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Vadnagara

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[54] **FUSED COUPLER ASSEMBLY**

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[52] **U.S. Cl.** **337/199,** 337/224

[51] **Int. Cl.** **H01h 85/02**

[58] **Field of Search** 337/201, 224, 199; 174/73

[56] **References Cited**

UNITED STATES PATENTS

2,216,661	10/1940	Dannenberg	337/224
2,660,644	11/1953	Murray	337/224
2,844,691	7/1958	Howell	337/224
3,318,995	5/1967	Buckley	174/73
3,344,391	9/1967	Ruete	174/73
3,376,541	4/1968	Link	174/73
3,513,425	5/1970	Arndt	337/201

FOREIGN PATENTS OR APPLICATIONS

479,211	2/1938	Great Britain	337/224

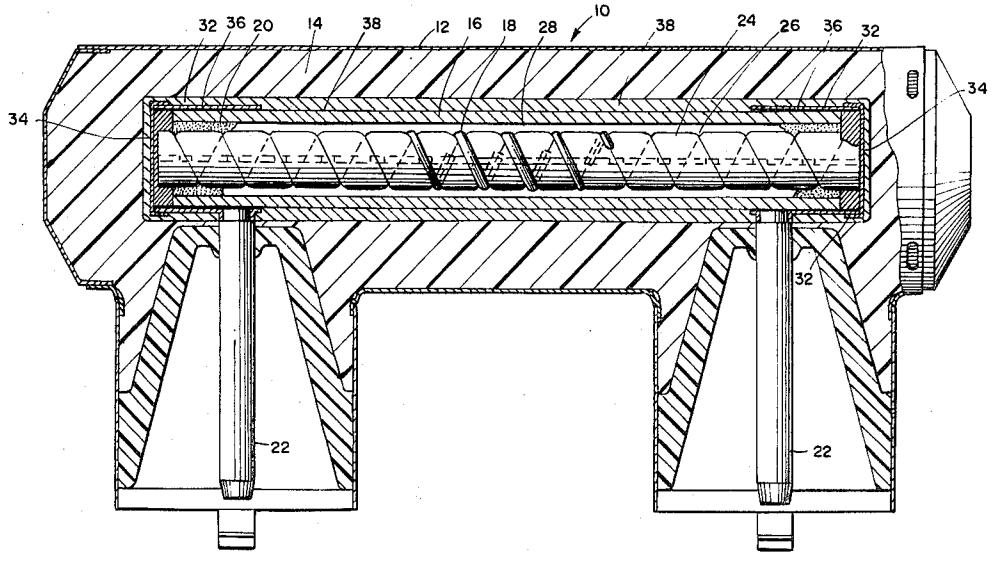
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[57] **ABSTRACT**

A fused coupler assembly includes a submersible conductive housing used in underground distribution systems. The housing contains a dielectric filler in which a cylindrical resistor shield encompassing a fuse element is located. The cylindrical shield is formed of a tube coated with a resistance material so that a shield is formed of sufficiently low resistance to prevent corona from occurring between the tube and the fuse element. The coating shield also is of sufficiently high resistance to minimize line-to-ground leakage when the fuse element is blown during a fault condition.

1 Claim, 2 Drawing Figures



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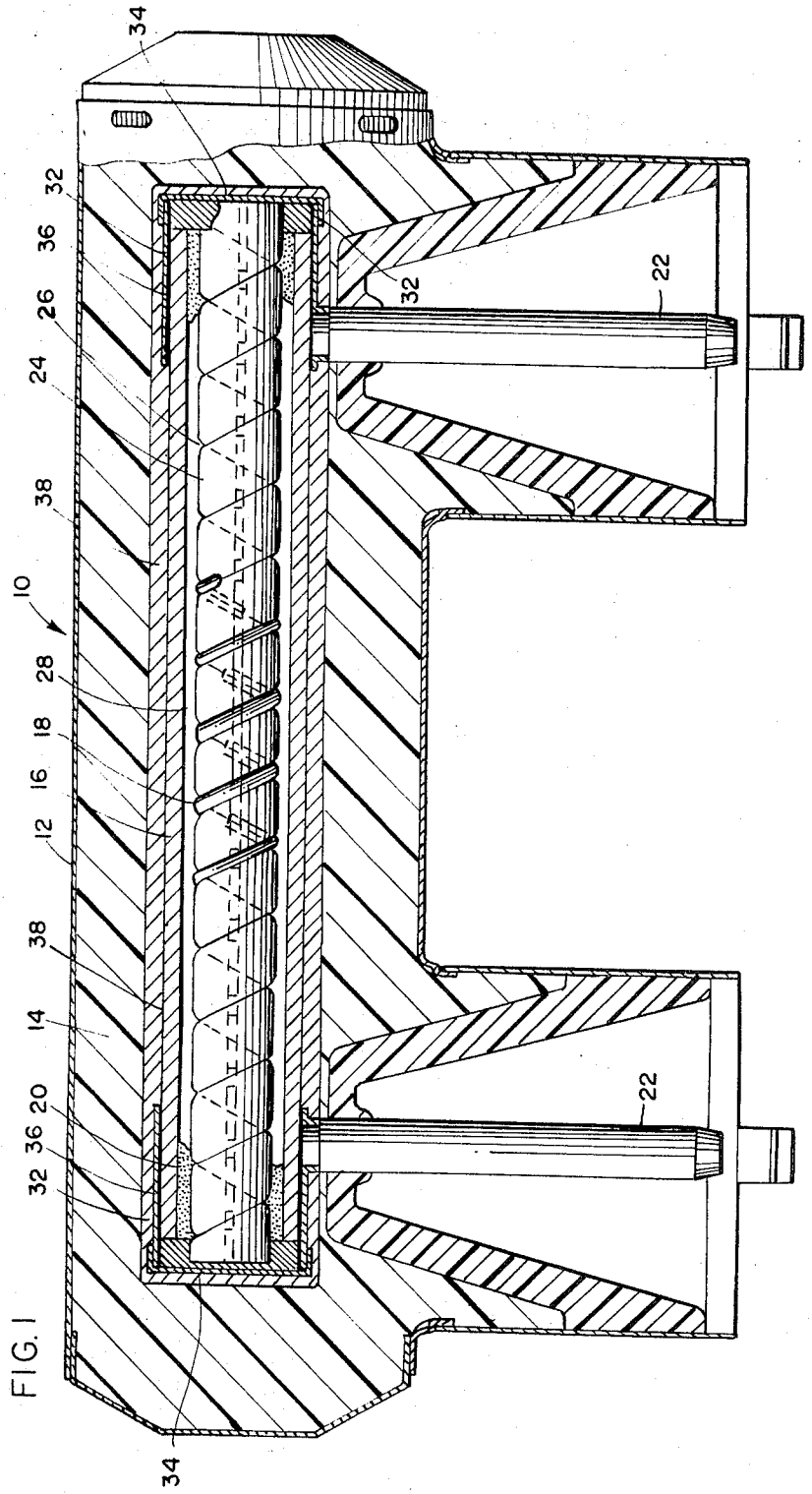


FIG. 1

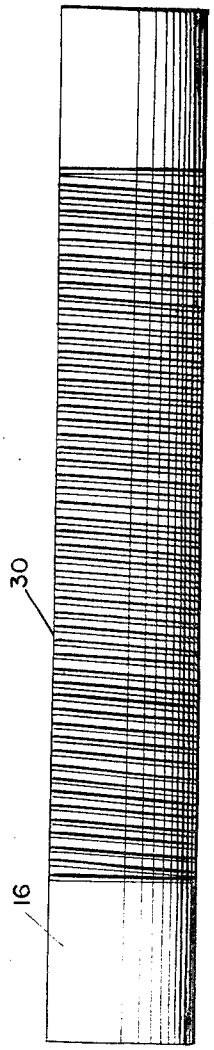


FIG. 2

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FUSED COUPLER ASSEMBLY

The present invention relates to a new and improved fuse, and particularly to a fused coupler assembly for use in an underground distribution system.

Fuse units are known for use with underground distribution systems which contain a silver fuse wire that will melt and vaporize when a fault condition appears and an overload current is carried by the fuse element. The fuse element is located within a dielectric inside a submersible conductive housing. Difficulty may be experienced with corona occurring between the fuse element and the dielectric encompassing it.

In accordance with the present invention, a conductive corona shield is placed in void-free engagement with the dielectric. When a fault occurs and a fuse is blown, the corona shield is subjected to line-to-ground voltage, and the corona shield must have a low enough resistance to substantially limit the corona, but a high enough resistance to prevent excessive line-to-ground leakage from occurring.

Accordingly, it is an object of the present invention to provide a new and improved fused coupler assembly for underground distribution systems.

Another object of the present invention is to provide a new and improved resistor tube within a fused coupler assembly defining a corona shield to prevent corona.

A further object of the present invention is to provide a new and improved fuse structure within a dielectric housing.

Briefly, the present invention relates to a new and improved fused coupler assembly particularly useful in underground distribution systems. The present fused coupler is an improvement over that shown and described in the copending patent application filed Aug. 15, 1967, by Edward H. Yonkers, S. N. 660, 748. The coupler includes a conductive submersible housing containing a dielectric filler in which a cylindrical resistor shield encompasses a fuse element. The resistor shield is formed by coating a dielectric tube with a resistive shield to preclude corona effect between the tube and the fuse element and to reduce line-to-ground leakage that may occur when the fuse element is blown. To ensure void-free interfacial engagement between the coated resistor tube and the dielectric filler in the housing throughout the thermal operating range of the fused coupler, a layer of pliable material is disposed between the tube and the dielectric filler.

For a better understanding of the present invention, reference may be had to the accompanying drawings wherein:

FIG. 1 is a cross sectional view of a fused coupler assembly according to the present invention; and

FIG. 2 is a side elevational view of a resistor tube and its coating shield.

Referring now more specifically to FIG. 1 of the drawings, therein is illustrated a fused coupler assembly which is indicated generally as **10** and which embodies the present invention. The fused coupler assembly **10** includes a conductive housing **12** in which is cast a center of hard dielectric filler **14**. A cylindrical resistor tube **16** insulates a fuse element **18** that is encompassed by the tube **16**. The fuse element **18** is of silver or other conducting material that will melt and vaporize into and over the surface of sand grains **20** which surround the fuse element **18**. The fuse element **18** has its respective ends electrically connected to a pair of contact rods or plugs **22**. The operation of melting and vaporization of such a fuse element **18** is well known and takes place so rapidly under fault conditions that the current is essentially cut off before it reaches the full value of the available fault current. Thus, when the fuse element **18** is melted, the circuit will become open and a load current is no longer carried by the fused coupler **10** between the contact rods **22**.

In order to minimize the length required for a fuse of a given rating, the fuse element **18** is wound around a core **24** that contains a spiral groove **26** along its length. The core **24** maintains sufficient distance between the turns of the fuse element **18** to prevent hot ionized gas from shorting out the turns. A space **28** encompassing the core **24** within the resistor tube **16** is filled with the sand grains **20** of suitable refractory granules such as alumina or silica.

The resistor tube **16** is of suitable high strength refractory material, at least in its lining, to withstand internal pressures which may develop during operation. As illustrated in FIG. **2**, the resistor tube **16** is coated with a helical winding **30** of high resistance material defining a corona shield in void-free interfacial engagement with the dielectric filler **14**.

At either end of the tube **16** is a cylindrical contact ferrule **32** that electrically connects one of the contact rods **22** to an adjacent end of the fuse element **18**. A pair of ferrule end caps **34** seals both ends of the resistor tube **16**. The resistive coating **30** is connected near one or both of its ends by a conductive epoxy bond **36** to the line potential through the ferrule contacts **32**. It was found that a charging current between the coating **30** and ground on the housing **12** produces a voltage drop along the resistive coating **30** so that a potential difference appeared between the coating **30** and the fuse element **18**. In order to minimize any corona effect, the resistive value of the coating **30** must be limited to a proper value depending on the actual dimensions of the particular design of the fused coupler **10**. On the other hand, if the resistive value of the coating **30** is not made sufficiently high, excessive line-to-ground leakage can occur when the fuse element **18** is blown. By selecting a resistor tube **16** with a high enough resistance, this leakage current is limited to safe values. A terminal-to-terminal resistance of the coating **30** in the range of 50 to 150 megohms was found satisfactory. In one commercial embodiment of an 8.3 kV fuse, a resistance of 120 megohms was found satisfactory, limiting the line-to-ground current to 69 microamps at a power dissipation of 0.57 watts.

The fused coupler assembly **10** is subjected to a wide range of temperature during normal operating conditions of the underground distribution system. The current flowing in the fuse element **18** also tends to create a certain amount of heat within the enclosed resistive tube **16** causing the tube **16** to be subjected to additional radical changes in temperature. The dielectric filler **14** and tube **16** may have different coefficients of thermal expansion which may result in cracking of the filler **14** or in separating of the void-free interfacial contact between the dielectric filler **14** and the shield **16** when the assembly **10** is subjected to temperature changes. This difficulty is overcome by providing a layer of pliable material **38** such as urethane encompassing the resistor tube **16** and its corresponding coating **30**. The layer of pliable material **38** is such that it

has a coefficient of thermal expansion that is much higher than that of the filler **14**. Thus, when a cold condition occurs, the layer of urethane **38** will allow the filler **14** to shrink around the layer **38** in order to eliminate the stress on the filler **14**.

During the period when the assembly **10** is heated, the filler **14** tends to expand away from the insulating tube **16**, but the urethane **38** with the higher coefficient of thermal expansion will expand to maintain void-free contact with the filler **14** and the tube **16**.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A fused coupler assembly for use in an underground distribution system comprising:

a conductive grounding housing,

a cylindrical tube defining a tube cartridge within said housing,

a fuse element disposed within said tube,

a coating helically wound on said tube, said coating being connected to line potential at least at one end and being of sufficiently low resistance to prevent corona occurring between said tube and said fuse element; and

a dielectric filler in the space between said tube and said housing, said filler being in void-free interfacial engagement with said tube and said housing.

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