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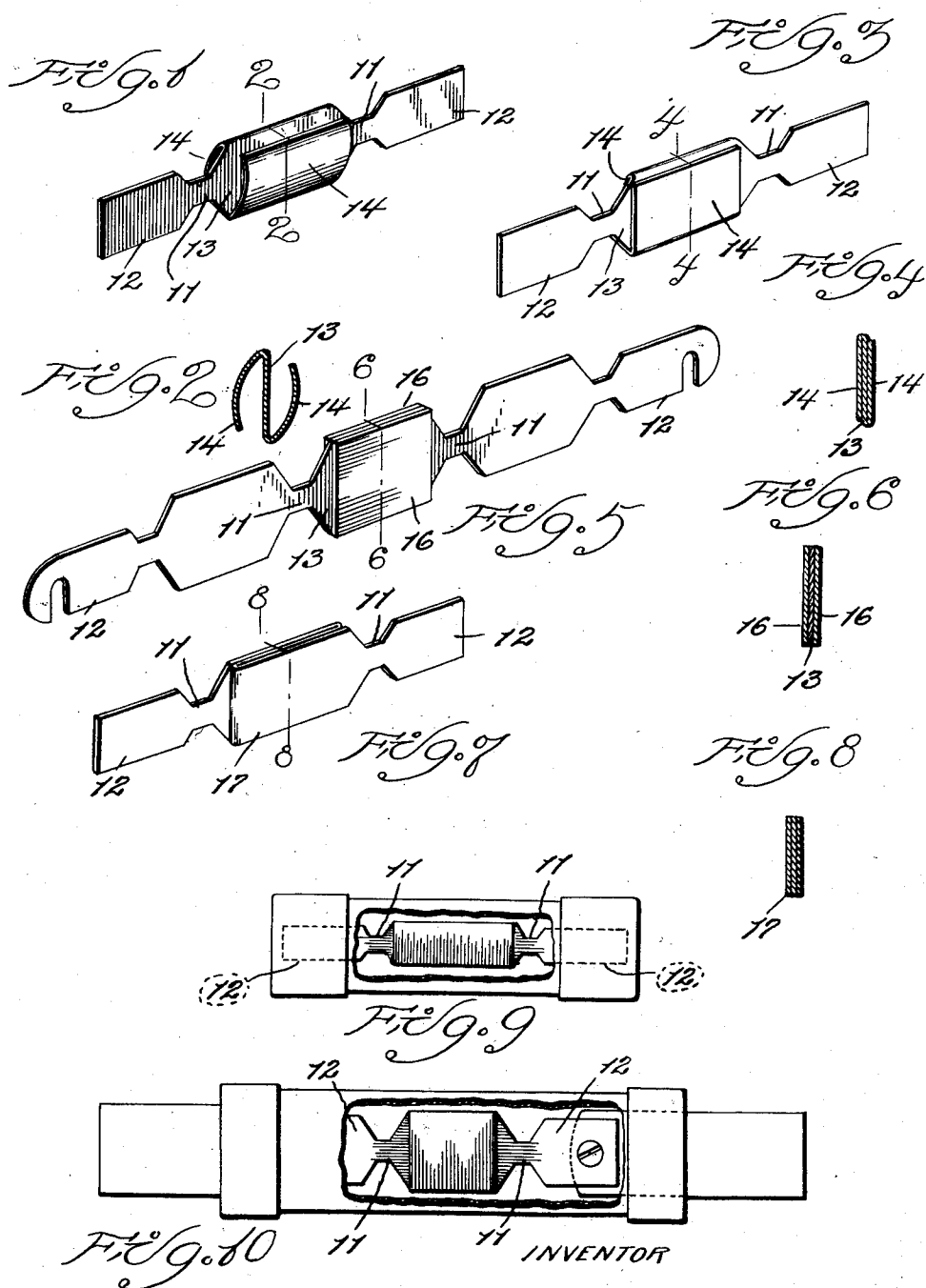
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ELECTRIC FUSE AND METHOD OF MAKING SAME

Filed Nov. 10, 1924

2 Sheets-Sheet 1



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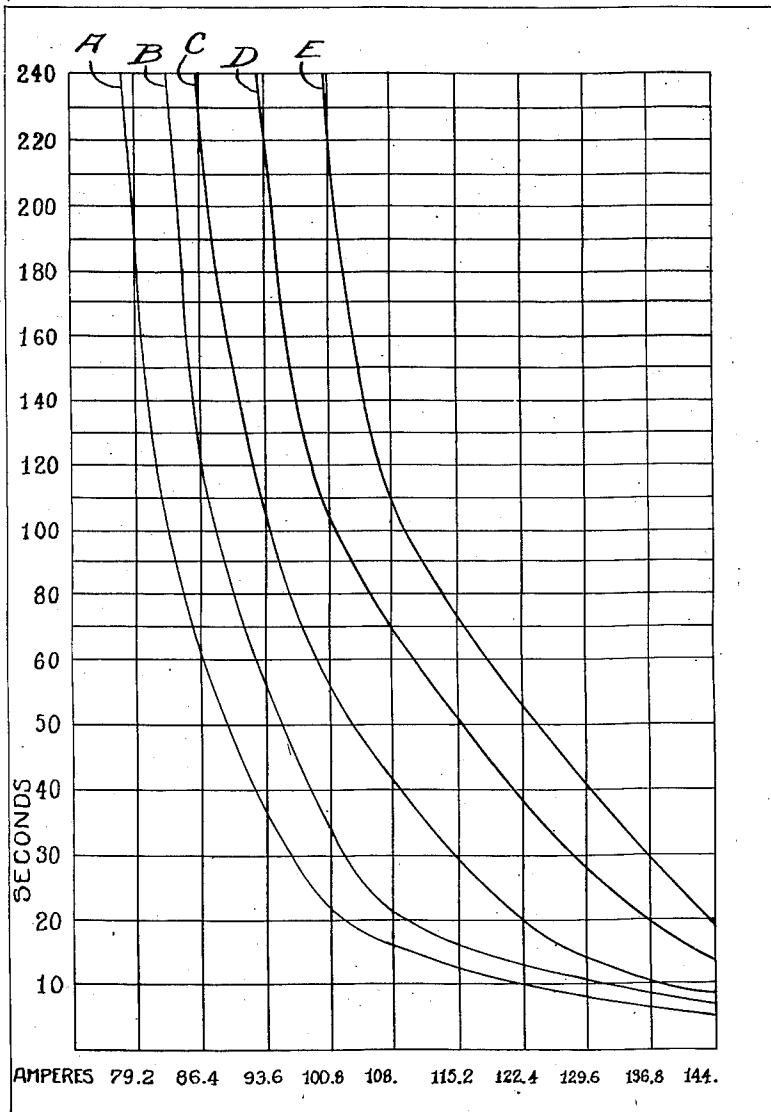
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2 Sheets-Sheet 2

Fig. 11



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ELECTRIC FUSE AND METHOD OF MAKING SAME

Application filed November 10, 1924. Serial No. 749,074.

My invention relates to electric fuses, which when forming a part of an electric circuit serve to protect said circuit from the effects of excessive current by melting and automatically opening the circuit when the current therein exceeds in magnitude that value for which the circuit is adapted.

This application is a continuation in part of my application for a patent on a Link for electric fuses, filed February 28, 1923, bearing the Serial Number 621,774.

One of the difficulties encountered with the use of fuses as heretofore made is that they blow too quickly on overloads of comparatively brief duration that would not be injurious to the electric wiring or apparatus the fuse is designed to protect. For example in starting an alternating current motor there is a sudden rush of current far in excess of the amount of current the motor will take while running at full load. This sudden rush of current lasts only a few seconds. The fuse should, of course, be made so that it will blow if the motor is overloaded for a considerable length of time, but the fuse should not blow because of the high starting current, as such current cannot be injurious to the motor or the wiring. If the fuse is blown by this heavy starting current, it is in reality a useless blow, giving no protection and causing the loss of the fuse plus loss of time occasioned by idle machinery and the need for having an electrician replace the blown fuse. Furthermore, such useless blows often result in the installation of a fuse of too large a size, thereby robbing the motor and circuit of proper protection, which frequently results in the burn-out of the motor and brings about a fire hazard.

One reason for this condition existing with the use of the present types of fuse links is because all fuses must be designed so that they will operate safely under short circuit conditions. Such short circuit conditions permit the flow of a very large amount of current which instantly volatilizes the fusing portions causing heavy internal pressures in the fuse enclosure. It is, therefore, highly desirable to keep the amount of metal to be volatilized down to a minimum, with the re-

sult that the fuse links heretofore made have the weakness of short blowing times at overloads.

One object of my invention is to provide a safe operating fuse link with a time lag so as to retard the blowing of the fuse on overloads and thereby provide a fuse which will accomplish what the present fuses fail to accomplish, at the same time assuring safe operation under short circuit conditions, and it is also my object to provide a method of making same.

Another object of my invention is to improve the short circuit characteristics of a fuse by reducing the amount of metal volatilized under such conditions, and I may, by varying the quality of the link, obtain both the time lag and improved short-circuit characteristics.

For the purpose of explaining my invention, I show in Fig. 11 of the drawings, curves plotted to show the blowing times of certain fuse links at certain overloads. These tests were made on fuses that would be commercially rated as 60 ampere, which means that they would carry at least 66 amperes continuously and blow at 90 amperes within two minutes, the standard requirements being that a fuse carry at least a 10% overload continuously and blow at 50% overload within a specified time limit.

Curve A in Fig. 11 shows the results obtained on a commercial type of two-notch link rated at 60 amperes, which had a maximum carrying capacity of 72 amperes and was properly installed in a fuse enclosure. It will be noted that this fuse has a blowing time at various currents as follows:

Amperes	Seconds
86.4	63
100.8	22
115.2	13
129.6	9
144	6

It would, of course, be possible to make such a link of heavier metal, to delay the blowing of the fuse, but that would mean that more metal would have to be volatilized on short-circuit, with a consequent increased

pressure in the fuse enclosure which might cause the bursting of such enclosure with the resulting hazards. Curve B shows the results obtained from such a link, which indicates the following blowing times at various currents:

Amperes	Seconds
86.4-----	136
100.8-----	36
115.2-----	16
129.6-----	10½
144.-----	7

This link was identical to that from which the results charted in curve A were obtained, but made of heavier metal, its maximum current carrying capacity being 77 amperes. It will be noted that the shape of this curve B is substantially the same as A and that because of the heavier metal, the blowing times have been delayed. In other words, increasing the thickness of the entire link serves to lengthen the blowing time but it brings up difficulties in the form of increased pressures on blowing of the fuse at heavy short-circuits because of the greater amount of metal that must be volatilized.

Curve C shows the results obtained from my improved form of link which at various overloads are as follows:

Amperes	Seconds
86.4-----	232
100.8-----	55
115.2-----	28
129.6-----	14
144.-----	9

This link was exactly like the one covered by curve A, but with a section of the link changed in accordance with my invention. The change effected a practical and commercially efficient time lag. This effect was pronounced at the overloads shown. When the overloads become greater than 100%, say at 200%, the difference in blowing time becomes less until on overloads approaching short-circuit conditions, the results on both links are substantially the same. From this it can be seen that although my improved form of link has a considerable time lag over the one shown by curve B, yet the performance on heavy short-circuits is better than that of the fuse covered by curve B and substantially the same as that of the fuse covered by curve A.

Curves D and E show results obtained from other of my improved links having a higher quality than the link covered by curve C. These links have a longer blowing time. However, by taking advantage of my invention, a shorter predetermined time lag may be obtained and at the same time, the amount of metal to be volatilized on short circuits materially reduced. This is accomplished by reducing the cross sectional area of the fusing portions and making the quality as high as

that used on the fuses covered by curve D or E.

In the drawings, Fig. 1 is a perspective view of a link embodying my invention, the intermediate member being folded on itself. Fig. 2 is a cross-sectional view of the same link on the line 2—2 of Fig. 1. Fig. 3 is a perspective view of a link having the intermediate member folded over on itself and compressed. Fig. 4 is a cross-sectional view of the same link on the line 4—4 of Fig. 3. Fig. 5 is a perspective view of a link having strips welded or otherwise attached to the central portion. Fig. 6 is a cross-sectional view of the same link on the line 6—6 of Fig. 5. Fig. 7 is a perspective view of the link having the intermediate member folded up on itself. Fig. 8 is a cross-sectional view of the same link on the line 8—8 of Fig. 7. Fig. 9 is a view of my invention applied to a ferule contact enclosed fuse, and Fig. 10 is a view of my invention applied to a knife blade renewable fuse. Fig. 11 shows comparative blowing time of links old in the art and links embodying my invention.

This invention deals with the design of the link and its various parts and in my specifications I also refer to certain methods of proportioning the link. The ordinary terms used for describing portions of the link as heretofore used are not sufficiently definite or accurate for the purpose of describing my invention and for making clear the proportioning of the link and I have therefore been compelled to adopt certain terms and arbitrarily define them. Particularly is this so because as far as I know, no one has ever attempted to proportion links to secure a time lag.

I use the term "potential fusing sections" to define or designate two sections of the link, one relatively near each terminal, each $\frac{1}{8}$ inch long and extending along the length of the link $\frac{1}{8}$ inch each way from the center of that part of the link as will burn out, when the link, while in a suitable fuse enclosure, is subjected to the short circuit tests prescribed by the standards on enclosed fuses adopted by the National Board of Fire Underwriters.

It is true that the blowing point of any particular fuse link might be designed to be greater or less than the one eighth inch length which I have designated as the length of the "potential fusing sections" and that a particular link might actually burn out for a greater or lesser distance. To definitely state what the area burned out will be, when such portion is blown on a short circuit, is a difficult if not impossible problem. Such area is dependent on the construction of the fuse enclosure, particularly as to the amount of venting; it is dependent on the voltage of the circuit, the current flowing, the capacity of the circuit as well as the inductance of the circuit and finally on the size and design of the

designation given above was selected to make link itself. Because of this, the arbitrary possible the definite proportioning of the link.

I also use the ordinary term "fusing portion" but such term should not be confused with the arbitrary term above mentioned.

That section of the link between the "potential fusing sections" I designate as the "intermediate member."

The "potential fusing sections" being made to burn out on a short circuit are therefore the points of greatest heat generation. The terminals to which the fuse link is connected are the greatest available means of conducting away heat generated in the fuse link. It is desirable that the point of greatest heat generation be as near a terminal as possible, because on the lighter overloads the heat generated will be conducted away almost as fast as it is generated, thereby delaying the blowing of the fuse at the lighter overloads, while at the heavier overloads this heat conduction can not be much of a factor because the heavier overloads cause the blowing of a "potential fusing section" so quickly that the terminals cannot conduct much of the heat away from the link.

Links have been made heretofore with the reduced portion removed from the center. The mere changing the link so that the reduced portion is closer to the terminals does not in itself produce a practical or commercially efficient time lag as can be seen by comparison of curves A and C. Curve A applies to the commercial type two-notch link previously mentioned. In this link the reduced portions are about as near the terminals as they can be placed, yet this link does not have such time lag because on light overloads the small amount of heat generated in the reduced portion has been conducted away by the terminals fast enough to keep the maximum temperature of these portions lower than the maximum temperature at the center of the link, even though the cross-section at the center is quite a bit larger than at the reduced portion. As a consequence, such links on light overloads fuse in the center rather quickly.

The problem is, therefore, not alone one of moving the "potential fusing sections" away from the center and near the terminals, but of proportioning the various parts of the link to achieve the novel results obtained in my invention.

In carrying out my invention, I increase the current carrying capacity of the "intermediate member" without increasing the current carrying capacity of the "potential fusing sections" or with an actual decrease in the current carrying capacity of the "potential fusing sections"; or where it is desirable to increase the current carrying capacity of the "potential fusing sections," the current

carrying capacity of the "intermediate member" is increased even more in proportion. This latter is possible without increasing the actual carrying capacity of the link as a whole, because the carrying capacity of the link is quite different than the carrying capacity of any of the component parts herein defined, being affected by the shape, size and character of the terminals and other factors.

This increased current-carrying-capacity of the "intermediate member" not only means lesser resistance with consequent lesser heat generation, but also means that some of the heat generated in the "potential fusing sections" is conducted away and radiated away through this substantially heavier "intermediate member", whereby the blowing of the fuse is delayed on such overloads where conductivity of heat from the "potential fusing sections" is an important factor and yet the blowing of the fuse is not in any wise interfered with on heavy overloads or short circuits where conductivity of heat away from the "potential fusing sections" is a substantially negligible factor.

I prefer, in order to obtain a time lag of practical or commercial efficiency on links having only two fusing portions, to so proportion the link that the intrinsic-current-carrying-capacity of a "potential fusing section" as compared to the intrinsic-current-carrying-capacity of the "intermediate member" is about 1 to 55/100. I may to obtain a lesser time lag make the proportion 1 to 52/100 or even 1 to 50/100.

In order to express in a simple manner the proportioning referred to, I use the term "quality" to designate the intrinsic-current-carrying-capacity of the "intermediate member" as compared with the intrinsic-current-carrying-capacity of a "potential fusing section"; it being understood that the intrinsic-current-carrying-capacities referred to are as defined and as determined by the method of procedure herein set forth.

It will be noted that with the proportions above given, the intrinsic-current-carrying-capacity of a "potential fusing section" is higher than that of the "intermediate member" in spite of the fact that the "potential fusing section" is mentioned as the point of greatest heat generation and may be, as shown in the drawings, very much smaller in cross-section than the "intermediate member". The reason for this is the well known electrical law that the current carrying capacity of a conductor is not alone dependent on its physical characteristics and cross section but on its length as well. The current carrying capacity of the "intermediate member" is greater than that of the "potential fusing section" only when compared on the basis of their relative per-unit-length-current-carrying-capacity.

In other words the per-unit-length-cur-

rent-carrying-capacity of the "intermediate member" is greater than that of the "potential fusing section," but because of the very much greater length of the "intermediate member," its intrinsic-current-carrying-capacity is less than that of the "potential fusing section" as stated above.

I therefore use the term "intrinsic-current-carrying capacity" to denote the current carrying capacity of the section or member as a whole, or in other words the maximum amount of current such section or member will carry without blowing. To determine the maximum current carrying capacity of any section or member by itself, that section or member must be so connected into a test circuit that no heating due to contact resistance, or to inadequate size of terminals can affect the fusing of that section but that the total heat generated in that section shall be due to the passing of the current there-through. Accordingly I may use the following arrangement for test: A current is passed through such section or member, after it has been tightly clamped between accurately positioned copper terminals, substantially wider than the greatest width of the link, of ample proportions for the current handled and arranged parallel to each other. I permit an amount of current estimated to be slightly below the maximum current carrying capacity to flow through the portion or member, for a period of 30 minutes. Then the current is boosted in steps of not more than 2%, each step being continued for 30 minutes. This is continued until the part under test blows, the last step held for 30 minutes being considered the intrinsic-current-carrying-capacity. This method of determining the current carrying capacity of a section or member of a fuse link I use because I know of no established method and in the absence of some absolutely accurate method, I have adopted this as being a reasonable one. Whatever methods there are for determining current carrying capacities are on such devices where there is a limit of temperature rise whereas in the case of fuses, the current carrying capacity of a link or portions of a link cannot be determined short of destruction.

Within certain limits it is possible to get increased time lag by increasing the quality of the link to not less than 6/10, 65/100, 7/10, 75/1000, 8/10, and even higher, and by the use of particular qualities I provide fuses having predetermined time lags. However, I keep the weight added to the intermediate member low so as to exert no appreciable gravitational strain on the fusing portions lest the fusing portions be mechanically ruptured when softened by the heat of the passing current, though at a temperature much below their fusing temperature.

With this method I can provide a predetermined time lag by altering the quality in any suitable manner. For the purpose of illustration, I may take a link having a blowing time of 9 seconds at 129.6 amperes, as shown by curve A in Fig. 11. In order to obtain a time lag of 5 seconds, so that the fuse would blow at about 14 seconds, I arrange such link so as to obtain a quality of 62/100. If I desire a further time lag of 14 seconds, so that the fuse will blow at the stated load at about 28 seconds, I arrange such link so that the quality is 71/100 and if I desire to lengthen the time another 14 seconds, I arrange such link so that the quality is 8/10.

In the design of my link like all other links, it is necessary to take into consideration the desired capacity, the length of the link, the possible width of the link, the size of the terminal portion, the cross-section and contact surface of the terminal, the shape of the fusing portion as well as the intermediate member, not including the various factors to be considered in designing the link to meet short-circuit conditions. In view of the fact that there are so many variables to be taken into consideration, which variables are known and understood by those familiar with the art, it is difficult to work out a precise mathematical formula for this purpose, but by my method anyone familiar with the art will be able to quickly design links to give any desired or predetermined time lag.

In providing the quality of my link I arrange the link so that the current carrying capacity of a length of the intermediate member equal in length to that of the fusing section is very materially greater than that of the fusing section. I find that reasonably favorable results are obtained by making this ratio 8 to 1. Generally I make it higher and preferably more than 10 to 1. It is obvious then that in a link having both the fusing portion and the intermediate member of the same metal that the cross section of an intermediate member, at least for part of its length, will be eight times that of a fusing section, as shown in the drawings. I vary these proportions according to the results desired. In Fig. 5 I show a ratio of 14 to 1 and under certain circumstances it is desirable to use even greater ratios.

The safe operation of an enclosed fuse on heavy short-circuits is greatly dependent on the amount of metal volatilized on the blowing of the fuse link under such conditions. As has been shown by the curves in Fig. 11, I have, by my invention, made it possible to obtain a practical commercially efficient time lag. That this has been accomplished without being detrimental to the short-circuit characteristics of the fuse is shown by the fact that no apparent difference on short-

circuit operation exists between fuses covered by the curve A and fuses covered by the curve C, or D, or E. This can be readily explained by the fact that the fusing portions of the links covered by curves A, C, D and E were identical in every respect, as to material, shape, length, width and thickness. The links covered by curves C, D and E were taken from the same lot from which curve A links were taken, but the proportion of current carrying capacity between a potential fusing section and the intermediate member was changed by attaching metal to the intermediate member in the manner shown in Fig. 5.

From the foregoing description it will be seen that I have not increased the amount of metal that must be volatilized when the fuse blows on a heavy short-circuit, yet I have provided means for obtaining this important commercially efficient time lag on overloads.

I may also, as has been mentioned, increase the quality of the link to a high point and then decrease the cross-sectional area or current carrying capacity of the potential fusing sections and thereby decrease the amount of metal that must be volatilized on heavy short-circuit blows, as, for example, I may take a fuse link commercially rated at 60 amperes, increase its quality to 7/10 and then decrease the potential fusing sections to a cross-sectional area no greater than that of a commercially rated 50 ampere link. I will then have a fuse link that will be commercially rated at 60 amperes, whose short-circuit performance would be substantially the same as that of the present 50 ampere links.

I may also, by making the quality of the link high enough, obtain this advantage of reducing the amount of metal to be volatilized on heavy short-circuits and at the same time obtain a predetermined time lag.

It will be noted that I have shown the intermediate member of the two-notch links as being of much greater length than the fusing portions. It is obvious to anyone versed in the art that the longer the fusing portions are made, the more cross-sectional area of metal must be used to carry the same amount of current. It is also a well known fact that that portion of a link which is of substantially reduced cross-section or reduced per-unit-length-current-carrying-capacity will volatilize on a heavy short-circuit. Therefore, I make the intermediate member relatively long and limit the fusing portion to a relatively short length, preferably as short as possible so as to reduce to a minimum the amount of metal that must be volatilized on a heavy short-circuit.

To increase the width of the intermediate member so materially as to obtain the ratios mentioned would be objectionable, in fact, impossible in enclosed fuses where the sizes of the enclosures are necessarily limited, and I,

therefore, make the link shown in Figs. 1 and 2 with portions 14 of the intermediate member 13 folded laterally on said intermediate member, which, if desirable, can be compressed within a limited dimension, as shown in Figs. 3 and 4; or I may make this link with separate pieces 16 welded or otherwise attached to a link having the center or intermediate member of ordinary width, as shown in Figs. 5 and 6; or I can make the intermediate member of ordinary width, but of great length, and fold this longitudinally on itself, as shown at 17 in Figs. 7 and 8, so as to form the equivalent of a solid mass of metal. It should be borne in mind that where metal is attached to the intermediate member, that the better the connection between such additional metal and the original link, the better the time lag and short-circuit characteristics will naturally be. Different types of intermediate member constructions will not necessarily give the same results even though the links are of similar proportion of quality and of similar size.

The terminal members 12 may be of any desired shape and of any suitable materials; likewise the fusing portions 11 and the intermediate member 13.

I do not limit myself in the accomplishing of my objects to the methods or arrangements shown. While I have shown certain proportions or arrangements, yet, I may use any other means whereby a practical or commercially efficient time lag may be produced in or by a fuse.

For links having reduced or fusing portions in addition to the two "potential fusing sections" I have described, I prefer to use proportions of 1 to 30/10, or in other words, a quality of 30/100. I may however, to obtain lesser time lag, use a quality as low as 26/100.

In such fuse links, I designate the "intermediate member" as all of the link between the two "potential fusing sections" which would mean that the additional reduced or fusing portions are within the "intermediate member." It will be noted that the number of "potential fusing sections" in all cases is limited to two, as fully outlined previously, although the link may have more than two fusing portions.

The additional metal on the "intermediate member" of such a fuse link may be throughout its entire length, or only along a portion thereof, and it may be applied on the material left in the reduced portions, or not, according to the time lag desired.

As is the case with links having no fusing portions within the length of the "intermediate member" it is possible within certain limits to increase the time lag by increasing the proportion of the current carrying capacity of the intermediate portion so that the

quality of the link is 35/100, 4/10, 45/100, 5/10, 55/100, 6/10 and even higher.

While I have shown and described several forms or embodiments of my inventions, I do not desire to be restricted to the exact details of construction noted herein, for it will be apparent to those skilled in the art that various modifications of construction details can be made without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent is:

1. The hereinbefore described method of making a fuse having a predetermined time lag which consists in so proportioning the members of the link with respect to each other as regards the relative dimensions of said members as to obtain such time lag.

2. The hereinbefore described method of making a fuse having a predetermined time lag which consists in so proportioning the members of the link with respect to each other as regards the current carrying capacity of said members as to obtain such time lag.

3. The hereinbefore described method of making a fuse link whereby the time lag of the said link is controlled without impairing the short circuit characteristics which consists in so proportioning one member with respect to another member of the said link as regards the dimensions of said members as to control the time lag.

4. The hereinbefore described method of making a fuse link whereby the time lag of the said link is controlled without impairing the short circuit characteristics which consists in proportioning one member with respect to another member of said link as regards the current carrying capacity of said members respectively.

5. The hereinbefore described method of making a fuse having a plurality of relatively short fusing portions and a relatively long intermediate member which consists in so proportioning said portions and said member as regards their relative dimensions as to obtain a time lag.

6. The hereinbefore described method of making a fuse link having relatively short fusing portions, two only, and a relatively long member therebetween which consists in so proportioning said portions and member as regards their current carrying capacity that the quality as herein defined be not less than 52/100.

7. The hereinbefore described method of making a fuse link having relatively short fusing portions, two only, and a relatively long member therebetween which consists in so proportioning said portions and member as regards their current carrying capacity that the quality as herein defined be not less than 55/100.

8. The hereinbefore described method of making a fuse link having relatively short

fusing portions, two only, and a relatively long member therebetween which consists in so proportioning said portions and member as regards their relative dimensions that the quality as herein defined be not less than 52/100.

9. The hereinbefore described method of making a fuse link having relatively short fusing portions, two only, and a relatively long member therebetween which consists in so proportioning said portions and member as regards their relative dimensions that the quality as herein defined be not less than 55/100.

10. A fuse link having a plurality of short fusing members and a member therebetween of a length greater than one of said fusing members, said intermediate member having in its length a cross-section not less than eight times that of a fusing section.

11. A fuse link having a plurality of short fusing members and a member therebetween of a length greater than one of said fusing members, said intermediate member having in its length a portion whose current carrying capacity exceeds that of a like length of a fusing member not less than eight times.

12. The hereinbefore described method of making a fuse link having a relatively short fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing places, which consists in so proportioning said portions and member as regards their current carrying capacity that the quality of the link as herein defined be not less than 26/100.

13. The hereinbefore described method of making a fuse link having a relatively short fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing places, which consists in so proportioning said portions and member as regards their current carrying capacity that the quality of the link as herein defined be not less than 3/10.

14. The hereinbefore described method of making a fuse link having a relatively short fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of reduced places, which consists in so proportioning said portions and member as regards their relative dimensions that the quality of the link as herein defined be not less than 26/100.

15. The hereinbefore described method of making a fuse link having a relatively short fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of reduced places, which consists in so proportioning said portions and member as regards their relative dimensions that the quality of the link as herein defined be not less than 3/10.

16. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the quality of said link as herein defined being not less than 5/10.
17. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the quality of said link as herein defined being not less than 55/100.
18. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the cross-sectional areas being such that the quality of said link as herein defined is not less than 5/10.
19. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the cross-sectional areas being such that the quality of said link as herein defined is not less than 55/100.
20. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the current carrying capacity of said portions and member being such that the quality of said link as herein defined is not less than 52/100.
21. A fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the current carrying capacity of said portions and member being such that the quality of said link as herein defined is not less than 55/100.
22. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the quality of said link as herein defined being not less than 26/100.
23. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the quality of said link as herein defined being not less than 3/10.
24. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the cross-sectional areas being such that the quality of said link as herein defined is not less than 26/100.
25. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the cross-sectional areas being such that the quality of said link as herein defined is not less than 3/10.
26. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the current carrying capacity of said portions and member being such that the quality of said link as herein defined is not less than 26/100.
27. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the current carrying capacity of said portions and member being such that the quality of said link as herein defined is not less than 3/10.
28. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of reduced portions, the quality of said link as herein defined being not less than 26/100.
29. A fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of reduced portions, the quality of said link as herein defined being not less than 3/10.
30. An enclosed fuse comprising a casing, terminals therefor and a fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the quality of said link as herein defined being not less than 5/10.
31. An enclosed fuse comprising a casing, terminals therefor and a fuse link having relatively short fusing portions, two only, and a relatively long member therebetween, the quality of said link as herein defined being not less than 55/100.
32. An enclosed fuse comprising a casing, terminals therefor and a fuse link having a fusing portion adjacent each end and a relatively long member therebetween having within its length a plurality of additional fusing portions, the quality of said link as herein defined being not less than 26/100.
33. An enclosed fuse comprising a casing, terminals therefor and a fuse link having a fusing portion adjacent each end and a relatively long member therebetween within the length of which is an additional fusing portion, the quality of said link as herein defined being not less than 3/10.
34. A fuse strip having a plurality of sections of restricted length and cross section in series and an intermediate section of substantially greater length, breadth and thickness.
35. An enclosed cartridge fuse having terminals at the ends thereof, potential fusing sections, two only, between said terminals and an intermediate member between the potential fusing sections, said potential fusing sections and said intermediate member being so proportioned that the quality as herein defined be not less than 52/100.
36. An enclosed cartridge fuse having terminals at the ends thereof, potential fusing sections, two only between said terminals and an intermediate member between the potential fusing sections, said potential fusing sections and said intermediate member

being so proportioned that the quality as herein defined be not less than 55/100.

37. An enclosed cartridge fuse having terminals at the ends thereof, two potential fusing sections between said terminals and an intermediate member between the potential fusing sections having within its length a plurality of additional fusing portions, said potential fusing sections and said intermediate member being so proportioned that the quality as herein defined be not less than 26/100.

38. An enclosed cartridge fuse having terminals at the ends thereof, two potential fusing sections between said terminals and an intermediate member between the potential fusing sections having within its length a plurality of additional fusing portions, said potential fusing sections and said intermediate member being so proportioned that the quality as herein defined be not less than 3/10.

39. A fuse link having a plurality of fusing sections and a member therebetween, said member having additional metal attached thereto in close proximity to the fusing sections.

40. A fuse link having a plurality of relatively short fusing sections close to the terminals of the link and a relatively long member therebetween having additional metal attached thereto in close proximity to the fusing sections.

41. A fuse strip having a plurality of sections of restricted length and cross section and a member therebetween of a length greater than one of said fusing sections; the relative proportion of the mass per unit length of the member to the mass per unit length of a restricted section being greater than the ratio of their respective widths.

42. In an electric fuse, a casing, terminals and a fuse strip attached to such terminals, said strip having a plurality of relatively short fusing sections and a relatively long member therebetween having a length greater than one of said fusing sections; the relative proportion of the mass per unit length of the member to the mass per unit length of a fusing section being greater than the ratio of their respective widths.

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