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J. LEPETIT

INSULATED ELECTRIC CONDUCTORS

Filed May 13, 1939

Serial No.
273,526

2 Sheets-Sheet 1

Fig-6

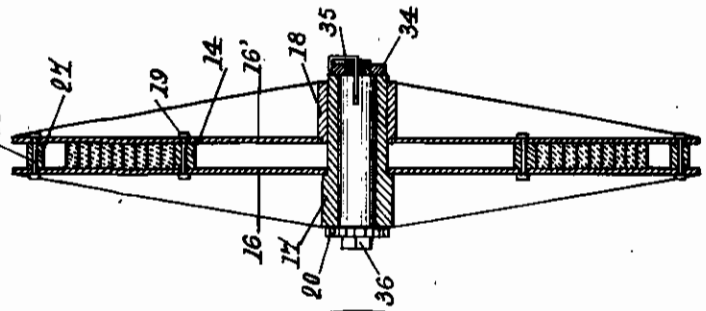


Fig-5

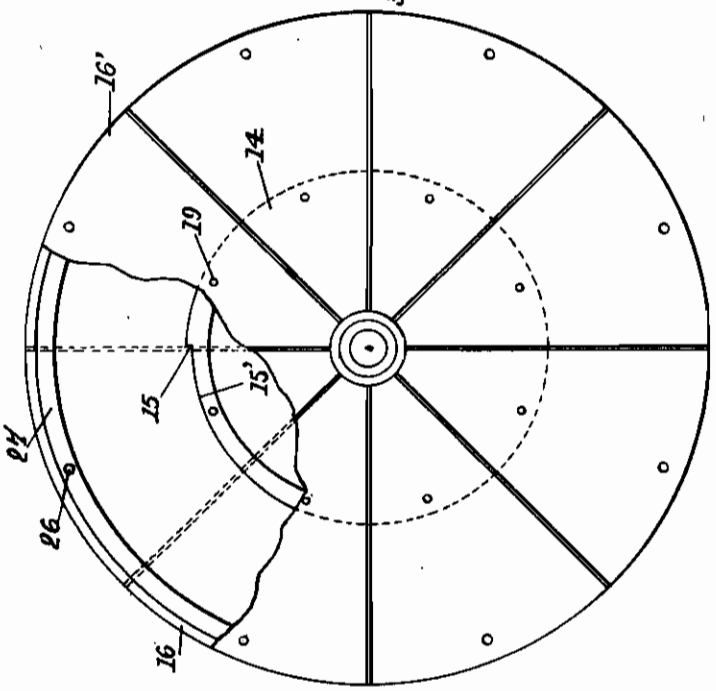


Fig-1

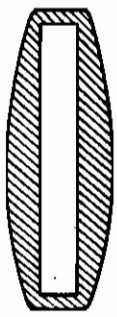


Fig-2

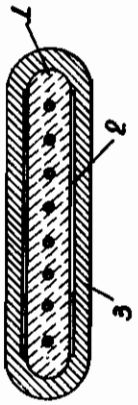


Fig-3

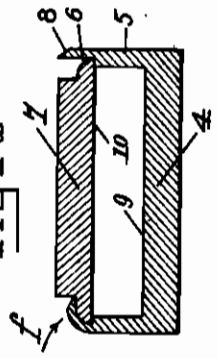
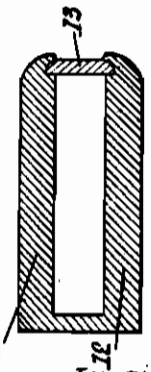


Fig-4



INVENTOR
BY J. Lepetit
E. F. Wendroth
ATTORNEY

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J. LEPETIT

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Fig. 7

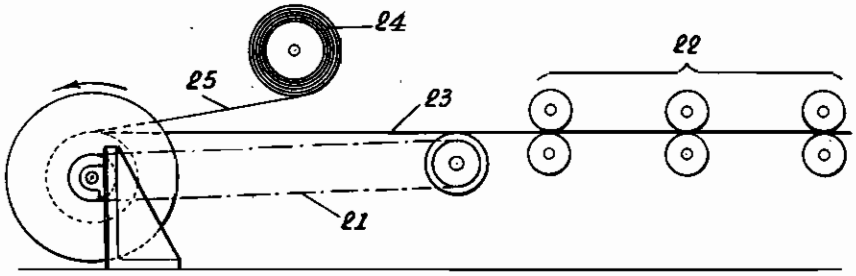


Fig. 8

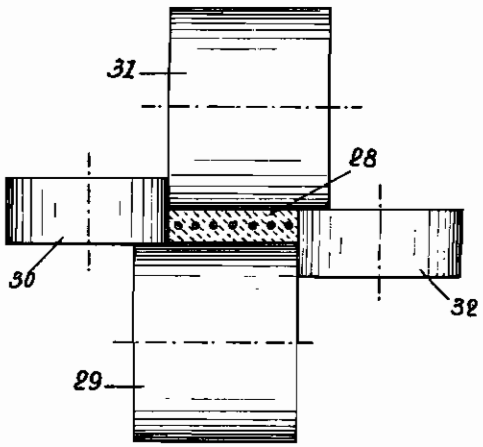
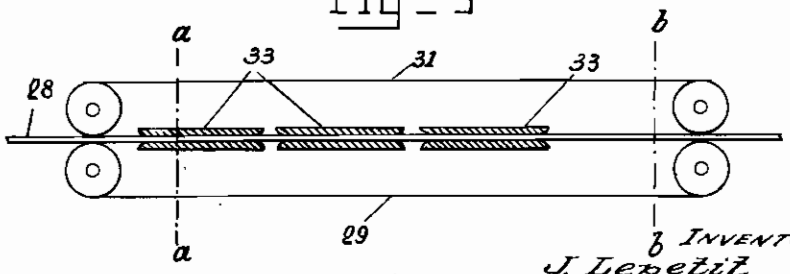


Fig. 9



INVENTOR
J. Lepetit
BY
E. F. Wunderlich
ATTORNEY

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ALIEN PROPERTY CUSTODIAN

INSULATED ELECTRIC CONDUCTORS

Jean Lepetit, Clichy, France; vested in the Alien Property Custodian

Application filed May 13, 1939

This invention relates to insulated electric conductors and has for its main object to provide an improved method of manufacture for the production of cables of flattened cross-section.

It has been proposed to subject a cable, insulated by a rubber coating of circular cross-section, to vulcanisation in a lead casing which is stripped off after the treatment has been completed. To this end the cable enclosed in the insulation is passed through a press which by extrusion through suitable dies, covers the insulation with a sheath or casing of regular thickness.

If this process is applied for the manufacture of cables of flattened cross-section, that is to say for example in which the cable, containing one or more conducting cores, has a rectangular cross-section, results are not satisfactory. In the first place covering such cable with a lead casing by means of a die press presents difficulties due, for example, to irregularity of spinning or congestion in the die. Even if the process is satisfactorily regulated the sheathing is insufficient to ensure a satisfactory mould during vulcanisation particularly on the major flat faces so that corresponding imperfections are produced on the corresponding faces of the insulation. Such imperfections are not only detrimental to the appearance of the cable but may result in local defects in the insulation thickness and may undesirably affect the cable as regards facility of rolling or stacking.

These difficulties are overcome by the present invention according to which the flat parts of the cable, particularly the major faces, are protected against the production of irregularities during the final moulding, for example during the vulcanisation treatment.

To this end these flat parts of the cable may, during moulding, be placed in contact with corresponding flat metallic elements of the sheath or casing, the said elements being of increased rigidity and having a perfectly smooth surface which, in consequence, ensures absolute regularity of the surfaces and thickness of the cable.

The flat elements may be provided in various ways. For example, a lead sheath may be applied whose transverse section is continuous about its periphery but whose thickness is varied in such a manner as to provide the inner surface with the necessary resistance, e. g. by thickening those walls of the sheath lying in contact with the major flat surfaces of the cable. According to another method hoops may be disposed within a sheath, of lead or the like, whose thickness is substantially constant on all sides and which is formed by spinning or extrusion.

According to a further method the sheath or casing of lead or the like suitably treated may be formed in separate parts, for example a trough-like part and a cover, the cable being laid in the trough-like part and the cover applied for example as by a clinched or besel joint. According to yet another method the cable may be wound in successive convolutions about a drum, a flat intermediate element or strip, for example of metal, being wound so as to lie between successive convolutions of the cable, the intermediate element being thus utilised on both its major faces. According to another method the cable is moved continuously between endless metallic bands which are juxtaposed so as to constitute a continuous mould which extends into or through the vulcanising chamber or zone.

In the accompanying drawings,

Figure 1 shows, in cross-section, one form of continuous spun sheath having an irregular thickness,

Figure 2 shows a multi-core cable in cross-section within a continuous sheath of constant thickness and spun with two stiffening or reinforcing foils,

Figures 3 and 4 are cross-sections of two further forms of sheath each constituted by separable parts,

Figures 5 and 6 show in side elevation and in axial section respectively a drum upon which a cable is wound when employing another method according to the invention,

Figure 7 shows diagrammatically the manner in which the cable and the intermediate element or strip are wound on the drum, and

Figures 8 and 9 illustrate, also diagrammatically, a further arrangement which employs endless bands.

Referring to Figure 1, the sheath shown is formed round the cable (including its insulation) by extrusion from a press, those walls of the sheath, which may be of lead or the like, lying adjacent to the two major flat faces of the cable being progressively thickened as shown. In Figure 2 metal foils 2 are fed from the press at the same time as the extruded sheath so that when the cable emerges the foils 2 are interposed between the major flat surfaces of the cable insulation 1 and the major flat inner surfaces of the sheath 3.

When employing either the sheath shown in Figure 1 or that shown in Figure 2 the sheath is stripped off after the cable has been subjected to vulcanisation, the foils 2 (in the case of Figure 2) being removed at the same time as the sheath. In this way a remarkably true flat surface is formed on each flat side of the cable insulation whilst at the same time the thickness of the cable is maintained constant.

According to another method a trough may first be formed in which the cable is placed prior to the vulcanising treatment. For example, as shown in Figure 3 the mould comprises a trough-

like part comprising a thickened base 4 with sides 5 furnished with ledges 6 for cooperating with a flat cover 7 which is also thickened. The two thickened sides of the mould constituted by the base 4 and the cover 7 form reinforcements which bear respectively against the major flat surfaces of the cable insulation, the cover 7 being retained in place by clinching over the ends 8 of the side walls 5. This operation may be effected by passing the mould containing the cable between the suitably shaped rollers of a press so as to ensure that the cover 7 is firmly locked to the trough. The interior surfaces 9 and 10 of the trough 4 and cover 7 are perfectly smooth and capable of resisting the forces applied during moulding and vulcanisation, so that the production if irregularities in the surfaces of the flat sides of the cable insulation during vulcanisation is obivated.

The trough-like part of the mould may be formed as shown in Figure 4 in which the two major or thickened walls 11 and 12 constitute part of the trough, the cover 13 constituting the fourth wall of the mould.

As shown in Figures 5, 6 and 7, the cable may be wound on a drum furnished with lateral cheeks, a metal band being wound between the convolutions of the cable. The cable thus lies at all points in engagement with metallic surfaces which are so juxtaposed as to constitute, in effect, a spiral mould whose cross-section is rectangular. Thus, on the one hand the flat surfaces of the cable are in contact respectively with two successive convolutions of the metal band and on the other hand the sides or edges of the cable are in contact with the surfaces provided by the two cheeks. In this arrangement the drum 14 is provided at a point in its periphery with a notch 15 connected to the cylindrical envelope by a helical ramp 15' so that the second convolution of the cable and the interposed metallic strip will lie over the first convolution without the formation of any gap or space between them. The drum 14 is gripped between two side walls or cheeks 16, 16', the cheek 16 being secured to the sleeve 17 whilst the cheek 18' is secured to a sleeve 18 which can slide on the sleeve 17 so that the separation of the cheeks can be regulated as required. The drum 14 is constituted by a fixed cylinder secured in position by screws 19. The assemblage and the pressure may be ensured by a nut 34 provided with a key 35 and a driving part 36 of square cross-section to which the drive can be transmitted from a motor.

This apparatus may be employed for cables of all dimensions by a simple adaptation of the fixed cylinder and by suitably determining the dimensions of the intermediate metallic strip or band. A rack 20 may be provided which will cooperate with a suitable pawl thereby preventing unintentional unrolling of the convolutions on the drum. The drum may be driven by a belt 21 (Figure 7) or any other suitable means whilst the cable (including the insulation) is fed from between rollers 22 to the drum and the metallic band 25 is fed to the drum from a roll 24.

When the cable and intermediate metallic band or strip have been wound on the drum the necessary pressure between the cheeks 16 and 16' adjacent to the outer periphery thereof is ensured by bolts 26 and spacers 27, the drum carrying the cable and metallic strip being then subjected to heat so as to vulcanise the cable insulation.

Figures 8 and 9 illustrate one form of apparatus whereby the vulcanisation can be carried out continuously. In this arrangement the cable 28 as it leaves the machine is engaged between four endless metallic bands 28, 30, 31, 32, which are so juxtaposed as to constitute a mobile mould of rectangular cross-section. The bands 29 and 31 constitute the major flat surfaces which are applied to the major flat faces of the cable insulation during vulcanisation, thus ensuring that these surfaces are free from irregularities and the cable thickness is constant. The smaller flat sides of the mould are constituted by the endless bands 30 and 32, the four endless bands being preferably so disposed adjacent to each other that, as shown in Figure 8, the longitudinal axis of each of them is slightly displaced with respect to the axis of the cable. In this way the endless bands will accurately adapt themselves relatively to each other and assure the required dimensions of the cable.

Having formed the mould as above described pressure members or guides 33 are arranged against the endless bands so that these will be accurately maintained against the cable with the correct spacing. The mobile mould thus formed extends through the vulcanisation chamber whose limiting walls are indicated by the lines *a*—*a* and *b*—*b*.

The invention includes as new industrial products not only the finished cables made by the method according to the invention but also the semi-finished product constituted by the insulated cable furnished with the temporary sheath or mould, and the mould itself.

The invention may be employed for the production of various forms of flattened or strip-like cable including a single conducting core or a number of conducting cores spaced apart in a plane parallel to the major cross-sectional axis of the cable.

According to a further feature of the invention the conducting core or cores of a flattened cable may be individually insulated and means provided between the individual insulation of each core and the main body of the surrounding insulation whereby this surrounding insulation is prevented from adhering to the insulation of the individual core or cores. To this end talc may be applied to the surface of the individual insulation of each core before moulding the insulated cores in the main body of insulation. In this way, extremities of the individual cores can retain their insulation right up to the point to which they are connected.

It will be understood, however, that whatever the internal arrangement of the core or cores within the main body of the insulation, the method according to the invention will ensure that in the case of a cable having four flat sides, the cable will be precisely rectangular so that the length of the cable can readily be superposed or juxtaposed within the minimum space. Moreover, the cable produced is very flexible and can be readily rolled and unrolled. When the cable produced is accurately rectangular in cross-section layers or lengths of the cable can easily be assembled in the form of precise geometric groups which can be readily maintained by means of supports such for example as clips or clamps. Particularly when such cables are stacked they do not have the tendency to slide one over the other since their flat faces lie exactly one on the other as opposed to cables having curved surfaces which would tend to slide off each other.

JEAN LEPETIT.