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RECIPROCATING PLUNGER PUMPS

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FIG. 1

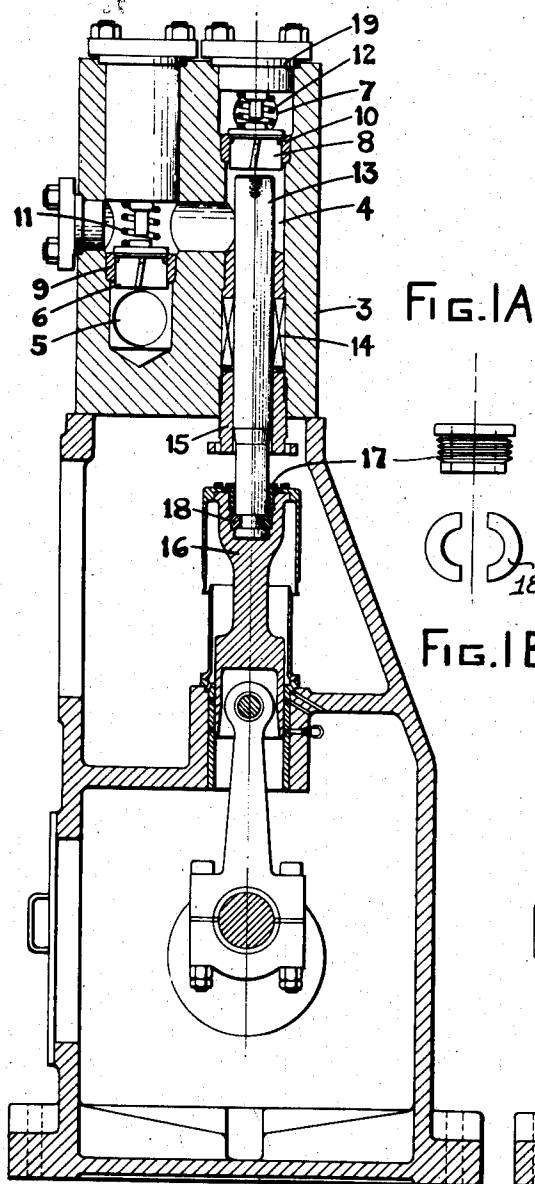


FIG. 2

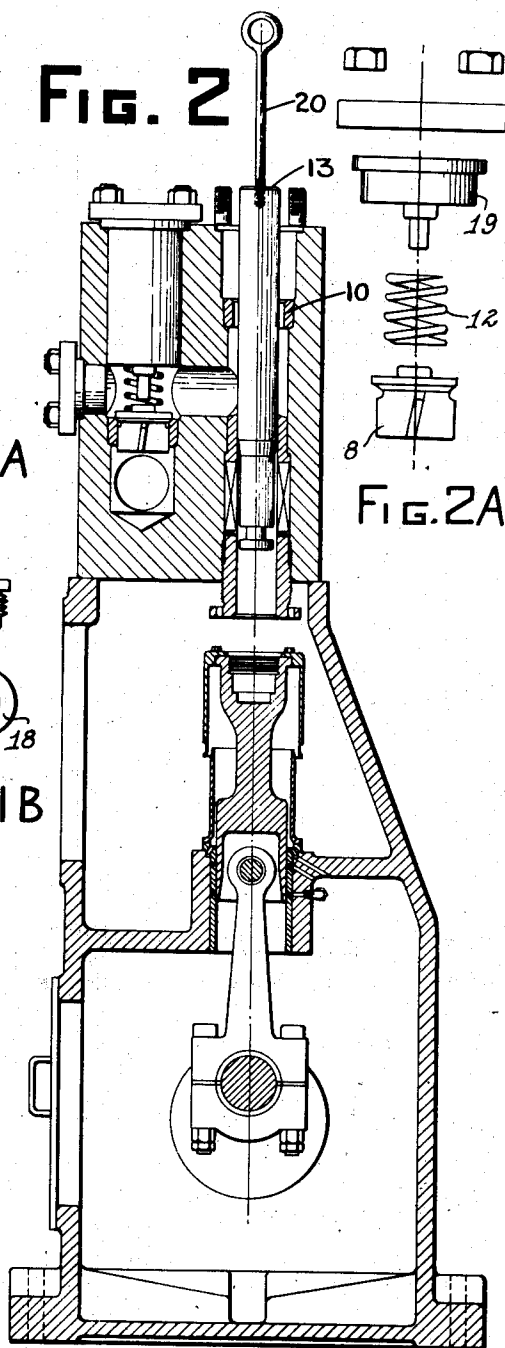


FIG. 2A

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RECIPROCATING PLUNGER PUMP

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2 Claims. (Cl. 103—153)

This invention relates to improvements in power driven reciprocating plunger pumps, and is more particularly directed to the provision of means to facilitate removal of the plungers of such pumps of vertical construction having the fluid-end thereof located at the top.

In this connection, it is to be pointed out that heretofore for the accomplishment of this purpose it has been the practice with such pumps to require (1) provision of a separate opening and cover therefor; or, (2) provision of overhead discharge valves having seat portions which must be removable from the fluid-end; or, (3) removal of the plungers downward through the stuffing-boxes which requires objectionably extensive dismantling of the operating drive mechanism; or, (4) removal of the fluid end as a unit which objectionably involves disconnecting same from the fluid inlet and discharge piping.

An important object of the present invention resides in the provision of means, whereby the plungers of such pumps may be withdrawn and/or inserted through the top ends of their boxes in the fluid end, without removing the fluid-end from the pump structure, without dismantling any of the plunger operating mechanism below; and without removing the seats of the discharge valves.

A further object of the present invention resides in the provision of means whereby each of the pumping chambers of such a pump may be arranged to have its discharge valve located in the uppermost part thereof, while affording means whereby, if desired, a replaceable valve-seat insert of hardened and/or non-corrosive material may be semi-permanently fitted without requiring its removal in order to withdraw and/or insert the plungers and without requiring an additional fluid-end opening and cover for so doing.

A further object resides in the provision of means whereby the plungers in such pumps may be inserted downwards through the top of the fluid-end after first installing the plunger stuffing-box packing and without dislodging or damaging same in so doing.

Other and more detailed objects and advantages of the present invention will be hereinafter pointed out in the accompanying specification and claims and shown in the drawing which, by way of illustration shows which I now consider to be preferred embodiments of my invention.

In the drawing:

Fig. 1 shows a lateral cross-sectional view through one of the pumping units of a vertical

multi-unit reciprocating-plunger power-pump having the fluid-end thereof located at the top and with the plungers arranged to be operated through stuffing-boxes located in the bottom of the fluid-end. In this view, the various parts are shown as connected for running operation.

Figs. 1A and 1B show the removable nut and split ring, respectively, by which the plunger is attached to the cross-head member.

Fig. 2 shows the same view as in Fig. 1 except that certain parts have been disconnected to more clearly illustrate the manner in which a plunger may be easily withdrawn and/or inserted through the discharge valve opening in the top of the fluid-end.

Fig. 2A shows parts which are removable from the pressure side of the pump, including nuts, retaining plate, valve cover, valve spring and valve.

Referring more particularly to the drawing, 3 is the fluid-end of the pump containing the pumping chambers 4 each respectively connecting with the common fluid-inlet duct 5 via an inlet valve 6, and with the common discharge duct 7 via a discharge valve 8. As shown, both valves 6 and 8 are of the wing-guided poppet type and they preferably work up-and-down within the bores of replaceable valve-seat inserts 9 and 10 respectively, having the valve-seating portion at the top ends of said bores.

In practice, under certain conditions, I consider it desirable to make the inlet valves 6 and discharge valves 8, together with their seats 9 and 10 and springs 11 and 12 respectively, of the same size and design so as to be interchangeable. However, in any case, to accomplish the principal object of this invention, I construct discharge valves 8 and valve seat inserts 10 to be of a size such that the inside diameter of the axial bore of the latter exceeds the outside diameter of the plunger 13 by at least a small amount. This to permit passage of plunger 13 through the bore of the aforesaid valve-seat insert 10 for removing or inserting the plunger.

As shown in Fig. 1, the pumping plunger 13 traverses the stuffing-box packing 14 and its adjusting gland follower 15 which is located on the underside of the fluid-end 3. The lower end of plunger 13 may be attached to the pump cross-head member 16 in any known fashion such as by the usual threaded connection therewith (not shown in the drawing) or by the preferred arrangement employing a sleeve-like nut 17 in conjunction with the removable split ring 18 whose

two halves engage a circumferential slot in the lower portion of the plunger as shown.

To withdraw a plunger, it is thus only necessary to first remove the discharge valve cover 19, spring 12 and valve 8 and pull the plunger vertically upwards using any suitable means such as the lifting bolt 20 which threads into the top of the plunger as shown in Fig. 2. This, of course, after first disconnecting the plunger from crosshead 16 by removing the sleeve nut 17 and the ring halves 18.

With the plunger removed, the condition of the stuffing-box packing 14 may be examined, around its entire circumference by observation down through the valve seat 10, without disturbing the packing. This makes it possible to ascertain whether the packing 14, as installed, is functioning all along its length; whether the end joints of the respective rings of packing are properly staggered, etc., with a minimum of time and trouble for so doing.

Novel provision is made to facilitate replacing the plungers 13 without damaging the stuffing-box packing 14 when they are inserted downwards. This is accomplished by making the lower portion of the plungers of less diameter than the upper cylindrical portion thereof, which contacts the packing, and providing a gradually tapered conical entering surface between the aforesaid portions of different diameter.

I do not intend to rigidly confine myself to the various details of the particular preferred embodiment shown and described as it will be readily apparent to any one skilled in the art that various elements may be varied without departing from the broad scope of the invention. For example, while it is desirable to arrange the discharge valves and their seat inserts so as to be substantially concentric with the longitudinal axis of the plungers for manufacturing reasons, the same objective may be achieved if the axial centers of the valves are offset from, to be eccentric with respect to that of the plungers provided, however, that the bore of the seat inserts is sufficiently larger to permit passage of the plunger therethrough. And, the discharge valve-seat inserts 10 may be secured semi-permanently to the

fluid-end differently than with a tapered drive fit as shown, by using a threaded connection therewith; a cylindrical press or shrink fit therewith, etc. And, further, the replaceable discharge valve-seat insert 10 might be eliminated to instead machine the guide-bore and seat for said valve in the fluid-end block 3 itself. And, of course, the discharge valve itself may be of different construction than as shown, in that it might have a flat seat instead of a tapered or bevel seat.

What is claimed is:

1. In a vertical reciprocating plunger pump having a reciprocating driving member, and including in combination a fluid-end construction having a substantially vertically extending bored out portion, a vertically acting plunger working within said bored out portion and disconnectably attached to said reciprocating driving member, a stuffing box including compressible packing in the lower portion of said bore through which the lower end of the plunger works, a removable discharge valve near the upper end of said bore and above the top of the plunger, said valve having valve seating portions having an inner bore laterally guiding the discharge valve and of a diameter exceeding the diameter of the portion of the plunger which slides through the stuffing box, said valve seating portions comprising a valve seat insert in said fluid end, a removable retaining cover for said discharge valve, the aforesaid construction affording removal of the plunger upwards and out through the inner bore of the valve-seat portions of the discharge valve with said seat insert in place in the fluid end following removal of the valve and valve cover and following the disconnection of the plunger from the reciprocating driving member.

2. A pump according to claim 1 wherein the pumping plunger is provided with tapering portions which lead up to the cylindrical portion of the plunger which passes through the stuffing box to facilitate insertion of the plunger downward through the stuffing box without damaging the stuffing box packing.

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