May 1, 1962 G. R. McCLOUD ETAL 3,032,630

PORTABLE LOAD BREAK TOOL

Filed Oct. 27, 1960 2 Sheets-Sheet 1

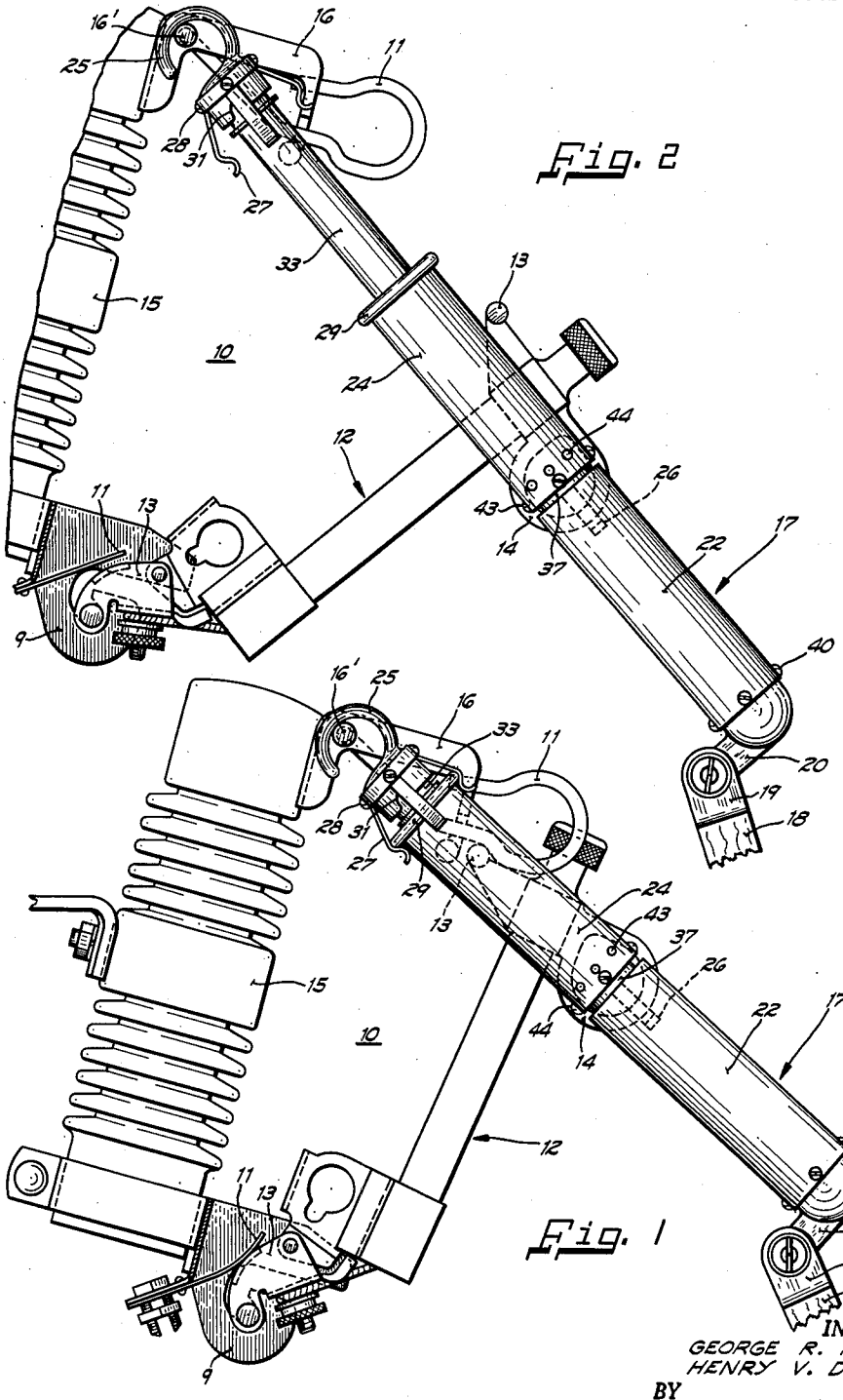


Fig. 2

Fig. 1

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2 Sheets-Sheet 2

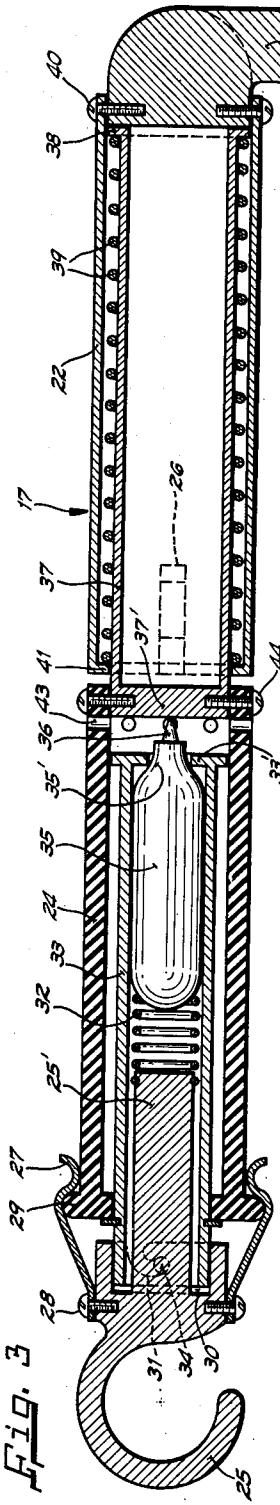


Fig. 3

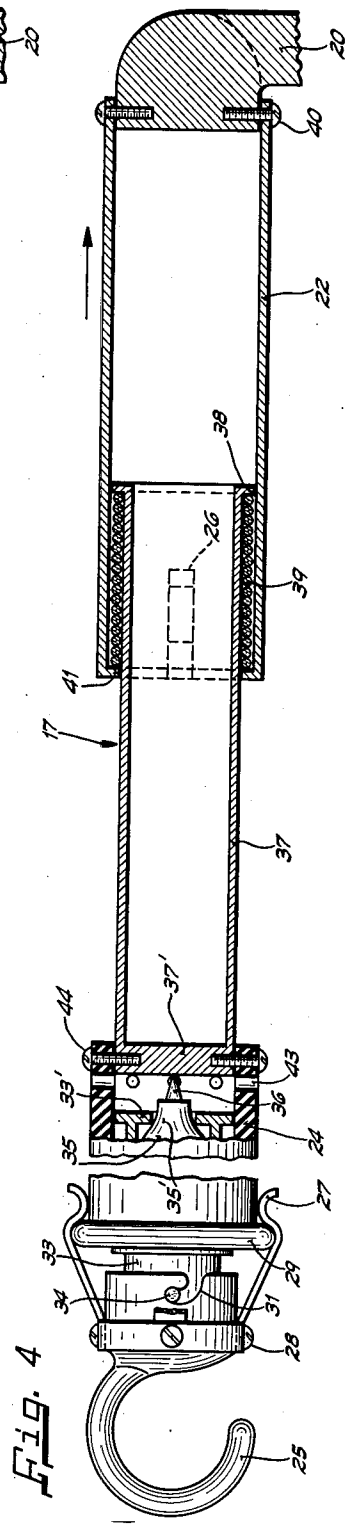


Fig. 4

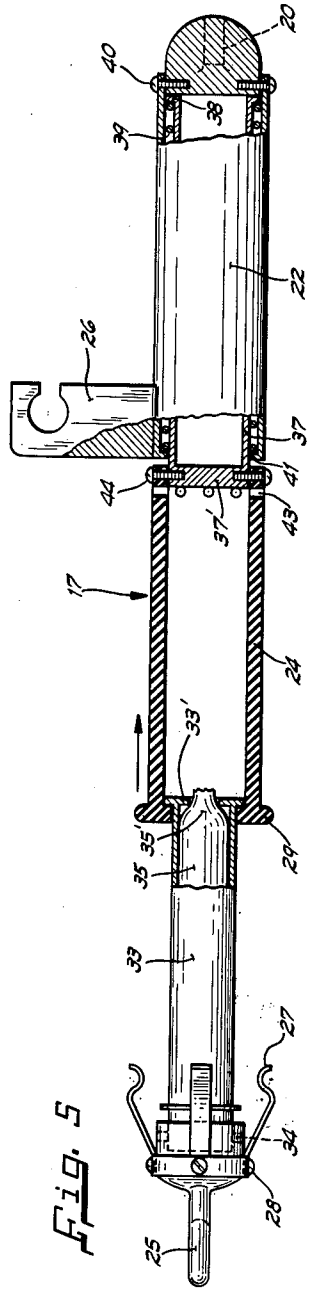


Fig. 5

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PORTABLE LOAD BREAK TOOL

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7 Claims. (Cl. 200—114)

This invention relates generally to a load break device and more particularly to a portable load break device which can be utilized in conjunction with circuit disconnecting devices such as, for example, fuse cutouts, disconnecting switches, and the like.

Load break tools or auxiliary circuit interrupters are utilized to open circuit disconnecting devices on a live line without allowing destructive arcing to take place in the primary circuit disconnecting device. In this respect load break tools provide a shunt path for the electrical circuit so that when the primary circuit disconnecting device is opened no arcing will take place between component portions thereof. Once the load break tool becomes a part of the circuit the primary circuit disconnecting device may be opened without danger. However, the current through the tool must be interrupted and this is generally accomplished by drawing an arc in the tool itself and extinguishing it.

Prior art load break devices have generally relied on extinguishing the arc in the tool by means of a gas evolving fiber liner. Basically the sequence that occurs in these prior art devices is that an arc is drawn, elongated, and as a result of the heat of the arc, deionizing gases are evolved from the interior of a portion of the load break tool which serve to extinguish the arc. Thusly, in order for the load break tool to function to interrupt the line current, enough gases must be evolved from the gas evolving liner within the tool to effectively extinguish the arc. If the volume of evolved gases is insufficient to extinguish a given arc, extreme burning and pitting of portions of the primary circuit disconnecting device may take place in addition to possible destruction of the load break tool. Physical damage to equipment and personal injury to persons in the vicinity of the tool or the primary circuit disconnecting device may also occur if the arc is not properly extinguished.

While prior art devices are designed to interrupt a number of varying circuits a careful record of the use of each tool must generally be maintained in order to insure that the device is capable of interrupting a given circuit. This is very difficult to do since the portable nature of the tool taken in conjunction with the fact that a utility may have a number of similar tools may lead to inaccurate record keeping and consequent usage of an ineffective tool.

One means of attempting to remedy this problem is to set up charts for specific tool operation and to refer to these "life charts" before utilizing the tool. However, if reliance is placed on this method the versatility of the tool is seriously hampered since it is impossible or most impractical to devise accurate "life charts" for all the possible uses and combinations of uses that a tool may be put to during its effective service life. Hence, if this approach to the problem is relied on, the tool must be used to perform only one or a very few different types of operations during its life.

Another means of attempting to remedy this problem (inadvertent usage of a tool that is incapable of interrupting a given circuit) is to measure the amount of erosion that has already taken place in the fiber liner of the tool. As is obvious, this method is prone to inaccuracies of measurement and also generally requires a complete disassembly of the tool in order to examine the fiber liner therewithin. For this reason a lineman may

have a tendency not to check the device before using it, with the result that a defective tool may be put into the circuit with incident physical damage and personal injury.

It is therefore an object of this invention to provide an improved portable load break tool wherein the condition and capabilities of the device may be positively ascertained by a simple visual inspection of same.

Another object of this invention is to provide an improved load break tool that will interrupt current in a more efficient manner.

A further object of this invention is to provide an improved load break tool which is inexpensive, easily assembled and disassembled, and which has a minimum of component parts.

Other objects and advantages of our invention will be apparent in the following description of the preferred embodiments of the invention taken in connection with the accompanying drawings in which:

FIG. 1 is a view in elevation of the load break tool in the initial position in conjunction with one type of circuit disconnecting device;

FIG. 2 is a view in elevation of the load break tool in extended position (subsequent to current interruption) in conjunction with one type of circuit disconnecting device;

FIG. 3 is a cutaway view in elevation of the load break tool in the initial position;

FIG. 4 is a partially cutaway view in elevation of the load break tool in intermediate position; and

FIG. 5 is a partially cutaway view in elevation of the load break tool in extended position.

Referring now to FIG. 1 there is shown a fuse cutout assembly **10** having upper and lower stationary contacts **11** and a fuseholder assembly **12** which is pivotally mounted on fuseholder supports **9** and which has upper and lower contacts **13** and a pull ring **14** on the upper end thereof. Attached to insulator **15** of fuse cutout assembly **10** is a conducting member **16** which may extend from the insulator **15** in the general direction of the fuseholder (contact bridging member) and which may include a substantially transverse portion **16'**. The member **16** is shown as being attached to the insulator **15** however it may be attached to the upper contacts or elsewhere on the cutout as long as it remains a stationary conducting portion of the cutout. While one type of disconnecting device is shown and described in conjunction with the invention, the load break device of this invention may be utilized with a variety of circuit disconnecting devices including disconnecting switches, other cutouts and the like.

Our auxiliary circuit interrupter or load break tool is indicated generally at **17** and comprises an elongate manually operable, insulating handle member **18** to which a ferrule member **19** is affixed at one end. Attached to ferrule member **19** is a connecting member **20** which is secured at its other end to an electrically conductive, tubular, telescopic member **22**. (While various connections between handle **18** and telescopic member **22** are conceivable it is preferable that the connection be a rigid one since this will facilitate the initial positioning of the tool relative to the cutout.)

Telescopic member **22** has a hook portion **26** projecting therefrom which is normally adapted to engage pull ring **14** on bridging member **12**. A second tubular member **24** which is non-conducting has an end portion thereof normally received in member **22** and a hook member **25** affixed to the other end thereof which is normally adapted to engage transverse conducting member **16'** on cutout **10**. Thusly portions of the portable load break device are attached to a stationary portion of a fuse cutout or disconnecting switch and a movable portion (fuse-

holder or switch blade) of the circuit disconnecting device.

FIG. 4 illustrates the relative movement between members 22 and 24 that takes place when a downward axial force is exerted on telescopic member 22 by the handle member 18. Since member 24 is attached to the cutout 10 at 16' and since member 22 is movable with respect to member 24 and attached to the pull ring 14 of the fuseholder 12 a downward force on handle 18 will occasion relative motion in the tool which causes the fuseholder 12 to be disengaged from the upper contacts 11. Note that since the cutout is assumed to be "live" that normally such an opening of the cutout, i.e. withdrawal of the fuseholder out of circuit bridging relation, would cause arcing between the upper fixed and movable cutout contacts, 11 and 13 respectively. However, at the time the upper movable and stationary contacts separate, the load break tool becomes injected in the circuit and current is shunted around the upper movable and stationary contacts and thru the portable load break tool. The particular structure making this and subsequent current interruption in the tool possible, will now be explained.

Referring now to FIG. 3 wherein the detailed structure of the load break tool is illustrated, hook member 25, which may be of brass or similar electrically conducting material, is attached to tubular insulating member 24 by resilient latching fingers 27 which are affixed at one end to hook 25 by fastening means 28 and which engage spaced apart areas on an annular raised lip portion 29 on the end of tubular member 24 at their free end. It is to be understood that tubular member 24 is of insulating material and may be of materials such as phenolic, fiberglass, acrylic, nylon or the like. The use of transparent insulating materials is particularly advantageous for reasons which will be explained hereinafter.

The hook member 25 includes an annular recess 30 which surrounds an extended cylindrical portion 25' which normally protrudes into the bore of member 24. The outer periphery of hook member 25 has at least one arcuate locking groove 31, the function of which will be explained subsequently. A helical compression spring 32 is positioned within the bore of member 24 and is mounted on one end of extended portion 25' of member 25.

A tubular conductive support member 33 which may be of any conducting material has one end thereof normally received in recess 30 in hook member 25 and surrounds extended portion 25' and helical spring 32 and normally protrudes into the bore of member 24.

On the periphery of support 33 in closest proximity to hook 25 is at least one projecting lug 34 which is receivable in locking groove 31. (If two or more locking grooves are desired then the same number of lugs is required.) The lug 34 when received in the groove 31 in member 25 comprises a quick break lock mechanism which operates in such a manner that when member 25 is rotated for example, a quarter turn relative to support 33, it becomes firmly affixed to support 33. Similar rotation in the opposite direction will serve to release the connection. It is to be understood that any similar releasable locking means may be utilized without deviating from the scope of the invention.

Within the confines of tubular support 33 is positioned a fluid filled metal cartridge 35 having a constricted neck portion 35' and a fusible tip portion 36. The bottom of the cartridge 35 abuts against compression spring 32 and is biased in a direction away from member 25. An inwardly projecting shoulder guide portion 33' on one end of support 33 surrounds the neck portion 35' of cartridge 35 and aids in centrally positioning the cartridge 35 and prevents the cartridge from "falling out" of that end of the tubular support. The cartridge 35 is preferably filled with CO_2 under pressure but may be filled with any arc extinguishing fluid such as compressed air, sulfur hexafluoride, carbon tetrachloride, or the like.

An electrically conducting extension member 37 having an electrical contact surface 37' is rigidly affixed to the "open" end of insulating member 24 as by screws 44 so as to close that end of member 24 by means of contact surface 37'. As can be seen extension member 37 normally is telescoped within member 22. Under the biasing action of spring 32 the cartridge tip 36 normally engages the contact portion 37' of member 37. The other end of member 37 has an outwardly turned annular shoulder 38 thereon which serves as a seat for compression spring 39 which extends along and surrounds the outer periphery of member 37.

Telescopic member 22 is of conducting material and is affixed to member 20 by screws 40 or similar fastening means. The member 20 may be integral with member 22 or as shown affixed thereto. The other end of member 22 has an inwardly extending annular lip 41 which serves as a seat for compression spring 39 so that when conducting member 22 is moved (FIG. 4) relative to insulating member 24 lip 41 will cause spring 39 to be compressed against shoulder 38 of member 37.

In FIG. 4 spring 39 is shown completely compressed between members 41 and 38. In this position the fuseholder or switchblade is out of contact with the stationary contact(s) of the cutout and all current is shunted thru the portable load break tool. While the spring 39 is shown as being completely compressed it is conceivable that a lesser degree of compression of the spring will suffice.

In operation hook 25 is made to engage conductive portion 16' of a circuit disconnecting device and projecting hook 26 on member 22 is made to engage the pull ring portion 14 of a contact bridging member. A downward and/or outward force is then applied to handle 18 which causes member 22 to move relative to insulating member 24. This relative movement causes opening of the circuit disconnecting device since the fuseholder 12 pivots around its base. When the fuseholder (or switchblade) is completely out of circuit bridging relation a current path exists between the stationary conducting portion of the circuit disconnecting device and the fuseholder thru the load break tool. More particularly the current follows a path through member 16', hook 25, support 33, cartridge 35, contact surface 37', member 37, member 22, hook 26, pull ring 14 and then through the bridging member to the lower stationary contact 11.

As downward axial force on handle 18 continues spring 39 is compressed to its ultimate (FIG. 4) and further force application serves to disengage the spring latch connection between hook member 25 and tubular member 24. (FIG. 2 and FIG. 5). This causes tip 36 of cartridge 35 to rapidly move away from electrical contact surface 37' on member 37 thereby creating an arc therebetween. Note that upon disengagement of hook 25 and tubular member 24 spring 39 forces member 24 toward member 22, thusly the speed of arcing contact separation (36 and 37') is substantially independent of the motion of handle 18. The arc between tip 36 and contact surface 37' serves to melt tip 36 of cartridge 35 and arc extinguishing fluid escapes from the cylinder and is directed into the path of the arc. The deionizing action of the fluid and elongation of the arc due to the action of spring 39 in separating tip 36 and surface 37' serves to quickly and efficiently extinguish the arc. This extinction of the arc will normally occur well before guide member 33' on support 33 impinges on the upper end of insulating member 24. Note also that the "jet type" reaction force on the cartridge, as a result of fluid escaping therefrom, also serves to elongate the arc (in addition to the spring force) since the cartridge and cartridge support member are forced upwardly away from the contact surface 37'.

Vent holes 43 are provided in member 24 just above contact surface 37'. These vents are of such a size that the discharged gases do not rapidly escape from the device. Hence, additional forces (gas pressure) are pres-

ent tending to force the cartridge and support away from contact surface 37'

After the arc is extinguished and the tool is removed from the circuit interrupter as by "fishing" hook 26 out of engagement with pull ring 14 and detaching hook 25 from conducting portion 16' the empty cartridge 35 may be replaced by turning the hook member 25 relative to the support member to thereby disengage the quick break lock mechanism. The hook member and the affixed spring may then be separated from the cartridge support member. This enables the "spent" cartridge to be removed from the support member. A new cartridge may then be inserted in the support and the tool reassembled in the reverse order of disassembly.

Any time a lineman is in doubt as to whether there is a fresh cartridge in the device or not a quick look through vent holes 43 will tell whether there is a fresh or spent cartridge in the device since in the case of the latter a clear view will be obtainable through the device as the tip 36 will have burned away from a spent cartridge. If the member 24 is of acrylic or other transparent insulating material visual inspection of the cartridge will be somewhat simplified.

It can thusly be seen that our device results in a safe load break tool in which the tendency of inserting a tool, incapable of interrupting current, in the circuit is materially reduced if not entirely eliminated.

Further the tool of our invention is capable of use with a wide variety of primary circuit disconnecting devices over a wide range of line current conditions. As is evident, there is no need to maintain any sort of record of tool operation other than periodic inspections to check on normal operating wear on the tool.

While one particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that various changes and modifications can be made therefrom without departing from the invention and, therefore it is intended for the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

We claim:

1. A portable load break tool for a circuit disconnecting device of the type having spaced apart stationary contacts, a projecting conducting member, and a contact bridging member pivoted at one end for movement into and out of circuit bridging engagement with said contacts and including a hook receiving member at the free end thereof; said tool comprising in combination, an elongated insulating handle member, a first tubular conducting member affixed to said handle member and having a portion thereof engageable with said hook receiving member, a second tubular member having a portion thereof normally received in said first member, said first member being movable with respect to said second member, said second member having a conducting member associated therewith which defines an electrical contact surface, conductive means engageable with said projecting conducting member on said disconnecting device and releasably engaging one end of said second member, a fluid filled conductive cartridge within said second member and normally in electrical contact with said conductive means and said electrical contact surface, said cartridge having a fusible portion which normally engages said electrical contact surface, whereby movement of said first member with respect to said second member moves said contact bridging member out of circuit bridging engagement and subsequently causes said cartridge to be moved away from said electrical contact surface thereby occasioning an arc therebetween which burns through a portion of said conducting cartridge to allow fluid therewithin to escape and to extinguish the arc so drawn.

2. A portable load break tool for inserting a current path in a circuit disconnecting device of the type having stationary conducting portions and a movable conducting portion, comprising in combination, manually operable handle means, a first tubular conducting member affixed to said handle means and engageable with said movable conducting portion of said device, a second tubular member having a conducting portion thereof normally received in said first tubular conducting member and in electrical contact therewith, said first tubular conducting member being axially movable with respect to said second tubular member, conductive means engageable with one of said stationary conducting portions of said device and releasably engaging one end of said second tubular member to normally enclose that end of said second tubular member, electrically conductive tubular support means releasably affixed to said conductive means and normally received in said second tubular member, an arc extinguishing fluid filled, fusible, conductive cartridge received in said support means and having a portion thereof normally in contact with said conducting portion of said second tubular member, whereby movement of said first tubular conducting member relative to said second tubular member removes said movable conducting portion of said device from the circuit and subsequently separates said fusible cartridge and said conducting portion of said second tubular member causing an arc to be drawn therebetween which burns through a portion of said cartridge to allow said fluids contained therewithin to escape and to extinguish the arc so drawn thereby interrupting the circuit through said load break tool.

3. A portable load break tool for a circuit interrupter of the type having stationary contacts and a movable conducting portion pivoted at one end for movement in to and out of circuit bridging position, said tool comprising in combination, an elongate insulating handle member, a first tubular conducting member affixed at one end to said handle member and having a projecting portion thereon engageable with said movable conducting portion of said circuit interrupter, a second tubular insulating member having a conductive portion thereof normally received in said first tubular conducting member, said first member being axially movable with respect to said second member, conductive means engageable with one of said stationary contacts of said circuit interrupter and releasably engaging and enclosing one end of said second member, tubular support means releasably affixed to said conductive means and normally disposed with said second member, an arc extinguishing fluid filled, pressurized, conductive cartridge received in said support means, resilient means mounted on said conductive means and normally biasing said cartridge into engagement with said conductive portion of said second member, and means associated with said cartridge for visually determining the condition thereof from the exterior of the tool, whereby initial movement of said first member relative to said second member removes said movable conducting portion of said circuit interrupter from circuit bridging position and subsequently electrically separates said cartridge and said conductive portion causing the arc so created to burn through said cartridge thereby allowing said fluid to escape and extinguish said arc.

4. A portable load break tool for a disconnecting device of the type having stationary contacts and a movable conducting portion pivoted at one end for movement into and out of engagement with said stationary contacts, said tool comprising in combination, manually operable insulating means, a first conducting member affixed to said manually operable means and normally engaging said movable conducting portion of said circuit interrupter, a second member having a conductive portion thereof in electrical contact with said first member, said first member being movable with respect to said second member, conductive means releasably engaging one end of said second member and normally engaging one of said stationary contacts of said disconnecting device, an arc extinguishing fluid filled, electrically conductive, fusible, cylinder in electrical contact with said conductive means and normally contacting said conductive portion

of said second member, whereby initial movement of said first member relative to said second member causes said movable conducting portion of said disconnecting device to be disengaged from at least one of said stationary contacts and a circuit to be established through the conductive portions of said tool and subsequent movement causes said cylinder and said conductive portion of said second member to be electrically separated thusly initiating an arc therebetween which burns through a portion of said cylinder allowing fluid to escape therefrom to the vicinity of the arc and thereby extinguish same and interrupt the circuit through said tool.

5. A portable load break tool adapted to insert a current path in a circuit disconnecting device of the type having spaced apart stationary contacts, and a contact bridging member movable into and out of circuit bridging engagement with said contacts; said tool comprising, first means electrically connectable to one of said stationary contacts, second means constructed and arranged to move with respect to said first means and engageable with said contact bridging member for moving said contact bridging member out of circuit bridging position, current carrying means associated with said first means and said second means for providing a current path between said one stationary contact and said contact bridging member upon movement of said contact bridging member out of circuit bridging engagement, a portion of said current carrying means comprising a fusible fluid-filled conductive cartridge which is capable upon electrical separation of said cartridge and other current carrying portions of said tool of spewing fluid in the vicinity of the electrical arc so created thereby extinguishing said arc and interrupting the current flow through said tool, whereby electrical separation of current carrying portions of said tool is initiated by movement of said second means relative to said first means.

6. A load break tool adapted to insert a current path in a circuit disconnecting device of the type having spaced apart stationary contacts, and a contact bridging member movable into and out of circuit bridging engagement with said contacts; said tool comprising, first means electrically connectable to one of said stationary contacts, second means constructed and arranged to move with respect to said first means and engageable with said contact bridging member for moving said contact bridging member out of circuit bridging position, current carrying means associated with said first means and said second means for providing a current path between said one stationary contact and said contact bridging member upon movement of said contact bridging member out of circuit bridging engagement, a portion of said current carrying means comprising a fusible fluid-filled conductive cartridge which is capable upon electrical separation of said cartridge and other current carrying portions of said tool of spewing fluid in the vicinity of the electrical arc so created thereby extinguishing said arc and interrupting the current flow through said tool, whereby electrical separation of current carrying portions of said tool is initiated by movement of said second means relative to said first means, and means associated with said cartridge for visually determining the arc interrupting capabilities of said cartridge.

7. A portable load break tool for use with a circuit disconnecting device of the type having spaced apart stationary contacts and a contact bridging member movable into and out of electrical engagement with said contacts, said tool comprising in combination, first means electrically engageable with one of said stationary contacts, second means constructed and arranged to move with respect to said first means and engageable with a portion of said contact bridging member for removing said member from contact bridging position, electrically conductive means associated with said first and second means for establishing a current path between said one stationary contact and said contact bridging member upon removal of said contact bridging member from electrical engagement with said contacts, a portion of said electrically conductive means comprising a fluid filled cartridge having a fusible tip which upon separation of said tip and other current carrying portions of said first means will burn away as the result of the arc created therebetween thusly providing fluid to extinguish the said arc, and resilient means associated with said first and second means to expedite separation of said cartridge and other current carrying portions of said first means.

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