Nov. 26, 1940. J. A. SZILARD 2,222,638

ELECTRIC CABLE

Filed Sept. 10, 1937

Fig. 1.

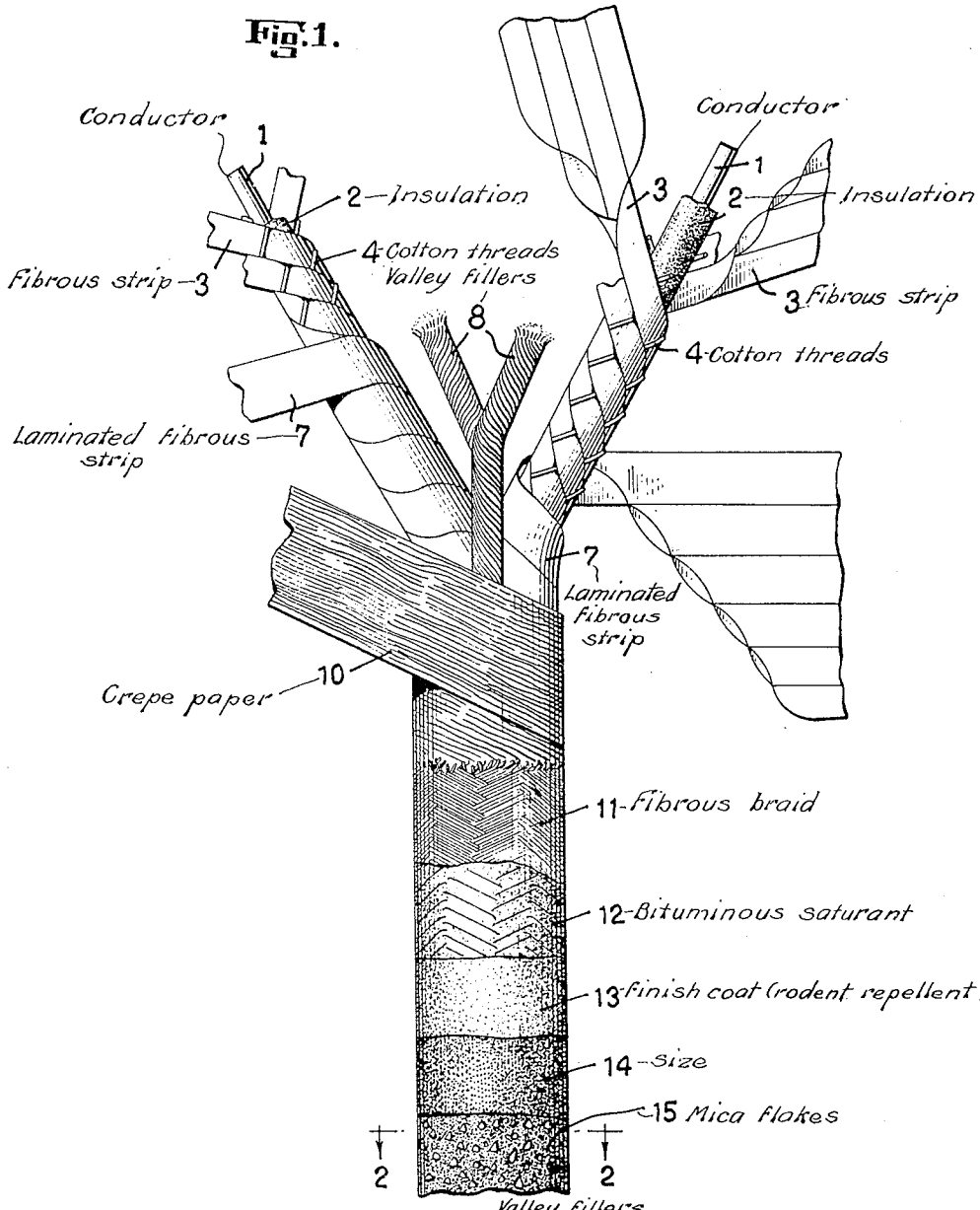
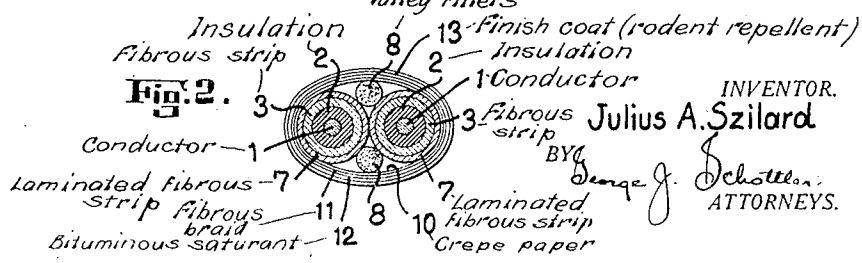


Fig. 2.



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ELECTRIC CABLE

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Application September 10, 1937, Serial No. 163,197

19 Claims. (Cl. 174—116)

This invention relates to improvements in insulated non-metallic sheathed conductors or cables, more particularly to a cable construction designed to minimize or eliminate the danger of damage to the insulating and protective coverings of the cables by rats, mice, squirrels or other rodents or, in fact, by any form of animal or insect life which is subject to control by the specified construction. A type of cable construction to which the invention may be applied is exemplified in the patent to Charles W. Abbott No. 1,520,680, granted December 23, 1924, and in the patent to A. A. Benner et al. No. 1,905,789 granted April 25, 1933.

It is an object of this invention to provide an improved non-metallic sheathed conductor particularly adapted for use in wiring buildings. It is a further object of the invention to provide a new method of manufacturing insulated electrical conductors to render the finished conductors repellent to rodents. Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention, selected merely for purposes of illustration, is shown in the accompanying drawing, in which:

Fig. 1 is a plan view of a short length of two conductor cable having the layers of materials overlying the conductors cut back progressively greater distances to show the interior construction; and

Fig. 2 is a transverse section through the cable substantially on the line 2—2 of Fig. 1.

The legends applied to the drawing are by way of illustration and not limitations.

In the use of non-metallic sheathed cables it may be necessary to install them in places where they are subject to attack by gnawing animals such as mice, rats, squirrels or other rodents. The problem is more serious in buildings than outdoors and particularly serious in rural buildings where rodents are more numerous. It is possible that rodents gnaw the cable coverings on account of certain food values in the coverings or saturants, but more likely that the attacks are made to the cables when they constitute barriers to food which the rodents desire. Whatever may be the cause of the attack, it is highly undesirable to have the cables injured in this manner. One danger is that short circuits may result with consequent damage to the cables or buildings by fire.

Prior to the development of the present invention there had been some investigation of the problem and certain suggestions for overcoming it. The use of certain poisons such as red squill, phosphorus, white arsenic or barium carbonate was considered but these substances are unsuitable because of the health hazard involved in manufacturing and using a cable containing sufficient amounts of poison to be effective. Moreover, this does not wholly solve the problem because the effectiveness of a poison depends upon the actual consumption of some of the cable covering.

At one time or another there has been used on the above-referred to type of non-metallic sheathed cable, commonly known under the trade name of "Romex," a finishing compound in which was incorporated a chlorinated naphthalene known as "Halowax." This was poisonous to rodents but had two outstanding disadvantages. It was somewhat volatile and its effectiveness decreased with age. The second and more serious objection or disadvantage to its use was the health hazard involved for the workmen who handled the material in the plant. In addition, it had the disadvantage, mentioned above, common to all poisons, in that it required consumption of the cable to be effective.

According to the present invention, substances which depend entirely for their effectiveness upon poisonous characteristics are not employed; instead there is employed a deterrent or repellent substance which has such characteristics, either disagreeable taste or odor or both, that it will entirely prevent the attack of rodents. Moreover, the substance is preferably of such nature that it will permanently maintain the desired characteristics in use. That is, it is stable and will not volatilize or melt under atmospheric conditions.

The rodent repellent or deterrent substance may be used in any part of the cable but as a practical matter it has been found that it is sufficient to place the substance only near the outer surface of the cable.

The cable illustrated herein to provide a setting for the invention comprises conductors 1; a covering of insulating compound such as rubber 2; a protective sheath of laminated fibrous strips 3 braided with cotton threads 4, the sheath being treated with a compound to render it moisture or flame resistant or both, if desired; a second protective sheath of laminated fibrous strips 7; cords 8 filling the valleys between the covered conductors; a spiral binding layer of crepe paper 10; and a strong outer fabric braid 11. The outer fabric braid may be treated with a flameproof and substantially moisture proof penetrating saturant such as a bituminous compound, for

example, stearine pitch. This is indicated at 12. A finishing coat 13 of a bituminous compound such as stearine pitch, a thin coating size 14, and a coating of mica flakes 15, may constitute the finish of the cable outside the fabric braid 11.

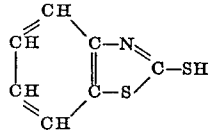
The rodent repellent or deterrent substance is preferably incorporated in the stearine pitch finish coat or in the layer of mica flakes in a cable of the above type. The sizing coat is normally too thin to carry an adequate amount of the substance and the stearine pitch saturant of the braid is too far below the outer surface to make the use of the repellent substance therein economical or immediately effective.

The rodent deterrent contemplated herein is a substance which is unpalatable to rodents, that is, it has a taste or smell which is objectionable to them. Since rodents have a highly developed sense of smell and since practically all substances give off some odor, it appears that any substance which is objectionable to the taste of rodents will also be objectionable to smell and so completely repel their attacks on the cable; although the substances may not, and preferably will not, have a smell which is noticeable or objectionable to humans. Rodents particularly avoid bitter or acrid substances, so such substances are favored for use on the cables.

It has been discovered that a number of substances used in connection with the vulcanization of rubber have the desired characteristics as rodent repellents, at least in the state in which they exist before vulcanization occurs.

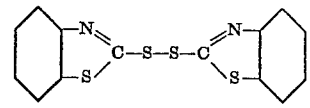
It has been found that compounds with CS, carbon-sulphur, and CNR, carbon-nitrogen, atom groups as a rule have a bitter taste. The bond between carbon and sulphur and carbon and nitrogen may be double as in C:S, C:NR, or single as in C.S, C.NR. Other atom groups which give occasionally bitter compounds are C:C, C:N, or N:N. The symbol C:NR is a specific case of the symbol C:N in which the third valance of N is linked to a radical group such, for example, as CH_3 known as the alkyl group, C_6H_4 known as the aryl group, C_6H_5 known as the phenyl group or radical, and so on. To be entirely correct, perhaps C:N should be written as :C:N. to indicate the four valences of carbon and the three valences of nitrogen. The single unsatisfied valence of nitrogen here may be linked to a single atom like H or to a radical group as in the examples given.

One substance containing both CS and CNR atom groups is mercapto-benzo-thiazole, an organic accelerator, known commercially as "Captax". The formula for this substance is as follows:



This compound has two C.S groups and one C:NR group. It is non-toxic and stable, having a melting point of 245° F. It is preferred because of its bitterness, stability and low cost. It blends well with a pitch compound, is not hazardous or objectionable to workmen during preparation or application to cables and gives practically no odor noticeable or objectionable to humans in use.

Another suitable compound similar to the above is benzo-thiazole-disulfide, known commercially as "Altax." The formula for this substance is as follows:

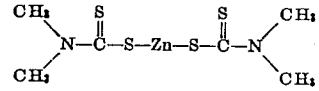


This compound has four C.S groups and two C.NR groups. It is non-toxic and stable, having a melting point of 345° F. It is very bitter, blends well with a pitch compound, is not hazardous or objectionable to workmen during preparation or application to cables and gives no odor noticeable or objectionable to humans in use.

Captax and Altax contain the thiazole atom group and are preferred for the present purposes because they have a bitter taste which is particularly objectionable to rodents.

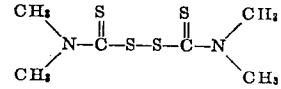
While "Captax" and "Altax," particularly the first, are preferred for combining with pitch or with other substances in which the deterrent may be integrally compounded, there are a number of other deterrents containing CS or CNR atom groups which may be compounded with pitch or the like and used on cables for the desired purposes. Among these further deterrent substances may be mentioned:

Zinc dimethyl-dithio-carbamate, known commercially as "Zimate"



This has two C:S, two C.S and two C.N groups. It is non-toxic and stable, having a melting point of 482° F.

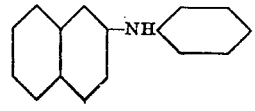
Tetra methyl thiuram disulfide, commercially known as "Tuads"



This has two C:S, two C.S and two C.N groups. It is non-toxic and stable, having a melting point of 284–293° F.

Other compounds, suitable for incorporation with pitch or the like for use as rodent deterrents, which have a bitter or acrid taste which do not contain CS groups but do contain C.N groups are as follows:

Phenyl - beta - napthylamine, an antioxidant known commercially as "Neozene D" or "Age-Rite Powder"



This is non-toxic and stable, having a melting point of 220–225° F.

Diphenyl guanidine, an accelerator known commercially as "D. P. G."

$$C(NH)(NHC_6H_5)_2$$

This is non-toxic and stable, having a melting point of 291° F.

Di-ortho-tolylguanidine, an accelerator known commercially as "D. O. T. G."

$$C(NH)(NHC_6H_4CH_3)_2$$

This is non-toxic and stable having a melting point of 340° F.

So far as known, all compounds containing the thiazole group have a bitter taste and may

be used as rodent repellents. They may not all be sufficiently stable to withstand high blending temperature but if not they may be otherwise applied.

A stearine pitch finish coat compound in which the above deterrents may be incorporated will be considered by way of illustration because it has been used on the type of cable used for an example herein, but with the understanding that the deterrents may be used in other very different pitch compounds or even in compounds without pitch content if the cable requirements demand. The composition of this compound is as follows:

	Pounds
Gilsonite	180
Stearine pitch No. 40	300
Paraffin	35

This compound has a melting point of 170–180° F. and a penetration at 77° F. of 8–12.

An example of a saturant with which the deterrent may be used is:

	Pounds
Stearine pitch No. 83	1850
Stearine pitch No. 464	200
Paraffin	200
Montan wax	50

This compound has a melting point of 144–154° F. and a penetration at 77° F. of 14–20. Herein it is not particularly recommended that the rodent deterrent substance be incorporated in the saturant because it is thought to be entirely adequate to place the deterrent in compounds which lie nearer the surface of the cable, but obviously if necessary or desirable the deterrent may be placed in the saturant for the fabric braid sheath of this cable or at any place in a cable.

In the manufacture of a cable according to the present invention there is added to the molten saturant or finishing compound a very small amount, say ½% to 5% of the bitter organic compound containing CS or CNR groups. The resultant compound is remelted and applied to the cable in the usual manner just as if the deterrent had not been added. The principal considerations from a manufacturing standpoint are that the rodent deterrent substance should be nonvolatile when blended with the pitch at about 350° F. and stand the temperature of application to cables which is about 300° F., which will not be dangerous or disagreeable to workmen, and which will not affect the performance tests such as flame and moisture retardant requirements of the compound. The substances mentioned above meet these requirements.

In some cases it is desirable to apply the rodent repellent to the surface of the cable and for this purpose the above repellents may be admixed with powdered mica. It will be recognized also that an additional group of materials having repellent and non-toxic properties, but incompatible or unstable at the temperature used with the bituminous finish, may be applied when admixed with mica since they are not incorporated in the bituminous pitch nor subjected to high temperatures. Among these additional materials are flowers of sulphur and naphthalene flake.

In manufacture either or both of these substances may be mixed with the mica flakes ordinarily used on the type of cable illustrated herein. About 25% of either sulphur or naphthalene is mixed with the mica and the mixture applied as the mica alone has been applied by adherence to the sticky coating of the cable.

The sulphur and mica mixture is odorless to humans. The naphthalene mixture has a noticeable odor of naphthalene.

When any of the repellents mentioned above, other than sulphur or naphthalene, is used with mica it is not necessary that more than five percent of the mixture be made up of the repellent.

Instead of using a single repellent it will be satisfactory to use several repellent substances together if that should be found to be desirable for any reason.

Cables made in accordance with the present invention have been manufactured and tested and have proved to be completely satisfactory. In no instance were the cables attacked in the slightest by rats when placed as a barrier between the rats and a supply of food, even up to the point of near starvation of the rats.

While the invention has been described in some detail for illustrative purposes, it is to be understood that it may have various embodiments within the limits of the prior art and the scope of the subjoined claims.

I claim:

1. A non-metallic sheathed cable, comprising in combination, a plurality of insulated conductors, a non-metallic fibrous sheath enclosing the insulated conductors, a thin coating of stearine pitch applied over the sheath, the stearine pitch having incorporated therein mercapto-benzo-thiazole, and a coating of flake mica applied over and adhering to the coating of stearine pitch, the mica coating having sulphur incorporated therewith.

2. A non-metallic sheathed cable, comprising in combination, a plurality of insulated conductors, a non-metallic fibrous sheath enclosing the insulated conductors, a thin coating of finishing compound applied over the sheath, the finishing compound having incorporated therein a substance which is non-toxic and unpalatable to rodents, and a coating of flake mica applied over and adhering to the coating of finishing compound, the mica coating having incorporated therewith a substance which is non-toxic and unpalatable to rodents.

3. An electrical conductor including a textile fabric braid provided with a finish coat of a bituminous compound within which is incorporated mercapto-benzo-thiazole.

4. An electrical conductor including a textile fabric braid provided with a finish coat of stearine pitch within which is incorporated a bitter stable rodent repellent substance containing one of the groups CS and CNR.

5. An electrical conductor including a textile fabric braid provided with a finish coat of pitch within which is incorporated a stable unpalatable rodent repellent substance.

6. An electrical conductor including a non-metallic sheath provided with a mica coating with which sulphur is incorporated.

7. An electrical conductor including a non-metallic sheath provided with a mica coating with which is incorporated a stable aromatic organic compound containing a thiazole group.

8. An electrical conductor including a non-metallic sheath provided with a mica coating with which is incorporated a stable unpalatable rodent repellent substance.

9. An electrical conductor including a non-metallic sheath provided with a finish coat of a

bituminous compound in which is incorporated mercaptobenzo-thiazole.

10. An electrical conductor including a non-metallic sheath provided with a finish coat of a bituminous compound in which is incorporated a bitter stable rodent repellent substance containing one of the groups CS and CNR.

11. An electrical conductor including a non-metallic sheath provided with a finish coat of a bituminous compound in which is incorporated a stable unpalatable rodent repellent substance.

12. An electrical conductor including a non-metallic sheath having incorporated therewith mercapto-benzo-thiazole to render the conductor repellent to rodents.

13. An electrical conductor including a non-metallic sheath having incorporated therewith a bitter stable rodent repellent substance containing one of the groups CS and CNR.

14. An electrical conductor including a non-metallic sheath having incorporated therewith a bitter stable rodent repellent substance.

15. An electrical conductor including a non-metallic sheath having incorporated therewith a stable unpalatable rodent repellent substance.

16. In a rodent-repellent covering for electrical cables, comprising an outer fabric layer rendered moisture resistant, and including a stable aromatic organic compound containing the groups CS or CNR.

17. An electrical conductor including a textile fabric braid rendered moisture resistant and including a stable aromatic organic compound containing a thiazole group and over which is a coating of inert powder having incorporated therewith not less than one per cent of a stable aromatic organic compound containing a thiazole group.

18. The method of rendering a non-metallic sheathed electrical conductor repellent to attack by rodents which comprises applying to the cable a coating of a bituminous compound having incorporated therein mercapto-benzo-thiazole.

19. The method of rendering a non-metallic sheathed electrical conductor repellent to attack by rodents which comprises applying to the cable surface a coating of material consisting of mica flakes and one of the substances sulphur and naphthalene and stable compounds having CNR or CS groups.

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