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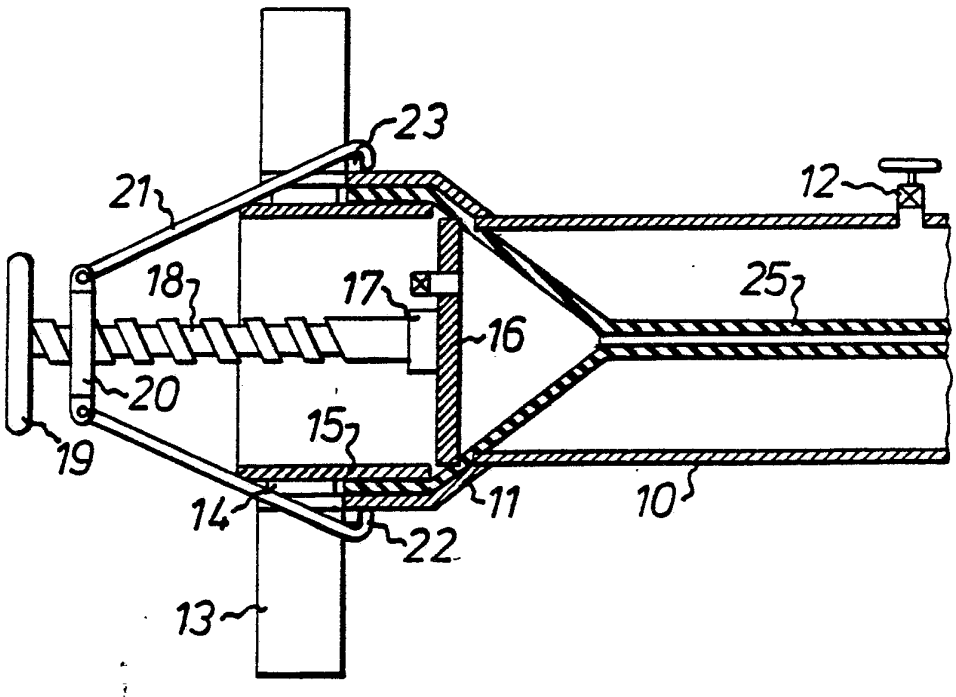

(57) Abstract

A body is provided with a relatively thick coating of elastic material by first expanding a sleeve (25) of said material, which is closed at one end, under the action of compressed air into engagement with the inner side of a tight casing (10) surrounding said sleeve, while venting the closed space between said sleeve (25) and said casing (10) via a valve (12). By closing the valve (12), the sleeve (25) is maintained in its expanded state, and the body is inserted therein, whereupon air is again admitted into the said space by opening the valve (12) so that the sleeve (25) contracts around and firmly engages the body.

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METHOD AND APPARATUS FOR ENCLOSING A BODY IN A RELATIVELY THICK ENCLOSURE OF ELASTIC MATERIAL

The present invention relates to a method of enclosing a body in a relatively thick enclosure of elastic material, especially rubber.

In many applications, there is a demand for rigid bodies made of, for example, wood, metal or concrete and having a relatively thick outer coating of rubber or other elastic material. Examples of such bodies are fenders of various types and rollers for roller conveyors. Providing these bodies with such a coating is difficult because considerable forces are required for expanding for example a rubber sleeve to such an extent that the body can be inserted therein, and for removing the expanders after the expansion. It is, of course, also conceivable to apply the coating by immersion of the body, or by vulcanisation technique, but also these methods are difficult and, above all, highly expensive.

The principal object of this invention is to eliminate the above-mentioned difficulties and to provide bodies with such a relatively thick external coating in a simple manner and at low cost. A further object of the invention is to enclose, in similar manner, liquid and gaseous bodies in a casing such that the casing exerts a considerable pressure on the body so that the body, if desired, can escape under pressure. These objects are attained in that the enclosing material, in the form of a sleeve or the like which is open at one end and has a cavity of a cross-sectional area far smaller than that of the body, is inserted in a tight casing of rigid material; that the open end of the sleeve is widened and tightly connected to the casing wall defining the entrance opening; that the widened sleeve end is tightly sealed by means of a sealing member that can

be clamped thereagainst; that pressure fluid is supplied to the cavity of the sleeve by means of a valve provided in said sealing member, while at the same time withdrawing the air from the space between the casing and the sleeve via a valve mounted in the casing wall; that the supply of pressure fluid is continued until the outer side of the sleeve substantially engages the inner side of the casing, the valve in the casing wall being closed so that the sleeve is maintained in its expanded state when the valve in the sealing member is opened and the sealing member is removed; that the body is inserted in the expanded sleeve; that the valve in the casing is opened, whereby the sleeve endeavours to resume its original dimension and thus tightly and with considerable force engages and endeavours to compress the body; and that finally the widened end of the sleeve is loosened from the casing and, if necessary, is sealed, and the enclosed body is removed from the casing.

The invention also comprises an apparatus for enclosing a body in a relatively thick enclosure of elastic material, especially rubber, said apparatus being characterised by a casing of rigid material, such as steel, which has been dimensioned on the basis of the dimensions of said body and said enclosure and which is open at one end but otherwise is closed, and in which the enclosing material can be inserted in the form of a sleeve or the like open at one end; a clamping device mounted at the open end of said casing and movable into engagement with the open end of said sleeve to clamp said end into tight engagement with the wall portion defining the opening of said casing; a sealing member which can be tightly clamped in the sleeve opening clamped against the said wall; a valve provided in said sealing member and connectible to a pressure fluid source for supply of pressure fluid to the cavity of said sleeve for widening said sleeve into engagement with the inner side of said casing; and a valve provided in the casing wall for with-

drawing air from the space between said casing and said sleeve upon said widening, said valve being closable when said sleeve has been widened into engagement with the inner side of said casing to maintain said sleeve in the widened state, and again openable when the body, after removal of said sealing member, has been inserted in said sleeve, such that said sleeve can contract to tightly enclose said body.

The invention will be described in more detail below, reference being had to the accompanying drawing which illustrates schematically an embodiment of the invention and in which Fig. 1 is a lateral sectional view of an apparatus for coating rigid bodies with elastic material, while Fig. 2 shows the apparatus according to Fig. 1 from one end thereof.

As has been mentioned by way of introduction, it is the object of this invention to enclose a body in a "relatively thick" enclosure of elastic material, especially rubber. By the phrase "relatively thick" in the subsequent description and in the claims is meant a coating that can be expanded only by exerting considerable force, which normally means a wall thickness exceeding about 2 mm for the rubber compounds most frequently employed. In the following, an apparatus will be described which is especially intended for coating elongate bodies, for example long fenders for use along quays. It will be appreciated, however, that the principle of the invention is applicable also to other types of bodies, and also to liquid and gaseous bodies.

Fig. 1 shows a small part of a pipe 10 which is made of steel and is closed at the end not shown in the drawing. To the open end of the pipe 10, which is shown in the drawing, a collar 11 is welded which has a larger diameter than the casing 10. At a distance from the collar 11, the casing 10 is provided in its wall with a valve 12 which is readily opened and closed. As will appear from Fig. 2, clamping means 13 in the form of piston and cylinder

units are radially attached to the collar 11 adjacent the open end thereof. It is not necessary that the clamping means 13 are in the form of piston and cylinder units; they may also consist of mechanical means, such as gear racks and pawls etc. The piston rods of the piston and cylinder units 13 are directed radially inwards and, for reasons that will be explained below, are provided with clamping jaws 15 within the collar 11. A sealing disc which may also be in the form of a tapering body has a shape corresponding to the cross-sectional shape of the collar and the casing and a dimension corresponding approximately to the outer dimension of the casing 10 and can be inserted in the collar 11 and clamped against the casing 10 by means of a shaft 18 rotatably mounted on the side of the disc 16 facing away from the casing in a bearing means 17, said shaft extending through a plate 20 having a threaded opening and, at its outwardly facing end, a handwheel for rotation of said shaft. The plate 20 is anchored to the outer side of the collar 11 by means of arms 21 which, at their ends facing away from said plate 20, are provided with hooks 22. The arms 21 can be swung against the outer side of the collar 11 to enable the hooks to grasp lugs 23 mounted on the collar, as will appear from Fig. 1. For reasons that will be explained below, the sealing disc 16 is provided with a valve 24.

It is assumed that an elongate body is to be provided with a coating of relatively thick rubber, and to this end a rubber sleeve is chosen which has the requisite wall thickness and, in the relaxed state, a transverse dimension which is far below the outer transverse dimension of the body to be coated. The sleeve which is designated 25 in the drawing, naturally has a length adapted to the length of the body. First, one end of the sleeve is closed, for instance by bending the sleeve end and placing a clamping member over the bent portion. The sleeve 25 from which the sealing disc 16

and its associated parts have been removed, is inserted in the casing 10 until the open sleeve end is on a level with the open end of the collar 11. Next, the end of the sleeve 25 is widened, for example by moving two opposed clamping jaws 15 towards one another by means of said piston and cylinder units until they can be inserted in the opening of the sleeve 25, whereupon the clamping jaws 15 by means of said piston and cylinder units are caused to move away from one another while expanding the sleeve. After that, second clamping jaws can be inserted in the sleeve opening, and finally all piston and cylinder units are activated, such that they pull the sleeve portion adjacent the sleeve opening into tight engagement with the inner side of the collar 11, as is shown in Fig. 1. Between the inner side of the casing 10 and the outer side of the sleeve 25, a tight space has now been established, and this space is made to communicate with the atmosphere by opening the valve 12. After that, the sealing disc 16 is placed in the widened sleeve end, and after the hooks have been placed around the lugs in the manner shown in Fig. 1, the handwheel 19 is rotated, whereby the sealing disc 16 is tensioned inwards into engagement with the inner side of the widened end portion of the sleeve. In this manner, the interior of the sleeve is sealed against the atmosphere. A compressed air hose is then coupled to the valve 24, and by the supply of compressed air to the interior of the sleeve 25, the sleeve is expanded, simultaneously as the air is expelled from the said space between the sleeve and the casing via the valve 12. When the outer side of the sleeve 25 engages the inner side of the casing 10, the valve 12 is closed, which means that the sleeve 25 cannot resume its original shape when, after removal of the compressed air hose and opening of the valve 24, the sealing disc 16 is detached and removed. The body to be coated is now readily insertable in the widened sleeve 25, and when the valve 12

then is again opened and air flows into the said space, the sleeve 25 strives to resume its original shape and thus is urged against the outer side of the body with considerable force. After the sleeve portion held by the clamping jaws 15 has been released by activation of the piston and cylinder units, the body can be removed from the casing 10 and now carries a coating which tightly encloses the body and, to all intents and purposes, cannot be removed without destroying either the body or the coating.

In the above embodiment, it is assumed that the casing 10 is closed at its other end, and that the sleeve 25 is closed by being folded at its other end. It is, however, also possible to effect this sealing of the casing 10 and the sleeve 25 in the same manner as at the first-mentioned end, i.e. by means of clamping members and a sealing disc so that a body can be inserted from either end of the casing 10, thereby to make the work more efficient.

As has been intimated, the invention may also be used for enclosing liquid and gaseous bodies in a strong enclosure. After expansion of the rubber or plastic sleeve, the liquid or gaseous body is supplied via a valve or other supply means, and then the sleeve is allowed to contract in the manner described above. In contrast to the technique previously described, the open sleeve end must, in the latter case, be reliably sealed or connected to a suitable delivery valve so that the sleeve and the liquid or gaseous body enclosed therein can be used for discharging liquid or gas at high pressure.

The construction of the apparatus herein described is extremely simple and intended primarily for manual handling. However, the expert will appreciate that the coating work can readily be automated by using hydraulic or electric means and suitable control means. The invention thus is not restricted to the embodiment

illustrated in the drawing and described above, but may be modified within the scope of the appended claims.

CLAIMS

1. A method of enclosing a body in a relatively thick enclosure of elastic material, especially rubber, c h a r a c t e r i s e d in that the enclosing material, in the form of a sleeve (25) or the like which is open at one end and has a cavity of a cross-sectional area far smaller than that of the body, is inserted in a tight casing (10) of rigid material; that the open end of the sleeve (25) is widened and tightly connected to the casing wall defining the entrance opening; that the widened sleeve end is tightly sealed by means of a sealing member (16) that can be clamped thereagainst; that pressure fluid is supplied to the cavity of the sleeve (25) by means of a valve (24) provided in said sealing member (16), while at the same time withdrawing the air from the space between the casing (10) and the sleeve (25) via a valve (12) mounted in the casing wall; that the supply of pressure fluid is continued until the outer side of the sleeve (25) substantially engages the inner side of the casing (10), the valve (12) in the casing wall being closed so that the sleeve (25) is maintained in its expanded state when the valve (24) in the sealing member (16) is opened and the sealing member (16) is removed; that the body is inserted in the expanded sleeve (25); that the valve (12) in the casing (10) is opened, whereby the sleeve (25) endeavours to resume its original dimension and thus tightly and with considerable force engages and endeavours to compress the body; and that finally the widened end of the sleeve (25) is loosened from the casing and, if necessary, is sealed, and the enclosed body is removed from the casing (10).

2. An apparatus for enclosing a body in a relatively thick enclosure of elastic material, especially rubber, c h a r a c t e r i s e d by a casing (10) of

rigid material, such as steel, which has been dimensioned on the basis of the dimensions of said body and said enclosure and which is open at one end but otherwise is closed, and in which the enclosing material can be inserted in the form of a sleeve (25) or the like open at one end; a clamping device (13, 14, 15) mounted at the open end of said casing (10) and movable into engagement with the open end of said sleeve (25) to clamp said end into tight engagement with the wall portion defining the opening of said casing (10); a sealing member (16) which can be tightly clamped in the sleeve opening clamped against the said wall; a valve (24) provided in said sealing member (16) and connectible to a pressure fluid source for supply of pressure fluid to the cavity of said sleeve (25) for widening said sleeve into engagement with the inner side of said casing (10); and a valve (12) provided in the casing wall for withdrawing air from the space between said casing (10) and said sleeve (25) upon said widening, said valve (12) being closable when said sleeve (25) has been widened into engagement with the inner side of said casing to maintain said sleeve (25) in the widened state, and again openable when the body, after removal of said sealing member (16), has been inserted in said sleeve (25), such that said sleeve (25) can contract to tightly enclose said body.

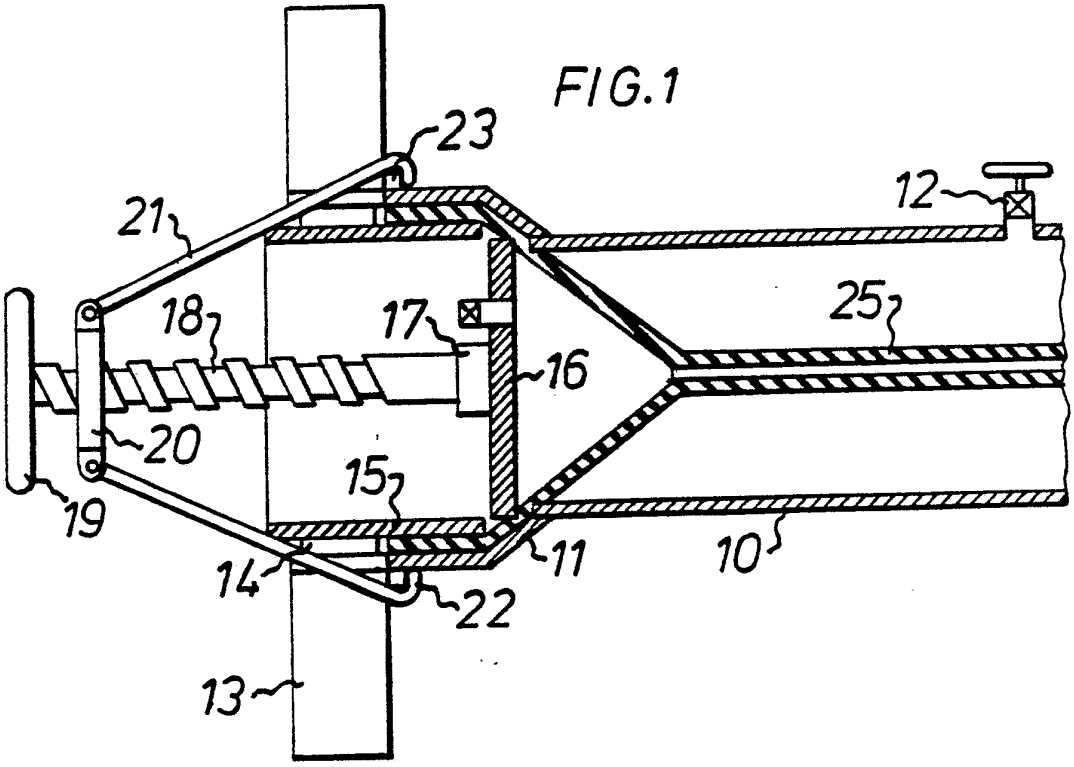
3. An apparatus as claimed in claim 2, c h a r - a c t e r i s e d in that the opening of the casing (10) is formed by an outwardly widened wall portion (11) to the outer side of which clamping means (13) are affixed which are connected with clamping jaws (15) projecting into the space defined by the said widened wall portion (11) and insertable in the open end of the sleeve (25) for pulling the sleeve portion adjacent said end, upon activation of said clamping means (13) into tight engagement with the inner side of said widened wall portion (11).

4. An apparatus as claimed in claim 3, c h a r - a c t e r i s e d in that said clamping means (13) are piston and cylinder units.

5. An apparatus as claimed in claim 3 or 4, c h a r a c t e r i s e d in that said sealing means (16) is a disc or inwardly tapering means which can be tightly clamped against the inner surface of the widened sleeve end by means of a shaft (18) which is rotatably mounted at one end in said disc or said means and is rotatable by means of a handwheel (19), said shaft being mounted in a holder (20) provided with anchoring hooks (21, 22) foldable over lugs (23) on the outer side of said casing.

6. An apparatus as claimed in any one of claims 2-5, c h a r a c t e r i s e d in that said sleeve (25) and said casing (10) can be closed at their other end facing away from the respective opening by means of clamping and sealing members corresponding to those engaging with the first-mentioned end of said sleeve (25) and said casing (10), such that bodies are insertable in said sleeve (25) from the opposite ends thereof.

FIG.1



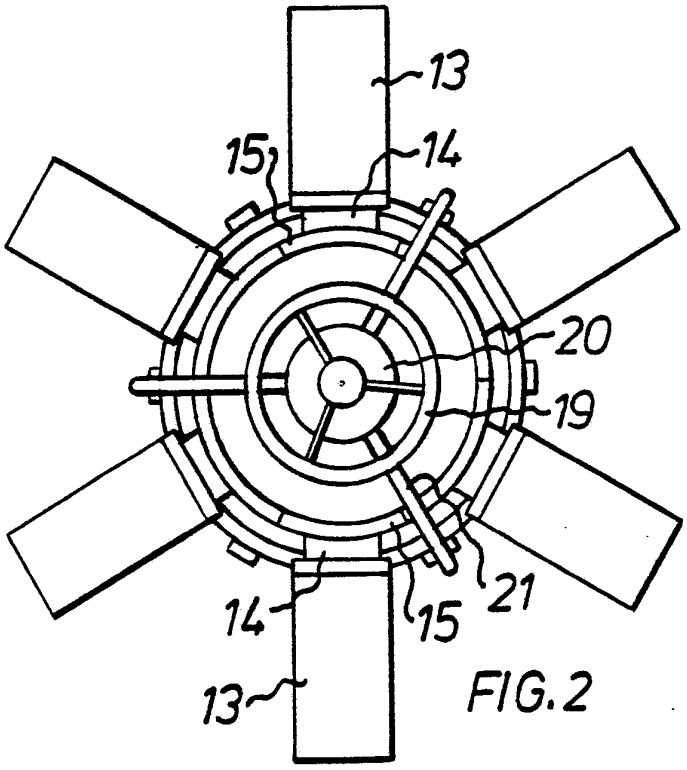


FIG.2

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE84/00361

I CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

B 29 C 63/20, 65/66, B 29 D 9/00

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC 3	B 29 H 9/00, 10, 11, 12; B 29 C 27/14, 18, 20
US Cl	118:33, 34, 50, 205; 156:84-86, 156, 165, 229, 285, 287, 381-382, 390, 496, 425:90, 111

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category [6]	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	DE, C, 385 782 (DEMETRIO MAGGIORA) 28 November 1923	1,2
A	DE, C, 358 727 (DEMETRIO MAGGIORA) 15 September 1922	
A	DE, C, 360 294 (DEMETRIO MAGGIORA) 30 September 1922	
A	DE, A1, 2 645 855 (AMES RUBBER CORP.) 28 July 1977	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
1985-01-14	1985 -01- 15
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Swedish Patent Office	Lars Assarson

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