Feb. 25, 1964 E. G. LEVERETT 3,122,102

MULTIPLE ROTARY PUMPS OF THE FLEXIBLE-VANE TYPE

Filed April 5, 1962 3 Sheets-Sheet 1

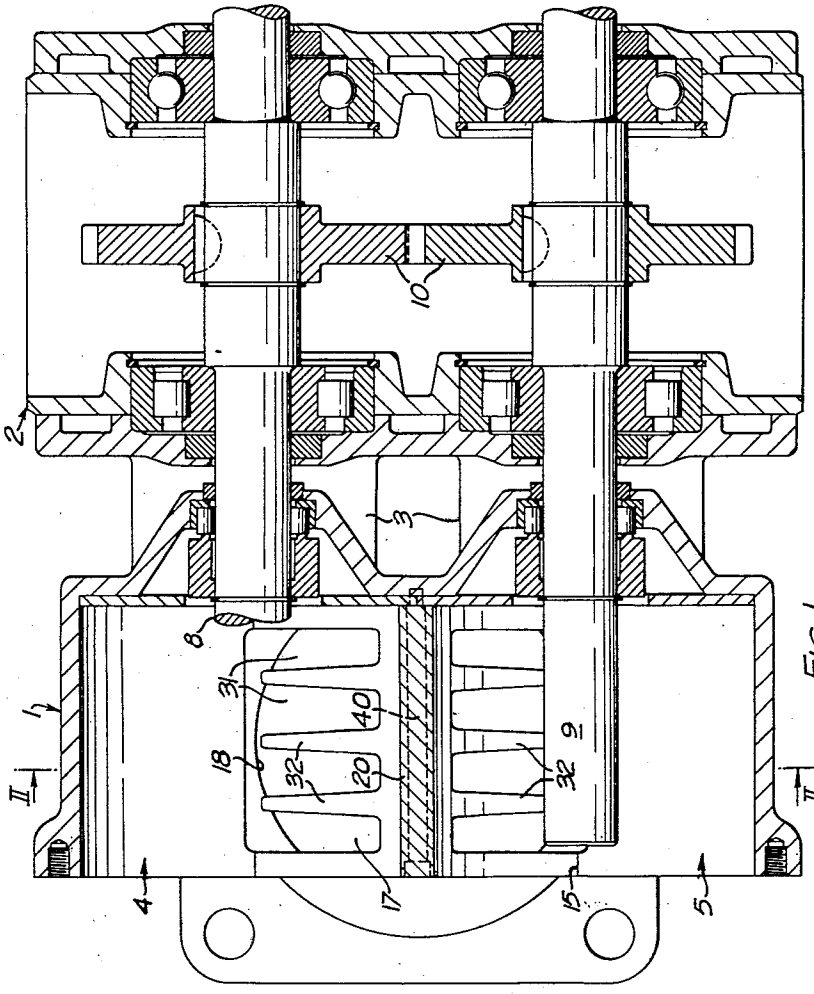


FIG. 1.

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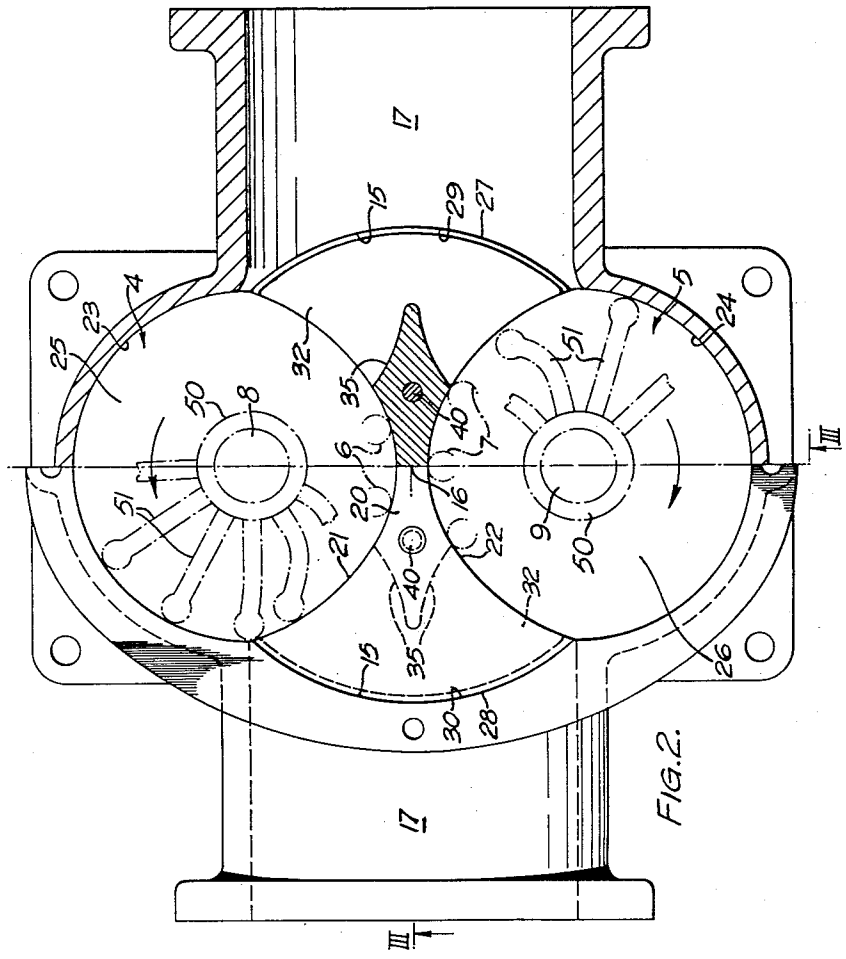


FIG. 2.

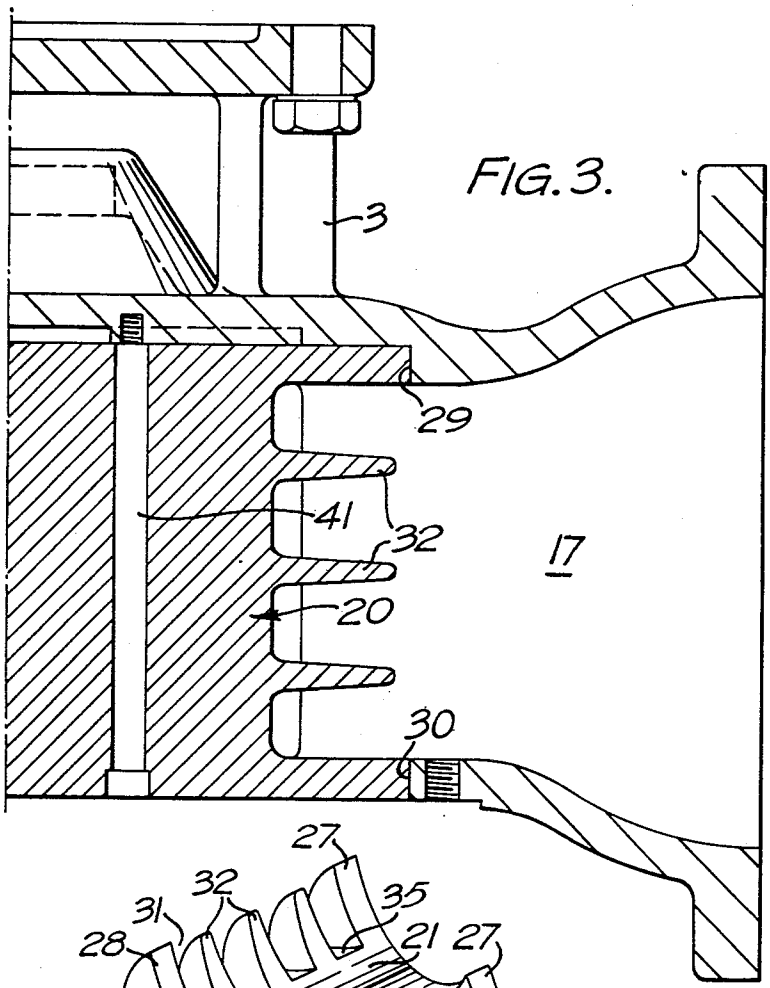
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MULTIPLE ROTARY PUMPS OF THE FLEXIBLE-VANE TYPE

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FIG. 3.



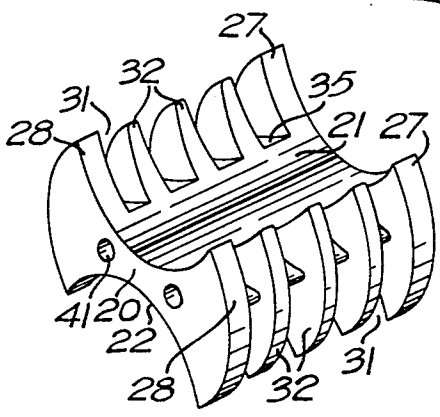


FIG. 4.

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MULTIPLE ROTARY PUMPS OF THE FLEXIBLE-VANE TYPE

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5 Claims. (Cl. 103—117)

This invention relates to pumps having impellers of the flexible radial vane type, impellers of this type being moulded of rubber or other material having similar characteristics as to flexibility, resilience and the like.

In accordance with the present invention, a multiple pump having a housing provided with two cylindrical bores therein in side-by-side, spaced relation and rotatable impellers of the flexible vane type contained in said bores, includes a third cylindrical bore intersecting the said two bores containing the impellers and a cam fitted within said third bore and provided with two oppositely facing cam surfaces respectively merging with the peripheral walls of said two bores and co-operating therewith to provide two impeller chambers, one defined by one of said pehipheral walls and one of said cam surfaces and the other defined by the other of said peripheral walls and the other of said cam surfaces, the two impellers being disposed in said impeller chambers and each of said flexible vanes being alternatively engageable with the bore wall and the cam surface defining the impeller chamber.

The cam is a separate element and may be removable from the pump housing, the pump including interengaging means on the housing and on the cam for securing the cam in the housing.

Preferably the axis of said third cylindrical bore lies parallel to and equidistant from the axes of the said two bores and the cam is provided with convex arcuate surfaces which seat snugly against concave arcuate surfaces defined by peripheral wall portions of said third bore.

Preferably, inlet and outlet passages in the pump housing, communicate with ports opening into the peripheral walls of the third bore, the centres of the ports and the axis of the third bore lying in a common plane.

An embodiment of a pump according to the present invention is illustrated in the accompanying drawings, in which:

FIGURE 1 is a longitudinal sectional view of the pump,

FIGURE 2 is a transverse sectional view along the line II—II of FIGURE 1,

FIGURE 3 is a part sectional and part plan view along the line III—III of FIGURE 2 and

FIGURE 4 is a perspective view of a cam which is mounted in the pump.

Referring to the drawings, the pump includes a pump housing **1** and a gear housing **2** rigidly connected together by struts **3**. The pump housing **1** is provided with two main cylindrical bores **4** and **5**, each adapted to receive an impeller **6** and **7** respectively mounted on shafts **8** and **9** which are coupled together for contra rotation by gear wheels **10**.

A third cylindrical bore **15** in the pump housing **1** intersects the two cylindrical bores **4** and **5** and, as can be seen in FIGURES 1 and 2, the axis **16** of the bore **15** lies parallel to and equidistant from the axes of the bores **4**, **5**. In the particular embodiment illustrated in the accompanying drawings, the axes of the three bores **4**, **5** and **15** lie in a common vertical plane.

The ends of the three bores **4**, **5** and **15** are closed at one end by a side wall of the pump housing **1** and at their other ends by a cover plate (not shown) which is secured to said pump housing **1**.

The pump housing **1** is provided with opposed inlet and outlet passages **17** communicating with ports **18**, the centres of which lie in a common plane with the axis of the third cylindrical bore **15**.

A cam **20** is located within the third cylindrical bore **15** and has a pair of opposed arcuate cam surfaces **21**, **22** which merge with the semi-cylindrical peripheral walls **23**, **24** of the bores **4**, **5**, thereby defining two pump chambers **25**, **26** respectively. The cam **20** at each end is provided with pairs of convex arcuate surfaces **27** and **28** which, when the cam is in position in the bore **15**, seat snugly against opposed concentric concave arcuate surfaces in the form of shoulders **29** and **30** defined by portions of the peripheral wall of the bore **15**. The shoulders **29** and **30** have a common center on the line joining the respective centers of the two main bores **4** and **5**, this common center being located equidistant from the centers of the main bores **4** and **5**. The shoulders **29** and **30** are located on opposite sides of this line of centers of the bores **4** and **5**.

It will be appreciated that due to the intersection of the bore **15** with the bores **4** and **5** and to the openings of the inlet and outlet ports **18** into the bore **15**, none of said bores have complete, cylindrical surfaces; in fact, the two bores **4** and **5** are left only with the aforementioned semi-cylindrical surfaces **23** and **24** and the bore **15** is only left with the concave arcuate surfaces **29** and **30**.

Where the cam **20** registers with the inlet and outlet ports **18** it is provided with slots **31** defining fingers **32** which extend across the ports **18**. To improve the flow characteristics of fluid past the fingers **32**, they may be tapered as can be seen in FIGURE 4 and the inner ends of the slots **31** may be made arcuate as indicated at **35**.

The cam **20** is secured in position in the bore **15** by dowels **40** which pass through bores **41** in said cam and threadedly engage in the side wall of the pump housing **1**.

The two impellers **6** and **7** are of the same construction and each is made of moulded rubber or like resilient material. Each impeller comprises a hub **50** and flexible vanes **51** projecting radially therefrom. The hubs are suitably keyed or otherwise secured on the shafts **8** and **9**.

Considering the operation of the pump for fluid flow from right to left, as shown in FIGURE 2, the shaft **8** and impeller mounted thereon rotate in a counter-clockwise direction and the shaft **9** and the impeller mounted thereon rotate in a clockwise direction. As the vanes **51** of the impellers alternately engage the peripheral walls of the bores **4**, **5**, and the cam surfaces **21**, **22**, the spaces between the vanes increase in volume adjacent the inlet ports to draw fluid thereinto from the inlet passage and decrease in volume adjacent the outlet ports to discharge fluid into the outlet passage. Thus fluid is drawn in a continuous manner from the inlet port into the spaces between the vanes, carried round with the vanes and then discharged through the outlet port into the outlet passage. Flexing of the vanes to decrease the volume of the spaces between adjacent vanes is under the influence of the cam surfaces **21** and **22**. These cam surfaces are formed on a single cam member.

It will be understood that with the particular construction hereinbefore described, wherein the cam **20** is symmetrical about a central vertical plane and wherein the inlet and outlet ports and passages are symmetrically arranged with respect to such plane, the flow of fluid through the pump may be reversed simply by reversing the direction of rotation of the two impellers. In other words by rotating the shaft **8** and impeller carried thereby in a clockwise direction and the shaft **9** and impeller carried thereby in a counterclockwise direction, there is fluid flow from left to right, as shown in FIGURE 2.

In some instances it may be said that the present pump

has improved operational characteristics particularly so far as noise is concerned in that the cam surfaces **21** and **22** merge smoothly with the peripheral walls **23** and **24** of the bores **4**, **5**. The main advantage of the present pump is that the improved construction of cam and its method of mounting facilitates ease of manufacture. In particular it will be appreciated that the three bores **4**, **5** and **15** can be produced to a very fine degree of accuracy by comparatively simple machine operations. Furthermore, the cam **20** so far as the important surfaces thereof are concerned, i.e. the cam surfaces **21**, **22** and the convex arcuate surfaces **27** and **28**, can likewise be manufactured to a high degree of accuracy by comparatively simple machine operations. Finally, assembly of the cam **20** with the pump housing can be performed simply and skilled labour is not necessarily required.

What is claimed is:

1. A multiple pump having a housing provided with opposed inlet and outlet passages and having two main cylindrical bores therein, in side-by-side, spaced relation transversely of said inlet and outlet passages, said housing including a third cylindrical bore intersecting the two said main bores and providing opposed concentric concave arcuate shoulders having a common center on a line joining the respective centers of said two main cylindrical bores, said common center being located equidistant from the centers of said two main bores and said shoulders being located respectively on opposite sides of said line; a cam having opposed concentric convex arcuate surfaces fitted within the arcuate shoulders of said third

cylindrical bore on opposite sides of said line, said cam being provided with two oppositely facing cam surfaces respectively merging with the peripheral walls of said two main bores and co-operating therewith to provide two impeller chambers, one defined by one of said peripheral walls and one of said cam surfaces and the other defined by the other of said peripheral walls and the other of said cam surfaces; and two rotatable impellers having flexible vanes disposed in said impeller chambers respectively, each of the flexible vanes of said impellers being alternatively engageable with the bore wall and the cam surface defining the respective impeller chamber.

2. A multiple pump according to claim 1 in which said two main bores and said third bore have their axes parallel to one another.

3. A multiple pump according to claim 1 including inlet and outlet ports providing communication between said third bore and said inlet and outlet passages respectively, the centers of said ports and said common axis of said third bore shoulders lying in a common plane.

4. A multiple pump according to claim 3 wherein said cam includes fingers extending across said inlet and outlet ports, said fingers lying in spaced, radial planes of said third bore.

5. A multiple pump according to claim 4 wherein the fingers are tapered in the dimension of their thickness.

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