Oct. 21, 1958 E. J. PURCELL ET AL 2,856,858

CENTRIFUGAL PUMP

Filed July 13, 1953 2 Sheets-Sheet 1

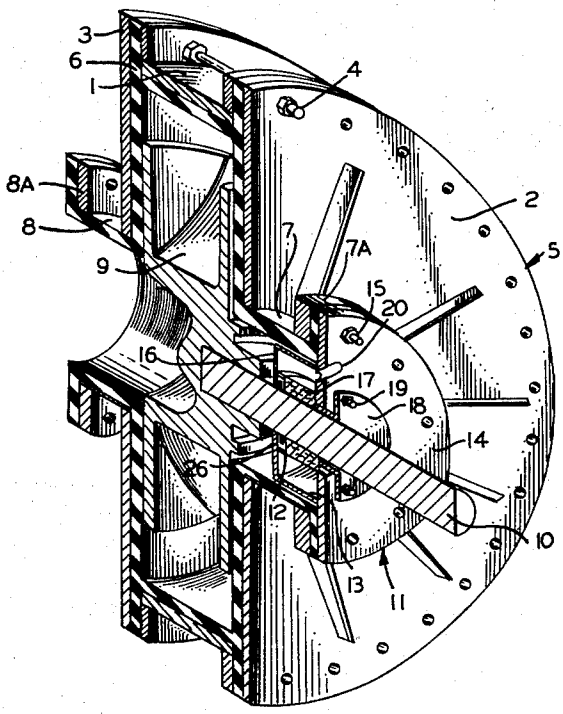


FIG. 1

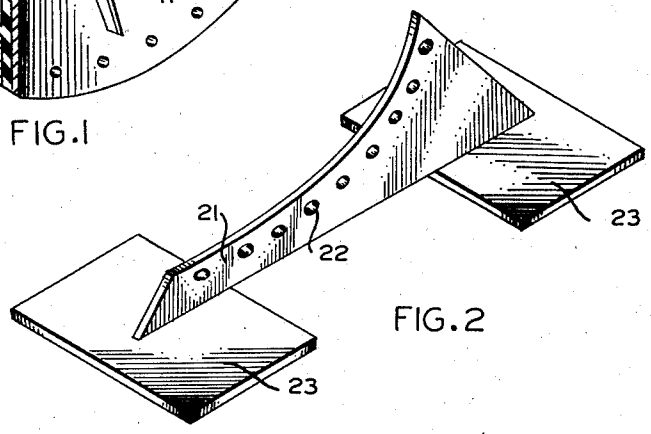


FIG. 2

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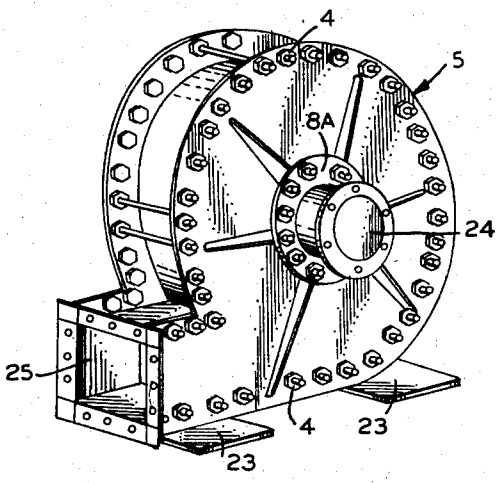


FIG.3

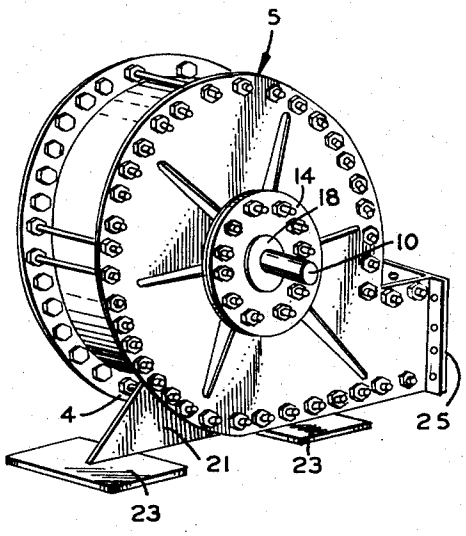


FIG.4

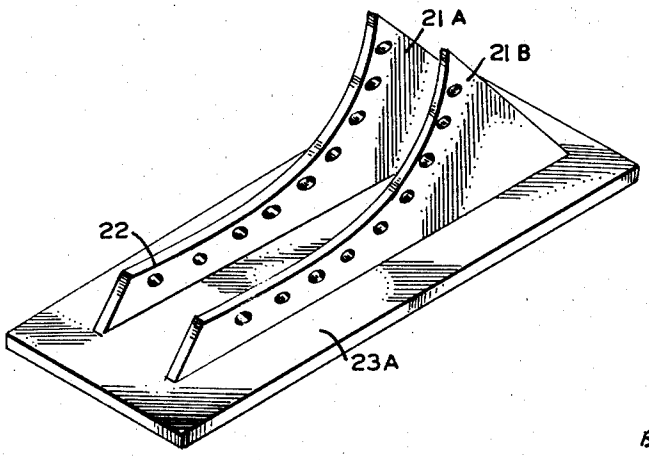


FIG.5

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CENTRIFUGAL PUMP

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3 Claims. (Cl. 103—103)

The present invention relates to centrifugal pumps and more particularly to a novel structure for dredge pumps.

Centrifugal pumps are of various designs, but always have a fixed direction of discharge with respect to the base. Thus, except for small pumps which can operate in upside-down position, one pump cannot serve to discharge to more than one direction. In certain mining operation, the mined material is moved along by pumping it in an aqueous slurry. This is common practice in mining phosphate rock. In this type of operation, the pumps must frequently be moved because of a shift in the mining operations. At times it is desired to pump to the right or left, or upward, or at an angle. In order to pump to different directions, it is necessary to have a separate pump for each direction. This means maintaining a large stock of pumps. When the number of spare parts which must be carried to service these pumps is considered, and the fact that the parts are not interchangeable, the disadvantages of maintaining several pumps become apparent.

Furthermore, the casings of many types of pumps are split horizontally, vertically or diagonally. Because the split sections of conventional pumps have irregular inner surfaces, it is difficult to line them with special materials, such as abrasive-resistant liners.

By the present invention, there is now provided a pump which is adapted to discharge in any desired direction tangential therewith and whose inner surfaces are of regular contour so that lining is simplified.

It is, therefore, a principal object of this invention to provide a pump that can be used to discharge in any direction.

Another object of this invention is to provide a pump in which the direction of discharge may be changed by simply reversing certain parts of the pump.

Still another object is to provide a unitary, removable, stuffing box for pumps.

A further object is to provide a pump that has only flat or cylindrical inner surfaces.

A still further object of this invention is a novel method of attaching the pump to a supporting base to secure the pump in place.

Other features of novelty will be apparent from the following description taken in connection with the drawing.

Referring to the drawing:

Fig. 1 is a cross-section of the pump of the present invention.

Fig. 2 is a perspective view of the supporting base for the pump.

Fig. 3 is a perspective view of a pump and base.

Fig. 4 is a perspective view of a pump showing the shaft, the unitary, removable, stuffing box bolted in place, and the supporting base.

Fig. 5 is a perspective view of a modification of the supporting base for the pump.

Referring now to Fig. 1, a flanged circumferential member **1** is disposed between side plates **2** and **3** which are joined by bolts **4** to form with said circumferential member a casing shown generally at **5**. For some uses, it is desirable to line the pump with an abrasion-resisting material, as at **6**, which may be rubber or any other abrasion-resisting material, depending upon the use to which the pump is intended. Side plates **2** and **3** of the casing **5** have axial openings of equal diameter and corresponding outwardly extending nozzles **7** and **8** having at their outer extremities, corresponding outwardly-directed flanges **7A** and **8A**. An impeller **9** is mounted on shaft **10**, which extends through one of said nozzles into casing **5** and which is connected to an outside driving means (not shown).

A unique feature of the present invention is the removable, unitary stuffing box **11** which consists of inner and outer concentric sleeves **12** and **13** secured to flange **14**, which, in turn, is attached to flange **7A** of nozzle **7** by means of bolts **15**. The inner and outer sleeves **12** and **13** project inwardly from flange **14** and, at their inner extremities, are secured to ring **16** to form an annular space **27**. The inside diameter of the inner sleeve **12** is somewhat greater than the diameter of the shaft **10** so that packing **17** can be inserted into the annular space between the shaft **10** and inner sleeve **12**. Ring **16** extends inwardly of sleeve **12** to form a flange therefor, as at **26**. This flange **26** acts as a retaining ring for the packing **17**, which is urged inwardly by packing gland **18** which is secured to flange **14** by means of bolts **19**. Inner sleeve **12** is perforated to permit the flow of water from the annular space **27** between sleeves **12** and **13** into the packing **17**, said water entering from an external source (not shown) through inlet **20**. The water in space **27** prevents the entry of air around packing **17** which would result in the loss of part or all of the pump suction. The water also acts as a cooling agent.

The unitary stuffing box may be attached to either of said flanges **7A** and **8A** since each side plate is a mirror image of the other. When the stuffing box is secured to the pump as in Fig. 1, nozzle **8** is used as the pump intake.

The intended use of the pump may dictate a modification in the structure of the unitary stuffing box.

To reverse the direction of discharge, bolts **15** are removed to permit withdrawal of stuffing box **11** from nozzle **7**, the pump sides are exchanged, the impeller is replaced by one of opposite hand, and the motor is reversed. Thus, stuffing box **11** is inserted, now, into nozzle **8** and is bolted to flange **8A**. Nozzle **7** now is employed as the intake of the pump.

Fig. 2 shows the supporting base for securing the pump **5** in place. The curved longitudinal metal rib **21** has bolt holes **22** and is welded transversely to metal base plates **23**. The bolt holes **22** receive the bolts **4** of the pump to secure the pump **5** in a vertical position. The supporting base may be modified to include two longitudinal ribs **21***a* and **21***b* as shown in Fig. 5, instead of one. When one longitudinal rib is used, spacing sleeves or collars (not shown) must be placed on the bolts **4** between said rib and the side plates **2** and **3** to prevent the pump from riding along the bolts **4**. Another variation in the structure of the supporting base is to employ only one metal base plate **23***a* as shown in Fig. 5. In this instance the base plate would extend in length slightly beyond the length of the rib. One or two ribs may be used with one base plate.

Fig. 3 shows the pump completely assembled and mounted on the supporting base. The material enters inlet **24** and is discharged through port **25**. This figure shows the pump in position for a left-hand bottom discharge with respect to intake. A right-hand top discharge may be formed by merely removing the bolts **4** from the bolt holes **22** (not visible) of the supporting base and turning the pump 180 degrees on its base. The pump is then bolted to a supporting base having holes correspond-

ing to the holes of the pump side plates at that position to secure the pump in place. Similarly, the point of discharge may be altered to any degree by following the aforesaid procedure.

Fig. 4 is a reverse view of Fig. 3 and shows the pump secured to the supporting base, having a single longitudinal rib **21**. The described collars or sleeves not shown would be used on the bolts 4 to prevent riding of the pump **5** on said bolts.

This pump is unique in that the side plates and openings and nozzles on the side plates are identical but reversed so that the pump can be made right or left-hand, top or bottom discharge, as previously described. The unitary stuffing box is a separate part of the pump and fits into the side plate rather than being an integral part thereof.

Another novel feature is the means of securing the pump. The pump is secured in place by a supporting base fabricated from steel plate and drilled to match the bolt holes around the side plates of the pump. The bolts which clamp the two side plates to the center member pass through the holes in the supporting base also. Because the pump is of a volute contour, when the pump discharge is rotated to any of a number of possible angles it is necessary to substitute an alternate supporting base which can be easily fabricated from steel plate. If the hand of the pump is changed from left to right or from right to left without changing the angle of discharge the supporting base does not need to be replaced.

A peculiar advantage of the pump construction is the use throughout of parts, other than the pump impeller, which are fabricated from steel plate or steel tubing and assembled by welding. Most such pumps are formed of cast iron, necessarily massive to prevent breakage and to withstand abrasion. The steel plate construction allows for much thinner and lighter sections to be used. The nature of steel is such that it tends to flex rather than fracture under stress. Since an abrasion-resistant material is used to cover the steel sections where the pumped material contacts it the thick wearing sectional areas of cast iron pumps are not needed. Ease of repair is another factor of importance in economical pump operation. If a cast iron pump is fractured or burst from any cause it cannot be repaired in any practical manner. If a pump fabricated from steel plate and tubing, cracks or is accidentally abraded the defective portions can be easily restored by welding and the pump put back in service with a minimum of delay and expense.

In addition to the previously listed advantages, the pump of the present invention has no irregular inside surfaces. For lining this pump, sheet material can be easily cemented or otherwise applied thereto. Materials, such as a metal or metal alloy, or rubber can be employed to line the inner surfaces, depending upon the use for which the pump is intended.

In mining phosphate rock, great quantities of sand and rock are handled in a water-slurry in centrifugal pumps and pipe lines. The material handled is very abrasive and ordinary cast iron pumps wear out rapidly. Rubber-lined pumps are available for handling fine sands, but manufacturers are reluctant to recommend rubber lined pumps for handling slurries containing large stones mixed with finer sands.

There are two ways of rubber lining a pump. One way is to mold a replaceable liner to fit loosely inside the pump casing. This has the disadvantage that any sharp object caught in the pump will cut the lining to pieces. The other way to rubber line a pump is to cement or vulcanize sheet rubber to the inside of the pump. In conventional pumps, this must be done with thin sheets, since the lining must be made to conform to the irregular inner surfaces of the pump. An occasional sharp object may scratch and score this sort of rubber lining, but it will not cut it to pieces. A cemented rubber lining gives satisfactory service where the material handled is fine grained. When large sized stones are present, however, the impact of a single stone on the rubber lining may be sufficient to cut through the rubber to the metal casing. Repeated pounding will soon beat the rubber lining off.

The design of our pump facilitates lining with rubber of any desired thickness. The correct thickness of the lining depends upon th peripheral speed of the pump impeller, the size of the maximum sized stone and the specific gravity of the slurry that will pass through the pump, and the resiliency of the rubber. In one installation, we have found that one inch of rubber of average resiliency will withstand about 600 foot-pounds of energy when the velocity of impact is about 90 ft. per second. Stones passing through the pump strike the rubber lining and bounce off without damaging the rubber.

While this invention has been described in detail with respect to a particular embodiment, it is not limited by the size or design or the application of the pump. The scope of the invention is indicated by the appended claims.

We claim:

1. A centrifugal pump comprising in combination paired identical flat metal side plates each having axial openings of equal diameter, corresponding nozzles of equal diameter extending outwardly from each axial opening, said nozzles having corresponding outwardly-directed flanges, a flanged circumferential member disposed between said side plates and having a substantially smooth inner surface, means removably securing said side plates to said circumferential member in fixed association to form a casing having an axial intake and a tangential discharge, a shaft extending through one of said nozzles into said casing, an impeller mounted on said shaft and disposed within said casing, a unitary stuffing box housed within one of said nozzles disposed around said shaft and removably secured to the flanged portion of said nozzle, and means adjustably supporting said pump.

2. The pump as defined in claim 1 wherein the inner surface of the circumferential member is lined with an abrasion-resistant material.

3. A centrifugal pump comprising in combination paired identical flat metal side plates each having axial openings of equal diameter, corresponding nozzles of diameter equal to the diameter of the axial openings and extending outwardly therefrom, said nozzles having corresponding outwardly-directed flanges, a flanged circumferential member disposed between said side plates and having a substantially smooth inner surface, means removably securing said side plates to the flanged portion of said circumferential member in fixed association to form a casing having an axial intake and a tangential discharge, a unitary stuffing box housed in the annular space between said shaft and the wall of said nozzle to form a seal, means removably securing said stuffing box to said nozzle at its flange, and means adjustably supporting said pump along the curvature of said casing.

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