Dec. 24, 1929. T. E. MURRAY 1,740,698

ELECTRIC FUSE

Original Filed Dec. 11, 1924

Fig. 1.

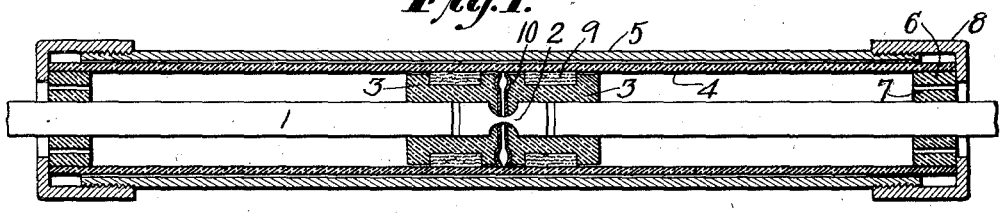


Fig. 2.

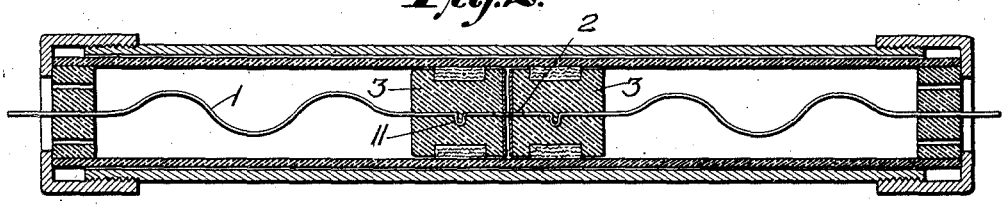


Fig. 3.

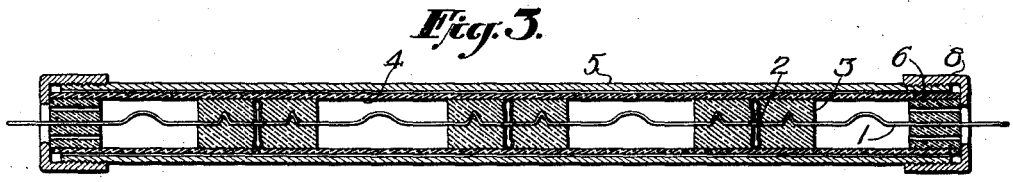
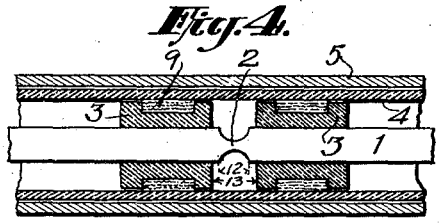


Fig. 4.



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Patented Dec. 24, 1929 1,740,698

UNITED STATES PATENT OFFICE

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ELECTRIC FUSE

Application filed December 11, 1924, Serial No. 755,135. Renewed March 5, 1929.

My invention aims to provide certain improvements in fuses designed particularly for high voltages but applicable also to ordinary or low voltages.

The accompanying drawings illustrate embodiments of the invention.

Figs. 1 and 2 are longitudinal sections of one type of fuse, taken on planes at right angles to each other;

Fig. 3 is a section similar to Fig. 2 illustrating a modification;

Fig. 4 is a section similar to Fig. 1 illustrating a third form;

Referring to the embodiments of the invention illustrated, the fuse strip 1 is provided at an intermediate point in its length with a portion 2 of reduced cross-section to form a localized blowing point. On opposite sides of the reduced section 2 the strip is encased in heads 3 separated from each other by a slight space. These heads are arranged to act as pistons, fitting in a cylinder preferably composed of an inner insulating tube 4 of fibre and an outer stronger tube 5 of iron or steel pipe. The ends of the tube are closed by end pieces 6 with air vent holes 7 therein, the end pieces 6 being mounted on the strips which pass out therefrom to the terminals, and the parts being held by flanged iron or steel caps 8 screwing onto the outer tube 5. The heads of pistons 3 may carry annular packing rings 9 and plates 10 of flexible material on their inner ends to make a close fit with the surrounding cylinder, so that the heads will be separated promptly and forcibly when a blowout occurs, and so that no burning gas will leak past them.

When the fuse blows or burns out at the narrow part 2, the gases generated therein will separate the heads 3 and force them back toward the ends of the fuse, the air escaping through the vents 7. The heads 3 may be of fibre, heat-treated wood or other suitable material. The vent holes 7 should be of sufficient size to prevent the building up of substantial pressures in the ends of the tubes when the heads 3 move outward. For greatest freedom of movement of the heads the end pieces 6 may be omitted as described below in connection with Fig. 5.

To ensure a good grip of the head 3 on the fusible strip the latter may be bent as at 11 in Fig. 2 before being imbedded in the head. Also by bending the sections of the strip beyond the heads, as shown in Fig. 2, they will yield more readily to the force exerted.

The chief difficulty involved in the use of fuses on high voltage circuits is a tendency of the current to form and retain an arc between the remaining ends of the fuse, with generation of large quantities of gas. The imbedding of the ends of the sections in the heads or plungers as shown diminishes the dangerous possibilities in this direction. The arc will not follow the fuse strip for any great distance into the heads. Particularly will it be stopped by the crooked direction of the fuse strip in the head as shown in Fig. 2. Furthermore, the location of these heads in a casing which produces a piston-like action ensures a wide separation of the ends of the strip after a blow and thus further reduces the chances of either establishing or maintaining an arc. In a previous patent of Thomas E. Murray, Jr., No. 1,120,226, December 8, 1914, a fuse is shown so arranged that the gas generated upon a blow will force the ends of the two sections apart. A similar arrangement is obtained in the present case, with the addition of the heads 3 with a confined space between them which will cause the gas pressure to throw the heads violently apart, and with the additional protection provided by the imbedding of the ends of the broken strip in the heads, and particulaly the crooked shape of the strip in such heads. Preferably, two movable heads 3 are used as illustrated. But the invention contemplates also cases in which a single movable head is arranged to confine the gases against a fixed abutment instead of a movable abutment such as is constituted by the movable heads illustrated.

The arrangement described may be applied also in the form of a series of heads or pistons located at different points in the length of a fuse strip, as in Fig. 3. The fuse strip 1 in this case has a number of points 2 of reduced cross-section, and the strip is imbedded in heads 3 adjacent to and on oppo-

site sides of the reduced part of the fuse. These heads are located at successive points in the length of the fuse and are all included in a single casing comprising an inner tube 4 of insulating fibre with end pieces 6, the whole being enclosed in an iron or steel tube 5 with end caps 8.

The present idea may be combined with that of the patent of Thomas E. Murray, Jr., referred to above, confining the blowing point of the fuse; or the clear space between the ends of the tube heads 3 may be greater than that illustrated in Fig. 1, giving more room for the blowing action.

Fig. 4 illustrates such an arrangement, in which the heads 3 are separated by a distance equal to or slightly in excess of the length of the restricted portion of the fuse strip. This is the form of apparatus in which I have made the successful demonstrations referred to hereinafter. In this figure also I have indicated the omission of the plates 10 of Fig. 1, these being optional. The distance between the adjacent faces of the plungers is indicated as slightly more than the length of the contracted portion of the fuse strip. The blowing point of the fuse element may be determined not only by contracting its width as illustrated but in various other usual or suitable ways known in the art.

For greater voltages it is desirable to give to the front ends of the fuse strip section a greater freedom of movement under the impulse of the gas generated. A specific arrangement of this sort is illustrated in my divisional application No. 252,439 filed February 7, 1928. In said divisional application I have also described various modifications and have described and claimed certain features of the invention which are equally applicable to the specific designs illustrated herein.

The head in which the strip is imbedded near the blowing point may be of various other shapes and may be guided in various other casings than the tubular casing illustrated. In fact, it is only essential that the head be arranged to yield under the pressure of the gas evolved, and that the strip be imbedded therein sufficiently to prevent the arc from traveling back along the strip.

Though I have described with great particularity of detail certain embodiments of my invention, yet it is not to be understood therefrom that the invention is restricted to the particular embodiments disclosed. Various modifications thereof may be made by those skilled in the art without departure from the invention as defined in the following claims.

What I claim is:—

1. A fuse comprising a case, having a fuse element with a number of blowing points in series with one another, and a number of plungers on either side of each blowing point, which plungers are free to move on the blowing of the fuse.

2. A fuse case, a fuse element and more than two plungers placed along the fuse element, which plungers are free to move on the rupture of a fuse.

3. A fuse comprising a case, a fuse element having a blowing point, a plunger in which the portion of the fuse element near the blowing point is encased with a close fit which limits the possibility of the arcs following the fuse strip, which plunger also fits the case and an abutment separated by a slight closed space from the face of said plunger, said plunger and abutment fitting the case so as to confine the gases generated by the blowing of the fuse in said slight closed space and to cause the plunger with its enclosed portion of the fuse to be moved promptly and swiftly away from the blowing point when the fuse blows.

4. A fuse comprising a case, a fuse element having a blowing point, a plunger engaging the fuse element near the blowing point and fitting the case and an abutment separated by a slight closed space from the face of the plunger so as to confine the gases generated by the blowing of the fuse and to cause the plunger with its engaged portion of the fuse to be moved promptly and swiftly away from the blowing point when the fuse blows, the case consisting of an inner tube of insulating material reinforced by a metal tube adapted to withstand a high pressure of the confined gases.

5. The fuse of claim 3, the portion of the strip embedded in the plunger being bent in a longitudinal direction so as to increase the difficulty of the arcs following the fuse strip.

In witness whereof, I have hereunto signed my name.

THOMAS E. MURRAY.