

Aug. 31, 1954

F. J. KOZACKA

2,688,061

TIME LAG FUSE

Filed Aug. 16, 1952

2 Sheets-Sheet 1

Fig. 1.

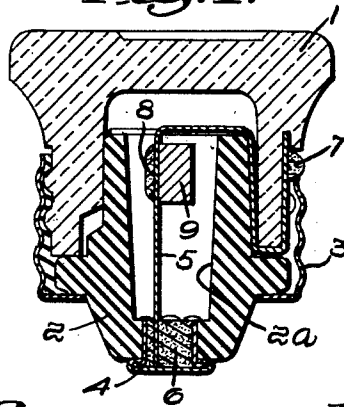


Fig. 2.

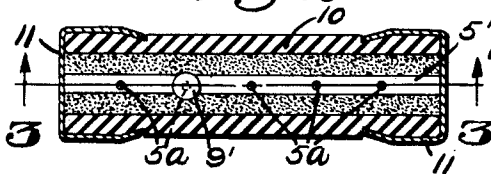


Fig. 3.

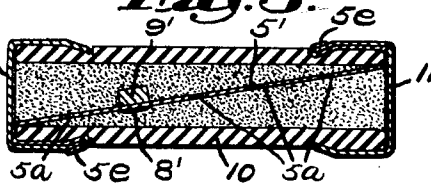


Fig. 4.



Fig. 5.

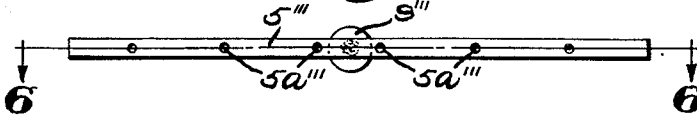
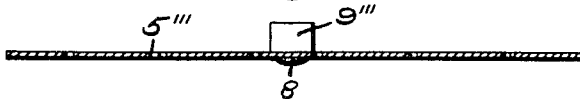
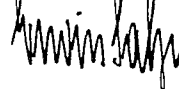


Fig. 6.



Inventor:

Frederick J. Kozacka,

by  *Attorney*

Aug. 31, 1954

F. J. KOZACKA

2,688,061

TIME LAG FUSE

Filed Aug. 16, 1952

2 Sheets-Sheet 2

Fig. 8.

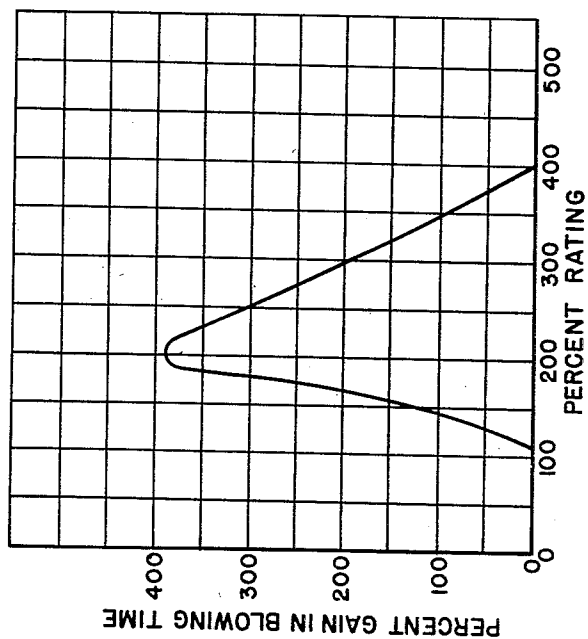
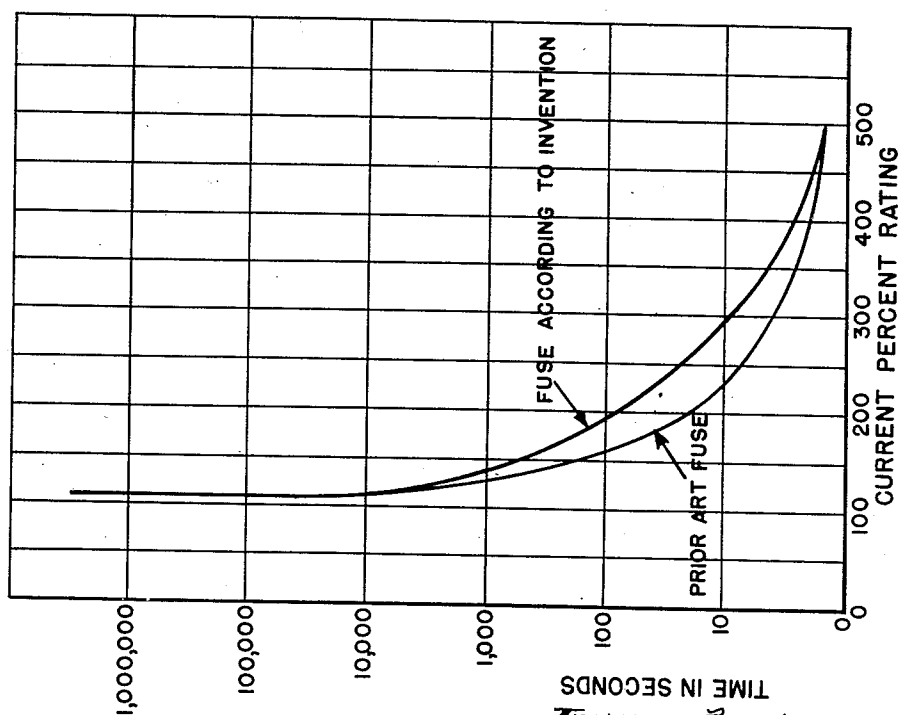


Fig. 7.



Inventor:
Frederick J. Kozacka,
by *[Signature]* Attorney

UNITED STATES PATENT OFFICE

2,688,061

TIME LAG FUSE

Frederick J. Kozacka, Amesbury, Mass., assignor
to The Chase-Shawmut Company, a corpora-
tion of Massachusetts

Application August 16, 1952, Serial No. 304,693

18 Claims. (Cl. 200—123)

1

The present invention relates to electric fuses for the protection of certain types of loads, more particularly electric motors, and it relates also to links or inserts for electric fuses.

A fuse should cause interruption of an electric circuit when the latter is dangerously overloaded; but if the overload is relatively small and of relatively short duration, the fuse should maintain continuity of service rather than blow. Fuses with delayed blowing action which takes effect only if an overload persists a predetermined period of time, depending upon the magnitude of the overload, are known as time-lag fuses. The present invention relates to fuses of this particular type.

It is generally desirable to make the link of a fuse of a metal having a relatively low specific resistance, or resistivity, and a relatively high fusing point. Silver and copper comply with these requirements and range among the metals best suited for making fuse links. The resistivity of silver and copper is normally low but rises very rapidly with increasing temperature which is a desirable feature with regard to rapid interruption of short-circuit currents. Whenever a fuse link is made of a metal having a relatively high fusing point, the link should be provided with a means for causing interruption of the circuit at relatively low temperatures resulting from relatively small but protracted overloads. To this end the fuse link may be provided with an element of a metal having a lower fusing point than the metal of which the fuse link is made and capable of forming an alloy with the metal of which the fuse link is made at temperatures below the fusing of the metal of which the fuse link is made. Upon occurrence of a relatively small but protracted overload the element made of a metal having the relatively low fusing point melts and forms an alloy with the metal of which the fuse link is made. This increases locally the resistance of the fuse link and hence results in accelerated heating. The alloy formed between the metal of which the link is made and the metal of which the link-destroying element is made has a resistivity which is higher than the resistivity of the metal of which the link is made and, therefore, the total resistance of the link increases progressively at the point where alloy formation takes place as the process of alloy-formation further progresses.

The link-destroying element may consist of tin, or of a tin-rich alloy, yet other metals than tin and alloys thereof may be used for severing the fuse link at relatively low temperatures. If

2

a link of silver is provided with a tin element, or an element made of a tin-rich alloy, alloying between the silver and the tin will take place upon fusion of the latter, and silver will diffuse into the melted tin, and vice versa melted tin will diffuse in the still solid silver. With fuses predicated upon the above alloying effect it was heretofore not possible to extend the delay period sufficiently to comply with the particular characteristics of certain loads as, for instance, motors, calling for relatively long periods of delay before interruption of the overloaded circuit is supposed to occur. Therefore the application of fuses predicated upon the above alloying effect was limited to cases requiring but relatively short delay times, and where delay times of greater length were required, resort had to be taken to different interrupting principles which, however, are much more costly to apply than the above referred-to alloying principle.

It is, therefore, an object of this invention to provide a time lag fuse which is predicated upon the principle of formation of an alloy for the purpose of effecting interruption of a circuit and which enables to increase the delay time beyond the range of delay times which could be accomplished by prior fuses predicated upon the above principle of alloy formation.

Considering the time current characteristic of a prior fuse predicated upon the principle of formation of an alloy for the purpose of effecting interruption of a circuit, a substantial increase in delay time is most needed in the overload range of about twice the rated current of the fuse. At 110% of the rated current the fuse must not blow and there is no need for an increase in delay time in the relatively high overload current range of, say, four or five times, or more, the rated current of the fuse.

It is therefore another object of the invention to provide a time lag fuse of the type predicated upon formation of an alloy for the purpose of effecting interruption of a circuit which fuse has greatly increased delay times in the range of about twice the rated current but relatively smaller increases of delay times for currents substantially lower, or substantially higher, than twice the rated current of the fuse.

Still another object of the invention is to minimize the changes, known as ageing, of the time current characteristic of time lag fuses of the aforementioned type.

The foregoing and other general and special objects of the invention and advantages thereof will more clearly appear from the ensuing par-

ticular description of the invention, as illustrated in the accompanying drawings, wherein

Fig. 1 is a longitudinal cross-section of a plug type fuse embodying the present invention;

Fig. 2 is in part a longitudinal cross-section and in part a top plan view of a cartridge type fuse embodying the present invention;

Fig. 3 is a section along 3—3 of Fig. 2;

Fig. 4 is a longitudinal cross-section of a fuse element embodying the present invention;

Fig. 5 is a top-plan view of another fuse element embodying the present invention;

Fig. 6 is a longitudinal cross-section of the fuse element shown in Fig. 5, taken along 6—6 thereof;

Fig. 7 is a pair of curves showing in which way the time-current characteristics of time-lag fuses are changed when applying the present invention; and

Fig. 8 is a curve which characterizes the mode of operation of time-lag fuses according to the present invention.

Referring now to Fig. 1, reference numeral 1 has been applied to a glass top and reference numeral 2 to a body of insulating material as, for instance, porcelain. Glass top 1 is provided with a screw shell 3 forming one terminal and insulating body 2 is provided with a rivet 4 forming the other terminal of the fuse structure. Screw shell 3 and rivet 4 are conductively interconnected by ribbon type fuse link 5. Rivet 4 is hollow and filled with solder at 6, establishing a good electrical contact between one end of link 5 and rivet terminal 4. The upper portion of link 5 includes two U bends and the upper end thereof rests against the outer surface of glass top 1, where it is conductively connected to screw shell 3 by means of a solder joint 7.

The path of the current through the fuse is as follows: rivet terminal 4, solder joint 6, link 5, solder joint 7, screw shell 3.

The insulating body 2 defines an interrupting chamber 2a accommodating the time lag interrupting means of the fuse. These means include an element 8 of a metal having a lower fusing point than the metal of which link 5 is made and forming an alloy with the metal of which link 5 is made at temperatures below the fusing point of the metal of which link 5 is made. The element 8 is in intimate contact with link 5 and may consist of a surface layer, or overlay, of tin which has a fusing point of 232 deg. centigrade. The ribbon type link 5 proper may consist of silver having a fusing point of 961 deg. centigrade, or of copper having a fusing point of 1084 deg. centigrade.

When the point of link 5 where the element, or overlay 8, of tin is located reaches the fusing point of tin, alloy formation between the tin of the element, or overlay 8, and the silver of the link 5 proper is initiated and progresses generally at a rapid rate, resulting in the formation of a break in link 5 and consequent interruption of the overloaded circuit.

Initiation of the above alloying process is, however, considerably retarded by the presence of a small block of metal or lag-block 9 which is preferably spot welded to link 5 at the side thereof opposite to the element or overlay 8 of tin. The lag-block 9 is made of a metal having a high specific heat, preferably of copper which has a specific heat in the order of .94 gram calories for the temperature range of 0 to 100 deg. centigrade and of .98 gram calories at a temperature of 300 deg. centigrade. Instead of copper brass may be used for making the lag-block 9. Both

the metal element or overlay 8 and metal block 9 are arranged in registry on opposite sides of the link 5. The close proximity of parts 8 and 9 is critical, i. e. of crucial importance. The time delay effect of the lag block 9 decreases if the lag-block is arranged more remotely from the point of link 5 where the metal element or overlay 8 is located.

Referring now to Figs. 2 and 3, reference numeral 10 has been applied to a tubular cylindrical casing of insulating material as, for instance, fiber or a synthetic resin laminate on a glass-cloth base. Fuse link 5' is arranged within casing 10 and inter-connects conductively the two crimped terminal caps 11 used to close casing 10. Link 5' is provided with a plurality of perforations 5a which are spaced substantially equidistantly along substantially the entire length of link 5' located within casing 10. The ends of link 5' are bent to the outside of casing 10 and clamped thereon by the terminal caps 11. The axially outer tips 5e of link 5 form a small U-turn and are bent upon the outer surface of caps 11 and conductively secured thereto by spot-welding. The general structure of the fuse shown in Figs. 2 and 3 is more fully disclosed in a patent application of Paul C. Hitchcock, Electric Fuse, Ser. No. 240,553, filed August 6, 1951, and assigned to the same assignee as the present invention.

At 8' link 5' is provided with a solder element, or solder overlay, having a considerably lower fusing point than the metal of which the link 5 is made. Lag-block 9', preferably made of copper or of a copper-rich alloy, is arranged in registry with the solder element 8' on the side of link 5' opposite to solder element 8'. The connection between lag-block 9' and ribbon type link 5' is effected by spot-welding. Casing 10 is filled with a granular or pulverulent arc-quenching filler as, for instance, substantially chemically pure quartz sand, i. e. quartz sand that does not contain any foreign matter tending to decelerate deionization of the path of the arc formed upon blowing of the fuse.

The preferred method of securing the lag-block 9' to the fuse link 5 is spot-welding. However, other fastening methods may be used, provided that they permit a sufficiently rapid transfer of heat from the link 5' to the lag-block 9'. A fuse link embodying the present invention having a lag-block which is riveted rather than spot-welded to it is shown in Fig. 4. The lag-block 9'' shown in this figure consists of a cylinder of copper or a metal having thermal properties similar to those of copper. The side of lag-block 9'' juxtaposed to link 5'' of silver is provided with a rivet 13 upset to attach lag-block 9'' to the link 5''. A tin washer 12 is arranged between link 5'' and lag-block 9''. The side of link 5'' where the head of rivet 13 is situated is covered with a layer 8'' of tin to initiate destruction of silver link 5''. There is a substantial time lag with regard to reaching the fusing point by the mass 8'' of tin. This substantial time lag is due to the relatively large heat absorbing capacity of lag-block 9'' and its location immediately adjacent to, and in registry with, the mass 8 of tin. Lag-block 9'' is arranged between a pair of perforations 5a''.

Referring now to Figs. 5 and 6, fuse link 5''' made of silver or copper is provided with an alloy-forming solder element 8''' having a relatively low fusing point and with a lag-block 9''' of a metal having a relatively high specific heat.

The tendency of the solder of which element 8''' is made to flow away upon fusion thereof from the point where it is normally located, and supposed to act as link-destroying agent, is limited, or precluded, by the provision of some flow impediment means. These flow impediment means may consist of a pair of perforations 5a''' which are situated as close as possible to the point of link 5''' where the solder element 8''' is located.

Where a multiperforated ribbon type fuse link is used the spacing between the perforations thereof is normally dictated by the electrical conditions of the circuit, primarily by the circuit voltage. However, where a solder element or solder overlay 8''' and a cooperating lag-block 9''' are provided on a fuse link, the latter should preferably be provided with a pair of perforations having a smaller spacing than the other perforations of the link, and the solder element or solder overlay 8''' and the lag-block 9''' should be arranged between the pair of more narrowly spaced perforations to minimize, or preclude, the tendency of the melted solder to flow away from the point of the link where the solder is supposed to perform its link-destroying duty.

Experiments with lag-blocks having different geometrical configurations tend to show that the best shape for the lag-block is that of a cylinder. The diameter of the cylinder should at least slightly exceed the width of the ribbon type link to insure the delay times which are required where the fuse is used for the protection of motors having a relatively high starting current.

It is also important that the overlay low fusing point be intimately united with the link. This can readily be achieved by depositing some globules of the overlay metal directly on the surface of the link.

The mass and surface of the lag-block and its specific heat should be so coordinated with the heat generated by the link on account of I^2R losses as to result in an increase in blowing time in the order of 250%, or more, if the load is in the order of 200% of the rated current of the fuse. Figs. 7 and 8 illustrate the operation of a fuse having a link which is thermally coordinated in the aforementioned manner.

In Fig. 7 the blowing time has been plotted against the current expressed in percent of the rated current. The abscissae are on a linear and the ordinates are on a logarithmic scale. One of the two curves shown in Fig. 7 is the time-current-characteristic of a prior art time lag fuse predicated upon alloy formation between a link of silver and an overlay of tin. The other of the two curves shown in Fig. 7 is the time-current-characteristic of an identical fuse having an identical fuse link except for the addition of a lag-block on the side of the link opposite to the overlay of tin and secured to the link by spot-welding in registry with the overlay of tin. It is apparent from Fig. 7 that the presence of the lag-block has no effect at currents up to 110% of the rated current of the fuse, or at currents equal to and above 500% of the rated current of the fuse. The maximum increase of time lag is in the region of twice the rated current of the fuse.

By proper coordination of the specific heat of the metal of which the lag-block is made and the mass and the surface of the lag-block on the one hand and the heat generated in the

fuse link on the other hand the blowing time of a link may be increased in excess of 300% for loads in the order of 200% of the rated current of the fuse. This has been illustrated in Fig. 8 wherein the gain in blowing time has been plotted against the current in percent of the rated current of the fuse. It is apparent from Fig. 8 that the largest gain in blowing time occurs at a current equal to 200% the rated current of the fuse, and that the gain in blowing time at that current is in the order of 390%. There is no gain in blowing time at currents of 110% of the rated current, or at currents of 400% or more than 400% of the rated current of the fuse.

Obviously these characteristics are very close to the ideal requirements to be imposed upon a time lag fuse for motor protection and similar applications. While it has been possible heretofore to live up to such requirements, none of the prior art designs which come reasonably close to ideal requirements is predicated upon the simple principle of link destruction by formation of an alloy.

On the occurrence of short-circuits the fuses according to this invention operate on account of instantaneous fusion and vaporization by the short-circuit current of the point of the link which has the smallest cross-sectional area. This limits the left-through current and effects interruption of the faulted circuit without any time delay whatever.

It will be apparent from the foregoing that the present invention is not limited to any particular type of time-lag fuses but can be applied to any type and in particular to both plug type and cartridge type time-lag fuses.

It will also be apparent from the foregoing that for maximum time delay the lag-block should be located directly over or in registry with the metal part 8 having a relatively low melting point.

It will furthermore be apparent from the foregoing that interruption is effected at the occurrence of protracted overloads without resorting to any movable mechanisms as, for instance, a pair of contacts normally held together by a low melting point solder and spring biased in contact opening direction to effect contact separation when the solder reaches a predetermined temperature. While it is true that longer delay times may be achieved by means of the aforementioned type of mechanisms involving a solder joint between two contacts and a contact separating spring than by means of structures of the kind shown in Figs. 3 to 6, the last referred to structures are fully adequate to achieve the delay times required for the protection of electric motors. The Underwriters Standards for Fuses prescribe that a plug fuse having a current rating within the range of 15-30 amperes, inclusive, and designated as a time-delay fuse shall blow in not less than twelve seconds when carrying 200 percent of its rated current. Fuses according to Fig. 1 come within this definition of time-delay fuses.

Upon progressive increase of the height of lag block 9 the gain in time delay decreases progressively until a point is reached where further increase of the height of lag block 9 does not result in any gain in delay time. Hence there is no point in increasing the height of lag block 9 beyond this particular saturation point.

In carrying the invention into effect the amount of link-destroying low fusing point solder

applied to the link must be carefully measured since that quantity affects the rating of the fuse.

Fuses designed to carry and to interrupt relatively high currents may be provided with a plurality of links which form parallel current paths, each of said plurality of links being substantially of the same nature as the links shown in Figs. 2-6 and said plurality of links being accommodated in a common casing.

Prior art time-lag fuses predicated on the formation of an alloy from a metal having a relatively low melting point and a metal having a relatively high melting point suffer from the drawback that the process of destruction of the link is likely to be interrupted in its initial stages if an overload initiates the interrupting process but decreases substantially immediately upon initiation of the process of formation of an alloy. As a result of such sudden decrease, the current carrying ability of the fuse link is permanently impaired since it is partially destroyed, i. e. since a partial conversion of the metal which has the higher fusing point and the smaller specific resistance into an alloy having a relatively higher specific resistance has taken place prior to the cessation of the process of destruction. This undesirable condition is known as ageing of a fuse. Fuses having fuse links according to this invention are less subject to ageing than most prior art fuses because the lag-block absorbs the heat generated by transient overloads of very short duration and permits a substantial heating of the low fusing point metal only if the overload lasts for a substantial period of time, in which case there is a high probability that the fuse link will be ultimately completely destroyed by alloy-formation rather than only partially destroyed.

It will be understood that I have illustrated and described herein several preferred embodiments of the invention and that various alterations may be made in the details thereof without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A fuse comprising insulating means defining an interrupting chamber, a link arranged within said chamber, an element of a metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, a block on said link made of a metal having a high heat absorbing capacity to delay alloy-formation between the metal of which said link is made and the metal of which said element is made, said element and said metal block being arranged substantially in registry on said link.

2. A fuse comprising insulating means defining an interrupting chamber, a ribbon type fuse link arranged in said chamber, an element of metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a lag-block of a metal having a high specific heat spot-welded to said link at a point thereof substantially in registry with said metal element.

3. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting

said terminal caps, an element of a metal on said link having a lower fusing point than the metal of which said link is made and forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a lag-block spot welded to said link at the side thereof opposite to said element and in registry with the point where said element is located.

4. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a ribbon-type fuse link within said filler conductively interconnecting said terminal caps, an element of a metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a lag-block of a material having a high specific heat secured to said link, said element and said lag-block being arranged substantially in registry on opposite sides of said link.

5. A fuse link comprising a casing, terminal caps closing the ends of said casing, a quartz sand filler within said casing, a ribbon-type fuse link within said filler conductively interconnecting said terminal caps, a body of soft solder in intimate contact with said link, the solder of which said body consists having a lower fusing point than silver and capable of forming an alloy with silver at temperatures lower than the fusing point of silver, and a lag-block of a metal having a high heat absorbing capacity spot-welded to said link, said body of solder and said lag-block being arranged substantially in registry on opposite sides of said link.

6. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an element of a metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, impediment means immediately adjacent said element for limiting the flow of fused metal in a direction longitudinally of said link, and a metal block on said link made of a metal having a high heat absorbing capacity for delaying alloy-formation between the metal of which said link is made and the metal of which said element is made, said element and said metal block being arranged substantially in registry on said link on opposite surfaces thereof.

7. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a ribbon type fuse link within said filler conductively interconnecting said terminal caps, an element of solder in intimate contact with said link, the solder of which said element consists having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, a pair of perforations immediately adjacent said element for limiting the flow of melted solder in a direction longitudinally of said link, and a lag-block having a high specific heat spot welded to said link, said element and said lag-block being arranged substantially in registry on opposite sides of said link.

8. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a ribbon type fuse link within said filler conductively interconnecting said terminal caps, a plurality of perforations arranged substantially equidistantly along said link, an element of metal of said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a metal block having a high specific heat spot-welded to said link to delay fusion of said element, said element and said metal block being arranged in the space between two of said plurality of perforations on opposite sides of said link and substantially in registry.

9. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, a plurality of perforations spaced along said link at varying distances, an element of metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a lag-block having a high heat absorbing capacity secured to said link, said element and said lag-block being arranged substantially in registry on opposite sides of said link at a point thereof situated midway between two of said plurality of perforations having a smaller spacing than others of said plurality of perforations.

10. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an element of a metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, a metal body made of a metal having a high specific heat spot-welded to one side of said link and protruding laterally therefrom, said metal body being arranged on the side of said link opposite to said element and substantially in registry with said element.

11. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-extinguishing filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an element of a metal having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a metallic cylinder having a diameter exceeding the width of said link spot-welded to the side of said link opposite to said element and substantially in registry therewith.

12. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-extinguishing filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an overlay of a metal having a lower fusing point than the metal of which said link consists intimately united with said link, the metal of which said overlay consists being capable

of forming an alloy with the metal of which said link consists at temperatures below the fusing point of the metal of which said link consists, and a block of a copper-containing alloy secured to said link on the side thereof opposite to said overlay and substantially in registry therewith.

13. A fuse comprising a casing, terminal caps closing the ends of said casing, a pulverulent arc-extinguishing filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an overlay of a metal having a lower fusing point than the metal of which said fuse link is made intimately united with said link, the metal of which said overlay is made being capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a block of copper secured to said link on the side thereof opposite to said overlay and substantially in registry therewith.

14. A fuse comprising a casing, terminal caps closing the ends of said casing, an arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an element of a metal on said link having a lower fusing point than the metal of which said link is made and capable of forming an alloy with the metal of which said link is made at temperatures lower than the fusing point of the metal of which said link is made, a block of metal secured to said link on the side thereof opposite to said element and substantially in registry therewith, the specific heat of the metal of which said block is made and the mass and surface of said block being so correlated to the heat generated in said link as to result in an increase in blowing time in the order of at least 250% if the load is in the order of 200% of the rated current of the fuse.

15. A fuse comprising a casing, terminal caps closing said casing, a pulverulent arc-extinguishing filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an overlay of a metal having a lower fusing point than the metal of which said link is made intimately united with said link, the metal of which said overlay is made being capable of forming an alloy with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made, and a metal block spot-welded to said link on the side thereof opposite to said element and substantially in registry with said element, the specific heat of the metal of which said metal block is made and the mass and surface of said metal block being so correlated to the heat generated in said link as to result in an increase in blowing time in the order of at least 250% if the load is in the order of 200% of the rated current of the fuse.

16. A fuse comprising a casing, terminal caps closing said casing, a pulverulent arc-quenching filler within said casing, a fuse link within said filler conductively interconnecting said terminal caps, an element of a soft metal on said link having a lower fusing point than the metal of which said link is made and capable of reacting with the metal of which said link is made at temperatures below the fusing point of the metal of which said link is made to form an alloy having a higher specific resistance than the metal of which said link is made, and a metal block secured to said link on the side thereof opposite to said element and substantially in registry with said element, the specific heat of the metal of which said metal block is made and the mass and

the surface of said metal block being so correlated to the heat generated in said link as to result in an increase in blowing time in excess of 300% if the load is in the order of 200% of the rated current of the fuse.

17. An insert for electric fuses of the time-lag type comprising a metal ribbon, an element on said ribbon having a lower fusing point than the metal of which said ribbon is made and capable of forming an alloy with the metal of which said ribbon is made at temperatures below the fusing point of the metal of which said ribbon is made, a block on said ribbon made of a metal having a high heat absorbing capacity to delay alloy-formation between the metal of which said ribbon is made and the metal of which said element is made, said element and said metal block being arranged substantially in registry on said ribbon on opposite surfaces thereof.

18. An insert for electric fuses of the time-lag

type comprising a metal ribbon, an overlay on said ribbon of a soft metal having a lower fusing point than the metal of which said ribbon is made and capable of reacting with the metal of which said ribbon is made at temperatures below the fusing point of the metal of which said ribbon is made to form an alloy having a higher specific resistance than the metal of which said ribbon is made, and a metal block secured to said ribbon on the side thereof opposite to said overlay and substantially in registry with said overlay.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,222,058	Klein	Oct. 29, 1940
2,251,409	Klein	Aug. 5, 1941
2,527,160	Taylor	Oct. 24, 1950
2,557,926	Swain et al.	June 26, 1951