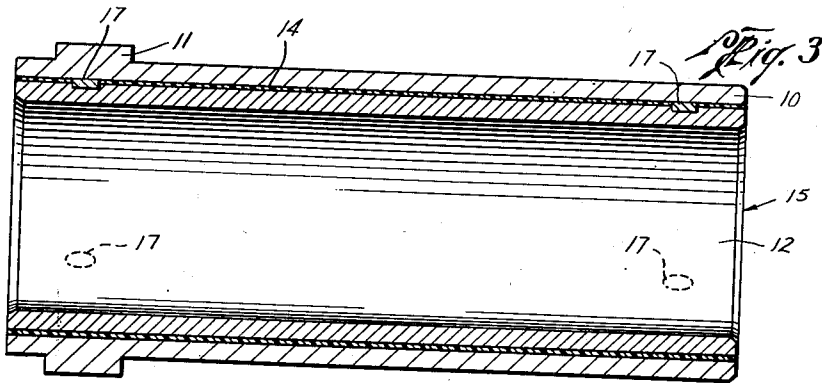
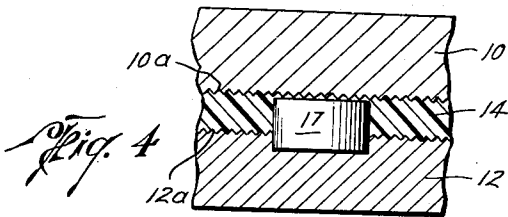


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PUMP LINER

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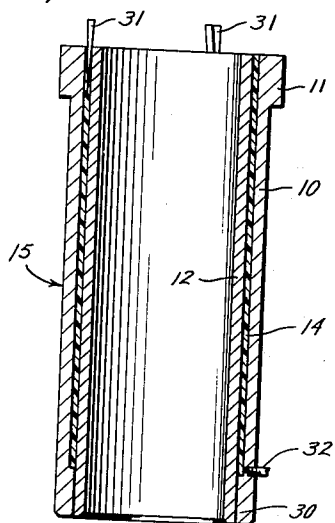
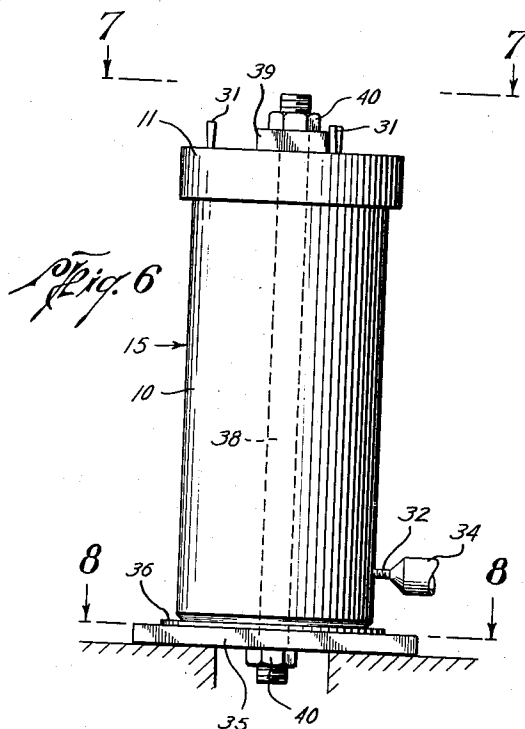
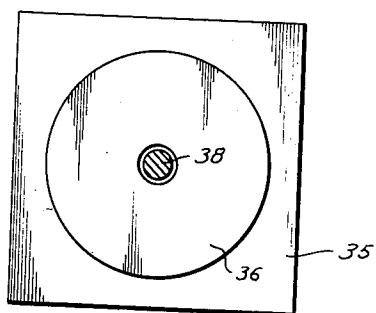
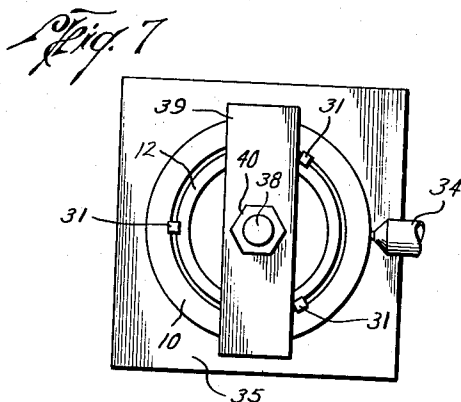


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PUMP LINER

2 Sheets-Sheet 2



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PUMP LINER

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6 Claims. (Cl. 309—3)

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This invention relates to new and useful improvements in pump liners, and particularly to a pump liner having an outer shell bonded to an inner sleeve by an adhesive material, and a method of uniting same.

It has been the common practice in the past to form a pump liner having an outer shell and an inner sleeve by either shrink fitting the sleeve and the shell together or by welding them together. In the shrink or press fit method of joining the outer shell and the inner sleeve to form the pump liner, the outer shell is heated to expand it and when the shell is in the expanded condition it is inserted in the sleeve, so that when the shell cools to normal room temperature the sleeve is held within the shell securely. The press or shrink fit can also be accomplished by cooling the inner sleeve to contract it, then inserting it within the shell at room temperature, and permitting the sleeve to return to room temperature in the shell. In such methods, it is of course necessary that the outer surface of the inner sleeve and the inner surface of the outer shell be of sufficient difference in diameter to permit the outer shell to grip the inner sleeve when the outer shell has cooled about the inner sleeve. Such methods, therefore, require close machining tolerances on the adjoining surfaces of the sleeve and shell and it is generally accepted that such tolerance should not exceed one-thousandth of an inch. Such close machining is very difficult, time consuming and expensive. Also, since the shrink fit method requires special heating and cooling equipment, it is necessary for the liner to be sent to a shop having such equipment in order for a worn sleeve to be replaced by a new sleeve in the pump liner. Where the shop having such facilities is not readily accessible to the location at which the pump liner is being used, there may be considerable delay in effecting such replacement of the pump liner, or it may necessitate having a supply of assembled liners on hand during the period in which the liner is being repaired.

In the weld method of joining the outer shell to the inner sleeve in the pump liner, the weld requires extreme heat at various localized points during the welding and such heat often results in the tempering or removing of the hardness characteristics of the inner sleeve. Since it is particularly desirable to have a sleeve with a hardened inner surface to reduce wear and increase the life of the liner, the welding method in effect destroys this important advantage.

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Also, when it is desired to replace a worn liner sleeve, it becomes necessary to cut or otherwise break the weld to separate the worn liner sleeve from the outer shell, and such separation usually results in damage to the outer shell and sleeve so that they can not be further used without extensive repair work.

It is therefore an object of this invention to provide a pump liner and a method of producing same, wherein the outer sleeve is secured to the inner sleeve by an adhesive, thereby eliminating the close tolerances necessary in the shrink fit method and the resulting damage caused during the welding method.

Another important object of this invention is to provide a new article of manufacture and a method of producing same, which includes a pump liner having an outer shell and an inner sleeve, the inner sleeve being aligned concentrically with the outer shell by an aligning means, and an adhesive between the shell and the sleeve to serve as the sole bonding medium therefor.

A further object of this invention is to provide a novel slush pump liner in which an inner sleeve is mounted within an outer shell in concentric relationship by means of an adhesive material, the outer surface of the inner sleeve and the inner surface of the outer shell being roughened or having grooves therein whereby an increased axial shearing strength is obtained in the bond between the shell and the sleeve.

A still further object of this invention is to provide a method of uniting an outer shell to an inner sleeve in forming a pump liner, wherein the inner sleeve is inserted within the outer shell, adhesive is injected between the sleeve and the shell, and caused to harden or set to form a bonding layer therebetween, such adhesive being capable of disintegration upon the application of heat thereto, whereby the sleeve and the shell may be separated for removal of the liner sleeve and the insertion of a new sleeve within the shell, without the necessity of having special equipment for such replacement.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is a sectional view of the pump liner of this invention, illustrating an embodiment

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having spaced recesses in the inner sleeve and the outer shell to receive the bonding adhesive.

Figure 2 is a sectional view of the pump liner of this invention, illustrating another embodiment wherein the pump sleeve and the outer shell have an elongate recess therein to receive the bonding adhesive.

Figure 3 is a sectional view of the pump liner of this invention, illustrating another embodiment in which the adhesive is located between the sleeve and the shell, with aligning pins or studs between the liner and the shell to assure concentric alignment thereof.

Figure 4 is a sectional view of a part of the pump liner of this invention, illustrating the roughened surfaces or grooves in the outer shell and inner sleeve which are adapted to be filled by the bonding adhesive for greater axial shearing strength.

Figure 5 is a sectional view of another form of the pump liner of this invention wherein the sleeve is centered by using wedges.

Figure 6 is an elevational view illustrating a suitable clamping device for retaining the adhesive when inserted under pressure.

Figure 7 is a plan view taken on line 7-7 of Figure 6.

Figure 8 is a horizontal sectional view taken on line 8-8 of Figure 6.

In the drawings, the numeral 10 designates the outer pump shell. This shell 10 is adapted to fit within a pump housing and therefore the shell 10 has a radially extending flange 11 near one end thereof which is adapted to abut the pump housing to prevent axial movement of the shell 10 in the housing during normal pump operation. It will be appreciated that such flange 11 may be eliminated in pump liner shells, or in some cases a shoulder used instead. Mounted within the outer shell 10 is an inner sleeve 12 which is bonded to the shell 10 by an adhesive material 14. Thus, the outer shell 10 and the inner sleeve 12 when united form the pump liner 15 of this invention. The inner sleeve 12 has preferably a hardened inner surface which is very smooth to provide a hard wearing smooth surface for the pump piston to reciprocate therein. The hardened inner surface of the sleeve 12 may be obtained by various means such as heat treating.

In the modification shown in Figure 3, the pump liner 15 includes the inner sleeve 12 which is of substantially uniform outside diameter. The external surface of the inner shell 12 need not be machined to a close tolerance as is necessary in the shrink or press fit, but instead it is often true that a roughened or grooved surface such as 12a shown in Figure 4 would be preferable. Likewise, the interior surface of the shell 10 could also have the roughened surface or grooves 10a. When such grooves 10a and 12a are utilized, the adhesive flows within the grooves and improves the axial shear strength of the bond between the shell 10 and the sleeve 12. In order to provide sufficient room for the adhesive 14 between the shell 10 and the sleeve 12, it is desirable to have a space therebetween into which the adhesive 14 may flow when the parts are being assembled. Particularly because of this spacing that is possible between the sleeve 12 and the shell 10, it is not necessary to hold the tolerances on the exterior surface of the sleeve and the interior surface of the shell to such a close measurement as is essential when using the shrink or press fit.

Since this space is left between the shell 10 and the sleeve 12, an aligning means should be utilized between the shell 10 and the sleeve 12 in order to align them in concentric relationship. This concentric alignment is essential and very important, as otherwise the pump piston when reciprocating within the sleeve 12 would be subjected, and would likewise subject the sleeve 12, to excessive wear. Also in some cases if the misalignment was particularly accentuated, damage or failure of the pump rod could very easily result. In the modification of Figure 3, the aligning means is shown as a plurality of spaced pins or studs 17. These studs or pins 17 may be integral with the sleeve 12, or may be secured to the sleeve 12 in any desired manner. Also in some instances it may be preferable to provide the pins 17 on the outer shell 10 rather than on the sleeve 12. The pins 17 are preferably three in number, being spaced preferably about 120° apart. In some cases it may be desirable to provide two sets of pins such as shown in Figure 3 with one set of three pins in the proximity of one end of the liner 15 and the other set of pins at the other end thereof. These pins or studs 17 thus provide for radial alignment of the sleeve 12 within the shell 10 to provide for their concentric relationship, while at the same time leaving space between the studs or pins 17 through which the adhesive 14 may be injected.

In the modification shown in Figure 2, the sleeve 12 has a recess 13 therein and the shell 10 has a recess 19 therein. These recesses 13 and 19 preferably extend circumferentially around the surfaces of the members. However, in some instances it may be desirable to have these recesses 13 and 19 formed as spaced longitudinal grooves about the surfaces of the liner members 10 and 12. The adhesive material is preferably injected into the recesses 13 and 19 through a passage in the outer shell 10 which is designated by the numeral 20. If these recesses 13 and 19 take the form of spaced longitudinal grooves, then a plurality of the passages 20 would be utilized. By reason of the recesses 19 being formed in the shell 10 there is provided a shoulder 19a at one end of the shell 10 and a corresponding shoulder 19b at the other end thereof. Likewise the shoulders 13a and 13b, respectively. These shoulders 13a, 19a and 13b and 19b cooperate with the adhesive 14 when it is hardened to provide an increased axial shearing strength. If even greater axial shearing strength is desired, the grooves or roughened surfaces 10a and 12a such as illustrated in Figure 4 may be utilized in the modification of Figure 2 within the recesses 13 and 19.

In the form of the pump liner 15 shown in Figure 2, the aligning means is illustrated as a collar or centering ring 22. It is desirable to have these collars or rings 22 at each end of the sleeve 12 to assure radial alignment of the sleeve 12 within the shell 10. It will be appreciated that these collars 22 could be replaced by centering pins such as 17 shown in Figure 3, if it is so desired.

In the modification of the pump liner 15 illustrated in Figure 1, the sleeve 12 has a plurality of radial recesses or grooves 23 therein which meet with a plurality of recesses or grooves 24 in the shell 10. The grooves 23 preferably extend around the entire circumference of the exterior surface of the sleeve 12, and likewise

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the grooves or recesses 24 extend around the entire circumference of the inside surface of the shell 10. These radial grooves 23 and 24 may be filled with adhesive through passages such as 25 in the shell 10. In Figure 1 the collars or rings 26 at each end of the sleeve 12 form the aligning means, although it will be appreciated that the intermediate surfaces at 25a and 25b could also be utilized as an aligning means.

In some instances it may be desirable to have the passages 20 and 25 threaded to receive a plastic or adhesive injection gun. It should also be understood that the passage 23 and the passages 25 need not be positioned exactly as shown in the drawings. For example, the passage 20 could be at either end of the recess 19 or at any intermediate point between the ends of the recess 19, so long as passage 20 communicates with such recess 19. Likewise, the passages 25 may be positioned longitudinally on the shell 10 so long as they communicate with their respective recesses. Additionally, it should be mentioned that the recesses 23 and 24 may be of varying widths and may be positioned at various points between the ends of the pump liner 15. There may be more than the three sets of recesses as illustrated in Figure 1, or in some instances it may not be necessary to provide even the three illustrated.

In Figure 5, still another form of the invention is shown. In this form the shell 10 has a centering ring or projection 30 at one end thereof. At the other end of the pump liner 15, the sleeve 12 is aligned in the shell 10 by aligning pins or wedges 31. These pins or wedges 31 are preferably three in number and are inserted after the sleeve 12 has been placed within the liner, but before the adhesive material 14 is injected through the opening 32 by the gun 34, or otherwise.

In carrying out the method of this invention, the sleeve 12 is first inserted within the outer shell 10 and aligned in concentric relationship thereto by the aligning means. The adhesive material 14 is then inserted or injected between the sleeve 12 and the shell 10. When the adhesive 14 is thus inserted between the shell 10 and the sleeve 12, it would be in liquid form so as to fill the space between the shell and the sleeve. In the modification shown in Figure 3 the injection of the liquid adhesive would be at either end thereof, while in the modifications of Figures 1 and 2 the liquid adhesive would be inserted through the passages 23 or 25, preferably by means of a pressure gun such as a gun commonly used for caulking.

In Figures 6-8, there is illustrated one type of clamp which can be used to assure the filling of the space between the shell 10 and the sleeve 12 with the liquid adhesive. This clamp includes a support plate 35 which has a gasket 36 thereon. The pump liner 15 is placed on the gasket and a force is applied to the liner 15 to obtain a seal with a gasket 36. This force can be applied by a press or weights resting on top of the liner 15, but it is preferably applied by a threaded rod 38 extending through openings in the gasket 36 and plate 35 on which is placed a clamp bar 39. The bar 39 extends across the ends of the shell 10 and sleeve 12 as seen in Figure 7, and the nuts 40 on the rod 38 are tightened to clamp the gasket 36 into sealing engagement. With such a seal, the adhesive is injected at opening 32 by a gun such as partially shown at 34. When the adhesive appears at the top of the liner 15, it is evident that the space between the shell and

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sleeve has been filled. In some cases, a plurality of openings 32 can be used and these may be circumferentially and longitudinally spaced so that the progress of the filling with adhesive can be readily checked. This is done by injecting at the lowest opening 32 until the adhesive flows from the next highest opening. The gun 34 is then moved to that next opening and filling is again continued. It will be appreciated that, although the clamping device shown in Figures 6 to 8 is illustrated for use with liner shown in Figure 5, it may also be used with other forms of the invention, such as that shown in Figure 3, if desired.

After the adhesive material 14 is within the space between the shell 10 and the sleeve 12, it is then hardened to form a bonding layer between the shell and the sleeve. In some instances it may be necessary to apply heat to accelerate or effect the setting or hardening of the adhesive 14, depending upon the type of adhesive used. Various types of adhesives can be used so long as they have sufficient strength to prevent shearing of the bond between the sleeve 12 and the shell 10 during normal pump operations, and so long as they may be injected as a liquid and thereafter hardened to a solid bonding state. Examples of suitable adhesives or bonding materials which can be used as the adhesive 14 are: the phenolic formaldehyde type of resin sold under the trade name "Bake-O-Lite," and the polyester resin sold under the various trade names such as "Chemplas" and "Lamplas."

When it is desired to disassemble the sleeve 12 from the shell 10 it is only necessary to disintegrate the adhesive 14 sufficiently to destroy the bond therebetween. This may be accomplished by heating the adhesive 14 to a sufficiently high temperature. When using the synthetic resins above mentioned as examples of the adhesive material 14, temperatures in the neighborhood of 500° Fahrenheit, or less, are sufficient to cause such disintegration to an easily frangible or fractural form, whereby the sleeve 12 may easily be slidably removed from the shell 10 without special equipment. This heating may be also accomplished without special equipment since a small gas jet or heated cylindrical chamber is sufficient to effect the disintegration of the adhesive 14. This feature of disassembly without special equipment is of particular advantage as compared to the prior constructions and methods because it enables a replacement of a new sleeve within the outer shell in the field and at points remote from shops where such special equipment would normally be located for use in the shrink fit and welded type constructions. Additionally, it will be appreciated that the new liner sleeve 12 could be inserted within the shell 10 in the field and the adhesive 14 could be also applied in the field without the necessity for any elaborate or special equipment. It may be desirable to employ a pressure gun to inject the adhesive 14, but such gun would normally be very small and inexpensive and of the type that is hand operated.

From the above, it is believed evident that the pump liner of this invention and the method of uniting or forming same has overcome the numerous disadvantages of the prior constructions and procedures.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape

and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. As a new article of manufacture, a pump liner comprising an outer shell having an external surface adapted to engage a pump housing, an inner sleeve mounted within said outer shell, said sleeve having a circumferential recess extending radially into the external surface thereof to form radially extending shoulders at each end of the recess, said shell having a circumferential recess extending radially into the internal surface thereof to form radially extending shoulders at each end of the recess, said recesses in the shell and the sleeve being of substantially the same width with said shoulders at each end of the recesses on the sleeve and shell aligned in substantially the same transverse plane whereby said recesses are aligned to form an annular area extending into said shell and said sleeve, and a solidified adhesive disposed in said annular area to span the joint between the sleeve and the shell whereby an annular ring of the adhesive is provided to prevent lateral movement of the sleeve relative to the shell in addition to the bonding action of the adhesive.

2. The article set forth in claim 1, wherein said adhesive is a heat-setting material which can be disintegrated into a frangible form by the application of extreme heat thereto whereby the sleeve and shell are readily separable from each other.

3. The article set forth in claim 1, wherein said adhesive is a material selected from the group

consisting of phenol formaldehyde resin and polyester resin.

4. The article set forth in claim 1, including another annular ring of adhesive identical with said annular ring and spaced longitudinally therefrom.

5. The article set forth in claim 1, including a radial opening through said shell in communication with said annular area for the injection of said adhesive into said annular area to form said annular ring of adhesive.

6. The structure set forth in claim 1, wherein said shoulders at each end of said recesses are formed on circumferential radially extending collars which serve to align said sleeve concentrically within said shell.

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