

Aug. 15, 1933.

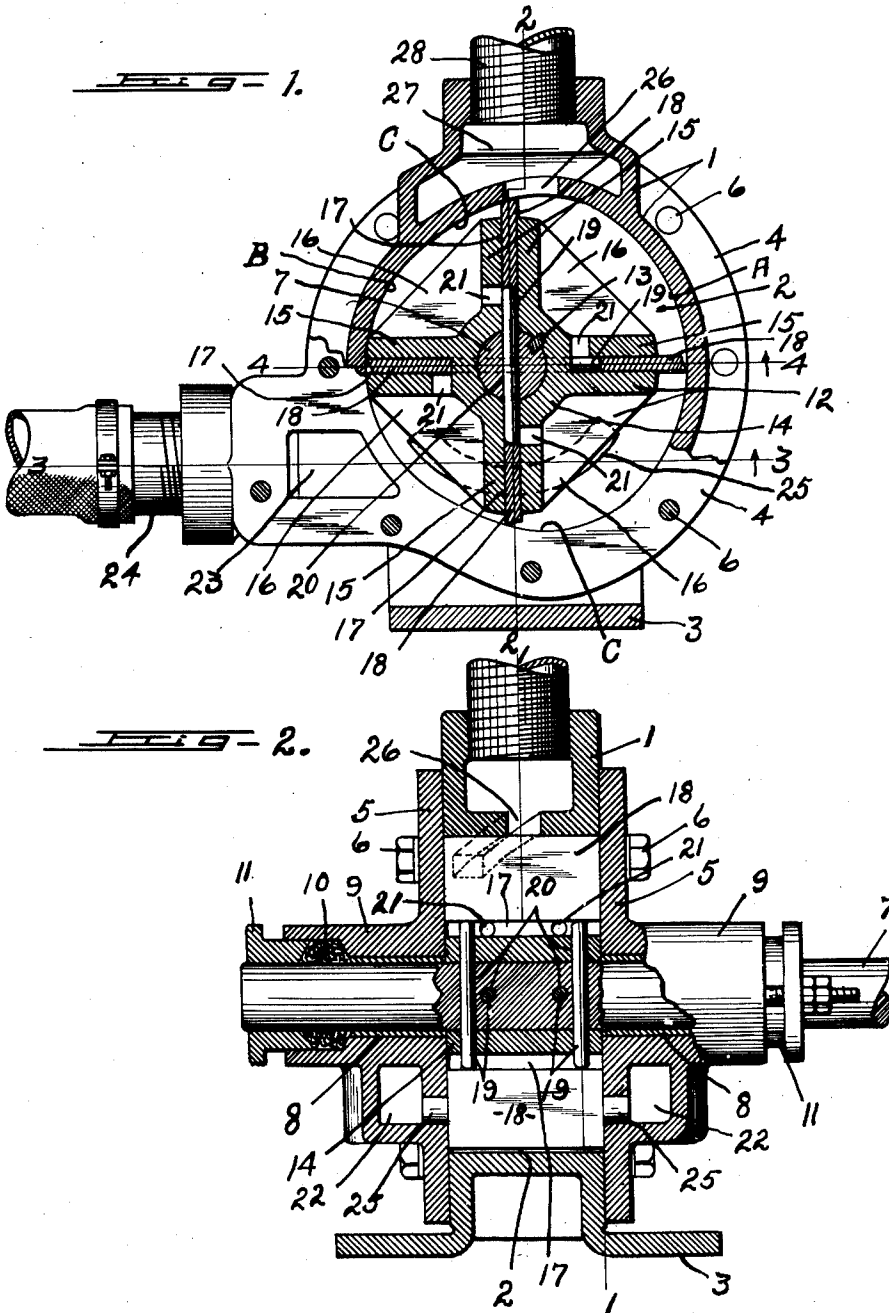
W. G. HAWLEY

1,922,951

ROTARY PUMP

Filed Feb. 3, 1930

3 Sheets-Sheet 1



WITNESS
H. L. Meade.

INVENTOR
By W. G. Hawley
Denison & Thompson
ATTORNEYS

Aug. 15, 1933.

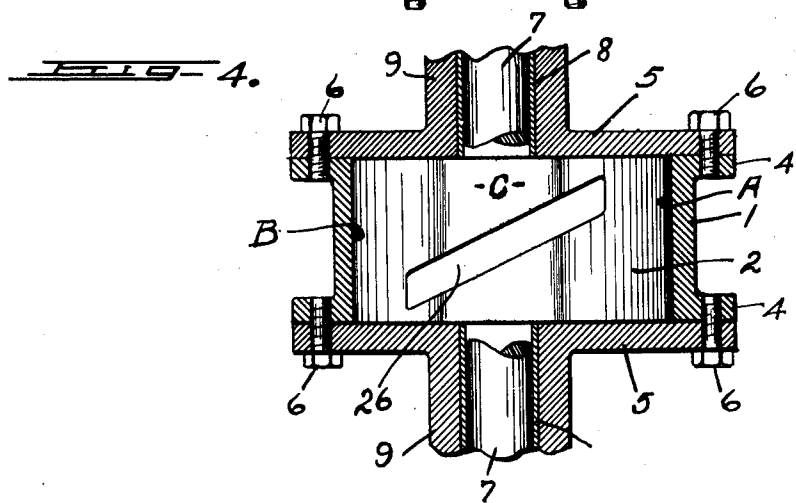
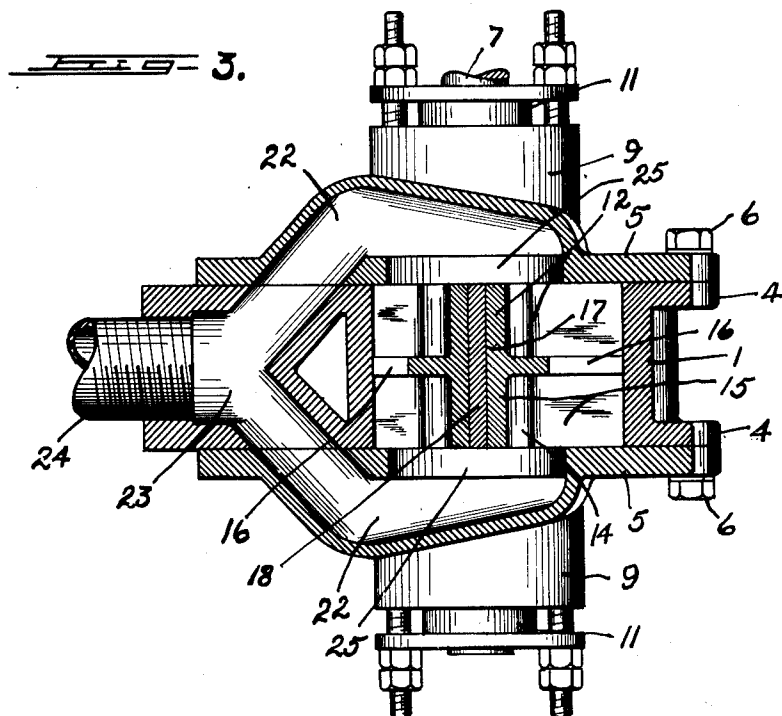
W. G. HAWLEY

1,922,951

ROTARY PUMP

Filed Feb. 3, 1930

3 Sheets-Sheet 2



WITNESS

H. L. Meade.

INVENTOR

By *W. G. Hawley*

Denison Thompson
ATTORNEYS

Aug. 15, 1933.

W. G. HAWLEY

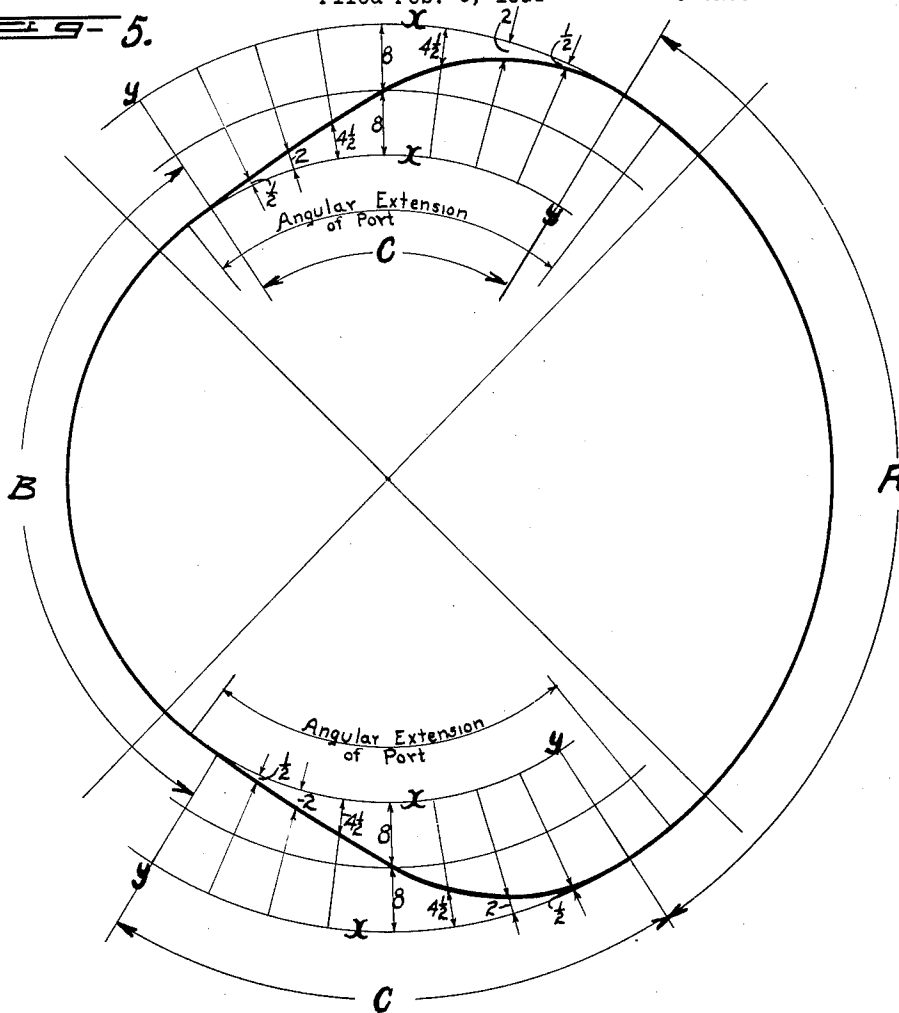
1,922,951

ROTARY PUMP

Filed Feb. 3, 1930

3 Sheets-Sheet 3

Fig. 5.



WITNESS

X. L. Meade.

INVENTOR
By *W. G. Hawley,*

Denison & Thompson
ATTORNEYS.

UNITED STATES PATENT OFFICE

1,922,951

ROTARY PUMP

William G. Hawley, Elmira, N. Y.

Application February 3, 1930. Serial No. 425,501

1 Claim. (Cl. 103—138)

This invention relates to certain new and useful improvements in rotary pumps of the sliding impeller vane type.

The main objects of this invention are to provide a highly efficient rotary pump which is equally applicable for all forms of fluid, whether liquid or gaseous substances, which is susceptible of long life, and that may be constructed economically.

In carrying out the foregoing objects, I have provided a rotary pump having a rotor and a plurality of diametrically opposed impeller vanes operably mounted in said rotor, all of which are rotatably mounted in a suitable pump chamber concentrically with the major portion of the peripheral wall thereof, the contour of said peripheral wall being formed with two diametrically opposed circular arcs concentric with the rotor and having unequal radii, the included angles of said arcs being equal and greater than 90 degrees with their adjacent ends joined by means of a curved surface which is developed with uniform acceleration curves so that each vane in passing from one concentric arc to the other will be moved radially with a uniformly accelerated and retarded motion, thus guiding the vanes during the radial movements thereof, smoothly and without shock or noise and producing a substantially uniform discharge from the pump.

The inlet and the outlet ports for the pump are each positioned adjacent a respective curved portion of the peripheral wall of the pump chamber with the angular extension of said ports greater than the included angles of said curved portion so that each impeller vane is in registration with one of said ports during the radial movements of the vane, thus relieving any pumping pressure on the vane by equalizing the pressure on opposite sides thereof which reduces friction and wear and permits a high degree of efficiency in operation.

Another feature of this invention is to utilize the centrifugal force produced by the rotor and impeller vanes to assist in filling the pump by positioning the inlet port intermediate the peripheral wall of the pump chamber and the axis of the rotor.

Other objects and advantages pertaining to the details of the structure and the form and relation of the parts thereof will more fully appear from the following description taken in connection with the accompanying drawings wherein:—

Figure 1 is a face view of one side of the pump partly in section with a side plate removed, taken in the plane of the line 1—1, Figure 2.

Figure 2 is a vertical sectional view taken in the plane of the line 2—2, Figure 1.

Figure 3 is a horizontal sectional view through the inlet ports of the pump taken in the plane of the line 3—3, Figure 1.

Figure 4 is a detail horizontal sectional view taken in the plane of the line 4—4, Figure 1, with the rotor and a portion of the drive shaft removed.

Figure 5 is a diagrammatic view illustrating the contour of the peripheral wall of the pump chamber and generation of the curve on which said wall is made and the relative relation of the inlet and outlet ports.

As illustrated in the drawings, the pump consists of a suitable case —1— provided with an internal pump chamber —2—. The case is mounted on an integrally formed base —3—. At each end of the case is formed an annular flange —4— to which the end plates or cylinder heads —5— are secured by bolts or screws —6—.

A horizontally disposed drive shaft —7— is mounted concentric with the major portion of the pump chamber and is journaled in suitable bushings —8—, provided in outwardly projecting bearing members —9— made integral with the respective head or end plates —5—. The outer ends of each of the bearing members —9— may be provided with suitable packing —10— and follower —11— for preventing the escapement of fluid along the shaft —7—. One end of the drive shaft —7— may, as shown, extend outwardly beyond the respective bearing member —9— for receiving a pulley, not shown, or other suitable means for rotating said shaft.

A rotor —12— is mounted on the drive shaft —7— and positioned within the pump chamber —2—. The rotor, in this instance, is secured by a key —13— to the shaft —7— to rotate therewith although it is evident that the rotor may be made integral with said shaft. The rotor —12— is substantially the same length as the pump chamber —2— and consists, in this instance, of a tubular body portion —14— having a pair of diametrically opposed radial flanges —15— arranged at right angles to each other and extending lengthwise of the body portion —14— of the rotor —12— and may be tied together by a supporting transverse web —16— extending from one flange to the other substantially midway between the ends thereof.

Each flange —15— is provided with a radial slot —17— which extends lengthwise of the flange and from the outer end thereof inwardly to within a short distance of the drive shaft

—7—, each of said slots being adapted to receive an impeller vane —18—. These vanes are slidably mounted in a respective slot —17— for radial movement of the vanes caused by the outer longitudinal edge of said vanes riding over the irregular contour of the peripheral wall of the pump chamber —2— during the rotation of the rotor —12—. These vanes are of substantially the same length as the cylinder chamber —2— so that the outer ends thereof contact with the inner surface of the respective end plates —5— while the outer longitudinal edges of the vanes are held in constant contact with the peripheral surface of the pump chamber —2— by centrifugal force during the rotation of the rotor.

However, push rods, as —19— may be employed for each pair of vanes for maintaining the vanes in substantially constant contact with the peripheral wall of the pump chamber. These rods —19—, as illustrated in Figures 1 and 2, may be arranged in pairs, one pair for each pair of vanes, each pair of rods being slidably mounted in spaced holes —20— which extend diametrically through the axis of the drive shaft —7— and rotor —12— in the plane of the respective pairs of impeller vanes with the outer ends of the rods engaging the inner longitudinal edge of diametrically opposed vanes for holding said vanes in a predetermined spaced relation.

One or more holes or openings —21— may be provided in the front wall of each of the radial flanges —15— in communication with the base of the respective slots —17— for venting said slots at the bottom of each vane for permitting the fluid which is being pumped to pass freely in and out of said slots as the impeller vanes are moved radially, thus permitting the fluid pumped to be drawn into the slots as the vanes move outwardly and to force the fluid from the slots into the pump chamber at the discharge side of the rotor as the vanes are moved inwardly thus preventing an interruption of the discharge due to the vane displacement.

The contour of the peripheral wall of the pump chamber —12—, in this instance, is formed with a regular surface as more clearly illustrated in the diagrammatic view, Figure 5, said wall being formed with two diametrically opposed concentric circular arcs —A— and —B— of unequal radii and which are formed co-axially with the drive shaft —7— and rotor —12—.

The radius of the smaller arc —B— is substantially equal to the radius of the rotor —12— for permitting the free rotation of the rotor in said chamber as clearly illustrated in Figure 1. The included angles of the arcs —A— and —B— are equal and each greater than 90 degrees with the adjacent ends of said arcs joined by a curved surface —C—. These surfaces —C— are developed with uniform acceleration curves; that is, with curves developed with circular and radial co-ordinates concentric with the arcs —A— and —B—.

Referring now to Figure 5, —x— equals circular co-ordinates and —y— equals the radial co-ordinates and if —a— equals the radial accelerations per unit of circular motion, then the equation of the curve is —y— equals

$$\frac{ax^2}{2}$$

By making —a— equal —1—, the equation becomes —y— equals

$$\frac{x^2}{2}$$

and when x equals 1, y equals $\frac{1}{2}$; when x equals 2, y equals 2; when x equals 3, y equals $4\frac{1}{2}$ and when x equals 4, y equals 8.

With the contour of the peripheral wall —C— of the pump chamber connecting the two concentric arcs —A— and —B— constructed in this manner with uniformly accelerated curves or some other forms of curves closely approximating this curve such as obtained from a development of a sine curve, the vanes —18— will be guided smoothly and without shock from one concentric arc to the other with a uniformly accelerated and retardation radial motion starting from rest on one arc and coming to rest on the other arc.

A pair of inlet passages —22— are provided for the pump chamber —2— and located one in each head or end plate —5— in a substantial horizontal plane below the axis of the drive shaft —7—. One end of each of the passages —22— is in communication with a common inlet chamber —23— provided in one side of the pump case —1— and which, in turn, is adapted to be connected by a pipe as —24— or other suitable means, to a source of fluid supply not shown.

The opposite ends of the passages —22— are each connected by an inlet or suction port —25— to the pump chamber —2—. The inlet ports —25— are positioned intermediate the body —14— of the rotor —12— and the path of movement of the outer ends of the flanges —15— and made concentric with the shaft —7— and the two concentric arcs —A— and —B—.

The ports are each in registration with the curved surface —C— located at the bottom of the pump chamber —2—, the circumferential length of each of said ports being sufficient to cause the ports to overlap the included angles of said curved surface; thus the outer ends of the ports are located beyond the radial plane of the ends of said curved surface so that both the front and rear surfaces of each impeller vane will be in registration with the inlet port before the vane reaches the respective curved surface —C— and before it leaves the smaller arc surface —B— and also for a short distance after the respective vane leaves said curved surface as it begins its travel along the larger arc —A—, thereby relieving any pumping pressure on the vane by equalizing the pressure on both front and rear surfaces of said vane which permits the free outward radial movement of the vane while passing over the curved surface —C— without excessive or undue friction.

The outlet or exhaust port —26— for the pump chamber —2— is located in the pump case —1— at the upper portion of the pump chamber —2— in registration with the upper positioned curved surface —C— of the peripheral wall of said pump chamber. The outlet port —26— is constructed similarly to the inlet port —25— in that the circumferential length of the curved surface —C— with the outer ends of said port positioned at equal distances either side of the curved surface so that as each vane, in turn, approaches the curved surface —C—, the forward and rear surfaces of said vane will be in registration with the port before the vane reaches the curved surface —C— and also for a short distance after it has passed said surface which equalizes the pressure on both side surfaces of the vane and permits the free inward radial movement thereof as it passes along the curved surface —C— in passing from the larger concentric arc —A— to the smaller arc —B—.

The exhaust port —26—, in this instance, is in communication with a suitable exhaust chamber —27— provided in the upper portion of the pump case —1—, said exhaust chamber being provided with a threaded opening in one side thereof for receiving an exhaust pipe as —28—.

Although I have shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the exact construction shown, as various changes both in the form and the relation of the parts thereof may readily be made without departing from the spirit of this invention, as set forth in the appended claim.

I claim:

In a rotary pump of the sliding vane type, a pump casing providing a chamber having a regular peripheral surface, a cross section of said surface taken in a plane normal to the axis thereof of being composed of two diametrically opposed

concentric arcs of unequal radii and uniform acceleration curves joining adjacent ends of said arcs so as to impart a uniformly accelerated and retardation motion in a radial direction when followed circumferentially, a rotor having radial flanges journaled in the case concentric with said arcs each of said flanges being provided with a radial slot, an impeller vane slidably mounted in each of said slots, a discharge port in the pump casing in registration with and overlapping one of said curved surfaces, and an inlet port in said casing communicating with the pump chamber intermediate the axis of the rotor and the path of movement of the outer ends of said flanges and overlapping the included angle of the other curved surface for balancing the pressure on opposite sides of said vanes during the entire radial movements thereof.

WILLIAM G. HAWLEY. -

25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150