Nov. 2, 1943.

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ELECTRIC FUSE OF CARTRIDGE TYPE

Filed Feb. 17, 1941

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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Att'y.
This invention has reference to powder filled cartridge fuses for continuous oil immersion in service.

A difficulty experienced hitherto in connection with powder filled fuses so immersed has been that arising from oil creepage into the interior of the cartridge fuse sheath by way of the passages between the sheath and the ferrules or the like at the ends of the sheath, it being understood that the oil in which the fuse is immersed has, in addition to its creeping properties, a pressure head in relation to the interior of the fuse. Such oil, even in minute quantity, is absorbed by the powder and vaporizes upon heating of the fuse. Upon operation of the fuse, i.e., circuit interruption thereby, the oil vapor is ignited and explodes the fuse, such explosion occurring even if only a minute quantity of oil seeped into the fuse.

The primary object of the present invention is the provision of a powder filled cartridge fuse for continuous oil immersion wherein it is impossible for oil to enter the fuse, the invention even safeguarding against the human element in making the seals between the fuse sheath and the ferrules or the like.

According to the invention, a double seal is provided between the sheath and each ferrule and one seal of each double seal, in addition to offering great resistance to oil creepage, shields the other seal against any form of deteriorating influence. The double-sealing is necessary because of the extremely high creepage factor of oil compared with other liquids. The seal providing the initial barrier against ingress of oil, this seal being the one which also shields the said other seal, comprises a metallic coating making direct sealing union with the material of the sheath. The metallic coating is formed by a metallic building-up process, for example, electrolytic deposition, spraying or the like effecting union of the said metal with the sheath without the interposition of cement. The said other joint is a compression joint which is shielded from deteriorating influences internally of the fuse by the metallic seal, either directly covering the compressed member or providing a seal between the sheath and a metal cap, ferrule or the like covering the said compression member.

When the seal according to the invention is in use, any minute quantity of oil which may succeed in creeping past the metal coating will be so reduced in pressure that the compression joint is able to offer a perfect barrier to it, the said quantity being too small to affect the compressed member adversely even if it be of a material less capable to withstand service pressure than standard material.

The above fuses according to the invention are liquid-tight and in order to avoid the human element and to ensure this quality of tightness even when the fuses are subjected to high external pressure, the degree of tightness is carried to air-tightness by the location of compression joints or seals between the sheath and the ferrules or end caps. Thus in the event of a minute quantity of liquid creeping along the sheath inside the metal applied by electrolysis or the like the compression joints act as barriers effectively preventing the ingress of fluid into the interior of the sheath, such fluid as does, however, creep as far as the joints being insufficient in quantity seriously to impair the said joints. Similarly air is unable to enter the interior of the sheath.

The sheaths may be annularly grooved and the ferrules or caps and/or the metal applied by electrolysis or the like extend into the grooves in order to produce a labyrinth path for creeping fluid.

Suitable metallisation processes, in addition to electrolytic and spraying above mentioned specifically, include platinising, dipping in molten metal, reduction, hot or vaporization processes, amalgamating and the like, the metal being intimately deposited on or otherwise intimately joined to the sheaths, or to the sheaths and to the ferrules, without the interposition of cement as previously stated.

The expression compression joint or seal used herein means a gasket, washer or the like of oil-resistant material which is continually compressed by metal terminal members at the ends of the sheath.

Fuses in accordance with the invention will now be described with reference to the accompanying drawing wherein:

Fig. 1 is a side elevation, partly in section, of a high rupturing capacity fuse having ferrules applied electrolytically or by other means according to the invention;

Figs. 2 to 4 show, in section, the ends of sheaths to which end caps or ferrules of different construction are applied.

Figure 5 is a section on line 5—5 of Figure 1.

In Fig. 1 the sheath 1 has reduced ends and the said ends are screw-threaded for the reception of caps as 2. Between the lips of the caps and the shoulders formed by reducing the sheath a packing 3 of litharge is located.

The support for the fusible elements 4 is indicated at 5. The hollow of the sheath and the
hollow of the support are filled with arc-extinguishing powder 

2. Hollow of the support are filled with arc-extinguishing powder 

4. The support is provided at its ends with split connecting sleeves as 6 which are a push fit onto bosses 7 secured, by means of clips 8, on the bosses, between the caps 2 and washers 9, preferably of rubber conventionally treated to be oil resistant, which are pressed against the plane ends of the sheath by the screw caps acting through the flanges. Thus, the washers comprise the compression joints previously referred to.

The ferrules are provided by metal 10 which is applied to those parts of the sheath near the caps, the outside of the litharge 3 and to the caps 2 by an electrolytic or other process previously defined. The sheaths are grooved at 11 so that the metal 10 enters them at 12, thus extending the surface of the joint between the metal and the sheath in labyrinth fashion.

The boss 1 carries a cylinder in which is an indicator pin 13 and the closed end of the cap 2 has a central opening 14 through which the pin 13 can pass when the fuse blows. The opening 14 is, however, normally closed by a thin metal disc 15 sealed to the cap 2 by solder and more particularly by the metal 10, the application of said metal being adapted to permit of the easy passage of the pin through the disc 15. It is not essential that the metal 10 completely cover the outer surfaces of the caps 2 but in cases where, for example, a metal to metal seal is required, as between the cap and the disc 15, the metal is continued as illustrated. This prevents oil or air from creeping into the fuse between the disc and the cap thereby preventing faults which might arise if these two members were simply soldered or brazed together.

In Fig. 2 a flanged screw plug 17 interposed into the end of the sheath 18 compresses the washer 19 whilst a band of metal 20 applied by electrolysis or the like seals the flange to the sheath and provides the ferrule.

In Fig. 3 the outer end of the sheath 21 is reduced, a band of metal 22 is applied to the reduced part by electrolytic or other process as previously defined, the band is screw-threaded and a screw cap 23 applied thereto. A washer 24 is located between the end of the sheath and the ferrule end of the sheath, and the cap is sealed to the band 22 by solder 25 and a layer of metal 26 applied by electrolysis or the like. The metal 26 is applied in order to lessen the likelihood of faults produced by the human element in applying the solder. Alternatively, soldering may be dispensed with.

In Fig. 4 the end of the sheath 32 is annularly grooved at 33, a metal ferrule 34 is shrunk onto the end of the sheath and the ferrule is swaged at 35 to fill the grooves 33. The outer end of the ferrule 34 extends slightly beyond the plane end of the sheath 32 and a disc 36 is slipped into this projecting portion and the disc and the ferrule are sealed together and the ferrule is sealed to the sheath by rings 37 and 38, respectively, applied by electrolysis or the like in accordance with the invention. If desired, the disc may be soldered to the ferrule before the ring 31 is applied. A compression joint or seal is indicated at 39, the joint comprising a washer compressed between the end of the sheath and the end of the disc 36.

The insulating, refractory material of which the sheaths are made may be of any suitable kind. For example, ceramic materials, fabric materials and materials having a hard paper base.

What we claim is:

1. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules comprising metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, and compression seals between the sheath and the metal coatings, said compression seals being covered by the said ferrules.

2. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules in the form of metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, and compression seals between the sheath and the metal coatings, said compression seals being covered by the said ferrules.

3. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules comprising metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, and compression seals between the ends of the sheath and the adjacent parts of said metal coatings, said compression seals being covered by the said ferrules.

4. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules comprising metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, and compression seals between the ends of the sheath and the adjacent parts of said metal coatings, said compression seals being covered by the said ferrules.

5. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules in the form of metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, and compression seals between the ends of the sheath and the adjacent parts of said metal coatings, said compression seal being covered by the said coatings.

6. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules at the ends of the sheath, a metal coating between each ferrule and the adjacent part of the sheath, said coating making direct sealing union with the material of the sheath, and compression seals between the ends of the sheath and the adjacent parts of said metal coatings, said compression seal being covered by the said ferrules.

7. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, screw-caps at the ends of the sheath and contact ferrules comprising metal coatings applied to said caps and to the sheath adjacent to the caps, said coat-
ings making direct sealing union with the material of the sheath and the caps, and compression seals between the ends of the sheath and the adjacent parts of the screw caps, said compression seals being covered by the said caps.

8. A cartridge fuse according to claim 2, said coatings comprising metallic bands, and closures sealed to the outer ends of the bands by intimately applied metal.

9. A cartridge fuse according to claim 3, said ferrules comprising metal bands applied as such to the ends of the sheath, and closures sealed to the outer ends of the bands by intimately applied metal.

10. A cartridge fuse according to claim 3, metallic coatings in the form of bands on the enus of said sheath, said coatings making direct sealing union with the material of the sheath, metal caps fitting said coatings, said coatings and said caps being screw-threaded in complementary manner, and a seal uniting each coating and its cap formed by metal intimately applied to the coating and to the cap.

11. A cartridge fuse according to claim 2, said sheath having grooves near its ends and said grooves being filled by said metal coatings whereby said grooves and said filling metal provide labyrinth paths which act as additional barriers to the ingress of oil or atmosphere.

12. A cartridge fuse according to claim 3, said sheath having grooves near its ends and said grooves being filled by said metal coatings whereby said grooves and said filling metal provide labyrinth paths which act as additional barriers to the ingress of oil or atmosphere.

13. A cartridge fuse for continuous oil immersion in service comprising an insulating sheath, a fusible element in said sheath, an arc-extinguishing powder filling in said sheath, contact ferrules comprising metal coatings at the ends of the sheath, said coatings making direct sealing union with the material of the sheath, compression seals between the extremities of the sheath and the contact ferrules, said compression seals being covered by the said ferrules, an indicator pin, a container for said pin, said container being located interiorly of said sheath, a cover for said container, said cover being located for piercing by the pin in operating, a solder seal between said cover and a ferrule and a metal coating applied to the ferrule, the solder and the cover, said metal coating applied to said ferrule, solder and cover making direct sealing union with these said elements and being absent at the point where the pin, in operating, pierces the cover.

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