Aug. 17, 1965 K. H. BURGIN 3,200,754

WATER PUMP

Filed Feb. 10, 1964 2 Sheets-Sheet 1

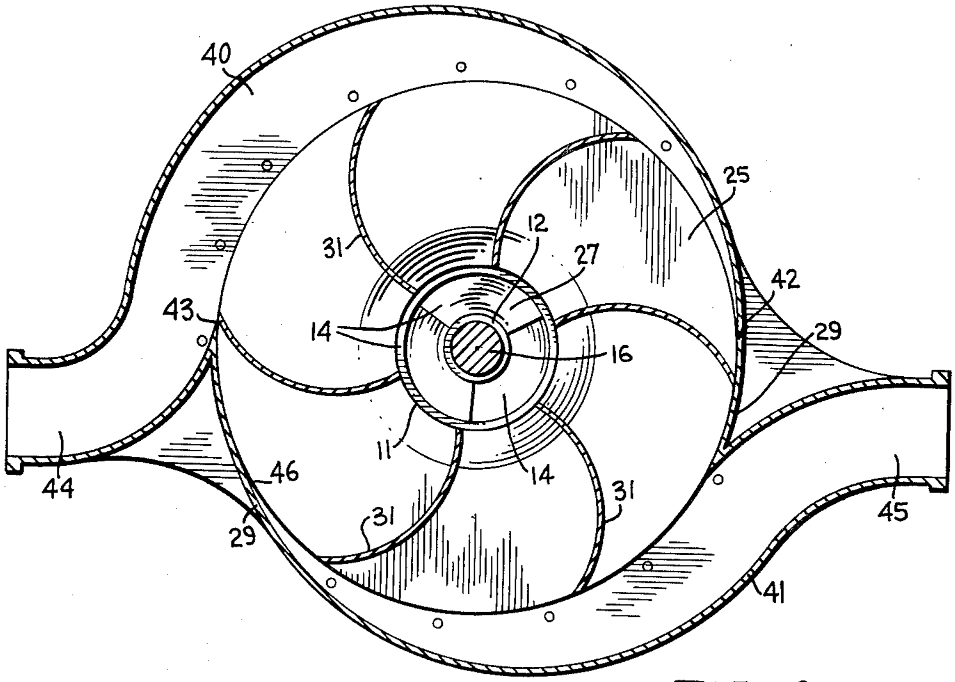

FIG.- 2

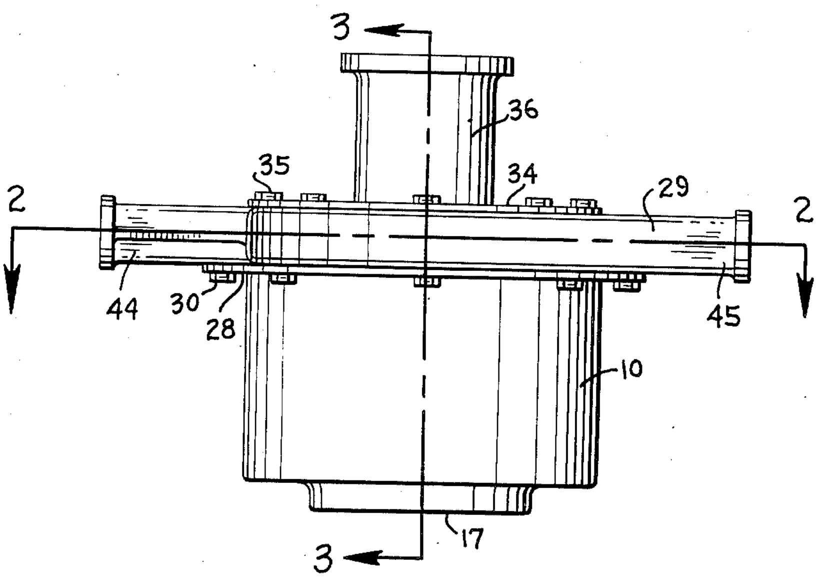

FIG.- 1

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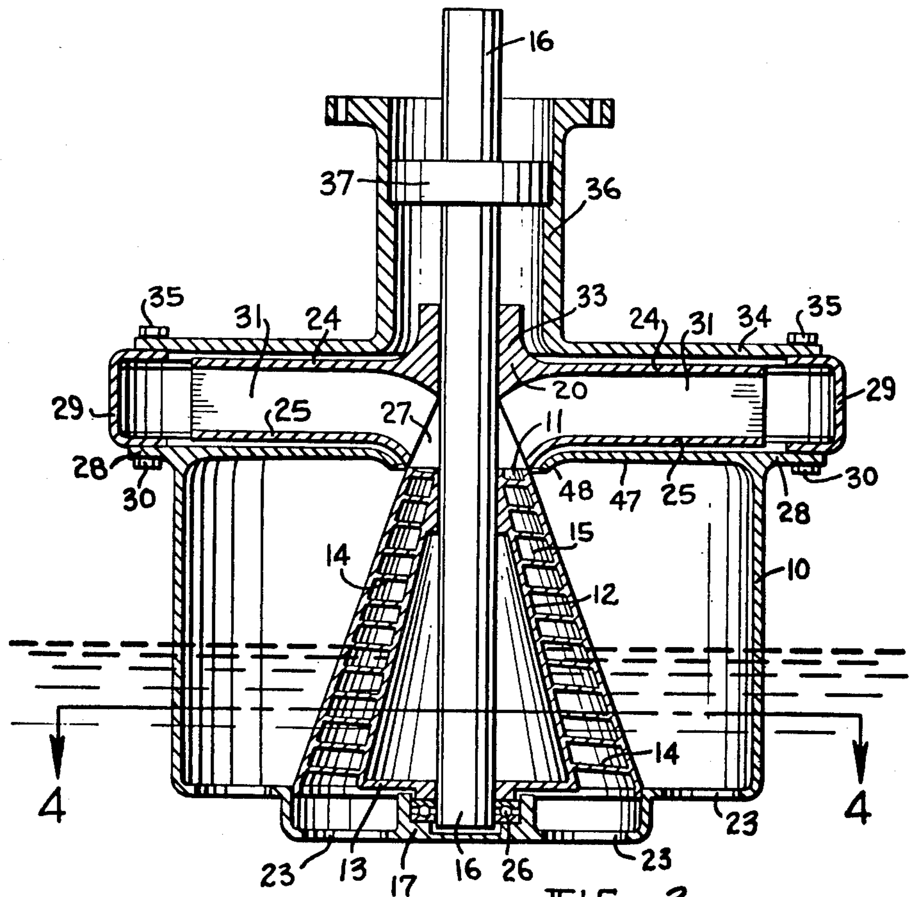

FIG.- 3

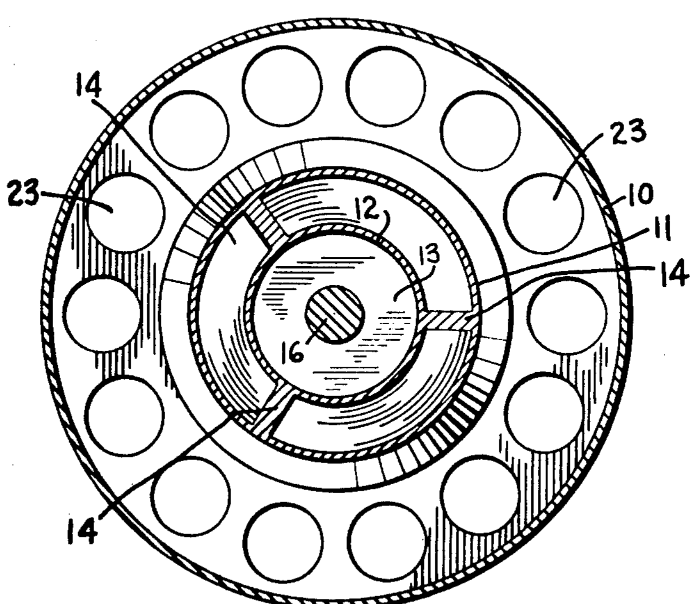

FIG.- 4

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WATER PUMP

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3 Claims. (Cl. 103—88)

This invention relates primarily to means for producing a delivery of high velocity of water or other liquid from a two stage centrifugal pump having a vertically disposed drive shaft, wherein the first stage is of a screw thread type with its intake to be submerged in the liquid to be pumped, and the second stage is of a centrifugal type.

Reference is made to my co-pending application Ser. No. 280,794, filed May 16, 1963, and allowed December 2, 1963 now U.S. Patent No. 3,128,740.

My invention herein set forth may be employed for pumping fluid in many situations. It may be employed to give a high thrust at the pump delivery end for jet propulsion of boats; to lift fluids to high elevations; deliver water for irrigating purposes; street flushing; and in fact in any situation wherein a high pressure or high velocity of water is required.

It is a known fact that when a fluid is accelerated or given a momentum change, a force is required to produce this acceleration in the fluid and, at the same time, there is an equal and opposite reaction force which is called the thrust. The principle of jet propulsion is based on this reactive principle. Then the efficiency of the drive depends upon the exhaust velocity of the mass of water being hurled from a jet nozzle.

It is also well known that a properly designed centrifugal pump is ideally suited to variable speed operations which means that in a water boat propulsion device, this type of pump will operate very well not only at high speeds, but at low speeds. The structure embodying the present invention is particularly well adapted to operate at high speeds.

In reference to a centrifugal pump, water is admitted into a central axial zone to the interior edges of a set of moving turbine-like buckets which discharge the water by outer edges of those buckets with kinetic energy sufficient to give the desired velocity of the water through a gradually enlarging spiral passage which transforms kinetic energy into pressure energy in turn setting up the desired velocity of the water through a conduit and out a discharge. A centrifugal pump in its elemental form generally requires priming in order to fill the center zone of the buckets with water at the initial start of rotation of the buckets. It is necessary of course that the centrifugal pump should run with all of its parts full of water in the absence of such filling, a low intake pressure would produce vaporizing of the fluid. Also in this regard, cavitation is to be avoided.

In the present invention, a centrifugal pump of a special design is employed as one form thereof to have discharge passageways from a single set of buckets. By so doing the exit fluid reactive thrusts will counteract a rotative reaction force of the pump as a whole. Also in the present invention, the centrifugal pump is located above the water level and the discharge must be above that water level in order to obtain the maximum reactive effect particularly when the device is applied to a boat drive.

Further, in the present invention, an auxiliary auger type of pump is employed to deliver water at a predetermined velocity into the intake zone of the centrifugal pump not only in order to be assured that the spaces within the pump and between the buckets be completely filled with water at all times, but that a high pressure be made in the intake zone to avoid cavitation at high impeller speeds.

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One particular form of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a vertical, side elevation of a pump structure embodying the invention;

FIG. 2 is a horizontal section on the line 2—2 in FIG. 1;

FIG. 3 is a vertical section on the line 3—3 in FIG. 1; and

FIG. 4 is a transverse section on the line 4—4 in FIG. 3.

In the present form of the invention, there is employed a base generally designated by the numeral **10** which is approximately cylindrical and hollow in shape. Within this base **10** there is freely, rotatively carried a frusto-conical member **11**. Then within the member **11** there is a second frusto-conical member **12**. This member **12**, while hollow, is preferably closed at both ends against entrance of water therewithin. The member **12** has a base **13** which is much less in diameter than is the internal base diameter of the member **11**, FIG. 2. The member **12** is substantially of the same height as is the member **11**. The upper end of the member **12** is of less diameter than is the diameter of the member **11** and the space between the upper ends of those two members **11** and **12** is open. This relationship of the two members **11** and **12** provides a conical annular chamber between the members **11** and **12** which chamber decreases in volume from bottom to top.

There are spiral lift members **14**, preferably three, extending throughout this annular spacing **15** between the members **11** and **12**. These lift members **14** constitute screw-like spiral members, the inner edges of which are secured sealably to the wall of the member **11** and the outer edge of those members **14** are sealably secured to the wall of the member **11**. This provides a closed water passageway from the bottom of the member **11** between ascending turns of the member **14** to the top open end of the space **15**. The spiralling space between the turns of the members **14** is confined with the members **11** and **12** turning therewith so that there is no outside or inside stationary walls over which the fluid could otherwise drag. As indicated in FIG. 2, the pitch of each of these spiral members **14** is approximately constant between the lower and upper ends of the members **11** and **12**.

There is a vertical drive shaft **16** extending axially through the member **12** and fixed thereto in rotative driving relation. Across the lower end of the housing **10** is fixed a drive shaft bearing support member generally designated by the numeral **17**. The member **17** is provided with a plurality of openings **23** for passage of fluid therethrough. The member **17** carries at least one thrust bearing **26** to support the lower end of the shaft **16**.

The upper end of the housing **10** is provided in the present showing with an outwardly extending, horizontally disposed flange **28** extending therearound. A centrifugal pump housing **29** is secured to this flange **28** by any suitable means, herein indicated as one possibility by cap screws **30**.

Within the housing **29** is carried a plurality of impelling vanes **31** which are integrally secured between top and bottom plates **24** and **25**, FIG. 3. The top plate **24** is provided with an upturned sleeve **33** through which the shaft **16** passes and is secured in rotative driving connection therewith. The underside of the plate **24** has a central, inverted conical shape **30**. A top side of the housing **10** constitutes a floor **47** over which the vanes **31** travel. The central zone of the floor **47** has a downturned curving collar **48** following the curvature of the inner ends of the vanes **31**.

A pump housing cover plate **34** covers over the housing **29** with a running clearance over the bucket plate **24**, and is secured to the housing **29** in any suitable manner herein indicated as by the cap screws 35. The central area of this plate 34 is open, and an upstanding, tubular support 36 has a lower end portion surrounding this plate opening end extends upwardly therefrom, the support 36 being indicated herein although not necessarily so, as an integral part of the plate 34. Within the support 36, there is a sealed bearing 37 through which the shaft 16 extends to take the radial as well as the vertical thrust of the shaft. A support member 36 may carry a pump drive motor (not shown.)

Referring now to the centrifugal pump primarily, the central inlet opening is designated by the numeral 27. From this opening the blades 31 curve horizontally spirally in spaced relation one from the other. It is to be noted particularly that there are two scrolls 40 and 41 receiving water discharging from between the blades 31. Each of these scrolls extend circumferentially around the housing 29 approximately equal distances such as on the order of 130 degrees each. The scroll 40 cross-sectional area starts from zero at the zone 42 and gradually increases in cross-sectional area to the zone 43 from where the scroll merges into the discharge conduit 44. The scroll 41 starts at the zone 46 from where it spirals to eventually merge into the second water conduit 45.

Assuming that the shaft 16 is rotating counter-clockwise in a driving manner, the combined units 11, 12 and 14 are turning in that direction also which will elevate water from the openings 23 primarily directly under the members 11 and 12, upwardly into the central zone 27 of the vanes 31. The members 10, 11, and 12 will normally be submerged in the water by their lower ends at least so that the water is always available in the lower end portion of the space 15 to be available for this elevating action. Since the pitch of the blades 14 is constant and the diameter of the space 15 decreases as the elevation increases, the elevating water will be gradually given an increased discharging speed, since the larger volume picked up at the lower ends is carried upwardly to discharge through a smaller opening. The vanes 31 are simultaneously turning, and water entering under pressure into the zone 27 spreads immediately out between the vanes 31 where it is given added impetus and its major velocity as it leaves the outer edges of those vanes 31 and enters the two scrolls 40 and 41. By entering the central neutral zone 27 of the vanes 31, there is no conflict between flow of water entering therein and that discharge from the outer ends of the vanes. The inner ends of the vanes 31 are turned downwardly to follow between the conical shape 20 and a downwardly curving central portion of the plate 25 as is indicated in FIG. 3. It has been noted in U.S. Patents Nos. 2,659,311 and 718,557, that an attempt has been made in the past to flow water horizontally in an unconfined manner to what has been termed a centrifugal pump rotating on a horizontal axis by discharging the horizontally flowing water directly into outer portions of the vanes, and this of course nullifies the normal action of a centrifugal pump.

The overall diameters of the outer edges of the vanes 31 are sufficiently great in connection with the number of vanes employed to supply sufficient water to the two conduits 44 and 45 at high velocity simultaneously, and the shaft 16 may be rotated at speeds of 3,000 r.p.m. with good pumping action.

Thus, by means of the structure above defined, there is a centrifugal pump having vanes rotating on a vertical axis and there is an axial water inlet to the vanes which discharge the water into at least one spiral scroll. Then, to insure a supply of water to the vanes there is a conical, screw lift from the water supply delivering water axially of and to the vanes to insure against cavitation and loss of "prime."

While I have herein shown and described my invention in this one particular form, it is obvious that structural changes may be made particularly in the exterior contours of the various members, and the number of vanes employed, and in the angle of the members 11 and 12, all without departing from the spirit of the invention, and I therefore do not desire to be limited to that precise form beyond the limitations which may be imposed by the following claims.

I claim:

1. A pump structure having two stages, comprising
a vertically extending drive shaft;
a first hollow frusto-conical member drivingly fixed to said shaft;
a second frusto-conical member of approximately equal height to and being within said first member, drivingly fixed to said shaft and radially spaced from the first member defining an annular space therebetween;
at least one continuous spiral member extending from the lower to top ends of said two members and engaging by its side edges to both of said members forming a confined spiral chamber therebetween open at bottom and top of those members;
an impeller unit above said members and driving fixed to said shaft;
said impeller unit having a central zone open from its underside and comprised a number of vanes of common length radiating horizontally from the zone with openings therebetween from said zone;
a housing surrounding the outer ends of said vanes with at least one side opening;
a discharge conduit; and
a scroll spiralling from over said opening and discharging into said conduit.

2. Ths structure of claim 1, in which there is
an upper plate fixed across the top edges of said vanes;
a lower plate fixed across the bottom edges of said vanes;
a surface extending from the under side of said upper plate, downwardly extending into a central, inverted conical shape about said shaft; and
said impeller unit bottom plate curving in said central zone to a central zone to a circular opening approximately equal to the top opening of said outer frusto-conical member.

3. The structure of claim 1, in which there is
a second side opening in said vane housing approximately opposite to said first side opening;
a second discharge conduit; and
a scroll spiralling from over said second opening and merging into said conduit;
said housing side openings being approximately diametrically opopsite each other.

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DONLEY J. STOCKING, *Primary Examiner.*