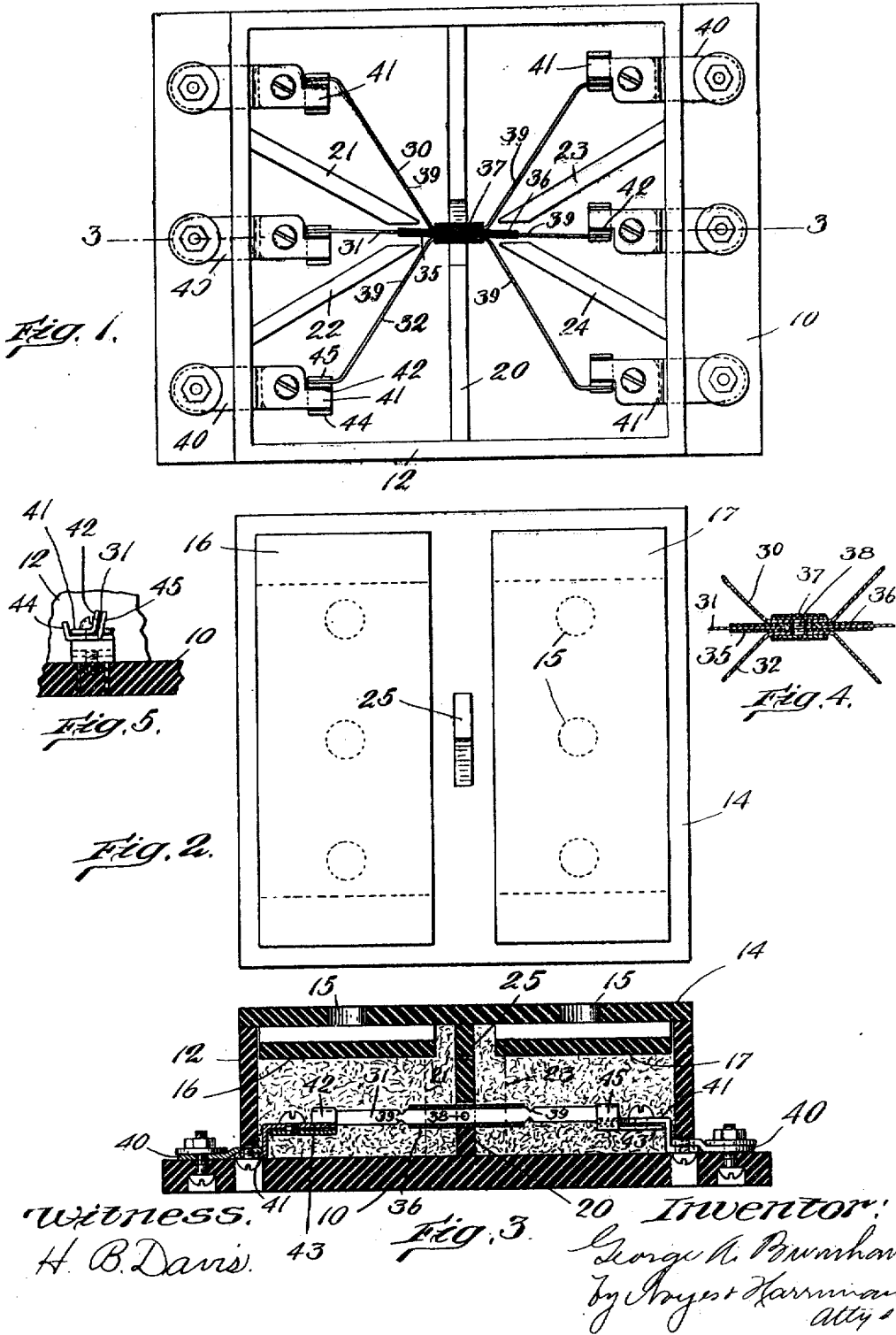


G. A. BURNHAM.
ELECTRIC FUSE.
APPLICATION FILED JULY 1, 1915.

1,239,876.

Patented Sept. 11, 1917.



UNITED STATES PATENT OFFICE.

GEORGE A. BURNHAM, OF SAUGUS, MASSACHUSETTS.

ELECTRIC FUSE.

1,239,876.

Specification of Letters Patent.

Patented Sept. 11, 1917.

Application filed July 1, 1915. Serial No. 37,607.

To all whom it may concern:

Be it known that I, GEORGE A. BURNHAM, a citizen of the United States, residing at Saugus, in the county of Essex and State of Massachusetts, have invented an Improvement in Electric Fuses, of which the following is a specification.

This invention relates to electric fuses especially adapted to be arranged in poly-phase circuits, for the protection of poly-phase motors, to prevent them from running single phase, and has for its object the construction of a fuse comprising a plurality of fuse-strips, one for each phase of the circuit, all confined in an inclosing-case and insulated from each other, portions of said strips being more or less closely associated together in a common fusing zone, to form a short-circuiting means whereby the fusing of any one of the fuse-strips will result in the rupture of the adjacent strip or strips.

Another object is the provision of a small closed chamber at the fusing zones of the fuse-strips which will confine, at least temporarily, the conducting gases produced by the fusing of any fuse-strip, which conducting gases will short-circuit the adjacent strip or strips, causing them to rupture.

Another object is to provide the fuse-strips with reduced portions for insuring the fusing of the strips upon a given overload, and for localizing the fusing zone at the chamber aforesaid, and in providing said strips with other reduced portions for insuring the blowing of the fuse upon a greater overload and for localizing such blow-out at points outside of the chamber aforesaid, but within the insulating inclosing-case.

Another object of the invention is the construction of an inclosing-case having a middle partition-wall with a hole through which all of the fuse-strips extend, and other partition-walls arranged at each side of said middle wall by which the interior of the case is divided into compartments in which the end-portions of the fuse-strips are separately arranged.

Another object of the invention is the construction of an improved form of detachable clamping-means for the fuse-strips, which admits of their easy renewal.

Figure 1, is a plan view of a fuse em-

bodiment of this invention, the cover of the inclosing-case being removed.

Fig. 2, is an underside plan view of the cover.

Fig. 3, is a longitudinal vertical section of the fuse taken on the dotted line 3-3, Fig. 1.

Fig. 4, is an enlarged sectional detail of those portions of the fuse-strips which are closely associated together.

Fig. 5, is a sectional detail of one of the end connections of the fuse-strips.

The inclosing-case here shown is composed of any suitable insulating material, and comprises essentially a bottom-wall 10, upright side walls 12, arranged on the bottom wall and within the margins thereof at both ends, and a cover arranged on said side walls. A ventilating cover is here shown comprising a top-plate 14, with numerous perforations 15, and under-plates 16 and 17, arranged beneath it and separated from it a short distance to provide air-spaces between them, said under-plates being joined or otherwise connected with the top-plate at their ends. These under-plates are usually arranged below the perforations. Within the box-like structure or case numerous partition-walls are arranged, as, for instance, there may be a middle partition-wall 20, extending from the bottom-wall to or approximately flush with the top of the side-wall, and there may be two diagonal partition-walls arranged at each side of the partition-wall 20 which rise from the bottom-wall to or nearly to the top of the side-wall, said diagonal partition-walls being designated by reference characters 21, 22, 23 and 24. The partition-walls 21, 22, and likewise the partition-walls 23 and 24, converge and terminate near the middle partition-wall, and the walls of each pair are separated at their extremities to afford a space between them. The middle partition-wall has a hole through it directly in front of the spaces between the extremities of the diagonal partition walls.

The cover may have arranged on its underside a projection 25, arranged to fill a correspondingly shaped recess or void in the middle partition-wall, thus to complete said partition-wall, and to assist in localizing the cover with respect to the case. With these several

partition-walls arranged in the case, it will be observed that three separate compartments are provided at each side of the middle partition-wall.

5 Within the case, as here shown, three fuse-strips are arranged, as 30, 31 and 32, although a greater or lesser number may be provided, in which instance the case will be provided with a corresponding number of
10 compartments. The fuse-strip 30, is arranged in two of the corner compartments, and extends through the hole in the middle partition-wall, and hence is tortuously disposed. The fuse-strip 32 is similarly ar-
15 ranged in the other two corner compartments, and likewise extends through the hole in the middle partition-wall and is tortuously disposed.

The fuse-strip 31, is arranged in the two
20 intermediate compartments and extends through the spaces between the extremities of the walls thereof; and through the hole in the middle partition-wall.

As all of the fuse-strips extend through
25 the same hole in the middle partition-wall, it will be observed that they are closely associated together along such portions, but are separated and insulated from each other. As a means of insulating the strips, thin
30 strips or plates of insulating material 35, 36, may be arranged between them, that is to say, between the middle strip and the two side strips, and one or more strips of insulating material 37 may be wound around all of
35 the strips, bundling them together at their closely associated portions, and inclosing them in a sheath, all as represented in Fig. 4. At a middle point, each of the fuse-strips and the insulating-strips 35, 36, have
40 a perforation, and all said perforations are disposed in alinement, and together form a closed chamber 38, see Fig. 4.

The fuse-strips each have a recess 39
formed in one or both of its edges at a point
45 or points beyond its middle portion, which substantially reduce the cross sectional area of the strip, and upon reference to Fig. 1 these reduced portions are arranged in the insulating compartments of the inclosing-
50 case.

The reduction in cross sectional area of the fuse-strips, due to the perforations formed therein, insures the fusing of any strips upon a given over-load and localizes
55 the fusing zone at the middle, and the alined arrangement of the perforations, whereby the chamber 38 is formed; results in each strip being exposed to the fusing action of any other strip. Upon the fusing of any
60 strip, the chamber 38 will become filled with conducting gases, which provide a conducting path between the fused strip and an adjacent strip, or strips, forming a short circuit, whereupon such adjacent strip or strips
65 together with the fused strip, will be caused

to rupture at the reduced portions 39. The reduction in cross sectional area of the fuse strips due to the notches 39 insures the blowing of the fuse strips upon a greater overload, and at such reduced places.

70 As an illustration of an embodiment of my invention, take, for instance, a single three-phase motor, supplied by a three-phase circuit, having a fuse in each phase or wire
75 which protects the motor from overload, suppose one of the fuses blows, from any cause, there is a sudden increase of current in the other phases supplying the motor which may not be of sufficient value to blow the remaining fuses, but is, or may be of sufficient
80 value to burn out the motor after a relatively long period of time, this being due to the fact that it is customary in supplying polyphase induction motors with fuses, to select a fuse of a capacity greater than that
85 which will protect the motor on overload, on account of the heavy starting current required for the motor. Herein, when one of the fuse strips fuses, the gas-chamber 38 becomes filled with conducting-gases which
90 provide a conducting path between the fused strips and the other fuse strips, forming a short circuit, whereupon said fuse strips and one or both of the remaining fuse strips will
95 now blow at a higher overload at the reduced portions 39, and as at least two of the fuses will blow in any event, the motor will be shut down.

The ends of the fuse-strips are attached to suitable connectors and herein a special form
100 of connector is shown, consisting of a plate 40, arranged on the bottom-wall outside of the side-wall, which extends through a slot in the side-wall, and the angularly-formed
105 plate 41, arranged inside of the side-wall and attached to said plate 40, and having an upwardly projecting ear 42; and a clamping-plate 43; arranged contiguous the plate 41, and secured thereto by an attaching-screw,
110 and having two upwardly projecting ears 44, 45, one of said ears being arranged at one edge of the plate 41, and the other ear being arranged adjacent the ear 42, and the end of the fuse-strip is disposed between the ears
115 42 and 45, and is held frictionally by the clamping action. This form of connector supports the fuse-strips entirely within the case and admits of renewals of the strips.

The fuse is electrically connected in circuit with the fuse-strips separately arranged
120 in the several phases. The inclosing-case may be filled with any of the well-known heat resisting materials commonly used in inclosed-fuses, as represented in Fig. 3.

I claim:—

125 1. An electric-fuse comprising a plurality of separate fuse-strips insulated from each other, portions of the strips being closely associated together to occupy positions in the fusing zones of each other to form short- 130

circuiting means for the strips, and other portions being separated to form blow-out portions.

2. An electric-fuse comprising an inclosing-case, a plurality of separate fuse-strips arranged in said case and insulated from each other, portions of the strips being closely associated together to occupy positions in the fusing zones of each other to form short-circuiting means for the strips, and other portions being separated to form blow-out portions.

3. An electric-fuse comprising an inclosing-case, a plurality of separate fuse-strips, some of which are tortuously arranged in said case and all of which are insulated from each other, portions of the strips being closely associated together to occupy positions in the fusing zones of each other to form short-circuiting means for the strips, and other portions being separated to form blow-out portions.

4. An electric-fuse comprising an inclosing-case, a plurality of separate fuse-strips arranged in said case and insulated from each other, and embedded in heat-resisting material, portions of the strips being closely associated to occupy positions in the fusing zones of each other to form short-circuiting means for the strips, and other portions being separated to form blow-out portions.

5. An electric-fuse comprising a plurality of separate fuse-strips, having associated fusing portions to form short-circuiting means for the strips, and widely separated blow-out portions insulated from each other.

6. An electric-fuse comprising a plurality of separate fuse-strips closely associated together at the fusing zones of each other, and thin spacing-pieces of insulating material arranged between said strips, and an insulating wrapper for the fuse-strips and spacing-strips.

7. An electric-fuse comprising a plurality of separate fuse-strips closely associated together at the fusing zones of each other, and perforated at such points, and spacing-pieces arranged between said strips having perforations arranged in alinement with the perforations in said strips, and an insulating wrapper inclosing all of said strips and spacing-pieces, said alined perforations, together with the wrapper, forming a closed chamber.

8. An electric-fuse comprising a plurality of separate fuse-strips, insulated from each other, portions of the strips being closely associated together at their fusing zones and having alined perforations to form a closed chamber at such place for the gases caused by the fusing of any of the strips.

9. An electric-fuse comprising a plurality of separate fuse-strips insulated from each other, having reduced portions at the middle and other reduced portions between the mid-

dle and the ends, portions of said strips, at the middle, being closely associated together, whereby the fusing of any fuse-strip, at the middle, will cause the blowing of the adjacent strip or strips.

10. An electric-fuse comprising an inclosing-case of insulating material having a plurality of compartments, and a middle partition wall with a hole through it, a plurality of fuse-strips arranged in said case, portions of said strips extending through the hole in said middle partition wall and being closely associated together at such place to occupy positions in the fusing zones of each other, and other portions of said strips being arranged in the separate compartments of the case.

11. An electric fuse comprising a plurality of fuse-strips, an inclosing-case for same having a middle partition-wall with a hole through it, through which all of the fuse-strips extend, and partition-walls at each side of said middle wall arranged to form compartments at each side thereof, adapted to receive the end-portions of the strips, the portions of the strips which pass through the hole in the middle partition-wall being closely associated together to form short-circuiting means for the strips upon the fusing of any strip, and thereby cause the end-portions of the short-circuited strips to rupture.

12. An electric fuse comprising three fuse-strips, an inclosing-case for same having a middle partition-wall with a hole through it, through which all of said fuse-strips extend, and diagonally-arranged partition-walls at each side of said middle-wall arranged to form three compartments at each side of said middle-wall adapted to receive the end-portions of the fuse-strips, the strips which pass through the hole in the middle partition-wall being closely associated together to form short-circuiting means for the strips upon the fusing of any strip, and thereby cause the end-portions of the short-circuited strips to rupture.

13. An electric fuse comprising a plurality of fuse-strips, an inclosing-case for same having a middle partition-wall with a hole through it, through which all of the fuse-strips extend, diagonally-arranged partition-walls at each side of said middle-wall which converge and terminate near the middle-wall with a space between their converging ends, opposite the hole in the middle-wall, to provide compartments adapted to receive the end-portions of the fuse-strips, the strips which pass through the hole in the middle partition-wall being closely associated together to form short-circuiting means for the strips upon the fusing of any strip, and thereby cause the end-portions of the short-circuited strips to rupture.

14. An electric fuse comprising a plural-

ity of separate fuse-strips adapted for electrical connection with separate conductors of a multiple phase circuit, portions of said strips being closely associated together at
5 their fusing zones, said strips having alined perforations to form a chamber at their fusing zones adapted to fuse the gases produced upon the fusion of any strip, which gases
10 form a conducting path to establish a short-circuit for the strips and thereby cause the

end-portions of the short-circuited strips to rupture.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE A. BURNHAM.

Witnesses:

E. F. LAWRENCE,

B. H. AHLERS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."