

Nov. 27, 1923.

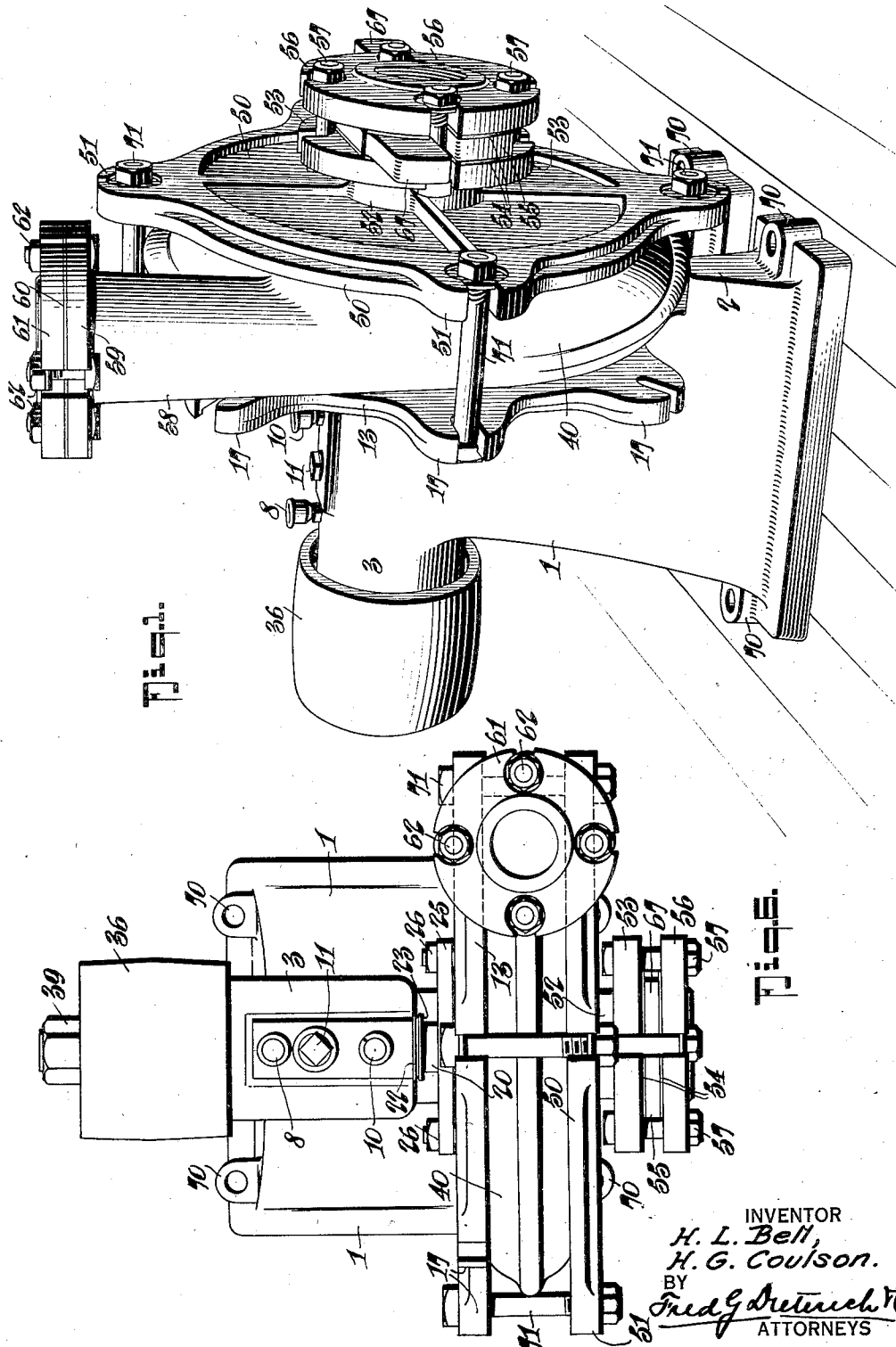
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H. L. BELL ET AL

CENTRIFUGAL PUMP

Filed Oct. 24, 1921

5 Sheets-Sheet 1



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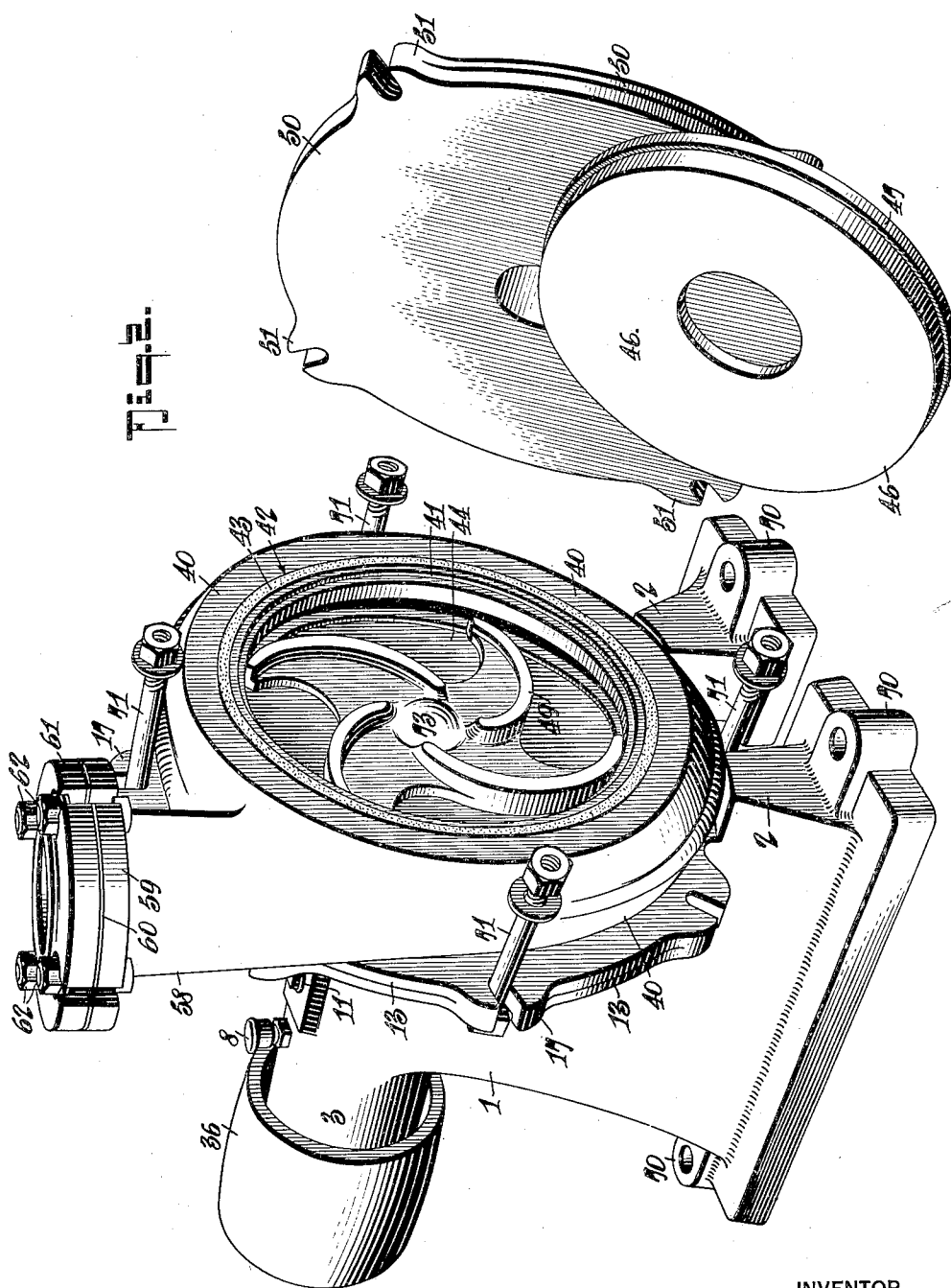
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5 Sheets-Sheet 2



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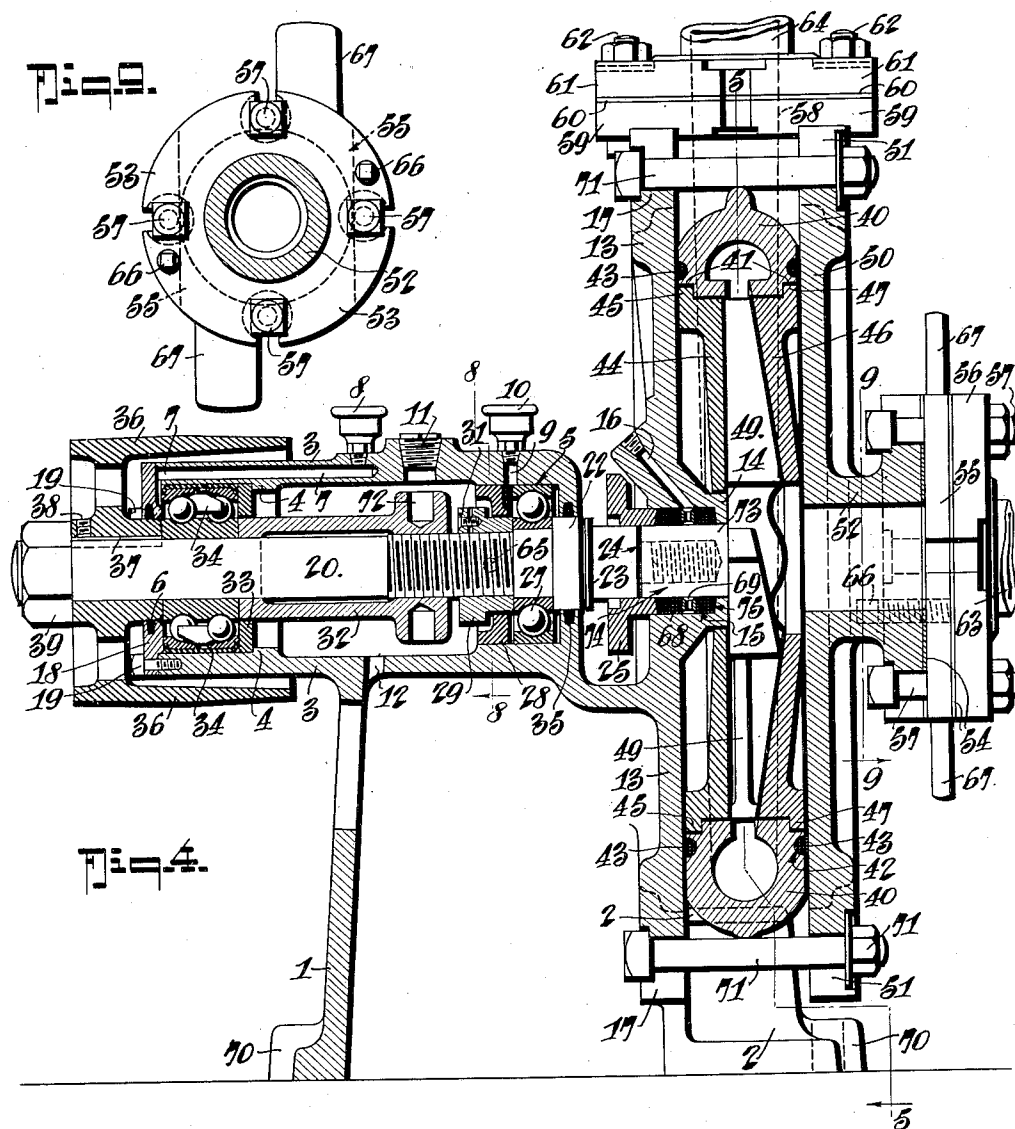
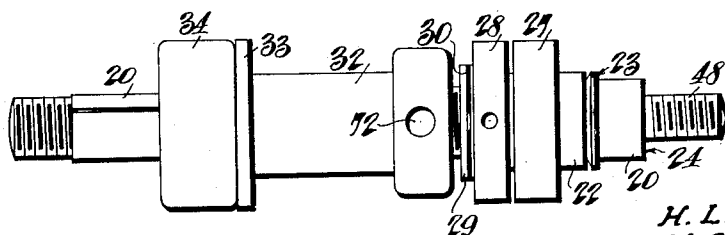


Fig. 7.

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Fig. 5.

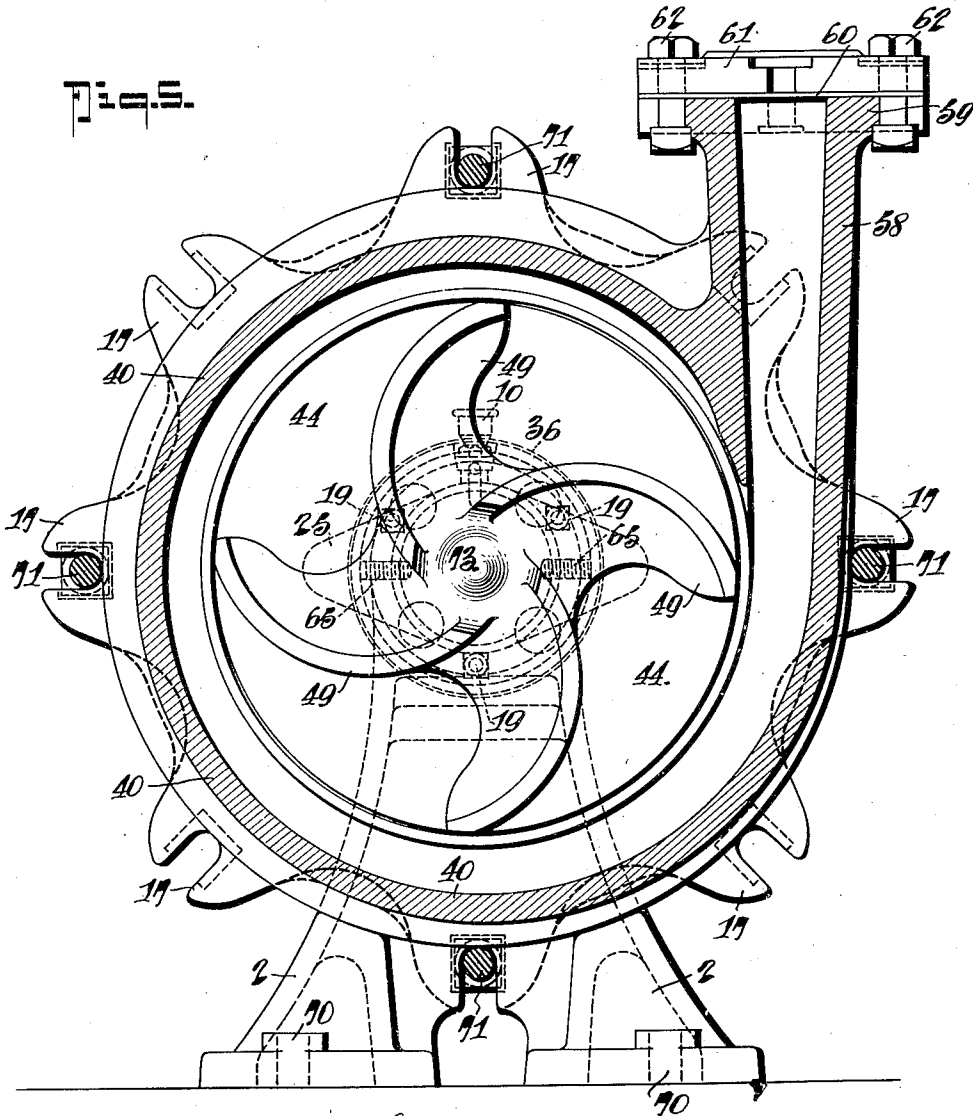
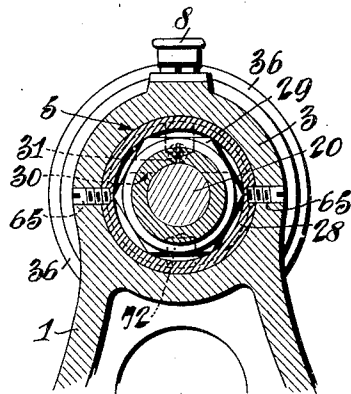


Fig. 6.

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UNITED STATES PATENT OFFICE.

HARRY LEWIS BELL AND HARRY GLEN COULSON, OF WALLACE, IDAHO, ASSIGNORS TO
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CENTRIFUGAL PUMP.

Application filed October 24, 1921. Serial No. 509,942.

To all whom it may concern:

Be it known that we, HARRY LEWIS BELL and HARRY GLEN COULSON, both citizens of the United States, residing at Wallace, in the county of Shoshone and State of Idaho, have invented a new and useful Centrifugal Pump, of which the following is a specification.

Our invention relates to improvements in single stage centrifugal pumps, and is designed more particularly for use in connection with ore concentrating, where the liquids pumped contain a percentage of more or less abrasive solids, such as sands and ore particles. However, the pump is also well adapted for pumping clear water or other liquids.

The objects of our invention are, first, to provide a construction by which the wearing parts can very quickly be removed and replaced (as a corollary to this, a spare pump is not required, as in the ordinary installation); second, to make the shape, proportions and material of the wearing parts such as to insure maximum life; third, to provide for changing the pump from right to left hand, or vice versa, by the change of only two parts; fourth, to make it possible for the discharge pipe to be led away in any direction through a range of about 250 degrees taken about the pump shaft as an axis; fifth, to render unnecessary, during long use under normal conditions, the replacing of shafts, glands or bearings; sixth, to reduce friction and power consumption to the minimum, thus increasing efficiency; seventh, to reduce upkeep expense to the lowest figure by minimizing the consumption of lubricant and the number of part replacements necessary; and, eighth; to provide a neat, compact design which requires the smallest possible space for installation and operation.

The invention also resides in those details of construction, combination and arrangement of parts, all of which will be first fully described and then be specifically pointed out in the appended claims, reference being had to the accompanying drawings in which:

Figure 1 is a perspective view of the pump embodying the invention, the same being arranged with the discharge throat at the left.

Figure 2 is a perspective view of the

same with the suction head and the suction wearing plates removed.

Figure 3 is a perspective view of the same with the suction head, the suction wearing plate, the impeller, the casing and the gland wearing plate dismantled.

Figure 4 is a central vertical longitudinal section of the pump embodying the invention with parts positioned so that the discharge throat is located at the right, i. e. reversed from that shown in Figure 1.

Figure 5 is a cross section on the line 5—5 of Figure 4.

Figure 6 is a top plan view of the pump.

Figure 7 is a detailed elevation of the shaft and bearing unit withdrawn from the base bearing housing.

Figure 8 is a cross section on the line 8—8 of Figure 4.

Figure 9 is a cross section on the line 9—9 of Figure 4.

In the drawings in which like numerals of reference designate like parts in all of the figures, 1 represents the base. Formed integral with the base is the circular disk or head 13 which has disposed about its periphery eight slotted bolt head lugs 17. At the center of the head 13 is a circular projection or boss 14. The circular projection or boss 14 is bored out to form a stuffing box 15. At the end of the base 1 opposite the head 13 is formed the barrel or housing 3 for the bearings, the same being provided with a drainage hole 12 which serves to prevent the accumulation of used grease inside the housing. Formed as an integral part of the base are two casing supports or lugs 2. The base is also provided with suitable hold down bolt lugs 70 as shown.

The pump enclosure proper is made of parts having great wearing resisting qualities and consist of the annular channeled casing 40, which is also extended to form the discharge throat 58, and the gland and suction wearing plates 44 and 46 respectively, which by means of the flanges 45 and 47 are held in a position such as to provide rotating clearance space for the impeller 49. The casing 40 has its weight supported on the lugs 2 of the base. The assembly, casing and wearing plates, are held in place between the head 13 and the suction head 50 by means of four casing bolts 71 passing through the slotted lugs 17 and 51 of the

suction head plate 50 and base head plate 13. It will be noted that the suction head 50 has but four slotted lugs 51, while the base head 13 has eight slotted lugs 17. The bolts are disposed in the four slotted lugs of the suction head and in four of the eight slotted lugs of the base head. The four intermediate lugs of the base head are used when the discharge is directed at certain angles other than the position shown on the drawings. The pump enclosure is made air and water tight by means of two rings of packing 43 which are located in the grooves 42 in the sides of the casing.

The suction head has formed upon it a neck 52 provided with a slotted flange 53 to which is attached the slotted suction flange 56 by the four bolts 57. The suction pipe line 63 coming to the pump is screwed into the flange 56. The removable filler flange 55 is placed between the flanges 53 and 56 for the purpose of providing necessary clearance when removing the suction head, wearing plates, casing and impeller. Suitable packing disks 54 are provided for the usual purposes.

The discharge pipe line 64 is screwed into the slotted flange 61 which is in turn bolted to the slotted flange 59 of the casing throat by four bolts 62, a suitable packing disk 60 being interposed for the usual purposes.

The impeller drive shaft 20 is mounted upon the radial and thrust bearing 34 and the radial ball bearing 27. The inner race of the bearing 27 is clamped by the integral collar 22 and the bearing lock nut 29, which is screwed upon the threaded portion 21 of the shaft. The lock nut 29 is separated at 30 and provided with a locking screw 31 so as to lock the nut on the threaded part of the shaft after the desired adjustment has been made. The outer race of the ball bearing 27 has space upon each side to allow slight endwise adjustments of the shaft.

The pulley 36 rotates the shaft by means of a feather key 37. The pulley hub and inner race of the radial and thrust bearing 34 are held together in place on the shaft between the extended sleeve adjusting nut 32 and the outer adjusting nut 39, both nuts being screwed upon the shaft. A thrust collar and grease retainer 33 rests against the shoulder 4 of the housing. The outer race of the bearing 34 is held between the thrust collar 33 and the end plate 18, which is in turn secured to the end of the housing by three cap screws 19. The felt washers 6 and 35 serve to exclude dirt from and retain grease in the bearings.

Lubrication for the bearings is introduced through the two grease cups 8 and 10. The grease flows from the cup 8 through the duct 7 to the end of the bearing housing adjacent to the end plate 18 from which it flows into the end of the housing through

the bearing 34. The grease retainer 28 is held in place by two set screws 65.

The pulley 36 has offset webs and hub in order to bring the center line of the belt pulley nearly over the center line of the bearing 34. The offset pulley construction is also used for the purpose of getting as great a distance as may be between the bearing 27 and 34, and at the same time keeping the overall length of the pump as small as possible. The pulley is also held in place by a set screw 38 and the nut 39.

The impeller 49 is threaded on the threaded end 48 of the shaft as shown.

When it is desired to slightly adjust the shaft endwise, the plug 11 is removed and a round pin used as a wrench is inserted through the hole in the housing into one of the two holes 72 of the adjusting nut 32. Then, after loosening the outer adjusting nut 39, the pulley is rotated in one direction or the other, thus screwing the shaft to right or left, after which the outer nut is re-tightened.

The integral extended hub 73 of the impeller is screwed upon the end of the shaft 20 up tight against the shoulder 24. The hub also presents the surface 74 upon which the gland packing 68 rests. The gland packing 68 is kept tight by the gland 25 which is held in by the two gland studs and nuts 26. Included between the rings of packing is a water cage 69 which admits clear water under pressure from the inlet 16 to the surface 74 of the hub. The water serves as a lubricant to the rotating hub as well as forcing its way along the hub toward the impeller, and out past the bevel projection 75, thus excluding grit from the stuffing box. This clear water also serves as a seal to prevent the admission of air into the pump enclosure.

The shoulder and water sling 23 serves to arrest and to throw off by centrifugal force any water that may creep along the shaft from the gland packing, thus preventing the water from entering the bearing housing.

The base bearing housing is provided with a recess 5 to receive the bearing 27 and the grease retainer 28 and is provided with a hole 9 by means of which the grease from the cup 10 may be delivered to the bearing 27. The casing 40 has counter bores 41 at its sides in which the flanges 45 and 47 of the wearing plates fit.

66 designates spreader screws and 67 designates the filler flange handles, the purposes of which will presently appear.

The impeller, as well as the casing and wearing plates, are made of hard wear resisting metal, and the blades are shaped with the proper curve and taper to do most efficient pumping.

The pump being complete in operating

position, the precedure of removing wearing parts is as follows: The nuts on the four suction flange bolts are loosened sufficiently to remove the bolts from their slots, then the
 5 two spreading screws 66 are screwed through the flange 53 out against the suction flange 56 forcing it slightly away from the filler flange 55. The filler flange, being thus loosened is taken by its handles and removed,
 10 following which the spreading screws are backed out enough to give full clearance space between the flanges 53 and 56. Next the nuts of casing bolts are loosened and the four casing bolts are removed from their
 15 slots. The suction head and suction wearing plates being released, are taken out. The casing, impeller and gland wearing plates may now be inspected. To proceed further with the dismantling, the four discharge
 20 flange bolts are loosened and removed, whereupon the casing is freed and may be taken away. Next, the nuts of gland studs 26 are loosened to relieve packing pressure. Then, the pulley 36 being held to prevent
 25 the shaft 20 from rotating, the impeller 49 is unscrewed from the shaft. Finally, wearing plate 44 is slipped off the projection 14 upon which it rests when not being held in place by the casing. To re-assemble the
 30 pump, the wearing parts, suction head, filler flange and the twelve bolts are replaced in the exact reverse order in which they were removed.

The ring packings 43 are retained in the
 35 annular grooves of the casing until the casing is worn out when they are transferred to a new one.

To remove the shaft and bearing assembly, it is first necessary to take off the suction
 40 head and suction wearing plate so that the impeller may be unscrewed from the shaft. Then the pulley being held against rotation the outer nut 39 is unscrewed and after loosening the set screw 38, the pulley and
 45 key are also removed. Next, the three cap screws which retain the end plate 18 in place and the end plate are slipped off the shaft. Finally the two set screws 65 are backed out sufficiently to free the grease retainer 28,
 50 whereupon the shaft and bearing assembly may be pulled out of the housing, see Figure 7. These parts are also replaced in the exact reverse order of their removal. To change
 55 the pump from right to left hand, for instance, a different impeller, having left hand curved blades and left hand screw threads in the hub and a different shaft having left hand impeller screw threads must be put
 60 into place. The casing, being reversible is simply turned about so that the face which was next to the suction head is now next to the gland or base head. All other parts are the same for either hand.

From the foregoing it will be observed

that with our construction of the pump the wearing plates contain no nuts, holes or bolt heads from which wear often starts, but are held in place by flanges at the rim. Furthermore, to offset the wear which is usually
 greatest in one quarter of the pump, these plates can be rotated from one position to another until completely worn out. Attachment of the impeller to the shaft is made
 75 by means of screw threads, which is, without doubt, the best construction for holding the impeller securely, as well as providing for its quick removal and replacement.

The assembly of the casing, wearing plates and suction head is held in place on the main
 base casting by four bolts arranged in slots, thus permitting it to be taken apart by simply
 80 backing up four nuts a few turns, and removing bolts from slots. Likewise the suction and discharge connections can each be taken apart by loosening four bolts. Wearing
 85 parts can be inspected, removed or replaced without moving the pump base, piping or suction box from their normal position. Hence, replacement of parts in this
 90 construction of pump is merely a question of minutes as against a matter of hours in many other types or even of days in those cases where linings are cemented in place. Furthermore it is not necessary to have spare
 95 pumps on hand since replacements can be made in a pump as quickly as a change of complete pumps. It will also be noted that with our construction of parts the discharge
 100 can be taken off in an upward direction, either horizontal direction or at intermediate angles. The casing is reversible and the wearing plates are interchangeable thus making
 105 it possible to convert a pump from right to left hand or vice versa by simply changing the shaft and impeller thereby eliminating the necessity of carrying a large number of spare parts where both right and left
 hand pumps are in use.

It will also be noted that the operating
 110 and upkeep cost of our pump is low primarily because of the use of ball bearings which insures minimum power consumption. Ball bearings also effect a marked saving in
 lubricants and eliminate replacements of shafts, glands and brass or babbitted bearings and bushings.
 115

From the foregoing description taken in connection with the accompanying drawings, it is thought that the complete construction,
 120 operation and advantages of our invention will be clear to those skilled in the art and while we have shown and described the preferred embodiment of our invention, we do not desire to be understood as limiting ourselves to the precise details shown and described in the drawings as changes in the details of construction and arrangement of
 125 parts may be made to suit the requirements

of particular practice without departing from the spirit of the invention or the scope of the appended claims.

What we claim is:

- 5 1. In centrifugal pumps, a base having a bearing housing and a head, a shaft jour-
nalled in bearings in said housing and pro-
jecting through an opening in said head, a
10 gland packing carried by said head, a suc-
tion head having a water inlet, a casing
interposed between said heads and having a
water chamber and a discharge throat, gland
and suction wear plates held between said
15 heads and casing and spaced apart to leave
an impeller chamber in communication with
said water chamber and said water inlet,
an impeller on said shaft within said im-
peller chamber, and means to hold said
20 heads, said casing, and said wear plates in
position.
2. In centrifugal pumps, a base having a
bearing housing and a head, a shaft jour-
nalled in bearings in said housing and pro-
jecting through an opening in said head,
25 a gland packing carried by said head, a suc-
tion head having a water inlet, a casing
interposed between said heads and having
water chamber and a discharge throat,
gland and suction wear plates rotatably
30 adjustable held between said heads and
casing and spaced apart to leave an impeller
chamber in communication with said water
chamber and said water inlet, an impeller
on said shaft within said impeller chamber,
35 and means to hold said heads, said casing
and said wear plates in position.
3. In centrifugal pumps, a base having a
bearing housing and a head, a shaft jour-
nalled in bearings in said housing and pro-
jecting through an opening in said head,
40 a gland packing carried by said head, a
suction head having a water inlet, a casing
interposed between said heads and having
a water chamber and a discharge throat,
gland and suction wear plates held between
45 said heads and casing and spaced apart to
leave an impeller chamber in communication
with said water chamber and said water
inlet, an impeller on said shaft within said
impeller chamber, and means to hold said
50 heads said casing and said wear plates in
position, and packing rings carried between
said casing and said heads.
4. In centrifugal pumps, a base, a head,
55 an impeller shaft passing through a hole in
said head, a packing gland on said head, a
suction head having an inlet, an annular
casing having a water chamber and a dis-
charge throat located between said heads,
60 means for securing said heads together with
said casing between them, said means hav-
ing provisions whereby said casing may be
adjusted around its axis to locate said dis-
charge throat at any desired angle, gland
65 and suction wear plates held between said

casing and said heads, and an impeller on
said shaft between said wear plates and
encompassed by said casing.

5. In centrifugal pumps, a base, a head,
an impeller shaft passing through a hole in
said head, a packing gland on said head, a
suction head having an inlet, an annular
casing having a water chamber and a dis-
charge throat located between said heads,
70 means for securing said heads together with
said casing between them, said means having
provisions whereby said casing may be ad-
justed around its axis to locate said dis-
charge throat at any desired angle, gland
and suction wear plates held between said
casing and said heads, an impeller on said
shaft between said wear plates and encom-
passed by said casing, said casing having
wear-plate-flange recesses and said wear
plates having flanges to lie in said recesses,
75 said flanges and recesses being circular
whereby said plates may be rotated about
the axis of the impeller shaft to take up
wear.

6. In centrifugal pumps, an annular cas-
ing having a discharge throat, wear plates
cooperating with said casing, heads between
which said casing and wear plates are held,
said casing being adjustable around the axis
of said wear plates to locate the discharge
throat of said casing at different angles, and
a shaft with impeller cooperative with said
casing and wear plates, one of said wear
plates and one of said heads having an inlet.

7. In centrifugal pumps, a casing having
a discharge throat, heads between which said
casing is held, said casing being adjustable
around its axis to locate the discharge throat
thereof at different angles, a shaft with im-
peller cooperative with said casing and
heads, one of said heads having a flanged in-
let neck, a fixed inlet duct flange, connections
between said duct flange and said neck
flange and including a filler flange.

8. In centrifugal pumps, a casing having
110 a discharge throat, heads between which
said casing is held, said casing being adjust-
able along its axis to locate the discharge
throat thereof at different angles, a shaft
with impeller cooperative with said casing
115 heads, one of said heads having a flanged
inlet neck, a fixed inlet duct flange, con-
nections between said duct flange and said
neck flange and including a filler flange, and
means carried by one of said flanges, other
120 than the filler flange, and engaging the
opposite flange, other than the filler flange,
to spread the same apart and permit re-
moval and replacement of said filler flange.

9. In centrifugal pumps, a fixed base,
125 pump elements mounted thereon which
include a suction head having a flanged neck,
a duct flange and a filler flange between said
duct flange and said neck flange, bolts and
nuts securing said flanges together, and

means to spread said head flange and duct flange apart when said bolts and nuts are loosened whereby said filler flange may be removed and replaced.

base having lugs on which said casing may rest.

13. In centrifugal pumps wherein is provided a rotary shaft and impeller, bearings for said shaft, a housing for said impeller including a head having a packing chamber and a gland cooperating therewith through which said shaft projects, the end of said shaft being threaded and said impeller having a hub threaded on to the end of said shaft and lying in said packing chamber, gland packing ring units in said packing chamber and a water cage located between said units and means for leading high pressure water to said cage.

14. In centrifugal pumps, a base having a bearing housing and a head, the latter lying normal to the axis of said bearing housing, a shaft journalled in bearings in said bearing housing, said bearing housing having an opening through which said shaft projects and said head having an opening into which said shaft projects and said head having an enlargement at said opening provided with a packing chamber, a gland cooperating with said packing chamber, gland packing in said chamber, means for leading high pressure water to said packing, an impeller having a hub threaded onto the end of said shaft and located within said packing chamber whereby said packing will engage said hub to effect an air tight seal.

15. In centrifugal pumps, a base having a bearing housing and a head, the latter lying normal to the axis of said bearing housing, a shaft journalled in bearings in said bearing housing, said bearing housing having an opening through which said shaft projects and said head having an opening into which said shaft projects, said head having an enlargement at said opening provided with a packing chamber, a gland cooperating with said packing chamber, gland packing in said chamber, means for leading high pressure water to said packing, an impeller having a hub threaded onto the end of said shaft and located within said packing chamber whereby said packing will engage said hub to effect an air tight seal, said shaft where it passes out of said bearing housing being provided with a water throw-off collar.

16. In a centrifugal pump of the character stated, a base, a head formed integral with said base, said head having a boss chambered to provide a packing recess, a gland secured to said head to enter said recess, said head having a water duct leading into said recess, said base having lugs, a second head, a casing located between said head and resting on said lugs, bolts securing said heads and casing in place, packing rings between the sides of said casing and said heads, one of said heads having a water inlet passage, said casing having a water receiving chamber and

10. In centrifugal pumps, a base, a gland head carried by the base, a suction head, bolt and nut connections for holding said heads together, a casing located between said heads and held in place thereby, a pair of wear plates having tongue and groove connection with said casing and located between said heads, one of said wear plates having a flat surface which opposes the other wear plate while the other wear plate has its opposing surface dished, said tongue and groove connection being symmetrical whereby said casing may be reversed in position between said heads without reversing said wear plates, an impeller shaft journalled in suitable bearings and projecting through the first mentioned head, an impeller located between said wear plates and mounted on said shaft, said casing having a throat, one of said heads and the adjacent wear plate having a water passage into the impeller chamber, substantially as shown and described.

11. In centrifugal pumps, a base having a bearing housing, a pump shaft journalled in bearings in said housing, a head formed integrally with said base and having a gland with packing into which said shaft projects, said head having slotted radial lugs, an annular casing having a water receiving chamber and a discharge throat approximately tangential to said chamber, a wear plate interposed between said casing and said head, a suction head with an inlet duct, a suction wear plate with inlet port located between said suction head and said casing, said wear plates being spaced apart to leave a chamber, an impeller on said shaft within said chamber, said suction head having slotted lugs, and nuts and bolts carried by the slotted lugs of said head plates to clamp said casing and wear plates in position.

12. In centrifugal pumps, a base having a bearing housing, a pump shaft journalled in bearings in said housing, a head formed integrally with said base and having a gland with packing into which said shaft projects, said head having slotted radial lugs, an annular casing having a water receiving chamber and a discharge throat approximately tangential to said chamber, a wear plate interposed between said casing and said head, a suction head with an inlet duct, a suction wear plate with inlet port located between said suction and said casing, said wear plates being spaced apart to leave a chamber, an impeller on said shaft within said chamber, said suction head having slotted lugs and nuts and bolts carried by the slotted lugs of said head plates to clamp said casing and wear plates in position, said

a water discharge throat, a gland wear plate apertured to fit over said boss of said first mentioned head, a suction wear plate having a water passage, said wear plates being located between said heads and spaced apart to form a chamber, an impeller located within said chamber and having a hub projecting into the boss of said head, a packing within said packing recess of said head and engaging said impeller hub to seal the same against passage of air, a housing formed with said base and held with its axis lying normal to the plane of rotation of said impeller, a shaft passing through said housing and said gland and connected with said impeller hub, said shaft where it passes out of said housing having a water throw-off ring, radial ball bearings and radial ball and thrust bearings in said casing for said shaft and removable with said shaft from said casing as a unit, and a pulley on said shaft overhanging said housing.

17. In centrifugal pumps, a shaft and an impeller, an annular casing with wear chamber and discharge throat encircling said impeller, wear plates at each side of said impeller, and heads with means for securing the same together, said casing and wear plates being held between said heads.

18. In centrifugal pumps, a shaft and an impeller, an annular casing with wear chamber and discharge throat encircling said impeller, wear plates at each side of said im-

peller, and heads with means for securing the same together, said casing and wear plates being held between said heads, said casing being reversible as to position between said heads for a left or right handed pump.

19. In centrifugal pumps, a shaft and an impeller, an annular casing with wear chamber and discharge throat encircling said impeller, wear plates at each side of said impeller, and heads with means for securing the same together, said casing and wear plates being held between said heads, said wear plates and said casing having overlapping portions, the contour of which is such that said wear plates may be turned about the axis of the pump shaft to take up wear.

20. In centrifugal pumps, a shaft and an impeller, an annular casing with wear chamber and discharge throat encircling said impeller, wear plates at each side of said impeller, and heads with means for securing the same together, said casing and wear plates being held between said heads, said casing being reversible as to position between said heads for a left or right handed pump, said wear plates and said casing having overlapping portions, the contour of which is such that said wear plates may be turned about the axis of the pump shaft to take up wear.

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