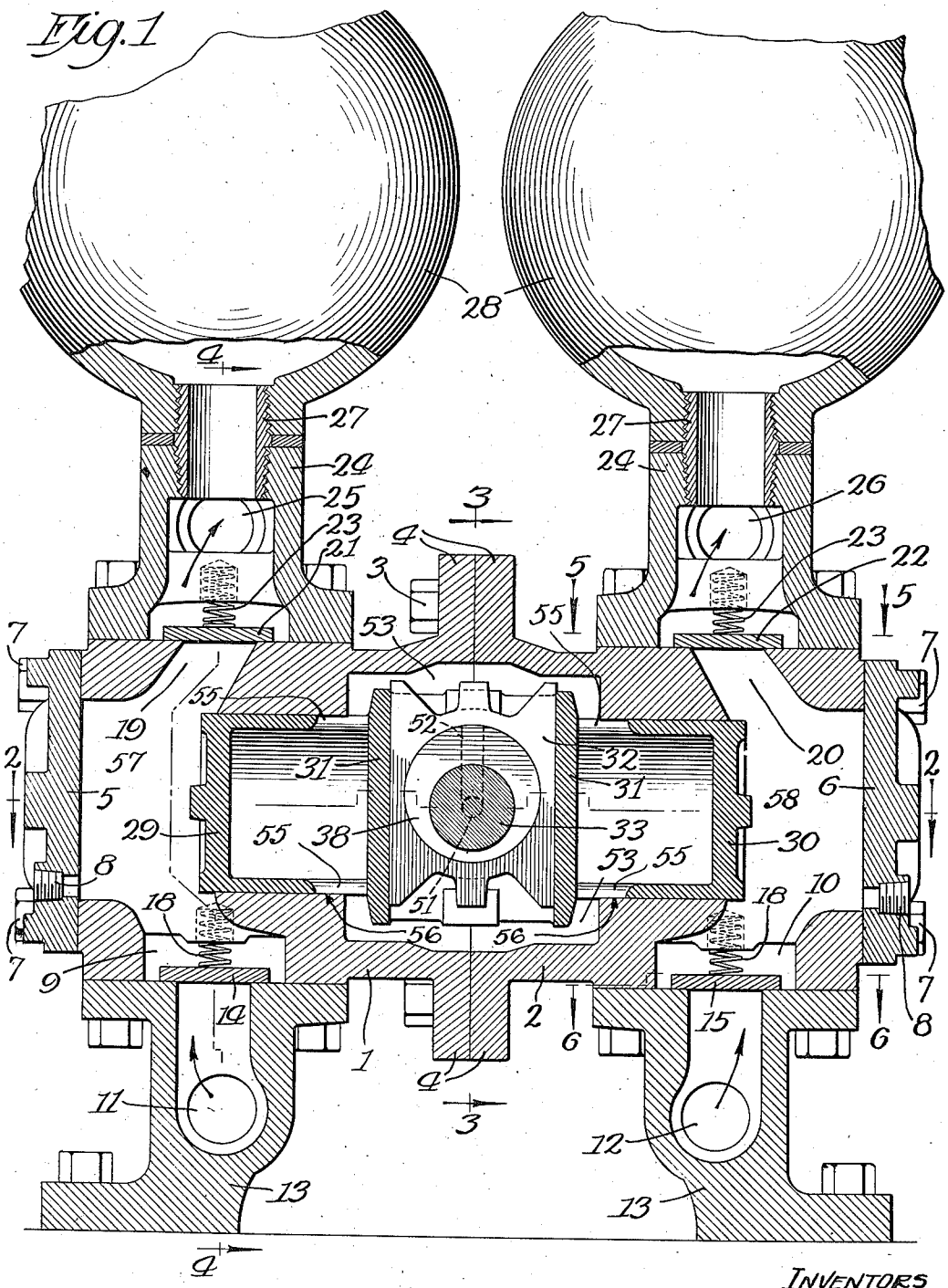
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PUMP CONSTRUCTION

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Fig. 1



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Fig. 2

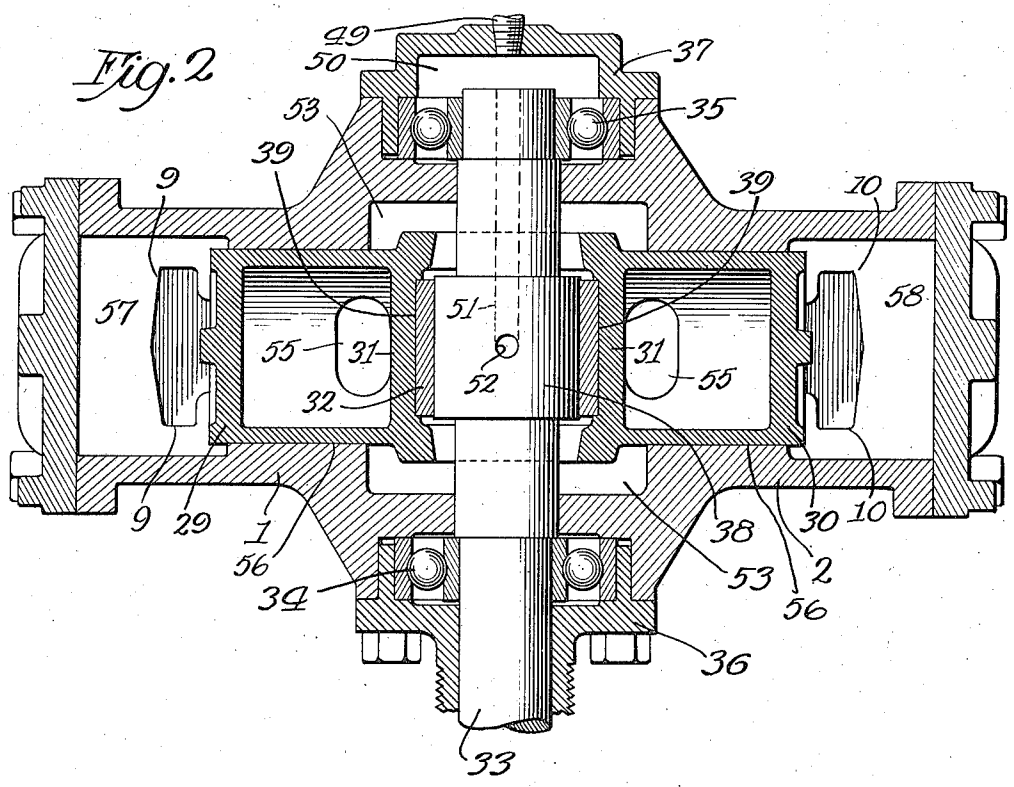
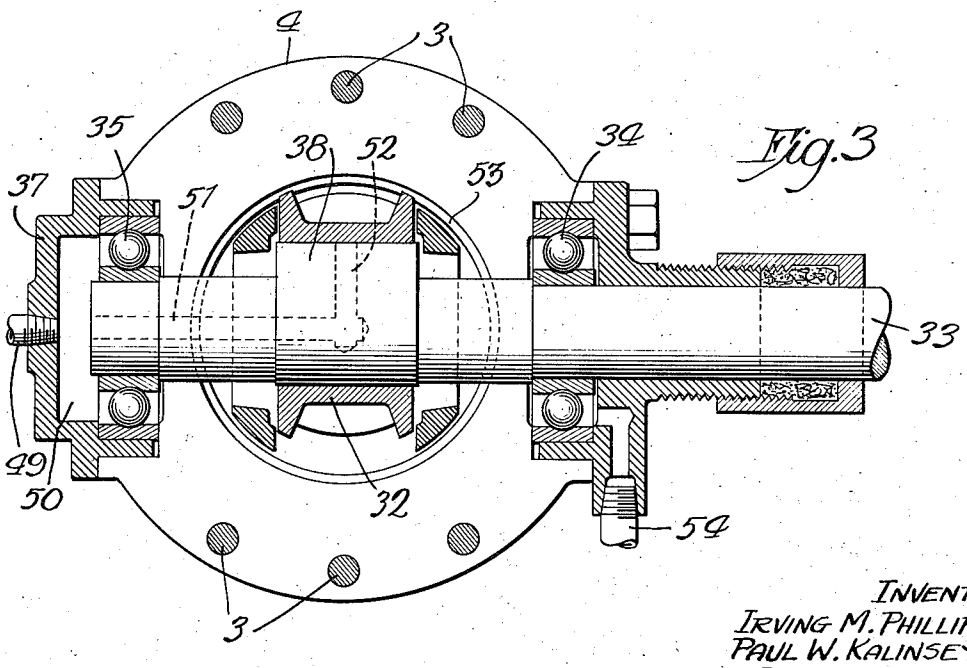


Fig. 3



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Fig.4

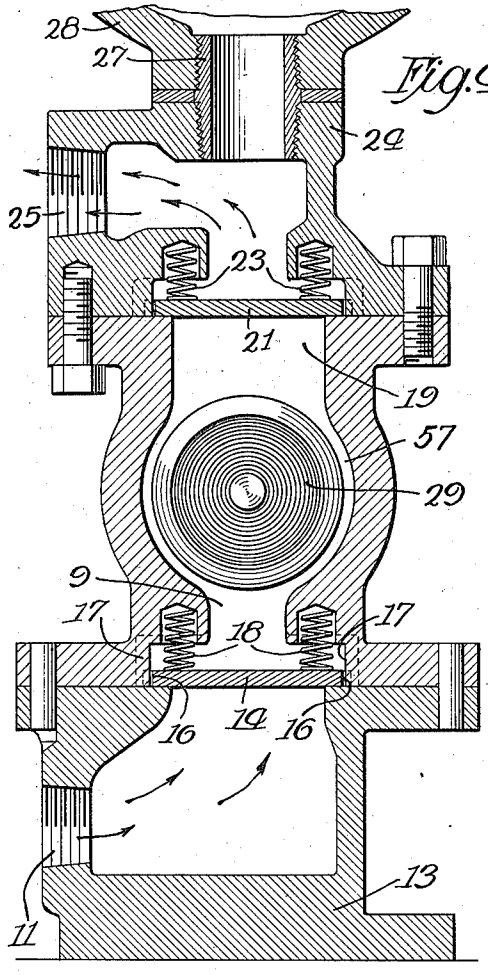


Fig.5

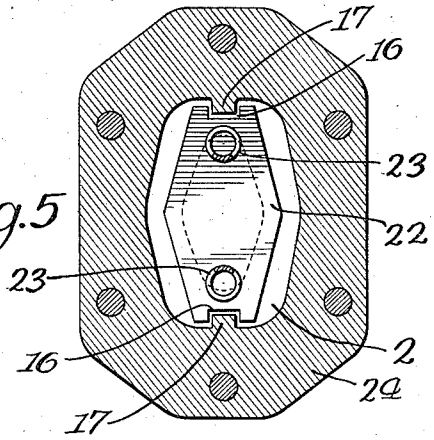


Fig.6

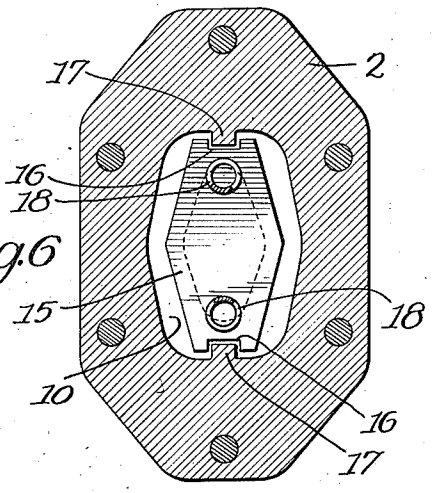
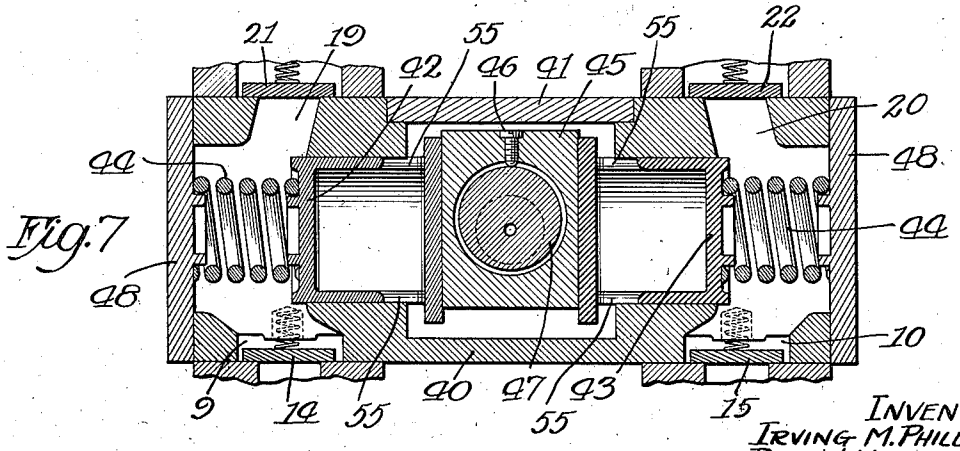


Fig.7



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UNITED STATES PATENT OFFICE

2,055,046

PUMP CONSTRUCTION

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Application May 1, 1933, Serial No. 668,719

4 Claims. (Cl. 103—171)

This invention relates to pumps, and more particularly to high speed high pressure reciprocating water pumps.

The object of the invention is to provide a novel and improved construction and arrangement whereby a reciprocating pump of this kind may have practically a minimum of moving parts, and may be operated at high speed, to develop maximum pressure, without danger of breakage, and without injurious vibration or other effects, thereby to provide a smooth-running and comparatively long lived reciprocating pump that will operate at high speed and high pressure, in a more satisfactory manner than those that have heretofore been employed for this purpose, and that is simple and comparatively inexpensive to manufacture.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of a reciprocating water pump of this particular character for high pressure purposes.

To the foregoing and other useful ends, the invention consists in matters hereinafter set forth and claimed and shown in the accompanying drawings, in which—

Fig. 1 is a longitudinal vertical section of a reciprocating water pump embodying the principles of the invention.

Fig. 2 is a horizontal section on line 2—2 in Fig. 1 of the drawings.

Fig. 3 is a transverse section on line 3—3 in Fig. 1 of the drawings.

Fig. 4 is a vertical transverse section on line 4—4 in Fig. 1 of the drawings.

Fig. 5 is a horizontal detail section on line 5—5 in Fig. 1 of the drawings.

Fig. 6 is a similar section on line 6—6 in Fig. 1 of the drawings.

Fig. 7 is a longitudinal section of a pump, showing a different form of the invention.

As shown in Figs. 1 to 6 inclusive, the invention comprises a pair of cylinder housing sections 1 and 2, which are substantially identical, except that one is a right and the other a left, and these sections are held together at the middle of the structure by bolts or screws 3 inserted through the flanges 4 of these cylinder sections. Removable heads 5 and 6 are secured to the opposite ends of the cylinder by bolts or screws 7, these heads being preferably provided with removable plugs 8, as shown, for drainage purposes or attachments.

The cylinder is preferably flat on top and flat on the bottom thereof, and the bottom is provided with inlet ports 9 and 10 which communicate with the intakes 11 and 12 of the supporting brackets or bases 13 upon which the cylinder is supported. Flat valves 14 and 15 rest upon the tops of the brackets 13, to act as check valves for the inlet ports 9 and 10 of the pump, these valves having their ends provided with notches 16 for engagement with the ribs 17 formed on the interior of the pump cylinder or housing. Coil springs 18 are provided for holding the valves normally down upon their seats, but these springs yield to permit the valves to rise and admit water alternately to the opposite ends of the cylinder.

The top of the cylinder is provided with outlet ports 19 and 20, and similar flat valves 21 and 22 rest upon the top of the cylinder and normally close these ports, being yieldingly held in this position by similar springs 23, as shown. Identical castings 24 are provided and bolted to the top of the cylinder, to cover the valves 21 and 22, in the manner shown, these castings providing the off-take passages 25 and 26 that communicate, when the valves 21 and 22 are open, with the outlet ports 19 and 20 of the cylinder. The passages 25 and 26 are connected, as shown, by screw thimbles or bushings 27 to the air chambers 28 in which the air is constantly under compression to insure a steady or even flow of the water from the pump.

The two plunger heads 29 and 30 are integrally connected together, and the plunger structure is provided with transverse walls 31 between which the eccentric block 32 is free to slide up and down. The transverse operating shaft 33 is supported in ball bearings 34 and 35, suitably held in position in the divided side portions of the cylinder by the annular members 36 and 37, as shown more clearly in Fig. 2 of the drawings. The middle portion of the shaft is provided with an eccentric cam 38 which fits the interior of the block 32, whereby the rotation of said shaft will cause reciprocation of the pistons, with the block 32 in effect reciprocating up and down between the walls 31 of the piston structure. It will be seen that the walls 31 have shallow flat vertical seats 39 in which the vertical sides of the block 32 are held, whereby this block is held against axial displacement on the eccentric cam.

With the foregoing construction, it will be seen that the two sections of the cylinder structure, with its inlet and outlet castings, are assembled first, and that they are then brought together with the plunger heads and the shaft

in position therein, the shaft and the plunger structure having been assembled together for this purpose. Then the bearings **34** and **35** are fastened in place, and the bolts or screws **3** are inserted through the flanges **4**, and in this way the two sections of the cylinder or housing are held together with the plunger structure free to reciprocate therein.

A feature of the pump, it will be seen, is that the heads **29** and **30** move forward into a body of water, at each end of the cylinder, so that the cylindrical sides of the heads are exposed to the water, as well as the faces of the heads. Therefore, these heads do not operate by pushing a body of water along merely in contact with the face of each plunger, but to the contrary operate by being submerged in a body of water, within each end of the cylinder, or partially submerged, causing sufficient displacement of the water to bring about an overflow thereof through the outlet ports **19** and **20** of the cylinder. The amount of water displaced by each piston is what is represented by the diameter of the plunger head, plus that portion of the length of the plunger which enters the body of water. In this way, the pump may work at surprisingly high speed, with a soft and comparatively gentle pulsating action, whereby increased efficiency is obtained.

As shown in Fig. 7 of the drawings, the construction and general mode of operation of the pump are similar to that previously described, but in this case the cylinder **40** is not split transversely at the middle thereof, but is simply provided with a top cover **41** at its middle portion. Also, the two heads **42** and **43**, forming the plunger, instead of being integrally connected, are structurally separate, and are retracted by heavy coil springs **44** which bear against the faces of the heads. With this construction, the heads can be dropped down through the top opening, before the cover **41** is secured in place, and the eccentric block **45** can also be dropped down through this opening, between the heads, and the eccentric shaft can then be inserted endwise. A screw **46** can be inserted in the block **45** to engage an annular groove on the face of the eccentric cam **47**, whereby the block **45** is held against axial displacement. The springs **44** can then be applied to the ends of the heads, and the cylinder heads **48** can then be secured in place.

Thus, in Figs. 1 to 6 of the drawings, the cylinder is necessarily split or divided transversely at the middle thereof, in order to permit the assembling of the piston structure and eccentric shaft therein. However, in Fig. 7 of the drawings, the cylinder may be integral from one end thereof to the other, inasmuch as the plunger heads are not integrally connected together, but are simply separately formed in the manner shown and described. While the members **29** and **30**, and the members **42** and **43**, are in the form of piston heads, it will be seen that they function as a reciprocating pump plunger. In either form of the invention, the plunger heads each enter a body of water, so that the cylindrical sides of the plunger are exposed to the water, causing displacement of a quantity of water according to the diameter of the plunger and the portion of the length thereof which enters the body of water. In this way, a comparatively short stroke is employed for the pump, but at high speed, so that the flow of the water through the pump is practically smooth and continuous, as a result of the rapid pulsating action caused by the plungers.

The lubrication of the eccentric mechanism may be accomplished in any suitable or desired manner. However, as a matter of special improvement, the box or cap **37** has a lubricant pipe **49** leading thereto, so that a lubrication chamber **50** is formed inside of said cap. The shaft **33** is provided with a longitudinal bore **51** leading to a transverse bore **52**, which latter terminates at the cylindrical surface of the eccentric **38**, whereby the surface of the latter is thoroughly lubricated, and there will be sufficient leakage of the lubricant to lubricate the wearing surfaces between the block **32** and the walls **31** of said mechanism. In addition, there will be sufficient leakage of the lubricant to partially fill the chamber **53**, thereby to lubricate the cylindrical surfaces of the two plungers. For this purpose, of course, the lubricant can be forced under pressure into the chamber **50** previously mentioned. In this way all bearings and wearing surfaces will be suitably lubricated. To lubricate the bearing **34** another feed line **54** is provided, and in this way all bearings and frictional surfaces are thoroughly lubricated. As the pressure in the chamber **53** may be less than the water pressure in the pump, it follows that the grease or oil forced into the chamber **53** by a lower pressure will stay in place and cannot get into the water. No water can reach the plunger actuating devices enclosed in said chamber **53**, as the grease will hold the water back if there is any leakage of water between the cylinder and plunger heads.

From the foregoing, or with equivalent construction, it will be seen that a reciprocating pump is provided having two reciprocating plunger heads pulsating at high speed, and with small displacement, with practically a minimum of moving parts for the heads. In this way, there are no rings or crank shafts or connecting rods, and no wrist pins, but the heads are thoroughly lubricated, and there are no valves necessarily made of metal, the valves being nonmetallic, if desired. Running at high speed, the pump is smooth and practically frictionless and vibrationless, and is capable of exerting a practically continuous pressure, approximating the steady pressure of a rotary pump.

It will also be seen that the double-acting plunger, shown in Fig. 1, composed of the heads **29** and **30**, or the double-acting plunger shown in Fig. 7, composed of the heads **42** and **43**, have top and bottom openings **55** that communicate with the clearance space **52** in the middle of the cylinder. In this way said clearance space, and also the interior of each plunger head, become a reservoir for the lubricant, and in addition the openings **55** facilitate the lubrication between the sides of the plunger heads and the axially aligned bores **56**, formed in the cylinder. Moreover, it will be seen that the two displacement chambers **57** and **58** have inlet valves **14** and **15** at the bottom thereof, and have the outlet valves **14** and **15** at the bottom thereof, and have the outlet valves **21** and **22** at the top of said displacement chambers. With this arrangement, and with a double-headed plunger, as a whole, of a length to extend only a short distance into each displacement chamber, there is no cutting off of said valves and no material or appreciable impedance of the upward flow of the fluid in each displacement chamber. By removing the cylinder heads **5** and **6**, access may be had to these displacement chambers. As shown, the bores

have their ends disposed directly in line with the middle portions of the upper and lower valves, so that the upward flow in each displacement chamber is first toward a cylinder head, and then away from this head to the outlet, with the inlet and outlet passages formed and arranged as shown. In addition, it will be seen that the double-headed plunger of Fig. 1, and also of Fig. 7, has transverse walls between which the blocks 32 and 45 reciprocate up and down. Also, tending to shorten the length of the pump, the springs 18 and 23, the bases 13 and the housings 24 and the air chamber 28 are preferably in the vertical planes of the outer ends of the plunger bores, so that these elements are lined up vertically and centered in this manner, which conduces to the shortening of the over-all length of the pump. With the construction and arrangement shown, it will be seen that the two plunger heads, shown in Fig. 1, or in Fig. 7, alternately expell the fluid from the pump, so that the flow is practically continuous, whereby no fluid is taken from one displacement chamber to the other. The chambers 53 and 57 and 58 are of greater diameter than the bores 56, as shown in Figs. 3 and 4 of the drawings. In this way, there is practically no limit to the speed of the pump, except the capacity of the valves to open and close fast enough, inasmuch as there is practically no limit to the speed of operation of the plunger.

The displacement or flow chambers 57 and 58, it will be seen, provide clearance for the ends of the plunger heads, whereby the distance between the end of each head and its allotted cylinder plate, 5 or 6, is always as great as the size of the water inlet and outlet of each flow chamber, and in this way the vertical flow of water in each flow chamber is always free and unimpeded and unrestricted by the plunger heads.

It will be seen that the cylindrical plunger having the heads 29 and 30 has, in effect, an enlarged middle portion to accommodate the sliding block 32 and the other elements of the actuating mechanism enclosed between the two vertical transverse walls 31 that are spaced apart at the middle of the plunger to form vertical guides and enclosing walls for said block. Thus, the middle portion of the plunger is too large to pass through the bores 56 in which the cylindrical heads 29 and 30 reciprocate, and hence the cylinder structure of the pump is composed of the sections 1 and 2 having the flanged union joint 3 and 4 between them. In this way, the two sections 1 and 2 of the cylinder structure must be brought together, over the end portions of the plunger, and the union joint bolts or screws 3 must then be inserted to clamp the flanges tightly together. Also, in order to take out the plunger, the bolts or screws 3 must be removed, and the sections 1 and 2 of the cylinder structure must be separated or moved away from each other, in a manner that will be readily understood. In addition, it will be seen that the input openings 11 and 12 are separate, not being united by a manifold passage within the pump construction, and that the output openings 25 and 26 are also separate, whereby there are two separate intakes for the pump, and also two separate offtakes therefor, each in a separate casing below or above the cylinder structure. Thus, the body of the pump is made up of two castings forming the two sections of the cylinder structure, two castings forming the separate intakes for the two separate vertical flow chambers of the pump, two separate castings forming the two separate offtakes for the upper ends of said flow chambers, and two separate castings forming the removable cylinder heads of the pump. And, of course, the plunger itself is an integral casting, and practically the only machine work necessary is on the surfaces between the heads 29 and 30 and the bores 56, and on the surfaces between the block 32 and the walls 31, when the said castings are finished, except that the said valves shown and described will need grinding or machining, as will the valve seats, in order to insure proper operation of the pump. But, as shown and described, by providing an integral enlargement for the middle portion of the plunger, which reciprocates horizontally in the lubrication chamber 53, it is possible to employ an actuating mechanism of the kind shown and described, between the walls 31, that is rugged and effective for reciprocating the plunger at high speed, so that the flow of the fluid through the pump is practically continuous.

What we claim as our invention is:

1. In a high speed reciprocating double acting pump, the combination of a pair of cylinder sections coupled tightly together at the transverse middle portion of the pump, the cylinder structure thus provided having flat top and bottom surfaces at opposite sides of the coupling between the two sections, and having a middle space forming a lubricant chamber, with vertical upward flow chambers in the end portions of the cylinder structure, with cylindrical bores connecting each flow chamber to said lubricant chamber, a plunger having heads reciprocating in said bores, the middle portion of the plunger being of greater height than the diameter of said bores, mechanism applied to the middle portion of the plunger in said lubricant chamber to reciprocate said heads in unison, means at the middle of the cylinder structure to provide access to the interior thereof, a separate detachable intake base for the lower end of each flow chamber, supporting the cylinder structure, a separate detachable offtake for the upper end of each flow chamber, supported on the cylinder structure, with said intakes and offtakes in the vertical planes of the outer ends of said bores, inlet and outlet valves for the lower and upper ends of said flow chambers, disposed in said vertical planes, and removable cylinder heads for closing the outer ends of said flow chamber.

2. A structure as specified in claim 1, and a separate air pressure chamber removably attached to the upper end of each offtake.

3. A structure as specified in claim 1, said plunger heads being integrally connected together by an enlargement of the plunger which is formed to accommodate said actuating mechanism.

4. A structure as specified in claim 1, the ends of said heads alternately projecting into said flow chambers, obviating the necessity of having the fluid being pumped enter said bores.

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