

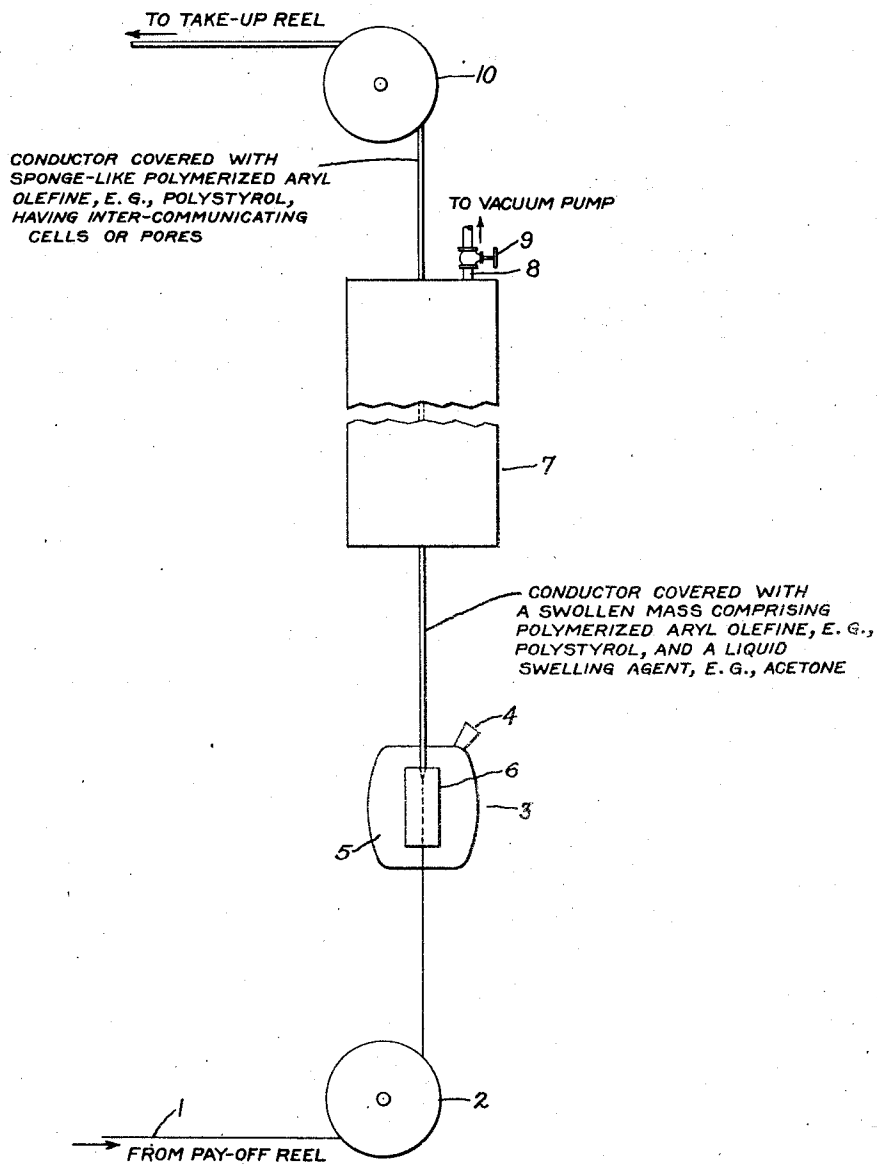
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W. SCHULZE

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METHOD OF MAKING AN INSULATED ELECTRICAL CONDUCTOR

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METHOD OF MAKING AN INSULATED ELECTRICAL CONDUCTOR

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Among the organic artificial substances which have found application as electrically insulating materials is especially suitable, since this substance is distinguished by its extraordinarily small loss angle and its very low dielectric constant. In view thereof it has already repeatedly been proposed to employ this substance in the construction of parts of apparatus produced by a die-casting method. It has, furthermore, been proposed in certain individual cases to make use of the polystyrol for improving the insulation of cables. But in these cases the drawback has been experienced that the said substance is mechanically very brittle so that its utilization for the insulation of flexible conductors is rendered difficult. To be sure, it has already been suggested that polystyrol can, by means of a particular treatment, be transformed into comparatively flexible bands and threads, but in general products thus obtained still have a considerable degree of brittleness.

Now, according to the present invention, polystyrol or another similar polymerized aryl olefine is not, as has hitherto been proposed, used in its homogeneous form, but in the form of a foam-like or sponge-like mass consisting of many thin-walled cells and having been obtained according to the method hereinafter disclosed. Such a sponge-like insulating material possesses, by reason of the comparatively great strength of the thin polystyrol films or membranes forming the cell walls, a sufficient mechanical strength, and possesses furthermore, compared with the homogeneous polystyrol, a much lower dielectric constant.

Such an insulating material is, besides, by no means so brittle as the homogeneous material and, depending on its space factor and on the thickness of the cell walls allowed, it can be varied in a large extent as regards its mechanical strength, its flexibility, its dielectric constant and its other dielectric properties. The polystyrol employed according to this invention contains, of course, additions of softening or hardening substances or other filling substances, such as thought suited to attain the desired mechanical or dielectric properties.

In carrying the present invention into effect polystyrol or another polymerized aryl olefine is introduced into a swelling material, for instance, acetone. There is obtained in this way a swollen material which is plastic at ordinary temperature and can be shaped as desired, for instance so as to constitute a band or a hose extruded around a conductor. When then the

shaped swollen material is dried by being subjected to the action of a vacuum, the solvent therein contained will evaporate and expand the remaining material so as to constitute a foamy structure. This drying operation under vacuum can be effected with a higher or lower degree of evacuation, depending upon the desired space factor or the nature of the interior structure, that is to say, according to the size of the pores within the material and to the thickness of the walls of the cells. It is, indeed, possible to produce the foamy material also by means of other processes. Thus, for instance, the swollen or dissolved material can be dried merely by the application of a higher temperature and without resorting to evacuation. It is, however, an essential feature of the invention to employ the polystyrol as insulating material not in its homogeneous state, but in a foamy state.

If, for instance, spacing elements such as employed in high-frequency cables as supporting members for the interior conductor are desired to be manufactured in accordance with one embodiment of this invention the swollen material may be introduced into moulds corresponding to the shape of the spacing elements to be made, and the moulds with the material in them then may be subjected to a drying process under vacuum. The swollen material, which at the beginning of the drying operation should not, of course, fill the moulds completely, will swell in a foamy manner while the drying proceeds and will then contact with the inner surfaces of the mold walls. It is possible to manufacture in this way all sorts of shaped members or parts needed for the manufacture of apparatus of many different kinds.

An electric conductor can be surrounded with foamy polystyrol in a continuous process by first extruding the swollen material onto the conductor and then passing this latter with its covering through a suitably closed drying chamber. It has been found that the insulating material produced according to this embodiment of the invention also possesses a comparatively great strength even if the space factor is extraordinarily slight.

Other forms of the insulating material can be manufactured in the manner hereinbefore described, for instance threads, bands, rods or bars, tubes, and so on.

The foamy polystyrol by no means is limited solely to the field of high-frequency engineering, although this has been thought of first of all, for it has been found that it can be soaked also

with a liquid insulating agent and the oil-impregnated material used, for example, in high-frequency electrical applications. The soaking, which may be effected, if desired, at an increased temperature and under vacuo, is possible because the pores of the foamy material communicate in general with one another, since the solvent which had been present therein, upon being evaporated, has left the material in continuous channels. Thus, oil- or compound-filled cables, the insulating structure of which consists of the foamy pyrostyrol, may be manufactured in this manner but cables so made should not be subjected to too high temperatures. The possibility to soak the material also renders possible the use of liquid insulating substances, especially those having a very low dielectric constant. The utilization of such insulating substances up to now has been possible only in a very limited manner in the manufacture of low-current cables, but in accordance with the present invention an insulating covering of foamy polystyrol may be soaked with such liquid insulating substances. It is in this way possible to manufacture long-distance communication cables which will withstand substantial pressure and are particularly suitable for marine purposes.

It may finally be noted that multiple-conductor telephone cables also may be insulated with material of the present invention in a continuous process similar to that employed in manufacturing paper-free insulation.

I wish it to be understood that the employment of this insulating material is, as a matter of course, not limited to such uses as above stated merely by way of example. In view of the great demand for a high-grade dielectric insulating material which, at the same time, may be worked mechanically in a simple manner, it is not possible to describe all the applications of the material.

The present invention provides a method of making an insulated electrical conductor which comprises applying a swollen mass comprising polymerized aryl olefine, for example polystyrol, and a liquid swelling agent, specifically acetone, to an electrical conductor and treating the conductor and applied mass to remove the swelling agent and thereby transform said mass to a sponge-like substance in which the cells or pores thereof communicate with each other.

The single figure of the accompanying drawing shows schematically a method of insulating a conductor in accordance with the invention. As there shown a wire 1 is drawn from a pay-off reel over a guide sheave 2 by any suitable driving means (not shown) and thence through a device such as the extrusion mechanism des-

ignated generally by the numeral 3. This device may be of any suitable type adapted to extrude or otherwise to apply and to form a uniform covering of a swollen mass comprising polymerized aryl olefine and a liquid swelling agent upon the wire. The hopper 4 provides means for supplying the swollen mass of polymerized aryl olefine from the exterior to the interior of the extrusion device through which the mass is conveyed to the extrusion head 5 and the die 6. Upon entering the head 5 the wire passes through the die 6 where the swollen polymerized aryl olefine is applied. The exit opening of the die 6 may be adjusted to provide a coating of any desired thickness on the wire. The wire with its coating of swollen polymerized aryl olefine thereon then is passed through a suitably heated zone. For example, the coated wire may be passed through the heated oven 7, which may be provided with the vacuum line 8 in which is the valve 9. In its passage through the oven the swelling agent, for example acetone, is evaporated. During this drying process the polymerized aryl olefine on the wire is converted into a sponge-like structure having inter-communicating cells or pores. The resulting coated wire then passes over a guide sheave 10 to a suitable take-up reel.

I claim:

1. A method of making an insulated electrical conductor which comprises applying a swollen mass comprising polymerized aryl olefine and a liquid swelling agent consisting of acetone to an electrical conductor and treating said conductor and applied mass to remove the swelling agent and thereby transform said mass to a sponge-like substance in which the cells or pores thereof communicate with each other.

2. A method of making an insulated electrical conductor which comprises applying a band of a swollen mass comprising polystyrol and a liquid swelling agent consisting of acetone to an electrical conductor and drying said conductor and applied band under reduced pressure to remove the acetone and thereby convert said mass to a sponge-like structure having inter-communicating cells or pores.

3. A method of making an insulated electrical conductor which comprises extruding upon the conductor a covering formed of a swollen mass comprising polystyrol and a liquid swelling agent consisting of acetone and drying said conductor and covering under reduced pressure to remove the acetone and thereby form a sponge-like structure with inter-communicating cells or pores.

WALTER SCHULZE.

CERTIFICATE OF CORRECTION.

Patent No. 2,218,385.

October 15, 1940.

WALTER SCHULZE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 3, before the word "is" insert "--polystyrol--"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of December, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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