Sept. 6, 1960 F. J. SCHULTZ 2,951,924

LOAD INTERRUPTING DEVICE

Filed Aug. 21, 1958 3 Sheets-Sheet 1

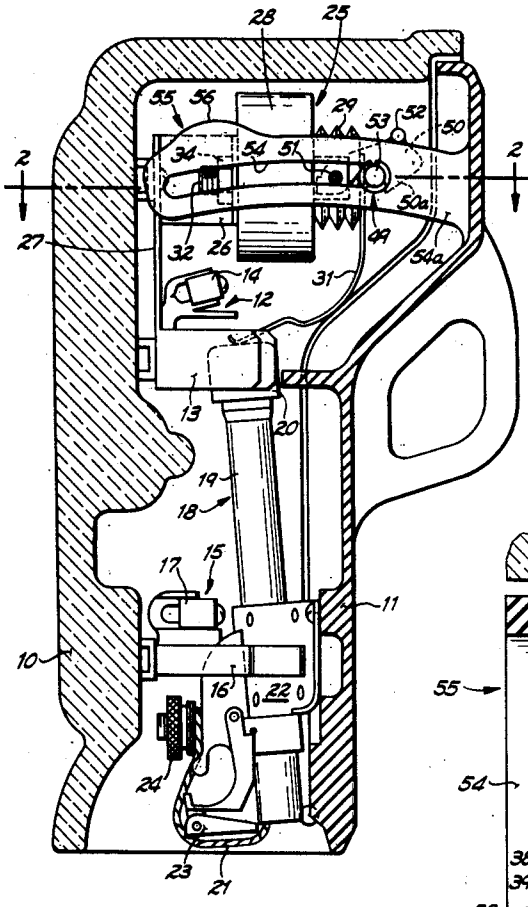


Fig. 1

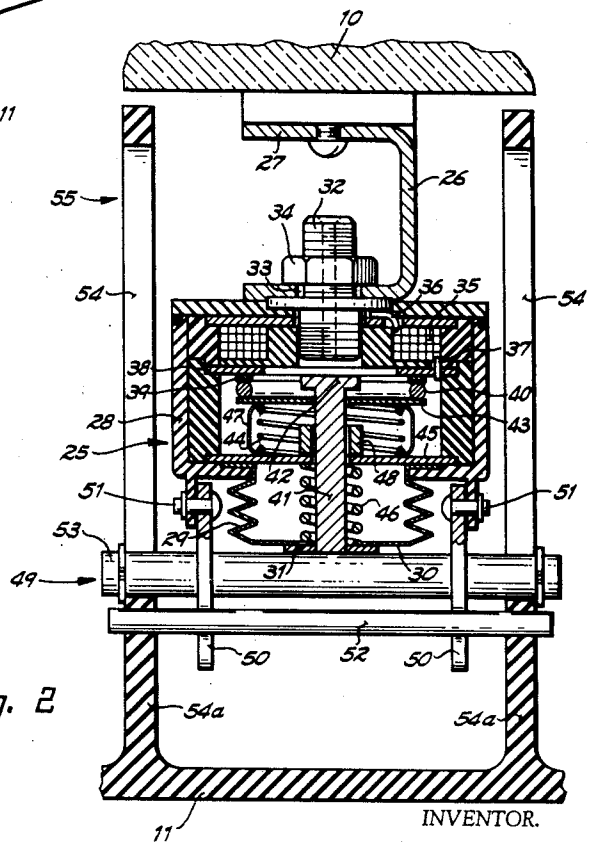


Fig. 2

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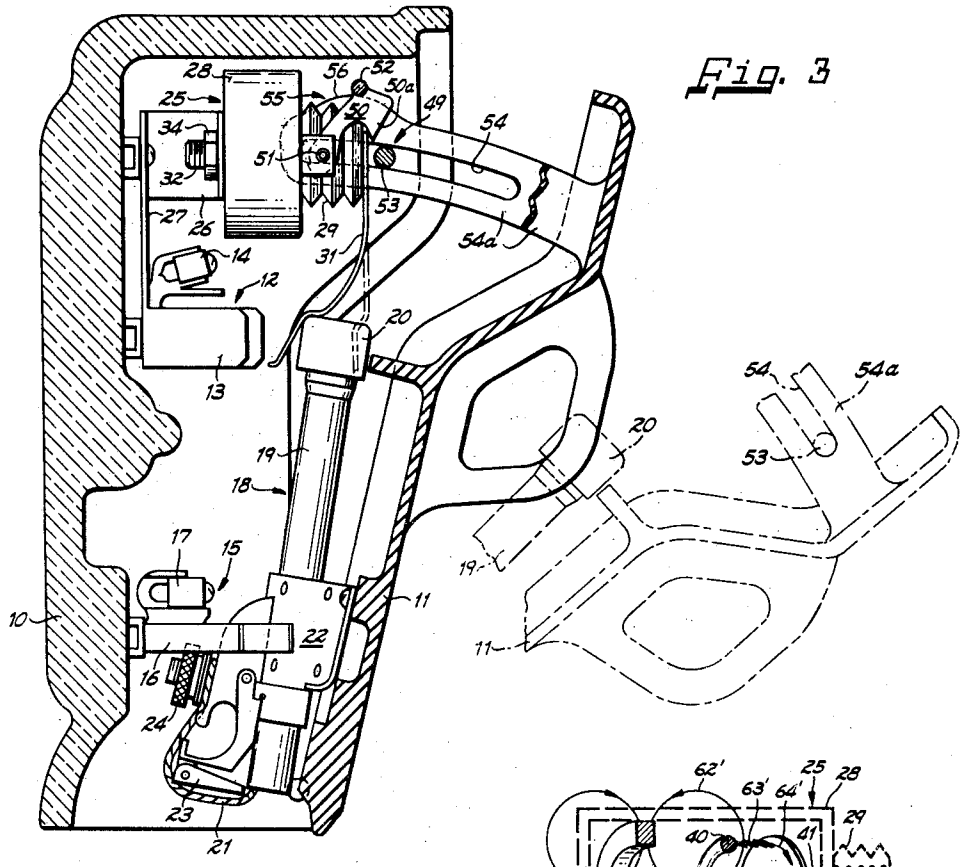


Fig. 3

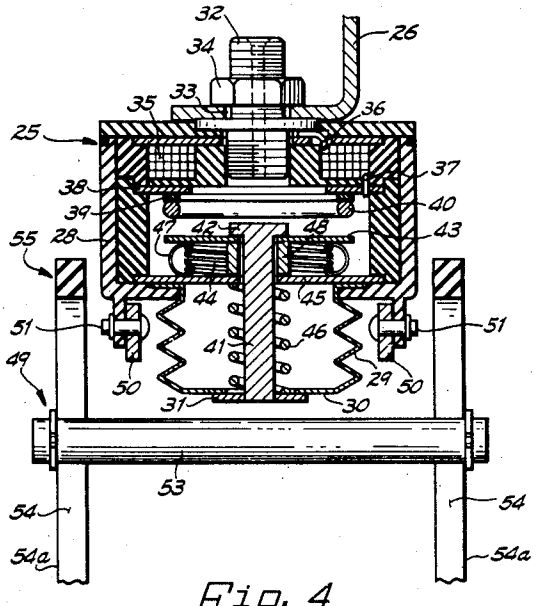


Fig. 4

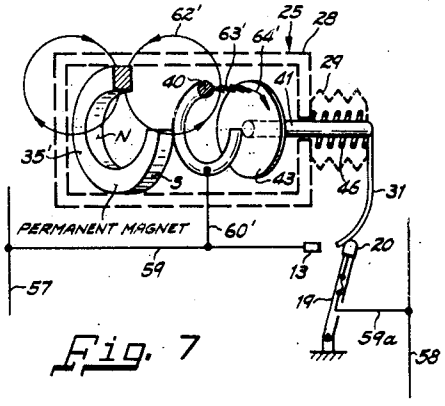


Fig. 7

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LOAD INTERRUPTING DEVICE

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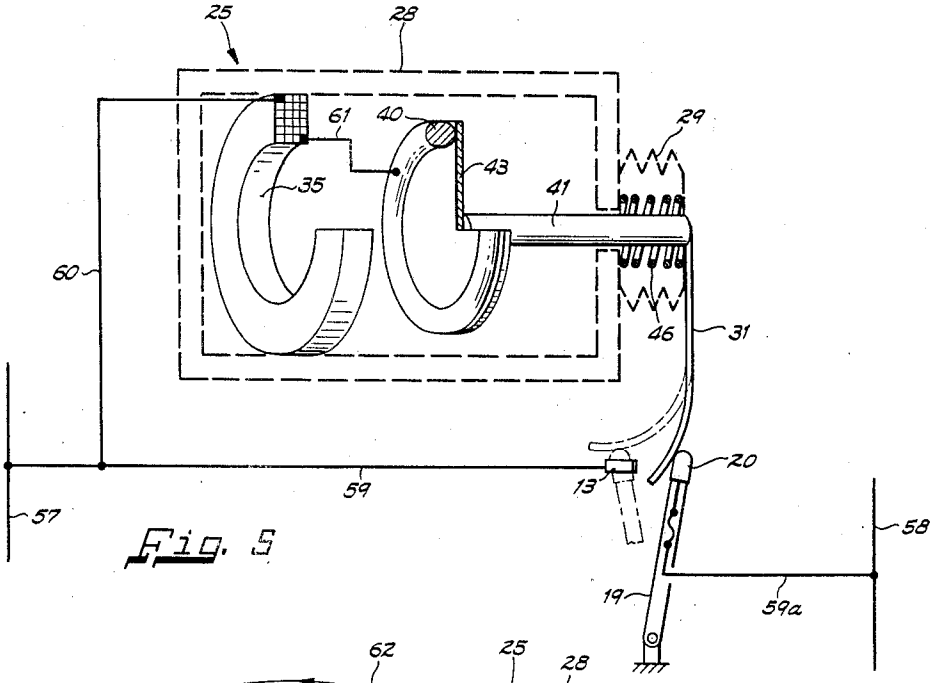


Fig. 5

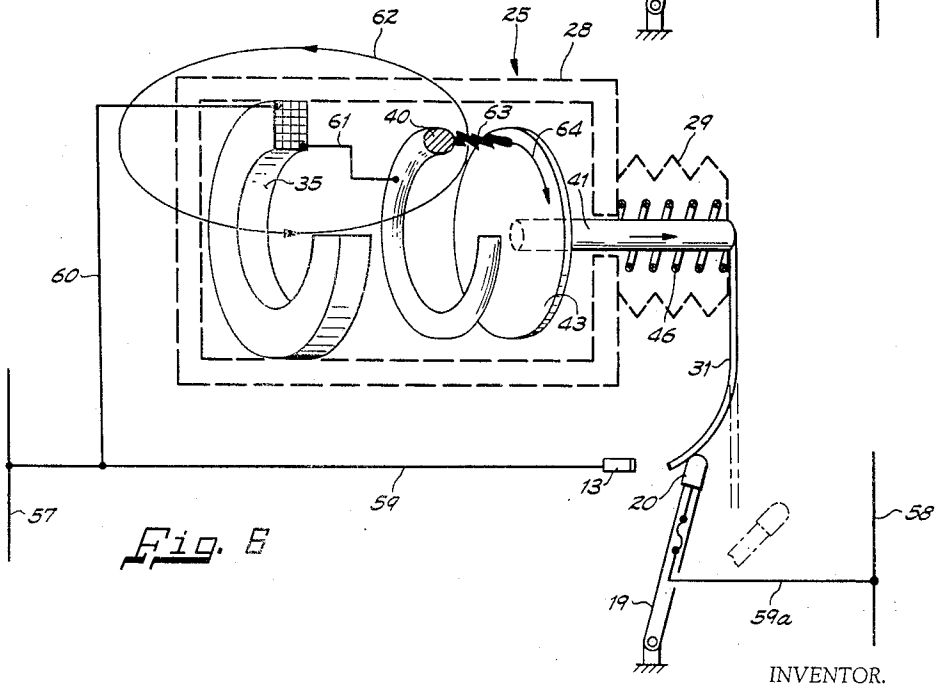


Fig. 6

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LOAD INTERRUPTING DEVICE

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Filed Aug. 21, 1958, Ser. No. 756,468

9 Claims. (Cl. 200—120)

This invention relates in general to load interrupting devices and more particularly relates to a load interrupting device well adapted for fuse cutouts, switches, and the like.

In fuse cutouts and the like, auxiliary load devices are often used to bypass current at the point of electrical engagement of the fuse tube with the fixed terminal contacts of the cutout to prevent arc damage thereat or possible apparatus flashover when opening the cutout under load. The prior practice in the design of load interrupting devices requires relatively large rotational or longitudinal motion to separate the auxiliary contacts. This is particularly objectionable in housed cutouts because of space limitations. The arc interruption of prior devices is generally aided by the generation of gases caused by playing of the arc on fibre pieces or the like. This is objectionable because venting of the gases may harm a lineman. Another generally accepted method of interrupting arcs is the so called cam follower method which requires a rather large longitudinal motion and generally requires mounting on the exterior of the housed cutout. Exposure of the parts to the elements and proximity thereof to the lineman are objectionable. Still another type of prior art load interrupting device attempts to force gases or oil through the arc path by means of various mechanical devices. These devices are complicated and cumbersome.

It is an object of the present invention to provide a load interrupting device which requires relatively short contact separation and thereby conserves on space requirements necessary to afford such movement.

It is a further object of the invention to provide an arc interrupter wherein the arc is rapidly moved between spaced auxiliary contacts by magnetic means so that the arc is spun around the periphery of the contacts to prevent burning of the latter while affording a high interrupting rating.

A further object of this invention is to provide arc interrupting means of the type aforementioned wherein magnetic means is used to force the arc through a fluid arc extinguishing medium thus eliminating mechanical puffer or plunger devices.

It is a further object of this invention to provide a load interrupting device which may be easily sequentially stacked in series to accommodate various voltage requirements.

It is a further object of this invention to provide an arc interrupting device of the type aforestated which because of compactness is particularly well adapted to disposal within the confines of a housed fuse cutout.

It is a further object of this invention to provide a load interrupting device for a fuse cutout or the like which is simple in construction, has a minimum of parts, is well adapted to the mass manufacturing process and is otherwise well adapted electrically and mechanically for the purposes for which it was designed.

The novel features that are characteristic of this invention are set forth with particularity in the appended

claims. The invention itself, however, both as to its organization and its method of operation together with additional objects and advantages thereof will best be understood by the following description of a specific embodiment when read in connection with accompanying drawings in which:

Fig. 1 is a vertical sectional view of a housed fuse cutout embodying the concepts of my invention;

Fig. 2 is a sectional view taken along lines 2—2 of Fig. 1;

Fig. 3 is a sectional view similar to Fig. 1 showing the relative position of the parts during opening movement of the door to the housed cutout;

Fig. 4 is a sectional view similar to Fig. 2 showing the relative positional relationship of the parts of the load interrupter when the door of the cutout is in the position shown in Fig. 3;

Fig. 5 is a semidiagrammatic view, partially in section, illustrating the relative position of the interrupting apparatus when the contacts are in engaged relation;

Fig. 6 is another semidiagrammatic view similar to Fig. 5 showing the relative position of the parts and the cooling movement of the arc when the contacts are in separated relation; and

Fig. 7 is a semidiagrammatic view similar to Fig. 5 illustrating the electrical circuitry when a permanent magnet is substituted for the electromagnetic coil.

While the auxiliary load interrupting device is shown and described with a housed fuse cutout, it is to be noted that it is also well adapted for attachment to any switching device where it is desired to have an auxiliary load break function.

Turning to the drawings, Fig. 1 shows a housed fuse cutout comprising insulated housing **10** having a door **11** rotatably mounted thereon for enclosing the electrical components disposed within said housing. Fixedly mounted within the housing **10** is a first terminal means **12** comprising upper contact means **13** and upper electrical conductor means **14** which is adapted to be attached to a line connector not shown. The contact means **13** is generally U-shaped in configuration to receive and embrace the contact cap **20** of the fuse tube as shall be later explained.

Second terminal means **15** is disposed below the first terminal means within the housing **10** and comprises U-shaped contact fingers **16** and the lower connector means **17** adapted to engage another conductor (not shown). Fuse means **18** is mounted on the door **11** and is adapted to detachably bridgingly engage the first and second terminal means. The fuse means comprises a fuse tube formed of insulating material having a conducting cap **20** at the upper end thereof for cooperation with contacts **13**. A contact sleeve **22** is embracingly disposed about the middle of the fuse tube and mounts the latter to the door in addition to engaging lower contact **16**. A headed fuse link cable is disposed within the fuse tube **19** and is electrically connected to cap **20** at one end and to the contact sleeve **22** at the other end by means of a mounting clamp **24**. An articulated spring biased flipout means **23** is attached to the contact sleeve **22** to move the fuse link cable **21** from within the fuse tube upon rupturing of the link. The foregoing subject matter except for configuration of the housing **10** and door **11** is standard in the art and represents generally conventional prior art practice.

An auxiliary load interrupting device **25** is fixedly disposed within the upper portion of housing **10** by generally channel shaped mounting means **26** which is electrically connected to the upper or first terminal means **12** by suitable connector strip **27**. As shown the connector strip **27** may be integral with the upper terminal means or a separate member if desired. The auxiliary load interrupting device **25** comprises a generally cylindrical

housing means 28 formed of insulating material having an axially aligned bellows 29 mounted on the right hand side as viewed in Fig. 1. The bellows 29 is flexible and extensible and is preferably made of copper or other good conducting material. Dependingly attached to the movable end 30 of the bellows is an auxiliary contact spring 31 which is so formed as to engage the cap 20 on the fuse tube 19. Thus, an auxiliary circuit is formed between the first terminal means 12 and the fuse cap 20 through conducting strip 27, mounting means 26, the interrupter means 25 and contact spring 31.

The interrupting device 25 per se comprises the mounting and conducting bolt 32 which is fixedly axially disposed in the housing 28 and extends through an aperture 33 formed in the mounting means 26. A nut 34 firmly affixes the bolt 32 to the mounting means to afford a good mechanical and electrical connection to hold the assembly 25 in rigid relation to the housing 11. Annular coil means 35 formed of copper windings or the like is concentrically disposed within the housing 28 and is electrically connected to bolt 32 by soldering of one end of the coil thereto or by other suitable connector 36. The coil means 35 is suitably insulated by conventional techniques. A retaining washer 38 is interfitted in the insulation and firmly holds the coil 35 in the fixed position shown, said retaining ring 38 being electrically connected to the coil by the other end of the winding or by suitable connector 37.

It is to be expressly noted that coil 35 may be replaced by a suitable toroidal shaped permanent magnet 35' having opposite poles on the interior and exterior surfaces. When a permanent magnet is substituted, the electrical connection bypasses the magnet and is directly shunted from bolt 32 to electrode 40. The electrical circuitry is then as shown in Fig. 7 of the drawings.

The fixed contact assembly of the interrupter device comprises an annular washer 39 affixed to retaining washer 38 and a generally toroidal shaped contact ring 40 which is brazingly mounted on the washer 39 all of which are coaxially aligned with bolt 32. It is to be noted that the electrical connection of the mounting bolt 32 to the fixed contact 40 is through the coil 35 which thus places a magnetic influence on the contact as shall be later explained.

The movable contact assembly comprises an elongated generally cylindrical plunger rod 41 having an enlarged head portion 42. The plunger 41 is fixed to contact spring 31 through a suitable aperture in the end wall 30 of the bellows, the connection being by brazing or the like to seal the end wall 30 and cause the end wall, the contact spring 31 and plunger to move as a unit. An annular flat movable contact plate 43 is disposed in opposed relationship to the contact ring 40 and is biased thereagainst by spring 44 which serves to maintain a constant contact pressure between contacts 43 and 40. The spring 44 also serves as a lost motion connection to bias the contact 43 for movement with the enlarged head 42 of plunger member 41. An anchor plate 45 is fixedly mounted by interfitting in the insulation of the housing 28 and serves as a fixed base plate for the other end of the contact and loss motion biasing spring 44. Copper shunt strips 47 are disposed around spring 44 to provide a convenient current bypass from contact 43 to plate 45, the circuit continuing through the bellows 29 to contact spring 31. The entire enclosure of housing 28 including bellows 29 is preferably sealed and an arc extinguishing fluid is disposed therein. Examples of arc extinguishing fluids are oil, carbon dioxide, dry air, sulfur hexafluoride, etc.

Contact 43 is biased away from contact 40 by a main biasing spring 46 which engages the end surface 30 of the bellows 29 and the other side of plate 45. Spring 46 is considerably stronger than spring 44 overpowering the latter to afford separation of the contacts 43—40. A guide member 48 may be centrally located on plate 45 to provide a bearing for the movable plunger 41.

Latch means 49 is provided to hold the contacts 43—40 in engagement against the bias of spring 46. The latch means comprises a pair of hook like members 50 which are pivotally mounted on suitable projection on the outer portion of housing 28 at 51. A transverse slide member interconnector 52 is fixedly mounted by brazing or the like to each of the hook like members 50 at the upper surface thereof so that the two members 50 act as a unitary latch as best shown in Figs. 1 and 3 of the drawings.

The tripping means 55 for the latch means comprises a pair of spaced integral arms 54*a* formed in or attached to the door 11. Each of the arms is formed with an elongated slot or aperture 54. A captive cocking rod 53 is held within the slots 54 of the tripping means 55 and is engageable with the end of the bellows 30. The rod 53 is so aligned with the end surfaces of the slots 54 so as to compress the bellows and coactingly receive the hook like members 50 which fit thereover to latch the contacts in the position shown in Figs. 1 and 2 of the drawings. For tripping purposes, a cam surface 56 is formed on the upper surface of arms 54*a* to engage transverse member 51 to releasably raise the hook members 50. The relative length of the slots 54 and position of cam surface 56 is such that it allows a partial opening movement of the door prior to transverse interconnecting rod 51 engaging with cam surface 56 to cause upward movement of the hook like members 50. Relatching upward movement of hook like members 50 with the captive rod 53 occurs by the cam surface formed in the leading edge 50*a* of the hook like members 50 engaging with the rod member 53 as the door is moved inwardly (to the left) when the rod 53 is against the right hand end of the slot as viewed in Fig. 1.

Operation.—Assume that the parts are in the position shown in Fig. 1. The pull ring on the door is engaged manually by a hook stick or other suitable device to pull the door outwardly or to the right as shown in Fig. 3 of the drawings. As the door is moved outwardly, fuse cap 20 parts with contact means 13, but spring contact means 31 of the load interrupter remains in electrical engagement with the cap 20. The latch tripping arms 54*a* moving with the door causes upper cam surface 56 thereon to engage the transverse rider bar 51 moving the latter upwardly so as to cause hook members 50 to disengage from captive rod 53 releasing the bellows end wall 30 for outwardly movement under the bias of spring 46. Assuming that conductor 57 (shown in schematic Figures 5 and 6) is connected to a source of electrical energy, the normal current path through the fuse cutout when it is closed is along conductor 59 through contact 13, through the fuse link, through the conductor 59*a* to the other side of the line 58. During the interrupting cycle above described the current bypasses conductor 59 taking the alternate path through conductor 60, through the coil 35, through conductor 61 to fixed contact 40, arcs the gap between contacts 40 and 43, follows through the bellows 29 through conductor spring 31 to the fuse cap 20 through conductor 59*a*, to return conductor 58. The current in the annular coil means 35 sets up a magnetic field 62 which causes the arc 63 to move in the direction shown by the arrows 64 causing a rapid movement of the arc along the periphery of the two contacts as shown semidiagrammatically in Fig. 6. Rapid movement of the arc 63 is such that deleterious pitting of the contacts does not occur. The arc, under the influence of the magnetic field, is thus forced into intimate contact with the unionized arc extinguishing fluid in the housing 28.

It will be apparent that a very short movement of the contacts is required in order to produce an arc and the arc is rapidly extinguished under the dual influence of the rapid movement thereof as well as by the arc extinguishing fluid which is forced into contact of the arc by the movement of the arc itself.

The door 11 continues its opening movement to the right causing disengagement of the contact spring 31

and the head of the fuse tube **20** to completely interrupt the circuit. The door and fuse tube may thus be removed from the cutout housing **10** in standard fashion.

When the door **11** is replaced, the door is rocked back into position, the fuse tube head **20** re-engaging the contact spring **31**, the cocking bar **53** re-engaging the end of the bellows **30** compressing the latter against spring **46** until latch hook **50** drops over cocking bar **53** to retain the load interrupter in latched cocked relation.

Although a specific embodiment has been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

What is claimed as the invention is:

1. A fuse cutout comprising first and second spaced terminal means, movable fuse means for electrically bridging said first and second terminal means and load interrupter means electrically connected to said fuse means and first terminal means, said load interrupter means comprising enclosure means, magnetic means within said enclosure means, first annular contact means disposed within said enclosure means and associated with said magnetic means, and movable contact means electrically and operatively connected to said fuse means and normally disposed in engaged movable relation to said first contact means within said enclosure means so that disengaging movement of said fuse means from said first terminal means affords movement of said movable contact means to spaced relation with said first contact means to interrupt the electric circuit therebetween within said enclosure means.

2. A short movement load interrupting device comprising sealed enclosure means having a movable end portion and containing arc extinguishing fluid, annular coil means disposed within said enclosure means, fixed annular first contact means magnetically associated and adjacent said coil means and electrically connected thereto, movable contact means engaging said fixed contact means and operatively connected for movement with said movable end portion of said sealed enclosure means, and means biasing said movable end portion outwardly to afford separating movement of said fixed and movable contact means, said separating movement of the contacts affording an arc which is rapidly spun by the magnetic influence of said coil means for extinguishment by said arc extinguishing fluid so that a relatively short separating movement of the contacts will interrupt relatively large electrical currents.

3. A fuse cutout comprising an insulated housing having movable closure means, first and second spaced terminal means fixedly disposed within said housing, fuse means disposed on said closure means for detachably electrically bridging said first and second terminal means, and load interrupter means fixedly disposed within said housing and electrically connected to said fuse means and first terminal means for bypassing the current therethrough upon movement of said closure means, said load interrupter means comprising sealed enclosure means, coil means within said enclosure means electrically connected to said first terminal means, first annular contact means disposed within said enclosure means and electrically connected to said coil means, and movable contact means electrically connected to said fuse means and disposed for coacting association with said first contact means within said enclosure means, said movable contact means being operatively connected to said closure means so that opening movement thereof affords movement of said movable contact means to spaced relation with said first contact means to interrupt the electric circuit therebetween within said sealed enclosure means.

4. A short movement load interrupting device comprising sealed generally cylindrical enclosure means having a flexible entensible bellows forming a movable end portion and containing arc extinguishing fluid, annular

coil means coaxially disposed within said enclosure means, fixed annular first contact means coaxially disposed adjacent and within the magnetic influence of said coil means and electrically connected thereto, relatively flat movable contact means coaxially aligned with and engaging said fixed contact means and operatively connected for movement with said movable end portion of said sealed enclosure means, and means biasing said movable end portion outwardly to afford separating movement of said fixed and movable contact means, said separating movement of the contacts affording an arc which is rapidly spun around the periphery of said contacts by the magnetic influence of said coil means for extinguishment by said arc extinguishing fluid so that a relatively short separating movement of the contacts will interrupt relatively large electrical currents.

5. A cutout comprising spaced first and second terminal means, movable fuse means for electrically bridging said first and second terminal means, load interrupting means fixed relative to said terminal means and electrically connected at one side to said first terminal means and on the other side to said fuse means, said load interrupting means comprising sealed enclosure means having a movable end portion and containing arc extinguishing fluid, annular coil means disposed within said enclosure means, fixed annular first contact means adjacent and within the magnetic influence of said coil means and electrically connected thereto, movable contact means engaging said fixed contact means and operatively connected for movement with said movable end portion of said sealed enclosure means, and means biasing said movable end portion outwardly to afford separating movement of said fixed and movable contact means, said separating movement of the contacts affording an arc which is rapidly spun by the magnetic influence of said coil means for extinguishment by said arc extinguishing fluid so that a relatively short contact movement will interrupt relatively large currents.

6. A fuse cutout comprising an insulated housing, door means rotatably mounted for closing said housing, first and second spaced terminal means disposed within said housing, fuse means fixed on said door means for electrically bridging said first and second terminal means, and load interrupter means fixed within said housing and detachably electrically connected to said fuse means, said load interrupter means comprising sealed enclosure means, coil means within said enclosure means electrically connected to said first terminal means, first annular contact means disposed within said enclosure means and electrically connected to said coil means, and movable contact means for cooperation with said first contact means and electrically and operatively connected to said fuse means, means biasing said movable contact means away from said first contact means, latch means operatively associated with said movable contact means to maintain the latter in engagement with said first contact means against said biasing means, latch tripping means fixed to said door means and operable to release said latch means so that opening movement of said door means affords tripping movement of said latch means to in turn afford movement of said movable contact means to interrupt the circuit therebetween within said sealed enclosure means and thereby prevent arcing between said fuse means and said first terminal means.

7. A short movement load interrupting device comprising sealed enclosure means having a movable end portion and containing arc extinguishing fluid, magnetic field means disposed within said enclosure means, fixed annular first contact means adjacent and under the influence of said magnetic means, movable contact means engaging said fixed contact means and operatively connected for movement with said movable end portion of said sealed enclosure means, and means biasing said movable end portion outwardly to afford separating movement of said fixed and movable contact means, said sepa-

rating movement of the contacts affording an arc which is rapidly spun by the magnetic influence of said magnetic means for extinguishment by said arc extinguishing fluid so that a relatively short contact movement will interrupt relatively large currents.

8. A fuse cutout comprising first and second spaced terminal means, movable fuse means electrically bridging said first and second terminal means, and load interrupting means electrically connected to said fuse means and said first terminal means, said load interrupting means comprising sealed enclosure means containing an arc extinguishing fluid, magnetic means disposed within said enclosure means, stationary contact means disposed within said enclosure means and magnetically associated with said magnetic means, and movable contact means disposed within said enclosure means and electrically and operatively connected to said fuse means, said movable contact means normally disposed in engaged movable relation to said stationary contact means and operative to be disengaged from said stationary contact means upon disengaging movement of said fuse means from said first terminal means so that an arc is drawn between said contact means, said stationary contact means and said movable contact means having a substantial dimension generally normal to the direction of said disengaging movement of said movable contact and said magnetic means acting on said arc and resulting in movement of said arc on said contact means and through said arc extinguishing fluid, whereby relatively short separation of said contact means interrupts relatively large currents.

9. A short movement load interrupting device comprising sealed enclosure means having a movable end portion and containing an arc extinguishing fluid, magnetic means disposed within said enclosure means, stationary contact means, disposed within said enclosure means and adjacent said magnetic means, movable contact means disposed within said enclosure means in engagement with said stationary contact and operatively connected for movement with said movable end portion of said sealed enclosure means, and means biasing said movable end portion outwardly to afford separating movement of said stationary and movable contact means, said stationary and movable contact means having a substantial dimension generally normal to the direction of said separating movement, said magnetic means acting upon the arc drawn between said contact means on separation thereof and affording movement of said arc on said contact means and through said arc extinguishing fluid, whereby relatively short separation of said contact means interrupts relatively large currents.

References Cited in the file of this patent

UNITED STATES PATENTS

659,671	Hewlett	Oct. 16, 1900
2,065,802	Graves	Dec. 29, 1936
2,411,893	Peters	Dec. 3, 1946
2,734,966	Schneider	Feb. 14, 1956
2,824,190	Mikos	Feb. 18, 1958

FOREIGN PATENTS

736,870	France	Sept. 26, 1932