

June 24, 1930.

G. L. FERGUSON ET AL.

1,768,313

PUMPING APPARATUS

Filed Dec. 29, 1927

2 Sheets-Sheet 1

Fig. 1

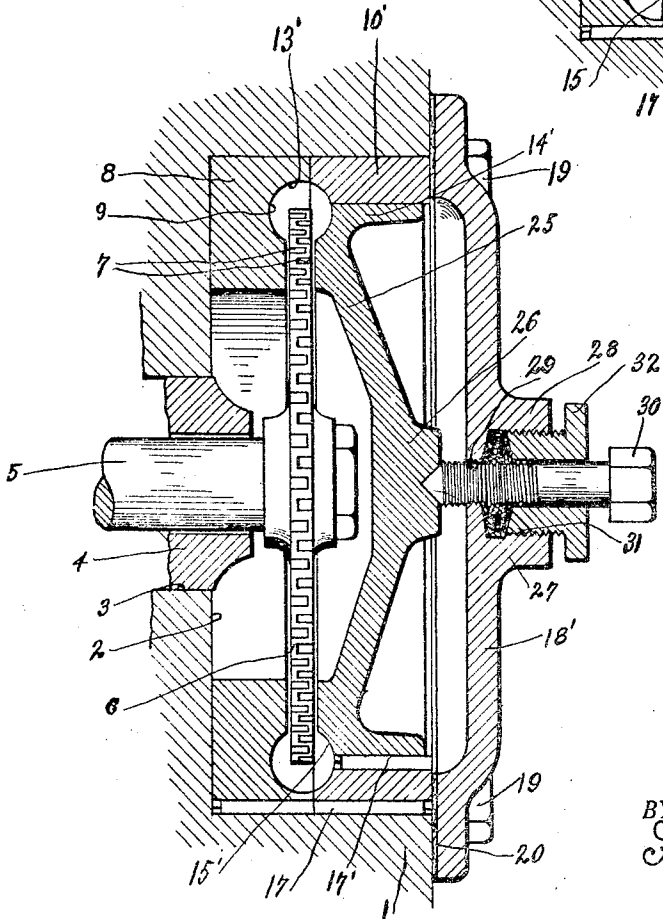
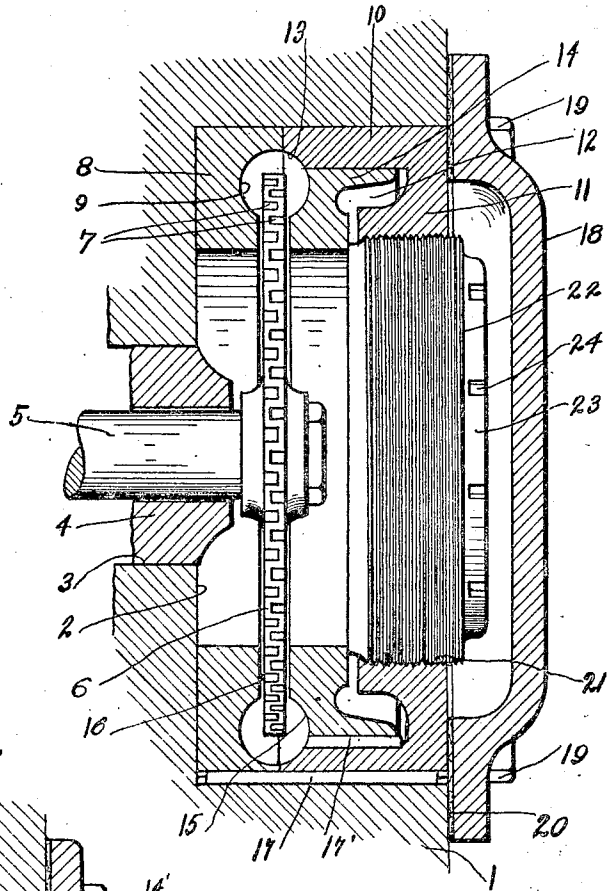


Fig. 2

INVENTORS
Gale L. Ferguson and
Clarence G. Wood
BY
Day, Oberlin & Day
ATTORNEYS.

June 24, 1930.

G. L. FERGUSON ET AL

1,768,313

PUMPING APPARATUS

Filed Dec. 29, 1927

2 Sheets-Sheet 2

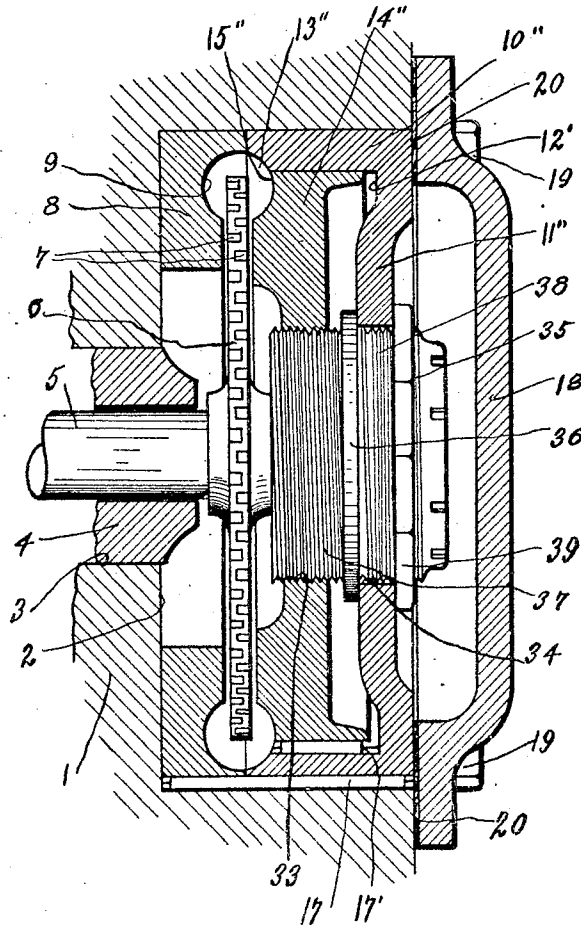


Fig. 3

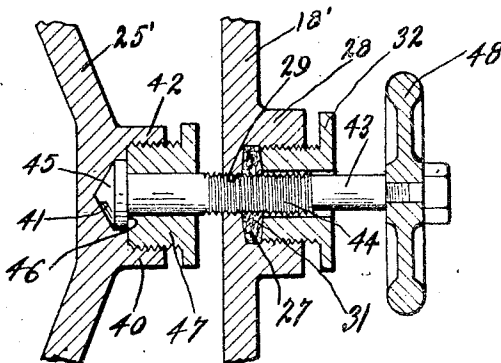


Fig. 4

INVENTORS
Gale L. Ferguson
BY Clarence G. Wood-
Pay. Obeilun & Pay
ATTORNEYS

UNITED STATES PATENT OFFICE

GALE L. FERGUSON AND CLARENCE G. WOOD, OF CLEVELAND, OHIO, ASSIGNORS, BY
MESNE ASSIGNMENTS, TO AUTO PRIME PUMP COMPANY, OF CLEVELAND, OHIO, A
CORPORATION OF OHIO

PUMPING APPARATUS

Application filed December 29, 1927. Serial No. 243,230.

The present invention, as indicated, relates to pumping apparatus, and more specifically to a device for adjusting the side clearance of the impeller of a centrifugal, turbine, or peripheral speed pump. The invention has for an object the provision of means whereby the clearance between the impeller of such a pump and the elements enclosing it may be adjusted either in setting up the machine or to compensate for wear after extended use. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a transverse section of one form of means whereby the above objects may be accomplished; Fig. 2 is a similar section of another form; Fig. 3 is a similar section of still another form, and Fig. 4 is a fragmental section of a further modification.

Referring more particularly to Fig. 1, the reference numeral 1 indicates a broken segment of a pump casing comprising an impeller chamber 2 open at its outer end and provided at its inner end with an aperture 3 for the reception of a bushing 4 in which is journaled an impeller shaft 5. An impeller 6 is mounted on the end of said shaft in said impeller chamber 2 and is provided on its periphery with alternating buckets 7. Snugly seated in the impeller chamber 2 is a pump ring 8 having an annular groove 9 formed in its outer face. A second ring 10, provided with a radially inwardly directed flange 11 forming an annular recess 12 which faces inwardly, is snugly seated in said chamber 2 in abutting relation with said first ring 8. The second ring 10 is provided with a sectoral groove 13 which registers with a portion of the groove 9. A third ring 14 is snugly but slidably received in the recess 12 of the ring 10 and is pro-

vided with a sectoral groove 15 in registry with a portion of the groove 9. As will be obvious from an inspection of the figure, the grooves 9, 13, and 15 cooperate to form a pump channel.

The rings above described are so formed as to provide a space 16 therebetween in which the impeller 6 is mounted. The clearance between the impeller and the outer face of the ring 8 and the inner face of the ring 14 is greatly exaggerated in the figure, said clearance normally amounting to approximately .005 of an inch.

It will be readily apparent that extremely accurate machining would be necessary in the formation of the impeller 6 and the enclosing rings if no means were provided for adjusting the clearance between said impellers and said rings, since it is obviously necessary so to form the elements that the clearance between the impeller and the rings will be very small and substantially uniform. Such clearance, in the absence of adjusting means, would also be dependent upon the accurate machining of the impeller chamber 2, as is also obvious. Such accurate machining is extremely expensive, and it will be apparent that any device which will obviate the necessity for such extremely accurate work is highly advantageous. It is the object of the present invention to provide such adjustable means to eliminate the necessity for extremely accurate machining in the manufacture of such pumps.

The impeller chamber 2 is provided at some point in its peripheral surface with a slot, and the rings 8 and 10 are provided with slots in their peripheral surfaces, and a key 17 is inserted in said slots to prevent rotation of the rings with respect to the casing and to each other. A similar key 17' is received in registering slots in the inner peripheral surface of the ring 10 and the outer peripheral surface of the ring 14 to prevent relative rotation between said rings. As has been stated, the ring 14 is slidably mounted in the recess 12 of the ring 10. A cover plate 18 is secured to the casing 1 by means of screws 19 or similar fastening means and bears upon the outer face of the

ring 10 to hold all of the rings securely in the impeller chamber 2. A washer 20 is interposed between the cover plate 18 and the casing 1 and ring 10. The flange 11 is interiorly threaded as at 21 for the reception of a screw-threaded plug 22 adapted to bear on its inner face against the ring 14. Said plug 22 is provided with an extension 23 having notches 24 therein for the reception of a wrench or the like for the purposes of adjustment, and for engagement by a locking device (not shown).

When the pump of the present invention is first set up, the ring 8 is set into the chamber 2 after which the impeller shaft 5, carrying the impeller 6, is inserted in the bore of the bushing 4 and is connected to driving means. The shaft is mounted, at that time in such a way as to permit axial movement thereof. The ring 10, ring 14, and plug 22, in assembled relation, are then inserted together in the chamber, a shim having been mounted between the ring 14 and the impeller, and said shim being of such thickness as to provide the desired clearance space. That is, the thickness of the shim is such as to space the ring 14 from the impeller by a distance equal to the combined clearances between the impeller 6 and the rings 8 and 14. As will be obvious all of this clearance is thus provided between the impeller 6 and the ring 14, the impeller being thus backed into engagement with the ring 8. An annular ring is then secured to the casing in place of the cover plate 18 to force the ring 10 into the position which it will assume after final assembly of the pump, and the plug 22 is set up until the shim is bearing firmly against the outer face of the impeller 6. The annular plate is then detached and the rings 10 and 14, plug 22 and shim are removed from the casing. The shim is then discarded and the rings 10 and 14 and the plug 22 are reinserted in the casing. It will be noted that, at this time, the slidable ring 14 is properly positioned to provide the desired clearance. The cover plate 18 is then secured to the casing and the pump is ready for operation. Remembering that the shaft and impeller are free for axial movement, it will be seen that, when the shaft is rotated, the friction between the impeller 6 and the outer surface of the ring 8 will cause the impeller to move toward the ring 14. The liquid contained in the pump casing cushions the impeller and prevents it from actually striking the face of the ring 14, but the impeller is nevertheless thrown back toward the ring 8 at a reduced speed. Experiments show that when the pump is first started after the above described setting-up process, the impeller and shaft will "shimmy" slightly for a few seconds and finally will assume the stationary position in which the impeller is

substantially equally spaced from the rings 8 and 14. When the position has been thus automatically selected, the bearing of the shaft 5 is adjusted to prevent further axial movement of said shaft, and the setting-up process is complete.

Where muddy or gritty water is being pumped, the impeller and rings are often badly scored, and in the absence of adjustable means such as are provided by the present invention, such scoring necessitates the replacement of the impeller or the rings or both. With the apparatus disclosed herein, however, such scoring necessitates merely an adjustment of the ring 14 which may be effected simply by removing the cover plate 18 and slightly setting up the plug 22.

In the form of the invention illustrated in Fig. 2, the parts numbered from 1 to 9 are identical with those similarly numbered in Fig. 1. The ring 10', however, is not provided with the flange 11, and the ring 14' is slidably mounted in the inner cylindrical surface of the ring 10'. The cover plate 18' is similarly secured to the casing by means of screws 19 or the like, and a packing ring 20 is provided between said cover plate 18' and the casing and outer surface of the ring 10' to provide a tight joint.

The ring 14' is formed with a central web 25 provided at its center point with an outwardly extending boss 26 having a central socket 27 therein. Centrally of the cover plate 18', and projecting outwardly therefrom is a recessed boss 28, and a screw-threaded aperture 29 extends from the bottom of said recess through the plate. An adjusting screw 30 is mounted in said recess and its end is received in the socket 27 of the boss 26. Packing material 31 surrounds the screw 30 within the recess of the boss 28 and a packing gland 32 is provided to compress such packing.

The operation and use of the device illustrated in Fig. 2 are similar to those of the device illustrated in Fig. 1, but the adjustment may be made without removing the cover plate 18'.

In the form of the invention illustrated in Fig. 3, the parts numbered from 1 to 9 are identical with those similarly numbered in Fig. 1. The ring 10'' is provided with a flange 11'' which, together with the major portion of the ring, forms an annular recess 12' similar to the recess 12 illustrated in Fig. 1. The ring 10'' is provided on its inner face with an annular groove 13'' co-operating with the groove 9 in the ring 8 and the groove 15'' in the ring 14'' to form a pump channel enclosing the periphery of the impeller 6. The ring 14'' is snugly but slidably mounted within the recess 12'. A cover plate 18 is secured to the casing by means of bolts 19 or similar fastening devices, and a packing washer 20 is mounted

between the cover plate 18 and the casing, bearing upon the casing and upon the ring 10" to hold all of the rings securely in the casing.

5 The inner cylindrical surface of the ring 14" is formed with screw threads indicated at 33, while the inner cylindrical surface of the flange 11' is smooth as at 34. A plug 35 is provided intermediate its ends with a collar 36 which may be integral with the plug or otherwise rigidly secured thereto. A series of screw threads 37 on one side of the collar 36 is adapted to cooperate with the threads 33 on the ring 14", and a second series of threads 38 is provided on the other side of the collar 36 for cooperation with a lock nut 39.

It will be understood that the operation and use of the device illustrated in Fig. 3 are similar to those of the device illustrated in Fig. 1. Adjustment of the ring 14" is effected by loosening the lock nut 39 and then rotating the plug 35. If the plug 35 is rotated in a clockwise direction as viewed from the right of Fig. 3, the ring 14" will be retracted, the lock nut 39 bearing upon the outer surface of the flange 11' to prevent inward movement of the plug 35. If the plug be rotated counterclockwise, the ring 14" will be projected toward the impeller, the collar 36 bearing upon the inner surface of the flange 11' to prevent outward movement of the plug 35.

Fig. 4 is a segmental section of a modification of the structure disclosed in Fig. 2. The parts of this last modification are identical with those described in connection with Fig. 2 except as follows. The central web 25' is provided at its center point with an outwardly extending recessed boss 40, and the base of the recess is formed with a smaller conical recess 41. The boss is internally screw threaded as at 42. A screw 43 is provided intermediate its ends with a threaded portion 44 for cooperation with the threads 29 on cover plate 18', and said screw carries at its inner end a conical head 45 forming a shoulder 46. A sleeve nut 47 is adapted to be secured into the recess in the boss 40 and to engage the shoulder 46 to hold the head 45 securely within said recess. A removable handle 48 is carried on the outer end of the screw 43 beyond the cover plate 18'.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. In a centrifugal pump, a casing providing a chamber, a pump ring snugly

seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber and provided with an annular recess in its inner face, a third ring snugly received in said recess, and means to adjust said third ring axially. 70

2. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber and provided with an annular recess in its inner face, a third ring snugly received in said recess and provided with an annular groove registering with the groove in said first ring to form a pump channel, and means to adjust said third ring axially. 75 80

3. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber, a third ring snugly but slidably mounted in said second ring and provided with an annular groove registering with the groove in said first ring to form a water channel, and means to adjust said third ring axially. 85 90

4. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber, a third ring snugly but slidably mounted in said second ring, means to prevent relative rotation between said rings and said casing and between said rings, and means to adjust said third ring axially. 95 100

5. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber, a third ring snugly but slidably mounted in said second ring and provided with an annular groove registering with the groove in said first ring to form a water channel, an impeller mounted in said chamber between said first ring and said second and third rings and extending into said channel, and means to adjust the clearance between said third ring and said impeller. 105 110 115

6. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber, a third ring snugly but slidably mounted in said second ring, a key seated in a slot in said casing and in slots in said first and second rings, a second key seated in an interior slot in said second ring and in an exterior slot in said third ring, and means to adjust said third ring axially. 120 125

7. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular 130

groove in its outer face, a second ring snugly seated in said chamber and abutting said first ring, a radially inwardly projecting flange at the outer end of said second ring, a third ring snugly but slidably mounted in said second ring, and means including said flange for adjusting said third ring axially.

8. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber and abutting said first ring, a radially inwardly projecting flange at the outer end of said second ring, providing a recess in the inner face of said second ring, a third ring snugly but slidably mounted in said recess, and means for adjusting said third ring axially.

9. In a centrifugal pump, a casing providing a chamber, a pump ring snugly seated in said chamber and having an annular groove in its outer face, a second ring snugly seated in said chamber and abutting said first ring, a radially inwardly projecting flange at the outer end of said second ring providing a recess in the inner face of said second ring, a third ring snugly but slidably mounted in said recess, and provided with an annular groove in its inner face adapted to register with the groove in said first ring to form a pump channel, an impeller mounted in said chamber and between said first ring and said second and third rings and extending into said channel, said third ring being provided with screw-threads on its inner cylindrical surface, a plug having two series of threads thereon, said series being separated by an annular collar, the inner series of threads being adapted to cooperate with said ring threads, said collar being adapted to bear against the inner surface of said second ring flange, a lock nut threaded onto the other of said series of plug threads and adapted to bear against the outer surface of said second ring flange, and a cover plate secured to said casing and bearing on the outer face of said second ring to hold all of said rings securely in said chamber.

Signed by us this 15th day of December, 1927.

GALE E. FERGUSON.
CLARENCE G. WOOD.