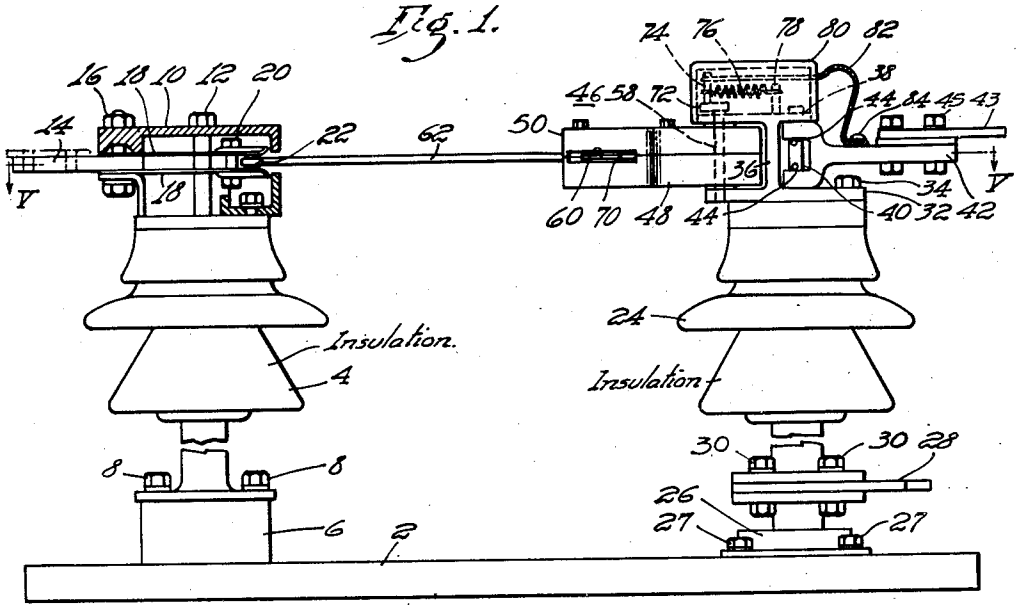
July 30, 1946. H. W. GRAYBILL 2,404,957

CIRCUIT INTERRUPTER

Filed July 7, 1944 2 Sheets-Sheet 1

Fig. 1.



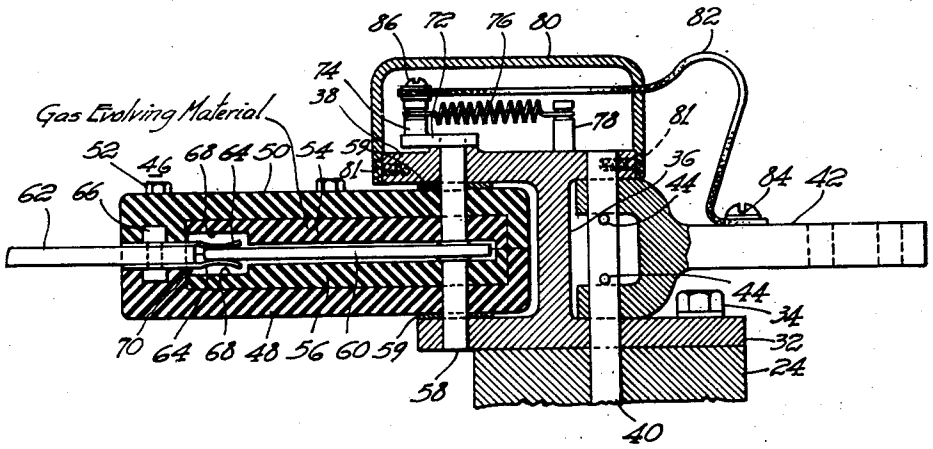


Fig. 2.

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CIRCUIT INTERRUPTER

Filed July 7, 1944 2 Sheets-Sheet 2

Fig. 3.

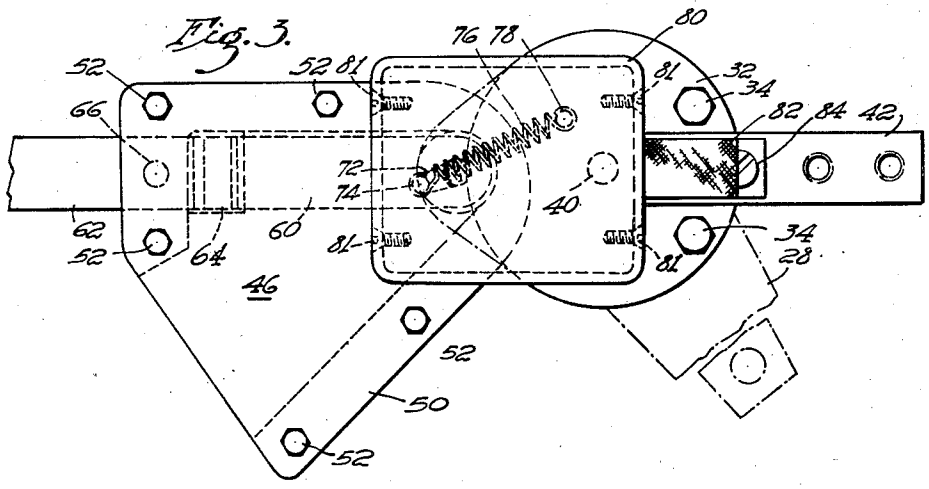


Fig. 4.

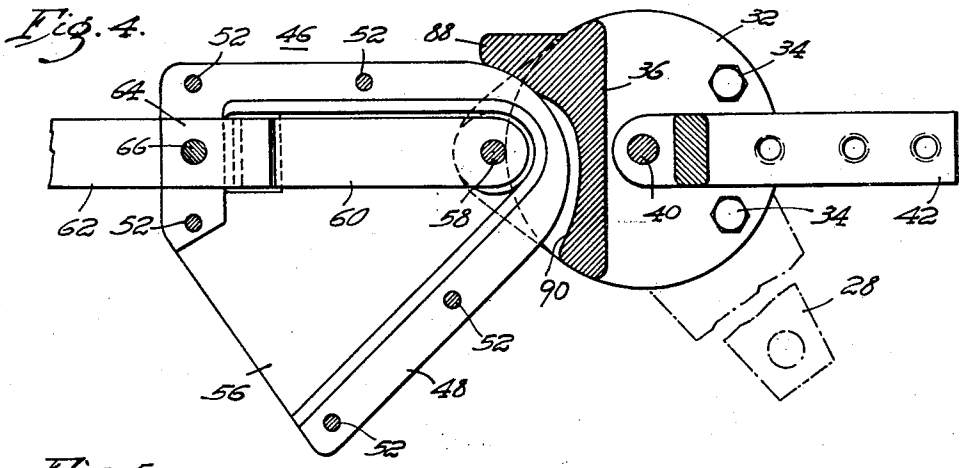
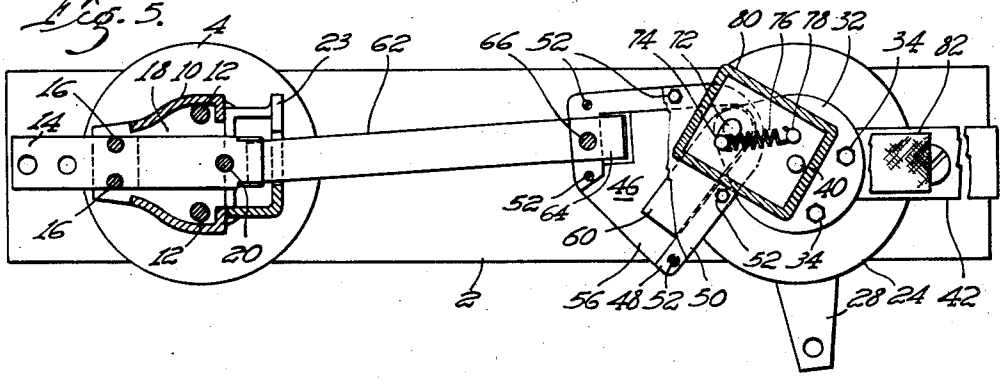


Fig. 5.



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UNITED STATES PATENT OFFICE

2,404,957

CIRCUIT INTERRUPTER

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Application July 7, 1944, Serial No. 543,910

15 Claims. (Cl. 200—48)

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This invention relates generally to electric circuit interrupting devices, and more especially to disconnect switches which are capable of interrupting load currents.

A recent development in the electric switch art are load break disconnect switches. These switches, in addition to performing the function of ordinary disconnect switches, that is, being capable of inserting a readily visible safe air gap in the circuit, must also be capable of safely interrupting load currents. Load break disconnect switches may take several general forms, but regardless of the particular form, all require some means for extinguishing the arc drawn during interruption of load currents. This invention comprehends certain improvements in arc-extinguishing means for load break disconnect switches, and is disclosed herein as incorporated in a switch of the type having a set of disconnect contacts and a set of interrupting contacts connected in series circuit relation, with actuating means for sequentially actuating the two sets of contacts so that all arcing occurs at the interrupting contacts for which arc extinguishing means is provided.

One object of this invention, therefore, is to provide a load break disconnect switch having a novel structural arrangement of circuit interrupting contacts and disconnect contacts electrically connected in series circuit arrangement.

Another object of this invention is to provide novel actuating means for a load break disconnect switch of the type described which includes an overcenter spring for actuating the interrupter contacts of the switch.

Another object of this invention is to provide a novel arrangement of arc-extinguishing means and circuit-interrupting contacts.

Still another object of this invention is to provide novel actuating means for a load break disconnect switch having a set of interrupter contacts and a set of disconnect contacts, for actuating said sets of contacts in a predetermined sequence.

These and other objects of this invention will become more apparent upon consideration of the following detailed description of a preferred embodiment thereof, when taken in connection with the attached drawings, in which:

Figure 1 is a side elevation view of a switch embodying this invention, with the stationary contact structure shown in section;

Fig. 2 is an enlarged partial section view taken substantially centrally through the movable support for the switch blade shown in Fig. 1;

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Fig. 3 is an enlarged plan view of the portion of the switch shown in Fig. 2;

Fig. 4 is a view similar to Fig. 3, but with a part of the switch enclosing casing removed, and with certain of the parts shown in section; and

Fig. 5 is a sectional view taken substantially on the line V—V of Fig. 1.

This invention is particularly disclosed herein as incorporated in a disconnect switch of the type shown in H. L. Rawlins Patent No. 2,303,496, issued December 1, 1942, to the same assignee as this invention. This type of switch comprises, in general, a supporting base 2 on which is mounted a stationary insulator 4, as by bolts 8 which engage a supporting post 6 on base 2. A contact housing 10 is secured on the upper end of stationary insulator 4, for example, by through bolts 12. Contact housing 10 preferably has openings at opposite sides thereof, with one opening adapted to receive a terminal plate 14 which is secured in the opening by bolts 16. Terminal plate 14 extends outwardly of contact housing 10 so as to have a line conductor secured thereto. Preferably, contact jaws 18 are also secured within contact housing 10 by bolts 16, with the jaws maintained in spaced relation by terminal plate 14 interposed therebetween. The contact jaws 18 terminate within housing 10 short of the opposite opening therein, and are provided adjacent their free ends with a bolt 20 extending therethrough, to limit separation of the free ends of the contact jaws. Preferably, each contact jaw is provided with a limited area projecting contact portion 22 for engagement with a movable switch blade. It will be noted that the opening in contact housing 10 adjacent the free ends of contact jaws 18 is provided with a side entrance 23 (Fig. 5) permitting the entrance of the movable switch blade from one side.

Supporting base 2 also has mounted thereon a rotatable insulator 24 in a bearing 26, which is secured to base 2 by bolts 27. Rotatable insulator 24 has a shaft portion rotatably received in bearing 26, and an actuating crank 28 may be secured to this shaft portion in any desired manner, for example as by bolts 30 provided through crank 28 and through flanges in separate parts of the shaft portion. The outer end of rotatable insulator 24 is provided with a housing bracket having a base plate 32 secured to rotatable insulator 24, as by bolts 34. An upstanding connecting portion 36 is provided integral with base 32 of the housing bracket, and a top plate 38 is provided integral with the other

end of portion 36. Rotatable insulator 24 is provided with a central aperture in the outer end thereof for receiving a supporting shaft 40, which extends through the top and bottom plates 36 and 32 of the housing bracket, to rotatably support a terminal plate 42. The inner end of terminal plate 42 is preferably forked to form opposed bearing portions for receiving supporting shaft 40, and the shaft is maintained in the position shown by pins 44 engageable with the inner sides of the forked portion of terminal plate 42. A line conductor 43 may be secured to terminal plate 42 by bolts 45.

An interrupter housing, generally designated 46, is adapted to be mounted between top and bottom plates 38 and 32 of the housing bracket mounted on rotatable insulator 24, at the opposite side of connecting portion 36. The interrupter housing is preferably formed of complementary, generally cup-shaped halves 48 and 50 of insulating material, such for example as a synthetic resin, porcelain, or the like. The portions 48 and 50 of the interrupter housing are secured together in opposed relation, with the flanges thereof in engagement, by through bolts 52. Each portion of interrupter housing 46 is provided with a generally cup-shaped liner 54 and 56, adapted to have the flanges thereof in abutting relation when the housing sections are secured together. Liners 54 and 56 are also of insulating material, preferably an insulating material which is capable of evolving an arc-extinguishing gas when in proximity with an electric arc such as fiber, boric acid, or a synthetic resin having this property.

Figs. 3 to 5 indicate that interrupter housing 46 is generally triangular in shape, and at the apex thereof the housing is transversely apertured for receiving an actuating shaft 58, which rotatably extends through the housing and through top and bottom plates 38 and 32 of the housing bracket mounted on the outer end of rotatable insulator 24. Within interrupter housing 46 actuating shaft 58 has rigidly secured thereto, as by welding or the like, an interrupter blade 60. Preferably, washers 59 are interposed between the interrupter housing 46, and the top and bottom plates 38 and 32 of the supporting bracket.

A main switch blade 62 is mounted at one end in interrupter housing 46, with recesses being provided in each housing portion 48, 50, adjacent one side of the base portion of the housing, for receiving switch blade 62. Correspondingly shaped recesses are also provided in housing parts 48 and 50, for receiving a bolt or rivet 66, which is adapted to secure contact jaws 64 to opposite sides of blade 62 at the point where the blade passes through opposed flanges of sections 48 and 50 of the interrupter housing. Obviously, when housing portions 48 and 50 are secured together by bolts 52 with blade 62 and securing means 66 received in the recesses provided in the housing sections, switch blade 62 and contact jaws 64 will be held in fixed relation with respect to interrupter housing 46. As shown in Fig. 2, liners 54 and 56 of the interrupter housing are also recessed as at 68, to form a chamber in which the outer ends of contact jaws 64 are located. Interrupter housing 46 is provided with a slot 70 (Fig. 1) to the exterior thereof through a portion of the base of the housing, so as to direct gases escaping from the housing in a direction at an angle to main switch blade 62.

In order to actuate interrupter switch blade

60, a crank 72 is provided on the upper end of actuating shaft 58, and this crank has an eccentric crank pin 74 which is connected to one end of an overcenter spring 76, the other end of which is anchored to pin 78 secured on top plate 38 of the housing bracket. Preferably, a cover 80, generally cup-shaped in form, is inverted over top plate 38 of the housing bracket, and is secured thereto as by screws 81, to protect the overcenter spring and other parts from the weather.

In the closed circuit position of the switch, the circuit therethrough extends from terminal plate 14 through contact jaws 18, main switch blade 62, contact jaws 64, interrupter blade 60, actuating shaft 58, crank 72, crank pin 74, and through a flexible shunt 82 connecting crank pin 74 and terminal plate 42. Preferably, flexible shunt 82 extends through an opening provided in cover 80 and is secured to the terminal plate and crank pin by screws 84 and 86, respectively.

It will be noted that in the closed circuit position of the switch, overcenter spring 76 lies at one side of actuating shaft 58, to hold interrupter blade 60 in engagement with contact jaws 64, and to also hold the interrupter housing against stop portion 88 formed integral with the vertical part 36 of the housing supporting bracket. In opening the switch, insulator 24 is rotated in a clockwise direction, and since main blade 62 is frictionally held in engagement between contact jaws 22, and since interrupter housing 46 may rotate on actuating shaft 58 relative to insulator 24, initial rotation of the insulator merely results in shifting of the axis of actuating shaft 58 to the other side of overcenter spring 76, while the free end of main blade 62 is held in engagement with contact jaws 18. Shifting of the axis of actuating shaft 58 to the other side of overcenter spring 76 causes the spring to exert a force to rotate interrupter blade 60 in a counterclockwise direction to move it out of engagement with contact jaws 64. This opens the circuit within interrupter housing 46, and results in the drawing of an arc in the narrow slot formed between housing liners 54 and 56. Since the liners are of a gas-evolving material, this will result in the production of a quantity of arc-extinguishing gas which must escape from slot 70 of the housing and thus pass through the arc and replace the ionized particles in the arc path by the un-ionized particles of such gases. This, coupled with rapid elongation of the arc due to the action of overcenter spring 76, results in an extremely efficient arc-extinguishing action, to thereby interrupt the circuit within housing 46 before main blade 62 is separated from contact jaws 18, as shown in Fig. 5. After the circuit has been interrupted within interrupting housing 46, stop shoulders 90, also integrally formed with the housing bracket portion 36, will engage the opposite side of interrupter housing 46 to prevent further relative movement of rotatable insulator 24 and the housing 46, so that continued clockwise rotation of insulator 24 causes the interrupter housing and main blade 62 to move with the insulator. This results in main blade 62 being moved out of engagement with fixed contact jaws 18 to insert a readily visible, safe air gap in the circuit.

In the open circuit position of the switch, where main blade 62 is separated from fixed contact jaws 18, overcenter spring 76 holds interrupter blade 60 at its open position spaced from interrupter contact jaws 64, and against one end of the narrow slot within interrupter housing 46, and consequently this spring also holds inter-

rupter housing 46 in engagement with stop portion 90 of the housing supporting bracket. Accordingly, in closing the switch, switch insulator 24 will be rotated in a counterclockwise direction, and blades 60 and 62 will be held by spring 76 substantially at the position relative to insulator 24 shown in Fig. 5. When main blade 62 enters side opening 23 in fixed contact housing 10 and engages between contact jaws 18, the circuit will not be completed, because interrupter blade 60 is still held in open circuit position. However, as soon as full engagement of blade 62 with contact jaws 18 occurs, blade 62 will be held against further movement at its outer end, and consequently continued counterclockwise rotation of insulator 24 results in relative movement of blade 62 and housing 46 with respect to the rotatable insulator. This relative movement causes the axis of actuating shaft 58 to be moved to the opposite side of overcenter spring 76, whereupon this spring will move interrupter blade 60 with a snap action into engagement between contact jaws 64, to thereby finally close the circuit.

It will be noted that according to this invention, a disconnect switch blade 62 is provided in series with an enclosed circuit interrupter blade 60, so that the circuit is always opened by the interrupter blade within its special arc-extinguishing enclosure, and on closing the switch the circuit is finally made by the interrupter blade 60, so that all arcing will occur between interrupter blade 60 and contact jaws 64, thus relieving main blade 62 and contact jaws 18 of all arcing. In view of the foregoing, it is also apparent that use is made of relative movement between the actuating means and switch blade 62 for causing an overcenter spring 76 to actuate the interrupter switch blade 60 with a snap action, both in opening and in closing the circuit. The particular cooperation and relationship of the circuit interrupting blade 60 and its arc-extinguishing means with the switch actuating means and main blade 62, results in obtaining sequential operation of the interrupting blade and main blade by the use of relatively simple operating mechanism, and yet results in efficient extinguishing of the arc within interrupter housing 46, with substantially no external display.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is desired that this invention be not limited to this particular embodiment, inasmuch as it will be apparent to persons skilled in the art that many changes and modifications may be made in this particular species of the invention without departing from the broad spirit and scope of the invention. Accordingly, it is desired that this invention be interpreted as broadly as possible, and that it be limited only as required by the prior art.

I claim as my invention:

1. In a circuit interrupter, a line contact, a switch blade adapted to frictionally engage said line contact, movable supporting means for said blade with said blade mounted on said supporting means for limited relative movement while said blade is held in frictional engagement with said line contact, said blade also being movable with said supporting means into and out of engagement with said line contact, separable interrupting contacts arranged in series circuit relation with said blade, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and means responsive to said relative movement between said blade and supporting means to actuate said spring overcenter to thereby actuate said interrupting contacts while said blade engages said line contact.

2. In a circuit interrupter, a line contact, a switch blade adapted to frictionally engage said line contact, movable supporting means for said blade with said blade mounted on said supporting means for limited relative movement while said blade is held in frictional engagement with said line contact, said blade also being movable with said supporting means into and out of engagement with said line contact, separable interrupting contacts carried by said blade and arranged in series circuit relation with said blade, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and said spring reacting between at least one of said separable contacts and said supporting means so as to be actuated overcenter in response to relative movement of said blade and supporting means, to thereby actuate said interrupting contacts while said blade engages said line contact.

3. In a circuit interrupter, a line contact, a switch blade adapted to frictionally engage said line contact, pivotally movable supporting means for said blade with said blade pivotally mounted on said supporting means for limited relative movement on an axis offset from the pivot axis of said supporting means while said blade is held in frictional engagement with said line contact, said blade also being pivotally movable with said supporting means into and out of engagement with said line contact, separable interrupting contacts carried by said blade and arranged in series circuit relation with said blade, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and said spring reacting between at least one of said separable contacts and said supporting means so as to be actuated overcenter in response to relative movement of said blade and supporting means.

4. In a circuit interrupter, a line contact, a switch blade adapted to frictionally engage said line contact, pivotally movable supporting means for said blade with said blade pivotally mounted on said supporting means for limited relative movement while said blade is held in frictional engagement with said line contact, said blade also being pivotally movable with said supporting means into and out of engagement with said line contact, separable interrupting contacts carried by said blade and arranged in series circuit relation with said blade, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and said spring reacting between at least one of said separable contacts and said supporting means so as to be actuated overcenter in response to relative movement of said blade and supporting means.

5. In a circuit interrupter, a line contact, a switch blade adapted to frictionally engage said line contact, pivotally movable supporting means for said blade with said blade pivotally mounted on said supporting means for limited relative movement while said blade is held in frictional engagement with said line contact, said blade also being pivotally movable with said supporting means into and out of engagement with said line contact, separable interrupting contacts arranged in series circuit relation with said blade, one of said interrupting contacts being mounted on said

blade and the other of said interrupting contacts being pivotally mounted on the same axis as said blade, means responsive to said relative movement between said blade and supporting means to actuate said spring overcenter to thereby actuate said interrupting contacts while said blade engages said line contact.

6. In a circuit interrupter, switch blade means, rotatable actuating means for said blade means, said blade means pivotally mounted on said actuating means on an axis offset from the axis of rotation of said actuating means, means limiting pivotal movement of said blade means relative to said actuating means, interrupting means mounted on one of said first two mentioned means and comprising a housing having spaced parallel walls of insulating material forming a narrow slot therebetween, contact means in said slot adjacent one end thereof, a pivoted switching member also in said slot mounted for pivotal movement through said slot into and out of engagement with said contact means, and overcenter spring means reacting between said switching member and the other of said first two mentioned means for actuating said switching member in response to relative movement of said blade means and actuating means.

7. In a circuit interrupter, switch blade means, rotatable actuating means for said blade means, said blade means pivotally mounted on said actuating means on an axis offset from the axis of rotation of said actuating means, means limiting pivotal movement of said blade means relative to said actuating means, interrupting means mounted on one of said first two mentioned means and comprising a housing having spaced parallel walls of insulating material forming a narrow slot, contact means in said slot adjacent one end thereof, a pivoted switching member also in said slot mounted for pivotal movement through said slot into and out of engagement with said contact means, said housing having an opening for venting gases from said slot to direct such gases in a direction at an angle to said blade means, and overcenter spring means reacting between said switching member and the other of said first two mentioned means for actuating said switching member in response to relative movement of said blade means and actuating means.

8. In a circuit interrupter having spaced terminals, bridging means for said terminals comprising a housing having a contact projecting from one side thereof, said housing adapted to be movably mounted at the other side thereof adjacent one of said terminals for movement of said contact into and out of engagement with the other of said terminals, said housing having spaced parallel walls of insulating material therein forming a narrow slot, contact means on the inner end of said contact in said slot at one side thereof, a pivoted switching member adapted to be electrically connected with said one terminal at least in the closed circuit position of said interrupter, said switching member being mounted in said slot to pivotally move through said slot into and out of engagement with said contact means, and common actuating means for said bridging means and switching member.

9. In a circuit interrupter having spaced terminals, bridging means for said terminals comprising a housing having a contact projecting from one side thereof, said housing adapted to be movably mounted at the other side thereof adjacent one of said terminals for movement of said contact into and out of engagement with

the other of said terminals, said housing having spaced parallel walls of insulating material therein forming a narrow slot, contact means on the inner end of said contact in said slot at one side thereof, a pivoted switching member adapted to be electrically connected with said one terminal at least in the closed circuit position of said interrupter, said switching member being mounted in said slot to pivotally move through said slot into and out of engagement with said contact means, said housing having an opening for venting gases from said slot to direct such gases in a direction at an angle to said blade means, and common actuating means for said bridging means and switching member.

10. In a circuit interrupter having spaced terminals, bridging means for said terminals comprising a housing substantially triangular in form, a contact projecting from the base of said housing at one side thereof, said housing adapted to be pivotally mounted substantially at the apex thereof adjacent one of said terminals for movement of said contact into and out of engagement with the other of said terminals, said housing having spaced parallel walls of insulating material therein forming a narrow slot, contact means on the inner end of said contact in said slot at said one side thereof, a switching member pivotally mounted in said slot substantially at the apex thereof and adapted to be electrically connected with said one terminal at least in the closed circuit position of said interrupter, said switching member being mounted in said slot to pivotally move through said slot into and out of engagement with said contact means, and common actuating means for said bridging means and switching member.

11. In a circuit interrupter having spaced terminals, bridging means for said terminals comprising a housing substantially triangular in form, a contact projecting from the base of said housing at one side thereof, said housing adapted to be pivotally mounted substantially at the apex thereof, adjacent one of said terminals for movement of said contact into and out of engagement with the other of said terminals, said housing having spaced parallel walls of insulating material therein forming a narrow slot, contact means on the inner end of said contact in said slot at said one side thereof, a switching member pivotally mounted in said slot substantially at the apex thereof and adapted to be electrically connected with said one terminal at least in the closed circuit position of said interrupter, said switching member being mounted in said slot to pivotally move through said slot into and out of engagement with said contact means, common actuating means for said bridging means and switching member, and the base of said housing being open at least at the other side thereof to vent gases from said slot.

12. In a circuit interrupter, a substantially flat housing which is generally of triangular shape in outline, said housing having at least inner walls of insulating material forming a narrow arc slot of substantially the same shape and form as said housing, a switch member in said slot and pivotally mounted substantially at the apex of said housing, a contact in said slot adjacent the base of said housing and at one side thereof, means for actuating said switch member into and out of engagement with said contact, and said housing being closed except for a vent in said base at a point spaced from said contact so that gases accumulated under

pressure in said housing during arcing will pass through the arc in escaping from said housing.

13. In a circuit interrupter, a substantially flat housing which is generally of triangular shape in outline, said housing having at least inner walls of insulating material which is capable of evolving an arc-extinguishing gas when in proximity to an electric arc forming a narrow arc slot of substantially the same shape and form as said housing, a switch member in said slot and pivotally mounted substantially at the apex of said housing, a contact in said slot adjacent the base of said housing and at one side thereof, means for actuating said switch member into and out of engagement with said contact, and said housing being closed except for a vent in said base at a point spaced from said contact so that gases accumulated under pressure in said housing during arcing will pass through the arc in escaping from said housing.

14. In a circuit interrupter, a pair of spaced supporting insulators one of which is rotatably mounted, a line contact mounted on the other of said insulators, switch blade means adapted to frictionally engage said line contact, said blade means mounted on said rotatable insulator for relative limited pivotal movement on an axis offset from the axis of rotation of said rotatable insulator while said blade means is held in frictional engagement with said line contact, said blade means also being rotatable with said rotatable insulator into and out of engagement with said line contact, separable interrupting contacts carried by said blade means and arranged in series circuit relation therewith, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and said spring reacting between at least one of said separable contacts and said rotatable insulator so as to be actuated overcenter in response to relative movement of said blade means and said rotatable insulator.

15. In a circuit interrupter, a pair of spaced supporting insulators one of which is rotatably mounted, a line contact mounted on the other of said insulators, switch blade means adapted to frictionally engage said line contact, said blade means mounted on said rotatable insulator for relative limited pivotal movement while said blade means is held in frictional engagement with said line contact, said blade means also being rotatable with said rotatable insulator into and out of engagement with said line contact, separable interrupting contacts carried by said blade means and arranged in series circuit relation therewith, an overcenter spring for actuating said interrupting contacts into and out of engagement with a snap action, and said spring reacting between at least one of said separable contacts and said rotatable insulator so as to be actuated overcenter in response to relative movement of said blade means and said rotatable insulator.

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