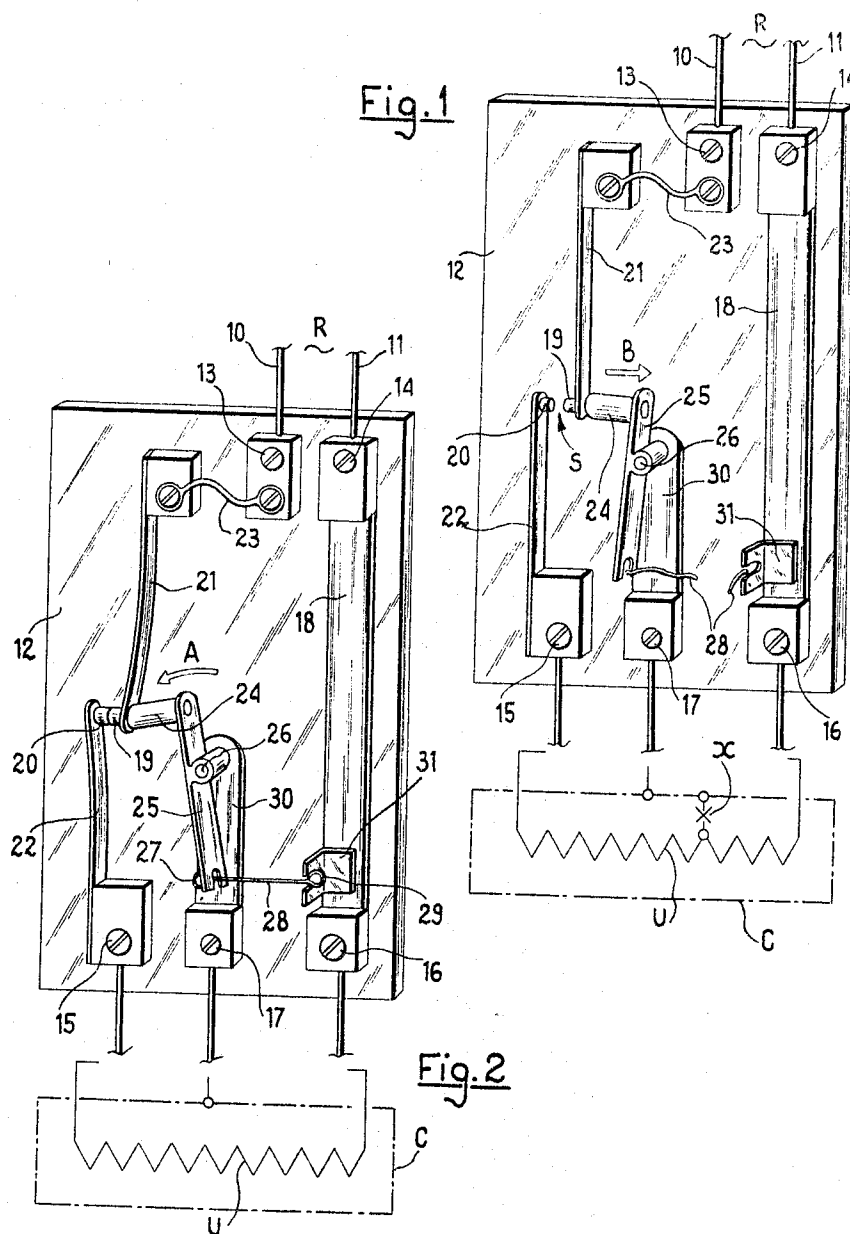


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SAFETY CIRCUIT BREAKER WITH FUSIBLE MEANS
OPPOSING MOVABLE CONTROL BIAS
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Fig. 1



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SAFETY CIRCUIT BREAKER WITH FUSIBLE MEANS OPPOSING MOVABLE CONTROL BIAS

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This invention generally relates to switch means designed to interrupt or break an electrical circuit when a malfunction, in particular, a defective insulation or other short-circuit occurs in an electric supplied apparatus such to cause a potential difference to exist between the ground and the metallic structure, and particularly, the casing of such apparatus.

It is known that misfunctions and even serious accidents may occur in the event of such defective insulation. For example, an operator may be seriously injured upon contact with a defectively insulated metallic casing or other component of an electrically supplied apparatus. Fires and other accidents, for example, may be started by short-circuiting. At least a part of such accidents may be conventionally prevented by carefully grounding the metallic frame of such apparatus, but the provision of grounding means is sometimes not possible or such grounding is poor. Such means are further objectionable by the fact that heavy current dispersions are caused thereby. Automatically operating safety circuit breakers, designed to promptly interrupt the supply as a difference of potential occurs as above, are generally preferable.

It is therefore an object of this invention to provide a new and improved circuit breaker noted by its simplicity and promptness of response when a substantial but not harmful potential difference exists between the casing or other metallic part or component, not included in the circuitry of an electrical apparatus or appliance, connected to the "hot" connection to a source of current.

More particularly it is an object of this invention to provide a new and improved safety circuit breaker including contact means through which an electrical supply network may be connected to an electrically operated apparatus, such contact means including at least one movable contact adapted to abut on one stationary contact, means for supporting and constantly urging said movable contact towards a circuit breaking position spaced from said stationary contact, a length of wire stretched between said means and a stationary connection so that said movable contact is maintained at its circuit closing abutting relationship with said stationary contact until such length of wire is sound and capable to resist to the action of said urging means, said length of wire being at least partially of composition and cross-sectional dimension such to be fused as subject to passage of a small and harmless current, and means to connect to ends of said length of wire to the casing or framing of the apparatus and respectively to the neutral lead of said network, whereby a defective insulation or other misfunction would cause a potential difference to exist between said neutral and said casing, said length of wire will promptly fuse and allow said urging means to urge said movable contact far from said stationary contact to form an air gap between said contacts such to safely cutout the electrical supply.

These and other objects of the invention will be made apparent from the following description. Reference is

now made to the accompanying drawing, forming an essential component of this disclosure, and wherein:

FIG. 1 is a diagrammatical perspective view of a device according to the invention with its circuit-breaking means in operative position, and

FIG. 2 is a similar view of the same device before its operation.

In the drawing there is diagrammatically indicated at U an electrical apparatus (such as a machine tool, a domestic appliance and so on) having a metallic casing C, which is to be electrically insulated from the supply wirings and the circuitry of said apparatus. Said apparatus is assumed to be supplied by a source of current, such as a network R, having a "hot" lead 10 and a neutral lead 11, connected to the inputs 13 and 14 respectively of the device. The various components of said device are shown supported by an insulating base plate 12, but it is evident that the structural details of said device may be modified at will. For example, such components might be conventionally arranged in an enclosure.

The device is provided with output connections or terminals 15 and 16 adapted to be electrically connected to the inputs of the electrical apparatus U, and with a third terminal 17 adapted for electrical connection to the casing C of such apparatus. The circuit cutout means may be provided either between terminals 13 and 15 or between terminals 14 and 16, or between both of said pairs of terminals, if complete cutout of the apparatus from the supply is desired.

In the embodiment shown, input terminal 14 is permanently connected to output 16 by a strip conductor 18, while the connection between input 13 and output 15 is provided by the abutting relationship of contacts 19 and 20, secured at the free end portions of cantilever supported metallic strips 21 and 22 respectively of resiliently flexible metal or metal alloy. From the standpoint of view of the operation of the device, as set forth below, the contact 19 will be assumed as being the movable contact. The said supporting strips 21 and 22 are supported and arranged in the device so that, when not subject to external forces, they return and stay in the relative position shown in FIG. 1, wherein an air gap S is formed and maintained between said contacts 19 and 20 for having the circuit safely broken between terminals 13 and 15.

The device may be further provided with an overload circuit breaker means, such as a fuse 23 between 13 and 15. It is obvious that such overload protective means may be differently provided and arranged, according to the art to which this invention appertains. Still further, the device may be provided with signalling means, such as a lamp connected to indicate that the supply is properly on, or that the device has operated to interrupt the supply. Such means are not shown in the drawing and will not be described in detail since they are easily conceivable by those skilled in the art.

As shown in FIG. 2, until the supply and the operation of the apparatus U is properly on, the contact 19 is urged in direction A and maintained at its abutting relationship with stationary contact 20 by a pusher member 24 of insulating material and supported at one end portion of a two-armed metallic lever 25 oscillably supported by and about a metallic pivot 26. Said lever is maintained at said position, overcoming the resiliency of strip support 21 of the movable contact 19, by the mechanical resistance of a length of wire 28 having one end portion 27 connected to the other end portion of lever 25 and

the other end portion 29 secured to a stationary clamp 31. To facilitate the application and the substitution of said length of wire 28, the said end portions 27 and 29 may be formed as buttons or enlarged heads of said wire, and the said other end portion of lever 25 and the said clamp 31 may be fork-shaped for easy clamping of said portions 27 and 29 thereto. Therefore, upon insertion of said length of wire 28 in the above described arrangement, until such wire is sound and capable of resisting the resiliency of strip 21, the contacts 19 and 20 will be maintained at their abutting relationship and the supply will be on. On the contrary, if such length of wire is broken, the movable contact 19 will promptly move in direction B (FIG. 1) to form the air gap S and interrupt the supply, as the circuit will be broken between 13 and 15.

The said end portions 27 and 29 are electrically connected to the casing C of the apparatus and respectively to the neutral lead 11 of the network. For example, the terminal 17 might be connected by a strip lead 30 to pivot 26 and therefore to said lever 26 and end portion 27. At its turn, the said clamp 31 may consist of a metallic member secured to said strip conductor 18 connected to neutral lead 11 at terminal 14.

From the above it will be readily apparent that, when a potential difference is produced between said casing C and said neutral line, such as upon contact or defective insulation as diagrammatically indicated at X in FIG. 1, a current will be caused to pass through the length of wire 28 via 17, 30, 26, 25 and 27, and respectively 14, 18, 31 and 29.

Now, by providing said length of wire 28 of such metallic composition and cross-section (according to the art) that it will fuse and break upon passage of a small and harmless current therethrough, the current supply will be promptly interrupted by the forming of air gap S by the consequent movement in the direction B of the movable contact 19 by the action of its resilient supporting strip 21, as shown in FIG. 1. Upon control of the apparatus and elimination of the cause of the malfunction, the supply may be readily restored by applying a new and sound length of wire 28 in the position and arrangement shown in FIG. 2.

It is obvious that, while only one embodiment of the invention has been heretofore described and shown in the accompanying drawing, various modifications may be made by those skilled in the art, in particular with relation to the structural details. Such modifications are intended to be comprehended within the meaning of this invention, as defined in the appended claims.

What is claimed is:

1. For a circuit to be connected to an electrical appliance having electrically energized components and a metallic component to be maintained at zero potential wherein said circuit has a "hot" lead and a neutral lead at zero potential: a safety circuit breaker comprising a base of insulating material, first and second input terminals connected to said "hot" and to said neutral lead respectively, three output terminals, the first and second of which are connected to said appliance to supply current thereto while the output terminal is connected to said metallic component, a conductor connecting said second input to said second output terminal, relatively movable contacts connected to said first input and to said first output terminal, respectively, and resiliently biased apart to form and maintain an air gap therebetween, a metallic pivot connected to said third output terminal, a metallic lever pivotally secured to said pivot and electrically connected thereto, an insulated pusher secured to said lever remote from said pivot, said lever and said pusher being arranged to be swung towards and against one of said relatively movable contacts for urging said contacts into contacting and electrically conductive relationship, and a fuse member replaceably secured between said conductor and said lever to maintain said lever and said pusher in

said position in which the contacts are urged into electrically conductive relation while providing an electrical connection between said neutral and said metallic component, so as to be subject to rupture when a potential occurs therebetween and cause said relatively movable contacts to form said air gap.

2. The combination claimed in claim 1, wherein said relatively movable contacts comprise flexible strip conductors having first end portions secured to said base, and opposite facing remote end portions, and contact means secured to the conductors at their opposite end portions in normally spaced relation to form said air gap.

3. The combination claimed in claim 1, wherein said conductor and said lever comprise each a bracket portion and wherein said fuse comprises a collapsible middle portion adapted to extend between said bracket portions and enlarged ends for being engaged in said bracket portions to maintain said lever sufficiently close to said conductor so that said movable contacts are maintained in said contacting and conductive relationship.

4. The combination of claim 3, wherein the said conductor consists of a rigid strip and said bracket consists of an angle bracket attached to the conductor intermediate the ends thereof for securing one end of said fuse.

5. The combination of claim 1, wherein said lever consists of a two-armed lever having opposite ends and being connected to said pivot intermediate said ends, a bracket being formed at one of said ends, the insulated pusher being disposed at the opposite end of the lever.

6. A circuit breaker comprising an insulating frame structure, first and second inlet terminals, first, second and third outlet terminals, a connection consisting of a strip conductor connecting the second input to the second output terminal, movable contact members constituted by resilient strip conductors each having one end fixedly secured to said frame structure and electrically connected to said first input and said first output respectively and biased to urge their opposite ends in spaced relation, a two-armed lever of conductive material in electrical connection with said third output terminal, said lever having opposite ends and having a bracket at one of said ends, a pusher of insulating material secured at the other end of the lever, said lever being pivotally mounted on said frame so that upon swinging of said lever said one end approaches one of said strip conductors and said pusher urges one of said movable contacts into contacting relationship with the other movable contact to complete a connection between said first inlet and said first outlet terminal, an electrically conductive angle bracket secured to said strip conductor, and a fuse member having enlarged opposite ends replaceably secured to the bracket of said lever and said angle bracket to maintain said one end of the lever close to said strip conductor while completing a connection between said second and third outlet terminals such that if a potential capable of causing breakage of the fuse occurs between said second and third outlet terminals, the breakage of said fuse causes breakage of the connection between said first inlet and said first outlet terminal.

7. The circuit breaker described in claim 6, wherein said movable contact members are constituted by a first resilient strip conductor having a contacting free end and biased to return to a given position, and a second resilient strip conductor having a contacting free end and biased to return to a position at which its said free end is spaced apart from the free end of said first strip conductor when in said given position, and wherein said two-armed lever and said insulating pusher are positioned so that when the lever is engaged by the fuse the free end of said second strip conductor is displaced against the free end of the first strip conductor to displace said latter free end from said given position, whereby said conductive free ends are pressed against each other by the biasing resistance of said first resilient strip conductor.

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8. A circuit breaker as claimed in claim 6, wherein said first and second terminals are adapted for connection with a hot supply line and with a neutral line respectively, said first and second outlet terminals being adapted for connection with the supply terminals of an electrically energized means, and said third outlet terminal is adapted for being connected to a metallic component of the latter means which is to remain isolated from the current supply.

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