Jan. 18, 1949. C. A. DE VYVER 2,459,688

INSULATING TUBULAR COVERING AND METHOD OF MAKING THE SAME

Filed June 1, 1946

Fig. 1.

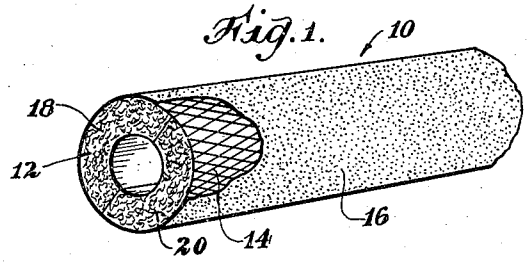



Fig. 2.

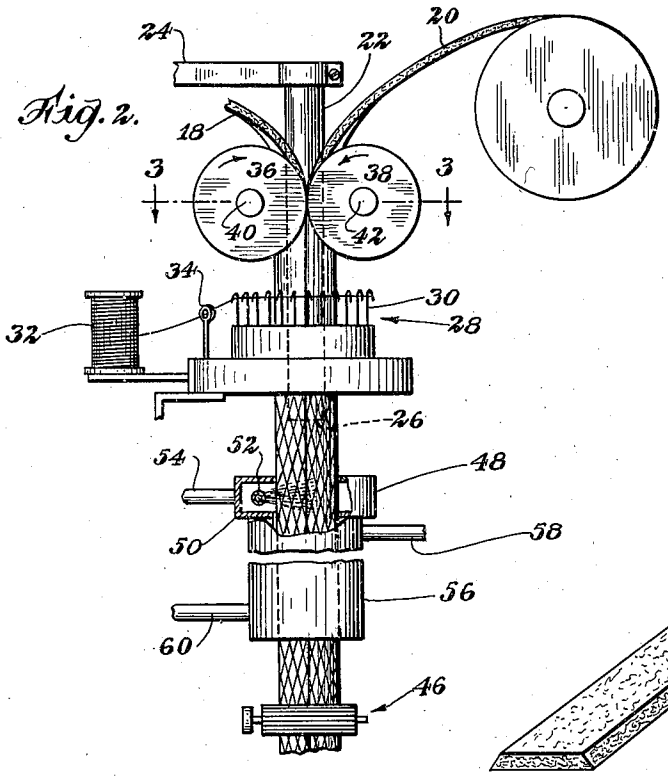
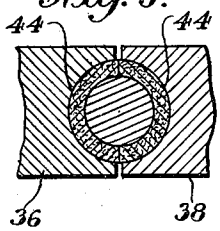



Fig. 4.



Fig. 3.




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## INSULATING TUBULAR COVERING AND METHOD OF MAKING THE SAME

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10 Claims. (Cl. 66—190)

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The present invention relates to insulating coverings and to a method of their manufacture and has for its principal object the provision of an improved, tubular insulating covering for pipes, tubes and other similar lines; for example, water, oil and air lines and the like. The tubular covering in the preferred embodiment of the invention is flexible and may be fed lengthwise onto a pipe and conformed to the irregularities and curvatures thereof.

Another object of the invention is the provision of an insulating covering including a tubular layer of insulating material and a flexible sleeve enclosing and confining the tubular layer.

A further object of the invention is the provision of a covering of the type referred to in which the insulating layer is composed of a preformed, felted, fibrous material, such as hair felt, mineral wool felt, or the like. A still further object of the invention is the provision of a method of making such covering, the method involving the application of the preformed, felted material in strip form to a mandrel, the shaping of the material around the mandrel to form a tubular layer, and the knitting of a seamless sleeve around the layer of insulating material.

My invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description of a preferred embodiment of the invention which is to follow and to the accompanying drawing in which:

Fig. 1 is a perspective view of a tubular covering in accordance with the invention;

Fig. 2 is a diagrammatic, elevational view with parts in section of an apparatus for carrying out the method;

Fig. 3 is an enlarged, sectional view taken on the line 3—3 of Fig. 2; and

Fig. 4 is a detail view of an element of the covering.

Referring now to the drawings and particularly to Fig. 1, the product of the invention comprises a tubular insulating covering 10 adapted particularly for use as an insulation for pipes, tubes and the like. The product is used, for example, for covering copper water lines employed in vehicles, buildings and other structures although as will be appreciated, it is adapted to serve other purposes. The covering includes a

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tubular insulating layer 12 and an outer sleeve 14 of preferably seamless, flexible construction, enclosing and confining the insulating layer. If desired, a waterproof coating 16 may be applied over the sleeve to retard or prevent the penetration of moisture into the insulating material and to give the covering a finished appearance. Coating materials such as bitumens, rubbers, glues, vinyl resins, natural or synthetic gums or resins and the like may be used for this purpose, the selection of the particular coating depending upon the particular characteristics desired.

Insulating layer 12 is composed of a preformed, self-sustaining, felted, fibrous material such as a conventional hair felt, mineral wool felt, glass felt or the like. The felt may include a suitable binder to maintain the inter-felted relationship of the fibers. For example, a mineral wool felt containing a minor proportion of a distributed binder made by the method disclosed in Powell Reissue Pat. No. Re. 22,090, dated May 5, 1942, is entirely suitable. The selected, preformed, felted material of the thickness required for the insulating layer is preferably supplied in sheet form and is divided into strips. These strips are formed into tubes, the longitudinal dimension of the strips extending lengthwise of the tubes. In the preferred embodiment of the invention a plurality of strips are used to make up a tube, two being employed as indicated by the reference characters 18 and 20 in the form of the invention illustrated in Fig. 1. Strips 18 and 20 are trapezoidal in cross-section whereby, when they are deformed transversely to define tube sections, with their shortest base dimensions at the interior of the tube, their adjacent edges meet in radial planes. A strip of the preferred cross-sectional shape is illustrated in Fig. 4.

Sleeve 14 is formed of a flexible, distortable, seamless fabric and suitably is a knitted tube. The knitting strands are selected to impart to the product the desired properties or characteristics, but preferably are fine wires or cut strands of metal or alloys of metal. The harder metals or alloys, such as steel, nichrome, monel metal, inconel and the like, may be used where the covering is to be subjected to extremely high temperatures. On the other hand, if the covering is to be employed under ordinary, or reasonably high temperature conditions, softer metals such as

copper, or even textile strands, including asbestos strands, cotton strands, or the like, may be employed. Where metal strands are used as is preferred, relatively fine strands, say, those having a diameter of about 0.006", are selected, and the fabric is preferably knitted to have relatively small mesh openings, for example, mesh openings of about 1/16". However, it will be understood that the gauge of the strands and the size of the stitches may vary considerably.

Referring now particularly to Figs. 2 and 3, the method of forming the tubular covering is illustrated. The method is carried out with suitable apparatus including a stationary mandrel 22, supported from some fixed portion of the frame as by bracket 24, and having a free, unsupported end 26. The mandrel is in the form of a rod of circular cross-section and extends centrally through a circular knitting machine of known type, including a stationary cylinder 28 carrying needles 30. One or more spools 32 of the selected strand material from which the sleeve 14 is to be fabricated are supported from the machine, as indicated, to be rotated around the cylinder, the strand extending from the supply through a guide 34 to the knitting point. The drive for the knitting machine, the supporting members and other conventional operating parts, such as the needle cam structure, and the like, have not been shown, and the knitting machine elements referred to have been shown only diagrammatically, as such features may be of any conventional known type and, per se, form no part of the invention.

Supported above the knitting machine are forming members 36 and 38 comprising rollers mounted for, preferably, free rotation on supporting shafts 40 and 42, respectively. Rollers 36 and 38 are provided on their circumferential surfaces with grooves 44 of semi-circular cross-section, the grooves, when the rollers are in substantially contacting relationship as illustrated in Fig. 3 defining a circle concentric to the mandrel and of substantially the outer diameter of the tubular insulating layer. Below the knitting machine is a take-off device 46 comprising opposed, knurled rolls driven from any suitable source (not shown).

In the operation of the device as thus far described, strips 18 and 20 are fed from suitable supplies between the forming rolls and the mandrel, the latter serving to deform or longitudinally wrap the strips around the mandrel and to bring the edges of the strips into adjacent relationship. As the strips pass below the forming members they may spring apart to some extent but will approximate a tube. This tube is threaded through the knitting machine and then through the rolls of the take-off device. The knitting machine is then placed in operation and the take-off device driven in timed relationship to the operation of the knitting machine. The take-off rolls cause a constant downward movement of the strips from the supplies and through the forming device and the knitting machine. As the approximately cylindrical tube passes through the knitting machine, sleeve 14 is knitted around it, the resilient characteristics of the knitted fabric forcing the sections of the insulating layer into closely adjacent relationship to define a true tube.

Where a coating 16 is desired, the selected coating material is applied by coating device 48 which may take any suitable form but, as shown, includes a housing 50 supported from the frame of the apparatus and enclosing a spray ring 52 connected with any suitable source of coating supply (not shown) by coating line 54. The coating is sprayed on the covering as the latter passes through the spray ring, the coating forming a protective layer overlying the knitted mesh and also penetrating the interstices of the mesh, at least to some extent. Directly below the coating device and suitably connected to it is a setting chamber 56. The setting chamber may be of any construction and length required to dry or set the particular coating material applied by coater 50. As shown, the chamber is in the form of an extended tube having inlet and outlet ports 58 and 60, respectively, through which a setting medium such as steam, hot air, or the like may be circulated, to completely or substantially completely set the coating before the covering leaves the lower end of the chamber.

The flexible insulating covering formed in a continuous length, as described above, may be cut into units of any suitable size for selected purposes. The tube is flexible and may be readily threaded onto the extended pipe lines to conform to their irregularities and curvatures. The operation is economical and may be carried out at high speed.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. A flexible, tubular covering composed of a felted, preformed, self-sustaining, fibrous material forming a tubular layer, and an enclosing and confining sheath comprising a seamless sleeve.

2. A flexible, tubular covering comprising a felted, preformed, self-sustaining, fibrous, material defining a tubular layer and a knitted sleeve enclosing and confining said layer.

3. A flexible, tubular covering comprising a felted, preformed, self-sustaining, fibrous, material defining a tubular layer, a sleeve of knitted metal mesh enclosing and confining said layer, and a waterproof coating on said sleeve.

4. A flexible, tubular covering comprising an insulating layer including preformed, self-sustaining, felted, fibrous material shaped into tubular form, and a knitted sleeve of metal mesh enclosing and confining said material in its tubular form.

5. A flexible insulating covering comprising an insulating layer including preformed, self-sustaining, felted strips shaped transversely to jointly define a tube, and a knitted sleeve enclosing and confining said layer in its tubular form.

6. An insulating, tubular covering comprising an insulating layer including preformed, felted strips, trapezoidal in cross-section and shaped transversely to jointly define a tube, and a knitted sleeve of metal mesh enclosing and confining said layer in its tubular form.

7. An insulating, tubular covering comprising an insulating layer including preformed, felted strips, trapezoidal in cross-section and shaped transversely to jointly define a tube, a knitted sleeve of metal mesh enclosing and confining said layer in its tubular form, and a waterproof coating on said sleeve.

8. The method of forming a tubular covering comprising applying felted, self-sustaining, insulating material to a mandrel to extend longi-

tudinally thereof and to form a tube, and knitting a sleeve around said tube.

9. The method of forming a tubular insulating covering comprising feeding flat, self-sustaining strips of felted, fibrous material between forming rolls and a mandrel to conform said strips to said mandrel and to form a tube, and knitting a seamless sleeve around said tube.

10. The method of forming a tubular insulating covering comprising feeding flat, self-sustaining strips, trapezoidal in cross-section between forming rolls and a mandrel to conform said strips to said mandrel and to form a tube, and knitting a seamless sleeve around said tube.

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