

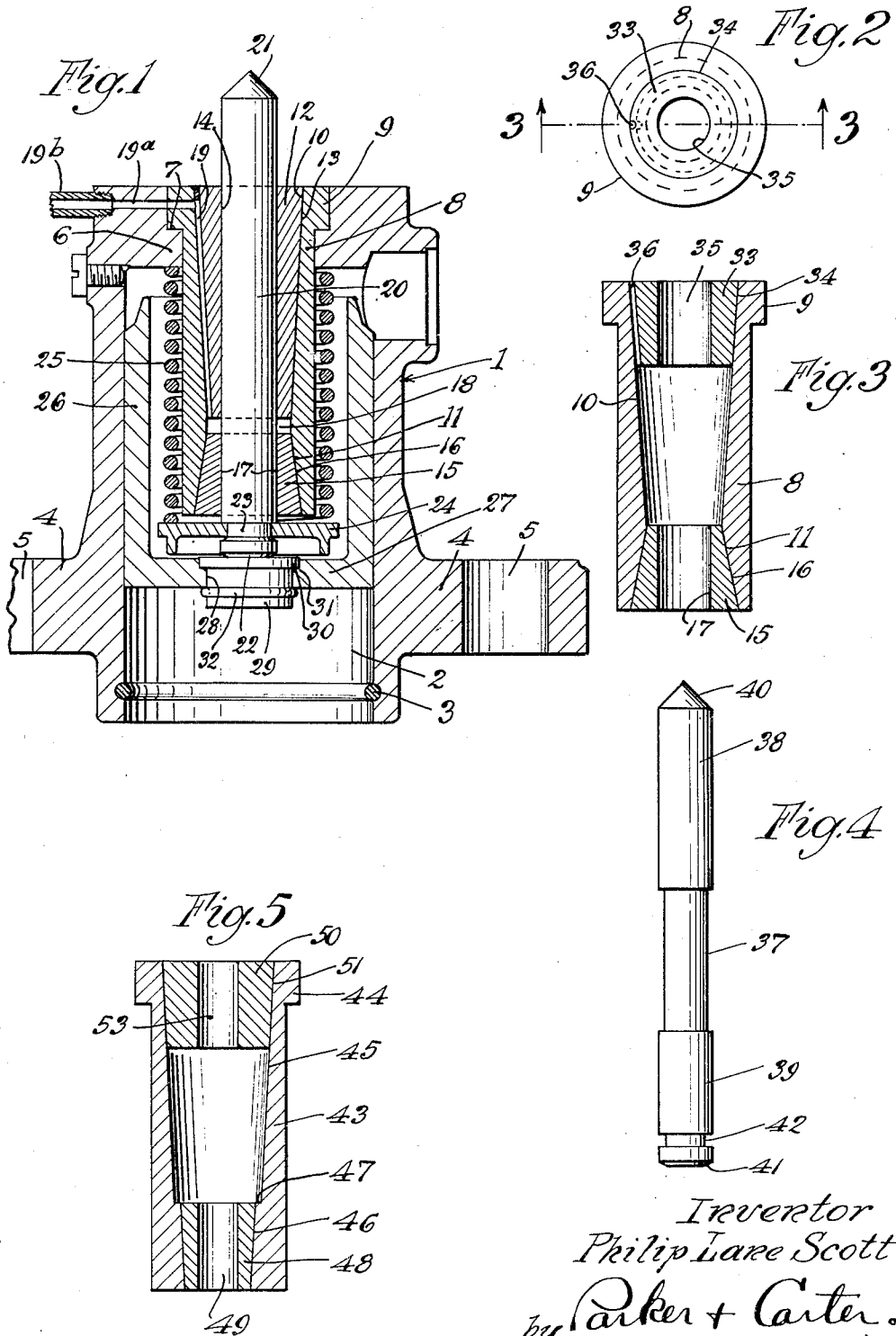
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P. L. SCOTT

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PUMP LINER CONSTRUCTION

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Inventor
Philip Lake Scott
by Parker + Carter.
Attorneys.

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PUMP LINER CONSTRUCTION

Philip Lane Scott, Chicago, Ill., assignor to Super Diesel Tractor Corporation, La Porte, Ind., a corporation of New York

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9 Claims. (Cl. 308—4)

This invention relates to a pump or generally analogous device and has for one object to provide means for constructing and sizing the barrel of the pump. In particular it has for an object the provision of means for constructing a pump barrel, for accurately sizing the barrel initially, for maintaining it accurately sized and for taking up wear from time to time, and for accurately and independently sizing the several parts of a multi-part liner.

Another object is to provide a two-part liner for a pump barrel or analogous device in which one part of the liner may be subjected to only relatively low pressures.

Other objects will appear from time to time in the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawing, wherein:

Figure 1 is a generally axial section of the pump barrel of the present invention located in the pump, the parts of the pump being omitted except where necessary to show the mounting and association of the barrel;

Figure 2 is an end elevation of the pump barrel of Figure 3;

Figure 3 is a sectional detail, on the line 3—3 of Figure 2, showing a modified barrel construction;

Figure 4 is an elevation showing a pump plunger of a modified form suitable primarily for use with the barrel construction of Figure 3; and

Figure 5 illustrates a further modification of liner and sleeve construction.

Like parts are designated by like characters throughout the specification and drawing.

The numeral 1 designates a portion of a pump housing provided with a cylindrical bore 2 in the lower end of which a spring or other retaining member 3 may be removably positioned to prevent separation of the parts. Extensions or ears 4 may be provided and where provided may be perforated as at 5 to provide means for attachment of the pump housing to a suitable base or other device. The pump housing is partially closed adjacent one end for example by the member 6 which is provided with a bore and which may be shouldered as at 7. A sleeve 8, which may be of generally cylindrical external contour, is seated in the perforation of the portion 6 of the housing and lies generally within the housing. It may be provided with a laterally extending flange 9 which is seated in the shoulder 7. The sleeve is provided with two preferably inwardly disposed tapers which may be

of the same size, length and contour or may differ from each other. As shown there is a relatively long taper 10 and a relatively short taper 11.

Two liner sections are preferably used and they correspond generally in length and exterior contour one to each of the tapered portions of the sleeve. Thus there is provided a relatively longer liner 12, tapered on its exterior as at 13 and having a central cylindrical bore 14, and there is also provided a second and relatively shorter liner 15 tapered on its exterior as at 16 and having an interior cylindrical bore 17, which is of the same diameter as and axially aligned with the bore 14 of the liner 12. When the liners are assembled a clearance or space 18 separates them. The liner 12 is provided with a groove or other clearance space 19 to provide for leakage return, which may communicate with the passage 19a in the housing section 6 and finally with the pipe 19b which may convey the fluid to any desired source.

Mounted within the two-part liner for reciprocation is a pump plunger 20. Its ends may be of any shape but as shown the inner or pumping end is generally conical as at 21. The exterior end may be rounded as at 22. Adjacent this end an annular groove 23 is formed in which is received a plate member 24 against which one end of a helical spring 25 bears. The opposite end of this spring bears against the portion 6 of the housing member 1. A cross head 26 is positioned within the bore 2 of the housing member 1 for reciprocation therein. It surrounds the barrel and spring assembly and may be partially closed at one end as at 27, being perforated as at 28 to receive a contact member 29 which has a laterally extending flange 30 seated in a corresponding shoulder 31 in the perforation 28. A spring 32 or other preferably removable retaining member holds the contact member 29 in place within the cross head.

No detailed description of the rest of the pump is necessary. It is sufficient that some member be added to complete the housing and to furnish a space for liquid passage. Obviously the inner end of the plunger is enclosed in this other section of the pump housing and obviously means for the inlet and outlet of fluid are provided but since these details are entirely independent from the construction of the pump barrel they are not shown as they are not necessary for an understanding of the present invention. The pump plunger and the cross head may be forced inwardly against the resistance of the spring by

any desired means and when free to do so the spring expands and moves the plunger and cross head outwardly.

In the modified construction of Figure 3 the sleeve is the same as that shown in Figures 1 and 2 and one of the liner sections is the same. For example, the section 15 with the bore 17 is inserted in the taper 11. At the opposite end, however, instead of the long liner 12, a short liner 33 exteriorly tapered as at 34 to correspond to the taper 10 within which it is positioned and having a central bore 35 is used. The liner member 33 is provided with a groove or other clearance space 36 to provide for a leakage return.

For use with the modified form of Figure 3, although almost any type of piston or plunger might be used, it is generally preferable to use the plunger as shown in Figure 4. This comprises a plunger body 37 having two enlarged sections 38 and 39 each of these sections being of the same diameter as the other and they are concentric and axially aligned; the plunger may be provided with a tapered or conical end 40 and preferably is rounded at the opposite end as at 41 and provided with an annular groove 42 similar to the groove 23 shown in the plunger 20 of Figure 1. The assembly and driving of the piston of Figure 4 in the apparatus is the same as that shown for the piston 20 in Figure 1.

In Figure 5 a further modification is shown. In that figure 43 is the sleeve or jacket having a flange 44 similar to the flange 9 of the other forms and this flange is seated against the shoulder 7 in the portion 6 of the housing member 1. The sleeve 43 is provided with an interior taper 45 and may be provided with a reduced taper 46. Shoulder 47 separates the two tapers. The taper 45 might, however, continue to the bottom uninterrupted. A low pressure liner member 48 is tapered on its exterior to correspond to the taper 46, and is provided with a cylindrical bore 49. A high pressure liner section 50 is tapered exteriorly as at 51 to correspond to the taper 45 of the sleeve and is positioned in that taper. The high pressure liner section 50 is provided with a cylindrical bore 53. The bores 49 and 53 are concentrically arranged and of the same diameter. While any piston or plunger might be used with this form of the barrel construction, a divided piston such as that shown in Figure 4 would normally be used.

In the present device one liner may or may not act as the lower pressure liner, being subjected only to lower pressures, while the other liner acts as the high pressure liner, or both may be high pressure liners. In the form shown in Figure 1, 12 is the high pressure liner and 15 the low pressure liner. In the form shown in Figure 3, 15 again is the low pressure liner and 33 is the high pressure liner. It is to be understood that the liners described as high pressure liners are subjected to the pressure of fluid within the pump. From the maximum there is a pressure gradient down along the barrel to the annular space between the two liner sections. This space and the low pressure section of the liner are subjected to whatever pressure exists in the leakage return system.

In practice it has been found advantageous to make the liner in two sections as shown herewith. By this construction the two liner pieces may be adjusted or fitted independently. It has been found in practice that in machining a relatively longer or single liner there may be a tendency to produce an unsatisfactory shape. Among such

unsatisfactory shapes which occasionally occur when a longer liner is made are a "bell-mouth" or "hour glass" shape. When either of these or any other irregular shape occurs the fit at one end or the other, or at some portion, is unsatisfactory, since the clearance between the plunger and the liner is uneven and frequently although the fit is proper at one point it is looser than can be tolerated at another point. It is obviously important to have as satisfactory and uniform fit throughout as possible. Therefore, the liner is made in a plurality of sections and these are separately and independently fitted and adjusted. After the sleeve and liners are made the liners are separately driven or otherwise forced into their proper positions within the sleeve. By means of the tapered construction shown the liners may be forced a greater or less distance into their respective tapered seats within the sleeve and a greater or less degree of pressure may be exerted on the liners. This pressure, if sufficient, actually compresses the liner to the degree necessary to bring its bore to proper size. As wear occurs the liners may be forced further into the taper, being thus again by compression within the sleeve brought to the proper internal diameter. If desired the liners may be positioned within the sleeve not only to secure satisfactory sizing but they may be so positioned that a considerable internal pressure is built up within the metal of the liner. In other words, the liner may be so positioned as to be under initial stress, which if desired may be greater than the fluid pressure to which it will be subjected during use.

A variety of tapers and taper arrangements will suggest themselves. I do not limit myself to any particular taper or arrangement of tapers. As shown in Figure 5 there are two tapers running in the same direction. A single taper might be used with two discontinuous liner sections positioned in it. Instead of the tapered relationship between liner and barrel the taper might be omitted and the liner otherwise held within the sleeve. The sleeve might be shrunk or pressed or otherwise treated so as to bring the liner to the desired size of bore and if desired to subject it to heavy initial compression.

Heretofore an accurate mating between a plunger and barrel in a packingless pump, that is to say, in which the main sealing effect is obtained by the nicety of fit between a plunger and barrel of relatively hard materials rather than by soft and easily compressible materials, has proved a very serious problem. General practice has involved hand lapping operations to extreme accuracies which has proved both costly and requiring excessive amounts of time. This is because no way has previously been known to handle these hard materials except by some form of cutting or abrasion. My invention overcomes this difficulty in that even though the materials are hard they do have slight elasticity and I am taking advantage of this slight elasticity to change the size a minute amount which, however, is sufficient to produce the desired fit.

I claim:

1. In a multi-part pump, a barrel, said barrel including a plurality of hollow unbroken liner sections having straight-sided bores and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising mating inclined surfaces on each liner section and corresponding portions of said co-

operative compressive member, and a plunger mounted in said liners.

2. In a multi-part pump, a barrel, said barrel including a plurality of hollow unbroken liner sections having straight-sided bores and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising mating tapered surfaces on each liner section and corresponding portions of said co-operative compressive member, and a plunger mounted in said liners.

3. In a multi-part pump, a barrel, said barrel including a plurality of hollow unbroken liner sections having straight-sided bores and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising mating tapered surfaces on each liner section and corresponding oppositely faced tapered portions of said co-operative compressive member, and a plunger mounted in said liners.

4. In a multi-part pump, a barrel, said barrel including a plurality of hollow unbroken liner sections having straight-sided bores and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising mating tapered surfaces on each liner section and corresponding tapered portions of said co-operative compressive member, said last mentioned tapered portions inclined each in the same direction as the other, and a plunger mounted in said liners.

5. In a multi-part pump barrel, a plurality of hollow unbroken liner sections, a plunger mounted for reciprocation therein and a surrounding co-operative compressive member, said liner sections being each provided with a straight-sided bore, within which said plunger fits, means for independently sizing the internal dimension of each of the liner sections, said means comprising mating tapered surfaces on each liner section and corresponding portions of said co-operative compressive member, the degree of taper on one liner being greater than that on another liner, and one liner being shorter than the other.

6. In a multi-part pump barrel, a plurality of hollow unbroken liner sections and a surround-

ing co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising tapered surfaces on each liner section and corresponding, mating portions on said co-operative compressive member, said liners when in position within said compressive member having their adjacent ends out of contact with each other and defining therebetween an annular clearance space about said barrel and within said compressive member, said barrel provided with a leakage discharge passage communicating with said annular clearance space.

7. In a multi-part pump barrel, a plurality of hollow unbroken liner sections, said sections being each provided with a straight-sided bore, the said bores being of the same diameter and concentric, and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising tapered surfaces on each liner section and corresponding, mating portions on said co-operative compressive member, said liners when in place having their adjacent ends out of contact with each other, and a piston within the bore of said hollow liner sections, said piston being reduced intermediate its ends.

8. In a multi-part pump barrel, a plurality of hollow unbroken liner sections and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising tapered surfaces on each liner section and corresponding, mating tapered portions of said co-operative compressive member, the tapered portions of said compressive member inclined in the same direction and being discontinuous with respect to each other.

9. In a multi-part pump barrel, a plurality of hollow unbroken liner sections and a surrounding co-operative compressive member, means for independently sizing the internal dimension of each of the liner sections, said means comprising tapered surfaces on each liner section and corresponding, mating portions of said co-operative compressive member, said liners being of a material of greater modulus of elasticity than that of the compressive member.

PHILIP LANE SCOTT.