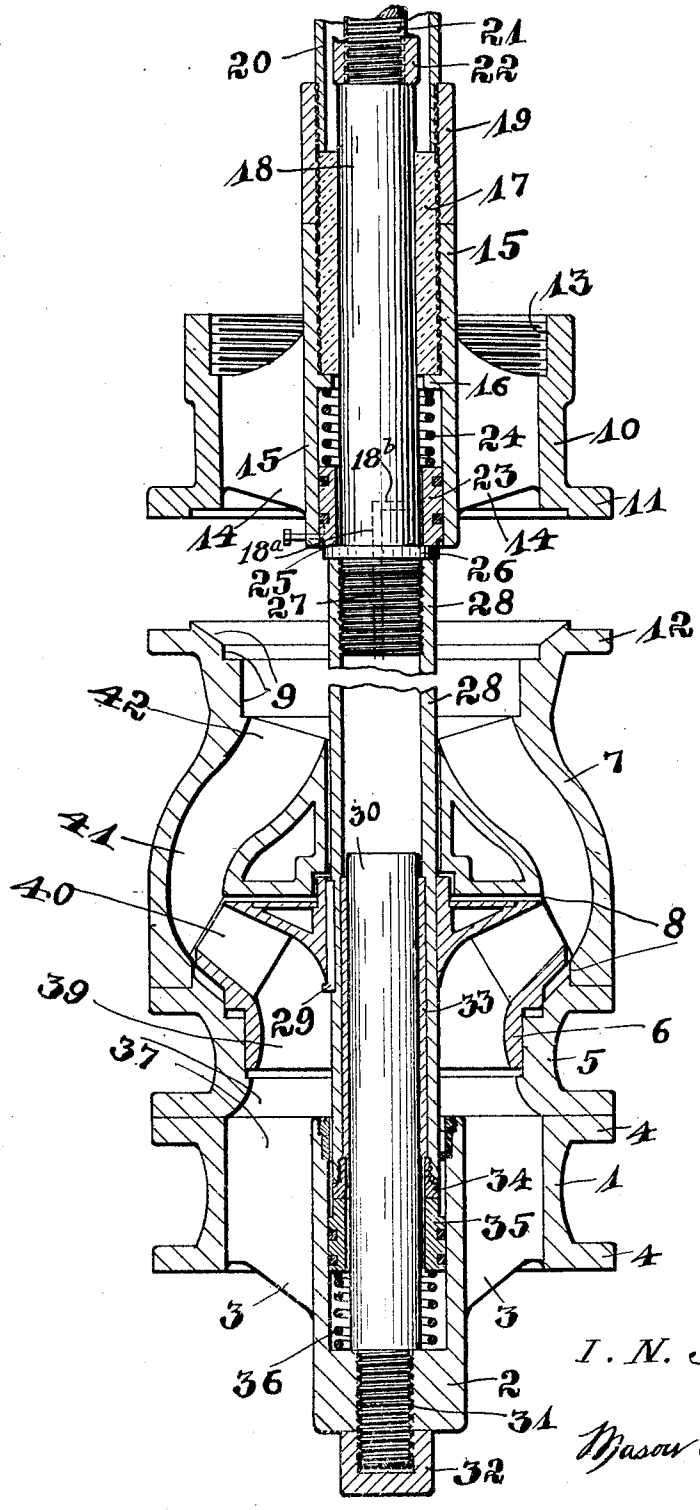
I. N. JOHNSTON.

DEEP WELL PUMP.

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DEEP-WELL PUMP.

1,370,451. Specification of Letters Patent. Patented Mar. 1, 1921.

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To all whom it may concern:

Be it known that I, ISAAC N. JOHNSTON, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Deep-Well Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to deep well pumps of the rotary type.

An object of this invention is to improve the mounting of the pump shaft.

One of the objects of the invention is to facilitate the operation of such deep well pumps by providing a practical, efficient and durable lubricating system for the shaft.

Another object is to provide a spring-operated piston or other packing device under continuous tension to assist in forming a tight joint for holding lubricant, and for preventing dirt, sand, and other waste in a well from getting into the bearings of the shaft in such pumps.

Another object is to provide lubricant-holding compartments on the shaft of such pumps and which are closed off from the well.

Another object is to provide a hollow shaft for the rotating members of such pumps having its bearings protected from the influences of the well.

Another object is to provide a socket in the lower stationary member of such pumps to receive and hold a longitudinally pressed or spring-operated piston to seat and seal against the end of the driving shaft of the pump, such end of the driving shaft being provided with a hardened steel ring ground fit on the end of the piston, preventing substance in a well from entering the socket below the piston and through the ground-fit joint between the steel ring and the end of the driving shaft holding at the same time the lubricant within the hollow driving shaft.

With these and other objects as will appear from the following description and appended claims as well as from the accompanying drawing, the invention etc. In the drawing,

The figure is a longitudinal, central, sectional view of the device normally the vertical section when the device is disposed in a well.

The casing of the pump is made of sections or stages facilitating an enlarging or reducing of the capacity of the pump.

The lowermost section 1 of the casing constitutes practically the lower supporting and intake member; embodying the socket 2 for supporting the shaft end, the vanes 3 directing the water into the pump and supporting the socket, and the casing proper with the flanges 4 forming the support for the following sections.

The next casing section 5 practically comprises nothing but a housing and guide for the lowermost runner or impeller 6. At the same time, this housing 5 forms also the connecting member between the lowermost housing 1 and the shell 7.

The shell or casing section 7 is constructed so as to receive and house the upper portion of the rotating runner or impeller 6 in a suitable recess or compartment 8 in its lower end and has in its upper end another recess or compartment 9 to receive and house another rotating runner or impeller, not shown, such rotating runner or impeller fitting with its lower end into the upper recess or compartment of the shell 7, as will easily be understood from the drawing.

Such pump casing sections as 6—7 can be used in any number to suit the exigencies of a well, as depth, pressure, power required to obtain a certain amount of water out of the well, etc., as will easily be understood.

The top casing section 10 is provided with a flange 11, designed to fit on the top end or flange 12 of the uppermost stage. The upper end of the section 10 is provided with threads 13, to allow the connection of tubes or well casings from the top of the ground to reach into the well to the top end of the pump for obtaining the water from the pump through such casing to the surface. The ribs or vanes 14 support and connect a hub or shaft casing member 15 with the pump or runner casing section 10. A shoulder 16 is provided within the bore of the hub 15 projecting inwardly to form the support for a sleeve 17. The sleeve 17 is provided as a bearing between the hub or shaft casing and the driving shaft 18. To allow lubrication of this bearing, a shaft incasing tube 20 is in fluid tight connection with the upper end of the bearing and extends upwardly

to the surface. To allow such connection, the sleeve 17 is threaded and tightly screwed into the hub 15. A coupling 19 connects such tube 20 with the sleeve 17 and thereby with the hub 15, as will easily be understood from the illustration.

The driving shaft 18 is threaded at its upper end as at 21, so that further shafts can be connected to extend up to the surface, such shafts to be interconnected by the couplings 22, a short portion of such coupling only being shown in the drawing, but it will easily be understood that any coupling can be used.

A lubricant can thus be inserted, and held between the tube 20 and the shaft 18 above the sleeves 17.

Such lubricant and the inclosing tube 20 serve also to protect the driving and working shaft 18 over its whole length, from the top of the well to the pump.

The lower end of the hub or shaft casing member 15 and thereby the lower end of this lubricating system is kept continuously closed by a pressure actuated piston here shown as the spring operated piston 23, the spring 24 being inserted between the shoulder 16 and the piston 23, and pressing the piston 23 downwardly and thereby forming a suitably tight sealed joint at 25 against the annular shoulder 26 of the driving shaft 18.

The lower end 27 of the driving shaft 18 is threaded and tightly screwed into a hollow pump-driving shaft section 28. The pump driving section 28 is naturally of suitable length to correspond to the combined length of the several stages of a given organization. In the drawing, only one pump stage is illustrated, but it will easily be understood that any number of such stages can be used and that the hollow shaft 28 can be of such length as to allow the securing of a corresponding number of runners or impellers 6 according to the number of regular stages to make each stage complete in such pump.

Each runner or impeller 6 is secured to the hollow shaft 28 by a key 29.

The lower end of the driving shaft, that is the combined shaft (driving shaft 18 and hollow section 28), has its bearing at its interior. A stub trunnion 30 is tightly screwed into the socket 2 as indicated at 31 and locked in its position by the cap and lock nut 32. The lining sleeve 33, is tightly pressed into the hollow shaft 28, and is turnably fitted over the trunnion 30. A locking and bearing or seat ring 34 is tightly screwed into the lower end of the hollow shaft against the lower end of the sleeve 33.

This arrangement allows the keeping of a lubricant for the bearing of the driving shaft above the sleeve 17 between the tube 20 and the shaft 18 at the upper end of the driving shaft, while a lubricant, as oil, can also be kept within the tube or hollow driving shaft 28 above and between the trunnion 30 and the sleeve 33, the latter being the lower end of the driving shaft of the device.

In order that lubricant may be conducted into tube 28 beneath the annular shoulder 26 from the supply contained within the tube 20, a duct is formed in the lower end of shaft 18, said duct comprising the longitudinal part 18^a and the transverse part 18^b, the former connecting with the hollow chamber in the hollow shaft or tube 28 and the latter opening at the exterior of the shaft 18 opposite the inner wall of the annular sealing piston 23.

Whirling of the water within the device is prevented or reduced by having ribs 37 forming the conduits in the lower stationary members in practically an upright direction toward the rotating member 6, while the conduits in the runner (or, if several runners are used in a pump, in all of the runners) are formed in the lower end in an upright direction in continuation of the conduits 37, as indicated at 39; the upper termination 40 of the conduits in the rotating member being formed in a suitably curved manner as a continuation from the conduits 39 slightly projecting upwardly in an outward direction to form proper conduits for such rotating members for centrifugal pumps. The conduits in the stages 7 are, in the lower portion, curved to be a continuation of the conduits 40 of the rotating members, while the same conduits curve in their upper portion in an upwardly direction to make the lower conduits 39 in the rotating members a continuation of these conduits 42 in the stages 7, the conduits 41 being the continuation from each of the rotating members below each of the stages.

A piston 35 is disposed in the socket of the member 1 below the ring 34. The ring is preferably hardened and ground-fit to the end of the piston 35, so as to make a lubricant sealing joint between the ring 34 and the piston 35. The piston is naturally provided with piston rings to keep the lubricant within the socket and within the bearing of the driving shaft, and to prevent any waste from entering such bearing. Any waste that might enter the top end of the socket is prevented from going any farther into the socket by the piston and its rings, as will easily be understood. The rotating members 6, only one of which is shown, being keyed to the hollow shaft 28, naturally hold the shaft 28 in a certain position within the pump and thereby the end of the shaft at a certain point within the socket. The spring 36 is disposed within the socket below the piston 35, holding the piston always tightly pressed against the hardened steel ring 34 on the driving shaft 28, thereby forming the

sealing joint between the bearing of the shaft and the inside of the shaft on one side and the inside of the pump on the other side. The spring operated piston 23 and the spring 24 at the top end of the pump produce the same effect as between the working parts of the pump and the matter passing through the pump, as will easily be understood from the description above. The lubricant surrounding the trunnion 30, may eventually pass between it and the bearing sleeve 33 downwardly and through the space between the ring 34 and the piston 35 on one side and the trunnion 30 on the other side to come into the space below the piston surrounding the spring 36, but the tightness of the piston and especially of the piston-rings prevents the lubricant from freely passing the piston out of the socket 2 of the stationary member 1, as will easily be understood.

By reason of the sectional construction disclosed hereinbefore, it is possible to renew worn bearings or shaft parts in the field or to increase the number of runners and casing sections. By separating the upper casing section from the section 7, shaft section 18 may be removed and renewed; and the bearing 3 may be renewed by uncoupling shaft section 18 at 22, and removing the coupling 19, giving access to the bearing sleeve 17. Similarly by separating the casing section above it from the section 1, and pulling out the shaft, the trunnion 30 may be removed and renewed. Also it will be apparent that any number of runners or impellers and the necessary runner sections may be supplied by separating the shaft 18 from hollow sections 28, the casing section 10 from the casing section 7, supplying a section 28 with the desired number of runners thereon and superposing the necessary casing sections 7, securing said parts together.

Having thus described my invention, what I claim is:

1. In a mechanism of the class described, a rotary shaft, a casing surrounding said shaft, a bearing sleeve for said shaft connected to said casing, and an elastic yielding packing device below said bearing sleeve held under constant tension tending to seal the space between the casing and the shaft to prevent free escape of lubricant and ingress of grit.

2. In a mechanism of the class described, a rotary shaft, a casing surrounding said shaft, a bearing sleeve for said shaft connected to said casing, an annular shoulder on the shaft, an annular packing piston disposed between the casing and shaft, and means for yieldingly pressing the packing piston into contact with said annular shoulder.

3. In a mechanism of the class described, a rotary shaft, a casing surrounding said shaft, a bearing sleeve for said shaft connected to said casing, an annular shoulder on the shaft, a packing piston disposed between the casing and shaft, and a spring disposed between the bearing sleeve and the piston and adapted to urge the piston against said annular shoulder.

4. In a mechanism of the class described, a rotary shaft, a casing surrounding said shaft, a bearing sleeve for said shaft connected to said casing, a shoulder within the casing below the lower end of the bearing sleeve, an external annular shoulder on the shaft, a packing piston disposed between the casing and the shaft, and a spring between the shoulder within the casing and the piston, tending to urge said piston against said annular shoulder.

5. In a mechanism of the class described, a pump casing section provided with vanes, a central hub or shaft casing member supported by said vanes and carrying a bearing sleeve, a rotary shaft journaled in said bearing sleeve, said shaft projecting therethrough, and a packing device below the bearing sleeve held under constant tension tending to seal the space between the shaft casing member and the driving shaft to prevent the free escape of lubricant and ingress of grit.

6. In a mechanism of the class described, a pump casing section provided with vanes, a central hub or shaft casing member supported by the vanes, said shaft casing member carrying a bearing sleeve, a shaft journaled in said bearing sleeve, an annular shoulder on the shaft, an annular packing piston disposed between the shaft and said shaft casing member, and means for elastically urging the packing piston into contact with the annular shoulder.

7. In a mechanism of the class described, a pump casing section provided with vanes, a central hub or shaft casing member supported by the vanes, said shaft casing member carrying a bearing sleeve, a shaft journaled in said bearing sleeve, an annular shoulder on the shaft, an annular packing piston disposed between the shaft and said shaft casing member, a spring disposed between the bearing sleeve and piston, said spring tending to press the piston into engagement with said annular shoulder on the shaft.

8. In a mechanism of the class described, a pump casing section provided with vanes, a central hub or shaft casing member supported by said vanes and carrying a bearing sleeve, a shoulder within the hub or shaft casing member below said bearing sleeve, a shaft journaled in said bearing sleeve, said shaft having an external annular shoulder, an annular packing piston disposed between said hub or shaft casing member and said shaft, a spring disposed between the shoulder within the casing member and the

piston, and exerting its tension to force the piston into engagement with said annular shoulder.

9. In a mechanism of the class described, a pump casing section provided with vanes, a central hub or shaft casing member supported by said vanes, said shaft casing member carrying a removable bearing sleeve, a short shaft section journaled in said bearing sleeve, said short shaft section having ends constructed to be coupled with other sections of the shaft, and means whereby an extension casing may be detachably secured in continuation of said shaft casing member above the bearing sleeve.

10. In a mechanism of the class described, a pump casing section having vanes, a hub or shaft casing member supported by said vanes, a bearing sleeve detachably secured within said hub or shaft casing member so as to have one end project therefrom, a coupling engaging the projecting end of the bearing sleeve, a shaft casing tube detachably engaging said coupling, and a rotary shaft journaled within said sleeve, concentric with said shaft casing member and tube.

11. In a mechanism of the class described, a pump casing section provided with vanes, a hub or shaft casing member supported by said vanes, a bearing sleeve detachably secured within said hub or shaft casing member and projecting therefrom, a detachable coupling member secured to the projecting portion of said bearing sleeve, a shaft casing tube detachably secured to said coupling member, a detachable shaft section journaled in said sleeve concentric with said tube and shaft casing member, and a packing device disposed between said shaft casing member and shaft section, said packing device being under constant tension to close the space between said casing and driving shaft section in order to prevent free escape of lubricant and ingress of grit.

12. In a mechanism of the class described, a rotary shaft having an annular shoulder, a casing inclosing said shaft, an annular piston disposed between said casing and said rotary shaft and yieldably pressed against said annular shoulder, and means to prevent rotation of said annular piston.

13. In a mechanism of the class described, the combination of a rotary shaft having an external annular shoulder, a casing surrounding said shaft, an annular packing piston disposed between said shaft and casing, the end of said piston making a snug joint with the annular shoulder, the joint between the piston and casing being packed, and means whereby said piston is constantly pressed elastically against said shoulder.

14. In a mechanism of the class described, a stub or trunnion bearing, a hollow shaft section fitted over and journaled on said trunnion bearing and having a lubricant chamber beyond the end of said trunnion.

15. In a mechanism of the class described, a stub or trunnion bearing, a hollow shaft section, a bearing sleeve therein fitted over and journaled snugly on said trunnion, said hollow shaft section providing a lubricant chamber beyond the end of said trunnion.

16. In a mechanism of the class described, a stub or trunnion bearing, a tubular shaft section sleeved over said trunnion and having bearing engagement therewith and providing a lubricant receiving chamber above the end of the trunnion, and an annular packing device surrounding the trunnion and elastically urged against the lower end of the shaft section.

17. In a mechanism of the class described, a stub or trunnion bearing, a hollow shaft section sleeved over said trunnion and having bearing engagement therewith, a hardened ring secured to the lower end of the shaft section, an annular packing device surrounding the trunnion and elastically urged against said ring, said hollow shaft section having a lubricant chamber above the trunnion.

18. In a mechanism of the class described, a stub or trunnion bearing, a rotary shaft section sleeved over said trunnion bearing, there being a lubricant reservoir in said hollow shaft section above the end of said trunnion, a hollow member surrounding the lower portion of said trunnion, an annular packing piston disposed between the inner walls of said hollow member and said trunnion, and elastic means constantly urging said piston against the lower end of said hollow shaft section.

19. In a mechanism of the class described, a hollow supporting member, a stub or trunnion concentric with said hollow member and supported thereby, a rotary shaft comprising a hollow end section sleeved over said trunnion and providing a lubricant reservoir above the upper end of the trunnion, an annular packing piston disposed between the walls of said hollow supporting member and the trunnion, and elastic means tending to force said piston into engagement with the end of said hollow shaft section.

20. In a mechanism of the class described, a hollow supporting member, a stub or trunnion concentric with the wall thereof, a rotary shaft comprising a hollow lubricant containing portion sleeved over and bearing on said trunnion and having its lower end disposed between said trunnion and the wall of said hollow supporting member, an annular packing piston disposed between the wall of the hollow supporting member and the trunnion, means tending to elastically force said piston into engagement with said ring and a packed joint between the piston and the hollow supporting member.

21. In a mechanism of the class described, a pump casing section having vanes, a hollow bearing-support held by said vanes concentric with said casing section, a stub or trunnion fixed concentric with said bearing support and spaced from the walls thereof, an annular packing piston disposed between said trunnion and the inner wall of said bearing support, and elastic means tending to force said piston toward the free end of said trunnion.

22. In a mechanism of the class described, an inlet pump casing section having vanes, a hollow bearing support held by said vanes concentric with said casing section, a stub or trunnion bearing detachably connected to the bottom of the hollow bearing support concentric therewith and spaced from the wall thereof, an annular packing piston disposed between said trunnion and the inner wall of said bearing support, and elastic means tending to force said piston toward the free end of said trunnion.

23. In a mechanism of the class described, a trunnion bearing, a casing concentric therewith, a hollow shaft section sleeved over said trunnion bearing and having a lubricant chamber above said trunnion, an annular piston having an external packing disposed between said trunnion and said casing, and a spring urging said piston into engagement with the lower end of said hollow shaft section.

24. In a mechanism of the class described, a rotary shaft, a shaft casing inclosing said shaft, a sleeve bearing for said shaft connected with said casing adjacent the lower end of the casing, a hollow rotary shaft extension below the casing, a runner secured to said hollow shaft, a bearing for the lower end of the hollow shaft, there being a lubricant duct through the rotary shaft for conducting lubricant from the shaft casing into the chamber of the hollow shaft, and means for conducting lubricant from the chamber of the hollow shaft to the bearing for the lower end thereof.

25. In a mechanism of the class described, a driving shaft having a hollow end section, a runner secured thereto, a trunnion bearing over which said end section is sleeved and providing a lubricant reservoir above the end of said trunnion, a casing surrounding the shaft above the hollow section and a bearing therein for the shaft, an annular packing device between the lower end of said casing and said shaft tending to prevent the escape of lubricant from said casing and the ingress of grit thereto, there being a duct affording communication through the driving shaft between the driving shaft and casing and the lubricant reservoir of the hollow section of said driving shaft.

26. In a mechanism of the class described, the combination of a rotary shaft having a lower hollow section, a runner secured thereto, an end bearing for the hollow shaft section comprising a trunnion over which said hollow section is sleeved providing a lubricant reservoir above the end of said trunnion, an external collar on said rotary shaft above said hollow section, a casing for said rotary shaft extending from said collar upward, a bearing for said driving shaft concentric with said casing, an annular packing piston disposed between said casing and said driving shaft, means for continually urging it against said shoulder, there being a duct in said driving shaft placing the casing and the lubricant chamber of the hollow section in communication.

27. In mechanism of the class described, a rotary shaft having a hollow end section, an end bearing comprising a stub or trunnion over which said hollow end section is sleeved, there being a chamber for lubricant within the hollow section above the end of the trunnion, a runner secured to the hollow section, a pump casing surrounding said hollow shaft section, a shaft casing inclosing the shaft above the hollow section, a bearing for the shaft connected to and concentric with said casing, a packing device at the lower end of said casing, said packing device having a constant tendency to close the space between said casing and shaft whereby to lessen the escape of lubricant and prevent the ingress of grit, there being a conduit for lubricant from the space between said shaft and casing into the chamber of the hollow shaft section, and a packing device surrounding the trunnion bearing and constantly urged into position to lessen the escape of oil between said trunnion and hollow shaft section and prevent the ingress of grit.

28. In a mechanism of the class described, a sectional rotary shaft, the end section of which is hollow, a runner secured to said end section, a sectional pump casing surrounding said hollow shaft section, a stub or trunnion bearing supported by the lower pump casing section over which trunnion bearing said hollow shaft section is sleeved, the upper runner section supporting a central hub or shaft casing member, a bearing sleeve within said shaft casing member in which said rotary shaft is journaled, a packing device having a constant tendency to close the space between said casing and driving shaft, a packing device constantly tending to close the joint between said trunnion and hollow shaft section, there being a duct placing said hollow shaft section in communication with the space between said casing and driving shaft.

29. In a mechanism of the class described, a rotary shaft, a runner secured thereto, a pump casing comprising a lower section,

a step bearing for said shaft connected to the lower pump casing section, a second detachable pump casing section supported on said lower section and coöperating with the runner, said second section having a guide seat for the runner and a third detachable pump casing section supported on said second section, said third section having a lower opening of a diameter as great as that of the runner.

30. In a mechanism of the class described, an upper pump casing section having vanes, a hollow hub or shaft casing member supported by said vanes, a bearing sleeve carried by said shaft casing member, a rotary shaft section journaled in said bearing sleeve, said shaft section having a lower threaded end and an external shoulder below said bearing sleeve, a hollow shaft section threaded to said threaded end against said shoulder, a runner carried by the hollow shaft section, a pump casing section surrounding said hollow shaft section and adapted to fit against said upper pump casing section, a lower pump casing section, a trunnion bearing supported by said lower pump casing section, said hollow shaft section being sleeved over said trunnion.

31. In a mechanism of the class described, a rotary shaft having a lower hollow section, a runner secured to said hollow shaft section, a shaft casing surrounding that part of the driving shaft above the lower hollow section, a section of a pump casing secured to and supporting the lower end of the shaft casing, a lower section of pump casing supporting a stub or trunnion bearing over which said hollow shaft section is sleeved and providing a lubricant chamber above the trunnion, separable pump casing sections between said upper and lower pump casing sections, a packing device at the lower end of said shaft casing, there being a conduit through said shaft whereby lubricant may flow from the shaft casing to the chamber in the hollow shaft section.

32. In a mechanism of the class described, a casing section having a central socket, a trunnion bearing disposed concentric with the wall of said socket, and removably secured in position.

33. In a mechanism of the class described, a rotary shaft having a runner secured thereto, a casing section surrounding said runner, and having an opening in its lower end of a diameter as great as the largest diameter of the runner, and an opening at its upper end conforming to the lower portion of a runner so as to form a guide therefor.

34. Mechanism of the character disclosed, comprising a pump casing, a hollow shaft therein, a pump runner on the hollow shaft, and a further upper shaft connected with the hollow shaft.

35. Mechanism of the character disclosed, comprising a pump casing, a hollow shaft therein, a pump runner on the hollow shaft, and a further upper shaft connected with the hollow shaft; there being a bearing provided for said further upper shaft, and a duct provided in said upper shaft whereby a circulatory system is provided through said hollow shaft and said further upper shaft.

In testimony whereof I affix my signature.

ISAAC N. JOHNSTON.