under the influence of the momentum previously acquired from said spring means, and additional spring means reacting between said other support member and said fuse and acting to swing the same upwardly on unlatching thereof to provide a thrust thereon in addition to that applied by the first mentioned spring means for breaking said fuse loose under all operating conditions likely to be encountered.

5. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position comprising in combination, horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a fuse pivotally mounted on the other arm of said mounting adapter to swing upwardly and latched to the other support member, and spring means reacting between said other arm of said adapter and said fuse to swing it upwardly on unlatching of the same from said other support member.

6. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a hinge member carried by one of said support members, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member and the intermediate portions of its arms being curved outwardly and upwardly on the side of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly; a fuse including a fuse tube having terminals at its ends, one of said terminals being pivotally mounted on said hinge member and being arranged and adapted to cooperate with said joined ends of said main spring to tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

7. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped hinge member having its lower central portion secured to one of said support members, stop means on the upwardly extending arms of said U-shaped hinge member on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a fuse including a fuse tube having terminals at its ends, one of said terminals being pivotally mounted on said arms of said hinge member and being arranged and adapted to cooperate with said joined ends of said main spring to further tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

8. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped hinge member having longitudinally slotted upwardly extending arms with shoulders extending inwardly at their upper ends and its lower central portion secured to one of said support members, stop means on said upwardly extending arms on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a removable fuse including a fuse tube having terminals at its ends, one of said terminals having trunnions for interfitting with the slots in said arms of said hinge member to removably hingedly mount said fuse and shoulders for engaging said shoulders on the upper ends of said arms of said hinge member to limit the opening movement of said fuse, said one terminal having an abutment for cooperating with said joined ends of said main spring to further tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

9. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a generally U-shaped hinge member having its lower central portion secured to the other arm of said mounting adapter, stop means on the upwardly extending arms of said U-shaped hinge member on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away

from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a fuse including a fuse tube having terminals at its ends, one of said terminals being pivotally mounted on said arms of said hinge member and being arranged and adapted to cooperate with said joined ends of said main spring to further tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

10. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a generally U-shaped hinge member having longitudinally slotted upwardly extending arms with shoulders extending inwardly at their upper ends and its lower central portion secured to the other arm of said mounting adapter, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly; a removable fuse including a fuse tube having terminals at its ends, one of said terminals having trunnions for interfitting with the slots in said arms of said hinge member to removably hingedly mount said fuse and shoulders for engaging said shoulders on the upper ends of said arms of said hinge member to limit the opening movement of said fuse, said one terminal having an abutment for cooperating with said joined ends of said main spring to tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

11. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a generally U-shaped hinge member having longitudinally slotted upwardly extending arms and its lower central portion secured to the other arm of said mounting adapter, stop means on said upwardly extending arms on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a removable fuse including a fuse tube having terminals at its ends, one of said terminals having trunnions for interfitting with the slots in said arms of said hinge member to removably hingedly mount said fuse and having an abutment for cooperating with said joined ends of said main spring to further tension the same when said fuse is swung to its generally horizontal closed position and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position, and a generally U-shaped auxiliary spring with the free ends of its arms secured to opposite sides of said terminal means, the intermediate portions of its arms being curved outwardly and upwardly on the side of said terminal means away from said one support member and toward the same with the joined end portions extending upwardly underneath said fuse tube adjacent said other terminal and engaging said fuse for biasing the same upwardly.

12. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a generally U-shaped hinge member having longitudinally slotted upwardly extending arms with shoulders extending inwardly at their upper ends and its lower central portion secured to the other arm of said mounting adapter, stop means on said upwardly extending arms on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a removable fuse including a fuse tube having terminals at its ends, one of said terminals having trunnions for interfitting with the slots in said arms of said hinge member to removably hingedly mount said fuse and having an abutment for cooperating with said joined ends of said main spring to further tension the same when said fuse is swung to its closed position inclined slightly to the horizontal and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position.

13. A fuse switch comprising, in combination, a pair of horizontally spaced insulating support members, a generally U-shaped resilient mounting adapter with the arms thereof extending generally horizontally one above the other and one arm secured to one of said support members, a generally U-shaped hinge member having longitudinally slotted upwardly extending arms with shoulders extending inwardly at their upper ends and its lower central portion secured to the other arm of said mounting adapter, stop means on said upwardly extending arms on the side thereof facing the other support member, a generally U-shaped main spring with the free ends of its arms secured to opposite sides of said hinge member adjacent its central portion and the intermediate portions of its arms being curved outwardly and upwardly on the side of said arms of said hinge member away from said other support member and toward the same with the joined end portions extending downwardly and underneath said stop means and adapted to be restrained thereby with said main spring in prestressed condition; a removable fuse including a fuse tube having terminals at its ends, one of said terminals having trunnions for interfitting with the slots in said arms of said hinge member to removably hingedly mount said fuse and shoulders for engaging said shoulders on the upper ends of said arms of said hinge member to limit the opening movement of said fuse, said one terminal having an abutment for cooperating with said joined ends of said main spring to further tension the same when said fuse is swung to its closed position inclined slightly to the horizontal and whereby said fuse is biased by said main spring to a generally vertical open position, and the other terminal on said fuse tube having latch means and latch releasing means; and terminal means carried by said other support member including latch means for cooperating with said latch means on said other fuse tube terminal to hold said fuse in closed position, and a generally U-shaped auxiliary spring with the free ends of its arms secured to opposite sides of said terminal means, the intermediate portions of its arms being curved outwardly and upwardly on the side of said terminal means away from said one support member and toward the same with the joined end portions extending upwardly underneath said fuse tube adjacent said other terminal and engaging said fuse for biasing the same upwardly.

14. A fuse arranged to be mounted on a post type insulator having limited cantilever load resisting characteristics comprising, in combination, a hinge member, a fuse pivoted to said hinge member to swing between closed and open positions, stop means for arresting said fuse in the open position where it constitutes generally a prolongation of said insulator, and a generally U-shaped resilient mounting adapter with the arms thereof extending generally normal to the longitudinal axis of said insulator, one arm fast thereon and the other arm carrying said hinge member, said adapter being arranged to flex on engagement of said fuse with said stop means whereby to dissipate a substantial portion of the energy applied thereto as a result of the momentum of said fuse.

15. Means for rockably mounting a fuse on a support comprising, in combination, a relatively rigid and heavy hinge member for pivotally supporting said fuse, a first resilient means mounting said hinge member on said support, and a second resilient means supported wholly by said hinge member and arranged to be engaged by said fuse when it swings to open position to receive the kinetic energy thereof whereby said relatively rigid and heavy hinge member is disposed between said first and second resilient means and acts mechanically in series therewith to reduce the shock imparted to said support.

16. Means for rockably mounting a fuse on a support comprising, in combination, a relatively rigid and heavy hinge member for pivotally supporting said fuse, a generally U-shaped resilient mounting adapter having one arm carrying said hinge member and the other arm mounted on said support, and a rubber bumper on said hinge member arranged to be engaged by said fuse when it swings to open position, said resilient mounting adapter and said rubber bumper and said hinge member acting in series to absorb the shock incident to arresting said fuse in the open position.

17. A fuse arranged to be moved automatically from a generally horizontal closed position to a generally vertical open position comprising, in combination, horizontally spaced insulating support members, a relatively rigid and heavy hinge member for mounting on one of said support members, a fuse pivotally mounted on said hinge member to swing upwardly and latched to the other support member, spring means reacting between said hinge member and said fuse to swing it upwardly on unlatching of the same from said other support member, a resilient mounting adapter interposed between said hinge member and said one of said support members and constituting the sole support of the former and acting as a shock absorber between said hinge and support member, and stop means on said hinge member cooperating with said spring means to cause the same to disengage said fuse in advance of its reaching its vertical position.

SIGURD I. LINDELL.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,940,203	Bowie	Dec. 19, 1933
1,965,391	Pittman et al.	July 3, 1934
2,074,913	Johnson	Mar. 23, 1937
2,118,270	Schultz et al.	May 24, 1938
2,166,782	Lemmon	July 18, 1939
2,178,650	Schultz	Nov. 7, 1939
2,230,955	Johnson	Feb. 4, 1941
2,318,817	Triplett	May 11, 1943
2,485,221	Turnham et al.	Oct. 18, 1949