A. R. WILFLEY.

CENTRIFUGAL PUMP.

APPLICATION FILED JULY 1, 1916.

1,276,847.

Patented Aug. 27, 1918.

2 SHEETS—SHEET 1.

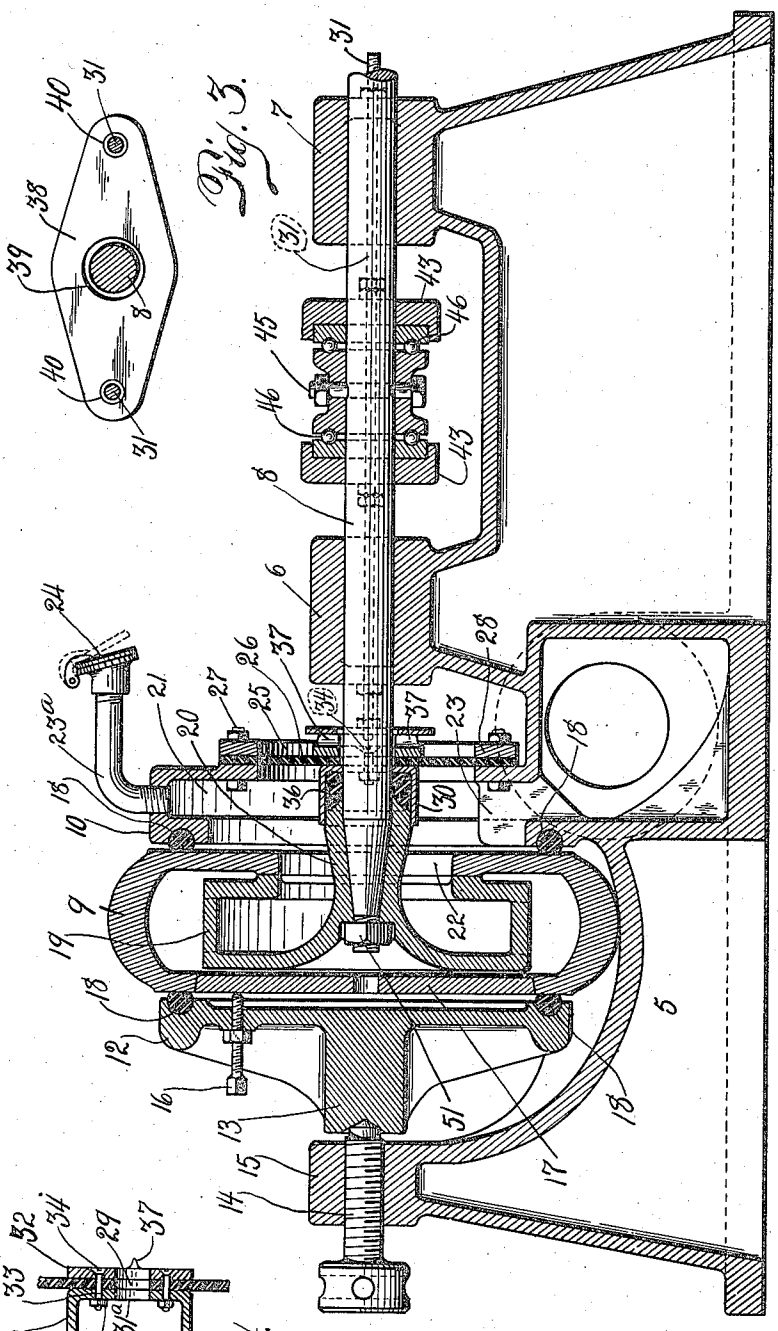


Fig. 1.

Fig. 3.

Fig. 4.

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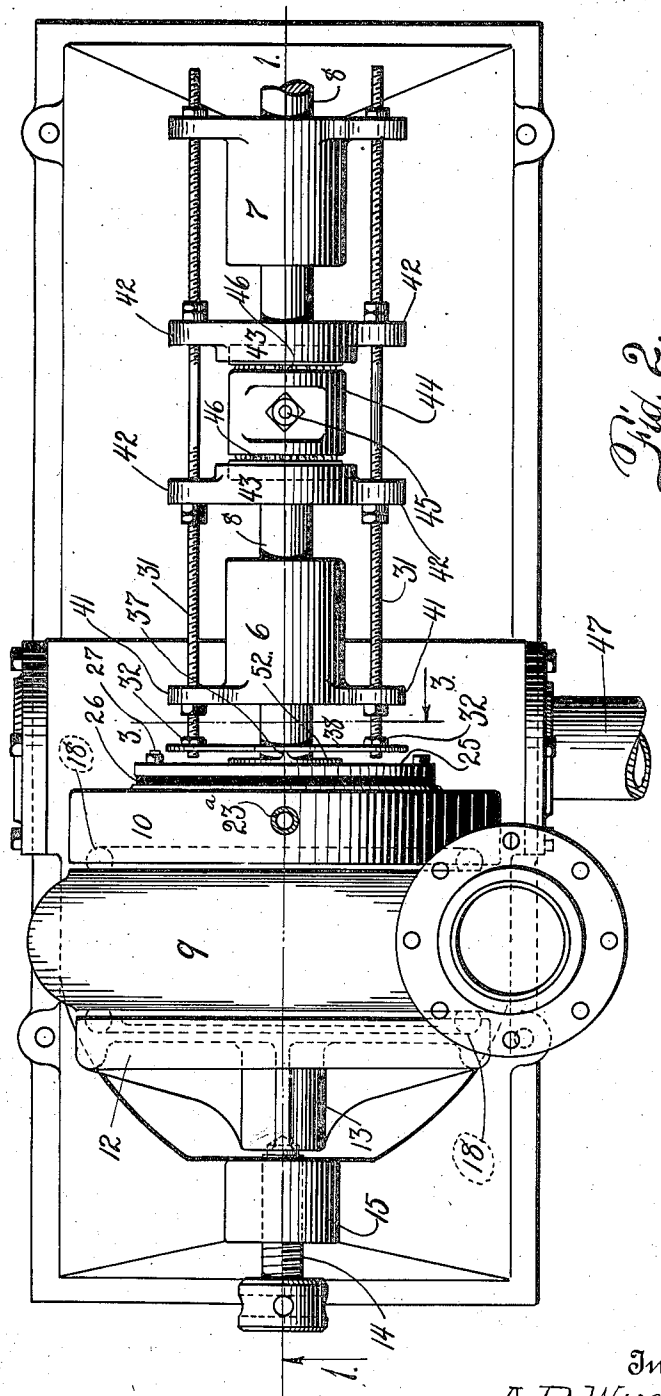


Fig. 2.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL PUMP.

1,276,847. Specification of Letters Patent. Patented Aug. 27, 1918.

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To all whom it may concern:

Be it known that I, ARTHUR R. WILFLEY, a citizen of the United States, residing at #1300 High street, in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Centrifugal Pumps; and I do 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, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in centrifugal pumps, my object being to overcome a number of the difficulties which have been experienced in the operation of these pumps, as heretofore constructed. One of these difficulties consists in the tendency of the shaft upon which the runner is mounted to be cut away or worn to such an extent as to render it useless within a comparatively short time, by reason of the dirt and sand working into the main bearing. This difficulty is experienced in a more pronounced degree where these pumps are employed in pumping water containing a considerable amount of sand. In other words, where these pumps are utilized for raising pulp to the necessary height for delivering it to concentrating apparatus, or other mechanism employed in its treatment, the sand works into the ordinary bearings and very soon destroys or cuts out the shaft. Hence one of the novel features of my improvement consists in providing means for supporting the stuffing box, through which the shaft passes, and which is engaged by the hub of the runner, in such a manner as to allow the stuffing box to vibrate with the shaft and runner both transversely and longitudinally; that is to say in the direction of the axis of the shaft, and also at right angles thereto.

The specific construction disclosed in the drawing for accomplishing this object consists of a flexible or resilient member or diaphragm, which is mounted on the casing framework of the pump, to which diaphragm is secured a sort of stuffing box. As shown in the drawing, this stuffing box consists of a sleeve fitted around the shaft of the runner at one end and open at its opposite end to receive the hub of the runner, the sleeve being provided with a quantity of packing material which the hub of the runner engages in such a manner that when the pump is in operation, the stuffing box and runner hub maintain their adjustment or proper coöperative relation, since the diaphragm which carries the stuffing box allows the latter to vibrate with the runner and its shaft whereby there is no transverse movement of the runner hub independently of the stuffing box. The endwise thrust of the runner shaft is resisted by a spring which bears upon a washer mounted on the opposite side of the diaphragm from the stuffing box.

Provision is also made for the endwise adjustment of the runner shaft in order to maintain the proper relation between the runner and its casing without disturbing the relation between the runner hub, the shaft and the stuffing box. In other words, the stuffing box moves endwise with the shaft and runner, due to the flexibility of the diaphragm which allows endwise as well as transverse movement of the shaft without disturbing the coöperative relation of the runner hub and the stuffing box after these elements have been properly adjusted. Therefore, it will be understood that this diaphragm permits the stuffing box to vibrate both longitudinally and transversely with the shaft and runner.

Provision is also made for preventing the trapping of air in the pump. This air enters the pump intake due to the failure at intervals of the supply of pulp or liquid in the sump which feeds the pump. This air unless removed, seriously interferes with the operation of the pump. In my improved construction I provide an auxiliary air chamber in the rear of and in communication with the runner chamber, and also in communication with the intake of the pump. Connected with this air chamber is an outlet equipped with a check valve, which is normally closed, but opens in response to air pressure in the chamber under the circumstances heretofore outlined.

Having briefly explained my improved construction, together with some of the functions it is intended to subserve, I will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof.

In this drawing, Figure 1 is a vertical, longitudinal section of a centrifugal pump, equipped with my improvements.

Fig. 2 is a top plan view of the same.

Fig. 3 is a detail view of a spring employed. The parts which support the spring are shown in section taken on the line 3—3, Fig. 2, looking toward the left, the parts, however, being shown on a larger scale.

Fig. 4 is a sectional detail cutting the diaphragm, the sleeve of the stuffing box and the washer which engages the diaphragm on the opposite side from the stuffing box. The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a suitable stationary framework, including two bearings 6 and 7, in which the shaft 8 of the pump is journaled. The casing 9 of the pump is supported between a member 10 of the casing and a removable disk 12 which engages the casing in front, and is provided with a hub 13, which is engaged by a set screw 14 threaded into a part 15 of the casing. This disk 12 is equipped with one or more set screws 16, which are threaded into openings formed in the disk and engage a plate 17, which forms a closure for the forward end of the runner casing 9; as shown in the drawing, packing rings 18 are arranged between the casing and the two members 10 and 12, between which the casing is clamped, as heretofore explained. Upon the forward extremity of the shaft 8 is mounted the runner 19. The hub 20 of the runner is open to receive the forward extremity of the shaft 8, the runner being fastened on the shaft by means of a nut 51. In the rear of the body of the casing, and formed in the member 10 which the casing engages, is an air chamber 21 which is in communication with the runner chamber, as shown at 22, and also with the intake of the pump, as shown at 23. In communication with the upper extremity of the air chamber 21 is an outlet pipe 23^a, equipped with a check valve 24 which prevents the entrance of air to the pump, but allows the air to escape from the chamber 21, in the event that air is drawn into the pump due to the fact that there is a failure of supply in the sump which feeds the pump, as heretofore explained.

Surrounding the shaft 8 immediately in the rear of the air chamber 21 is an opening 25 which is closed by a diaphragm 26, preferably composed of rubber, or some other suitable flexible and resilient material. This diaphragm is secured to the member 10 around the opening 25 by means of bolts 27 which are passed through registering openings formed in the adjacent portion of the member 10, in the outer portion of the diaphragm, and on a ring 28 which engages the diaphragm in opposing relation to the member 10. This diaphragm is centrally perforated, as shown at 29, to receive the shaft 8. Secured to the diaphragm is a sleeve 30, having an opening 31^a registering with the opening 29 of the diaphragm. A washer 52 is also secured to the diaphragm in opposing relation to the sleeve 30. The sleeve, the washer and the diaphragm are connected by means of suitable fastening devices, as bolts 33, which as shown in the drawing, have their heads 34 countersunk in the washer, nuts 35 being applied to their opposite threaded extremities. This sleeve or cup shaped member 30 is provided with a quantity of packing material 36. The rear extremity of the hub 20 of the runner enters the forward extremity of the sleeve 30 and engages this packing material when the parts of the pump are assembled in cooperative relation. The washer 52 is provided with a pair of projections 37 arranged on opposite sides of the shaft, and which form a bearing for the central part of an elongated spring 38, which is perforated, as shown at 39, to receive the shaft. The opposite ends of this spring are provided with openings 40, through which the forward extremities of rods 31 pass, the spring being connected with the rods by means of nuts 32 threaded on the rods; by virtue of the fact that the central portion of the spring engages the projection 37, the spring will always act upon the washer to properly resist the rearward pressure of the shaft, even though the extremities of the spring do not lie in a plane, cutting the axis of the shaft at right angles.

The rods 31 pass through perforated ears 41 formed on the bearings 6 and 7, through which the shaft passes. These rods also pass through ears 42 formed on bearing members 43, through which the shaft passes, these members being arranged on opposite sides of a hub 44, secured to the shaft by a bolt 45, bearing balls 46 being arranged between the hub 44 and the end bearings 43. By virtue of this construction, the shaft may be adjusted endwise or longitudinally, in order to compensate for wear between the runner and the casing, and this adjustment may be effected without disturbing the relation between the runner hub, the stuffing box and the shaft, since all of these members move together during such adjustment, this movement being permitted by the flexible diaphragm 26.

From the foregoing description the use and operation of my improved centrifugal pump will be readily understood. As shown in the drawing (see Fig. 2), the material as pulp enters the pump through a feed pipe 47, whose extremity remote from the pump is connected with a sump, or other suitable source of supply (not shown). This material enters the pump in response to the

suction produced by the rotation of the runner, which movement may be imparted in any suitable manner, as by connecting the shaft 8 with a motor of any suitable character. In pumps of this class there is always considerable vibration of the runner and its shaft, and under ordinary circumstances, this vibration soon results in wearing the parts to such an extent that sand will work into the shaft and cut out the latter in a comparatively short time, as heretofore outlined. My improvement, whereby the stuffing box, the shaft and the runner hub, move together during such vibration, overcomes this difficulty, as will be readily understood.

Attention is called to the fact that instead of a rigid or metal closure for the suction chamber in the rear of the pump, I employ a resilient wall, diaphragm or partition, upon which the stuffing box or packing member is mounted, thus permitting this member to vibrate or move both laterally and longitudinally with the shaft. The distinction between my improved construction and the ordinary construction, whereby a rigid wall is employed, and to which the stuffing box is secured against movement or vibration with the shaft, will, therefore, be readily understood.

Having thus described my invention, what I claim is:

1. A centrifugal pump, including a runner, its shaft, packing material, forming a tight joint around the shaft, and means for supporting said packing material to cause the same to vibrate with the shaft.

2. A centrifugal pump, including a runner, its shaft, packing material applied to the shaft, and means for supporting said packing material to cause the same to vibrate transversely with the shaft.

3. A centrifugal pump, including a runner, its shaft, packing material applied to the shaft, and means for supporting said packing material to cause it to vibrate with the shaft both transversely and longitudinally.

4. A centrifugal pump, including a runner, its shaft, and a flexible diaphragm carrying a stuffing box through which the shaft passes.

5. A centrifugal pump, including a framework and runner, a shaft on which the runner is mounted, a flexible member mounted on the framework, and a stuffing box mounted on the flexible member through which the shaft passes.

6. A centrifugal pump, including a framework, a runner, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, and means for supporting the stuffing box to cause the latter to vibrate with the shaft and runner.

7. In a centrifugal pump the combination of a runner, the shaft on which the runner is mounted, a sleeve surrounding the shaft and containing a quantity of packing material, and means for supporting the sleeve and packing material to cause them to vibrate with the shaft.

8. A centrifugal pump, including a runner, its shaft, packing material applied to the shaft and forming a tight joint, an abutment mounted on the shaft and engaging said packing material, and means for supporting the packing material to cause it to vibrate with the shaft and abutment.

9. A centrifugal pump, including a runner, its shaft and a flexible diaphragm carrying a stuffing box through which the shaft passes.

10. A centrifugal pump, including a framework, a runner, a shaft on which the runner is mounted, a flexible member mounted on the framework, and a stuffing box mounted on the flexible member, and through which the shaft passes.

11. A centrifugal pump including a framework, a runner, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, and means for supporting the stuffing box to permit the latter to vibrate with the shaft and runner.

12. In a centrifugal pump, the combination with the runner and shaft, of a stuffing box through which the shaft passes, and means for supporting the stuffing box to cause it to vibrate with the shaft and runner.

13. In a centrifugal pump, the combination of a runner, a shaft on which the runner is mounted, a sleeve surrounding the shaft and containing a quantity of packing material, the hub of the runner entering the sleeve and engaging said packing material to cause them to vibrate transversely with the shaft and runner.

14. In a centrifugal pump, the combination of a runner, a shaft on which the runner is mounted, a sleeve surrounding the shaft and carrying a quantity of packing material, the hub of the runner entering the sleeve and engaging said packing material, and means for supporting the sleeve and packing material to cause them to vibrate with the shaft and runner.

15. In a centrifugal pump, the combination of a runner, a shaft on which the runner is mounted, a sleeve surrounding the shaft and carrying a quantity of packing material, the hub of the runner entering the sleeve and engaging said packing material, and means for supporting the sleeve and packing material to cause them to vibrate with the shaft and runner in the direction of the axis of the shaft, and also at right angles thereto.

16. A centrifugal pump, including a runner and shaft on which the runner is mounted, a stuffing box through which the

shaft passes, and means for supporting the stuffing box in coöperative relation with the shaft to cause the stuffing box to vibrate with the runner and hub both transversely and longitudinally.

17. The combination of a casing, a runner, a shaft on which the runner is mounted, a resilient diaphragm through which the shaft passes, a stuffing box mounted on said diaphragm and arranged on the runner side thereof, and a spring acting on the opposite side of the diaphragm to give the necessary resistance.

18. A centrifugal pump, including a casing, a runner, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, and means for adjusting the shaft longitudinally to compensate for wear between the runner and its casing without disturbing the relation of the runner, the stuffing box and the shaft.

19. The combination of a casing, a runner, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, a resilient diaphragm through which the shaft passes and on which the stuffing box is mounted, and means yieldingly engaging the diaphragm on the opposite side from the stuffing box.

20. The combination of a casing, a runner therein, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, a resilient diaphragm through which the shaft passes and on which the stuffing box is mounted, and a spring acting on the diaphragm on the opposite side from the stuffing box, and means for supporting said spring and regulating its tension.

21. The combination of a casing, a runner, a shaft on which the runner is mounted, a stuffing box, a resilient diaphragm through which the shaft passes and on which the stuffing box is mounted, a leaf spring arranged on the opposite side of the diaphragm from the stuffing box and through which the shaft passes, the diaphragm being equipped to engage the central portion of the spring, and rods adjustably connected with the extremities of the spring on opposite sides of the shaft.

22. The combination of a casing, a runner, a shaft on which the runner is mounted, a stuffing box through which the shaft passes, a resilient diaphragm on which the stuffing box is mounted, a spring coöperating with the diaphragm, a rod with which the spring is adjustably connected, and a thrust bearing for the shaft, said bearing being adjustably mounted on the rod.

23. A centrifugal pump, including a casing, a runner therein, a shaft on which the runner is mounted, a resilient partition closing the suction chamber on one side and through which the shaft passes, and a stuffing box or packing member mounted on the said partition, and forming a tight joint around the shaft, whereby the stuffing box or packing member is allowed to vibrate with the shaft when the pump is in operation.

In testimony whereof I affix my signature in presence of two witnesses.

ARTHUR R. WILFLEY.

Witnesses:
E. M. DOUGLAS,
ALBERT O'BRIEN.