Nov. 24, 1931. A. B. ANTISELL 1,832,890

PUMP

Filed Sept. 12, 1928

Fig. 2.

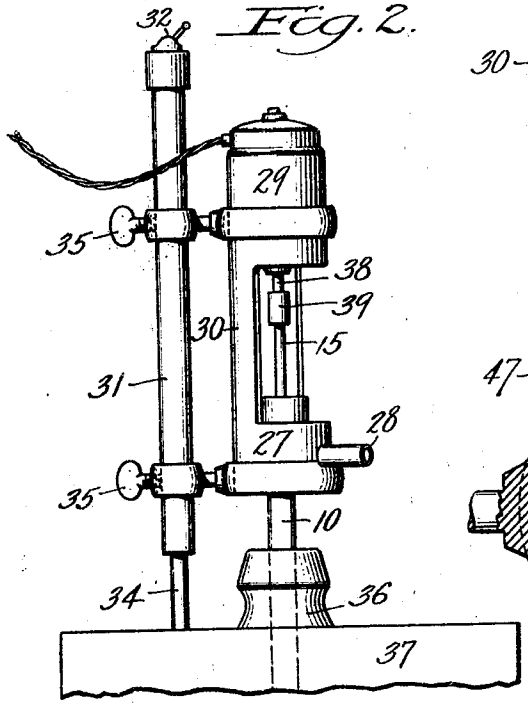


Fig. 1.

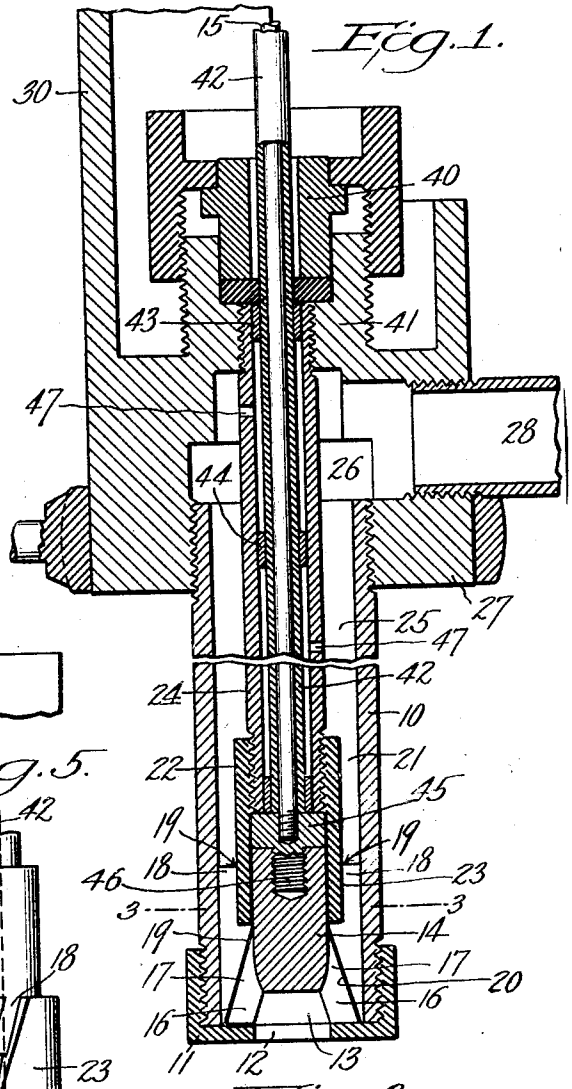


Fig. 4.

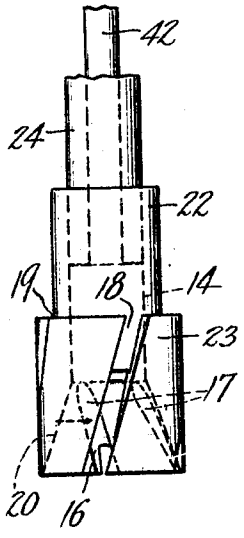


Fig. 5.

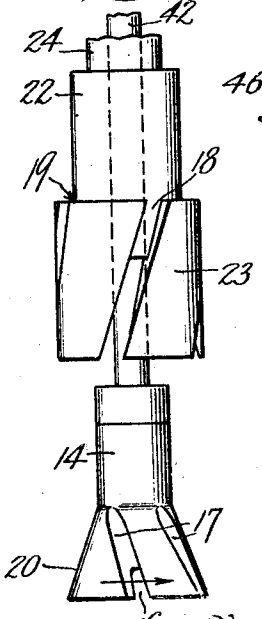
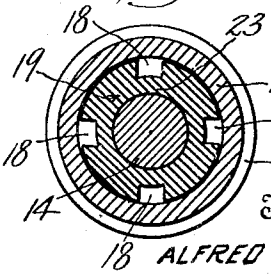


Fig. 3.



WITNESS

Oliver H. Holmes

Inventor

ALFRED B. ANTISELL

By his Attorney

Benj. T. Rauber

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1,832,890

UNITED STATES PATENT OFFICE

ALFRED B. ANTISELL, OF NEW YORK, N. Y.

PUMP

Application filed September 12, 1928. Serial No. 305,459.

My invention relates to rotary pumps and more particularly to centrifugal pumps capable of being inserted through narrow openings such as through the necks of carboys for drawing off liquids contained therein.

Because of the simplicity and convenience of centrifugal pumps and their freedom from sliding packings exposed to the liquid being pumped, they are ideally suited for pumping corrosive liquids such as acids. As centrifugal pumps for pumping liquids are not capable of creating a vacuum sufficient to lift liquids by suction to any considerable height, it is necessary to immerse the rotor of the pump in the liquid to be lifted. To obtain the required centrifugal force as heretofore designed a rotor of considerable diameter was required which made the pump too bulky to be inserted through the narrow passage. Inasmuch as acids are corrosive this limitation precluded the use of pumps for removing acid or other corrosive liquids through the narrow necks of carboys or other containers and therefore necessitated the lifting and tilting of carboys, which is troublesome and dangerous.

An object of my invention is to provide a rotary pump having a pumping element of small diameter capable of being inserted through small passages.

Another object of my invention is to provide a rotor for rotary pumps that has a maximum lifting power for its diameter.

Other objects and features of my invention are to provide a pump that is portable, light in weight and simple and with a minimum of moving parts and to provide a pump having a minimum of wearing surfaces exposed to the liquid being pumped and therefore especially adapted for the pumping of corrosive liquids.

With these and other objects in view, my invention comprises the apparatus described and set forth in the following specification and claims.

The various features of my invention are illustrated in the accompanying drawings in which:

Fig. 1 is a vertical, sectional view of a pump embodying a preferred form of my invention,

Fig. 2 is a side view of the driving motor and its mounting on the upper part of the pump, illustrating the manner in which the pump may be inserted through the neck of a carboy,

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 1,

Fig. 4 is an elevation of a part of the pump, showing the position of the rotor relative to the pump chamber, and

Fig. 5 is a vertical view of the elements shown in Fig. 4 with the rotor displaced longitudinally of the inner lining of the pump chamber to more clearly show its construction.

In my invention the pump chamber and the rotor are mounted at the receiving end of a long tubular pump casing of relative narrow diameter. An inlet opening is provided at the center of the base or inlet end of the pump chamber and the base of the rotor within the chamber is provided with a central receiving space and with a number of passages or grooves that extend radially from the inlet space and in an upward or longitudinal direction on the outer surface of the rotor and form impelling surfaces on the rotor. These upwardly extending passages may extend vertically or parallel to the axis of the rotor or at an angle thereto and preferably slope upwardly at an angle away from the direction of rotation of the rotor so as to create a resultant upward or lifting force in addition to the centrifugal force imparted by the rotation of the rotor. The peripheral surface of the rotor is tapered upwardly from the inlet end and the inner surface of the casing is tapered inwardly correspondingly and is provided with longitudinal passages or grooves, preferably inclined slightly in an opposite direction to those of the rotor. Consequently as the liquid passes upwardly through the longitudinal passages of the rotor, it is forced into or taken into longitudinal grooves or passages in the wall of the pump chamber. The inclination of the chamber grooves serves to provide an additional upward thrust on

the liquid. The liquid then passes upwardly between the pump casing and a shaft on which the rotor is suspended and overflows from an outlet opening.

Referring more particularly to the accompanying drawings, the lifting elements of the pump are positioned within a longitudinal casing 10, having a lower closing plate 11 in which is provided a central inlet 12. The casing 10 may be inserted into a container to be emptied and the lower end immersed in the liquid therein whereupon the liquid enters through an inlet 12 into a central space 13 within the base of a rotor 14, which is positioned in the lower end of the casing and is rotated therein by means of a shaft 15. From the central space 13 the liquid spreads into the radial grooves or passages 16 in the lower face of the rotor and receives an outward centrifugal force created by the rotation of the rotor. The liquid is confined in the grooves 16 by the inner surface of a rotor chamber in the casing and it is thereby caused by centrifugal pressure to flow upwardly in longitudinally disposed grooves 17 in the circumference of the rotor. In addition to the centrifugal force acting on the liquid, its vertical movement is assisted by having the grooves 17 inclined at a slight angle to the vertical and in a direction away from the direction of rotation as illustrated in Fig. 5, the direction of rotation being indicated by the arrow. The rapid rotation of the rotor and grooves 17 against the momentum of the liquid provides a component vertical thrust.

The rotational velocity of the liquid that has been given a rapid rotation and upward movement in its passage through the passageways 16 and 17 is transformed into a vertical pressure by reactance against inclined grooves or passageways 18 in a stationary member 19 forming a chamber in the lower part of the casing 10. To facilitate the transferring of liquid from the grooves or passageways 17 to the grooves 18, the lower part 20 of the rotor containing the grooves 17 is of a frusto-conical shape, thereby causing the effective depth of the grooves to decrease in an upward direction. The adjacent surface of the stationary chamber 19 is tapered upwardly from the lower end to conform to the shape of the rotor, the effective depth of grooves 18 correspondingly increasing in an upward direction so that as the liquid moves upwardly it is transferred from the grooves 17 to the grooves 18.

Inasmuch as the grooves 17 are positioned only at spaced intervals about the circumference of the rotor 14, and as the grooves or passageways 18 are spaced at intervals in the walls of chamber 19, it will be understood that the passages on the rotor do not coincide with the grooves or passages 18 at all times during their rotation, but intersect the passages 18 at varying heights at intervals. However, the total result of the rotation and of the passing of the rotor grooves within the chamber grooves 18 provides a resultant, steady upward stream through the passages 18. The intersection of the passages 17 and 18 forms a continuous passage from the annular chamber 25 to the inlet 12 so that the pump drains upon being lifted out of the liquid.

The liquid passing upwardly out of the passages 18 is received in an annular space 21 between the casing 10 and an upper cylindrical collar 22 of the chamber element 19 which is of less diameter than the casing 10.

As shown in Figs. 2, 3 and 4, the lower part of the tube 10 closely fits the cylindrical part 23 of the chamber element so as to form an outer wall for the channels or passages 18. The chamber 19 and its collar 22 are thereby centered and supported in position in the lower end of the casing 10. The upper part of the rotor is journaled and centered in a recess in the lower part of the collar 22. The upper part of the collar 22 is provided with an internal screw-thread, which receives the lower end of a vertical tube 24, enclosing the shaft 15 and forming with the inner surface of the casing tube 10 an annular passage 25 continuing upwardly from the passage 21. The liquid flowing upwardly through the passage 25 is received in a chamber 26 in the lower part of a supporting block 27, into the lower end of which the tube 10 is threaded. From the chamber 26 the liquid flows outwardly through a delivery tube 28.

The motor for rotating or driving the shaft 15 is mounted in a housing 29 supported integrally with and above the block 29 by means of an upright 30 which provides access to the space between the block 27 and the housing 29. Block and housing 27—29 are provided with a supporting handle 31 in the upper end of which is placed a switch 32 controlling the supply of current to the motor of housing 29. An extensible supporting rod 34 is adjustably mounted with the handle 31 and secured by means of thumbscrews 35 so that when the pump casing is inserted through the neck of a carboy 36, as shown in Fig. 2, the supporting rod 34 may be adjusted to rest on the box 37 of the carboy during the pumping.

The lower end 38 of the shaft of the driving motor is connected to the upper end of the shaft 15 by means of a coupling 39. The shaft 15 extends downwardly from the coupling 39 through a stuffing box 40 in the upper wall of the chamber 26 and thence into the tube 24 which is threaded into the wall 41 at its upper end and into the chamber 22 at its lower end. That portion of the shaft which extends through the stuffing box and down to the rotor 14 is covered with an acid

proof hard rubber shell 42 to protect it against corrosion by the liquid being pumped. The shaft 15 is centered within the tube 24 by means of spaced bearings 43 and 44 between the hard rubber shell 42 and the tube 24. The lower end of the shaft 15 is not threaded directly into the rotor 14, but into an intermediate bronze disc 45. This disc 45 is, in turn, threaded into the upper part of the rotor 14 by means of a threaded stem 46 of larger diameter. When the pump is to be used for pumping acids, or similar corrosive liquids, all parts such as the casing 10, cap 11, rotor 14, chamber block 19, tube 24 and block 27 are made of hard rubber or other acid proof material. The tube 24 is provided with holes 47 which permit the entrance of fluid to the tube 24 to lubricate the bearings 44. The purpose of the tube 24 is to minimize the swirling that might be induced by the rotation of the shaft 15, as well as to support the lower bearings of the shaft.

Through the above invention a rotary pump of small diameter has been provided, enabling the pump to be inserted through narrow passageways so that carboys, acid tanks and other similar structures may be quickly and easily emptied. The pump is, moreover, of a light and simple construction enabling it to be easily transported and set in position. The rotor is adapted to create a very large pressure or thrust relative to its diameter, and it is thus particularly adapted for a pump of small diameter. It will be understood that the number of passages 17 and 18 may be varied to suit the size, purpose and condition of use of the apparatus.

Having described my invention what I claim and desire to secure by Letters Patent is:

1. A pump comprising a cylindrical casing and a frusto-conical chamber formed in the lower part of said casing, said chamber having a central inlet in its base, and a rotor having a frusto-conical portion conforming to the wall of said chamber, said rotor having passages in its base extending outwardly from the center and communicating with upwardly extending passages in its side wall and said chamber having upwardly extending passages in said frusto-conical wall communicating with the passages on said rotor.

2. A pump comprising a cylindrical casing and frusto-conical chamber formed in the lower part thereof, said chamber having a central inlet in its base, a rotor having a frusto-conical portion conforming to the walls of said chamber, said rotor having outwardly extending passages in its base communicating with passages in its frusto-conical face sloping upwardly from the direction of travel, and said chamber having passages in its inner surface opening toward the passages on said rotor.

3. A pump comprising a cylindrical casing and a frusto-conical chamber in the lower part thereof, said chamber having a central inlet in its base, a rotor in said chamber conforming to the walls of said chamber, said rotor having passages in its base extending outwardly from said central inlet to passages in its frusto-conical surface sloping upwardly from the direction of travel of said rotor, said chamber having passages in its wall sloping upwardly in a direction opposite to the slope of said rotor passages and communicating therewith.

4. A pump of the type described comprising a chamber, said chamber having a central inlet in its base, the side walls of said chamber converging upwardly and having passages formed in their inner surfaces, a rotor in said chamber conforming to the walls thereof and having passages communicating with said inlet and extending upwardly in its side surface.

5. A pump of the type described comprising a chamber, said chamber having a central opening in its base and having upwardly extending passages in its side walls, the depth of said passages increasing in a vertical direction, a rotor in said chamber, said rotor having in its surface passages communicating with the central inlet in said chamber and extending upwardly the depth of said passages decreasing in a vertical direction.

6. A pump of the type described which comprises a tubular casing having a frusto-conical chamber in its lower end and a central inlet to said frusto-conical chamber, said chamber having upwardly extending grooves in its side wall, said grooves becoming deeper towards the upper end of said chamber and communicating with said cylindrical casing, and a rotor in said chamber having upwardly extending grooves communicating with the grooves in said chamber and with said central inlet, the grooves in said rotor decreasing in depth towards their upper portions.

7. A pump of the type described which comprises a cylindrical casing having a central inlet in its lower end, a stationary element in the base of said casing forming a frusto-conical chamber, the upper end of said stationary element forming an annular passage within said tubular casing and the lower part fitting the wall of said casing, said stationary element having grooves cut in the lower part to form passages to said frusto-conical chamber of decreasing depth towards the base, and a frusto-conical rotor in said chamber having upwardly extending grooves communicating with said central inlet and with said passage grooves in said stationary element.

8. A pump rotor having a frusto-conical portion, a central receiving space in the base of said rotor and upwardly extending grooves in the frusto-conical surface of said rotor,

the depth of said grooves decreasing as the diameter of said rotor decreases.

9. A pump rotor having a central space at its base to receive liquids and impelling surfaces extending outwardly from the central receiving space and thence upwardly, the outer edges of said surfaces extending radially inwardly toward their upper portions to decrease the width of said surfaces.

10. A pump rotor having a receiving space at its base and upwardly inclined impelling surfaces having their outer edges extending upwardly decreasing their width with their distance from the base of the rotor.

11. A pump comprising a chamber, said chamber having a central inlet at its base and having upwardly extending grooves in its side wall and a rotor of a solid block of material having side walls closely fitting the walls of said chamber and capable of rotation therein, said rotor having upwardly extending grooves in its side wall, a recess in its base in communication with the central inlet of said chamber and passages from said recess to said grooves, the grooves in said wall of said chamber and in said rotor being inclined relatively to each other so as to cross each other at a changing point as said rotor rotates.

In testimony whereof I hereunto affix my signature.

ALFRED B. ANTISELL.