March 7, 1944. J. HORST 2,343,376

CIRCUIT INTERRUPTER

Filed Dec. 9, 1941

Fig. 1.

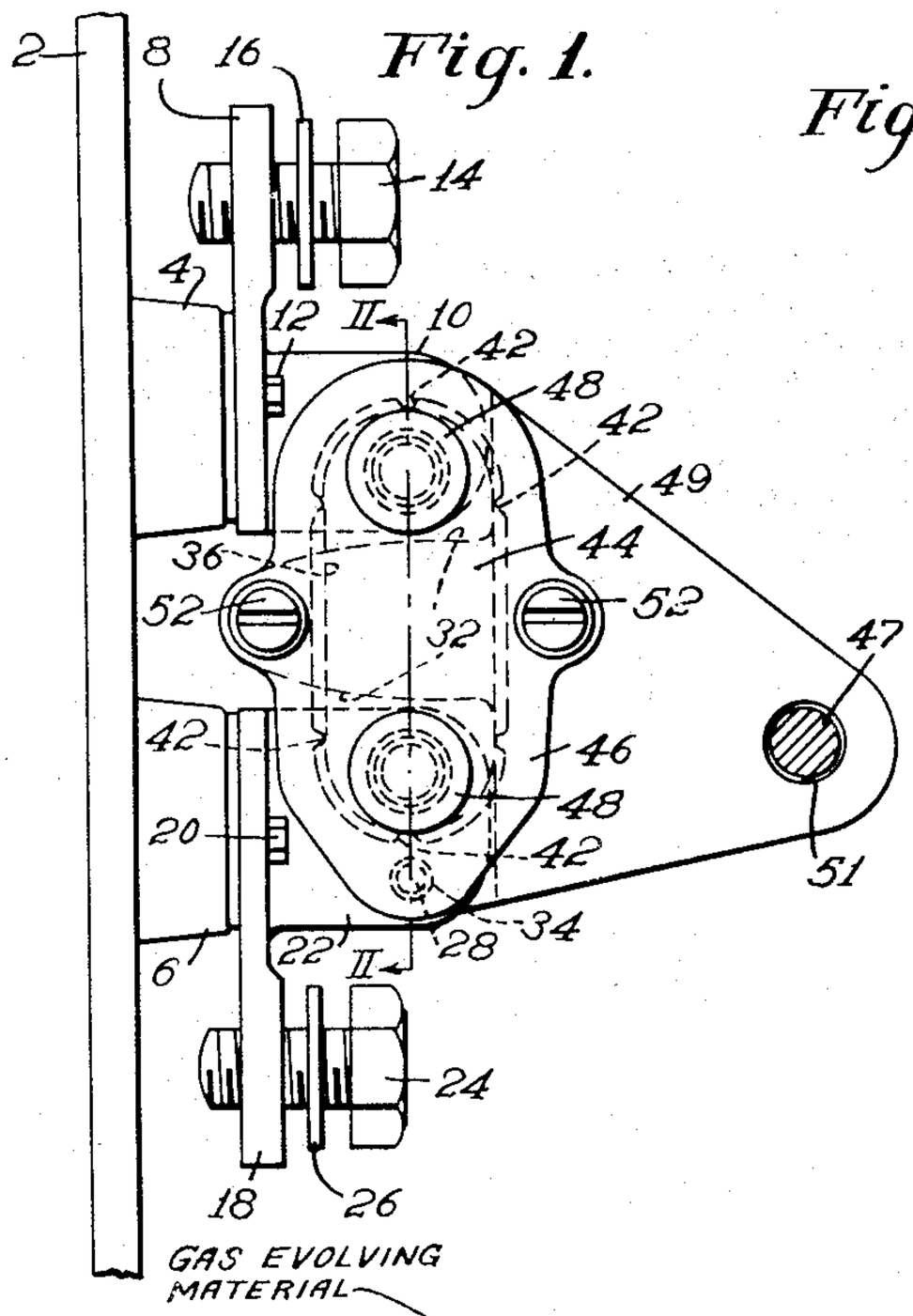


Fig. 2.

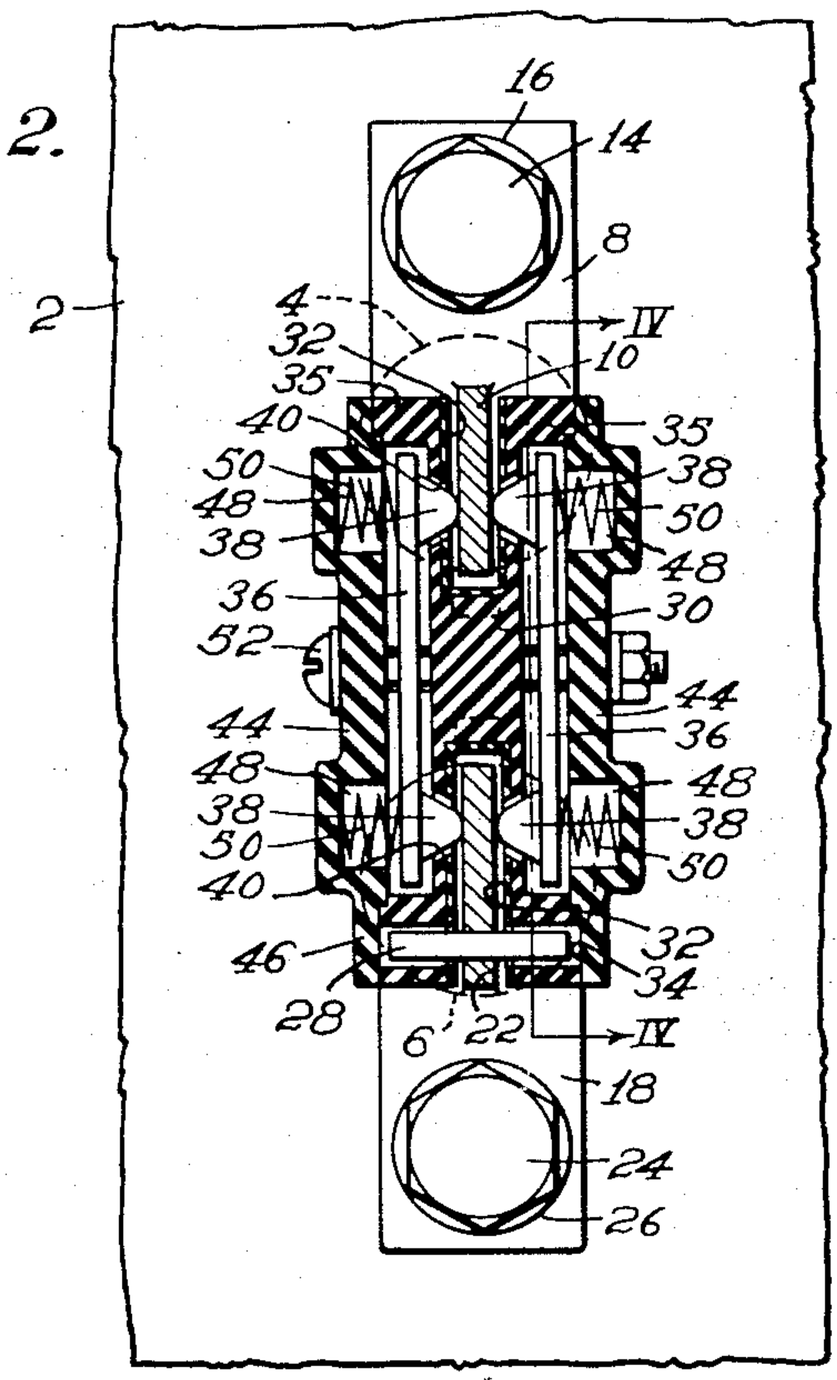


Fig. 3.

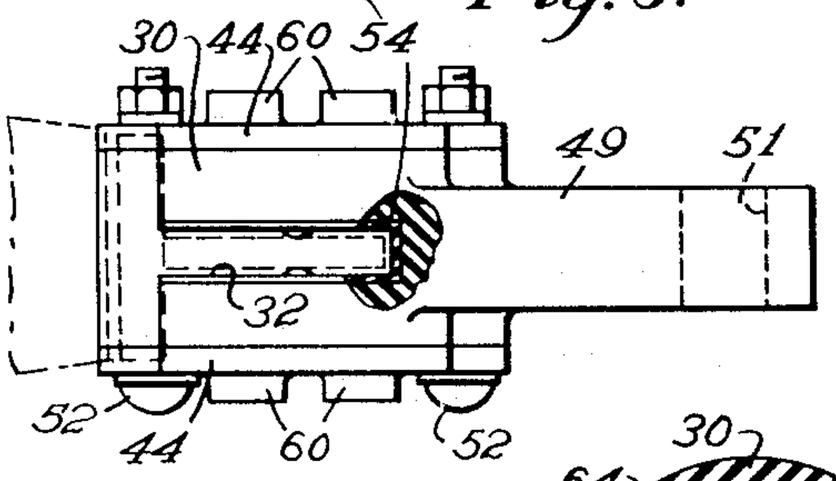


Fig. 4.

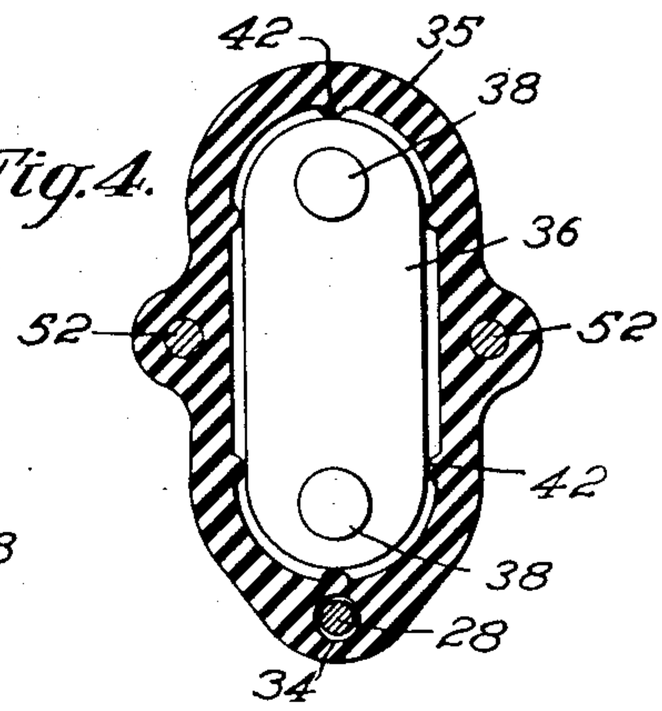
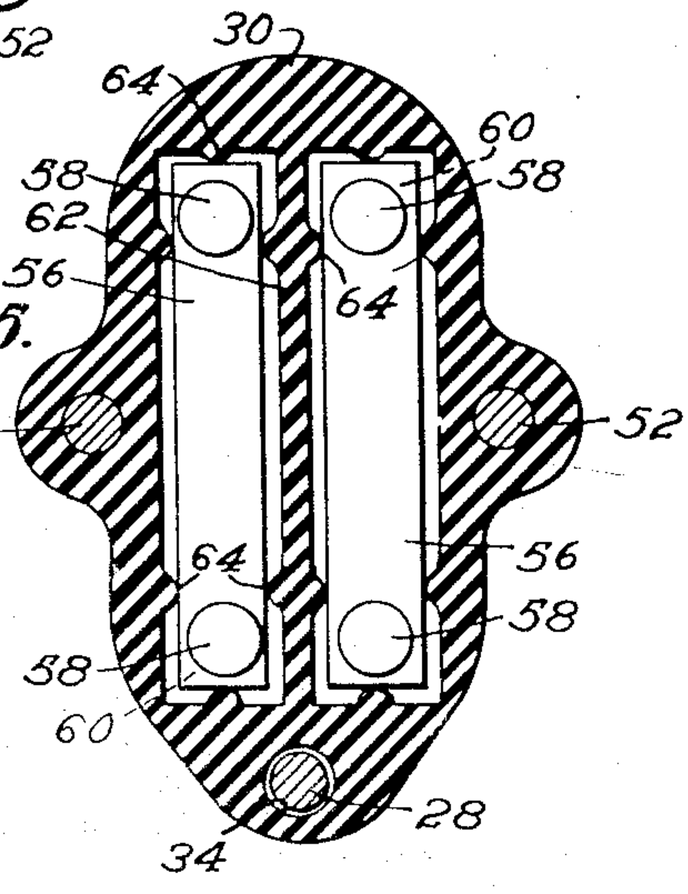


Fig. 5.



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2,343,376

CIRCUIT INTERRUPTER

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11 Claims. (Cl. 200—162)

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

Disconnecting switches are usually designed purely for disconnecting purposes, and therefore where it is desired to open a circuit carrying load currents it is necessary to provide circuit breakers or other apparatus in addition to disconnecting switches for this purpose. At the same time disconnecting switches are essential for the purpose of inserting a visible safe air gap in the circuit when it becomes necessary to work on the circuit. Accordingly, it can be seen that for certain applications, structures combining the functions of disconnecting switches with at least a load current interrupting ability, are highly desirable.

It is, therefore, one object of this invention to provide a novel type of disconnecting switch which is capable of interrupting load currents.

Another object of this invention is to provide the movable contact of a switch with means for extinguishing any arc formed when the switch is opened.

Another object of this invention is to provide a novel type of insulated disconnecting switch.

Another object of this invention is to provide a disconnecting switch with novel means for confining the arc formed when the switch is opened.

A still further object of this invention is to provide a disconnecting switch of a novel construction embodying raised, limited area contacting portions.

Still another object of this invention is to provide a disconnecting switch with novel means for extinguishing an arc struck when said switch is opened.

These and other objects of this invention will become more apparent upon consideration of the following specification of preferred embodiments thereof, taken in connection with the attached drawing, in which:

Figure 1 is a side elevational view of a disconnecting switch embodying one form of the invention;

Fig. 2 is a longitudinal sectional view taken substantially on the line II—II of Fig. 1;

Fig. 3 is an end view of a modified form of the invention with a portion thereof in cross-section. and showing a break contact tongue in dotted lines;

Fig. 4 is a longitudinal sectional view of the switch blade shown in Fig. 2 taken substantially along line IV—IV of Fig. 2 thereof; and

Fig. 5 is a longitudinal sectional view of the modified form of blade shown in Fig. 3.

Referring to the drawing, there is illustrated a disconnecting switch mounted on a base plate 2 which may be of insulating material if desired, and the base plate rigidly carries a pair of spaced, laterally extending insulating members 4 and 6, respectively, which may be of any desired insulating material such as porcelain, glass or a molded insulating material. The insulating member 4 carries a break contact member 8 secured thereto, for example, as by means of screws 12. The break contact member 8 is provided with an integral outwardly extending break tongue 10 and, as shown in Fig. 1, with an upwardly extending terminal plate provided with a threaded aperture for threadedly receiving a machine screw 14, having a washer 16, for attaching a line conductor thereto. Similarly, insulating member 6 is provided with a hinge contact member 18 having a base secured to the insulating projection 6 by screw bolts 20, and further including an integral outwardly extending hinge tongue 22. The hinge contact member 18 is provided, as shown in the drawing, with a downwardly extending terminal plate having a threaded aperture for receiving the screw bolt 24, having a washer 26 thereon, for securing a line conductor thereto. The hinge contact tongue 22 is provided with a transverse aperture adjacent one edge thereof, as shown in Fig. 2, for receiving a pivot pin 28 for pivotally mounting the switch blade member thereon.

The switch blade constructed in accordance with this invention includes a central insulating support 30, which may be made of any desired insulating material such, for example, as a ceramic material, but preferably is of a material which is capable of evolving an arc extinguishing gas when in proximity to an electric arc, such as an amino plast or urea-formaldehyde condensation product. This central insulating blade supporting member 30 is provided with slots at each end thereof which extend inwardly from the respective ends, and are formed slightly wider than the contact tongues 10 and 22 so as to freely receive the contact tongues in one position thereof. One end of the insulating blade supporting member 30 is provided with a transverse bearing aperture 34 for receiving the hinge pin 28, to pivotally mount support 30 on hinge contact tongue 22. The pivot pin 28, after insertion in bearing aperture 34 and the aperture in hinge tongue 22, is preferably secured to the hinge tongue so that the insulating support member 30 is freely rotatable thereon. It can thus be seen that the insu-

lating support member 30 is pivoted about pin 28 on hinge tongue 22 so as to move the opposite end thereof to and from a position in which break contact tongue 10 is received in outer end slot 32. Inasmuch as pivot pin 28 is offset from the central axis of hinge tongue 22 it will also be obvious that the major portion of the hinge tongue is likewise susceptible of being substantially fully enclosed or of being substantially entirely out of the slot 32 adjacent the pivot pin, depending on the relative position of support 30. In this connection it will be noted that the bottom walls of the slots 32 are curved in the manner shown in dotted lines in Fig. 1, so as to clear the contact tongues and permit pivotal movement of support 30 about pin 28.

The central insulating support member 30 is provided on opposite sides thereof with peripheral outwardly extending flanges 35, to thereby form a cavity on each side of the member in which are adapted to be received elongated switch blade members 36. It will be noted that each of the blade members 36 is provided with projecting limited area contact portions 38, which may be formed integral with the blade members 36, or formed separately therefrom and rigidly secured thereto adjacent opposite ends of each blade member 36. The two blade members 36 form a split blade which divides the current in two parallel paths and the magnetic reaction biases the two blade members together and into good contact with the contact tongues therebetween. Referring to Fig. 4, it will be noted that the inner side of flange 35 is provided with spaced positioning lugs 42 integral therewith, designed to prevent shifting of each switch blade in the plane of movement of the blade support within its cavity, but permitting limited sliding movement of the blade in a direction at right angles to this plane.

A cover plate 44 is provided for each switch blade cavity, and these cover plates are also of an insulating material which may be of the same material comprising the insulating supporting member 30. Each of the cover plates includes a peripheral outwardly extending flange 46 adapted to seat on the flange 35 of supporting member 30, and the plates are secured in this position by through bolts 52, extending through ears provided on the cover plates and supporting member 30 at opposite sides thereof. It will be observed that spaced sockets 48 are formed integral with cover plates 44, and positioned to be aligned, respectively, with the projecting contact portions 38 on the switch blade members, for receiving coil compression springs 50 seated in the sockets 48, and engaging blade members 36 for biasing the blade members towards each other. Central insulating member 30 is provided with apertures 40 through the walls thereof forming the sides of slots 32, for permitting the raised limited area contact portions 38 to project therethrough and into slots 32 so as to engage the contact tongues when the switch blade is in the position shown in Figs. 1 and 2 of the drawing. A substantially triangular extension 49 may be formed integral with central supporting member 30 to form a means by which the switch blade may be pivotally moved about pivot pin 28. As shown, the operating extension 49 is provided with aperture 51, for receiving an operating rod 47 which may extend through a plurality of switches identical with that shown in Figs. 1 and 2 for gang operation.

In the operation of the switch described above, it will first be noted that in this switch there is provided limited area contacts at both the break and hinge tongues of the switch, and both may be disengaged when the blade is moved to an open-circuit position. It should also be noted that each of the blade contacting portions is provided with a biasing means which is independent of the biasing means for the other blade contacting portion, and independent of the biasing means for the other blade 36. By this construction, it is possible to obtain a predetermined contact pressure on each contacting portion of the switch, independently of any other contacting portion thereof. Another important feature of this invention resides in the provision of an insulating closure for a switch blade which acts to entirely enclose the blades with the exception of the limited area contacting portions thereof, which project into the slot 32 in the insulating enclosure. When the switch is opened or closed by rotating the same about the pivot pin 28, it is obvious that the limited area contact portion 38 thereof will have a wiping engagement with hinge tongues 10 and 22, respectively, and thereby aid in maintaining clean contact surfaces. When the switch blade is rotated in a clockwise direction about pivot pin 28, as viewed in Fig. 1 of the drawing, to thereby open the switch, limited area contact portions 38 engaging break contact tongue 10 will first separate from the contact tongue, and an arc will be drawn between the portions 38 and the contact tongue 10, which, at the moment of separation and for a substantial amount of opening movement of the blade, will be entirely confined within the outer end of slot 32 in the insulating enclosure for the blades. Obviously the slot 32 acts to restrict the cross-section of the arc to thereby increase the arc voltage, and since the walls of the slot are preferably of a material which evolves an arc extinguishing gas when in proximity to an electric arc, the evolution of this gas will not only act to cool the arc and furnish a supply of un-ionized gas across the arc path, but will also cause a gas blast moving toward the open side of the slot tending to blow out the arc. These combined actions on the arc, that is, restriction thereof and the supplying of un-ionized cooled gases in a blast along the arc, are extremely effective in extinguishing arcs drawn on interruption of relatively high load currents. Also the insulating enclosure for the switch blades confines the arcing to the limited area contact portion 38 thereof, and prevents the arc from traveling along the blade when the switch is open, thus maintaining the arc in insulating slot 32. In the fully open position of the switch, limited area contact portions 38 will also become disengaged from the hinge contact tongue 22, and if the arc at the break end of the switch still persists, a second arc in series therewith will be drawn in insulating slot 32 at the hinge end of the switch, which latter arc will be subjected to substantially the same extinguishing factors as the arc at the break end of the switch. When the switch is opened the springs 50 will obviously move the switch blades towards each other, but this movement is limited by engagement of the blades with the side walls of central insulating support 30. The blade limited area contact portions 38, as shown, have the sides thereof inclined so that when the switch blade is moved to closed-circuit position the contact tongues 10 and 22 exert a camming action on the contact portions 38 to urge them

apart against the bias of springs **50**, until the parts occupy the positions shown in Figs. 1 and 2 of the drawing.

In Figs. 3 and 5 there is illustrated a slightly modified form of switch blade structure. However, many of the parts are the same as described in connection with the switch shown in Figs. 1, 2 and 4, and therefore like reference numerals will be used to designate like parts. The insulating enclosure illustrated in Figs. 3 and 5 of the drawing may be made of a ceramic material such as porcelain or the like and need not be of a gas evolving material, as in this form of this invention there is preferably provided a lining **54** for slots **32** which lining **54** is of a material capable of evolving relatively large amounts of un-ionized gases when in proximity to an electric arc. The lining **54** may be of any such material, for example, such as fiber, boric acid or a synthetic resin. Also in this form of the invention, a pair of switch blades **56** are provided on each side of central insulating support member **30**.

As appears more clearly in Fig. 5, in this modification the blade receiving cavity in each side of insulating support **30** is provided with a longitudinally extending central partition **62** integral therewith, for dividing the cavity into two separate blade cavities for receiving the blade members **56** therein respectively. These blade members **56** are substantially one-half the width of the blade members **36** illustrated in the embodiment of the invention previously described. and are each provided at opposite ends thereof with raised limited area contacting portions **58** similar to the portions **38** described in connection with the aforesaid embodiment. Insulating cover plates **44** are also provided for the switch blade shown in Figs. 3 and 5, and each cover plate is provided with a pair of sockets **60** adjacent each end thereof, each of which is aligned with one of the blade contacting portions **58** for receiving a coil spring similar to springs **50**, shown in Figs. 1 and 2, for independently biasing each of the blade contacting portions **58** into engagement with its associated contact tongue. As shown in Fig. 5, the blade receiving cavities in insulating support **30**, are provided with spaced integral positioning lugs **64** to properly position the blades within the cavities.

The operation of the switch shown in Figs. 3 and 5 is substantially the same as that previously described in connection with the embodiment of the invention shown in Figs. 1, 2 and 4, with respect to extinction of an arc or arcs formed when the switch is open, the slots **32** act in the same manner previously described, to restrict the arc, and gas is evolved by the lining **54** to augment this arc extinguishing action. The advantages of this construction, of course, reside in the possibility of utilizing a relatively strong insulating material for the switch blade enclosure, while at the same time providing an efficient gas evolving material where it is needed, that is, as a lining for slots **32**. Also, by using pairs of blades rather than solid blades, it is possible to obtain a greater number of points of contact between the switch blade and contact tongues, each of which is independently biased into engagement with its respective tongue when the switch is closed, to thereby provide a plurality of contacts between the blade and tongue under predetermined pressures. The use of limited area contacts in disconnecting switch blades has been found to be particularly advantageous, because in utilizing the same contact pressures, it is possible by limiting the area of contact to obtain a greater unit pressure on the contact portions, thereby providing for better electrical contact between these parts.

In the foregoing there has been disclosed novel types of disconnecting switches having means mounted on the blade for extinguishing arcs drawn when the blade is opened, and a switch wherein the blade may be totally enclosed by insulating material except for the contacting portions thereof, and there has also been disclosed a novel blade construction and mounting, by means of which predetermined contact pressures on each contacting portion of the blade can be obtained, independently of the pressure on the other contacting portions thereof.

Having described preferred embodiments of the invention in accordance with the patent statutes, it is desired that this invention be not limited to the specific embodiments disclosed herein, inasmuch as it will be obvious, particularly to persons skilled in the art, that many changes and modifications may be made in these particular structures without departing from the broad spirit and scope of the invention. Therefore it is desired that this invention be interpreted as broadly as possible and that it be limited onl by the prior art, and by what is expressly set forth in the following claims.

I claim as my invention:

1. In a switch, movably mounted blade supporting means of insulating material, an elongated blade member supported on said means, said blade member extending in the plane of movement of said means and supported on said means for limited movement in a direction at an angle to the path of movement of said means, contact means positioned to engage one side of said blade member in the closed position of the switch, said blade member comprising a plurality of separate longitudinally extending conducting members positioned at one side of said contact means, and resilient means independently biasing said conducting members toward said contact means.

2. In a switch, a contact member mounted for movement into and out of engagement with a cooperating contact member, at least one of said members having spaced sides for receiving the other of said members therebetween, said one member including at least one projecting limited area cofitact portion adapted to engage the other of said members in the closed circuit position thereof, and means of insulating material entirely enclosing said one member with the exception of said contact portion, and said contact portion projecting beond said means of insulating material.

3. In a switch, movably mounted blade supporting means, a pair of spaced, substantially parallel blade members supported on said means, said blade members extending in the plane of movement of said means and supported on said means for limited movement in a direction at an angle to the path of movement of said means, contact means positioned to be received between said members in the closed position of said switch, each of said blade members comprising a plurality of separate longitudinally extending conducting members, and resilient means biasing said conducting members, respectively, towards each other.

4. In a switch, a contact member, movably mounted hollow blade supporting means of in-

sulating material having an apertured wall, said means movable towards and away from a position in proximity to said contact member with said apertured wall facing said member, said aperture in said wall being spaced at least from the edge of said wall adjacent said contact member, and blade means mounted in said hollow supporting means and having a portion of limited area adapted to extend through the aperture in said wall of said insulating means to engage said contact member in the closed position of said switch.

5. In a switch, a contact member, movably mounted hollow blade supporting means of insulating material having an apertured wall, said means movable towards and away from a position in proximity to said contact member with said apertured wall facing said member, said aperture in said wall being spaced at least from the edge of said wall adjacent said contact member, blade means mounted in said hollow supporting means and having a portion of limited area adapted to extend through the aperture in said wall of said insulating means to engage said contact member in the closed position of said switch, and resilient means in said insulating means for biasing said blade portion in a direction outwardly of said aperture.

6. In a switch, a contact member, movably mounted hollow means of insulating material having a slot opening to one end thereof, said means movable to and from a position in which said slot freely receives said contact member, said slot having opposed walls of insulating material, opposite walls of said slot being apertured, and blade members positioned in said hollow means at opposite sides of said slot, said blade members including limited area contacting portions adapted to extend through said apertures, respectively, to engage said contact members in the closed position of said switch.

7. In a switch, spaced contact members, movably mounted means of insulating material having slots at opposite ends thereof, said means being movable to and from a position in which said contact members are freely positioned in said slots, respectively, bridging blade members carried by said means outside of said slots and at opposite sides thereof, each of said blade members including contacting portions extending into said slots for engagement with said contact members in the closed position of said switch.

8. In a switch, spaced contact members, movably mounted means of insulating material having slots at opposite ends thereof, said means being movable to and from a position in which said contact members are freely positioned in said slots, respectively, bridging blade members carried by said means outside of said slots and at opposite sides thereof, each of said blade members including contacting portions extending into said slots for engagement with said contact members in the closed position of said switch, and insulating cover means secured on opposite sides of said movable insulating means and forming threwith an enclosure for said blade members.

9. In a switch, movably mounted blade supporting means of insulating material, an elongated blade member supported on said means for limited bodily movement in a direction at an angle to the path of movement of said means, contact means positioned to engage one side of said blade member in the closed position of the switch, said blade member comprising a plurality of separate longitudinally extending conducting members positioned at one side of said contact means, and separate resilient means for each of said conducting members biasing said members toward said contact means.

10. In a switch, spaced contact members, movably mounted means of insulating material having slotted opposite ends movable to and from a position in which said contact members are freely positioned in said slots, respectively, bridging blade members carried by said means outside of said slots and at opposite sides thereof, each of said blade members including limited area contacting portions extending through apertures in said means of insulating material into said slots for engagement with said contact members in the closed position of said switch.

11. In a switch, spaced contacts, blade means for bridging said contacts in the closed position of said switch, said blade means pivotally mounted adjacent one of said contacts for movement into and out of engagement with at least the other of said contacts, and said blade means carrying spaced walls of insulating material forming a narrow slot extending beyond the contact engaging portion of said blade means in a direction toward said other contact so as to receive said other contact during the first part of the opening movement of said blade means after said blade means disengages said other contact to confine the arc drawn, and said walls of insulating material movable with said blade means upon continued opening movement thereof to a position spaced from said other contact.

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