

Aug. 15, 1933.

H. E. LA BOUR

1,922,050

PUMP

Filed June 28, 1929

5 Sheets-Sheet 1

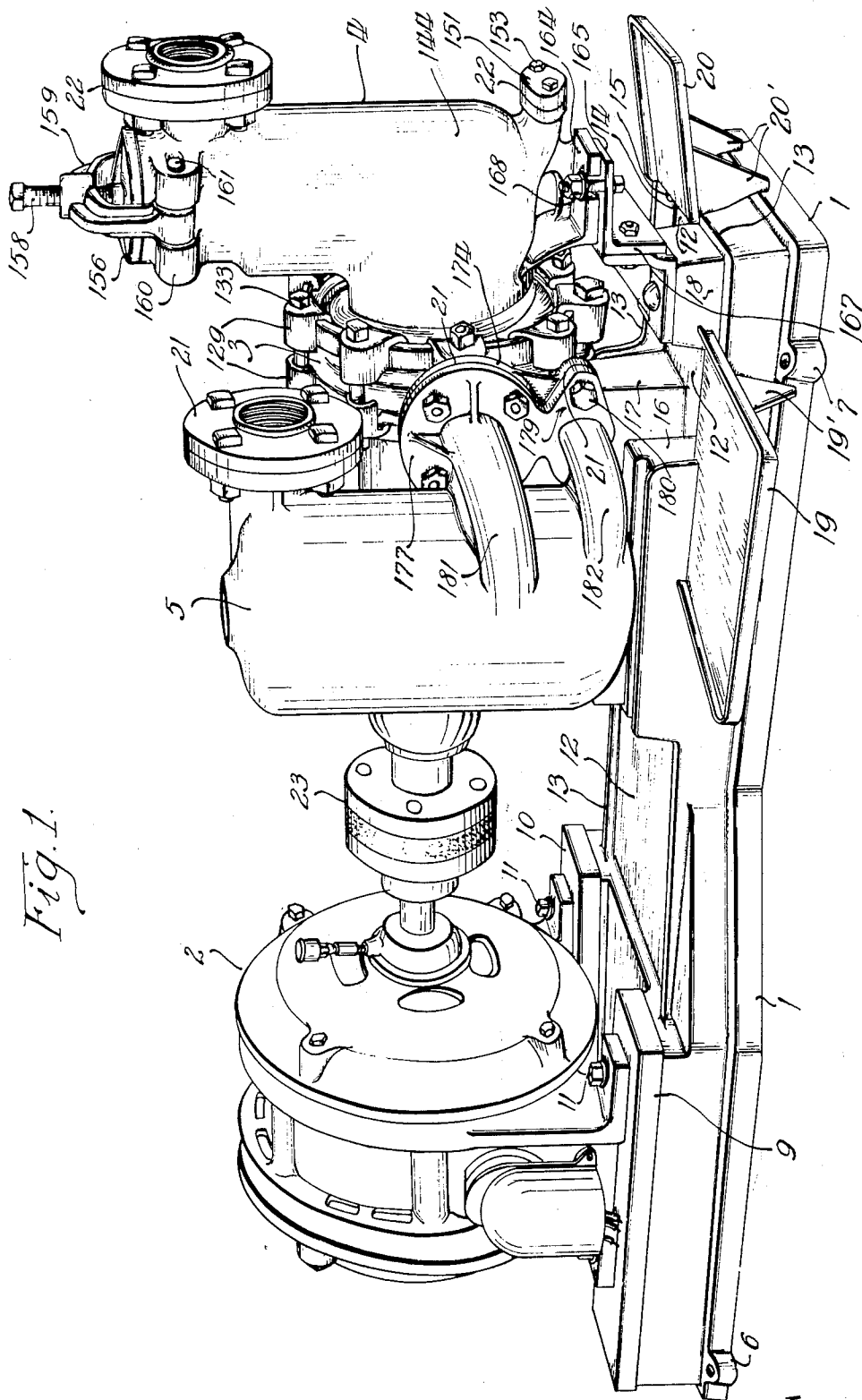


Fig. 1.

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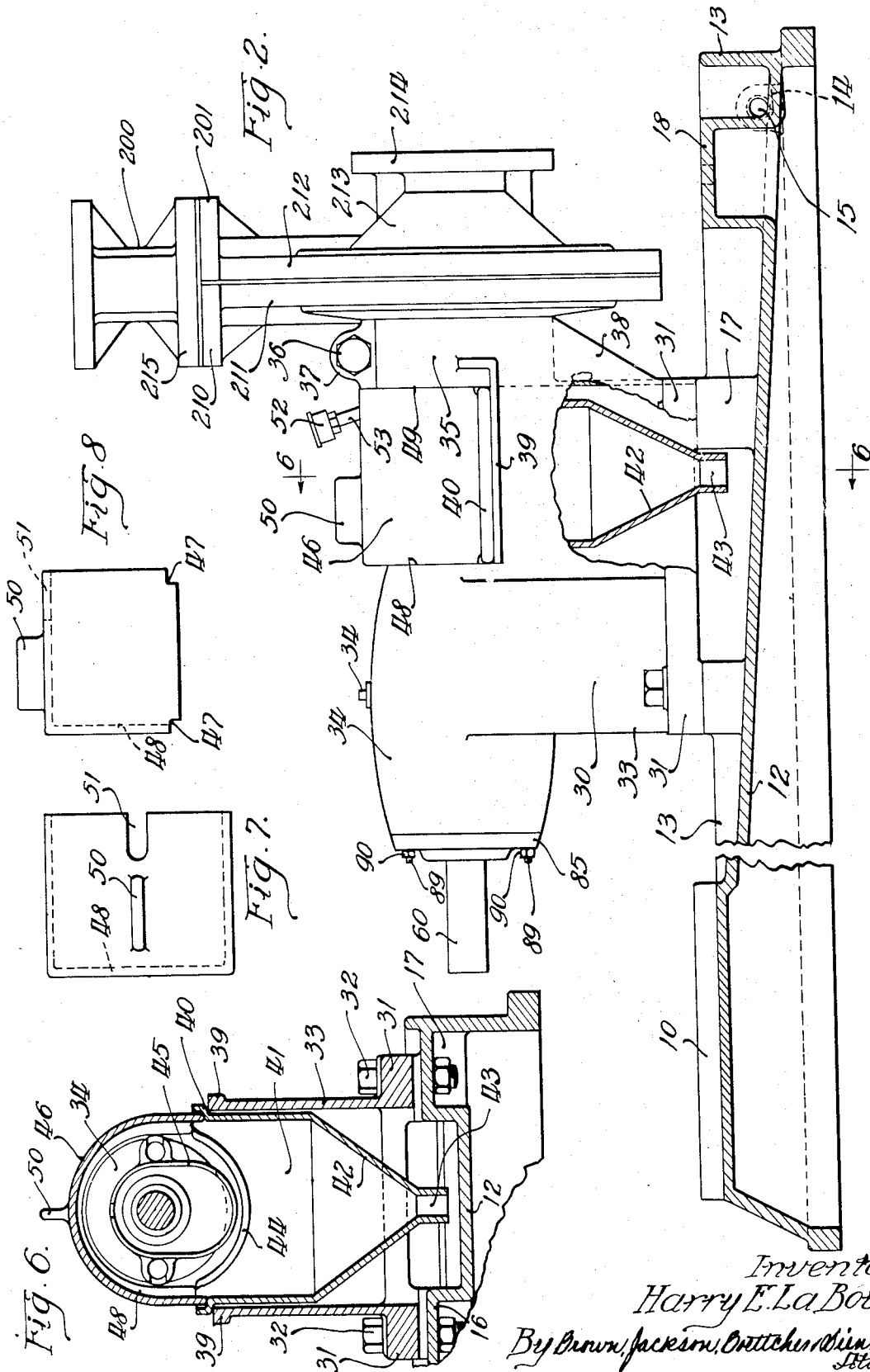
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5 Sheets-Sheet 2



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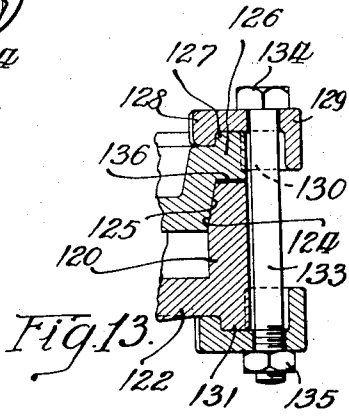
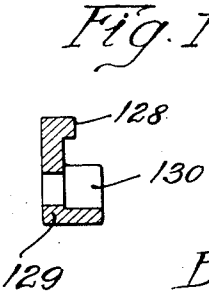
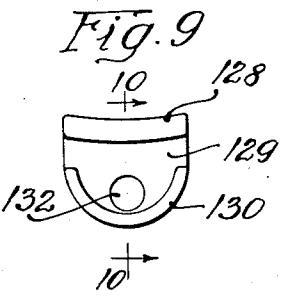
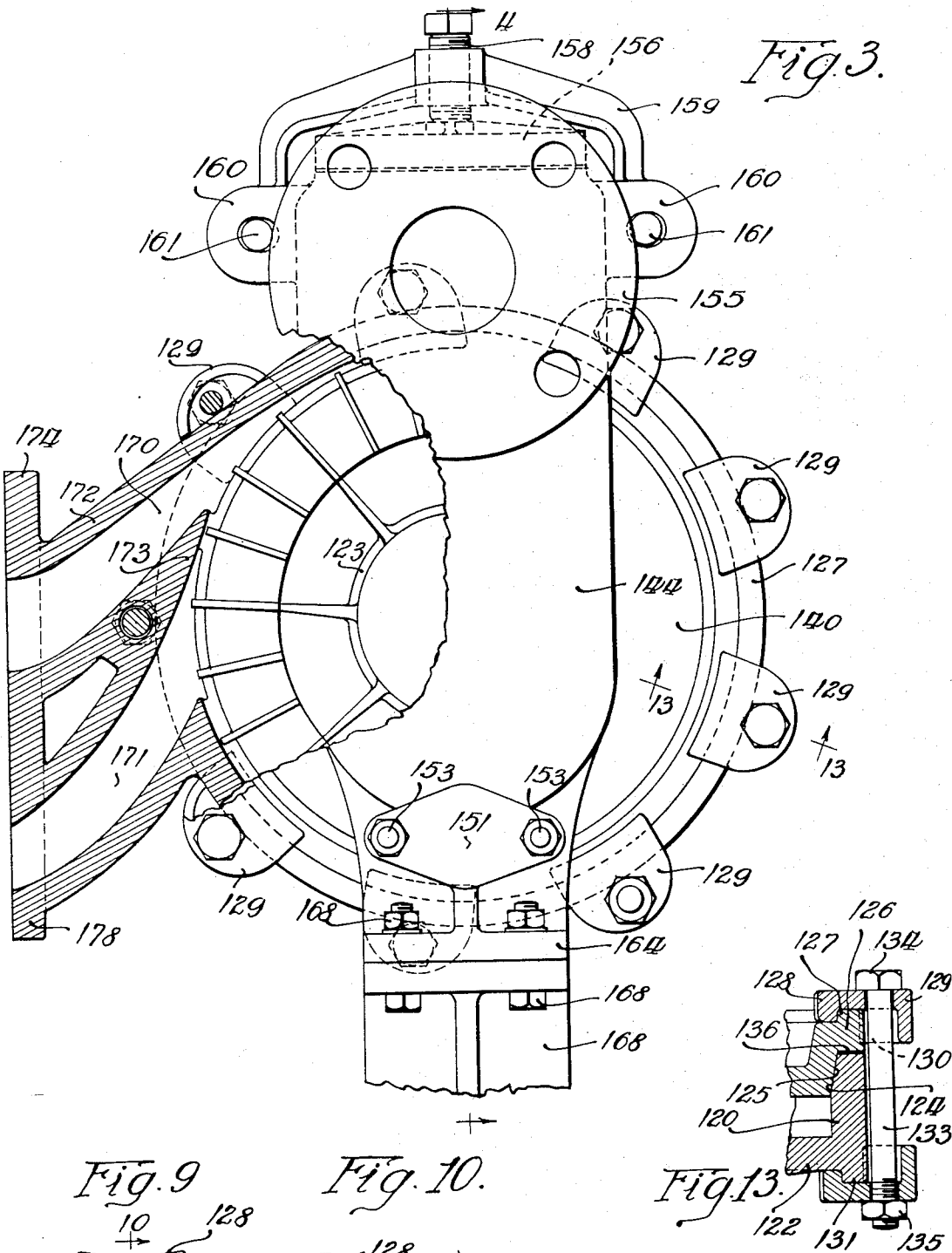
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5 Sheets-Sheet 3



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5 Sheets-Sheet 4

Fig. 4.

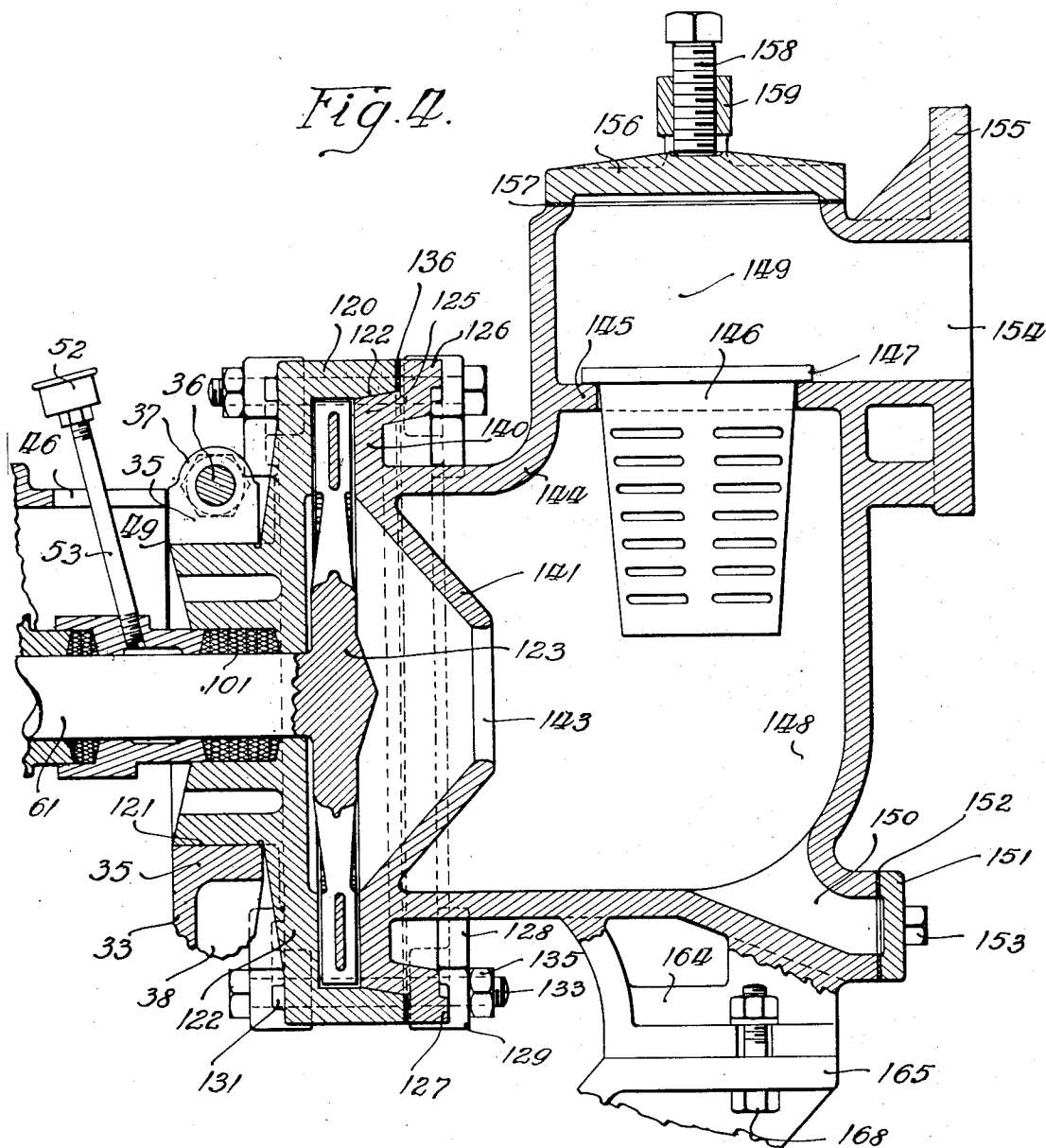


Fig. 11.

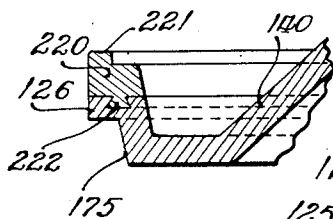
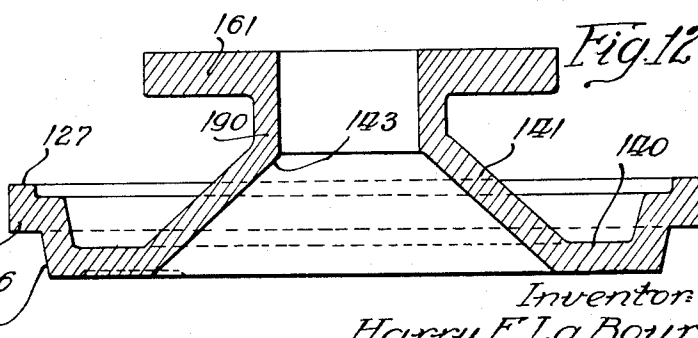


Fig. 12.



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5 Sheets-Sheet 5

Fig. 5.

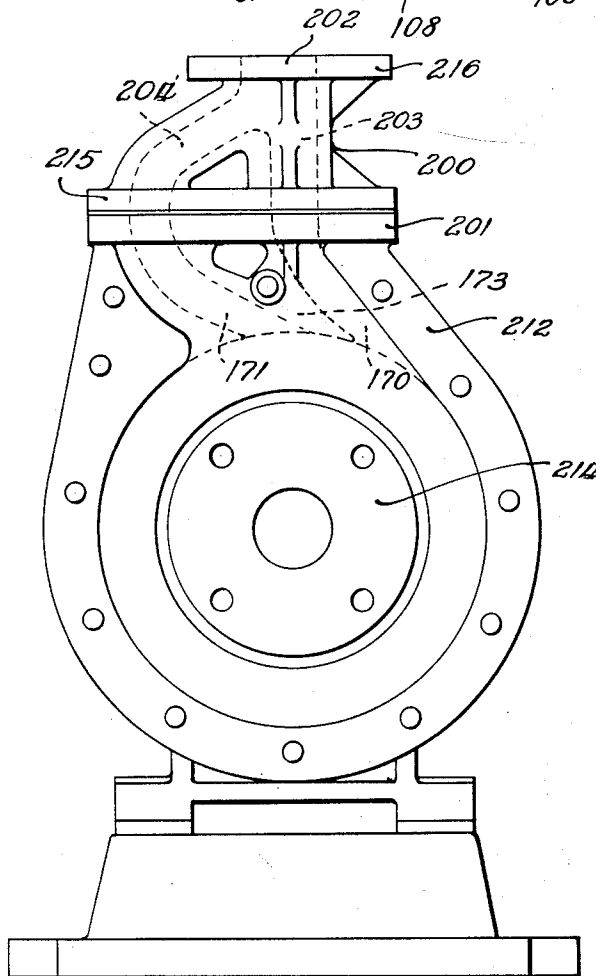
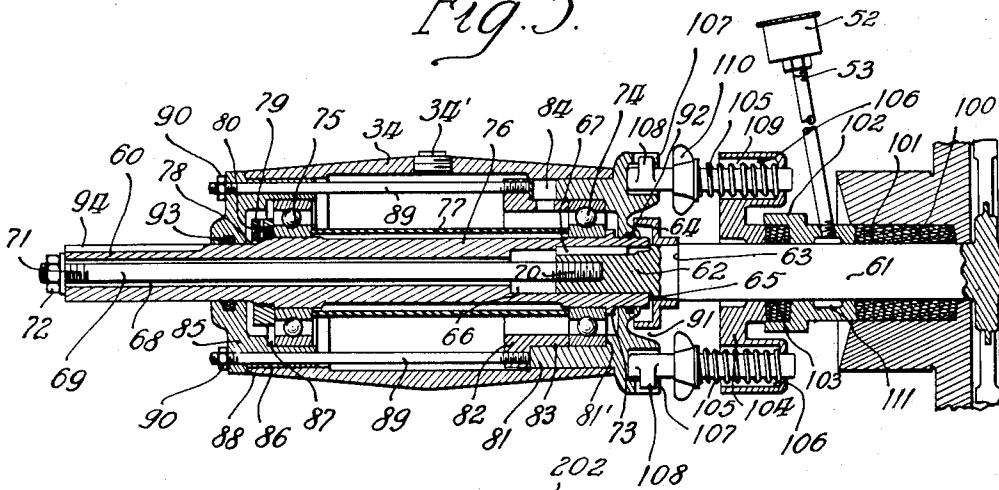


Fig. 14.

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UNITED STATES PATENT OFFICE

1,922,050

PUMP

Harry E. La Bour, Elkhart, Ind.

Application June 28, 1929. Serial No. 374,409

9 Claims. (Cl. 103—103)

This invention relates in general to self priming centrifugal pumps, and specifically the invention relates to mechanical improvements in the structure of pumps of this kind, and in the mounting of the pump and its auxiliaries.

In my prior Patent, 1,578,236, issued March 23, 1926, I disclose a centrifugal pump of the self priming type, in which the impeller or runner is mounted on a substantially horizontal shaft and caused to rotate in a vertical plane within a pump casing. The liquid drawn into the impeller is discharged through a tangential port into a separator from which it is carried away by the discharge piping.

During the priming period a mixture of air and liquid is thrown from the impeller into the separator in which the air escapes from the liquid and the liquid is returned through an auxiliary duct to the impeller to be recirculated. This continues until the pump primes itself and begins its normal pumping operation. No air is entrained in the liquid during the normal pumping operation.

After the pump has been primed, and is pumping solid liquid, little or no liquid is returned from the separating chamber to the impeller chamber, but rather the auxiliary duct may also act as a discharge duct and assist the main duct in carrying off the liquids drawn into the impeller chamber by the impeller.

The pump disclosed in this patent discharges vertically from the impeller chamber, that is the discharge port of the chamber was located on the top side of it and the separator located above the pump.

In my copending application, Serial No. 751,210, filed November 21, 1924, I disclose a pump which operates on substantially the same principle as that of the pump disclosed in the above mentioned patent, but which is modified to the extent that the pump is turned over on its side and the discharge port located on the side of rather than on the top of the pump. The separator which is attached to the discharge port of the pump is reached by a horizontal duct rather than a vertical duct as shown in the patent. The liquid and air forced into the separator by the pump are thus made to whirl in a horizontal plane about a vertical axis, with the result that a more efficient separation of liquid and air is achieved. The liquid so separated is returned to the impeller to assist in priming the pump.

In the pumps disclosed in both my above mentioned copending application and patent the inlet port of the pump is connected to a trap in which

I have located a strainer for removing solids from the liquids being pumped to thereby protect the impeller from injury and the pump from being clogged.

In my present invention I provide a new and improved pump which operates upon the principles set forth in the above mentioned copending application and patent. The mechanical design of the pump is arranged so that the outlet port may be located either at the top of the impeller chamber or at the side thereof, further arranged that the same casting may be used regardless of the location of the outlet port. In the pumps manufactured heretofore, separate castings were required for each different location of the outlet port of the pump.

The chamber in which the impeller runs is made in two sections, the one containing the outlet port and mounting means for holding the casing on a suitable support and the other the suction port. In pumps in which the suction intake is led through a straining chamber, the construction of the pump is simplified to a considerable extent by making one of the walls of the straining chamber also serve as a wall of the impeller chamber. That is, in my improved design I have formed the screening chamber in such a manner that its outlet, which is also the inlet or suction opening of the impeller chamber, are as one, and the walls of the screening chamber are formed to fit in the section of the casing containing the outlet ports of the pump.

It has been the custom heretofore to provide casings of this kind with outwardly extending flanges in which are located a plurality of bolt holes through which bolts are placed and drawn tight to hold the sections together. While this construction is satisfactory if the relative positions of the parts is always the same, the necessity of registering the bolt holes makes this type of construction objectionable in a pump where the outlet ports are arranged to be located in different positions.

Furthermore, in pumps which are to be used to circulate liquids which are highly corrosive to iron and steel, such liquids as strong acids for example, it is necessary to construct all of the parts of the pump which come in contact with the liquid of an acid resisting material. The most satisfactory acid resisting materials for certain acids are lead alloy products which, while they are satisfactory from the standpoint of their resistance to corrosion, are frequently somewhat soft and relatively weak mechanically. In a pump in which the outwardly extending flanges

and bolts running therethrough are depended upon to hold the sections of the pump casing together in a liquid tight joint, considerable difficulty has been experienced when the casings are made of such an acid resisting material, since the material is too soft and too weak mechanically to be properly clamped together by flanges and bolts.

I have, therefore, provided in the improved design of my pump a new and improved arrangement for holding the two sections of the impeller chamber together, an arrangement which eliminates the bolts projecting through flanges on the chamber and substitute therefor hook-like clamp members which hook over the rim of a flange on the member, and are drawn tight by a bolt projecting through the clamps rather than through the flange.

These clamps are readily removable, and since no bolt holes must be brought into registration, the two halves of the impeller chamber can be rotated with respect to each other without difficulty. The clamps which may be made of cast iron or other suitable strong metal, since they do not come in contact with the corrosive liquids, are brought to bear upon the walls of the castings directly over the point at which the seal is made, so that the softness of the acid resisting material comprising the castings does not impair the efficiency of the sealed joint.

The impeller of the type disclosed in my above mentioned patent is substantially balanced and free from end thrust. However, some slight end thrust may develop and it is, therefore, necessary to provide a bearing structure which will resist this end thrust and hold the impeller truly located in the center of the impeller chamber. Since the suction port of the pump is located at the center of the impeller it is difficult to locate a bearing on the suction side of the impeller, and it is, therefore, common in pumps of this class to support the impeller on an overhanging shaft. That is, on the side of the impeller opposite the suction face a large bearing is provided and the shaft projected therethrough and the impeller attached to the projection of the shaft.

In my improved pump I have provided a new and improved bearing assembly which not only supports the shaft for free rotation but also is arranged to take up end thrust put on the shaft by the impeller and motor thrust put on the shaft by the motor or driving means used to rotate the impeller.

As is the custom in a pump of this kind, I provide a packing gland for closing off the opening through which the impeller shaft projects through the walls of the impeller casing into the chamber, and I employ a packing gland follower which is adjustable so that wear of the packing may be compensated for and the joint kept tight. The packing gland follower is adjusted by bolts which are held in the adjacent end of the main bearing of the impeller shaft and to prevent the throwing of grease from the main bearing by the exposed part of the shaft or of liquids which may leak past the packing, I have provided a cover which fits over the packing gland and bearing end, and a drip pan which is located beneath these members and the cover to collect any such liquids or grease and to carry them through suitable passages away from the pump.

In the construction of an impeller of the design set forth in my above mentioned copending application and patent, it is preferable to form

the impeller shaft as an integral part of the impeller.

Particularly, is this true if the impeller is cast of an acid resisting material. The shaft so formed is relatively short, and since the acid resisting material is less resistant to wear it is preferable that the impeller shaft does not rest in the supporting bearings of the pump.

Accordingly, in my improved bearing mounting, I have provided an auxiliary shaft supported in the bearings of the pump, that shaft being provided with an end adapted to receive and clamp the impeller shaft. This arrangement permits using a bearing shaft of steel or other preferred material, regardless of the material of which the impeller and its shaft are constructed. The bearing shaft affords a solid support for the impeller, and the particular design of the connecting joints between the bearing shaft and the impeller shaft permits rigidly attaching the two shafts together and accurately aligns them so that the impeller may be rotated without wobbling. Furthermore, the particular design of connecting joints permits ready detachment of the two shafts when it is necessary to remove the impeller from the pump.

Further objects and advantages of my invention, not specifically mentioned here, will be best understood from a reading of the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of my invention is disclosed to acquaint those skilled in the art with the teachings of it, and in which;

Figure 1 is a perspective view of a completely assembled pump and motor for driving the same;

Figure 2 is an elevation view of the pump and bearing assembly with the base sectioned to show its construction;

Figure 3 is an end view of the pump showing the trap and having a part of the walls thereof broken away to show the interior construction of the impeller chamber;

Figure 4 is a cross sectional view taken substantially along the line 4—4 of Figure 3 showing the interior details of the impeller chamber and of the trap;

Figure 5 is a cross sectional view showing the bearing and packing gland construction;

Figure 6 is a cross sectional view taken along the line 6—6 of Figure 2 showing the drip pan and cover employed to protect the packing gland of the pump;

Figures 7 and 8 are respectively plan and side elevation views of the cover;

Figures 9 and 10 are respectively plan and section views of the clamp employed to lock the two sections of the impeller chamber together;

Figure 11 is a cross sectional view of a reinforced cover flange;

Figure 12 is a cross section view of a complete suction cover of the pump;

Figure 13 is a cross sectional view taken along the lines 13—13 of Figure 3; and

Figure 14 is an end view of a modified form of the pump showing an alternative separator construction.

From Figure 1 it will be apparent that I have provided a base 1 which forms a mounting support for the motor 2, the pump casing 3, the trap 4 and the separator 5, thereby permitting the construction of the pump as a complete unitary structure.

The base plate 1, which is preferably a cast

iron plate, is provided with ears 6 and 7 through which bed bolts are projected to mount the plate upon a suitable bed or foundation.

At one end of the base I have provided a slightly elevated section upon which motor pads 9 and 10 are attached to form a footing for the motor 2 which is held on the base and pads by the bolts 11. The pads 9 and 10 may be varied in thickness so as to bring the shaft of the motor to the proper height with respect to the shaft of the pump, that height varying with different makes and types of motors.

The motor shaft is connected to the pump by the flexible coupling 23, which may be of any preferred form.

At the opposite end of the base 1 I have provided piers 16 and 17 upon which the feet of the pump drive bracket rest and are bolted by suitable through bolts projecting through those feet and through the piers 16 and 17.

I have also provided the pier 18 which projects centrally from the upper face of the base adjacent the piers 16 and 17, and serves as a mounting support for the trap 4.

The upper surface of the base 1, except for these piers and motor pads, is generally flat sloping gradually from a high point at the motor end to a low point 14 located beneath the trap 4, the edges of this sloping surface 12 being protected by a flange 13 projecting upward from this surface.

To provide for the carrying off of any liquids which may leak from the pump or grease which may work its way out of the bearing of the pump or motor, I have provided a port 15 located in the flange 13 of the base adjacent the low point 14 in the surface 12, into which opening 15 a suitable pipe connection is threaded and connected to a drain or catch basin to carry off the liquid that has collected on the surface 12.

The trap 4 is provided with two flanged joints 22 the upper one of which connects with the intake pipe of the pump and the lower one serves as a cover for the cleanout opening of the trap. In order that any liquid that may happen to leak out of these flanged joints 22 may be collected and carried away from the pump, I have provided the drip pan 20 which is hooked over the flange 13 on the base 1 and supported by the feet 20' resting against the outside surface of the base. The sloping surface of this drip pan collects the liquids which may drip from these joints and carries it to the surface 12 of the base from which it runs through the pipe 15 into the suitable drain connection attached thereto.

Similarly, the separator 5 is provided with the flanged joints 21 the uppermost of which connects with the discharge pipe leading from the separator, the middle one of which connects with the main discharge port of the pump and the lower one with the auxiliary discharge port of the pump. Any leakage which may work its way through these flange joints is collected in the drip pan 19 which is disposed below the separator 5 and which slopes toward the surface 12 of the base 1. This drip pan 19 is hooked over the flange 13 of the base and supported by feet 19' which rests against the outside surface of the base.

As will best be seen in Figures 2 and 6 the drive bracket, indicated generally at 30 in Figure 2 and which supports the rotating parts of the pump, rests upon the feet 31 which are bolted to the piers 16 and 17 by the bolts 32.

This drive bracket comprises the generally rec-

tangular base portion 33 rising vertically from the feet 31 and terminating in the bearing collar 34 and the split clamping ring 35. The bearing collar 34 comprises a generally cylindrical hollow body in which the bearing assembly is disposed and clamped in the manner which will subsequently be explained.

A threaded opening in the top of collar 34, into which the plug 34' is fitted, provides for lubrication of the bearing assembly.

The clamping ring 35 is a split ring having a circular interior which receives a projecting hub or collar of the pump casing, that hub being clamped in the ring by the bolt 36 projected through ears 37 on the upper side of the ring.

The bearing collar 34 projects from the one end of the rectangular base 33 of the driving bracket and the clamping ring 35 projects from the opposite end, the ring being supported by flanges 38 cast integral with the walls of the base and attached to the ring at its intersection with the base.

The inside end of the bearing collar 34 and the inside end of the clamping ring 35 are spaced apart, and the upper edges 39 of the walls of the base 33 are dropped somewhat below the center line of the collar 34 and ring 35.

This edge 39 serves as a support for the flanged edge 40 of the rectangular drip pan 41 which is disposed within the walls 33 of the driving bracket 30. The lower part of the drip pan 41 comprises the funnel like portion 42 which terminates in the opening 43 disposed adjacent to the sloping surface 12 of the bed plate 1.

The upper edge of the drip pan 41 adjacent to the bearing collar 34 includes the rounded edge 44 which snugly fits beneath a projecting lip or flange 45 on the bearing assembly. By this arrangement any grease or oil which may leak from the bearing is collected by the projecting lip 45 of that bearing and allowed to drop into the drip pan 41 from which it runs through the opening 43 onto the sloping surface 12 of the bed plate 1. Since this surface 12 slopes down to a low point 14 from which a drain pipe leads through the port 15 in the walls of the flange 13 of the bed plate, the oil that leaks from the bearing and is collected by the drip pan can be drained from the pump.

The opposite ends of the drip pan fit snugly beneath the packing members which surround the shaft leading into the pump, so that any liquids that may leak from the pump through these packing members are collected by the drip pan and drained through the opening 43 onto the bed plate surface 12 from which they are likewise drained through the port 15.

The moving parts of a pump of this kind travel at a relatively high speed and oil or liquid which might leak out of the bearing or pump respectively are thrown by the revolving shaft of the pump and if special means are not provided to collect the liquids so thrown they will be thrown out of the pump.

To prevent the throwing of these liquids from the pump and to protect the packing glands from injury I have provided a cover 46, the lower edge of which is cut away at 47 to fit within the flanged upper edge of the drip pan 41. This cover is a U-shaped cover and surrounds the shaft and moving parts of the pump, and serves to collect the liquid thrown off by the rotation of the pump shaft and to discharge it into the drip pan. The end of the cover, adjacent the bearing collar 34, is turned down in the form of a flange 48 which

rests on the outside surface of the bearing collar. The opposite end of the cover butts against the square face 49 of the clamping ring to tightly close that opening.

5 In the upper face of the cover I have formed a projecting handle 50 which facilitates removing the cover for inspection and adjustment of the parts disposed beneath it. I have also provided a slot 51 in the upper surface of the cover
10 through which slot an oil pipe 53 is projected, that oil pipe terminating in the grease cup 52 which cup forces grease or other lubricant through the pipe 53 into the packing gland of the pump.

15 The bearing structure which is shown in detail in Figure 5 comprises a bearing arrangement for supporting the shaft 60 and also for resisting end thrust of that shaft.

20 The shaft 60, which is connected to the motor and runs through the bearing, is connected within the bearing to the shaft 61 of the impeller of the pump. This arrangement of employing a separate shaft is of particular utility in pumps which are employed to circulate strong acids. In such
25 pumps, the impeller, its shaft 61, and the casings of the pump and auxiliary apparatus through which the acid is circulated are all usually made of an acid resisting material, so that no dissimilar metals are in contact with the acid. The impeller and shaft are cast integral to eliminate a
30 trouble making joint within the pump, and to make all parts of the impeller equally resistant. By providing the shaft 60 and connecting that shaft to the acid proof shaft 61 of the pump, the
35 shaft 60 can be made of steel or other material best suited to withstand the strains that are to be placed upon it, and the acid proof shaft can be employed to resist the acids circulated by the pump.

40 The pump shaft 61 projects through suitable packing and terminates in a reduced end portion 62 which is of smaller diameter than the main shaft, the reduction of diameter being accomplished in two steps each of which forms a shoulder
45 on the shaft. The first shoulder 63 serves as an abutment for the slinger ring 64, which ring is tightly fitted on the shaft 61 and thereby made to rotate with it. The shoulder 63 and the end of shaft 60 prevent the ring from sliding
50 along the shaft 61.

55 The slinger ring 64 is preferably of generally Z-shaped section having a portion encircling the shaft 61, a portion projecting radially from that shaft, and a portion disposed parallel to the shaft portion and spaced away from it. This ring serves to protect the bearing against the entrance of the liquids being pumped by the pump. Should these liquids leak past the packing, they are
60 collected by the slinger ring 64 and thrown outward from the shaft, striking against the cover 46 and eventually dripping into the drip pan 41. The use of this slinger ring prevents these liquids from entering the pump bearings and diluting the lubricant therein or otherwise causing injury to the bearing and shaft.

65 The second shoulder 65 is disposed within the cup-like portion of the slinger ring 64, that shoulder serving as an abutment for the end of the shaft 60. The shaft 60 is counterbored at 66 to fit over the small diameter portion 62 of the shaft 61. A keyway is cut in the counterbore 66 and a corresponding keyway in the small diameter portion 62 of shaft 61 which keyways are brought
70 into registration to receive the key 67 which locks

the shafts 60 and 61 against rotation with respect to each other.

The shaft 60 also contains the hole 68 running axially of the shaft and connecting with the counterbore 66.

80 A bolt 69 is disposed in this hole 68, that bolt being threaded into the end of the shaft 61 as shown at 70. The opposite end of the bolt 69 contains the threads 71, the threaded portion projecting beyond the end of the shaft 60 to receive the nut 72. By tightening the nut 72, the portion 62 of the shaft 61 is forced into the counterbore 66 in the shaft 60, and the key 67 is forced into the key seats. The nut 77 is tightened until the end of the shaft 60 butts against the shoulder
85 65 on the shaft 62, at which time the key 67 is fully seated within the seats in the counterbore 66 and on the shaft 61.

90 On the outside surface of the shaft 60, adjacent the counterbore, I have provide a ring 73 which forms an abutment for the shaft member of the bearing 74, the surface of the shaft 60 adjacent this ring being machined to accurately fit within the inner opening of this member. Furthermore, the outside surface of the shaft between this bearing surface and the surface beneath the bearing 75 is machined off to reduced diameter as shown at 76 to afford clearance between the shaft and the spacing cylinder 77 which is disposed around it.

95 On the motor end of the bearing 75 I have provided the threaded portion 78 in the outside surface of the shaft on which the split nut 79 is threaded and butted against the shaft member of the bearing 75.

100 By tensioning this nut to bear against the shaft member of the bearing 75, the spacing cylinder 77 is made to bear against the shaft member of the bearing 74, which member in turn is butted against the ring 73 projecting from the shaft to thereby lock the bearings against longitudinal movement on the shaft. After the nut 79 has been so adjusted, the screw 80 is tightened to draw the split portions of the nut together to thereby lock it on the threads 78.

105 By this arrangement the motor thrust placed on the shaft 60 by the motor or other means employed to rotate the shaft, is transmitted through the threads 78 and nut 79 to the shaft member of the bearing 75, that member transferring the thrust to the spacing cylinder 77 which in turn transfers it to the bearing 74, where this thrust is resisted as will hereinafter appear.

110 A bearing support ring 81 is fitted into the open pump end of the bearing collar 34, and provided with a counterbore terminating in the shoulder 81' against which the stationary portion of the bearing 74 is abutted. A bearing clamping ring 82, which has a projecting collar 83 that fits within the counterbore in the bearing support ring 81, butts against the opposite face of the stationary member of the bearing 74.

115 This clamping ring 82 is held in place against the bearing support ring 81 by the pin 84 projecting through the ring and the member 82. By this arrangement the stationary member of the bearing 74 is locked against movement longitudinally of the shaft, the thrust placed on it from the left hand end of the shaft 60 as seen in Figure 5 being resisted by the shoulder 81, and the thrust placed on it in the opposite direction being resisted by the collar 83 butting against the opposite face of the bearing member.

120 A second bearing support ring 85 is provided

with a collar portion which fits within the opposite open end of the bearing collar 34. This ring is also provided with a counterbore into which the stationary member of the bearing 75 is accurately fitted. The projecting flange 88 of the supporting ring 85 butts against the end of the bearing support collar 34.

The ring like portion of the bearing support ring 82 is threaded and a plurality of bolts 89 are registered with these threaded openings. The supporting ring 85 is provided with a plurality of openings through which the bolts 89 project. These bolts 89 are disposed within the collar 34 and outside of the spacing cylinder 77. By tightening the nuts 90 on the ends of the bolts 89 projecting through the surface of the supporting ring 85, the ring 85 and the ring 81 can be drawn tightly together on opposite ends of the bearing support ring 34 to lock the bearing assembly in place.

The bearing support ring 81 is also provided with a radially projecting portion terminating in a fork like end or collar which is disposed adjacent to the surface of the shaft 60 and on the outside of the collar 73. This flange forms a casing for the packing member 92 which bears against the surface of the shaft 60 and prevents the leakage of lubricant from the bearing assembly. The outside surface of the supporting ring 81 is also provided with projecting ears into which the ends of the packing gland follower adjusting bolts are butted, and with a ring like channel 91 disposed between the shaft end of the web and the bolt abutments. The end of the slinger ring 64 is disposed in this ring like channel, to prevent mixing of leakage liquids from the pump with the lubricant of the bearings.

Similarly, the bearing supporting collar 85 terminates in a fork like portion adjacent the shaft 60 in which the packing 93 is disposed to prevent leakage of lubricant out of that end of the bearing casing 34.

By removal of the plug 34' from the upper part of the bearing supporting collar 34, the bearing assembly can be filled with suitable lubricant, preferably a hard oil, which oil is confined with the bearing assembly and therefore capable of lubricating it for a long period of time.

The free end of the shaft 60 is provided with the keyway 94 into which is fitted a suitable key for attaching the shaft to the flexible coupling.

The impeller shaft 61 projects through a counterbore 100 in the walls of the pump casing in which counterbore the packing material 101 is disposed around the shaft. A packing gland 103 is also disposed around the shaft and brought to bear against this packing material 101. A second packing material 103 is disposed within the packing gland 102, being held therein by the packing gland follower 104.

This follower 104 is held tightly against the packing material by the bolts 105 which fit into the pockets 106 in the follower, and into the pockets 107 in the bearing supporting ring 81. Ears 108 on the bolts 105 register with slots in the bearing supporting ring 81 to prevent rotation of the bolts. Springs 109 are disposed around the bolts 105 and within the pockets 106 in the packing gland follower, and wing nuts 110 are threaded onto the bolts and turned to put tension into the springs 109 to thereby insure that the packing gland follower 104 will tightly bear against the packing 103 and the packing gland 102.

By this arrangement the packing gland 102 can

be moved tightly against the main packing 101 to tightly seal off the shaft and casing to prevent leakage of the liquids pumped by the pump through this opening.

The amount of tension that must be placed on the packing gland follower depends upon the type of packing material used. Preferably where conditions permit I prefer to use a relatively soft packing material that can be maintained tightly against the revolving shaft with a small endwise pressure on the follower, in which case a finger tight adjustment of the wing nuts 110 is all that is necessary to keep the joint tight. The choice of particular packing material will, to a large extent, be governed by the character of the liquids that are being pumped by the pump, since this packing material must successfully resist deterioration caused by those liquids.

The packing gland 102 is provided with a circular cavity 111 into which the oil pipe 53 opens to permit the grease cup 52 to force a lubricant into the cavity 111. This lubricant works its way along the shaft 61 to lubricate the surface of that shaft in engagement with the packing 101 and with the packing 103.

The pump casing in which the impeller runs may be made in accordance with any one of a number of designs within the teaching of my invention. In Figures 1, 3 and 4 I have shown a design in which the discharge ports of the pump are completely contained within the walls of the back plate of the casing, that is the member adjacent to the bearing and motor of the pump. In Figures 2 and 13 I have shown a different type of pump casing, one in which the discharge ports of the pump are located half in the back plate of the casing and half in the front plate of the casing.

In the former type of pump casing, that is the casing in which the outlet ports are located solely within the back plate of the casing, it is not necessary to bring a front plate of the casing into accurate rotary registration with the back plate, that is, the front plate may be rotated around the axis of the pump with respect to the back plate without damage. Conversely, if the front plate is held stationary, as is the preferred form where the front plate also forms a part of the walls of the trap, the back plate may be rotated through a wide angle to bring the discharge ports of the pump to any desired position.

In the pump casings designed heretofore in which the two halves of the casing were held together by bolts projecting through holes in the flanged portion of the casing, the rotation of one half of the casing with respect to the other is limited by the necessity of bringing the bolt holes into registration with each other. In the present invention, I have provided a clamping means for holding the two halves of the casing together, a means which does not necessitate bringing bolt holes in the various sections into registration. This arrangement, therefore, does not in any way limit the rotation of one section with respect to the other since the improved clamping means can be applied regardless of the relative rotary positions of the two sections.

In the modification of the pump employing the casing shown in Figure 13 and in Figure 2, the two halves of the pump must be accurately registered because the outlet ports of the pump are located one half in each of the sections, therefore in this modification the bolt holes prove advantageous rather than a hindrance since they

facilitate proper alignment of the two sections of the casing.

As will be best seen in Figure 4 when taken in connection with Figure 1, the back plate 120 of the pump casing is generally cup shaped, being provided with the circular flange 122 disposed around the outer periphery of the plate. A mounting collar or hub 121 is formed integral with the walls of the plate and located concentrically with the back wall of the plate. This hub 121 is machined to fit accurately within the split clamping ring 35 to thereby mount the pump casing upon the drive bracket. The exterior walls of the packing box which retains packing 101 are also formed concentrically within the hub 121. The impeller shaft 61 projects through an opening in the center of the back plate member 120 and supports the impeller 123 within the casing.

This impeller 123 is preferably of the type shown in my above mentioned Patent No. 1,578,236 issued March 23, 1926. The impeller rotates within the chamber defined in part by the walls and flange of the back plate member, but does not touch these walls.

The outward edge of the flange of the back plate 120 is beveled as shown at 124, to form a seating surface for the front plate of the pump.

Within the teachings of the invention, the front plate may be either a part of a trap, as shown in Figure 4, or may be any other preferred form such as a plate of the general design shown in Figure 12, the latter being employed when a trap is not used in connection with the pump.

The front plate in either case consists of a disc like member provided with a tapered portion 125 which registers with the tapered shoulder in the flange of the back plate, and with the flange 126 which overhangs the flange 120 of the back plate. As will best be seen in Figures 9, 10, 13 and 4 the front cover of the casing is held on the back cover with the taper portion 125 registering with the taper 124 in the flange 120 of the back cover, by clamps 129, which are shown in detail in Figures 9 and 10. The outer rim of the back plate 122 is provided with a plurality of annular bosses 131 and the corresponding rim of the front plate with a ring or collar 127. The clamp 129 includes a flat portion which fits over these bosses and collars and a hook-like rim 128 which engages the inside surface of them. The clamps also include the foot-like portions 130 which engage the peripheral face of the flanges, to form a solid seat for the clamp member.

The clamps are provided with an opening 132 through which a bolt 133 is projected, the head of the bolt 134 resting against one clamp and the nut 135 against the opposite clamp to draw the two together and thereby securely fasten the front and back cover of the pump casing together. By having the flange interrupted to form separate sections 131 it is not necessary to loosen the bolt such as 133 any more than just enough to release pressure whereupon the clamp consisting of the bolt 133 and clips 129 may be slipped into the space between projections 131 whereupon the clamp may be removed. The clamps may be applied in a similar manner.

A suitable packing 136 is interposed between the outward end of the back plate flange 120 and the face of the flange 126 registering therewith to prevent leakage of liquid at this point.

Thus it will be seen that by use of these clamping members 129 and suitable bolts 133 the front and back members of the pump casing can be

locked together securely without reference to the angular position of the one with respect to the other.

Returning now to Figure 4, in which the front plate of the impeller chamber is also an integral part of the trap, it will be noted that the web-like portion of the front plate 140 projects radially inward from the tapered seating face 125 terminates in a conical frustum 141 which contains an opening 142 concentrically located in it. This opening, which is disposed opposite the center of the impeller 123, serves as an inlet port for the pump. The conical wall 141 provides an inlet passage and an inlet chamber which flares to the chamber in which the vanes of the impeller run. This flared inlet chamber is of value in providing a gradual angular acceleration of the liquid as it enters the pump casing and moves toward the channel. The web-like portion 140 also contains and is cast integral with the casing of the trap 144 which trap is employed to screen out solid objects from the liquid admitted to the pump.

The trap comprises the generally cylindrical chamber defined by the walls 144 and containing an inwardly projecting flange 145 which serves as a support for the conical strainer 146.

This strainer contains a flange 147 projecting outward from its upper edge and engaging the upper face of the supporting flange 145 to hold the strainer in the trap.

The chamber 148 located in the bottom of the trap and separated from the upper chamber 149 by the screen 146, opens through the inlet port 143 into the impeller chamber of the pump. The chamber 148 also opens into the cleanout trap 150 which is normally covered by the cover 151 placed over the mouth of the trap 150 with the gasket 152 interposed therebetween, and held in place by the stud bolt 153. By removal of the stud bolt and cover 151 sediment which has collected in the bottom of the chamber 148 can be removed from this trap.

The upper chamber 149 opens into the inlet port 154, the walls of which port are formed in the shape of a flange 155 to which suction pipe may be attached by the usual flanged connection.

The top of the chamber 149 is provided with a cover 156 which is seated on the edges of the walls of the chamber with the gasket 157 interposed, this cover 156 being held thereon by the stud screw 158 projecting through the clamping collar 159.

As will be best seen in Figure 3, the collar 159 reaches over the outside surface of the walls of the separator and is held by pins or bolts 161 projecting through it and through suitable ears 160 formed in those walls. To remove the cover 156 from this chamber to permit removal and cleaning of the strainer 146, the stud screw 158 is loosened, pins 161 removed from the ears 160, and the straddle clamp 159 removed from the trap casing. The cover can then be removed and the inside of the trap thereby exposed for cleaning.

By reference to Figures 1, 3 and 4 it will be seen that the supporting foot 164 is formed integral with the walls 144 of the trap. This foot rests upon the bracket 165, that bracket being in turn bolted by the bolts 166 to the bracket 167 which is mounted upon the pier 18 of the base 1. The foot 164 of the trap is fastened on the bracket 165 by the bolts 168, thereby securely fastening the trap on the base plate of the pump and definitely locating it with respect to the other parts of the pump.

Referring now to Figure 3 in which I have broken away a section of the trap 144 and of the front cover plate 140 to show the interior construction of the impeller chamber, it will be noted that the impeller 123 rotates within this chamber and that the discharge ports 170 and 171 lead from the chamber tangentially of the impeller.

Ports 170 and 171 are formed in the walls 172 of the back plate casting of the impeller chamber, being separated by the partition 173 which is likewise cast integral with the chamber. The walls 172 terminate in the flanged portion 174 to which the separator 5, Figure 1, is attached by bolts 176 projecting through the flange 174 and the registering flange 177 of the separator.

The walls of the auxiliary discharge duct 171 terminate in the flange 178 which registers with the flange 179 of the separator 5, the latter flange being held on the former by the bolts 180 projecting through the two flanges.

The separator 5 comprises essentially a cylindrical chamber disposed with its axis vertically. The main discharge duct 170 of the pump connects with the main discharge duct 181 of the separator, which latter duct opens into the main chamber of the separator tangentially so that liquids thrown into the separator are whirled around the interior surface of its walls. The auxiliary discharge duct 171 of the pump likewise connects with the auxiliary duct 182 of the separator which also has tangential opening into the interior of the chamber of the separator, this duct 182 opening at a point near the bottom of the chamber.

As will be best understood from the detailed description of my copending application, Serial No. 751,210 filed November 21, 1924, when the pump is first started the impeller throws out a mixture of air and water, or other liquid that the pump is arranged to pump, this mixture entering the separator tangentially through the main discharge ducts 170 and 181. The air is separated from the liquid in the separator, and escapes through the discharge port 183 of the separator. The liquid so separated from the air falls to the bottom of the separator chamber and returns to the impeller chamber through the duct 182 and the duct 171 where it is again caught by the impeller and mixed with air and returned to the separator chamber.

This recirculation of the liquid in the pump continues until sufficient suction has been built up in the pump to draw additional liquid in through the trap. After this condition has been reached, the impeller receives so much liquid that the discharge port 170 cannot carry all of it, and the auxiliary port 171 is then called upon to handle the surplus liquid. That is, the flow of liquid through the port 171 is from the separator to the pump during the priming stage of the pump and from the pump to the separator when the pump is operating under its normal working condition.

Since there is no air entrained in the liquid when the pump is operating normally, the separator soon becomes filled with liquid and the liquid discharged into it by the ports 181 and 182 flows through it and out of the discharge port 183 without material change of its condition.

In instances where the supply of liquid to be circulated by the pump is such that there is no danger of solid materials being in the liquid, it is not necessary to employ the trap 144, in which case the cover plate 140 of the impeller chamber can be simplified as shown in Figure 12. It will be noted that this cover comprises the tapered

portion 125 and the overhanging flange 126 which register with the taper 124 and the flange 120 of the back plate 122. The conical frustum 141 which opens into the suction port 143 is modified in that it is connected by the collar 190 to the intake flange 191. This flange affords a clamping surface through which the flanged end of the suction pipe can be attached so that liquids may be drawn in from that pipe to the impeller chamber.

Nor is it necessary in all instances to use a separator, particularly where the pump is used under conditions that supply the liquid to the suction end of the pump under gravity so that there is always an abundance of liquid in the pump and the self priming feature is, therefore, not necessary. In Figure 14 I have shown a pump modified in that the separator is replaced by the coupling member 200 which fits onto the flange 201 of the separator casting. This coupling unit 200 connects the main discharge port 170 to the discharge opening 202 by the duct 203, and also connects the auxiliary discharge port 171 of the pump to the discharge port 202 by the duct 204.

The liquids thrown out of the impeller chamber through the ports 170 and 171 by the impeller are thus collected and carried from the pump through suitable pipe being connected to the outlet port 202.

As will best be seen in Figure 2, of which Figure 14 is an end view, the pump casing employed in this adaptation of the pump is one in which the outlet ports 170 and 171 of the pump are cast one half in the back plate and one half in the front plate of the pump casing.

The back plate member of the pump casing contains the peripheral flange 211 which registers with the peripheral flange 212 of the front plate member. The back plate also contains the flange 210 which registers with the flange 215 of the connecting member 200.

To hold the front and back plate members of the pump casing together, the flanges 211 and 212 are provided with a plurality of holes in which bolts are disposed to draw the two halves of the casing together. Similarly the flanges 201 of the front plate cover, 210 of the back plate, and 215 of the connecting member 200 are provided with holes, not shown, through which bolts are projected to hold the connecting member 200 onto the pump casing.

The front cover is also provided with a conical frustum 213 which terminates in the suction plate comprising the flange 214 to which the suction pipe, not shown, is connected by the usual flange connection. Thus it will be seen that by the use of the members shown in Figures 2 and 14 a pump employing neither the trap on the suction side nor the separator on the discharge side can be constructed and mounted in the driving bracket by a suitable boss, not shown, registering with the split clamping ring 35. As explained more at length above in connection with the form shown in Figure 1, by virtue of the particular construction of the driving bracket the pump may be disposed optionally to discharge either horizontally or vertically, or in any other direction, whereby the same pump may be adapted for various installation conditions. Instead of bolting flanges this form of pump may also employ the clamping members 129 or the equivalent.

In pumps that are to be used to pump water

or other noncorrosive liquids, the impeller, pump casing, trap, separator, and auxiliary equipment coming in contact with the liquids can all be made of cast iron. However, if the pump is to be used to pump an acid or other liquid which is corrosive to cast iron, the impeller, pump casing, trap and separator must be constructed of an acid resisting material.

Certain acids can be successfully contained only in chambers made of lead or lead alloys, which are relatively soft, and if a pump is to be constructed to pump liquids of this kind, the clamping flanges of the pump casing must be reinforced with a harder metal to successfully withstand the pressure placed on them by the clamping members 129. In Figure 11 I show such a construction in which the cover plate 140 is shown equipped with the usual taper portion 125 and flange portion 126. The steel clamping ring 220 is provided with the clamping shoulder 221 over which the hooked end 128 of the clamping members 129 is disposed, this clamping ring 220 being attached to the member 126 by the dove tailed joint 222.

In constructing a member in this manner, the ring 220 is put in the mould, and the pump member 140 cast thereon, the melting point of the lead alloy used in this instance being sufficiently low that the molten alloy will not injure the dove tailed member 222 of the iron ring.

Similarly, other clamping surfaces in the other members of the pump can be reinforced by iron rings which do not come into contact with the acids or other liquids which are corrosive to iron.

Notwithstanding that the leakage of corrosive liquids past the packing into the drip pan 41 is rather slight, I prefer to construct this drip pan and the cover 46 of acid resisting metal in pumps that are to be used to circulate strong acids.

In the foregoing description and in the drawings the pump is shown and described as being driven by a motor mounted on the same base as the pump. Obviously, this is not a requirement of the design of my invention since by suitable modification of the base, a pulley may be mounted on the free end of the shaft 60 and the pump driven by a belt connection to a suitable prime mover.

For the successful operation of the pumps it is preferable that the impellers be driven at the rate of approximately 1150 to 1750 R. P. M., for small sizes and from 900 to 1450 R. P. M. for larger sizes, and any source of motive power capable of supplying sufficient power to the impeller at these speeds may be used to drive it in place of the motor shown by way of illustration.

Furthermore, the particular type of bearing construction shown in the preferred embodiment of my invention may be modified within the teachings of the invention, since I am aware that there are other types of bearings which can be fitted within the bearing support collar 34 and successfully employed to support the runner of the pump.

While I have chosen to show my invention in connection with a preferred embodiment of it, I have done so by way of example only as there are many modifications and adaptations which can be made by one skilled in the art without departing from the teachings of the invention.

Having thus complied with the statutes and shown and described a preferred embodiment of

my invention, what I consider new and desire to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. In a pump, a back casing comprising a cup like portion having a hub projecting concentrically from one of its faces, and an annular flange on its opposite face, a trap having a circular portion registering with said back plate flange and cooperating with that plate to define a runner chamber, said circular portion containing a conical member whose base opens into the chamber and whose apex projects into said trap, means for holding said trap and casing plate together, a discharge port leading from said chamber, the walls of which are formed integral with the walls of the back plate and terminate in a flange, a separator having a flange registering with said discharge port flange to connect the separator to the port, a drive bracket having a clamping ring engaging said hub to thereby attach said casing plate on the bracket, said bracket and clamping ring together permitting the casing to be rotated with respect to the inlet trap and separator to bring said port flange into registration with the separator flange, a multivane runner in said runner chamber having a shaft projecting through a packing member disposed within said hub and a bearing supported on said bracket and supporting said runner in said chamber.

2. In a pump, a casing comprising a front plate and a back plate defining between them a chamber for a runner, a runner in said chamber, a shaft for said runner projecting through said back plate, a hub projecting rearwardly of said back plate concentrically with said shaft, a drive bracket having a clamping ring embracing said hub to mount said casing thereon, bearing means on said bracket spaced away from said ring and supporting said shaft, a drip pan disposed in said bracket between said ring and bearing means, and having flanges overhanging said bracket to support it therein, and a cover disposed over said pan and shaft and butted against said clamping ring and bearing means, said cover having projections which telescope into the flanges of said pan to support it thereon.

3. In a pump of the class described, a base, a branched drive bracket attached thereto, one of the branches, of said bracket terminating in a split ring supporting member and the other terminating in a bearing collar, a pump casing supported in said split ring, a bearing supported in said collar, a shaft projecting through said bearing and ring into said casing, a packing gland surrounding said shaft and projecting into the space between said ring and collar, a drip pan disposed in said bracket beneath said gland, and a cover disposed on said pan and over said packing gland, said cover being telescoped into and supported by said drip pan.

4. In a pump, a back casing plate comprising a hub, a web projecting radially from the hub substantially at right angles to the axis of the hub, a flange on the periphery of the web disposed at substantially right angles thereto, a plurality of bosses on said web opposite said flange, a beveled seat and an adjacent flat face formed on said flange, a front casing plate having a flange registering with said back plate flange, a collar on the front side of said front plate flange, a beveled shoulder on said front plate flange registering with said beveled seat and a flat face on the front plate flange register-

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As will be best understood from the detailed description of my copending application, Serial No. 751,210 filed November 21, 1924, when the pump is first started the impeller throws out a mixture of air and water, or other liquid that the pump is arranged to pump, this mixture entering the separator tangentially through the main discharge ducts 170 and 181. The air is separated from the liquid in the separator, and escapes through the discharge port 183 of the separator. The liquid so separated from the air falls to the bottom of the separator chamber and returns to the impeller chamber through the duct 182 and the duct 171 where it is again caught by the impeller and mixed with air and returned to the separator chamber.

This recirculation of the liquid in the pump continues until sufficient suction has been built up in the pump to draw additional liquid in through the trap. After this condition has been reached, the impeller receives so much liquid that the discharge port 170 cannot carry all of it, and the auxiliary port 171 is then called upon to handle the surplus liquid. That is, the flow of liquid through the port 171 is from the separator to the pump during the priming stage of the pump and from the pump to the separator when the pump is operating under its normal working condition.

Since there is no air entrained in the liquid when the pump is operating normally, the separator soon becomes filled with liquid and the liquid discharged into it by the ports 181 and 182 flows through it and out of the discharge port 183 without material change of its condition.

In instances where the supply of liquid to be circulated by the pump is such that there is no danger of solid materials being in the liquid, it is not necessary to employ the trap 144, in which case the cover plate 140 of the impeller chamber can be simplified as shown in Figure 12. It will be noted that this cover comprises the tapered

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For the successful operation of the pumps it is preferable that the impellers be driven at the rate of approximately 1150 to 1750 R. P. M., for small sizes and from 900 to 1450 R. P. M. for larger sizes, and any source of motive power capable of supplying sufficient power to the impeller at these speeds may be used to drive it in place of the motor shown by way of illustration.

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2. In a pump, a casing comprising a front plate and a back plate defining between them a chamber for a runner, a runner in said chamber, a shaft for said runner projecting through said back plate, a hub projecting rearwardly of said back plate concentrically with said shaft, a drive bracket having a clamping ring embracing said hub to mount said casing thereon, bearing means on said bracket spaced away from said ring and supporting said shaft, a drip pan disposed in said bracket between said ring and bearing means, and having flanges overhanging said bracket to support it therein, and a cover disposed over said pan and shaft and butted against said clamping ring and bearing means, said cover having projections which telescope into the flanges of said pan to support it thereon.

3. In a pump of the class described, a base, a branched drive bracket attached thereto, one of the branches, of said bracket terminating in a split ring supporting member and the other terminating in a bearing collar, a pump casing supported in said split ring, a bearing supported in said collar, a shaft projecting through said bearing and ring into said casing, a packing gland surrounding said shaft and projecting into the space between said ring and collar, a drip pan disposed in said bracket beneath said gland, and a cover disposed on said pan and over said packing gland, said cover being telescoped into and supported by said drip pan.

4. In a pump, a back casing plate comprising a hub, a web projecting radially from the hub substantially at right angles to the axis of the hub, a flange on the periphery of the web disposed at substantially right angles thereto, a plurality of bosses on said web opposite said flange, a beveled seat and an adjacent flat face formed on said flange, a front casing plate having a flange registering with said back plate flange, a collar on the front side of said front plate flange, a beveled shoulder on said front plate flange registering with said beveled seat and a flat face on the front plate flange register-

ing with the flat face on the back plate flange, and means engaging said collar and said bosses for holding said plates securely together, said means including clamps and bolts which when in tension hold the clamp compressed against their respective members.

5. In a pump of the class described, a hollow rectangular drive bracket, a plurality of feet on said bracket having holes for receiving mounting bolts, a split clamping ring formed in the upper wall of one end of said bracket, a bearing support formed in the upper wall of the other end of said bracket, there being a space between said support and ring in which space the side walls of said bracket terminate in a flanged edge, a drip pan disposed within said bracket and having an edge overlapping said flanged edge to support the pan in the bracket, and a cover fitted over said pan and resting against said support and ring.

6. In a pump of the class described, a hollow rectangular drive bracket, a plurality of feet on said bracket having holes for receiving mounting bolts, a split clamping ring formed in the upper walls of one end of said bracket, a bearing support formed in the upper wall of the other end of said bracket, there being a space between said support and ring in which space the side walls of said bracket terminate in a flanged edge, a drip pan disposed within said bracket and having an edge overlapping said flanged edge to support the pan in the bracket, a pump casing supported by said clamping ring, a shaft projecting through said casing, a bearing in said bearing support, a packing gland surrounding said shaft, and a cover for said gland fitted over said pan and resting against said support and clamping ring.

7. In a pump of the type adapted to pump a mixture of liquid and gas, a pump casing comprising a back member and a front member, defining therebetween an annular raceway provided with a discharge passage, and an impeller having a multiplicity of fluid impelling buckets cooperating with said raceway and rotatably

mounted therein, said front member comprising a central substantially conical wall defining an inwardly flaring passageway extending substantially to the buckets of the impeller, and an inlet trap secured to the member peripherally around the flaring passageway and extending vertically to trap a body of liquid in communication with the interior of the pump casing.

8. In combination a pump casing comprising a pair of members defining a cylindrical annular channel of relatively short radial depth between them, an impeller having a spider and a circular member carried by the spider and disposed in said channel and having a multiplicity of short radially extending vanes relatively closely fitting said channel, one of the members comprising a front plate having a conical wall with an axial inlet opening and flaring from said opening to the inner periphery of the channel and an L-shaped inlet trap formed integral with the front plate and having a horizontal portion enclosing the conical wall and a vertical portion with a side outlet and a removable screen disposed partly in the horizontal and partly in the vertical portion of the trap.

9. A pump comprising a back casing plate having a circumferentially disposed annular flange and a discharge outlet formed integrally therewith, a trap adapted to be secured to said flange in a number of adjusted positions relative thereto and including a supporting portion and an apertured conical reentrant wall cooperating therewith to define a runner chamber and at one side thereof forming a tapered portion whose large end opens into said chamber and whose small end projects into and communicates with the interior of the trap, said back casing plate having a concentrically disposed hub projecting from its outer face, a base including a bracket arranged to receive said hub and the supporting portion of said trap and a clamping ring to engage said hub and clamp the same in the bracket, and a runner mounted for rotation in said runner chamber.

HARRY E. LA BOUR.