Oct. 23, 1962 F. E. SINDARS 3,060,069

INSULATING JACKET FOR FLUID LINES AND THE LIKE

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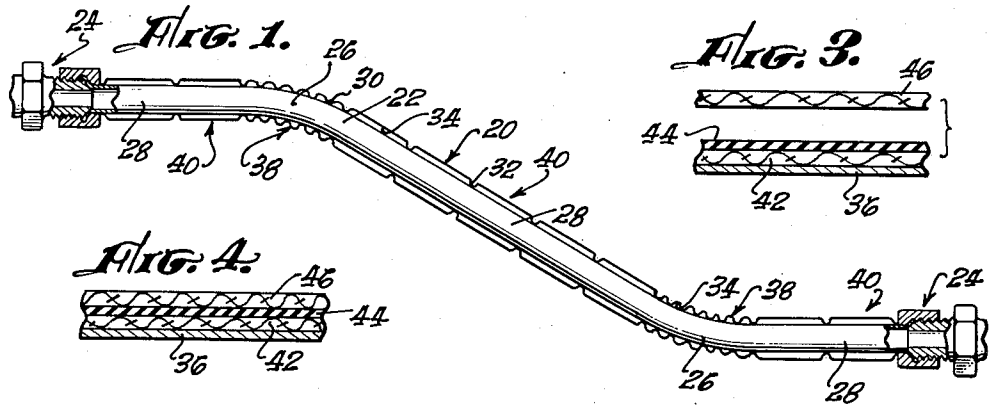
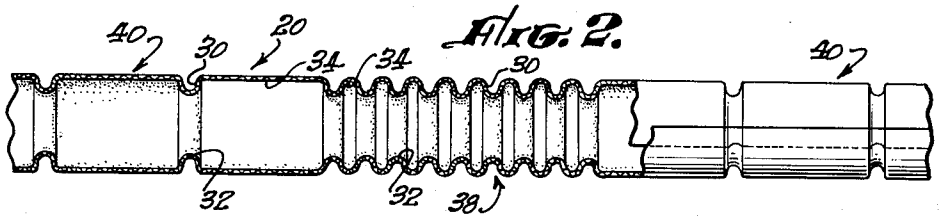




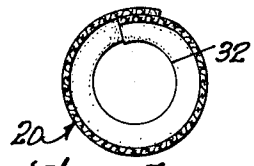
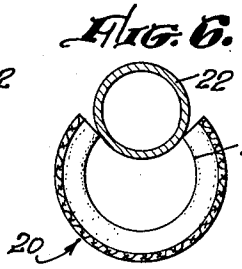


FIG. 5.



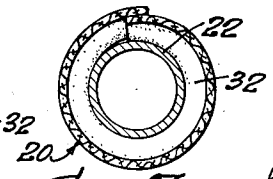
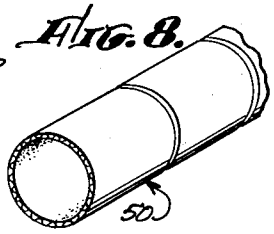
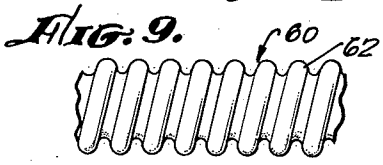
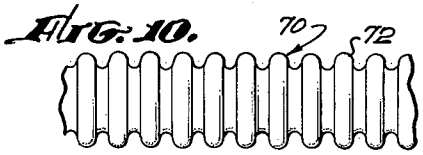
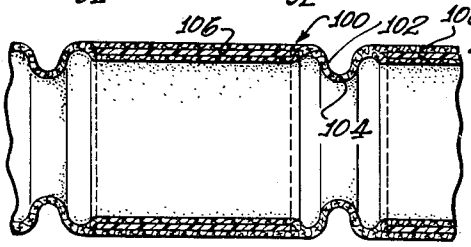


FIG. 7.









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INSULATING JACKET FOR FLUID LINES AND THE LIKE

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11 Claims. (Cl. 154—45)

The present invention relates in general to insulating jackets for application to members to be insulated and, more particularly, to insulating jackets for minimizing heat transfer to or from the insulated members, a primary object of the invention being to provide a sheet-like insulating jacket which is adapted to enclose the member to be insulated and which includes means engageable with the insulated member for spacing portions of the jacket outwardly from the insulated member to provide substantially dead air spaces around the member.

The invention is particularly applicable to a tubular insulating jacket for heat insulating such elongated members as fluid conductors, electrical conductors, and the like. For convenience in disclosing the invention, it will be considered herein as embodied in a tubular insulating jacket for application to relatively small fluid lines, such as fuel lines, hydraulic lines, and the like, which are to be insulated against heat transfer thereinto. However, it will be understood that the invention is susceptible of other applications.

An important object of the invention is to provide a tubular insulating jacket for a member such as a fluid line which jacket is formed with spaced indentations providing spaced internal ribs engageable with the member, the insulating jacket being spaced outwardly from the member between the internal ribs to provide substantially dead air spaces therebetween.

More particularly, an important object is to provide a tubular insulating jacket having longitudinally spaced, circumferential indentations which provide the tube with longitudinally spaced, circumferential internal ribs engageable with the member and providing dead air spaces therearound. In some embodiments of the invention, the longitudinally spaced indentations and internal ribs are annular while, in others, they are helical.

Another object is to provide tubular insulating jackets wherein the circumferential indentations are closely spaced where flexibility is required to accommodate bends in the member to be insulated, and to provide tubular insulating jackets wherein the circumferential indentations are spaced relatively far apart longitudinally of the jacket where such flexibility is not required.

Another object is to provide a tubular insulating jacket having one or more portions provided with closely spaced indentations to render such portions flexible to accommodate tubing bends, and the like, and having one or more portions wherein the circumferential indentations are spaced relatively far apart to accommodate straight tubing sections. A related object is to provide such a tubular insulating jacket wherein the portions mentioned are either integral, or are separate tubes having overlapping ends.

The tubular insulating jacket of the invention may be slipped over one end of a fuel line, or the like, during installation of such line, in which case the jacket may be circumferentially continuous.

An important object of the invention, however, is to

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provide a tubular insulating jacket which is longitudinally split so that it may be slipped onto a previously installed member laterally by separating the jacket at the longitudinal split therein, the jacket being sufficiently resilient to close around the member after it is slipped laterally thereonto. Another object in this connection is to provide a longitudinally-split tubular insulating jacket which has overlapping longitudinal edges to insure circumferential continuity of the insulating effect of the jacket upon installation.

Another object is to make the tubular insulating jacket of the invention in the form of a plastic sheet, and particularly a reinforced plastic sheet. Preferably, the jacket is formed of an elastomeric material having a fibrous reinforcing material, such as glass, cloth, asbestos, or the like, embedded therein. In some instances, however, the jacket may include a metallic reinforcing material.

Another object of the invention is to provide the insulating jacket with a radiant heat reflecting surface to assist in minimizing heat transfer, the reflecting surface being either the inner or the outer surface of the jacket, depending on whether outward or inward heat transfer is to be minimized.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the art in the light of this disclosure, may be achieved with the exemplary embodiments of the invention described in detail hereinafter and illustrated in the accompanying drawing, wherein:

FIG. 1 is a semidiagrammatic view, partially in section and partially in elevation, illustrating one embodiment of the invention as installed on a fluid line;

FIG. 2 is an enlarged view, partially in longitudinal section and partially in elevation, illustrating in more detail the embodiment of the invention which is shown in FIG. 1;

FIG. 3 is an exploded view showing components of the embodiment of FIG. 2 prior to assembly;

FIG. 4 is a view similar to FIG. 3, but showing the components illustrated therein in assembled condition;

FIG. 5 is a transverse sectional view of the embodiment of FIG. 2;

FIG. 6 is a transverse sectional view illustrating how the embodiment of FIG. 2 is slipped onto a fluid line, or the like;

FIG. 7 is a transverse sectional view showing the embodiment of FIG. 2 in place on a fluid line;

FIG. 8 is a perspective view of another embodiment of the invention;

FIGS. 9 and 10 are elevational views respectively showing still other embodiments of the invention; and

FIGS. 11 and 12 are fragmentary longitudinal sectional views respectively showing still other embodiments of the invention.

Referring first to FIG. 1 of the drawings, illustrated therein is a tubular insulating jacket **20** of the invention in place on a fluid line **22**. The latter may be a fuel line, hydraulic line, or the like, and is shown as connected at its ends to fittings **24** in a conventional manner. The fluid line **22** is shown as provided intermediate its ends with bends **26** and straight, or substantially straight, sections **28**.

The jacket **20**, which will be described in more detail

hereinafter, comprises a relatively flexible sheet formed into a tube of a size to receive the fluid line **22**. The jacket **20** is provided with a plurality of annular indentations or corrugations **30** which form internal annular ribs **32** engageable with the fluid line **22**. The internal ribs **32** space the jacket outwardly from the fluid line **22** to provide between the ribs dead air spaces **34** which act to minimize heat flow to or from the fluid line, depending upon the direction of any temperature differential between the fluid line and the surrounding atmosphere. As will be discussed hereinafter, the material of the jacket **20** itself has heat insulating qualities which further minimize heat transfer. Also, the jacket **20** may be provided with a radiant heat reflecting coating **36**, FIGS. 3 and 4, such coating being either on the inner surface or the outer surface of the jacket depending upon whether outward or inward heat flow is to be minimized.

The jacket **20** is provided with portions **38** at the bends **26** wherein the indentations **30** and ribs **32** are quite closely spaced to render the jacket **20** sufficiently flexible in the vicinities of the bends to accommodate them readily. Preferably, the ribs **32** are longitudinally spaced apart throughout the flexible portions **38** distances of the order of the longitudinal dimensions of the ribs to achieve the desired flexibility.

However, the ribs **32** are spaced apart considerably farther throughout portions **40** of the jacket **20** which are designed to fit the straight sections **28** of the fluid line **22**. Preferably, the longitudinal spacing of the ribs **32** throughout the portions **40** of the jacket **20** is several times the longitudinal dimensions of the ribs. Such increased spacing of the ribs **32** throughout the portions **40** of the jacket **20** reduces the heat flow through such portions, as compared to the heat flow through the flexible portions **38**, for several reasons. First, the area of contact between the jacket **20** and the fluid line **22** is reduced by increasing the spacing of the ribs **32** in the portions **40**. Secondly, the volume of the dead air spaces **34** in the portions **40** is increased. Third, more radiant heat is reflected away by the use of relatively long unindented or uncorrugated sections throughout the portions **40**, it being apparent that, in the flexible portions **38**, some of the reflected radiant heat is reflected against the surfaces of the indentations **30** so that more of it is transmitted through the jacket. Thus, by using closely spaced indentations **30** and ribs **32** only where necessary for flexibility, the over-all heat flow through the jacket **20** is minimized, which is an important feature.

Considering the physical characteristics of the jacket **20**, it comprises, in effect, a plastic sheet formed into a tube. More particularly, the wall of the jacket **20** preferably comprises a reinforced plastic material, the reinforcement preferably being fibrous in nature, although other reinforcing materials may be used, and the plastic material being elastomeric, although nonelastomeric materials may be utilized in some instances, such as, for example, where the jacket is to be used only on straight members and is adapted to be slipped over the ends of such members.

FIG. 3 shows a cross section of a fragment of the wall of the jacket **20** prior to assembly, the jacket wall being shown as including a reinforcing layer **42** which is preferably glass cloth, but which may be asbestos mat, asbestos cloth, or cloth of a material such as nylon, rayon, or the like. In some instances, the layer **42** may even be metallic cloth for greater strength, electrical continuity, or the like. The layer **42** is provided on one side with the radiant heat reflecting coating **36**, which may be an aluminum coating applied by vapor deposition. However, other reflective materials may be used. If the coating **42** is uniformly applied throughout the entire length of the jacket **20**, it is made thin enough to provide the required flexibility throughout the flexible portions **38** of the jacket. However, the reflective coating may be applied non-uniformly with sufficient thickness to rigidify at least to some extent portions which are not required to flex.

The reinforcing layer **42** is impregnated with a plastic material, preferably an elastomeric material such as rubber, and, in the construction shown, is provided with a coating **44** of the same or a similar material. The purpose of the coating **44** is to permit bonding to the reinforcing layer **42** a second reinforcing layer or ply **46**, which is also impregnated with a material the same as or similar to that of the reinforcing layer **42** and the coating **44**. FIG. 4 of the drawing shows the two reinforcing layers or plies **42** and **46** bonded together, as by vulcanizing, or otherwise curing, the plastic material employed.

As will be apparent, the tubular jacket **20** may be slipped over an end of a fluid line prior to connecting such end of the fluid line to a fitting, or the like. However, an important feature of the invention is that the jacket **20** may be installed on a fluid line, such as the fluid line **22**, with the line in place and connected at its ends to the fittings **24**, for example. To achieve this, the jacket **20** is longitudinally split and is sufficiently flexible that it may be slipped onto the fluid line **22** laterally, as shown in FIG. 6, by separating the longitudinal edges of the jacket sufficiently to receive the fluid line therebetween. Thus, the jacket **20** may be applied readily to existing fluid lines.

In order to provide an insulating effect which is circumferentially continuous, the longitudinal edges of the jacket **20** overlap sufficiently, as shown in FIG. 7, upon installation on the fluid line to render the insulating qualities of the jacket in the vicinity of the joint between the longitudinal edges thereof substantially equal to the insulating qualities thereof intermediate the longitudinal edges. As shown in FIG. 5, the jacket **20** is formed initially with a somewhat greater overlap between the longitudinal edges thereof than exists in the final installation, shown in FIG. 7. The reason for this is to have the jacket **20**, when installed on the fluid line **22**, in a somewhat stressed condition so that it will tend to close around the fluid line and thus cling thereto in a positive manner. In other words, the jacket **20** tends to resume the original configuration shown in FIG. 5, and thus firmly grips the fluid line **22** when installed thereon as shown in FIG. 7. It will be understood that the jacket **20** is cured initially while in the original configuration of FIG. 5 so that it always tends to resume this configuration.

Referring now to FIG. 8 of the drawing, illustrated therein is a tubular insulating jacket **50** of the invention which is similar to the portions **40** of the jacket **20**, except that it is not longitudinally split. The jacket **50** is designed to be utilized on a straight fluid line, electrical conductor, or the like, and to be slipped over one end thereof. However, the jacket **50** may also be provided with flexible portions, not shown, similar to the flexible portions **38** of the jacket **20**, to accommodate bends.

FIGS. 9 and 10 of the drawing respectively show tubular insulating jackets **60** and **70** which are similar to the jacket **20**, or the jacket **50**, except that they are provided with circumferential indentations **62** and **72**, respectively, which are closely spaced throughout the entire lengths of these jackets. Thus, the jackets **60** and **70** are similar to the flexible portions **38** of the jacket **20** throughout their entire lengths and are flexible throughout their entire lengths. The jackets **60** and **70** differ in that the indentations **62** of the jacket **60** are helical, while the indentations **72** of the jacket **70** are annular. As will be apparent, the jacket **60** provides a single, helical air space when installed on a member to be insulated, whereas the jacket **70** provides a plurality of separate, longitudinally spaced air spaces. Thus, the jacket **70** is more effective from the standpoint of minimizing heat flow since the air spaces provided thereby are actually dead air spaces, whereas there can be some air flow from one end of the air space of the jacket **60** to the other unless the ends of such air space are completely closed upon installation of the jacket **60**.

Referring to FIG. 11 of the drawing, illustrated therein is a tubular insulating jacket **80** which is similar to the jacket **20** in that it includes a flexible portion **82** hav-

ing closely spaced indentations and internal ribs **84** and **86** and includes less flexible portions **88** having more widely spaced indentations and internal ribs **90** and **92**. The jacket **80** differs from the jacket **20** in that the flexible portion **82** and the more rigid portions **88** are separate tubes overlapped at their adjacent ends. As shown, the internal rib **86** at one end of the portion **82** is disposed in the indentation **90** at the adjacent end of one of the portions **88**. At the other end of the portion **82**, one of the ribs **92** of the other portion **88** is disposed in the endmost indentation **84** of the portion **82**. However, this specific overlapping relation between the portions **82** and **88** may be varied as dictated by the conditions under which they are to be used. The portions **82** and **88** of the jacket **80** may either be circumferentially continuous, or they may be longitudinally split.

FIG. 12 of the drawing shows a tubular insulating jacket **100** which is similar to one of the portions **40** and **88** of the jackets **20** and **80** in that it includes relatively widely spaced indentations **102** forming internal ribs **104**. The jacket **100** differs in that it is provided with additional reinforcing elements **106** embedded, as by molding, in the wall of the jacket **100**. These reinforcing elements may be made of any suitable material, such as a plastic material, or a metallic material. The jacket **100** may be circumferentially continuous, or it may be longitudinally split in the same manner as the jacket **20**. In the latter event, the reinforcing elements **106** are sufficiently flexible to permit slipping the jacket **100** laterally onto a member to be insulated. In this instance, the reinforcing elements **106** assist in gripping the insulating member.

Although several exemplary embodiments of the invention have been disclosed herein for purposes of illustration, it will be understood that other embodiments of the invention are possible and that various changes, modifications and substitutions may be incorporated in the embodiments disclosed, all without departing from the spirit of the invention as defined by the claims which follow.

I claim:

1. A heat insulating jacket for such members as fluid lines, electrical conductors, and the like, comprising a heat insulating tube adapted to receive therein a member to be insulated, said tube having longitudinally spaced indentations therein which provide said tube with longitudinally spaced internal ribs engageable with the member, said tube being spaced outwardly from the member between said internal ribs to provide substantially dead air spaces therebetween, and said tube having a radiant heat reflecting coating.

2. A tubular jacket of flexible heat insulating material having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket having a portion in which said internal ribs are longitudinally spaced apart distances of the order of the longitudinal dimensions of said internal ribs, and said jacket having another portion in which said internal ribs are longitudinally spaced apart distances several times the longitudinal dimensions of said internal ribs, the outside diameters of said portions of said jacket being substantially equal.

3. A tubular jacket of flexible heat insulating material having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket having a portion in which said internal ribs are longitudinally spaced apart distances of the order of the longitudinal dimensions of said internal ribs, and said jacket having another portion in which said internal ribs are longitudinally spaced apart distances several times the longitudinal dimensions of said internal ribs, the outside diameters of said portions of said jacket being substantially equal, said portions of said jacket being integral.

4. A tubular jacket of flexible heat insulating material

having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket having a portion in which said internal ribs are longitudinally spaced apart distances of the order of the longitudinal dimensions of said internal ribs, and said jacket having another portion in which said internal ribs are longitudinally spaced apart distances several times the longitudinal dimensions of said internal ribs, the outside diameters of said portions of said jacket being substantially equal, said portions of said jacket being separate tubes having overlapping ends.

5. A tubular heat insulating jacket of flexible material having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket having a portion in which said internal ribs are longitudinally spaced apart distances of the order of the longitudinal dimensions of said internal ribs, said jacket having another portion in which said internal ribs are longitudinally spaced apart distances several times the longitudinal dimensions of said internal ribs, the outside diameters of said portions of said jacket being substantially equal, said jacket being longitudinally split and having overlapping longitudinal edges, and said jacket being resilient so that it is inherently biased toward a cross sectional configuration wherein said longitudinal edges overlap.

6. A tubular jacket of flexible heat insulating material having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket being longitudinally split and having overlapping longitudinal edges, and said jacket being resilient so that it is inherently biased toward a cross sectional configuration wherein said longitudinal edges overlap.

7. A tubular heat insulating jacket having indentations therein which provide said jacket with internal ribs, said jacket being longitudinally split and having overlapping longitudinal edges, and said jacket being resilient so that it is inherently biased toward a cross sectional configuration wherein said longitudinal edges overlap.

8. A tubular jacket of flexible heat insulating material having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket having a portion in which said internal ribs are longitudinally spaced apart distances of the order of the longitudinal dimensions of said internal ribs, and said jacket having another portion in which said internal ribs are longitudinally spaced apart distances several times the longitudinal dimensions of said internal ribs, the outside diameters of said portions of said jacket being substantially equal, said other portion of said jacket having reinforcing elements embedded therein intermediate said internal ribs thereof.

9. A tubular heat insulating jacket formed of a fibrous material impregnated with an elastomeric material and having longitudinally spaced indentations therein which provide said jacket with longitudinally spaced internal ribs, said jacket being longitudinally split and having overlapping longitudinal edges, and said jacket being resilient so that it is inherently biased toward a cross sectional configuration wherein said longitudinal edges overlap.

10. A two-piece tubular jacket of flexible heat insulating material having pieces telescoped together in end-to-end relation, one of the pieces of said jacket having internally thereof means for spacing it radially outwardly from a member therein which is to be insulated, the other piece of said jacket having longitudinally spaced internal ribs spaced apart distances of the order of their longitudinal dimensions.

11. A tubular jacket of flexible heat insulating material having means internally thereof for spacing it radially outwardly from a member therein to be insulated, said jacket being longitudinally split and having overlapping longitudinal edges, and said jacket being resilient so that it is inherently biased toward a cross sectional configuration wherein said longitudinal edges overlap, where-

by said jacket may be slipped laterally onto a member to be insulated by spreading said longitudinal edges apart sufficiently to receive the member therebetween, the resilience of said jacket subsequently causing said longitudinal edges to resume an overlapping relation with said jacket spaced radially outwardly from the member to be insulated.

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