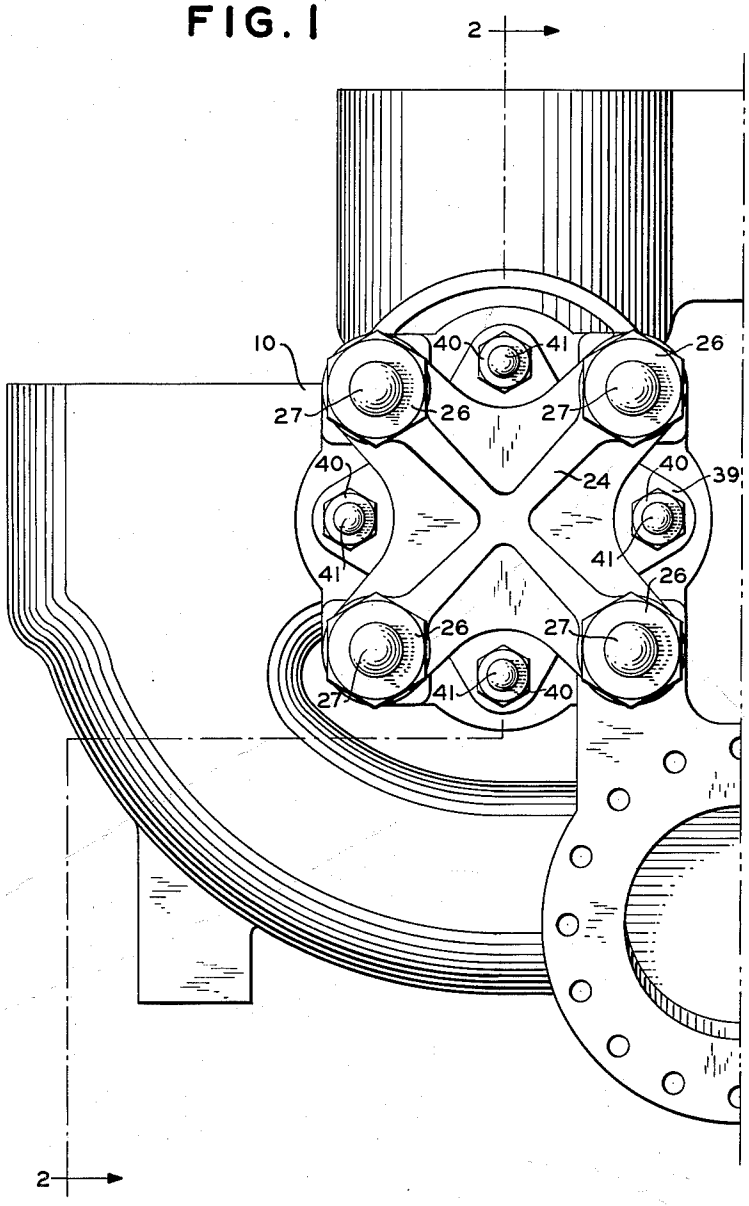
Sept. 6, 1955 G. E. CAMPBELL 2,717,186

METAL-TO-METAL STABILIZED PUMP LINER
WITH INDEPENDENT PACKING ADJUSTMENT

Filed March 29, 1954 4 Sheets-Sheet 1

FIG. 1



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Filed March 29, 1954 4 Sheets-Sheet 2

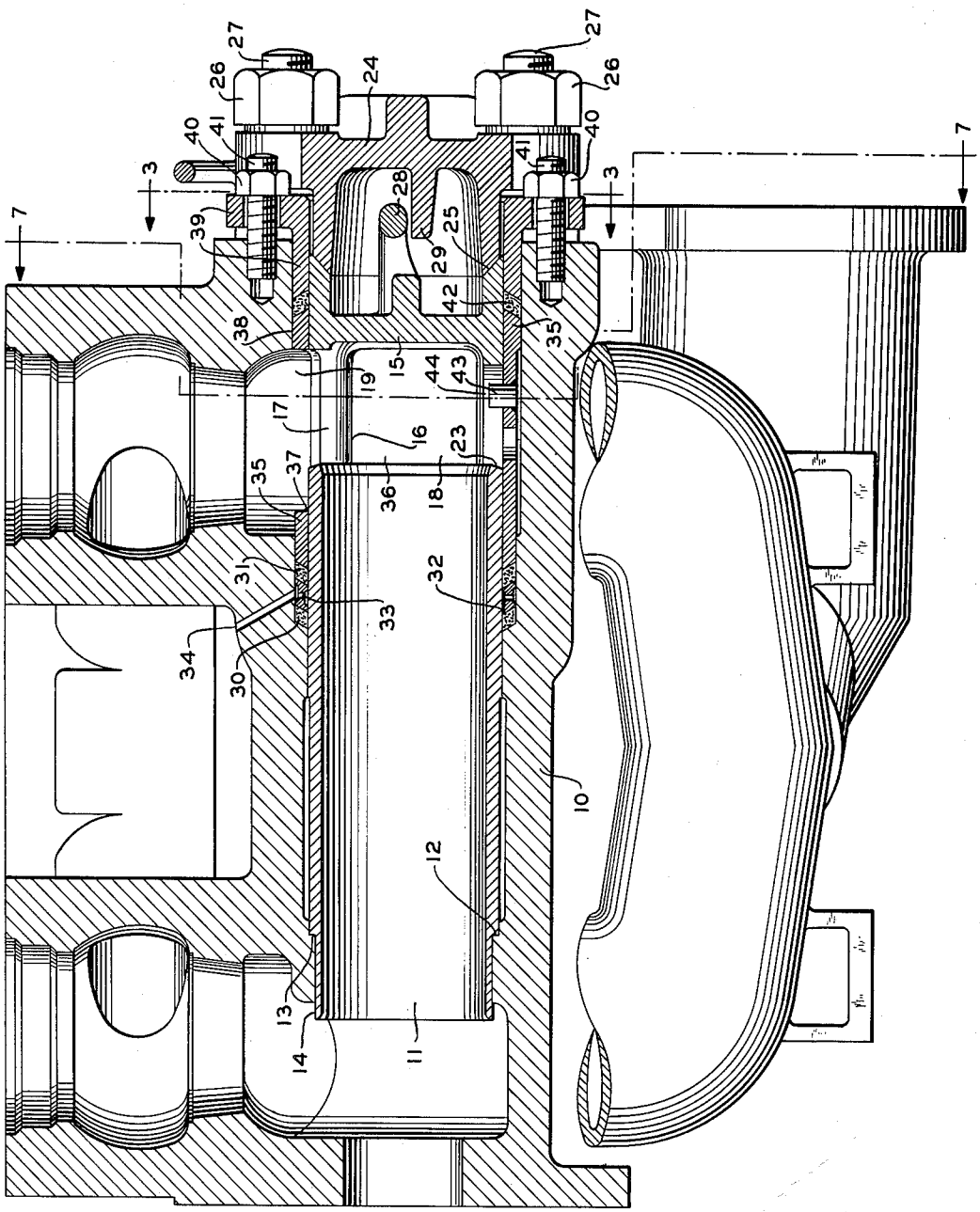


FIG. 2

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FIG. 3

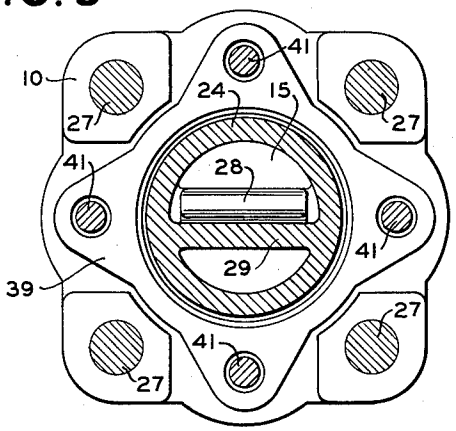


FIG. 4

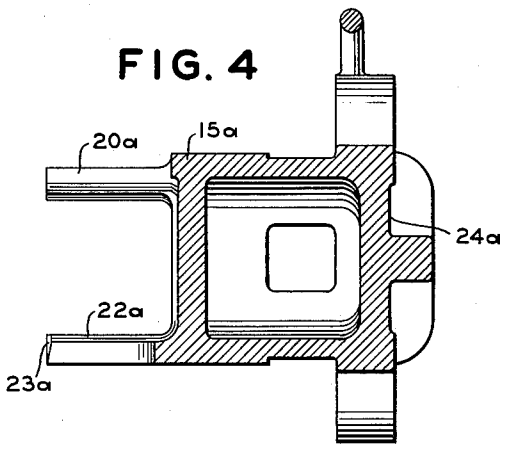


FIG. 5

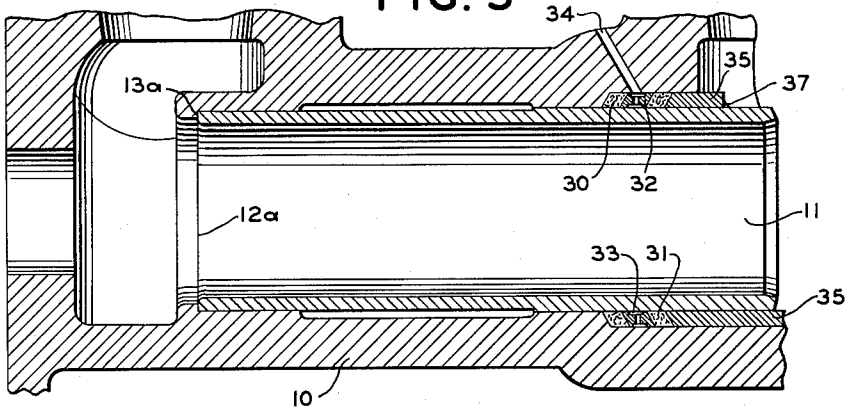
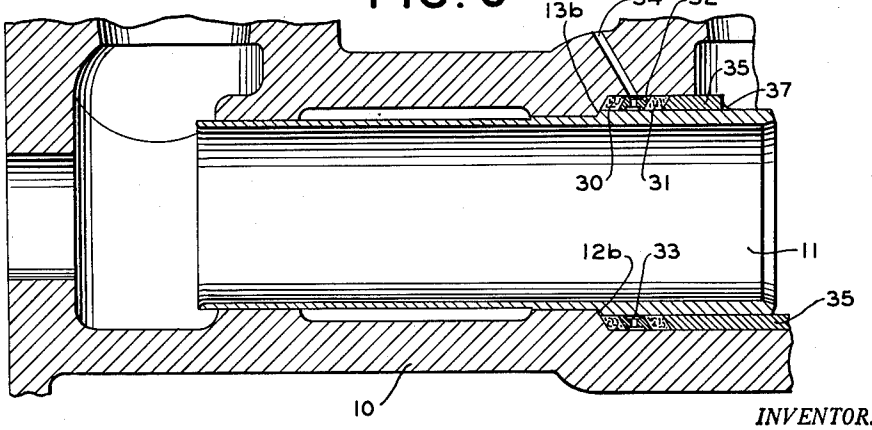


FIG. 6



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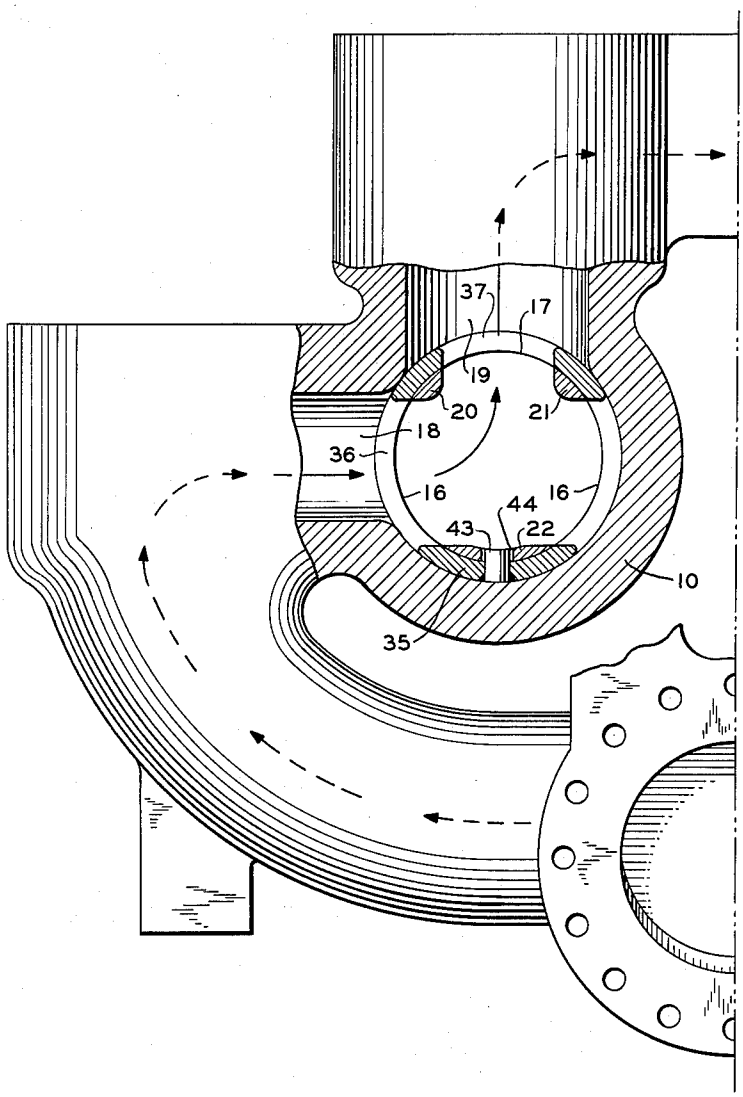
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Filed March 29, 1954 4 Sheets-Sheet 4

FIG. 7



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United States Patent Office 2,717,186 Patented Sept. 6, 1955

2,717,186

METAL-TO-METAL STABILIZED PUMP LINER WITH INDEPENDENT PACKING ADJUSTMENT

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Application March 29, 1954, Serial No. 419,468

7 Claims. (Cl. 309—3)

The invention here indisclosed relates to the liner and packing construction of high pressure, heavy duty slush pumps.

Objects of the invention are to stabilize the liner solidly at both ends so as to be unaffected by the reversal of pressure occasioned by the reciprocating pump strokes, and to effect packing of the liner and cylinder head independently of and apart from the securing of the liner in the cylinder.

Other special objects of the invention are to enable ready removal and replacement of liner and packings and to insure assembling of the parts in proper relation.

Further special objects of the invention are to locate all securing and adjusting means exteriorly of the pump, out of the mud stream and accessible and adjustable while the pump is in operation.

Other important objects and advantages attained by the invention are set forth or will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain present practical embodiments of the invention but it will be appreciated that structure may be modified and changed, all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawings is an end elevation of one cylinder of a slush pump having the invention incorporated therein;

Fig. 2 is a broken longitudinal sectional view of the one cylinder, taken on substantialy the plane of line 2—2 of Fig. 1;

Fig. 3 is a sectional view across the cylinder head as on substantially the plane of line 3—3 of Fig. 2;

Fig. 4 is a longitudinal sectional view of a modified form of cylinder head having the liner retainer incorporated therewith;

Figs. 5 and 6 are broken longitudinal sectional views of modified forms of the liner;

Fig. 7 is a broken cross sectional view on substantially the plane of line 7—7 of Fig. 2.

In the several views a cylinder of a heavy duty, high pressure mud pump is indicated at **10** having a liner **11**.

In the first illustrated embodiment of the invention the liner is shown as having an external annular shoulder **12** near the inner end in direct engagement with a companion stop shoulder **13** in the cylinder.

Fig. 5 shows how these companion shoulders, in this case designated **12***a* and **13***a*, may be located at the extreme inner end of the liner. This construction has the advantage that the liner may be of the same external diameter its full length, instead of being turned down to a lesser diameter as at **14** in the first illustrated form, Fig. 2.

Fig. 6 illustrates a further variation in which the abutment shoulders **12***b* and **13***b* on liner and cylinder respectively, are located near the outer end of the liner.

In all instances the liner is seated solidly against the abutment shoulder in the cylinder by the combination

of a retainer and cylinder head bolted solidly to the end of the cylinder.

The retainer, as shown at **15**, Fig. 2, is in the nature of a piston of the same external diameter as the outer end portion of the liner, having ports **16**, **17** in the sides and top of the inner end portion of the same to register with the fluid passages **18**, **19** in the pump body.

These side and top ports are shown as extended inward through the inner end of the retainer sleeve, leaving this sleeve separated at its inner end into two spaced narrow upper struts **20**, **21**, and a somewhat wider, lower segmental strut **22**, and these three spaced struts provide a self-equalizing three-point bearing engagement with the outer end of the liner through the medium of a bevel joint thrust connection at **23**.

The cylinder head **24** is shown as having a beveled or ball joint engagement at **25** with the outer end of the liner retainer **15**, and as being secured by self-aligning nuts **26** on the screw studs **27** so as to apply self-equalizing, solid seating force to the retainer and hence to the liner.

While for large pump sizes it may be best to construct the retainer sleeve and cylinder head in separate parts, it is contemplated that these two may be made as one, as shown in Fig. 4, where the retainer sleeve **15***a* is indicated made as an integral extension portion of the cylinder head **24***a* with struts such as **20***a*, **22***a* making bevel or ball-joint engagement at their inner ends at **23***a* with the outer end of the liner. In such construction the metal-to-metal engagement of cylinder head and liner retainer takes the form of a solid or continuous integral connection.

When separately formed as in Figs. 2 and 3, the liner retainer and cylinder head may be made with companion parts which will permit assembly only in the one, correct relation. In the illustration the retainer is shown as having a projecting cross handle **28** which will overlap and avoid a cross rib **29** on the inside of the head when the parts are assembled in their proper relation, appearing in these views.

The liner is shown as packed in the cylinder by inner and outer companion packings **30** and **31** separated and spaced by a lantern **32** internally and externally grooved and ported at **33** in general register with a weep hole **34** opening through the top of the cylinder.

The inner, liner packings **30**, **31** are shown as held by a liner packing spacer sleeve **35** slidable over the liner retainer sleeve and ported in the sides at **36** and in the top at **37**, in register with the fluid ports in the retainer sleeve.

The liner packings **30**, **31**, lantern **32** and packing spacer **35** all fit in the counterbore **38** provided in the outer end portion of the cylinder, and adjustment of these parts in this packing counterbore is effected by a gland **39** secured by nuts **40** on studs **41**.

The packing spacer **35** and liner retainer **15** are sealed by packing **42** surrounding the retainer sleeve and disposed between the opposed beveled ends of the packing spacer and gland.

Adjustment of the four externally located gland nuts **40** is thus effective to set the packings for the liner, the packing spacer and the liner retainer, and such adjustment can be effected while the pump is in operation and without affecting or being affected by the liner which is secured in fixed, stabilized condition in the cylinder.

To assure assembly of the packing spacer with the ports therein registering with the ports in the liner retainer, the spacer is shown as carrying an inwardly projecting pin **43** to register with a longitudinal slot **44** in the retainer. This construction permits independent adjustment of packing spacer and liner retainer while assuring that these parts will assemble and be held only in this proper rela-

tion, and the interlock between the retainer and cylinder head assures that the retainer will be in proper position to line up the packing spacer in correct position.

With the construction disclosed the liner is held by steel-to-steel engagement at both ends in a fixed, stabilized condition. The cylinder head is secured in fixed metal-to-metal engagement. The packing for both liner and cylinder head, on the other hand, are free for adjustment independently of both liner and cylinder head. All adjustments for take-up on the liner and cylinder head on the one hand, or for adjustment of the packings on the other hand, can be effected independently of each other, externally of the pump and while the pump is in action. All adjustment means being on the outside, are free and clear of the corrosive action of the pump fluid.

The lantern between the liner packings and the weep hole lined up therewith afford visual indication for proper adjustment of the packing gland. The packings can be assembled on the liner and retainer for insertion as a single unit. Liners of different size or different material can easily be replaced at low cost, in the field, and in a short shut-down time. All parts are of simple, low cost, rugged, readily interchangeable design.

As a practical matter the invention may be considered as made up of two separate assemblies, an inline packing assembly completely adjusted and tightened by nuts on studs located outside of the fluid cylinder and an inline liner and cylinder head assembly that will pass through the packing assembly to seat against a steel shoulder in the fluid end and hold immovably in place with nuts on studs located outside the fluid cylinder.

What is claimed is:

1. Metal-to-metal stabilized pump liner with independent packing adjustment, comprising a pump cylinder having a bore with a stop shoulder and a counterbore enlargement at the outer end of the cylinder, a liner seated in said bore and having a shoulder in engagement with said stop shoulder, a packing spacer engaged in said counterbore about the outer end portion of the liner, packing at the inner end of said spacer between the liner, packing spacer and cylinder, a liner retainer within the packing spacer in engagement at its inner end with the outer end of the liner, a cylinder head in direct metallic pressure applying connection with said retainer, a gland in the outer end of the counterbore about the outer end of said retainer, packing between the outer end of said spacer and the inner end of said gland and counterbore sealing said retainer and packing spacer in the counterbore, screw studs on the end of the cylinder, nuts on said studs engaged with said cylinder head and effective with said stop shoulder to hold the liner in metal-to-metal stabilized condition, and a second set of screw studs on the cylinder and nuts thereon engaged with said gland for effecting adjustment of said liner, packing spacer and liner retainer packings independently of and apart from any pressure applied to the liner, said pump cylinder having fluid passages, said packing spacer and liner retainer having ports to register with said pump passages and registering means on said liner retainer, packing spacer and cylinder head for aligning said parts in proper relation to register said ports in the liner retainer and packing spacer with the passages in the pump cylinder.

2. Metal-to-metal stabilized pump liner with independent packing adjustment, comprising a pump cylinder having a bore with a stop shoulder and a counterbore enlargement at the outer end of the cylinder, a liner seated in said bore and having a shoulder in engagement with said stop shoulder, a packing spacer engaged in said counterbore about the outer end portion of the liner, packing at the inner end of said spacer between the liner and cylinder, a liner retainer within the packing spacer in engagement at its inner end with the outer end of the liner, a cylinder head in engagement with the outer end of said retainer, a gland in the outer end of the counterbore about the outer end of said retainer, packing between the outer end of said spacer and the inner end of said gland sealing said retainer and packing spacer in the counterbore, screw studs on the end of the cylinder, nuts on said studs engaged with said cylinder head and effective with said stop shoulder to hold the liner in metal-to-metal stabilized condition, and a second set of screw studs on the cylinder and nuts thereon engaged with said gland for effecting adjustment of said packings independently of and apart from any pressure applied to the liner, said pump cylinder having fluid passages, said packing spacer and liner retainer having ports to register with said pump passages and registering means on said liner retainer, packing spacer and cylinder head for assuring assembly of said parts in proper relation to register said ports in the liner retainer and packing spacer with the passages in the pump cylinder.

3. Metal-to-metal stabilized pump liner with independent packing adjustment, comprising a pump cylinder having a bore, a liner seated in said bore, companion shoulders on said cylinder and liner located to engage metal-to-metal when the liner is fully seated in the bore, packing between the cylinder and outer end portion of the liner, a packing spacer about the outer end portion of the liner and engaging said packing at its inner end, a liner retainer within the outer portion of said packing spacer and in metal-to-metal engagement with the outer end of the liner, packing about the outer portion of said liner retainer and in engagement with the outer end of said packing spacer and the cylinder, a gland engaged about the outer end portion of the liner retainer and in engagement with said second mentioned packing, screw means for adjusting said gland, a cylinder head in direct pressure applying metal connection with said liner retainer and screw means for securing said cylinder head independently of said screw means for securing the gland and whereby said liner is stabilized against movement in opposite directions independently of the packing and the packing is adjustable independently of and apart from the liner, said cylinder having fluid pasages, the liner retainer and packing spacer having ports to register with each other and with the fluid pasages in the cylinder, said liner retainer and packing spacer being slidingly keyed together to maintain the ports of the seam in registry and said cylinder head and liner retainer having a fixed relation for thereby locating ports in both the retainer and packing spacer in line with said fluid passages in the pump cylinder.

4. Metal-to-metal stabilized pump liner with independent packing adjustment, comprising a pump cylinder having a bore, a liner seated in said bore, companion shoulders on said cylinder and liner located to engage metal-to-metal when the liner is fully seated in the bore, packing between the cylinder and outer end portion of the liner, a packing spacer about the outer end portion of the liner, and engaging said packing at its inner end, a liner retainer within the outer portion of said packing spacer and in metal-to-metal engagement with the outer end of the liner, packing about the outer portion of said liner retainer and in engagement with the outer end of said packing spacer and the cylinder, a gland engaged about the outer end portion of the liner retainer and in engagement with said second mentioned packing, screw means for adjusting said gland, a cylinder head in metal-to-metal engagement with said liner retainer and screw means for securing said cylinder head independently of said screw means for securing the gland and whereby said liner is stabilized against movement in opposite directions independently of the packing and the packing is adjustable independently of and apart from the liner, said cylinder having fluid passages, the liner retainer and packing spacer having ports to register with each other and with the fluid passages, said liner retainer and packing spacer being slidingly keyed together to maintain the ports in the same in registry, and registering means on the cylinder head and liner retainer for locating the retainer in position for

alignment of the registered ports with the fluid passages.

5. Metal-to-metal stabilized pump liner with independent packing adjustment, comprising a pump cylinder having a bore, a liner seated in said bore, companion shoulders on said cylinder and liner located to engage metal-to-metal when the liner is fully seated in the bore, packing between the cylinder and outer end portion of the liner, a packing spacer sleeve about the outer end portion of the liner and engaging said packing at its inner end, a liner retaining sleeve within the outer portion of said packing spacer sleeve and in metal-to-metal engagement with the outer end of the liner, packing about the outer portion of said liner retaining sleeve and in engagement with the outer end of said packing spacer sleeve and the cylinder, a gland surrounding the outer end portion of said liner retaining sleeve and in engagement with said second mentioned packing, screw means on the outside of the cylinder for adjusting said gland, a cylinder head in direct pressure applying metal-to-metal connection with said liner retaining sleeve and screw means on the outside of the cylinder for securing said cylinder head independently of said screw means for securing the gland and whereby said liner is stabilized and held against movement in opposite directions independently of the packing and the packings for the liner, the packing spacer sleeve and liner retaining sleeve are all adjustable by said single screw means and wholly independently of and apart from the ilner.

6. The invention according to claim 5, in which said liner retaining sleeve is separate from the cylinder head and said cylinder head and sleeve have end-to-end abutting engagement.

7. The invention according to claim 5, in which said liner retaining sleeve is an integral extension on the inner face of said cylinder head.

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