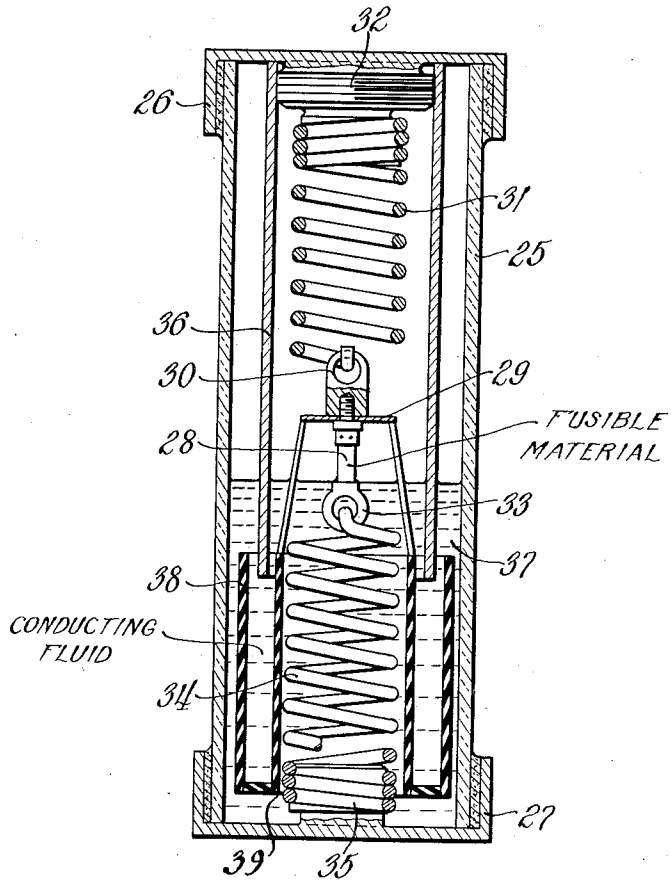
Aug. 1, 1939. E. O. SCHWEITZER, JR 2,167,781

CURRENT INTERRUPTING MEANS

Original Filed Feb. 20, 1936



Inventor
Edmund O. Schweitzer, Jr.

By Brown, Jackson, Battelle & Dinnan

Attys.

Patented Aug. 1, 1939

2,167,781

UNITED STATES PATENT OFFICE

2,167,781

CURRENT INTERRUPTING MEANS

Edmund O. Schweitzer, Jr., Northbrook, Ill.

Original application February 20, 1936, Serial No. 64,800, now Patent No. 2,122,872, dated July 5, 1938. Divided and this application February 21, 1938, Serial No. 191,619

7 Claims. (Cl. 200—117)

My invention relates, generally, to circuit opening devices and it has particular relation to fuses. This application is a division of my copending application, Serial No. 64,800, filed February 20, 1936 which became Patent No. 2,122,872 on July 5, 1938.

In the prior art, considerable difficulty has been experienced because of arcs drawn between the separable metallic terminal members of circuit opening devices. In many instances there is the danger that an inflammable gas may be ignited in the event that an arc occurs on separation of the terminals or that other damage may be done as a result of the arc being drawn. Many devices have been proposed for extinguishing arcs when they are formed. However, in so far as I am aware, no one has ever provided for preventing the formation of an arc, when a fuse link blows, by changing the conditions under which the fuse link melts and separates or the final break in the circuit is effected.

In circuit opening devices provided with metallic terminal members interconnected by a fusible element, arcing is caused by the vaporization of the fusible element and of portions of the surface of one or both of the terminals. Also a certain amount of thermionic emission takes place from the terminals due to the intense heat of the arc. The amount of vaporization and of thermionic emission is a function of the heat generated by the current flowing in the arc. Since the specific heat of metal is relatively low, there is a rapid vaporization and ionization of the metal in the opposed surfaces of the terminal members. The metal vapor and ionized particles form a conducting path between the terminal members and it is this path which allows the arc to be sustained, the path being of relatively low resistance.

The object of my invention, generally stated, is to provide a circuit opening fuse device which shall be simple and efficient in operation and which may be readily and economically manufactured and installed.

The principal object of my invention is to provide for opening an electric circuit by the blowing of a fusible element followed by interrupting the circuit between two portions of a non-metallic conducting liquid.

Another object of my invention is to provide a circuit breaking device having a fusible element for carrying the main portion of the current and a conducting liquid between two portions of which the final break in the circuit is effected on blowing of the fusible element.

Other objects of my invention will in part be obvious and in part appear hereinafter.

Accordingly, my invention is disclosed in the embodiment hereof shown in the accompanying drawing and comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of my invention, reference may be had to the following detailed description, taken in connection with the accompanying drawing, in which the single figure shows my improved fuse, partly, in side elevation and, partly, in section.

According to my invention I provide for effecting the final break in a circuit opening device between two portions of a non-metallic conducting liquid, preferably of a non-metallic type, rather than between two metallic members or between a conducting liquid and a metallic member. When this manner of opening an electric circuit is employed, I have found that there will be no ionized arc path set up by ionized particles, as is the case when the circuit is broken between the metallic contact surfaces. The final break is effected entirely between two portions of a non-metallic conducting liquid.

In order to form and sustain an arc there must be a certain amount of thermionic emission from one of the terminals between which the arc is formed. When the terminals are formed of metal having a relatively low specific heat, there is a considerable amount of thermionic emission, as set forth hereinbefore, and therefore there is a tendency for an arc once formed to be sustained. For the same amount of heat energy involved, the rise in temperature of a non-metallic conducting liquid will be relatively small compared to the temperature rise of a metallic contact member. There is, therefore, no tendency for an arc to form or be sustained when current flow is interrupted between two portions of a non-metallic conducting liquid. In addition, because of the cooling effect of the conducting liquid, a sufficiently high temperature necessary to produce the ionized arc path is not reached.

Referring now to the drawing, it will be observed that I have embodied the principles of my invention in a construction of a fuse. The reference character **25** designates an outer tubular member of non-conducting material such as glass, the ends of which are closed by means of

upper and lower terminal caps or ferrules 26 and 27, respectively. The upper and lower terminal caps 26 and 27 are interconnected by means of a fuse link 28 supported from a yoke 29 having an eye 30 on the top thereof. The eye 30 has secured thereto a coil tension spring 31 which may be secured to the upper terminal cap 26 by means of a suitable boss 32. The lower end of the fuse link 28 is provided with an eye 33 to which may be secured a coil tension spring 34 that may be secured, as illustrated, to a boss 35 formed with the lower terminal cap 27. It will be understood that the fuse link 28 is held in some position which may be substantially midway between the upper and lower caps 26 and 27, as illustrated, under the tension of the springs 31 and 34. Under operating conditions the normal path of the current will be from the lower cap 27 through the spring 34, fuse link 28, spring 31, to the upper cap 26.

In order to prevent arcing in the event that the fuse link 28 is blown, I have provided a by-pass circuit which includes an inner tubular member 36 depending from the upper terminal cap 26. The inner tubular member 36 is constructed of a conducting material and, is illustrated, it surrounds the upper tension spring 31 and the yoke 29. While I have illustrated the inner tubular member 36 as being in the form of a cylinder, it will be understood that any other suitable form may be provided and that a single strip of conducting material may be used, rather than a closed cylinder, if such construction is desired.

In order to complete the auxiliary circuit between the upper and lower terminal caps 26 and 27, a conducting liquid 37 is provided which may be any of several non-metallic kinds; for example, solutions of salts such as zinc sulphate, copper sulphate, sodium chloride, potassium nitrate, and dilute solutions of strong acids such as hydrochloric and phosphoric.

Attached to the yoke 29 and immersed in the conducting liquid 37 is a bucket or auxiliary container 38, formed preferably of non-conducting material, and which is formed of two concentric cylinders and arranged to interfit with the inner tubular member 36, as shown. The annular space between the concentric cylinders is closed off by a fluid tight bottom 39, which may be separate from or integral with one or both of the cylinders forming the container 38. It will be observed that the auxiliary container or bucket 38 surrounds the lower tension spring 34. It will be understood that an auxiliary conducting circuit extends between the upper and lower terminal caps 26 and 27 through the inner tubular member 36 and the conducting liquid 37. However, the resistance of this circuit will normally be considerably higher than the circuit including the fuse link 28 and as a result very little current will be conducted through it.

In the event that sufficient current flows through the fuse link 18 to cause it to blow, the tension springs 31 and 34 will be released. The spring 34 will move downwardly, while the spring 31 will move upwardly, carrying with it the yoke 29 and the auxiliary container or bucket 38. The circuit between the upper and lower terminal caps 26 and 27 is now completed solely through the conducting liquid 37 and because of this auxiliary circuit no arc will be formed as a result of the blowing of the fuse 28. The continued upward movement of the auxiliary container or bucket 38 will finally cause the circuit to be broken between the portion of the conducting liquid remaining in the bottom of the outer tubular member 25 and the portion of the conducting liquid carried upwardly with the auxiliary container or bucket 38.

Since certain further changes may be made in the foregoing construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matters shown in the accompanying drawing or set forth in the foregoing description shall be interpreted as illustrative, and not in a limiting sense.

What I claim is:

1. An electrical circuit breaking device comprising, in combination, a pair of terminals, circuit means including a fusible member interconnecting said terminals, a body of conducting liquid, and a means disposed to effect the final breaking of the circuit interconnecting said terminals between two portions of said liquid when said fusible member is blown.

2. An electrical circuit breaking device comprising, in combination, a pair of terminals, circuit means including a fusible member interconnecting said terminals, a conducting liquid also interconnecting said terminals, and a means disposed to effect the final breaking of the circuit interconnecting said terminals between two portions of said liquid when said fusible member is blown.

3. An electrical circuit breaking device comprising, in combination, a pair of terminals, circuit means including a fusible member interconnecting said terminals, an electrolytic solution also interconnecting said terminals, and a means disposed to effect the final breaking of the circuit interconnecting said terminals between two portions of said liquid when said fusible member is blown.

4. An electrical circuit breaking device comprising, in combination, a tubular main body member, upper and lower terminal caps for said member, a fuse link, means for resiliently mounting said fuse link between said caps, a conducting member depending from said upper cap, a container mounted for movement with the upper portion of said fuse link and disposed to interfit with said conducting member, and a conducting liquid in said main body member in contact engagement with said conducting member and said lower terminal cap.

5. An electrical circuit breaking device comprising, in combination, a tubular main body member, upper and lower terminal caps for said member, a fuse link, means for resiliently and electrically connecting said fuse link between said caps, a conducting member depending from said upper cap, a container mounted for movement with the upper portion of said fuse link and disposed to interfit with said conducting member, and an electrolytic solution in said main body member in contact engagement with said conducting member and said lower terminal cap.

6. An electrical circuit breaking device comprising, in combination, an outer tubular member of non-conducting material, upper and lower terminal caps for said member, a tension coil spring depending from said upper cap, a yoke secured to said spring, a fuse link secured to said yoke, a tension coil spring interconnecting said fuse link and said lower cap, an inner tubular member of conducting material depending from said upper cap and surrounding said first named spring and said yoke, a concentric walled container of non-conducting material carried by

said yoke, said container surrounding said last named spring and disposed to interfit with said inner tubular member, and a conducting liquid in said outer tubular member in contact engagement with said inner tubular member and said last named spring.

7. An electrical circuit breaking device comprising, in combination, an outer tubular member of non-conducting material, upper and lower terminal caps for said member, a tension coil spring depending from said upper cap, a yoke secured to said spring, a fuse link secured to said yoke, a tension coil spring interconnecting said fuse link and said lower cap, an inner tubular member of conducting material depending from said upper cap and surrounding said first named spring and said yoke, a concentric walled container of non-conducting material carried by said yoke, said container surrounding said last-named spring and disposed to interfit with said inner tubular member, and an electrolytic solution in said outer tubular member in contact engagement with said inner tubular member and said last named spring.

EDMUND O. SCHWEITZER, JR.