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STRANDED ELECTRIC CABLE WITH VULCANIZED STRAND SEALING COMPOSITION

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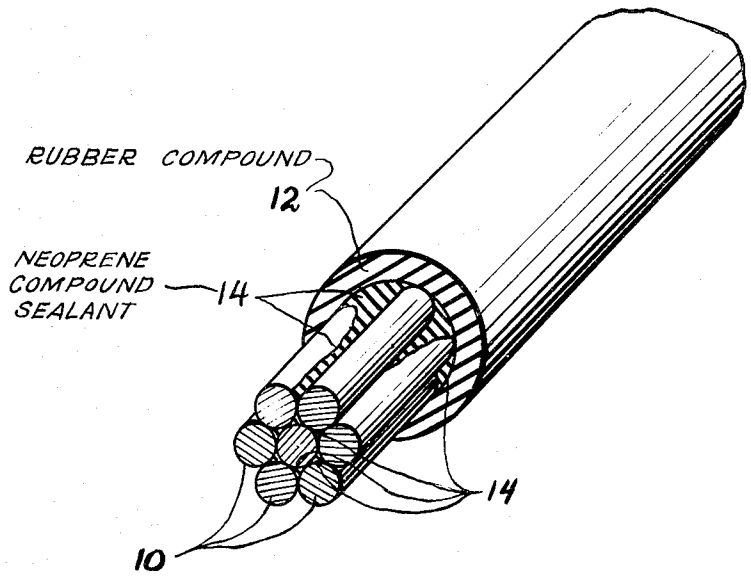

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STRANDED ELECTRIC CABLE WITH VULCANIZED STRAND SEALING COMPOSITION

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This invention relates to a vulcanizable strand sealing compound suitable for use with cable to be used in an environment in which the cable is subjected to high hydrostatic pressures.

Stranded cable, constructed with conventional round wire strands, has open spaces between contiguous strands. The interstrand spaces on large stranded cables is a significant percentage of the total cross sectional area of the cable.

When such cables pass through water barriers, the cable will act as a pipe unless the spaces between strands are filled with a sealant. Thus, if a part of the cable is damaged, the integrity of the water barrier is destroyed.

For this reason electrical cables used, for example, on naval vessels must be sealed, so as to preclude the passage of water through such barriers if the vessel is damaged.

In recent years, the sealant requirements have become increasingly stringent to allow use of cable within the hull of naval vessels, and, in particular, submarines. In such applications, the cable is subjected to high hydrostatic pressures if damaged and the sealant must resist such pressures.

The conventional sealing compounds have been unable to meet the more stringent operating requirement. For example, sealing compounds conventionally known to the art have been composed of oils, mineral fillers and resins and are plastic in nature. They have been applied as hot melts which harden on cooling or applied in plastic form which harden on standing.

However, it is desirable that the strand sealant be a flexible, elastic material in preference to a relatively hard material. It should also be oil resistant for use in transformer lead cables.

It is, therefore, the primary object of this invention to provide a strand sealer composition which will provide a flexible elastic material when applied to the cable.

Strand sealing compounds known to the art, which have had the requisite flexibility, have been unsuitable as strand sealers because they do not have the requisite tackiness and often will exude oil. Due to the limited compatibility, oil will often bleed to the interface of the wire and insulation. Under hydrostatic pressure the water will force the oil layer out, allowing the water to replace the oil and eventually to pass through the strand.

It is, therefore, a further object of this invention to provide an improved strand sealing compound having a high degree of tackiness with a relatively low viscosity.

It is a further object of this invention to provide a strand sealing compound which can be vulcanized after application to the cable strands to give good adhesion between the wires of the strand and between the strand and the insulating compound to provide the requisite sealing action.

It is a still further object of the present invention to provide a strand sealing composition which may easily and conveniently be prepared on a roll mill and which may be applied to the strand and subsequently vulcanized thereon after insulation of the strand to provide the necessary flexible strand sealing having a good body.

In accordance with these objects there is provided in a preferred embodiment of this invention a strand sealing composition consisting of a low molecular weight polymer of chloroprene mixed with an aromatic petroleum oil,

an acid acceptor, and curatives. The compound may be applied to the strands of the cable since it has a relatively low viscosity and a high degree of tack so that it will flow readily onto the strand and adhere both to the wires of the strand and to the insulation applied over the strand. After the strand is insulated, the sealant is vulcanized during the cure of the insulation by conventional processing methods such as continuous vulcanization, open steam pan cure, or cure in a lead sheath.

Having briefly described this invention, it will be described in more detail along with additional objects and advantages thereof in the following detailed description of a preferred embodiment of the present invention which may best be understood by reference to the accompanying figure which is a partially sectioned perspective view of a cable constructed in accordance with the present invention.

In accordance with the invention, the sealing compound is prepared by mechanical mixing of the following ingredients:

	Parts
Neoprene FB[1]	100
Compatible aromatic petroleum oil[2]	50–300
Magnesium oxide (acid acceptor)	approx. 4
Zinc oxide (curative)	approx. 5
Ethylene thio urea	approx. 1

[1] A polychloroprene polymer made in accordance with U.S. Patent No. 2,385,739.

[2] A viscous liquid petroleum derivative composed of hydrocarbons of comparatively high molecular weight and relatively aromatic in nature. The general characteristics are as:

Viscosity gravity constant	.936
Viscosity of 210° F. SUS	83
Percent reaction in 85 sulphuric acid	7.1
Percent aromatics by silica gel separation	76
Aniline point, ° F.	108
Gravity at 60° F.	.982

Available from Sun Oil under the trade name Sundex 53.

The mechanical mixing may be done on a 2 or 3 roll mill or in a dough mixer.

The compound should, for optimum results, have a viscosity range at room temperature of 40,000 to 50,000 centipoises.

The mixed compound flows freely and has a high degree of tackiness so that it may be applied to and will adhere to the individual wires of a stranded conductor and to any insulation applied thereover.

The compound is flowed on the conductor strands **10** and the applied insulation rubber compound **12** is extruded thereover. The strand sealant **14** is then vulcanized during the cure of the insulation by conventional processing such as continuous vulcanization, open steam pan cure, or cure in a lead sheath. The sealant fills the interstices between the individual strands **10** and adheres to the strand as well as to the insulation **12** thereby to provide a cable structure highly resistant to the entry of water when water under pressure is applied to the open end thereof.

A three conductor cable, in which each conductor consisted of 7/.020 inch tinned annealed copper strand **10** and having a 25 mil wall thickness of SBR (the government approved designation for styrene-butadiene rubber, a general purpose synthetic rubber previously identified as GRS) insulation **12**, was prepared by flooding the conductor with the sealant **14** of this invention The insulation was extruded over the conductor and the sealant vulcanized during vulcanization by continuous vulcanization. The resultant cable withstood 1,000 p.s.i. hydrostatic pressure applied to the open end of the cable for over two hours.

It will be appreciated that the strand sealant compound may be employed as a conductor strand sealant for transformer leads where resistance to passage of oil is required.

This invention may be variously modified and embodied within the scope of the subjoined claims.

What is claimed is:

1. A cable comprising at least one conductor formed of a plurality of individual strands, a free-flowing strand sealant applied thereto, said strand sealant consisting essentially of a physical mixture of 100 parts of neoprene rubber, 50–300 parts of aromatic petroleum oil, and acid acceptor, a curative and an accelerator, a rubber insulator applied over said conductor with the sealant completely filling the spaces bounded by the strands and the insulator, said sealant and said insulator being vulcanized, and said strand sealant adhering both to the strands and to the insulator applied thereover with a bond strength greater than the force of 500 pounds per-square-inch fluid pressure applied to the sealant at an exposed cross section of the sealant.

2. The cable described in claim 1 characterized by the sealant having a viscosity, when applied to the strands, between 40,000 and 50,000 centipoises at room temperature.

3. The cable described in claim 1 characterized by said strand sealant containing about 145 parts of said aromatic petroleum oil.

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