CENTRIFUGAL PUMP FOR HANDLING SUSPENSIONS CONTAINING LARGE PARTICULATE MATTER

William D. Hessler, Wyckoff, N.J., assignor to International Telephone and Telegraph Corporation, New York, N.Y., a corporation of Maryland
Filed Feb. 24, 1964, Ser. No. 346,974
1 Claim. (Cl. 103—103)

This invention relates generally to centrifugal pumps, and particularly to a pump adapted to pump slurries, sludges or slilt containing trash, rock, debris or other large particulate matter.

One of the principal objects of this invention is to provide a pump adapted to pump liquids containing large particulate matter in suspension, and to provide in such a pump structure whereby the inlet side of the pump can be disassembled to provide ready access to the pump interior to remove solid matter which has become lodged in the pump body.

Another object is to provide a readily detachable suction elbow connecting a fixed suction pipe with the eye of the pump, which suction elbow can be readily disconnected from the pump body, so that large particulate matter can readily be removed when the same is jammed in the pump impeller and volute scroll, and to provide in such pump further removable structure for laying open the entire pump cavity for replacing the volute scroll and the pump impeller when the same becomes necessary, or for permitting the dislodgement of the particulate material when the same is not readily possible by removal of the suction elbow alone.

Other objects of the invention will become apparent from a study of the following specification taken with the drawings, which together illustrate and describe a preferred embodiment of the invention and which is now considered to be the best mode of practicing the principles thereof. Other embodiments of the invention may be suggested to those having the benefit of the teachings hereof, and such other embodiments are intended to be preserved especially as they fall within the scope and purview of the subjoined claims.

In the drawings:
FIG. 1 is a vertical sectional view taken through a centrifugal pump having the improvements according to the present invention embodied therein;
FIG. 2 is an end view thereof looking in the direction of the arrows 3—3 of FIG. 1; and
FIG. 3 is an opposite end view looking in the direction of the arrows 5—5 of FIG. 1; and
FIG. 4 is a vertical sectional view looking in the direction of the arrows 4—4 of FIG. 1.

Referring now to the drawings, the improved pump according to the present invention is referred to generally by the reference numeral 10 and includes a substantially cylindrical pump housing 11 which is surrounded by a discharge and priming tank 12 having a discharge opening 12a therefrom. The lower extremities of the housing 11 have webs 13 extending therefrom, which terminate at their lower end in spaced feet 14 having drilled openings 16 therein whereby the pump housing can be secured to any suitable base, not shown.

The housing 11 has a front wall 17 provided with a circular opening 18 to receive a front closure 19 sealed at opening 18 by an O-ring seal 20. The closure 19 has ears 21 extending therefrom, and the same are held in position by wing nuts 22 threaded onto studs 23 extending from each 24 in the pump housing 11, and registering with drilled holes in closure 19.

The housing 11 has a rear wall 26 spaced from the front wall 17, and wall 26 may be cast integrally with an annular rib 27 to receive a generally annular shaped shaft support 28. The center of shaft support 28 has a hub 29 enclosing the conventional shaft seals and bearings, not shown, for a shaft 31. Hub 29 may be cast integrally with a stiffener web 30 extending to shaft support 28, and the latter is secured to housing 11 by cap screws 28a tapped into housing 11.

As seen in FIGS. 1 and 4, the opposite side of the annular rib 27, within housing 11, is arranged to receive a volute scroll 32 having an annular rib 33 fitting snugly within the annular rib 27 of the housing 11, and an annular flange 34 bearing against the inside of annular rib 27. The volute scroll 32 is located properly in position at the annular rib 27 by an aligning screw 34 tapped into the rib 27.

The volute scroll 32 has a wall 36 extending against the closure 19, as seen more particularly in FIG. 1, and the wall 36 has a curve in the form of an involute, as seen more particularly in FIG. 4.

An impeller referred to generally by the reference numeral 35 consists of a disc 37 having a central hub 38 connected to the shaft 31. One such form of connection to the shaft 37 may be by means of a milled slot 39 in the hub 38 and shaft 31 and a conventional Woodruff key 41, in a manner well known, the hub 38 bearing against a shoulder 42 on the pump shaft 31. The assembly is held against longitudinal displacement on shaft 31 by a retaining nut threaded to the end of shaft 31. Another mode of connection of the impeller 35 to the shaft 31 consists of threading the end of the shaft 31 as at 43, and blind tapping the hub 38 with complementary threads.

The impeller 35 has vanes 46 which are curved in the manner shown, and which are spaced a distance at their inner ends corresponding to the diameter of an opening 47 in the closure 19. Opening 47 is coaxial with the axis of the drive shaft 31, opening 47 being large enough to accommodate the larger size particulate matter, which is moved together with the liquid suspending the same by curved vanes 46 to the discharge and priming tank 12 having the discharge opening 12a therefrom.

The inner face of closure 19 is provided with an annular wear plate 40 which is hardened and surface ground. Wear plate 40 is held to closure 19 by counter sunk screws, not shown.

The housing 11 and the discharge tank 12 are cast integrally with a fixed inlet suction pipe 51 having an inlet fitting 49 secured thereto. Inlet suction pipe 51 includes a curved wall 52 separating the discharge chamber 12 from the inlet pipe 51. A suction valve indicated generally by the reference numeral 53 is interposed between the inlet fitting 49 and the inlet pipe 51, and is held in place by cap screws 54, see FIG. 3, which also hold the inlet fitting 49 in place against the inlet pipe 51.

An opening 56 is provided from the inlet suction pipe 51, and the opening 56 is coterminous with a suction elbow 57 connecting the suction inlet pipe 51 with the opening 47 in the removable closure 19. A gasket 58 is held in an annular rib 59 on the upper end of the suction elbow 57, and against the opening 56 of the inlet pipe 51. A similar gasket 61 is held in a recess 62 at the removable closure 19, and gasket 61 seals against a flange 63 at the lower end of the suction elbow 57.

Structure is provided for holding the suction elbow 57 in position between the opening 56 of the inlet suction pipe 51 and against the removable closure 19 at the opening 47 therein, and comprises a pair of spaced abutments 64 which are preferably cast integrally with the removable closure 19. The two abutments 64 cooperate with a securing member in the form of a yoke 66 straddling the suction elbow as seen in FIG. 3. Yoke 66 has leg members 67, each of which terminates in a clevi
3. Suitable bolt means 69 afford a pivotal connection between the abutments 64 and the clevises 68.

Structure is provided which cooperates with the yoke 66 to hold the suction elbow 57 in position, and includes an "L" screw 71 which is tapped centrally of the yoke 66 at a boss 72 therein, to bear against a boss 73 on the suction elbow 57, the "L" screw 71 bearing against a conical depression 74 in the boss 73.

It should be noted that the two abutments 64 lie in a plane which is a bisector of the included angle of suction elbow 57, and that the yoke member 66 and the legs 67 thereof likewise lie on such plane when securing suction elbow 57 in position. Such structure insures that the force exerted by the yoke 66 and the screw 71 is such that it can be divided into two components insuring firm seating of the upper end of the elbow 57 at the opening 56, and of the lower end of the elbow 57 at the opening 47 in the closure 19.

Usually, if there is clogging of the pump 10, the same can be corrected by quickly releasing the screw 71 and rocking the yoke 67 to a position where it will not hinder the removal of the suction elbow 57. The yoke 66 will customarily be rocked in a counter-clockwise direction as seen in FIG. 1 upon release of the screw 71, whereupon the suction elbow 57 can be readily removed. The opening 47 in the removable closure 19 is of a size permitting insertion of suitable tools to dislodge any matter which is "hung up" at the impeller 35 or at the volute scroll 32.

In those cases where the particulate matter is of such a size that it cannot be removed by the aforesaid operation, the closure 19 may then be readily removed by releasing the wing nuts 22 seen in FIG. 3, the closure then being guided along the studs 23 for such removal.

It will be seen from the foregoing description that there have been provided some new and useful improvements in the art of centrifugal pumps for pumping heavy liquid suspensions having large suspended particulate matter therein. The structure disclosed according to the present invention makes it possible readily and expeditiously not only to correct a clogged condition thereof, but also to make immediate repairs which may become necessary by wear of the parts, these repairs being capable of being done in the field, if necessary. For example, the volute scroll 32 can readily be removed from the pump housing 11 by release of the securing screw 34 seen in FIG. 4. Since the closure 19 carries the hardened and ground wear plate thereon, a new closure 19 may be supplied or a new wear plate 40 substituted for the worn one.

While the invention has been described in terms of a preferred embodiment thereof, the scope is intended to be limited only by the claims hereto appended.

I claim:

In a centrifugal pump particularly adapted to pump fluids having large particulate matter suspended therein and adapted to permit rapid opening of the pumping chamber to dislodge said particulate matter when necessary, a pump housing including a pump volute therein defining a pumping chamber, a pump impeller adapted to rotate about an axis within said pump volute, a readily removable closure for said pump housing including an opening in said closure lying on the axis of rotation of said impeller, a fixed suction pipe spaced from said opening, suction elbow means connecting said fixed suction pipe with said opening in said closure, and means for holding said suction elbow in position between said fixed suction pipe and said opening and for providing ready removal of said suction elbow apart from said closure to enable said particulate material near said axis to be removed from said impeller without removing said closure, said means comprising a pair of abutments formed on said closure flanking the opening of said closure, the centers of said abutments lying in a plane which is approximately a bisector of the included angle of said suction elbow, a yoke member straddling said suction elbow and having leg members pivotally connected to said flanking abutments, and threaded means acting between said yoke member and a point on said suction elbow and along the plane which is the aforesaid angle bisector, said closure being removable together with said yoke member after removal of said suction elbow to expose said volute and impeller for the removal of particulate matter lodged therein.

References Cited by the Examiner

UNITED STATES PATENTS
2,635,549 4/1953 Rupp 103—114
2,831,434 4/1958 Paashauss 103—113
3,040,669 6/1962 Rupp 103—111

FOREIGN PATENTS
378,662 7/1923 Germany.
520,141 3/1955 Italy.

SAMUEL LEVINE, Examiner.
JOSEPH H. BRANSON, JR., KARL J. ALBRECHT, Examiners.
HENRY F. RADUAZO, Assistant Examiner.