United States Patent Office

2,789,511

FLEXIBLE VANE PUMP IMPELLER

Warren Doble, North Hollywood, Calif., assignor, by
mutual assignments, to Jabaco Pump Company, Bur- 
bank, Calif., a corporation of California

Application May 25, 1953, Serial No. 356,968
2 Claims. (Cl. 103—117)

The present invention relates to a pump having an im- 
peller of the flexible vane type, such as that disclosed
and claimed in United States Patent Number 2,189,356,
granted February 6, 1940, to Arthur M. Briggs. im- 
pellers of this type ordinarily being formed in whole or
in part of rubber, or similar elasticomeric materials.

An impeller of the foregoing general character may be
provided with flexible vanes the outer ends of which
are bulbous as viewed in a plane normal to the axis
of rotation of the impeller, and a primary object of the
invention in this connection is to offset the bulbous outer
ends of the vanes in a direction opposite to the direction
of rotation of the impeller. This construction has the
effect of reducing the flexure of the vanes for a given
thickness of the cam employed to flex the vanes, this re-
duction in vane flexure resulting in a material increase in
the service life of the impeller, which is an important
feature of the invention.

Another important object is to provide an impeller
of the foregoing character having flexible vanes provided
with feathered edges engageable with the end walls of
the impeller chamber of the pump, the feathered edges
of the vanes lying on the neutral axes thereof. With
conventional flexible vanes having unfeathered edges,
the vanes of the cam produces what might be
termed "knuckles" where the vane edges engage the end
walls of the impeller chamber, such knuckles resulting
from the fact that the fibers of rubber on the outer sides
of the curves in the vanes are in tension while the fibers
on the inner sides of the curves in the vanes are in com-
pression, which has the effect of causing the rubber to
expand axially with a resultant increase in friction be-
tween these knuckles and the end walls of the impeller
chamber. Such knuckles have been found to be a source
of internal leakage in pumps of this type. By feathering
the vane edges, the present invention eliminates such
knuckles since the neutral axes of the vanes are neither
in tension nor compression when the vanes are flexed by
the cam, the feathered edges, as hereinbefore indicated,
lying on the neutral axes of the vanes. Such elimination
of internal leakage by feathering the vane edges con-
stitutes an important feature of the present invention.

Another important object of the invention is to pro-
vide the end faces of the hub of the impeller with a
plurality of axially projecting ribs, each end face of the
hub preferably having a plurality of annular and radial
ribs forming a pattern somewhat similar in appearance
to that of an ordinary waffle iron. This "waffle iron"
configuration on each end of the impeller hub provides
baffles to prevent internal leakage past the hub and also
materially reduces friction between the end faces of the
hub and the end walls of the impeller chamber, which
are important features.

The foregoing objects, advantages and features of the
present invention, together with various other objects, ad-
vantages and features thereof which will become ap-
parent, may be attained with the exemplary embodiment
of the invention which is illustrated in the accompanying
drawing and which is described in detail hereinafter.

Referring to the drawing:

Figure 1 is a cross-sectional view of a pump incor-
porating the impeller of the present invention;

Figure 2 is a fragmentary sectional view taken along
the arrowed line 2—2 of Figure 1; and

Figure 3 is an enlarged, fragmentary sectional view
taken along the arrowed line 3—3 of Figure 2.

In the drawing, the numeral 10 designates a pump
housing which is provided with an impeller chamber 11
and which is provided with inlet and outlet ports 12 and
13 communicating with the impeller chamber, a cam 14
being provided between the inlet and outlet ports, as is
conventional. Conceivably mounted in the impeller
chamber 11 on a shaft 15 is an impeller 16 of the inven-
tion which is rotatable in the direction of the arrow 17,
the impeller preferably being formed in whole or part
of rubber, or a similar material, and including a central
hub 18 having flexible vanes 19 forming the feature.

These vanes are flexed by the cam 14 as the impeller 16
rotates so as to pump fluid from the inlet port 12 to the
outlet port 13, as is well known in the art.

Considering the impeller 16 of the invention in more
detail, the vanes 19 are provided with outer ends 23
which are bulbous, as viewed in a plane normal to the
axis of rotation of the impeller, the bulbous outer ends,
or bulbs, being offset laterally relative to the vanes 19
in a direction opposite to the direction of rotation 17
of the impeller, i.e., the centers of the bulbs being offset
laterally relative to the radial center lines or neutral
axes of the vanes in a direction opposite to the direc-
tion of impeller rotation. With bulbs 23 offset in this
direction, the sides of the bulbs which engage the cam
14 do not project beyond, or project only very slightly
beyond, the forward faces of the vanes 19. The effect
of this construction is to materially reduce the amount
of flexure of the vanes, as compared to vanes having
centred bulbs at their outer ends, as taught by the afore-
mentioned Briggs patent, for example. In other words,
it will be apparent that the flexure of the vanes is re-
duced by an amount equal to the reduction in the amount
which the bulbous outer ends project forward of the
forward faces of the vanes 19. This reduction in vane
flexure is quite important since, as hereinbefore pointed
out, it adds materially to the service life of the impeller.
As best shown in Figure 3 of the drawing, the edges
24 of the vanes 19, which are engageable with the end
walls of the impeller chamber 11, are feathered, or sub-
stantially feathered, the thickness of the edges 24 being
very small as compared to the vane thickness. As here-
inbefore discussed in detail, this has the effect of reduc-
ing friction and of eliminating or minimizing internal leakage
between the edges of the vanes and the end walls of the
impeller chamber, which are important features.

As best shown in Figure 1 of the drawing, each end
of the hub 18 of the impeller 16 is provided with a plu-arity of ribs 25 and 26 which project axially of the
impeller and which are engageable with the adjacent end
wall of the impeller chamber 11, the ribs 25 being an-
ular and the ribs 26 being radial in the particular con-
struction illustrated. Also in the particular construction
illustrated, the radial ribs 26 are shown as being, in effect,
extensions of the feathered edges 24 of the vanes 19.
The pattern of ribs 25 and 26 provides each end face of
the hub 18 with a configuration similar to that of a
waffle iron in the particular construction shown. How-
ever, different patterns of axially projecting ribs on the
end faces of the impeller hub 18 might be employed, such
as rib patterns resulting from dimples in the end faces
similar to the dimples in the surface of a conventional
goft ball. In either event, the axially projecting ribs on
the end faces of the impeller hub 18 act as baffles to pre-
vent internal leakage past the hub and also reduce friction between the hub ends and the end walls of the impeller chamber, which are important features.

Although I have disclosed an exemplary embodiment of my invention herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiment without necessarily departing from the spirit of the invention as defined by the claims appended hereto.

I claim as my invention:

1. A pump impeller having flexible elastomeric vanes which have neutral axes and the outer ends of which are bulbous when viewed in a plane normal to the axis of rotation of said impeller, the centers of said bulbous outer ends being offset relative to the neutral axes of said vanes in a direction opposite to the direction of rotation of said impeller both when said vanes are flexed and when they are unflexed.

2. In a pump, the combination of: a housing providing an impeller chamber and providing inlet and outlet ports which communicate with said chamber; a cam in said chamber between said ports; and an impeller concentrically located in said chamber and rotatable in a predetermined direction therein, said impeller having flexible elastomeric vanes which have neutral axes and the outer ends of which are engageable with the peripheral wall of said impeller chamber and with said cam and are bulbous when viewed in a plane normal to the axis of rotation of said impeller, said vanes being flexed at least when said bulbous outer ends are in engagement with said cam, the centers of said bulbous outer ends being offset relative to the neutral axes of said vanes in a direction opposite to said direction of rotation of said impeller both when said vanes are flexed and when they are unflexed.

References Cited in the file of this patent

UNITED STATES PATENTS

2,189,356 Briggs .......................... Feb. 6, 1940
2,258,371 Wernert .......................... Oct. 7, 1941
2,455,194 Rumsey .......................... Nov. 30, 1948
2,460,952 Simer et al. ....................... Apr. 22, 1949
2,466,440 Kiekhaefer ........................ Apr. 5, 1949
2,492,935 McCulloch et al. ................. Dec. 27, 1949
2,499,163 Rand .............................. Feb. 28, 1950
2,542,268 Weyer ............................. Feb. 20, 1951
2,599,600 Arnold ............................ June 10, 1952
2,644,402 Lehman ........................... July 7, 1953
2,648,287 Thoren et al. ..................... Aug. 11, 1953
2,663,263 Mayus et al. ..................... Dec. 22, 1953
2,664,050 Abresch .......................... Dec. 29, 1953

FOREIGN PATENTS

244,826 Italy .............................. Feb. 27, 1926