Feb. 7, 1956 F. J. KOZACKA 2,734,112

FUSE AND FUSE HOLDER COMBINATIONS

Filed Aug. 30, 1954 2 Sheets-Sheet 1

Fig. 1.

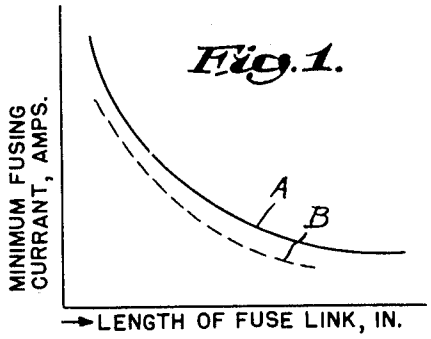


Fig. 5.

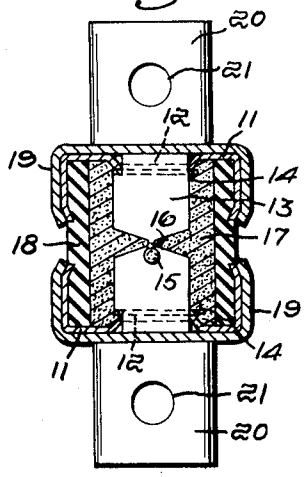


Fig. 6.

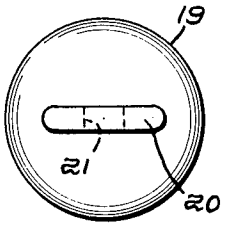


Fig. 2.

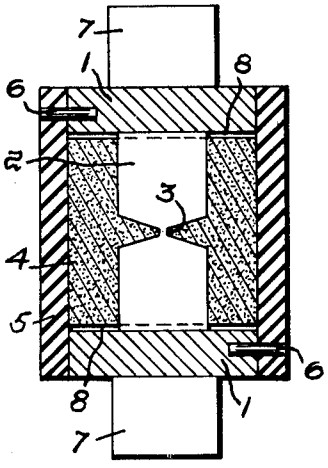


Fig. 3.

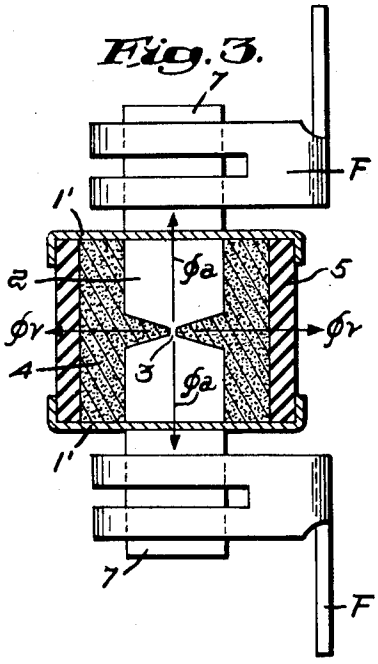
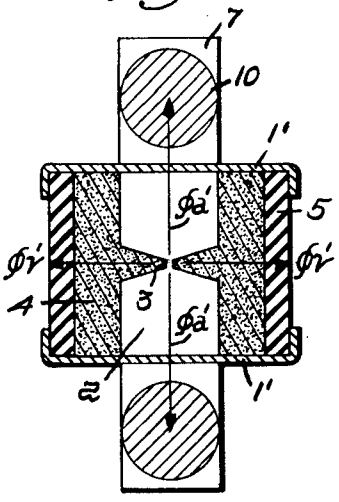


Fig. 4.



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Feb. 7, 1956 F. J. KOZACKA 2,734,112

FUSE AND FUSE HOLDER COMBINATIONS

Filed Aug. 30, 1954 2 Sheets-Sheet 2

Fig. 7.

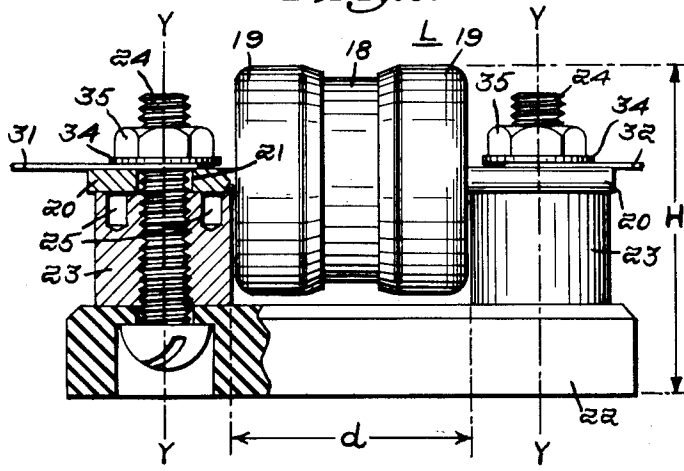


Fig. 8.

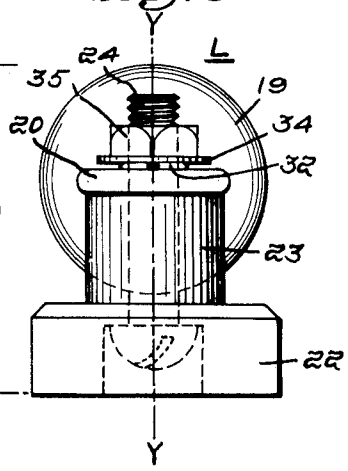


Fig. 9.

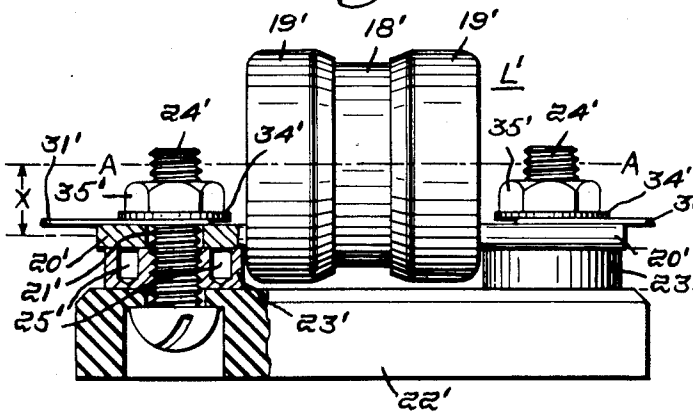
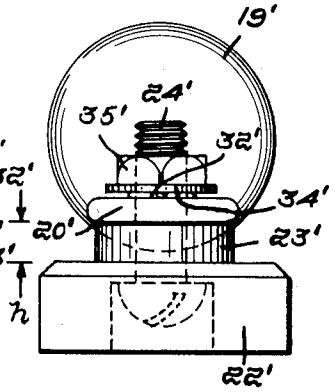


Fig. 10.



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2,734,112

FUSE AND FUSE HOLDER COMBINATIONS

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Application August 30, 1954, Serial No. 453,044

8 Claims. (Cl. 200—133)

This invention relates to the protection of electric circuits against major fault currents by means of current-limiting fuses, i. e. fuses limiting major fault currents well below the peaks which they normally reach, i. e. well below the available short-circuit current at the particular point where the fuse is located.

It has been found to be possible to interrupt major fault currents by means of current-limiting fuses at surprisingly short gaps, provided that the system voltage is sufficiently low, particularly if the system voltage is under the 600 volt level. This is conducive to the development of very compact current-limiting fuses capable of clearing virtually any major fault current, even if by far exceeding available 100,000 amps. r. m. s.

The problem of designing compact current-limiting fuses capable of limiting very high fault currents has found a number of acceptable solutions in the past, yet serious difficulties still prevail in designing these compact current-limiting high interrupting capacity fuses in such a way as to enable them to carry sufficiently large load currents without overheating and without blowing, unless required to blow.

Current-limiting fuses having very short fuse links are inherently capable of carrying relatively large load currents because this geometry facilitates heat conduction away from the hot point approximately in the center of the fuse axially outwardly to the fuse terminals. Subdivision of a fuse link into a plurality of links in parallel is another means tending to increase the current-carrying ability of a current-limiting fuse; yet this means has its limitations, and it has become necessary to search for other means for increasing current-carrying capacity without increasing bulk, or for decreasing bulk without decreasing current-carrying capacity.

A successful design proposal tending to solve this problem is disclosed in United States Patent 2,592,399 to William S. Edsall et al., April 8, 1952, Current-Limiting Fuse. Some of the fuses disclosed in this patent comprise a pair of massive spaced terminal blocks of copper which are arranged within the casing of the fuse and which are conductively connected by one or more ribbon-type fuse links having a high current carrying capacity. These terminal blocks have a considerable heat absorbing and heat dissipating ability, i. e. they absorb and dissipate the heat resulting from temporary overloads and they provide a continuous increase of heat dissipation by heat flow away from the hot point approximately at the center of the fuse link, or links, in opposite directions longitudinally of the link, or links.

It is one object of this invention to provide improved current-limiting fuses which are even more compact than those disclosed in the above patent and have the same, or a higher, current-carrying capacity.

Another object of this invention is to provide current-limiting fuses wherein the aforementioned massive terminal copper blocks may be reduced in size, or altogether dispensed with, and wherein there nevertheless is an intense heat flow away from the hot point approximately

at the center of the fuse link, or links, toward the axially outer ends thereof.

Another object of this invention is to provide a combination of a current-limiting fuse and of a fuse holder therefor wherein the heat absorbing and heat dissipating masses form an integral part of the fuse holder rather than an integral part of the fuse.

Another object of this invention is to provide a compact combination of a current-limiting fuse having blade contacts and of a fuse holder wherein the contact resistance between the blade contacts of the fuse and the cooperating contacts of the fuse holder is very low, and the heat flow from the blade contacts of the fuse to the cooperating contacts of the fuse holder very large.

Another object of the invention is to provide a compact combination of a current-limiting fuse having conventional blade contacts and of a fuse holder for the fuse wherein the blade contacts of the fuse engage the cooperating contacts of the fuse holder under considerable pressure in butt contact fashion rather than in line contact fashion, and wherein the contact resistance between cooperating contacts is small and the heat flow between cooperating contacts large.

Further objects and advantages of this invention will become more apparent as this specification proceeds, and the novel features characterizing this invention will be pointed out with particularity in the claims appended to and forming part of this specification.

Current-limiting fuses are often arranged on a relatively flat block of insulating material, or fuse base, with their blade contacts arranged at right angles to the front surface of the fuse base, and inserted into a pair of spaced finger contacts which are mounted on the block or fuse base. According to this invention, the blade contacts of current-limiting fuses are arranged parallel to the front surface of the fuse base and engage under pressure in butt contact fashion a pair of uprights, supports, or metal blocks, having contact surfaces substantially parallel to the front surface of the fuse base. These uprights, supports, or metal blocks, are mounted in spaced relation on said fuse base, their spacing being such as to be situated as closely as possible to the hot point of the fuse. In other words, their spacing ought to exceed only slightly the length of the fuse link, or fuse links, of the current-limiting fuse, and the length of the casing of the fuse, respectively.

For a better understanding of this invention reference may be had to the accompanying drawing wherein

Fig. 1 is a diagram illustrating the mode of operation of the invention;

Figs. 2 to 4, inclusive, are diagrams of fuse structures illustrating the invention;

Fig. 5 is substantially a longitudinal section of a current-limiting fuse which may be applied for carrying the invention into effect;

Fig. 6 is a side elevation of the structure shown in Fig. 5;

Fig. 7 is substantially a side elevation of a first embodiment of the invention with some of the parts thereof being shown in longitudinal section;

Fig. 8 is an end view of the structure shown in Fig. 7;

Fig. 9 is substantially a side elevation of a second embodiment of this invention with some of the parts thereof being shown in longitudinal section; and

Fig. 10 is an end view of the structure shown in Fig. 9.

Referring now to Fig. 2, this figure shows a fuse comprising two massive spaced cylindrical terminal blocks 1, preferably of copper, which have a relatively high heat absorbing capacity and a relatively high heat dissipating ability. Terminal blocks 1 are conductively interconnected by a fuse link 2 made of a metal having a relatively low total current time integral

$$\int_0^T i^2 dt$$

wherein i is the current during the pre-arcing period, 0 the time of fault inception, and T the time at which vaporization starts. Fuse link 2 has a neck 3, or portion of drastically reduced cross-section, where the temperature rise is steepest during normal operation and on occurrence of a major fault and consequent arc initiation. The cross-sectional area of neck 3 is sufficiently small to cause arc initiation at currents substantially below the available short-circuit current of the system with which the fuse is associated. A pulverulent arc quenching substance 4 having a relatively high heat absorbing capacity surrounds closely fuse link 1. Substance 4 is preferably of a silicious nature, such as 50/60 quartz sand, from which ferrous impurities have been carefully removed. Casing 5 of a suitable insulating material as, for instance, a glass-cloth-synthetic-resin-laminate, accommodates ribbon-type fuse link 2 and the pulverulent arc quenching filler 4. Casing 5 is pinned to terminal blocks 1 by means of transverse steel pins indicated by reference character 6. Each of the two terminal blocks 1 is provided with a blade contact 7 projecting in opposite directions from casing 5. Fuse link 2 is conductively connected to terminal blocks 1 in any desired way as, for instance, by soldering. According to Fig. 2 each of the terminal blocks 1 is provided with a radial groove 8 into which the axially outer ends of fuse link 2 are inserted. A mass of solder (not shown) establishes a current-path of low resistance between link 2 and terminal blocks 1.

Fig. 1 illustrates the behavior of a current-limiting fuse of the character shown in Fig. 2. In Fig. 1 the minimum fusing current of the fuse has been plotted against the length of the link in inches and the resulting curve has been marked A. It appears from Fig. 1 that the current-carrying capacity can be increased by shortening the length of the link; but such size reduction is subject to limitations since it requires a certain gap length—depending upon the constants of the circuit—for effecting interruption upon fusion of the link and initiation of an interrupting arc.

Fig. 3 shows a current-limiting fuse having (1) fuse link means, (2) a body of arc extinguishing pulverulent filler and (3) an interrupting chamber formed by a casing which three elements are identical with the corresponding elements shown in Fig. 2. The only significant difference between the structure shown in Fig. 2 and that shown in Fig. 3 consists in the fact that in the latter the massive terminal blocks of copper have been omitted, whereby an appreciable size reduction has been achieved. Under similar operating conditions as those illustrated by curve A of Fig. 1, a structure of the type shown in Fig. 3 exhibits a behavior illustrated by the curve marked B in Fig. 1. Curve B lies below curve A which is due to the fact that heat dissipation by conduction in a direction substantially longitudinally of the fuse is smaller in the structure of Fig. 3 than in the structure of Fig. 2.

As mentioned above curves A and B refer to similar operating conditions, i. e. both curves are obtained by tests made under the same ambient conditions and using conventional finger contact fuse holders, exerting the same amount of contact pressure upon the blade contacts of the fuse, exhibiting the same heat dissipating properties, etc. Such a pair of fuse holders has been shown in Fig. 3 and indicated by the reference character F.

Inasmuch as the structure of Fig. 3 is in part identical with the structure of Fig. 2, Fig. 3 does not call for a detailed description thereof. Like parts have been indicated in both Figs. 2 and 3 by the same reference characters, and reference character 1' has been applied to a pair of ferrules of sheet metal taking the place of the heavy massive copper blocks 1. Fig. 3 indicates also in a diagrammatic fashion by arrows the heat flow in the fuse under stationary conditions.

$$\oint_r$$

is the heat flow which occurs in substantially radial direction and

$$\oint_a$$

is the heat flow which occurs in a direction substantially longitudinally of the fuse. The radial heat flow is relatively limited because the arc quenching media required in current-limiting fuses have a relatively limited heat conductivity and because the interstices between the filler particles tend to decrease the heat conductivity.

It is desirable to dispense with the terminal blocks 1 of the structure of Fig. 2 in order to drastically reduce the size or bulk, and weight, of the fuse yet, the characteristic A of Fig. 1 ought to be retained, i. e., it is not permissible to achieve the desired reduction in size or bulk, and weight, at the expense of lowering the characteristic from position A to position B.

Fig. 4 indicates diagrammatically a long-sought solution to this problem. Generally speaking, this solution consists in associating the reduced size fuse structure shown in Fig. 3 with a pressure type butt contact fuse holder having a high heat dissipating ability rather than a finger contact fuse holder as generally associated with current-limiting cartridge fuses having blade contacts, which kind of fuse holder has but a relatively small heat dissipating ability. Pressure type butt contacts permit a more intense heat flow from the link means and the blade contacts of the fuse to the fuse holder proper, and hence the latter may be used as an effective heat dissipator instead of the heavy bulky terminal blocks 1 of Fig. 2.

In Fig. 4 the parts substantially identical to those shown in Figs. 2 and 3 have been indicated by the same reference characters, and reference numeral 10 has been applied to a pair of spaced butt contacts engaged under pressure by the blade contacts of the fuse, as more clearly shown in Figs. 7 to 10, inclusive, and described in connection with these figures. In Fig. 4 reference character

$$\oint_a$$

has been applied to arrows indicating diagrammatically the heat flow which occurs substantially in a direction longitudinally of the fuse and reference character

$$\oint_r'$$

has been applied to arrows indicating diagrammatically the heat flow which occurs substantially in radial direction. The ratio of

$$\frac{\oint_{a'}}{\oint_{r'}}$$

is considerably larger than the ratio

$$\frac{\oint_a}{\oint_r}$$

This behavior of the structure of Fig. 4 is due to increased contact pressure and increased area of heat flow from the fuse to the fuse holder and to increased heat dissipating ability of the latter.

Figs. 5 and 6 show in detail how the fuse structure diagrammatically shown in Fig. 4 is preferably being constructed. Referring now to Figs. 5 and 6, reference numeral 11 has been applied to a pair of spaced terminal caps of sheet metal of which each has a slot 12 for insertion of a ribbon-type fuse link 13. Fuse link 13 is sol-

dered to terminal caps or ferrules **11** by joints (not shown in the drawing) to minimize the resistance to current flow. The axially inner ends of slots **12** are closed by washers **14** to minimize, or preclude the escape of hot arc products from the inside, or arcing chamber, of the fuse. Link **13** is provided with a neck, or region of drastically reduced cross-sectional area **16**, where heat generation is highest and arc initiation occurs on major faults. If desired a tin rivet **15** may be arranged close to neck **16** to destroy link **13** by alloy-formation on the occurrence of relatively small overloads of excessive duration. Link **13** is closely surrounded by a body of 50/60 quartz sand **17**, and casing **18** of insulating material accommodates both link **13** and the arc extinguishing filler **17**. The axially inner caps or ferrules **11** support a pair of axially outer ferrules **19** which are made of a heavier or thicker material than the axially inner caps or ferrules **11**. The blade contacts **20** of which each is provided with a hole or bore **21** or other appropriate aperture for the passage of a screw-threaded stud (not shown in Figs. 5 and 6) form an integral part of caps or ferrules **19**. The axially inner ends of caps or ferrules **11** and **19** are crimped to provide an effective mechanical connection between them and the casing **18** and to preclude the escape of hot products of arcing out of the casing **18** of the fuse. The area of engagement between the axially outer caps **19** and the axially inner caps **11** is considerable, and caps **19** engage caps **11** under considerable pressure, thus tending to increase heat conduction in a direction substantially longitudinally of the fuse.

The fuse link **13** is made of silver, copper, or both, this being the metals generally referred to as fuse link metals having the lowest total current-time integral. The total current-time integral of a metal is the sum of several partial current-time integrals, namely the current-time integral

$$\int_0^{t_1} i^2 dt$$

required for increasing the temperature of the metal from ambient temperature to fusing temperature, the current-time integral

$$\int_{t_1}^{t_2} i^2 dt$$

required for providing the latent heat of fusion, and the current-time integral

$$\int_{t_2}^{T} i^2 dt$$

required for increasing the temperature of the fused metal to vaporization temperature.

$$\int_0^{t_1} i^2 dt + \int_{t_1}^{t_2} i^2 dt + \int_{t_2}^{T} i^2 dt = \int_0^{T} i^2 dt$$

The total current-time integral

$$\int_0^{T} i^2 dt$$

of the fuse link metal must be low if a substantial current-limiting action is to be achieved by the fuse.

The table below indicates current-time integrals of silver and copper in $(\text{amp.}/\text{cm.}^2)^2 \cdot \text{sec.}$

	silver	copper
$\int_0^{t_1} i^2 \cdot dt$	5.91×10^8	8.63×10^8
$\int_{t_1}^{t_2} i^2 \cdot dt$	1.02×10^8	1.33×10^8
$\int_{t_2}^{T} i^2 \cdot dt$	1.07×10^8	1.68×10^8
$\int_0^{T} i^2 \cdot dt$	8.00×10^8	11.72×10^8

$$\int_0^{t_1} i^2 \cdot dt$$

has been computed assuming the initial temperature to be 20 deg. centigrade.

In Figs. 7 and 8 reference character L has been used to generally designate a fuse structure indentical to that shown in Figs. 5 and 6, comprising the axially outer caps or ferrules **19** and a pair of blade contacts **20** forming an integral part of ferrules **19** and projecting therefrom in opposite directions. Ferrules **19** are firmly mounted on casing **18** as more fully explained in connection with Fig. 5 The insulating fuse base **22** formed by a square relatively flat block of insulating material is arranged substantially parallel to the plane defined by the wide sides of the pair of blade contacts **20**. Fuse base **22** supports a pair of bare supports **23** for blade contacts **20**. Uprights or supports **23** consist of cylindrical blocks of copper spaced a distance *d* only slightly exceeding the length of the fuse link within casing **18** and the length of casing **18**. The height of each upright **23** is substantially equal to the radius of casing **18**. The axes Y—Y of uprights **23** are arranged at right angles to the plane defined by blade contacts **20**. A pair of screw-threaded studs **24** projects transversely across the base **22**, and supports **23** are internally screw-threaded and mounted on screw-threaded studs **24**. To facilitate engagement of the internal screw-threads in supports **23** with the screw-threads on studs **24**, supports **23** are provided with a pair of spaced holes or bores **25** adapted for insertion of an appropriate key, by the use of which supports **23** may readily be firmly screwed against the base **22**. Each blade contact **20** is provided with a bore or hole **21** through which one of the screw-threaded studs **24** projects. Conductors **31** and **32** which form part of an electric circuit are tigntened by washers **34** and screw nuts **35** against blade contacts **20**, and the latter are firmly clamped against the upper or butt contact surface of copper blocks **23**.

It will be noted that copper blocks **23** have a smaller diameter than the casing of the fuse, the reason being that this structure is a more efficient heat dissipator than that shown in Fig. 2, and consequently requires a relatively smaller heat dissipating surface. The improved heat dissipating ability is mainly due to the size of the area of heat transfer between blade contacts **20** and copper blocks **23**, the amount of pressure between the cooperating surfaces and to the fact that heat absorbed by blocks **23** is readily carried away by convection currents. Another crucial factor resides in the fact that the distance between the hot point within the fuse and the external heat dissipating surface is very small. This distance can be kept very small only in current-limiting fuses capable of producing high arc voltages. The rating or current carrying capacity of standard fuses, i.e. National Electrical Code fuses, is not affected by the nature of the fuse holder in which they are used, except that if the contact resistance of the fuse holder is inadmissibly high, the fuse may run too hot, and blow prematurely. The short distance which is possible between the hot point within a current-limiting fuse and an external heat dissipating surface forming an integral part of a fuse holder associated with the fuse results in very steep temperature gradients peculiar to structures of the nature shown in Figs. 5 to 8. In a fuse-fuse-holder-unit of this kind rated 400 amps., at 130 volts a link of silver may be 1 inch in length and the shortest distance between the hot point within the fuse and the copper blocks **23** slightly more than ½ inch. Under such circumstances temperature gradients in the order of 670 deg. centigrade per centimeter may be reached if the fuse operates close to the fusing point of silver.

In Figs. 9 and 10 like parts as in Figs. 7 and 8 have been designated by the same reference characters with addition of a prime sign. It will be noted that the cylindrical copper blocks **23'** are lower than the copper blocks **23**, and that the overall height *h* of the structure of Figs. 9 and 10

is less than the overall height H of the structure of Figs. 7 and 8. In the structure of Figs. 9 and 10 the blade contacts 20' are arranged in a common plane spaced distance x from the longitudinal axis A—A of the fuse L'. The distance of the plane of blade contacts 20' from base 22' is less than the distance of A—A from base 22'. Each of the blade contacts 20' engages with the wide side thereof remote from the longitudinal axis A—A of the fuse the top surface of one of cylindrical copper blocks 23'. Screw-threaded studs 24', washers 34' and screw nuts 35' firmly clamp blade contacts 20' against cylindrical supports or brackets 23'.

The effect of the heat-dissipating supports 23 and 23', respectively, upon the current-carrying capacity of the fuse depends in turn upon the design of the fuse with which the heat-dissipating supports are associated. The effect of supports 23 and 23', respectively, upon the current-carrying capacity of the fuse is largest where the heat generated within the fuse is small, particularly where the link has one single neck or portion of reduced cross-sectional area which is more or less in the nature of a point heat source, and where the length of the link and that of the casing of the fuse is in the order of 1 inch, or even less. Where the length of the link means is relatively large, e. g. in the order of three inches, or more, and where the link means is provided with a plurality of necks or portions of reduced cross-sectional area to form multi-breaks upon fusion thereof, and where the necks or portions of reduced cross-sectional area deviate markedly from point heat sources and generate relatively large amounts of heat, the current-carrying capacity of the fuse-fuse-holder-unit depends primarily upon the fuse structure per se rather than upon the presence, size and configuration of the heat-dissipating supports 23 and 23', respectively.

It will be understood that, although I have shown and described in detail but two embodiments of this invention, the invention is not limited thereto, and that the illustrated embodiments may be modified or other embodiments made without departing from the spirit and scope of the invention as set forth in the accompanying claims.

It is claimed:

1. In combination ribbon-type fuse link means of the current-limiting type made of a metal having a relatively low total current-time integral, a pair of spaced blade contacts conductively interconnected by said link means, a pulverulent arc-quenching substance having a relatively high heat absorbing capacity closely surrounding said link means, a casing of insulating material accommodating said link means and said substance, an insulating fuse base arranged substantially parallel to the plane defined by the wide sides of said pair of blade contacts, a pair of metallic supports for said pair of blade contacts supported by said base spaced a distance only slightly exceeding the length of said casing, each of said pair of supports being approximately equal in height to the radius of said casing and having a flat surface engaging in butt-contact-fashion one of the wide sides of one of said pair of blade contacts, and tightening screw means projecting transversely across said wide sides clamping each of said pair of blade contacts against said flat surface of one of said pair of supports.

2. In combination fuse link means of the current-limiting type having one single neck portion approximating a point heat source, a pair of blade contacts spaced in the order of one inch conductively interconnected by said link means, a pulverulent silicious arc-quenching substance closely surrounding said link means, a tubular casing of insulating material accommodating said link means and said substance, an insulating fuse base arranged substantially parallel to the plane defined by the wide sides of said pair of blade contacts, a pair of conductive supports for said pair of blade contacts supported by said fuse base spaced a distance only slightly exceeding the length of said casing, each of said pair of supports having a lateral heat dissipating surface substantially freely exposed to convection currents and substantially equal in height to the radius of said casing, each of said pair of supports having a contact surface engaging in butt-contact-fashion one of the wide sides of one of said pair of blade contacts, and a pair of screw means each projecting transversely across one of said wide sides clamping each of said pair of blade contacts against said contact surface of one of said pair of supports.

3. In combination fuse link means of the current-limiting type made of a metal having a relatively high fusing point and a relatively low total current-time integral, a pair of spaced blade contacts conductively interconnected by said link means, a body of quartz sand closely surrounding said link means, a casing of insulating material accommodating said link means and said body of quartz sand, a fuse base of insulating material arranged substantially parallel to the plane defined by the wide sides of said pair of blade contacts, a pair of conductive supports for said pair of blade contacts supported by said fuse base spaced a distance only slightly exceeding the length of said casing, said pair of supports comprising a pair of bare massive metal blocks arranged with the longitudinal axes thereof at right angles to said plane defined by said wide sides of said pair of blade contacts each having a contact surface substantially equal in width to the width of said wide sides, said pair of blade contacts engaging in butt-contact-fashion one of said wide sides, and screw means for attaching said pair of supports to said fuse base and for clamping said pair of blade contacts against said contact surface of each of said pair of supports.

4. In combination a casing of insulating material, a pulverulent arc-quenching filler within said casing, a first pair of caps of sheet metal supported by the axially outer ends of said casing, current-limiting fuse link means less than 2 inches in length having one single neck portion approximating a point heat source directly interconnecting said first pair of caps, a second pair of metal caps each mounted on one of said first pair of caps, a pair of blade contacts each forming an integral part of one of said second pairs of caps, a pair of butt contacts each engaging one of the wide sides only of one of said pair of blade contacts, a base plate of insulating material arranged substantially parallel to the plane defined by the wide sides of said pair of blade contacts supporting said pair of butt contacts, and screw means extending transversely across the plane defined by said wide sides for clamping said pair of blade contacts against said pair of butt contacts.

5. In combination a casing of insulating material, a pulverulent arc-quenching filler within said casing, a first pair of caps of sheet metal supported by the axially outer ends of said casing, current-limiting fuse link means less than two inches in length having one single neck portion approximating a point heat source directly interconnecting said first pair of caps, a second pair of metal caps each mounted on one of said first pair of caps, a pair of blade contacts each forming an integral part of one of said second pair of cups, a pair of cylindrical copper blocks each engaging with one of the plane sides thereof one of said pair of blade contacts, a base of insulating material arranged substantially parallel to the plane defined by said wide sides of said pair of blade contacts supporting said copper blocks, a pair of screw-threaded studs each extending in a direction longitudinally of one of said pair of copper blocks for securing said pair of copper blocks to said base, and a pair of screw nuts each mounted on one of said pair of studs for clamping said pair of blade contacts against said pair of copper blocks.

6. In combination an insulating base, a pair of spaced metal blocks each having a base surface and a top surface parallel thereto, each of said pair of blocks abutting with said base surface thereof against said insulating base and

being attached thereto, a current-limiting fuse having a casing approximately one inch long and having a pair of blade contacts arranged in a common plane spaced from the longitudinal axis of said fuse and positioned closer to said insulating base than said longitudinal axis, each of said pair of blade contacts engaging with the wide sides thereof remote from said longitudinal axis, said top surface on one of said pair of blocks, and screw means extending transversely across said base, said pair of blocks and said wide sides establishing contact pressure between said wide sides and said pair of blocks.

7. In combination an insulating base, a current-limiting fuse comprising a casing of insulating material filled with a silicious pulverulent arc-quenching medium and closed on both ends thereof by terminal elements conductively interconnected by fuse link means having a relatively low total current-time integral, said fuse further comprising a pair of blade contacts projecting in opposite directions from said terminal elements and arranged parallel to the general plane of said insulating base, heat absorbing and dissipating means for said fuse comprising a pair of metal blocks spaced a distance only slightly exceeding the length of said casing and substantially equal in height to the distance between said insulating base and said pair of blade contacts, each of said pair of metal

blocks resting with the base surface thereof directly on said insulating base and each of said pair of metal blocks having a top surface in immediate physical engagement with one of said pair of blade contacts, and a pair of studs each projecting transversely across said insulating base and through one of said pair of metal blocks and through one of said pair of blade contacts clamping said pair of metal blocks against said insulating base and clamping said pair of blade contacts against said pair of metal blocks.

8. An arrangement as specified in claim 7 wherein said pair of metal blocks are made of copper and are in the shape of cylinders with the cylindrical surfaces thereof in substantially unimpeded heat exchanging relation with the ambient along the entire periphery of said surfaces.

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