June 11, 1940. H. M. WILKOFF 2,204,288

INSULATION

Filed Aug. 12, 1936 2 Sheets-Sheet 1

Fig. 1.



Fig. 2.

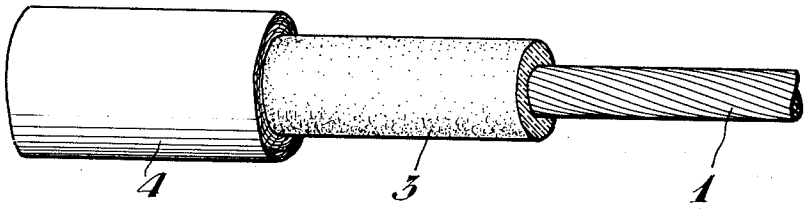


Fig. 3.

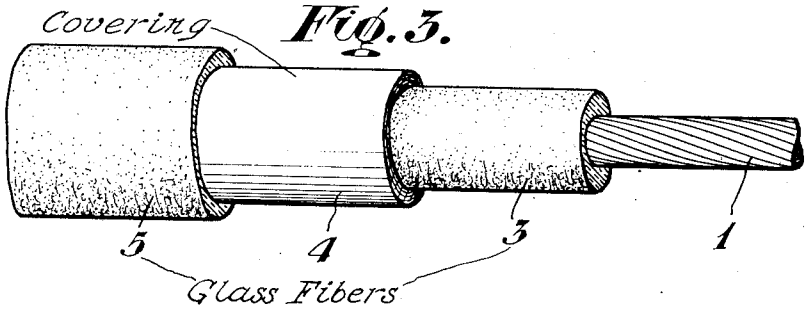
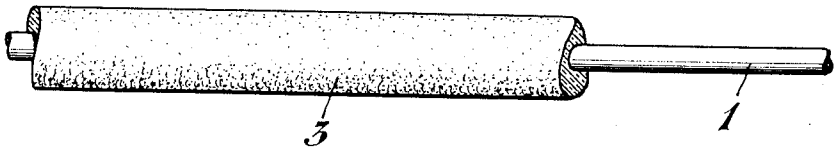


Fig. 4.



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Filed Aug. 12, 1936 2 Sheets-Sheet 2

Fig. 5.

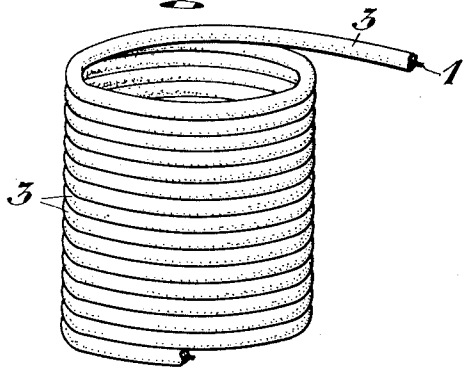


Fig. 6.

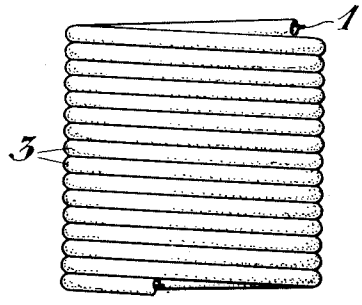


Fig. 7.

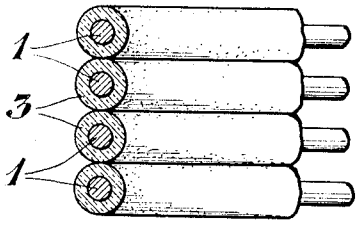


Fig. 8.

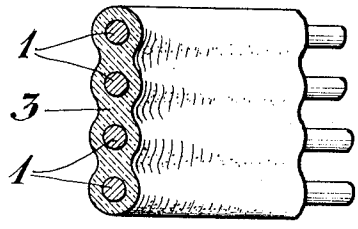
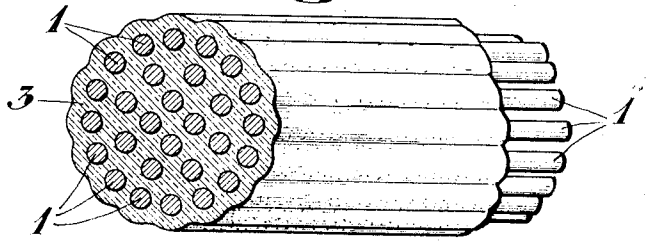


Fig. 9.



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Patented June 11, 1940

2,204,288

UNITED STATES PATENT OFFICE

2,204,288

INSULATION

Howard Milton Wilkoff, Worcester, Mass., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey

Application August 12, 1936, Serial No. 95,645

1 Claim. (Cl. 154—2.6)

This invention relates to insulation, and, more particularly, to the insulation of electrical conductors, one of the objects being to use spun glass for this purpose in a more practical manner than is taught by the prior art and so as to impart heretofore unconsidered advantages.

According to the present invention, spun glass is used in the form of a covering of interentangled glass fibers felted to form a coherent mass. It may be applied by conventional methods such as, for instance, in the same manner that asbestos covered cords and cables are produced. It is to be understood that the present invention is particularly concerned with the insulation of conductor wires or strands.

One advantage connected with the above is the ability of such an insulation to fuse so as to form a gas-tight envelope for a conductor which it covers in case this conductor should become heated to the point of fusion. It has been found that this requires that at least 50% by weight of the fibers be of spun glass. Underground cables are frequently installed in atmospheres which may for some reason or other be of an explosive character. In such instances, an explosion may result when a conductor is called upon to carry such a load that it fuses so as to separate and produce an arc.

If the conductor is covered with the described insulation the glass fibers fuse together before the conductor separates and thus form a gas-tight vitreous enclosure or envelope which shields the inevitable arc so as to prevent its igniting the surrounding atmosphere. It might be mentioned that one reason the atmosphere may be explosive is that some of the coverings of underground cables are sometimes impregnated with materials which generate an explosive gas when heated.

As previously mentioned, the insulation under discussion need not consist entirely of spun glass fibers. It has been discovered that a covering possessing particular advantages may consist of 50% spun glass, 25% asbestos, 15% cotton and 10% silk; these materials being all in a fibrous interentangled state and the various fibers thoroughly blended together and felted to produce a coherent mass. The figures are weight percentages. Methods of doing this blending and felting are known to those skilled in the textile art.

This particular insulation is of advantage in that the spun glass provides the felted mass with a reasonably high dielectric strength than has been heretofore obtainable from the use of glass or mineral material, and renders it capable of fusing when raised to a high temperature. The asbestos imparts flexibility after the mass has been fused due to the fact that it will be blended with the vitreous mass because of its previously blended and interentangled condition; the cotton imparts sufficient mechanical strength to the mass to allow it to be handled with ease by ordinary production methods, and, finally, the silk gives a desirable sheen and appearance or, in other words, provides the sales appeal necessary in the marketing of any modern product. It is obvious that this silk may be omitted without detracting from the other advantages.

Another advantage in using spun glass in the manner and form described is that an electrical conductor may be provided with an adhesive coating which holds a layer of the interentangled fibers to the conductor. If these fibers are felted sufficiently it is possible to form a firm coherent mass so that those fibers which are not directly held to the conductor by the adhesive coating are positively positioned against displacement. In such an instance no binding or other covering is needed although it may be desirable for other reasons.

It will be understood that I do not limit myself to the percentages of elements going to make up the insulating material as set forth above, since such percentages may be varied materially without departing from the scope of my invention and various ones or even all of the fibers other than the glass fibers may be omitted or various combinations may be made. When it is desired to provide a positively heat and fireproof flexible insulation spun glass fibers and asbestos fibers alone may be used. The asbestos fibers will withstand the heat of fusion of the glass fibers with the result that the glass will become a vitrified mass and the asbestos fibers will remain unaffected and serve to reinforce the vitrified mass of glass and render it flexible.

Spun glass fibers of the present invention when interentangled and felted without the addition of any other fibers offers an insulating material having many advantages not obtainable from any other form of material. Such material has all the advantages of insulation composed of braided, longitudinally arranged, or spiral-wrapped glass fibers, and, in addition, it is substantially free from voids and interstices and has an inherent capability of being able to withstand greater flexing than any forms of spun glass insulation previously used.

Several specific examples of cables embodying the various features which have been discussed

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are illustrated by the accompanying drawings, Figures 1 through 3 showing ends of electric wires with portions of the conductors and the successive layers exposed for illustrative purposes, while Figures 4 through 9 show modifications of the invention.

Figure 1 shows a conductor 1, an adhesive coating 2 over this conductor and a layer 3 of interentangled fibers of which at least 50% are glass, this covering being held to the conductor by the adhesive coating and the fibers being felted sufficiently to form a firm coherent mass which does not require an auxiliary support.

Figure 2 shows the conductor 1 and the covering 3, this example being distinguished from the above in that no adhesive coating is used whereby the covering 3 must be held tightly against the conductor by an outer covering 4. The latter may be of any of the conventional types provided it causes the covering 3 to hug the conductor 1.

Figure 3 shows the same as Figure 2 excepting that an outer layer 5 of the described new covering is applied over the covering 4 which holds what is in this case the first covering 3 of the new insulation.

It may be desirable at times to utilize the invention of this application to provide a vitreous form of insulation which may be of pure glass or a glass and asbestos mixture as described above.

In Figures 4 to 9 of the application I have shown a modification of my invention.

Figure 4 shows an ordinary bare copper wire or conductor 1 upon which has been applied directly a concentric layer of felted spun glass insulation 3. It would be understood that this insulation may be of any of the compositions disclosed above.

Figure 5 is a perspective view of the insulated conductor of Figure 4 coiled upon itself to form a closed spiral.

Figure 6 shows the same coil in elevation.

Figure 7 is a fragmentary enlarged sectional view through a portion of the coil of Figure 6.

Figure 8 shows a similar view to Figure 7 with the insulation fused so as to form a solid mass.

Figure 9 is a fragmentary sectional view of a further modification in which a plurality of wires 1 having the insulation of this invention applied thereto have been bunched or coiled and the insulation fused.

By assembling coils such as illustrated in Figures 5 to 8 and 9, and then fusing the mass of insulation by the application of sufficient heat, the insulation is caused to form into a unitary vitreous mass. Therefore, the coil which has been formed from a continuous wire or a plurality of wires becomes a unitary structure encased in a vitrified mass and the various convolutions of the wire 1 are retained in spaced insulated relationship. Coils formed as above described may be employed in the manufacture of various forms of resistance units, inductance coils, etc.

Because of the adaptability of the described covering or insulation it is possible to use it in practically any manner commonly resorted to. There is obviously no need to show further examples of its use. However, it should be noted that the application of glass fibers to a conductor by means of an adhesive coating over this conductor is unknown to those skilled in the art because of the fact that they were heretofore unable to conceive that glass fiber could be made having the necessary characteristics for use in this manner and did not appreciate or understand its advantages as a safeguard against explosions in case of conductor failures caused by overloading. It is to be understood that the glass and copper have melting temperatures which provide these advantages when the respective materials are of conventional compositions.

I claim:

As an article of manufacture, an insulating material comprising interentangled fibers of which at least 50% by weight are spun glass, 25% by weight are asbestos, 15% by weight are cotton and 10% by weight are silk, said fibers being felted to form a coherent mass.

HOWARD MILTON WILKOFF.

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