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PUMP

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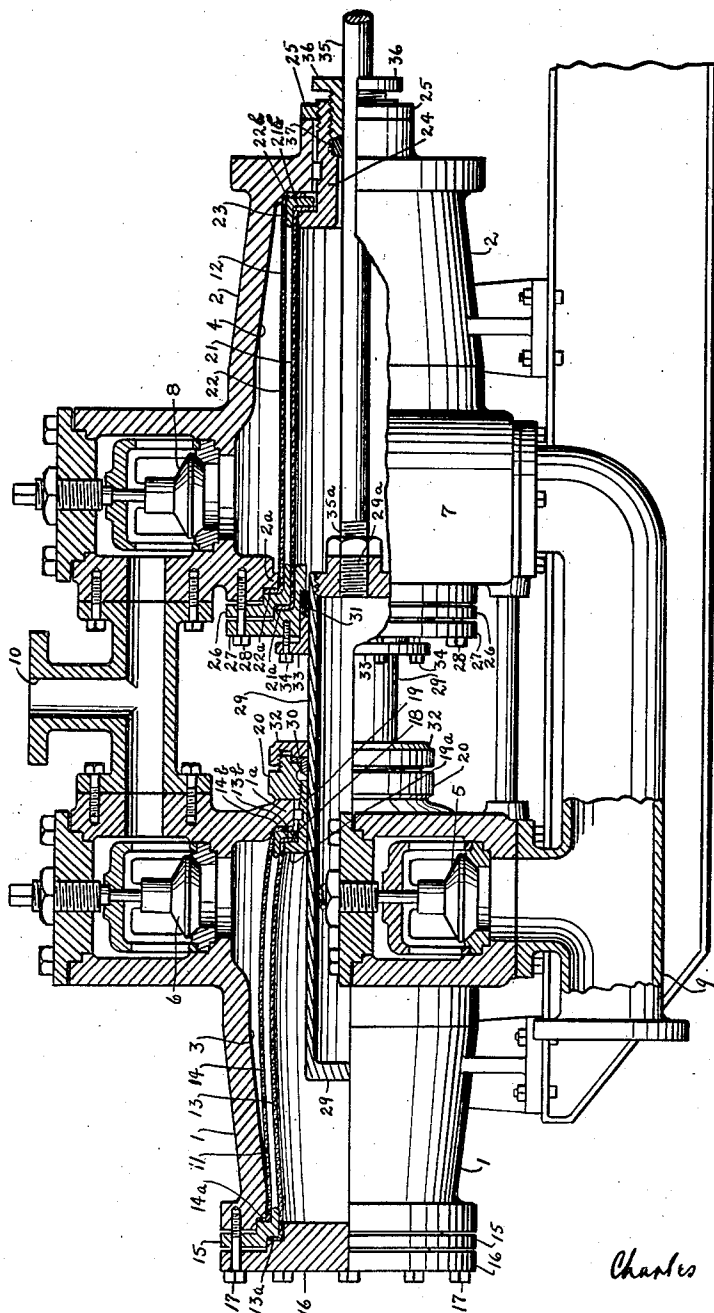


Fig. 1.

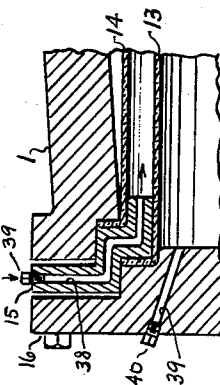


Fig. 2.

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PUMP

Application filed February 27, 1931. Serial No. 518,697.

This invention relates to pumps designed for pumping abrasive and corrosive fluids, of the general type covered by my pending applications for Letters Patent of the United States, Serial No. 363,213, filed May 15, 1929; Serial No. 421,651, filed January 18, 1930; and Serial No. 478,878, filed August 30, 1930.

the expulsion of pumped fluid from the barrels into the common exhaust pipe 10; and prevent the passage of fluid into the barrels from said exhaust pipe.

Mounted within and co-extensive with the barrels 1 and 2 are the members 11 and 12, each comprising expansible inner and outer tubes, preferably made of rubber, spaced apart, co-extensive with each other, and normally cylindrical.

The inner and outer tubes of member 11 are indicated at 13 and 14. The inner tube 13 has on its outer end an external annular flange 13a; and the outer tube 14 has on its outer end an external annular flange 14-a. The flange 14-a is compressed by and held between the outer end of the barrel 1 and the ring 15; and the flange 13-a is compressed by and held between ring 15 and the head 16. The ring 15 is stepped, as shown, and is clamped between the outer end of the barrel 1 and the head 16 by the bolts 17, which are accessible from the exterior of the pump. The outer ends of tubes 13 and 14 are thereby held spaced apart and securely connected and sealed simultaneously to the outer end wall of the pumped fluid chamber 3.

The inner ends of these tubes have internal annular flanges 13-b and 14-b. The flange 14-b is compressed by and held between the internal flange 1-a (which defines an opening in the inner end of barrel 1) and the ring 18. The flange 13-a is compressed by and held between the ring 18 and the flange 19-a of the sleeve clamp 19. This clamp is keyed against rotation in the barrel, as shown. Threaded on the clamp 19 and bearing against the inner end of barrel 1 is a nut 20, which is accessible from the exterior of the pump. The inner ends of tubes 13 and 14 are thereby held spaced apart and securely connected and sealed simultaneously to the inner end wall of chamber 3.

The inner and outer tubes of member 12 are indicated at 21 and 22, and have, respectively, on their inner ends external annular flanges 21-a and 22a; and, on their outer ends, internal annular flanges 21-b and 22-b. The flange 22-b is compressed by

This type of pump is particularly adapted for use as a mud or slush pump in deep well drilling operations, but is capable of efficient performance in various other fields. It includes a pair of pumped fluid chambers, inlet and outlet valves therefor, hollow expansible members within the chambers, and a reciprocable piston to actuate fluid confined within the members to cause expansion and contraction thereof, whereby fluid is drawn into and forced out of said chambers, the pumped fluid being thereby kept out of contact with the piston and associated parts to prevent wear thereof.

The present invention has for its principal objects the provision of a new and improved expansible member adapted to withstand the wearing action of the pumped fluid; and new and improved means to combine the same with the conventional elements of the pump.

Other objects will hereinafter appear.

The preferred embodiment of the invention is illustrated by the accompanying drawings, of which Fig. 1 is a side elevation of the pump partly in section; and Fig. 2 a detail view illustrating means whereby fluid may be introduced into the inner tubes of the expansible members, and into the space between the inner and outer tubes of each member.

The pump comprises a pair of substantially frusto-conical barrels 1 and 2, which are spaced and axially aligned so that their base ends are adjacent each other. The barrels 1 and 2 define, respectively, the pumped fluid chambers 3 and 4. The barrel 1 has an intake valve 5, and an exhaust valve 6; the barrel 2, an intake valve 7 and exhaust valve 8. The intake valves 5 and 7 permit entrance into the barrels of the pumped fluid from the common intake pipe 9; and prevent the escape of pumped fluid from the barrels into said intake pipe. The exhaust valves 6 and 8 permit

and held between the ring 23 and the outer end wall of chamber 4. The flange 21—b is compressed by and held between ring 23 and sleeve clamp 24 which extends through
 5 and is keyed in an opening in the outer end of barrel 2. Upon the outer end of clamp 24 is threaded a nut 25 bearing against the outer end of barrel 2, and accessible from the exterior of the pump. The outer ends
 10 of tubes 21 and 22 are thereby spaced apart and securely connected and sealed simultaneously to the outer end wall of chamber 4.

The flange 22—a on the inner end of the outer tube 22 is compressed by and held between
 15 the stepped ring 26 and the internal annular flange 2—a, which defines an opening in the inner end of barrel 2. Flange 21—a on the inner end of inner tube 21 is compressed by and held between the stepped
 20 ring 26 and the stepped ring 27. The ring 27 is removably secured to the inner end of barrel 2 by bolts 28 accessible from the exterior of the pump; and the ring 26 is held therebetween. The inner ends of tubes 21
 25 and 22 are thereby spaced apart, and securely connected and sealed simultaneously to the inner end wall of chamber 4.

The piston 29 is disposed between and extends into the openings in the adjacent ends
 30 of the spaced barrels and the open inner ends of inner tubes 13 and 21. By-passing of fluid about the piston from one inner tube to the other can not take place in view of the disposition of the piston; and any leakage may readily be detected. Packing rings
 35 30 and 31, the first of which is compressed between and held by nut 20 and nut 32 threaded thereon, and the last of which is compressed between and held by the gland
 40 33 and ring 27, prevent the escape of fluid from the inner tubes about the piston. The gland 33 may be removably held on ring 27 by bolts 34.

The piston rod 35 is connected to the piston 29 and extends through the inner tube 21 and gland 36 outwardly to the conventional power means, not shown. The rod 35 is sealed by the packing 37 compressed by the gland 36.

Into the space between the inner and outer tube of each member, a spacing fluid is introduced by any suitable means such, for example, as that illustrated by Fig. 2, in which the ring 15 is provided with a duct
 55 38 closed by a removable plug 39. Another duct, not shown, may be provided in the lower portion of the ring 15, so that the air in the space between the tubes may be expelled through one duct when spacing fluid
 60 is forced into the other; and so that air may enter said space through one duct when spacing fluid is withdrawn therefrom through the other. Various other means will occur to those skilled in the art.

65 The inner tube of each member is filled

with an actuating fluid through a suitable duct such as that shown at 39 in Fig. 2; and another duct, not shown, may be provided in the lower portion of the head 16 to permit the escape of air as the actuating fluid enters the inner tube, and the entrance of
 70 air as the actuating fluid is withdrawn from the inner tube. These ducts may be closed by a removable plug 40. The inner tube 21 is filled when the piston is in its forward position shown by the drawings. The piston is then moved to the right, and inner tube 13 is then filled.

The spacing fluid between the inner and outer tubes is preferably water, which is practically incompressible, so that when the inner tubes are expanded and contracted as hereinafter described, the outer tubes are also expanded and contracted, and the inner and outer tubes are held spaced apart. The
 85 outer tubes are subjected to the wearing action of the abrasive particles in the pumped fluid, and serve to prevent puncturing and wear of the inner tubes.

The actuating fluid in the inner tubes is preferably soapy water, which will act as a lubricant for the piston, and will serve to cause a positive expansion and contraction of the inner tubes upon reciprocation of the
 90 piston.

Actuating fluid having been introduced into each inner tube, and spacing fluid into the space between each inner tube and its outer tube, the operation of the pump is as follows:
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As shown by Fig. 1, when the piston 29 is in its forward position, the member 11 is expanded; the member 12, in its normal cylindrical shape. Now when the power means, not shown, moves the piston on its return stroke, the member 12 is expanded by the actuating fluid displaced in the inner tube 21 by the piston, and the member 11 is contracted by the withdrawal of the piston from the inner tube 13. Upon expansion of member 12, the inlet valve 7 is closed; the outlet valve 8, opened, and the pumped fluid in chamber 4 is forced through the exhaust pipe 10. Meanwhile, the contraction of member 11 has closed the outlet valve 6, opened inlet valve 5, and drawn a fresh charge of pumped fluid through the inlet valve 5 into the chamber 3.
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 105
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A reverse operation occurs upon movement of the piston. The piston displaces the actuating fluid in the inner tube 13 and withdraws fluid from the inner tube 21. Consequent expansion of member 11 effects closure of inlet valve 5, opening of outlet valve 6, and expulsion of fluid from the chamber 3 through exhaust pipe 10. Simultaneously, contraction of the member 12 effects closure of outlet valve 8, opening of inlet valve 7, and suction of fluid through inlet pipe 9 into chamber 4.
 120
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The alternate expansion and contraction of the members 11 and 12 upon reciprocation of the piston 29, is radial, and the intake and exhaust ports are in the large or base ends of the barrels, so that there is sufficient clearance between the members and the walls of the barrels adjacent said ports. The members are, therefore, not forced into wearing contact with the chamber walls, and a free circulation of fluid to be pumped is insured.

The packing rings 30 and 31 may readily be removed and replaced without disturbing the connection of the tubes to the barrels. This may be accomplished by disconnecting rod 35 from the power means, not shown, and moving the piston and rod to the left until the connected ends 29-a and 35-a thereof are disposed between the barrels. The rod 35 may then be screwed out of the piston 29, the nut 32 and bolts 34 removed, and the packing rings 30 and 31 taken away from the pump. New packing rings may then be substituted for the packing rings removed and the other parts remounted.

The invention is not limited to the preferred embodiment disclosed. Various changes will occur to those skilled in the art, and may be made, within the scope of the following claims.

I claim:

1. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having an inner and an outer tube; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

2. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having an outer tube and an inner tube in said outer tube and spaced therefrom; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

3. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having a substantially cylindrical outer tube and a substantially cylindrical inner tube in said outer tube and spaced therefrom, the axes of said tubes being coincident; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

4. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having an inner

and an outer tube; and a piston movable in said inner tube to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

5. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having substantially cylindrical inner and outer tubes; and a substantially cylindrical piston reciprocable in said inner tube to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means, said piston and tubes being substantially in axial alignment.

6. In a pump: a pumped fluid chamber; inlet and outlet means associated with said chamber; a hollow, expansible member in said chamber, said member having an outer tube, an inner tube within said outer tube and spaced therefrom, and a liquid filling the space between said tubes; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

7. A pump having a pumped fluid chamber, said chamber having end walls; inlet and outlet means associated with said chamber, a hollow, expansible member in said chamber, said member having an inner tube and an outer tube; means to connect and seal the ends of said tubes to the end walls of said chamber; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

8. A pump having a pumped fluid chamber, said chamber having end walls; inlet and outlet means associated with said chamber, a hollow, expansible member in said chamber, said member having an inner tube and an outer tube; means accessible from the exterior of the pump to connect and seal the ends of said tubes to the end walls of said chamber; and means to cause expansion and contraction of said member to draw fluid into said chamber through said inlet means and to force it out of said chamber through said outlet means.

9. A pumping member comprising a pair of expansible tubes, one within the other.

10. A pumping member comprising a pair of expansible tubes, one within the other, and spaced apart.

11. A pumping member comprising a pair of expansible tubes, one within the other, and spaced apart, said tubes being substantially cylindrical, the axes of said tubes being substantially coincident.

12. A pumping member comprising a pair

of expansible tubes, one within the other, said tubes having external annular flanges at one end and internal annular flanges at the other.

13. A pumping member comprising hollow, expansible, inner and outer tubes spaced apart, and a liquid filling the space between said tubes.

14. In a pump: a pair of spaced barrels; a hollow expansible member in each of said barrels, said member having an inner and an outer tube; a piston between said barrels and extending into the inner tubes of said members; and removable packing means on the adjacent ends of said barrels and about said piston.

15. In a pump: a barrel having an opening therein, a hollow expansible member in said barrel; said member having an inner and an outer tube; said inner tube having an open end adjacent said opening in said barrel; a piston extending through said opening in said barrel and into the open end of said inner tube; and removable means to connect and seal said open end of said inner tube to said barrel and to pack said piston, said means being accessible from the exterior of said barrel.

16. In a pump: a pair of spaced barrels, each of said barrels having an opening in its end adjacent the other of said barrels; a hollow, expansible member in each of said barrels, each of said members having an inner and an outer tube, the inner tube of each of said members having an open end adjacent the opening in its barrel; a piston between said barrels and extending through said openings in said barrels and into the open ends of said inner tubes; and adjustable and removable means to connect and seal the adjacent ends of said tubes to said barrels, and to pack said piston in said openings in said barrels, said means being accessible from the exterior of said barrels.

17. A pump of the character described having a barrel, said barrel having end walls; an expansible member in said barrel, said member having an outer tube and an inner tube within said outer tube; and means to connect and seal the ends of said tubes to the end walls of said barrel.

18. A pump of the character described having a barrel, said barrel having end walls; an expansible member in said barrel, said member having an outer tube, and an inner tube within said outer tube; and means to connect and seal the ends of said tubes to the end walls of said barrel, said means being accessible from the exterior of said barrel.

19. A pump of the character described having a barrel, said barrel having end walls, an expansible member in said barrel, said member having an outer tube, and an inner tube within said outer tube; and means to simultaneously connect and seal the ends of said tubes to the end walls of said barrels, said

means being accessible from the exterior of said barrel.

20. A pump of the character described having a barrel, said barrel having end walls; an expansible member in said barrel, said member having an outer tube and an inner tube within said outer tube; each of said tubes having at one end an external flange, and at the other an internal flange, the external and internal flanges of said tubes being adjacent each other; and means to connect and seal said flanges to the end walls of said barrel.

In testimony whereof, I hereunto affix my signature.

CHARLES D. STEPHENS.