THE PRESENT INVENTION

A principal object of the present invention is the provision of a new and improved pump of the character referred to which is particularly effective in pumping liquids and which may be operated dry for indefinite periods at relatively high r.p.m.'s without adversely affecting its pumping characteristics, which initiates pumping operations without priming, and is not adversely affected by grit, dirt and foreign particles in liquids pumped thereby.

Another object of the invention is to provide a new and improved pump of the character mentioned in which surfaces of the rotor and hub structure have no fluid sealing functions so that the rotor is preferably spaced from the port plate and the hub structure is preferably spaced from the rotor and the port plate thereby eliminating maintenance of close tolerances in the manufacture of the pump.

It is another object of the present invention to provide an improved pump of the general type described in which the vane members are joined together at their ends and attached to the rotor and hub so that the ends of the pump chambers are formed by contiguous joining of the vane forming opposite sides of the pump chambers whereby the only fluid seals between relative moving parts which are subjected to fluid passing through the pump are formed by edges of the vanes engaging smooth wall surfaces.

A further object of the invention is the provision of an improved pump of the character described in which fluid cannot become trapped between the vanes and their backing surfaces thereby eliminating tendency of the hub to overrun the rotor.

A more specific object of the invention is the provision of a pump of the character mentioned in which the vane members are attached to the hub and rotor structures by overlapping end portions of adjacent vanes and clamping the vanes to the structures whereby the edges of the vanes engaging the radial end wall and the port plate form fluid tight running seals therewith so that in the assembly of the pump the edges of the vanes may be compressed between the end rotor wall and port plates and provide exceedingly low friction, close running tolerances upon rotation of the rotor.

Other objects and advantages of the invention will be apparent from the following description of a preferred form thereof, reference being made to the accompanying drawings wherein:

FIG. 1 is a fragmentary end elevational view of a water pump embodying the invention;

FIG. 2 is a sectional view of the pump similar to FIG. 1 taken on line 2—2 of FIG. 3; and

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

While I have described my invention as a pump, it is to be understood that the invention may be embodied in any type of device having expansible chambers, such as a pump, compressor, motor or similar structure and that the word "pump," when used in the specification and claims should be so interpreted.

Referring to the drawings, my invention is shown embodied in a water pump 10 which comprises a housing 11 formed by a generally drum shaped member 12 having an end assembly 13 secured across and by bolts secured to a flange about the periphery of the member. A pump drive shaft 15 is journaled by bearings 16 in a sleeve 17 formed on the member 12 and extending axially thereof. An oil seal 18 retains lubricant in the sleeve. The end assembly 13 includes a port plate 20 having tubular coupling members 21, 22 formed thereon and a wear plate 23. The port plate 18 may be conveniently formed
of a suitable plastic and the couplings 21, 22 provide
means to connect the intake and discharge of the pump to
suitable hoses or the like. The wear plate 23 is prefer-
ably of stainless steel and forms the inner surface of the
end assembly. The housing 11 may also include means
to attach the pump to a support and in driving relation
to a motor or engine connected to the shaft 15. For the
sake of brevity such means and motor are not shown.
The shaft 15 rotates a pump assembly counterclockwise,
as viewed in FIG. 2, inside the housing member 12 which
draws water into the intake member 21 and discharges
the water forward to the discharge member 22.
The pump assembly comprises a cup shaped rotor 24
having a cylindrical wall 25 and a fluid impervious radia-

tally extending end wall 26. A socket 27 is formed integral
with the end wall 26 and the inner end of the drive shaft
15 is suitably secured to the walls of the socket so that
the rotor 24 is rotated by the shaft about an axis coinci-
dent with the axis of the cylindrical wall 25. The edges
of the open end of the cylindrical wall 25 are preferably
spaced an appreciable distance from the wear plate 23,
and the journaling of shaft 15 is such as to prevent end-
wise movements of the shaft and shifting of the rotor
toward the wear plate 23.
A hub structure 30 is journaled for free rotation about
a stub shaft 31, one end of which is secured in a socket
32 in the end assembly 13, and the axis of which shaft
is parallel and eccentric to the axis of rotation of the rotor
24. The hub structure 30 includes an octagonal member
33 having an axial socket 34 which receives the stub shaft
31. Preferably, a needle bearing 35 is interposed between
the shaft and walls of the socket 34. It will be noted that
the length of the hub member 33 is such that an apprecia-
ble clearance exists between the ends thereof and the
plate 23, and the wall 26 of the rotor.
Eight hub members having reference char-
acters 36 to 43 have one end attached to the hub struc-
ture 30 and the opposite end attached to the rotor wall
25. The vane members are formed of bands or ribbons
of suitable fluid impervious, flexible and slightly deform-
able material such as a suitable fabric, leather, flexible
metals, or any of the rubber substitutes or so-called plas-
tics now well known in the art and which have the char-
acteristics desired. The vane members 36-43 are disposed
with the transverse sections thereof extending parallel to the axes
of the rotor 24 and the hub structure 30 so that the edges
thereof sweep the opposed surfaces of the plate 23 and rotor
wall 26. The width of the vanes 36-43 prior to as-
sembly in the pump is slightly greater than the distance
between the inside surface of the plate 23 and the inside
face of the end wall 26 so that when the rotor 24 is as-
sembled in the housing 12, the opposite side edges of the
vanes will be slightly deformed by compression and will
closely engage the surfaces of the plate and wall. Upon
initial operation of the pump, the edge portions of the
vanes quickly form a low friction, fluid tight running seal
with the surfaces engaged thereby. Preferably, the sur-
faces of the plate 23 and end wall 26 engaged by the edges
of the vanes are polished to enhance the sealing qualities
of the pump assembly.
The vane members 36-43 are substantially longer than
the maximum distance between the hub structure 30 and
the rotor wall 25 and curve or loop from the hub struc-
ture outwardly in the direction of rotation of the rotor.
It will be seen that adjacent vane members 36-43 form
opposing edges of a pump chamber, the other end of which are formed by the plate 23 and the end wall 26.
When the rotor 24 is driven by the shaft 15 torque is ap-
plied to the hub structure 30 through the vanes 36-43
and the pump assembly rotates, causing expansion in vol-
ume of the pump chambers as they swing through 180°
from bottom to the top of the pump, as viewed in FIGS. 1, 2, and contraction in volume as they swing from
top to bottom of the pump.
The port plate 18 and the plate 23 of the end assembly

13 have aligned arcuate openings or ports 44, 45 therein
which are positioned and arranged so that the port 44
is open to the sides of the pump chambers during a sub-
stantial portion of their expansion movement for the in-
take of fluid. The port 45 is open to the sides of the pump
chambers during their contracting movement so that fluid
is expelled from the chambers through the port. The ends
of the ports 44, 45 are angularly spaced apart so that as
the pump chambers swing from their expanding cycles
to their collapsing cycles and vice versa during each of
their revolutions they are opened to both sides of the pump.
The plate 18 is formed to provide a passage between the inlet
connection 21 and port 44 and between the port 45 and
the outlet connection 22.
An important feature of the invention is the manner
in which the vane members 36-43 are attached to the hub
structure 30 and the rotor wall 25. Referring to the hub
structure 30, the inner end portions of each of two adjacent
vane members are secured to one of the octagonal faces
of the member 33 in overlapping contiguous relation and
clamped thereto. The flexible, deformable character of the
material forming the vanes causes these overlapping and
compressed portions to form continuous fluid tight end
structures for the fluid chambers.
As a specific example of effecting the seals described,
referring to the vane 36, the inner end section of the vane
is clamped to two adjacent octagonal faces of the hub 33
and overlies the end portion of the vane 43. In turn, the
end portion of vane 36 is overlapped by the end portion
of the vane 37, as shown. As may be seen, each of the
vanes overlaps an adjacent vane in the manner described.
Vane 36 is engaged by a metal clamp member 50 which
has a flat surface 51 resting on the vane and a convexly
curved side surface 52 about which the vane may wrap
as the pump assembly rotates. The block 50 is attached
to the hub member 33 by a bolt 53 and schematic repre-

dent with the adjacent octagonal face of the hub member
by dowels 54. The overlapping vanes on each octagonal
face of the hub member 33 are clamped to the hub mem-
ber by clamp blocks like the block 50 and to avoid repet-
tion these blocks are not described in detail and are re-
ferred to by the same reference character.
The surfaces 52 of the blocks 50 provide support sur-
faces for the vanes and prevent sever and damaging flex-
ure of the vanes. To maintain a desirable configuration
of the pump chambers the sides 54 of the clamp members
50 are convexly curved to provide back-up supports for
the vane on the sides opposite the sides supported by the
surface 52.
It is to be noted that the length of the blocks 50 is
the same as that of the hub member 33 which provides flow
spaces 55 between the ends thereof and the adjacent plate
23 and end wall 26. These flow spaces permit fluid to pass
from between the respective vanes and the adjacent side
52 of the clamping block for the vanes to the space be-
 tween the next vane and the surface 54 of its clamping
block. Thus, as the vane moves to the end of the compres-
sion stroke and out of alignment with the outlet port
45, the fluid of the contracting pump chamber may flow to
the next pump chamber by compression to expand. In high
speed pumps, it may be desirable to provide additional flow
passages through the blocks 50 from the surface 52 to
the surface 54 and this is accomplished by providing holes
56 from one side of the blocks to the other, as shown.
The outer ends of the vanes 36-43 are attached to the
rotor wall 25 to form opposite end portions of pump
chambers so that the outer ends of the pump chambers
are effectively and efficiently closed by a construction simi-
lar to that of the inner ends.
Referring to FIG. 2, it will be seen that the outer end
portion of vane 36, for example, overlaps a substantial end
section of the vane 43 and when the outer end of the adja-
cent vanes so that the outer ends of the pump chambers
are effectively and efficiently closed by a construction simi-
lar to that of the inner ends.
comprising a rotor having a wall section surrounding said hub structure and between the planes of said wall surfaces the other end section of one of said vane members opposite said one end section thereof attached to said rotor wall section and the other end section of the other vane member opposite said one end section thereof overlapping the said other end section of the first mentioned vane member on said rotor wall section, the opposite edges of said overlapping vane sections forming fluid seals with said rigid wall surfaces, and means securing said overlapping sections together and to said rotor wall section.

3. A fluid pump and the like comprising a rotor having a wall and adapted to rotate in a given direction about and eccentric to the axis of a hub structure, a plurality of flexible band-like van members extending radially from said hub structure, said vane members attached at one end to said hub structure and attached at the other end to said rotor wall with the transverse sections of said vane members extending parallel to said axis, said vane members curving from said hub structure outwardly to said rotor, wall means forming two spaced apart rigid wall surfaces extending generally normal to the opposite edges of said vane members and engaged by said vane member edges to form a fluid seal for the area between said vane members and said rigid wall surfaces said providing a pump inlet and a pump outlet, characterized by the outer end sections of said vane members engaging said rotor wall end sections of one vane member overlapping the outer end segment of one adjacent vane member to form fluid seals between the adjacent ends of said vane members and with said rigid wall surfaces.

4. A fluid pump and the like as defined in claim 3 further characterized by the end portions of adjacent vane members being disposed in overlapping positions at said hub structure, and clamp means forcing said overlapping portions to said hub structure and rotor wall respectively.

5. A fluid pump and the like as defined in claim 4 further characterized by means at said hub structure forming curved surfaces to support said vane members adjacent said hub during flexure of said vane members towards a volume reducing movement of said hub, and fluid passage means leading from said curved surfaces to facilitate escape of fluid from between said curved surfaces and the vane members moving thereagainst.

6. A fluid pump and the like as defined in claim 4 further characterized by said clamp means including a curved support surface adapted to be engaged by and to support one of said vane members as said vane member is flexed in a direction to constrict the volume of said pump chamber, said clamp means having a fluid passage from said curved surface to another surface thereof for permitting flow of fluid from between the last mentioned vane member and said curved supporting surface.

References Cited

UNITED STATES PATENTS
1,086,488 2/1914 Wachter ________ 103—117
2,336,580 12/1943 Yeatman ________ 103—121
2,444,234 6/1948 Stageberg ________ 103—121
2,882,830 4/1959 McDuifie ________ 103—121
3,381,583 5/1968 Vansteen ________ 91—56

FOREIGN PATENTS
630,507 10/1927 France.
355,042 8/1931 Great Britain.

HENRY F. RADUAZO, Primary Examiner

U.S. Cl. X.R.

91—56; 103—130; 418—65, 156