Flexible-Vaned Pump with Liner Cam

Inventor: Robert Edward Parrett

By his attorneys: Harris, Kiech, Russell & Kern

Filed: Nov. 5, 1963

Patent No.: 3,218,983

Fig. 1, Fig. 2, Fig. 3, Fig. 4.
The present invention relates in general to a pump of the type which includes a flexible-vaned impeller rotatable about the axis of a cylindrical impeller bore and which includes an annular cam lining the peripheral wall of the bore and so formed as to respectively decrease and increase the volumes of the intervane spaces as the flexible vanes sweep past outlet and inlet ports communicating with the bore on one side thereof, a primary object of the invention being to provide a pump of this type which is an improvement on that of Patent 2,933,046, granted April 19, 1960, to Alan A. McCray, and assigned to the same assignee as this application.

The McCray patent discloses a cam for a flexible-vaned pump of the concentric type which merely comprises a flexible, sheet metal annulus lining the peripheral wall of the cylindrical impeller bore and formed to provide an internal radius which varies circumferentially in the vicinity of the outlet and inlet ports in a manner to respectively decrease and increase the volumes of the intervane spaces as the flexible vanes sweep past the outlet and inlet ports, thereby providing the pumping action characteristic of pumps of this type. The external peripheral wall of the annular cam is spaced inwardly from the peripheral wall of the impeller bore between the inlet and outlet ports by means of an elastomeric spacer which is secured to the pump housing, which holds the annular cam in place in the bore, and which separates the outlet and inlet ports in a fluid-tight manner.

The primary object of the invention is to provide a pump of the foregoing type having improved means for very simply and effectively restraining the annular cam against circumferential movement relative to the peripheral wall of the impeller bore and for restraining the spacer (which is not necessarily elastomeric) against circumferential movement relative to the annular cam.

More particularly, an important object of the invention is to provide the housing of the pump with a longitudinal slot in the peripheral wall of the impeller bore on the side thereof opposite the inlet and outlet ports, and to provide an annular cam which is longitudinally split adjacent such longitudinal slot and which has radially outwardly extending ends disposed in the longitudinal slot to key the annular cam against circumferential movement relative to the peripheral wall of the bore in a positive manner.

Another important object is to provide the annular cam with integral, circumferentially spaced, radially outwardly extending tabs engaging and receiving the spacer therebetween and acting to key the spacer against circumferential movement relative to the annular cam in a positive manner.

Thus, the present invention provides very simple and effective means, integral with the annular cam, for positively preventing circumferential movement of the annular cam and the spacer relative to the peripheral wall of the impeller bore.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the pump art in the light of this disclosure, may be achieved with the exemplary embodiment of the invention described in detail hereinafter and illustrated in the accompanying drawing, in which:

FIG. 1 is a view, partially in side elevation and partially in longitudinal section, illustrating a pump which embodies the invention;

FIG. 2 is a transverse sectional view taken along the arrowed line 2—2 of FIG. 1;

FIG. 3 is a perspective view of an annular cam of the invention;

FIG. 4 is a perspective view of a spacer for use with the annular cam of the invention.

In the drawing, the numeral 10 designates a pump housing which is shown as bolted to a supporting housing 12 having a mounting pedestal 14. The pump housing 10 is shown as including a wear plate 16, a tubular pump body 18, and an end cover 20, these elements being shown as secured together and to the supporting housing 12 by suitable bolts to permit easy disassembly.

The pump body 18 is provided therein with a cylindrical impeller bore 22 and circumferentially spaced ports 24 and 26 in communication with the impeller bore. In the particular embodiment shown, the ports 24 and 26 extend through the peripheral wall 28 of the impeller bore 22. For the particular direction of impeller rotation hereinafter considered, the port 24 acts as an inlet port and the port 26 acts as an outlet port, and the ports 24 and 26 will henceforth be termed inlet and outlet ports for convenience.

Within the impeller bore 22 is a flexible, preformed, annular cam 30, preferably of sheet metal, which serves as a liner for the impeller bore. The annular cam 30 is provided with inlet and outlet ports 34 and 36 therethrough respectively registering with the inlet and outlet ports 24 and 26 in the pump body 18. In the particular construction illustrated, each of the inlet and outlet ports 34 and 36 comprises a plurality of longitudinally spaced, circumferentially extending slots.

The annular cam 30 is seated against the peripheral wall 28 of the impeller bore 22 on the side of the impeller bore opposite the inlet and outlet ports 24 and 26. In this region, the annular cam 30 has a maximum internal radius equal to or slightly less than the radius of a flexible-vaned pump impeller 40 which is rotatable within the annular cam about the axis of the impeller bore 22, as will be described in more detail hereinafter. The portion of the annular cam 30 of maximum internal radius extends substantially throughout the major circumferential distance between the inlet and outlet ports 24 and 26, as will be clear from FIG. 2 of the drawing. In the region of the inlet and outlet ports 24 and 26, and in the region of the minor circumferential distance between these ports, the annular cam 30 is spaced radially inwardly from the peripheral wall 28 of the impeller bore 22. In the region of the minor circumferential distance between the inlet and outlet ports 24 and 26, the annular cam 30 provides a circumferentially extending segment 42 having a minimum internal radius relative to the axis of the impeller bore 22, this minimum internal radius preferably being substantially constant throughout the minor circumferential distance between the inlet and outlet ports 24 and 26.

Adjacent the inlet and outlet ports 24 and 26, the annular cam 30 is provided with circumferentially extending transitional segments or ramps 44 and 46 of internal radii increasing circumferentially from the minimum of the segment 42 to the maximum of the portion of the annular cam which is in engagement with the peripheral wall 28 of the impeller bore 22 or the annular cam ports 24 and 26. The configurations of the internal peripheral walls of the transitional segments or ramps 44 and 46 are such as to provide the entire internal peripheral wall of the annular cam 30 with a substantially smooth contour.

Disposed in the space between the peripheral wall 28 of the impeller bore 22 and the external peripheral wall...
3,218,983

of the segment 42 of the annular cam 30 is a spacer 50, which is preferably formed of metal and which has a radial dimension sufficient to hold the annular cam 30 firmly in place against the peripheral wall 28 of the impeller 22 on the side thereof opposite the inlet and outlet ports 24 and 26. The spacer 50 is disposed in the minor circumferential space between the inlet and outlet ports 24 and 26 and engages the peripheral wall 28 of the impeller bore 22, the external peripheral wall of the segmental 42 of the annular cam 30, the wear plate 16 and the end cover 20 in a fluid tight manner to prevent fluid leakage between the inlet and outlet ports 24 and 26. Thus, the spacer 50 performs the dual function of preventing transverse movement of the annular cam 30 relative to the pump body 18 and of providing a fluid tight seal between the inlet and outlet ports 24 and 26.

An important feature of the present invention resides in the manner in which the annular cam 30 is prevented from moving circumferentially relative to the pump body 18. In this connection, the annular cam 30 is longitudinally split laterally opposite, and preferably midway between, the inlet and outlet ports 24 and 26 and is provided with abutting, radially outwardly extending ends 52 disposed in a longitudinal slot 54 in the pump body 18. The radially outwardly extending ends 52 of the annular cam 30 act to key the annular cam 30 to prevent circumferential movement in a simple and positive manner.

Another important feature is the manner in which the spacer 50 is held in place against circumferential movement relative to the annular cam 30 and relative to the pump body 18. In this connection, the annular cam 30 is provided with integral, circumferentially spaced, radially outwardly extending tabs 60 which receive the spacer 50 therebetween and which engage the circumferentially spaced ends or edges thereof. There are preferably two or more of the tabs 60 in engagement with each of the circumferentially spaced edges of the spacer 50, whereby the spacer 50 is held in a circumferential movement in a very simple and positive manner.

Preferably, in forming the circumferentially extending slots which constitute the inlet and outlet ports 34 and 36 in the annular cam 30, parts of the pieces of sheet metal which must be removed remain integrally attached and are merely struck radially outwardly to form the tabs 60, which is important since it provides a simple way of forming the tabs.

As previously mentioned, the pump impeller 40 is rotatable within the annular cam 30 about the axis of the impeller bore 22, which is typical of pumps of the concentric type. The pump impeller 40 may have molded therein into an insert 70 which is internally splined to engage a complementary, externally splined portion of a pump shaft 72 mounted for rotation about the axis of the impeller bore 22 in bearings 74 and 76 carried by the supporting housing 12. A suitable shaft seal 78 prevents leakage of the pumped fluid along the pump shaft 72.

As will be apparent, if the pump impeller 46 is rotated in the clockwise direction, as viewed in FIG. 2 of the drawing, the flexible vanes thereof are swept from the outer end away from the impeller bore. The pump impeller 40 may be rotated in the counterclockwise direction, if desired, to provide a reverse fluid flow.

4. In a pump, the combination of:
   (a) a flexible, preformed, annular cam lining the peripheral wall of said bore and engaging the peripheral wall of said bore on the side thereof opposite said inlet and outlet ports;
   (b) an impeller mounted for rotation within said annular cam about the axis of said bore and having flexible vanes engaging the internal peripheral wall of said annular cam.

2. In a pump, the combination of:
   (a) a housing provided with an impeller bore and provided with circumferentially spaced inlet and outlet ports in communication with said bore on one side thereof;
   (b) a flexible, preformed, annular cam lining the peripheral wall of said bore and engaging the peripheral wall of said bore on the side thereof opposite said inlet and outlet ports;
   (c) said annular cam having a circumferentially varying internal radius relative to the axis of said bore;
   (d) said internal radius of said annular cam being a minimum between said bore and inlet and outlet ports and progressively increasing adjacent said inlet and outlet ports;
   (e) there being a space between the external peripheral wall of said annular cam and the peripheral wall of said bore between and overlapping said inlet and outlet ports;
   (f) the radial dimension of said space being a maximum between said inlet and outlet ports to provide said annular cam with said minimum internal radius therebetween;
   (g) the radial dimension of said space progressively decreasing adjacent said inlet and outlet ports to provide said annular cam with said progressively increasing internal radius thereadjacent;
   (h) means for preventing circumferential movement of said annular cam relative to said peripheral wall of said bore;
   (i) a spacer in said space and extending radially from the external peripheral wall of said annular cam to the peripheral wall of said bore;
3,218,983

(j) said spacer providing a fluid-tight seal between said annular cam and the peripheral wall of said impeller bore between said inlet and outlet ports;
(k) said annular cam having integral, circumferentially spaced, radially outwardly extending tabs engaging and receiving said spacer therebetween and preventing circumferential movement thereof relative to said annular cam; and
(l) an impeller mounted for rotation with said annular cam about the axis of said bore and having flexible vanes engaging the internal peripheral wall of said annular cam.

In a pump, the combination of:

(a) a housing provided with an impeller bore circumferentially spaced inlet and outlet ports in communication with said bore on one side thereof, and a longitudinal slot in the peripheral wall of said bore on the side thereof opposite said inlet and outlet ports;
(b) a flexible, preformed, annular cam lining the peripheral wall of said bore and engaging the peripheral wall of said bore on the side thereof opposite said inlet and outlet ports;
(c) said annular cam having a circumferentially varying internal radius relative to the axis of said bore;
(d) said internal radius of said annular cam being a minimum between said inlet and outlet ports and progressively increasing adjacent said inlet and outlet ports;
(e) there being a space between the external peripheral wall of said annular cam and the peripheral wall of said bore between and overlapping said inlet and outlet ports;
(f) the radial dimension of said space being a maximum between said inlet and outlet ports to provide said annular cam with said minimum internal radius therebetween;
(g) the radial dimension of said space progressively decreasing adjacent said inlet and outlet ports to provide said annular cam with said progressively increasing internal radius thereadjacent;
(h) said annular cam being longitudinally split adjacent said longitudinal slot and having radially outwardly extending ends in said longitudinal slot to prevent circumferential movement of said annular cam relative to the peripheral wall of said bore;
(i) a spacer in said space and extending radially from the external peripheral wall of said annular cam to the peripheral wall of said impeller bore;
(j) said spacer providing a fluid-tight seal between said annular cam and the peripheral wall of said impeller bore between said inlet and outlet ports;
(k) means including interengageable elements on said spacer and said annular cam for preventing circumferential movement of said spacer relative to said annular cam; and
(l) an impeller mounted for rotation within said annular cam about the axis of said bore and having flexible vanes engaging the internal peripheral wall of said annular cam.

References Cited by the Examiner

UNITED STATES PATENTS

2,816,513 12/1957 Watson -------------- 103—216
2,933,046 4/1960 McCray ------------- 103—117

KARL J. ALBRECHT, Primary Examiner.
JOSEPH H. BRANSON, JR., Examiner.