Aug. 29, 1967 H. I. STANBACK ET AL 3,339,119

FUSIBLE SWITCH

Filed Sept. 23, 1964

4 Sheets-Sheet 1

Fig. 1.

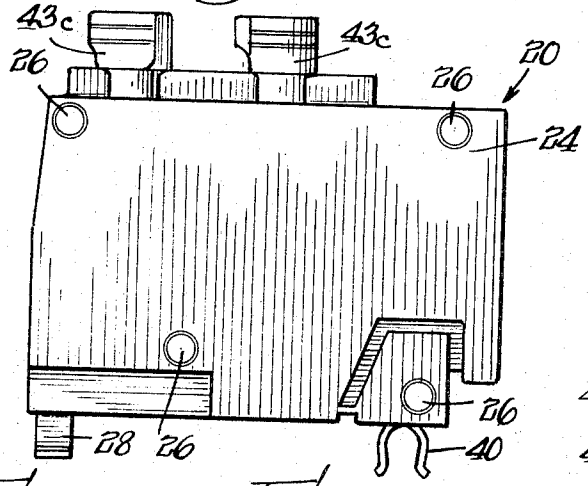



Fig. 6.

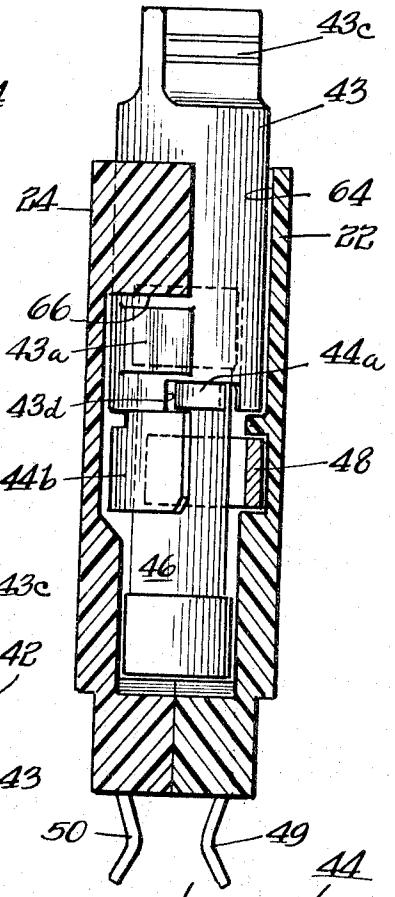



Fig. 7.

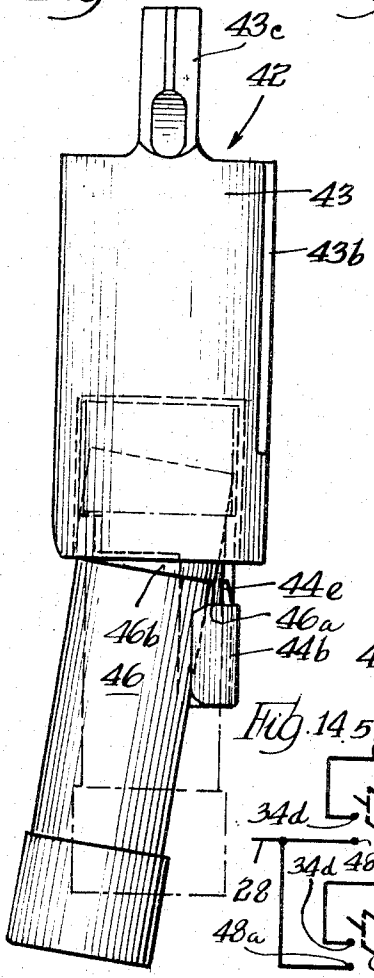



Fig. 8.

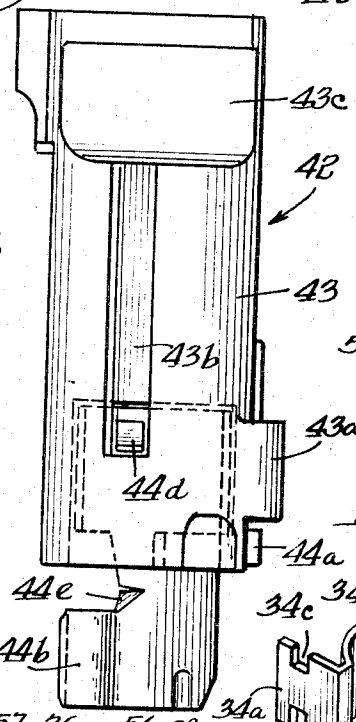



Fig. 9

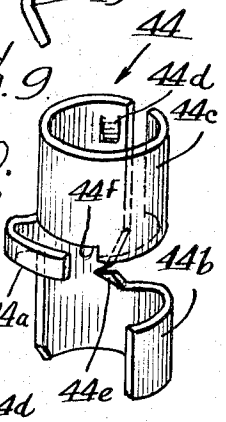



Fig. 10.

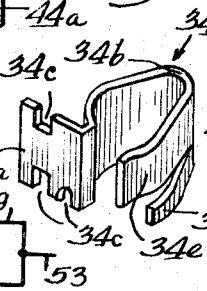
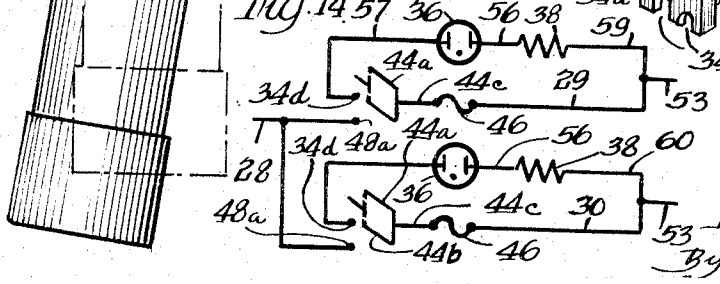



Fig. 14




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Fig. 2.

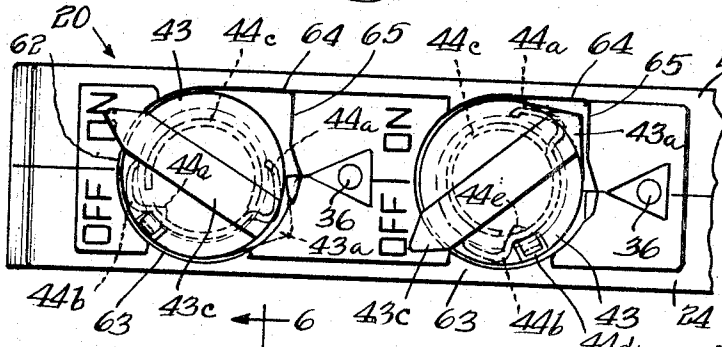



Fig. 5

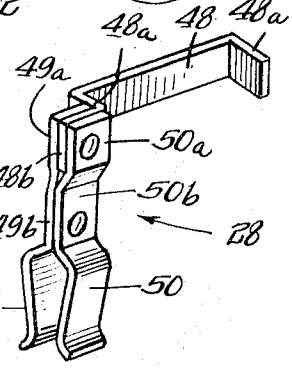



Fig. 3.

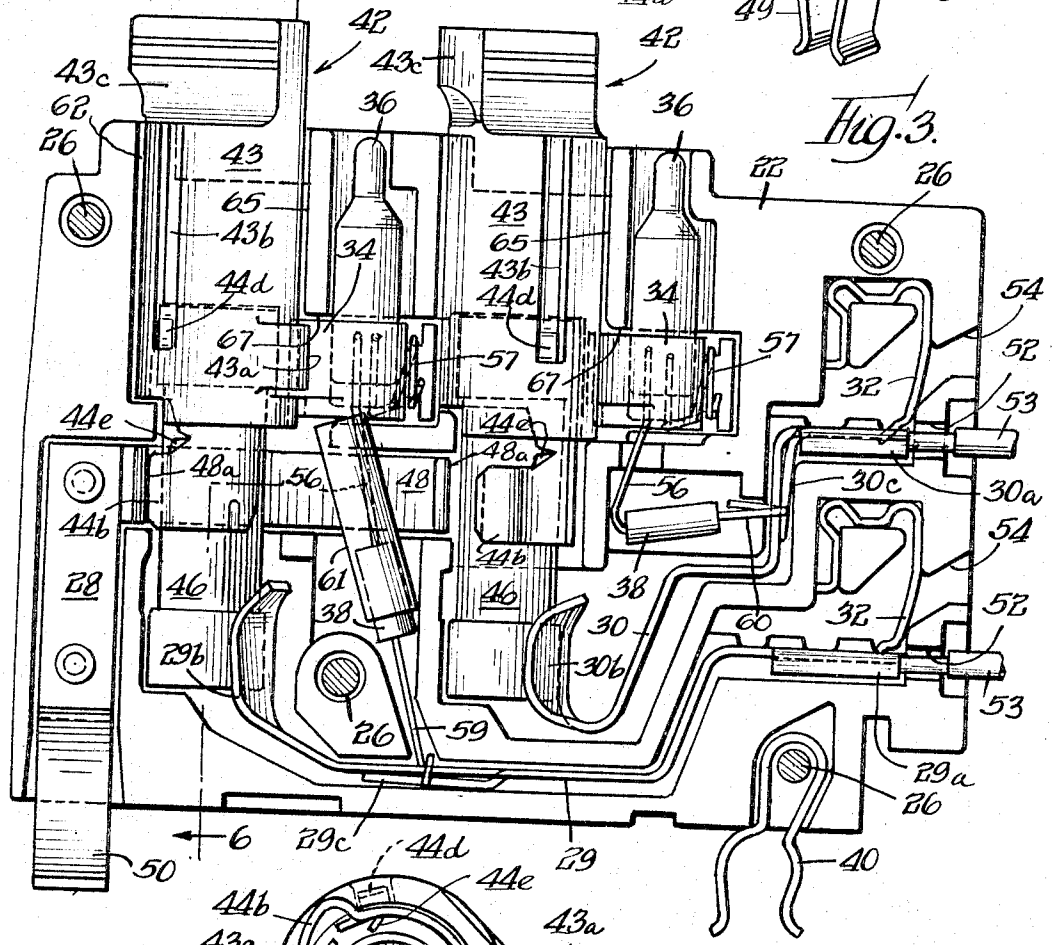



Fig. 4.

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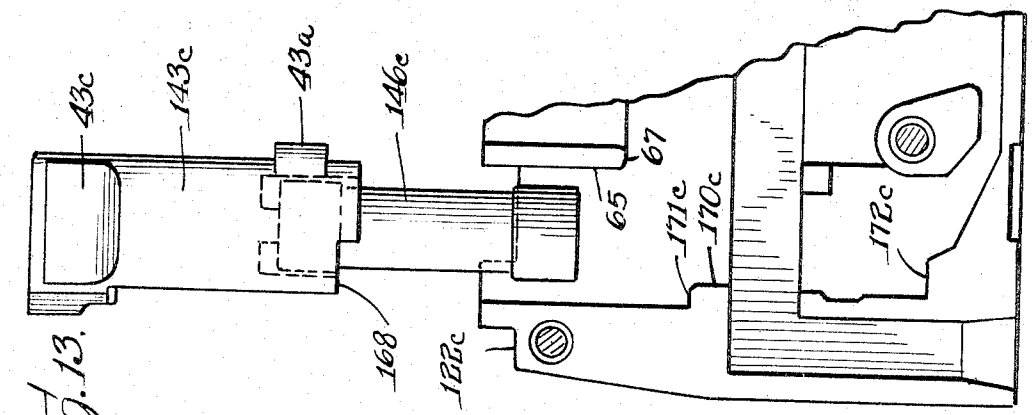



Fig. 13.

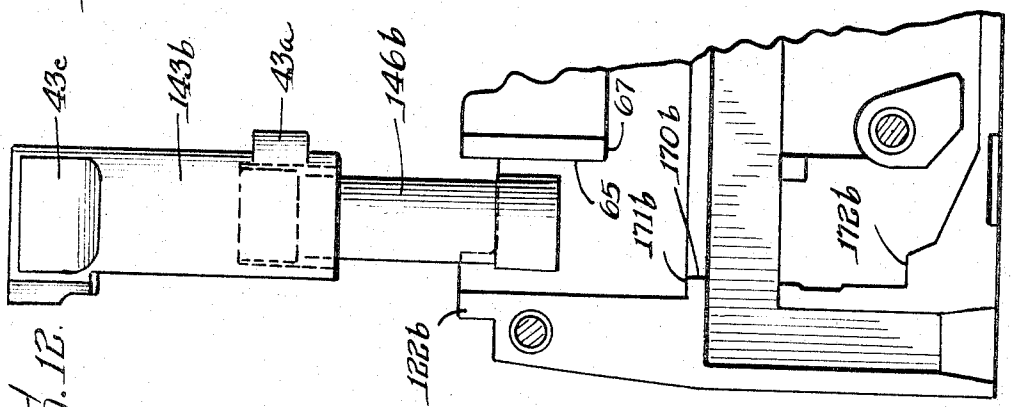



Fig. 12.

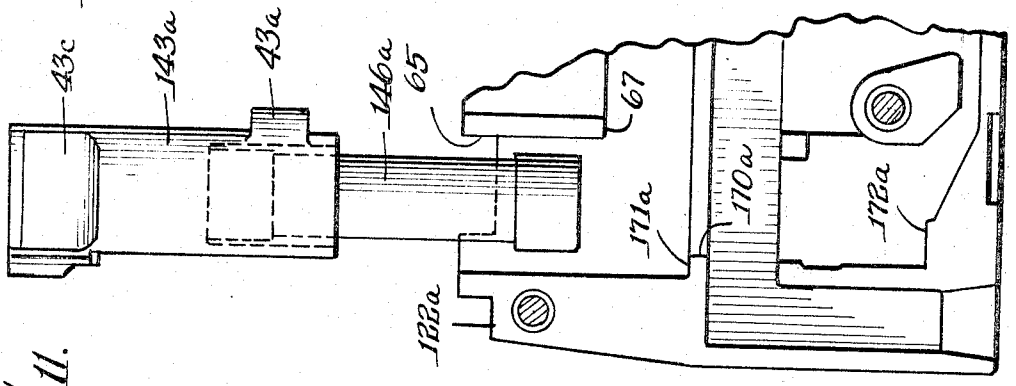



Fig. 11.

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Fig. 15.

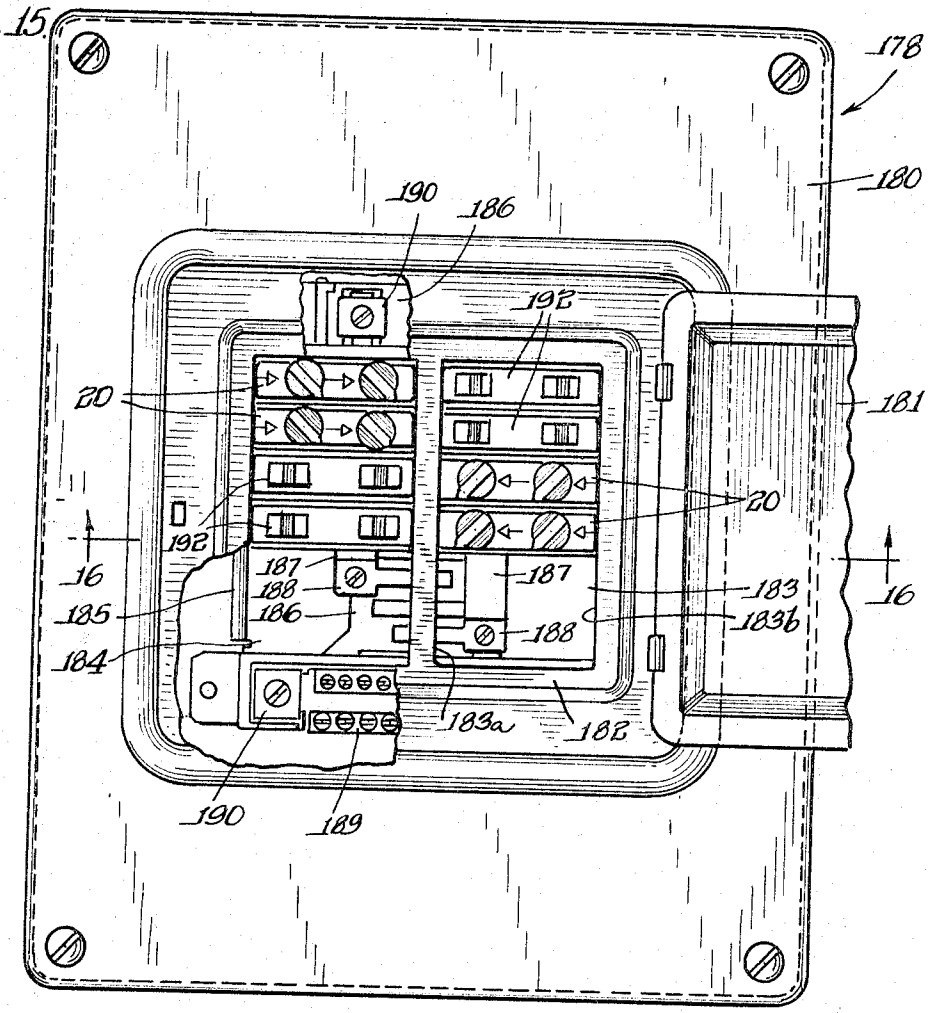
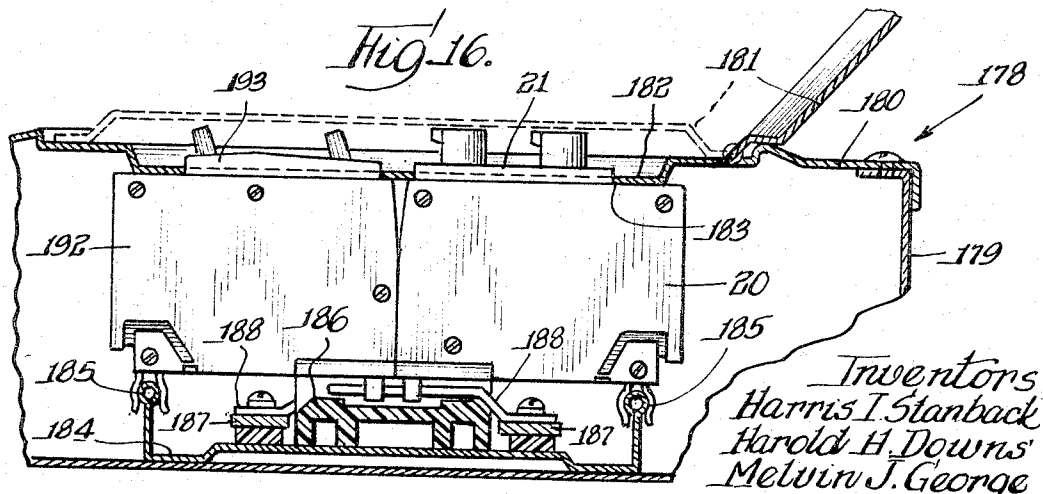



Fig. 16.




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United States Patent Office 3,339,119
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3,339,119

# FUSIBLE SWITCH

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9 Claims. (Cl. 317—116)

This invention relates generally to fusible switches, and more particularly to fusible switches of substantially the same size and shape as automatic electric circuit breakers so as to be interchangeable therewith in electrical panelboards.

Objects of the invention include the following:

(a) To provide an improved fusible switch for an electrical panelboard;

(b) To provide a fusible switch including a movable switch handle formed of electrically insulating material, and an electrically conductive combination fuse clip and movable contact secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which is adapted to complete a circuit through a cartridge fuse held by the fuse clip portion;

(c) To provide a fusible switch including a stationary contact, a switch handle formed of electrically insulating material and turnable to "on" and "off" positions, an electrically conductive combination fuse clip and movable contact secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which engages the stationary contact in the "on" position of the switch handle, and a single spring member cooperable with the switch handle and acting both as an indexing spring in the turning of the switch handle between the "on" and "off" positions and as a contact pressure spring exerting pressure between the stationary contact and the movable contact portion in the "on" position of the switch handle;

(d) To provide a fusible switch including a stationary contact, a movable switch handle formed of electrically insulating material, an electrically conductive combination fuse clip and movable contact secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which is engageable with the stationary contact, and a spring member engaging the switch handle from the side thereof opposite the movable contact portion and establishing pressure between the stationary contact and the movable contact portion when the movable contact portion is in engagement with the stationary contact, the switch handle and a cartridge fuse acting as a rigid lever member when an end portion of a cartridge fuse is installed in the fuse clip portion, and the spring member tending to rotate the ridge lever member formed by the switch handle and cartridge fuse about the other end portion of the cartridge fuse and being disposed farther from the other end portion of the cartridge fuse than the movable contact portion so as to possess a mechanical advantage thereover and increase the pressure between the stationary contact and the movable contact portion;

(e) To provide a fusible switch including a casing molded of electrically insulating material, a switch handle formed of electrically insulating material and being removably insertable in the casing, an electrically conductive fuse clap secured to an inner end portion of the switch handle and adapted to releasably receive and electrically engage an end portion of a cartridge fuse, and means insuring removal of a fuse from the casing when the fuse has been installed in the fuse clip, and the switch handle, fuse clip, and fuse have been inserted in the casing and the switch handle and fuse clip are thereafter removed from the casing;



(f) To provide a plurality of fusible switches respectively adapted to receive a plurality of fuses of different first, second, and third current ratings, each of the switches including a casing molded of electrically insulating material, a stationary contact in the casing, a switch handle formed of electrically insulating material, and an electrically conductive combination fuse clip and movable contact secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which engages the stationary contact in an "on" position of the switch handle and is disengaged from the stationary contact in an "off" position of the switch handle, the switch handle being removably insertable in the casing and turnable to the "on" and "off" positions, and rejection means preventing any one of the switch handles of the fusible switches respectively adapted to receive fuses of the first, second, and third current ratings from being turned to the "on" position in the casing of the fusible switch adapted to receive a fuse of the second current rating when it has an end portion of a cartridge fuse of the first current rating received in the fuse clip portion of the combination fuse clip and movable contact secured thereto, preventing the switch handles of the fusible switches respectively adapted to receive fuses of the first and second current ratings from being turned to the "on" position in the casing of the fusible switch adapted to receive a fuse of the third current rating, and preventing the switch handle of the fusible switch adapted to receive a fuse of the third current rating from being turned to the "on" position in the casing of the fusible switch adapted to receive a fuse of the third current rating when it has an end portion of a cartridge fuse of one of the first and second current ratings received in the fuse clip portion of the combination fuse clip and movable contact secured thereto;

(g) To provide a fusible switch including a movable switch handle formed of electrically insulating material and an electrically conductive combination fuse clip and a pair of movable contacts secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse, a first movable contact portion which is adapted to complete a circuit through a cartridge fuse held by the fuse clip portion, and a second movable contact portion which is adapted to complete a circuit through an indicating lamp;

(h) To provide a fusible switch including a stationary contact, a switch handle formed of electrically insulating material and turnable to "on" and "off" positions, an electrically conductive combination fuse clip and pair of movable contacts secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a first movable contact portion which engages the stationary contact in the "on" position of the switch handle, an indicating lamp, and a spring member cooperable with the switch handle and acting as an indexing spring in the turning of the switch handle between the "on" and "off" positions, a second movable contact portion of the combination fuse clip and pair of movable contacts engaging the spring member in the "on" position of the switch handle to complete a circuit through the indicating lamp; and

(i) To provide a fusible switch including a casing molded of electrically insulating material, a stationary contact in the casing, a switch handle formed of electrically insulating material and turnable in the casing to "on" and "off" positions, an electrically conductive combination fuse clip and pair of movable contacts secured to an inner end portion of the switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a first movable contact portion which engages the stationary contact in the "on" position of the switch handle, a spring member in the casing cooperable with the switch handle and acting as an indexing spring in the turning of the switch handle between the "on" and "off" positions, a load terminal strap in the casing having an outer end portion serving as a part of a load terminal, an inner end portion adapted to electrically engage the other end portion of the cartridge fuse, and an intermediate portion having a resilient offset tongue portion, and an indicator lamp in the casing having a first lead wire electrically connected to the spring member and another lead wire electrically connected to the resilient offset tongue portion of the load terminal strap by entrapment between the resilient offset tongue portion and a portion of the casing, a second movable contact portion of the combination fuse clip and pair of movable contacts engaging the spring member in the "on" position of the switch handle.

Other objects and advantages of the invention will appear when the following specification is considered along with the accompanying drawings, in which:

FIG. 1 is a side elevational view of a fusible switch constructed in accordance with the invention;

FIG. 2 is a fragmentary enlarge top view of the fusible switch of FIG. 1, the combination fuse clips and movable contacts being shown in broken lines without fuses in the fuse clip portions thereof;

FIG. 3 is an enlarged view similar to FIG. 1, but with the cover of the fusible switch removed, showing fuses installed therein;

FIG. 4 is an enlarged view of one of the switch handle and combination fuse clip and movable contact assemblies of the fusible switch of FIGS. 1, 2, and 3, looking at the inner end thereof;

FIG. 5 is a perspective view of the line terminal and stationary contact assembly of the fusible switch of FIGS. 1, 2, and 3;

FIG. 6 is a sectional view of the fusible switch of FIG. 1 taken generally along the line **6—6** of FIG. 3;

FIG. 7 is an elevational view of a fuse and one of the switch handle and combination fuse clip and movable contact assemblies of the fusible switch of FIG. 1, showing the fuse in solid lines tilted for removal from or insertion into the fuse clip portion, and in broken lines fully installed in the fuse clip portion;

FIG. 8 is a view taken from the right of FIG. 7, but omitting the fuse;

FIG. 9 is a perspective view of the combination fuse clip and movable contacts of one of the switch handle and combination fuse clip and movable contact assemblies of the fusible switch of FIG. 1;

FIG. 10 is a perspective view of one of the handle index and contact pressure springs of the fusible switch of FIG. 1;

FIGS. 11, 12, and 13 are views illustrating a system of non-interchangeability for differently rated fusible switches, fuses and switch handles constructed in accordance with the invention, the combination fuse clips and movable contact assemblies being omitted for clarity, the bases of the fusible switches being shown fragmentarily, the fuses and switch handles being shown partially inserted into their respective bases, which are arranged in order of decreasing current rating, and the switch handles being shown midway between "on" and "off" positions;

FIG. 14 is a circuit diagram for the fusible switch of FIG. 1.



FIG. 15 is a fragmentary front view of an electrical panelboard having fusible switches constructed in accordance with the invention and electrical circuit breakers interchangeably mounted thereon; and

FIG. 16 is a sectional view taken generally along the line **16—16** of FIG. 15.

A fusible switch **20** constructed in accordance with the invention is shown in FIGS. 1 and 2. The switch **20** includes a casing molded of insulating material and having a base portion **22** and a cover portion **24** which are generally symmetrical but which have certain important differences hereinafter described. The base portion **22** and the cover portion **24** are held together preferably by a plurality of rivets **26** and each is provided with a plurality of inner projections and wall portions for entrapping various parts of the fusible switch such as a line terminal and stationary contact assembly **28**, a pair of load terminal straps **29** and **30**, a pair of resilient, push-in type connector springs **32**, a pair of handle index and contact pressure springs **34**, a pair of indicator lamps **36**, a pair of resistors **38**, and a mounting clip **40**.

Removably mounted in the casing for pivotal movement between "on" and "off" positions are a pair of switch handle and combination fuse clip and movable contact assemblies **42** each including a switch handle **43** and a member **44** which is a combination fuse clip and pair of movable contacts and is best shown in FIG. 9. Each member **44** is adapted to receive an end portion or ferrule of a cartridge fuse **46**.

The line terminal and stationary contact assembly **28** is best shown in FIG. 5 and includes a terminal strap **48** received in a groove in the base portion **22** as shown in FIG. 6 and shaped to provide a pair of stationary contact portions **48***a*. An offset end portion **48***b* of the terminal strap **48** is riveted or otherwise secured between inner end portions **49***a* and **50***a* of a pair of plug-in jaws **49** and **50** having central portions **49***b* and **50***b* which are riveted or otherwise secured to each other.

The casing formed by the base portion **22** and the cover portion **24** is of substantially the same size as the casing of the circuit breaker disclosed in U.S. Patent No. 3,134,051, and the distance between the mounting clip **40** and the line terminal formed by the jaws **49** and **50** is substantially the same as the distance between the mounting clip and plug-in line terminal of the circuit breaker, whereby the fusible switch is interchangeable with the circuit breaker in an electrical panelboard.

The load terminal straps **29** and **30** are provided respectively with a pair of outer end portions **29***a* and **30***a* which form a pair of load terminals. The casing is provided with a pair of apertures **52** for respectively receiving a pair of load wires **53** and with a pair of apertures **54** for selectively receiving a screw driver or other tool in order to depress the respective resilient connector spring **32** inwardly to release the espective load wire **53**. As will be understood, the load wires **53** may be connected simply by pushing them respectively between the outer end portions **29***a* and **30***a* and the associated resilient connector springs **32**.

The load terminal straps **29** and **30** are respectively provided with a pair of contoured inner end portions **29***b* and **30***b* each of which is shaped to receive and electrically engage the other end portion or ferrule of the respective cartridge fuse **46** on only one side thereof and to hold the other side thereof against a portion of the casing. The end portions **29***b* and **30***b* thus form a pair of one-sided fuse clips. The intermediate portions of the terminal straps **29** and **30** are respectively provided with resilient offset tongue portions **29***c* and **30***c*. Each indicator lamp **36** is provided with a lead wire **56** which is electrically connected to a respective one of the resistors **38**, and a lead wire **57** which is electrically connected to a respective one of the springs **34**. Further, the resistors **38** are electrically connected respectively to the load terminal

straps 29 and 30 by a pair of wires 59 and 60 trapped respectively between the resilient tongue portions 29*c* and 30*c* and portions of the base portion 22 of the casing. The wire 56 which extends across the terminal strap 48 is provided with an insulating sheath 61.

The handle index and contact pressure springs 34 are formed from flat strip stock and are shaped as best shown in FIG. 10. Each spring 34 includes a flat end portion 34*a* confined in a respective appropriate recess in the base portion 22 and serving as an anchoring leg, and an intermediate relatively sharply curved anchoring nose portion 34*b* received in a respective appropriate recess (not shown) in the cover portion 24. The anchoring leg 34*a* of each spring may be provided with appropriate slots such as indicated at 34*c* for retaining the respective wire 57, which is electrically connected to the spring 34 preferably by entrapment between the anchoring leg 34*a* and the base portion 22. The end portion of each spring 34 opposite the anchoring leg 34*a* is split to provide a stationary contact portion 34*d* cooperable with a movable contact portion 44*a* of a respective one of the combination fuse clip and movable contact members 44, which are shaped as best shown in FIG. 9. Between the split end portion and the anchoring nose portion 34*b*, each spring 34 is curved through an obtuse angle to provide a handle index and contact pressure establishing portion 34*e* cooperable with a projecting portion 43*a* of a respective one of the switch handles 43 to index the switch handle in the turning thereof to "on" and "off" positions and to establish pressure in the "on" position of the handle between the respective stationary contact portion 48*a* and a movable contact portion 44*b* of the respective member 44.

Each member 44 includes a fuse clip portion 44*c* received in a suitable recess in an inner end portion of one of the switch handles 43 and adapted to receive an end portion or ferrule of one of the cartridge fuses 46. Each switch handle 43 is provided with an axially extending groove 43*b* the inner end portion of which intercepts the recess in the inner end portion of the switch handle in which the respective fuse clip portion 44*c* is received, and each fuse clip portion 44*c* is provided with an outwardly extending resilient tongue portion 44*d* which projects into the respective groove 43*b* to retain the member 44 in the recess in the respective switch handle 43 by engagement with the surface defining the inner end of the groove 43*b*. Each member 44 is also provided with an inwardly extending projection 44*e* formed in any suitable manner and spaced from the fuse clip portion 44*c* to prevent removal of a fuse 46, while the longitudinal axes of the fuse and of the respective switch handle 43 are collinear, by interfering with an edge 46*a* of a ferrule 46*b* of the fuse 46 (FIG. 7). Thus, when a switch handle 43 is removed from the casing, a fuse 46 associated with the respective member 44 will also be removed therewith rather than being retained in the casing by one of the inner end portions 29*b* or 30*b* of a load terminal strap. However, a fuse 46 can be inserted in or removed from a fuse clip portion 44*c* if it is tilted or cocked with respect to the axis of the respective handle 43, so that the edge 46*a* of the fuse ferrule 46*b* clears the projection 44*e*, as shown in FIG. 7 by the solid-line position of the fuse. The tilting of the fuse 46 is accommodated by the provision of a notch 44*f* in the fuse clip portion 44 (FIG. 9) and a notch 43*d* in the switch handle 43 (FIG. 6), the notch 43*d* also accommodating the movable contact portion 44*a* and the notch 44*f* resulting from the forming of the movable contact portion 44*a* and being opposite the projection 44*e*.

The casing formed by the base portion 22 and cover portion 24 is provided with two sets of suitable "on" and "off" indicia as shown in FIG. 2, and outer end portions 43*c* of the respective switch handles 43 are shaped to provide easy gripping by an operator as well as to define pointers for the respective sets of "on" and "off" indicia. The switch handles 43 are turnable in the casing to the "on' and "off" positions, it being understood that in the "on" position of a switch handle, the contact portion 44*b* of th respective member 44 will be in engagement with the respective contact portion 48*a* of the terminal strap 48 and the contact portion 44*a* of the respective member 44 will be in engagement with the contact portion 34*d* of the respective spring 34, and that in "off" position of the switch handle, these cooperable contact portions will be out of engagement.

As indicated at 62 in FIGS. 2 and 3, enough clearance may be provided between a switch handle 43 in the "on" position thereof and the casing formed by the base portion 22 and the cover portion 24 so that the switch handle 43 and the fuse 46 installed therein act as a single rigid member tending to turn counterclockwise, as viewed in FIG. 2, about the inner end portion of the fuse 46, as a result of the force of the respective spring 34, which is disposed farther from the inner end of the fuse 46 than the respective stationary contact portion 48*a* and movable contact portion 44*b* and thus has a mechanical advantage with respect thereto to increase the contact pressure therebetween. Alternatively, the base portion 22, cover portion 24, and switch handles 43 may be constructed without clearance, as at 62, therebetween in the "on" position of the switch handles. Without such clearance, a switch handle 43 and fuse 46 do not act as a single rigid member, and the switch handle 43 tends to turn clockwise, as viewed in FIG. 2, about its outer end portion, as a result of the force of the respective spring 34, which is disposed closer to the outer end portion of the switch handle 43 than the respective stationary contact portion 48*a* and movable contact portion 44*b* so as to have no mechanical advantage with respect thereto, but nevertheless provides adequate contact pressure therebetween.

Means are provided for preventing insertion and removal of a switch handle 43 from the casing while it is in the "on" position with respect thereto. As shown in FIGS. 2 and 6, the base portion 22 and cover portion 24 are shaped differently adjacent the respective switch handles 43, the portions of the handle-receiving openings in the cover portion 24 being substantially semi-circular, as at a pair of semi-circular surfaces 63 shown in FIG. 2, so as not to accommodate the projecting portion 43*a* of a switch handle, but the portions of the handle-receiving openings in the base portion 22 being squared off, as at pairs of surfaces 64 and 65 shown in FIG. 2, to accommodate the projecting portion 43*a* of a switch handle. Thus, a switch handle 43 may be inserted in the casing only in a relative angular position in which the projecting portion 43*a* is received in one of the squared off portions of the handle-receiving openings, as defined by a pair of the surfaces 64 and 65 in the base portion 22, and this position corresponds to the "off" position of a switch handle 43, as shown for the right-hand switch handle in FIG. 2. However, inside the casing, the portions of the cover portion 24 defining the semi-circular surfaces 63 end, as at a pair of surfaces 66, one of which is shown in FIG. 6, and the portions of the base portion 22 defining the surfaces 65 end, as at a pair of surfaces 67 shown in FIG. 3. When the projecting portion 43*a* of a switch handle 43 is entirely inwardly of the respective surfaces 66 and 67, it is no longer completely restrained and the handle may be turned to the "on" position, as shown for the left-hand switch handle in FIG. 2. To remove a switch handle from the casing, it must first be turned to the "off" position to dispose the projecting portion 43*a* adjacent the respective surface 64 of the base portion 22 and out of interfering relationship with the respective surface 66 of the cover portion 24 and the respective surface 67 of the base portion 22.

FIG. 14 shows the circuit diagram for the fusible switch of FIGS. 1–3, the numerals for the electrical symbols being identical to the numerals of the

corresponding mechanical structures as described in FIGS. 1–10.

FIGS. 11–13 illustrate a system of non-interchangeability for fusible switches respectively adapted to receive fuses of three different ratings, including means preventing the effective installation of a fuse of a higher current rating than the current rating of a fuse intended for the particular switch. Thus, FIG. 11 shows a base portion **122***a* for a switch adapted to receive a fuse having the highest of three different current ratings, FIG. 13 shows a base portion **122***c* for a switch adapted to receive a fuse having the lowest of the three current ratings, and FIG. 12 shows a base portion **122***b* for a switch adapted to receive a fuse having the intermediate of the three current ratings, the base portions being shown fragmentarily and the interal parts of the switches being omitted for clarity. FIG. 11 also shows a fuse **146***a* of the highest current rating and a switch handle **143***a* intended for use with the switch having the base portion **122***a*, FIG. 12 shows a fuse **146***b* of the intermediate current rating and a switch handle **143***b* intended for use with the switch having the base portion **122***b*, and FIG. 13 shows a fuse **146***c* of the lowest current rating and a switch handle **143***c* intended for use with the switch having the base portion **122***c*. The combination fuse clips and movable contacts of the switch handles **143***a*, **143***b*, and **143***c* are omitted for clarity.

In accordance with the invention, rejection means are provided preventing the turning of a switch handle having one of the fuses **146***a* and **146***b* mounted therein to an "on" position in the switch having the base portion **122***c* and preventing the turning of a switch handle having a fuse **146***a* mounted therein to an "on" position in the switch having the base portion **122***b*.

The fuses **146***a*, **146***b*, and **146***c* are of the same diameter, but the fuse **146***a* is longer than the fuse **146***b*, and the fuse **146***b* is longer than the fuse **146***c*. The fusible switches having the bases **122***a*, **122***b*, and **122***c* are of the same physical size and outer shape. The switch handles **143***a*, **143***b*, and **143***c* are of the same diameter and the same overall length, but the recesses therein opposite the gripping and pointer portions **43***c* for receiving fuses are of different effective depths, the fuse **146***a* projecting farther into the switch handle **143***a* than the fuse **146***b* projects into the switch handle **143***b*, and the fuse **146***b* projecting farther into the switch handle **143***b* than the fuse **146***c* projects into the switch handle **143***c*.

While the switch handle **143***c* is of the same overall length as the switch handles **143***a* and **143***b*, the switch handle **143***c* is formed so that, in comparison with the switch handles **143***a* and **143***b*, a portion of the periphery defining the fuse receiving recess might be said to have been cut away, as at **168** in FIG. 13.

The base portions **122***a*, **122***b*, and **122***c* are formed respectively with projections **170***a*, **170***b*, and **170***c*, respectively defining or providing inner surfaces **171***a*, **171***b*, and **171***c*. Further, the base portions **122***a*, **122***b*, and **122***c* are formed respectively with inner surfaces **172***a*, **172***b*, and **172***c* as shown in FIGS. 11, 12, and 13. The projection **170***c* is thicker than the projections **170***a* and **170***b*, and the surfaces **171***a* and **171***b* are respectively disposed farther inwardly of the fuse-receiving openings of the switches respectively having the base portions **122***a* and **122***b* than the surface **171***c* is disposed inwardly of the fuse-receiving opening of the switch having the base portion **122***c*. Also, the surface **172***a* is disposed farther inwardly of the fuse-receiving opening of the switch having the base portion **122***a* than the surfaces **172***b* and **172***c* are respectively disposed inwardly of the fuse-receiving openings of the switches respectively having the base portions **122***b* and **122***c*.

If a fuse **146***a* or **146***b* is mounted in the switch handle **143***c* and the switch handle and fuse are inserted in the switch having the base portion **122***c*, the inner end of the fuse **146***a* or **146***b* engages the surface **172***c* before the projecting portion **43***a* of the switch handle **143***c* is disposed entirely inwardly of the surface **67** of the base portion **122***c*, and the projecting portion **43***a* interferes with the surface **65** of the base portion **122***c* to prevent the switch handle **143***c* from being turned to the 'on" position.

If either of the switch handles **143***a* or **143***b* is inserted in the switch having the base portion **122***c*, it engages the surface **171***c* before the projecting portion **43***a* thereof is disposed entirely inwardly of the surface **67** of the base portion **122***c*, and the projecting portion **43***a* interferes with the surface **65** of the base portion **122***c* to prevent the switch handle **143***a* or **143***b* from being turned to the "on" position. Therefore, even if a fuse **146***b* is mounted in the switch handle **143***a* to produce a combination shorter than the overall length of the switch handle **143***c* and a fuse **146***c* so as not to interfere with the surface **172***c* of the base portion **122***c*, the combination of the fuse **146***b* and switch handle **143***a* still cannot be turned to the "on" position in the base portion **122***c*, due to the engagement of the switch handle **143***a* with the surface **171***c* before the projecting portion **43***a* has cleared the surface **67** of the base portion **122***c*.

If any one of the switch handles **143***a*, **143***b*, and **143***c* and a fuse **146***a* mounted therein are inserted in the switch having the base portion **122***b*, the inner end of the fuse **146***a* engages the surface **172***b* before the projecting portion **43***a* of the respective switch handle is disposed entirely inwardly of the surface **67** of the base portion **122***b*, and the projecting portion **43***a* interferes with the surface **65** of the base portion **122***b* to prevent the respective switch handle from being turned to the "on" position.

Therefore, it will be seen that no switch handle can be turned to an "on" position in a particular switch when it has a fuse mounted therein of a larger current rating than intended for that switch.

FIGS. 15 and 16 show an electrical panelboard **178** including an open-front box **179**, a cover **180** secured to the front of the box, a door **181** pivotally mounted on the cover, a trim panel **182** preferably, though not necessarily, integral with the cover **181**, and a mounting pan assembly including a mounting pan **184** secured to a rear wall portion of the box and having a pair of oppositely disposed mounting means such as mounting rails **185** formed integrally therewith, an insulating base **186** secured to the mounting pan, a pair of main bus bars **187** secured to the insulating base in spaced parallel relationship, a plurality of branch bus bars **188**, each branch bus bar being secured to one of the main bus bars and extending toward the other main bus bar and the branch bus bars being alternately arranged so that each pair of consecutive branch bus bars are secured respectively to opposite main bus bars, a neutral bar assembly **189** secured to the insulating base, a pair of electrical connectors **190** for connecting a pair of power lines respectively to the main bus bars, and a third electrical connector **190** for connecting a main neutral wire to the neutral bar assembly.

Shown interchangeably mounted on the mounting rails **185** and the branch bus bars **188** are a plurality of fusible switches **20** constructed in accordance with this invention and a plurality of electrical circuit breakers **192** constructed in accordance with the disclosure of the aforementioned U.S. Patent No. 3,134,051, the casings of the fusible switches **20** being of substantially the same size and shape as the casings of the circuit breakers **192** and the mounting clip **40** and terminal jaws **49–50** of each of the fusible switches **20** corresponding respectively to the mounting clip **33** and terminal jaws **34** of the circuit breaker of the aforementioned patent. In particular, the casings of the fusible switches **20** and the casings of the circuit breakers **192** each have a thickness substantially equal to but not greater than the distance between the

center lines of the branch bus bars **188**. Further, the trim panel **182** is provided with a pair of openings **183** each partially defined by a pair of opposed parallel inner edge portions **183***a* and **183***b*, the casing of each fusible switch **20** is provided with a generally rectangular projecting portion **21** having a dimension substantially equal to but less than the distance between a pair of the edge portions **183***a* and **183***b*, and the casing of each circuit breaker **192** is provided with a generally rectangular projecting portion **193** having a dimension substantially equal to but no greater than the distance between a pair of the edge portions **183***a* and **183***b*. Thus, the fusible switches **20** and the electrical circuit breakers **192** are interchangeably mountable without alteration of the trim panel **183**, and identical panelboards may be furnished by a manufacturer to each of two different customers, one of whom prefers to use fusible switches and the other of whom prefers to use electrical circuit breakers.

Of the fusible switches **20** mounted in the electrical panelboard **178**, one may be considered to be of relatively high current rating, such as the fusible switch of FIG. 11, one of intermediate current rating, such as the fusible switch of FIG. 12, and one of relatively low current rating, such as the fusible switch of FIG. 13.

It will be seen that we have provided an improved fusible switch satisfying all the objects set forth before herein. Various modifications may be made in the structure shown and described without departing from the spirit and scope of the invention.

We claim:

**1.** A fusible switch comprising a casing molded of electrically insulating material, a stationary contact in said casing, an elongated switch handle formed of electrically insulating material and having an inner end portion disposed in said casing, said swtich handle being movable between ON and OFF positions, an electrically conductive combination fuse clip and movable contact secured to said inner end portion of said switch handle and having a fuse clip portion which is adapted to receive an end portion of a cartridge fuse axially of the fuse and longitudinally of said switch handle and a movable contact portion which is disposed adjacent one side of said switch handle transversely thereof and engages said stationary contact when said switch handle is in ON position, and a spring member in said casing engaging said switch handle transversely from a side thereof opposite said movable contact portion and establishing pressure between said stationary contact and said movable contact portion when said movable contact portion is in engagement with said stationary contact, said switch handle and a cartridge fuse acting as a rigid lever member when an end portion of a cartridge fuse is installed in said fuse clip portion, and said spring member urging the rigid lever member formed by said switch handle and cartridge fuse pivotally about the other end portion of said cartridge fuse and being disposed farther from said other end portion of said cartridge fuse than said movable contact portion so as to possess a mechanical advantage thereover and increase the pressure between said stationary contact and said movable contact portion.

**2.** A fusible switch comprising a casing molded of electrically insulating material, a switch handle formed of electrically insulating material and having an inner end portion removably inserted in said casing, a generally cylindrical electrically conductive fuse clip secured to said inner end portion of said switch handle and adapted to axially receive a ferrule of a cartridge fuse having a cylindrical casing closed at opposite ends respectively by a pair of ferrules, and a radially inwardly extending projection on a portion of said fuse clip preventing complete removal of a fuse axially thereof from said fuse clip by interfering with an edge of said ferrule, said fuse clip having a notched edge portion disposed generally opposite said projection and accommodating tilting of said fuse in said fuse clip to allow said edge of said ferrule to clear said projection for removal of said fuse from said fuse clip.

**3.** A fusible switch as claimed in claim **2**, wherein said fuse clip is provided with a movable contact portion formed to extend outwardly of the remainder of said fuse clip and said notched edge portion results from the forming of said movable contact portion.

**4.** A fusible switch comprising a casing, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion disposed in said casing, said switch handle being turnable to ON and OFF positions, an electrically conductive combination fuse clip and pair of movable contacts secured to said inner end portion of said switch handle and having a fuse clip portion adapted to receive and electrically engage an end portion of a cartridge fuse and a first movable contact portion which engages said stationary contact in said ON position of said switch handle to complete a circuit through a cartridge fuse held by said fuse clip portion, and a spring member cooperable with said switch handle and acting as an indexing spring in the turning of said switch handle between said ON and OFF positions, said combination fuse clip and pair of movable contacts having a second movable contact portion engaging said spring member in said ON position of said switch handle to complete a circuit through an indicating means.

**5.** A fusible switch comprising a casing, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion disposed in said casing, said switch handle being turnable to ON and OFF positions, an electrically conductive combination fuse clip and a pair of movable contacts secured to said inner end portion of said switch handle and having a fuse clip portion adapted to receive and electrically engage an end portion of a cartridge fuse and a first movable contact portion which engages said stationary contact in said ON position of said switch handle to complete a circuit through a cartridge fuse held by said fuse clip portion, a spring member cooperable with said switch handle and acting as an indexing spring in the turning of said switch handle between said ON and OFF positions, and an indicator lamp having a lead wire electrically connected to said spring member, said combination fuse clip and pair of movable contacts having a second movable contact portion engaging said spring member in said ON position of said switch handle to complete a circuit through said indicator lamp.

**6.** A fusible switch comprising a casing molded of electrically insulating material, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion disposed in said casing, said switch handle being turnable in said casing to ON and OFF positions, an electrically conductive combination fuse clip and pair of movable contacts secured to said inner end portion of said switch handle and having a fuse clip portion adapted to receive and electrically engage an end portion of a cartridge fuse and a first movable contact portion which engages said stationary contact in said ON position of said switch handle to complete a circuit through a cartridge fuse held by said fuse clip portion, a spring member in said casing cooperable with said switch handle and acting as an indexing spring in the turning of said switch handle between said ON and OFF positions, a load terminal strap in said casing having an outer end portion serving as a part of a load terminal, an inner end portion adapted to electrically engage the other end portion of a cartridge fuse held by said fuse clip portion, and an intermediate portion having a resilient offset tongue portion, and an indicator lamp in said casing having one lead wire electrically connected to said spring member and another lead wire electrically connected to said resilient offset tongue portion of said load terminal strap by entrapment between said resilient

offset tongue portion and a portion of said casing, said combination fuse clip and pair of movable contacts having a second movable contact portion engaging said spring member in said ON position of said switch handle to complete a circuit through said indicator lamp.

7. A fusible switch comprising a casing, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion disposed in said casing, said switch handle being disposable in said casing selectively in ON and OFF positions, an electrically conductive fuse clip and pair of first and second movable contacts secured to said inner end portion of said switch handle, said fuse clip being adapted to receive and electrically engage an end portion of a cartridge fuse, said first movable contact engaging said stationary contact in said ON position of said switch handle to complete an electrical circuit through a cartridge fuse held by said fuse clip, a resilient electrical conductor in said casing, and an indicating lamp in said casing, said indicating lamp having a lead wire electrically connected to said resilient electrical conductor, and said second movable contact engaging said resilient electrical conductor in said ON position of said switch handle to complete an electrical circuit through said indicating lamp.

8. The combination comprising an electrical panelboard and three fusible switches mounted therein, said three fusible switches being of substantially the same size and shape, respectively having relatively high, intermediate, and low current ratings, and respectively being adapted to receive three cartridge fuses respectively of relatively high, intermediate, and low current ratings, each of said fusible switches including a casing molded of electrically insulating material, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion normally disposed in said casing, said switch handle normally being turnable in said casing alternatively to ON and OFF positions relatively thereto, and an electrically conductive combination fuse clip and movable contact secured to said inner end portion of said switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which engages said stationary contact when said switch handle is disposed in said casing in said ON position and is disengaged from said stationary contact when said switch handle is disposed in said casing in said OFF position, said switch handle being removably insertable in said casing and turnable to said ON position when a fuse of the current rating adapted to be received by the respective fusible switch is mounted in the fuse clip portion of the combination fuse clip and movable contact secured to the switch handle, each of the switch handles of said three fusible switches having a portion which interferes with a portion of the casing of the fusible switch of said intermediate current rating to prevent turning of the switch handle to an ON position in the casing of the fusible switch of said intermediate current rating when a fuse of said high current rating is mounted in the fuse clip portion of the combination fuse clip and movable contact secured to the switch handle and the switch handle with the fuse of said high current rating mounted therein is inserted in the casing of the fusible switch of said intermediate current rating and an attempt is made to turn the switch handle to said ON position, the switch handle of the fusible switch of said low current rating having a portion which interferes with a portion of the casing of the fusible switch of said low current rating to prevent turning of the switch handle to an ON position in the casing of the fusible switch of said low current rating when one of the fuses of said high and intermediate current ratings is mounted in the fuse clip portion of the combination fuse clip and movable contact secured to the switch handle and the switch handle with one of the fuses of said high and intermediate current ratings mounted thereon is inserted in the casing of the fusible switch of said low current rating and an attempt is made to turn the switch handle to said ON position, and each of the switch handles of the fusible switches of said high and intermediate current ratings having a portion which interferes with a portion of the casing of the fusible switch of said low current rating to prevent turning of the switch handle to an ON position in the casing of the fusible switch of said low current rating when the switch handle is inserted in the casing of the fusible switch of said low current rating and an attempt is made to turn the switch handle to said ON position.

9. The combination comprising an electrical panelboard and two fusible switches mounted therein, said two fusible switches being of substantially the same size and shape, respectively having relatively high and low current ratings, and respectively being adapted to receive two cartridge fuses respectively of relatively high and low current ratings, each of said fusible switches including a casing molded of electrically insulating material, a stationary contact in said casing, a switch handle formed of electrically insulating material and having an inner end portion normally disposed in said casing, said switch handle normally being turnable in said casing alternatively to ON and OFF positions relatively thereto, and an electrically conductive combination fuse clip and movable contact secured to said inner end portion of said switch handle and having a fuse clip portion which is adapted to receive and electrically engage an end portion of a cartridge fuse and a movable contact portion which engages said stationary contact when said switch handle is disposed in said casing in said ON position and is disengaged from said stationary contact when said switch handle is disposed in said casing in said OFF position, said switch handle being removably insertable in said casing and turnable to said ON position when a fuse of the current rating adapted to be received by the respective fusible switch is mounted in the fuse clip portion of the combination fuse clip and movable contact secured to the switch handle, and the switch handle of the fusible switch of said high current rating having a portion which interferes with a portion of the casing of the fusible switch of said low current rating to prevent turning of the switch handle to an ON position in the casing of the fusible switch of said low current rating when the switch handle is inserted in the casing of the fusible switch of said low current rating and an attempt is made to turn the switch handle to said ON position.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,683,598 | 9/1928 | Benoit | 200—119 |
| 1,927,335 | 9/1933 | Cole | 200—121 |
| 1,966,716 | 7/1934 | Green | 200—114 |
| 2,417,692 | 3/1947 | Kline | 200—129 |
| 2,929,966 | 3/1960 | Bangert | 317—119 |
| 3,134,051 | 5/1964 | Lyon | 317—119 |
| 3,225,164 | 12/1965 | Linton | 200—121 |
| 3,286,061 | 11/1966 | Henderson | 200—114 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 402,386 | 4/1909 | France. |
| 431,840 | 6/1911 | France. |

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