June 7, 1966 N. O. ROSAEN 3,254,606

CONSTANT DELIVERY PUMP

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FIG. 2

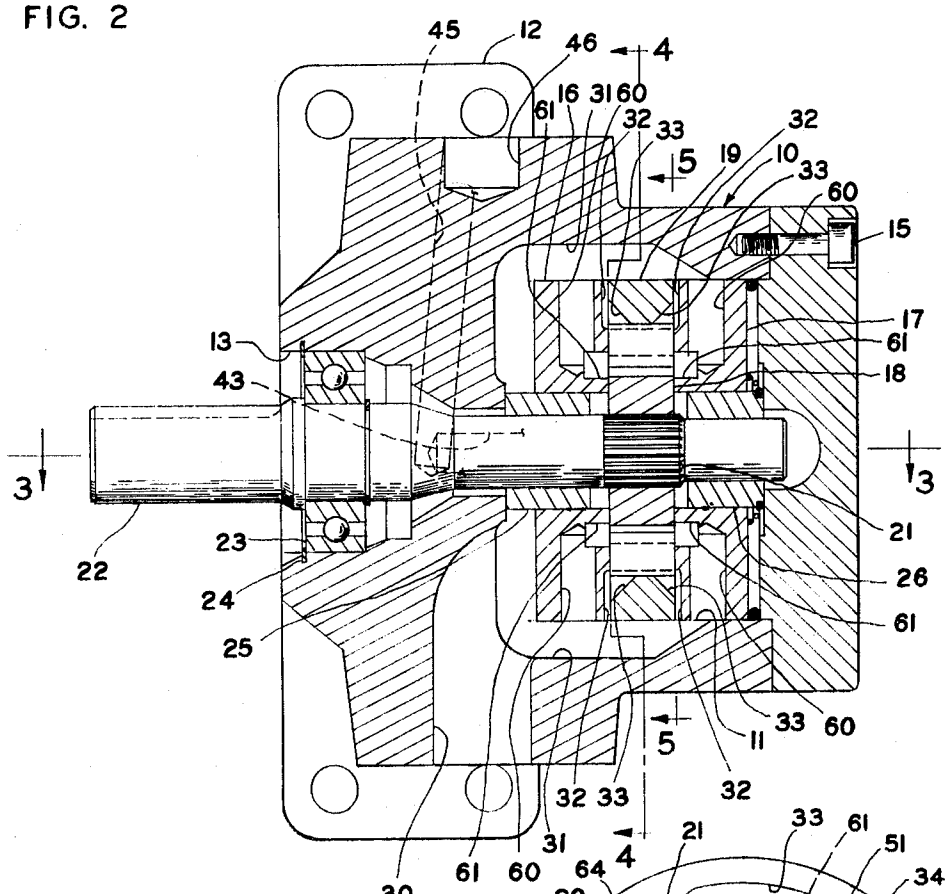


FIG. 1

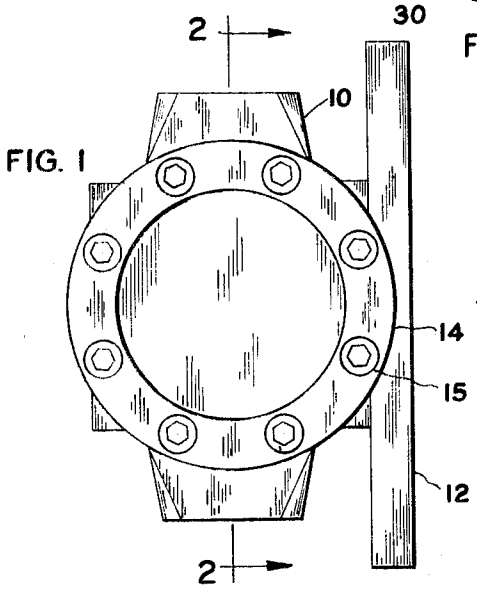


FIG. 5

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FIG. 3

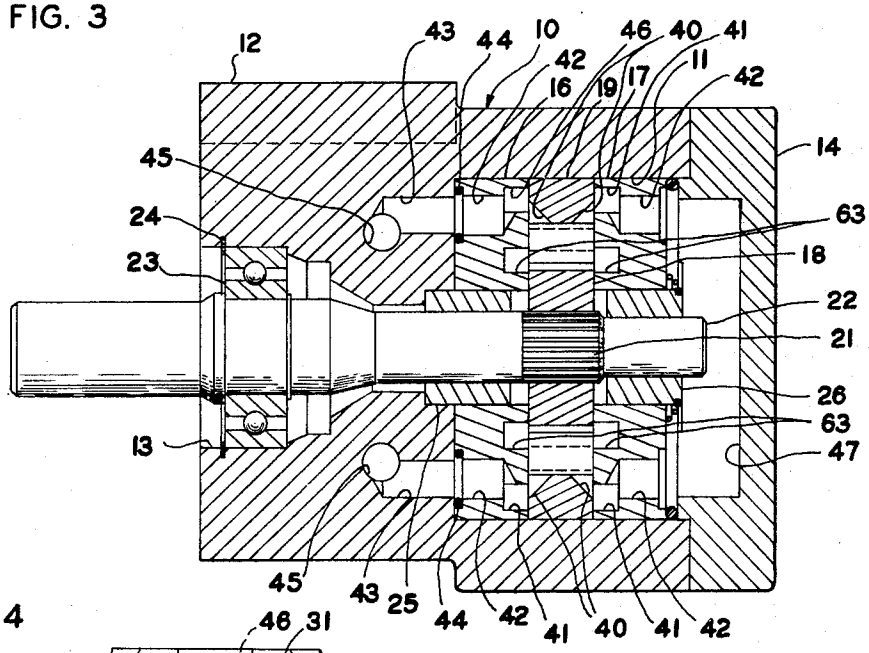


FIG. 4

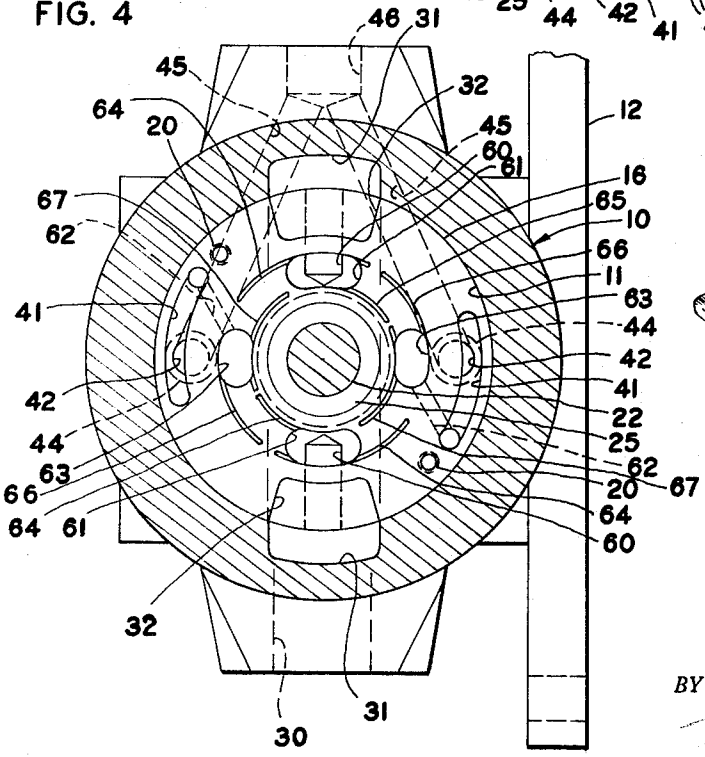
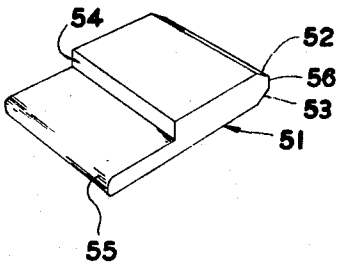


FIG. 6



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CONSTANT DELIVERY PUMP

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3 Claims. (Cl. 103—136)

My invention relates to fluid pumps and more particularly to vane-type pumps having improved means for pressure-balancing the vanes.

In the vane pumps of the present invention, the vanes are slidably carried in slots provided around the periphery of a rotor and are guided for movement by a cam ring surrounding the rotor, so that the vanes will pump fluid from an inlet to an outlet area provided between the cam ring and the rotor, all in a known manner.

Heretofore, such vanes have been pressure balanced end-to-end by admitting fluid pressure beneath them, which fluid pressure will generally approximate the pressure to which a beveled face at the outer end of each vane is subject. The outer end bevel will generally be on the leading edge, and the trailing edge will have only a small area which might be affected by pressure at the trailing side of the vane.

However, the effect of pressure at the trailing side is only minimized by such construction, and in some instances, where very high pressures are achieved, the small unbalance is enough to cause vane and cam ring damage and poor performance.

An object of the present invention is to improve such pumps by providing a more effective vane balance.

Another object of the invention is to increase the life and improve the performance of vane-type pumps by providing means for separately balancing the leading and trailing portions of the vanes.

These and other objects of the invention will become apparent upon reference to the following description and the accompanying drawings illustrating a preferred embodiment of the invention in which like reference characters refer to like parts throughout the several views and in which

FIG. 1 is an elevational view of a preferred pump incorporating the present invention.

FIG. 2 is a longitudinal cross-sectional view of the pump taken substantially on the line 2—2 of FIG. 1.

FIG. 3 is a longitudinal cross-sectional view of the pump taken substantially on the line 3—3 of FIG. 2.

FIG. 4 is a transverse cross-sectional view of the pump taken substantially on the line 4—4 of FIG. 2.

FIG. 5 is an elevational view of the cam ring and rotor assembly of the pump as seen substantially from the line 5—5 of FIG. 2; and

FIG. 6 is a perspective enlarged view of one of the vanes incorporated in the present pump.

Description

As disclosed, the preferred pump comprises a housing **10** having a chamber **11**, an integral mounting plate **12**, and a stepped shaft bore **13**. The chamber **11** is closed by an end cap **14** secured to the housing by any means such as screws **15**.

A pair of cheek plates **16** and **17** are carried in the chamber **11**, sandwiching between them a rotor **18** peripherally surrounded by a cam ring **19**. The cheek plates **16** and **17** and cam ring **19** are preferably held together by screws **20** or the like for convenience in assembling.

The thereby enclosed rotor **18** is splined as at **21** to a drive shaft **22** carried by ball bearing assembly **23** retained in the bore **13** by any means such as a snap ring **24**, and centered with the cheek plates by bearings **25** and **26**.

Fluid enters an intake passage **30** in the housing **10** from any suitable fluid source (not shown) and is directed into a channel **31** provided around the chamber **11**, thence through shallow recesses **32** in the faces of the cheek plates adjacent the cam ring **19**, into registering inlet recesses **33** in opposite faces of the cam ring **19**, and into pumping chambers **34** which are formed by radial spacings between the cam ring periphery and the rotor periphery, as seen in FIG. 5. Intermediate the chambers **34** the cam ring is spaced close to the rotor periphery as at **35**.

Outlet recesses **40** in the cam ring **19** are angularly spaced from the inlet recesses **33** and register with arcuate grooves **41** in the cheek plates, such that fluid, now under pressure as will be explained is passed to ports **42**.

The ports **42** in cheek plate **16** register with ports **43** provided in the housing **10** which ports are sealed by O-rings **44**, and fluid pressure is discharged through the passages **43** into passages **45** and thence out an outlet port **46** to a fluid pressure user (not shown).

It will be noted that cheek plate **17** is substantially a mirror image of cheek plate **16**, and the ports **42** on diametrically opposite sides of the cheek plate **17** open to a channel **47** provided in the end cap **14**. This fluid pressure, and suction, will be balanced in the pump on both sides of the rotor **18**.

The rotor **18**, as best seen in FIG. 5, is cylindrical and has substantially radial stepped slots **50** annularly spaced around the periphery and extending laterally from face to face. Vane elements **51** are slidably carried in the slots **50** and are stepped as shown to be substantially complementary to the slots **50**.

As the rotor **18** turns, in a clockwise direction as seen in FIG. 5, the vanes **51** are guided by the contour of the cam ring inner periphery for radial sliding movement in the slots **50**, thereby pumping fluid from the inlet recesses **33** through the pumping chambers **34** and out the outlet recesses **40**. Intermediate the pumping chambers **34** the vanes **51** will be retracted into the slots **50**, and in the vicinity of the pumping chambers **34** the vanes **51** will be extended as shown.

Construction of a vane **51** is shown in FIG. 6, as having beveled portions **52** and **53** at the outer end on, respectively, the leading and trailing sides of the vane **51**. The vane is stepped as shown to provide a leading side inner end **54** and a trailing side inner end **55**.

Between the beveled portions **52** and **53** is a cam follower edge **56**. It will be apparent that at any period of operation except when the vane cam follower edge **56** is in an area of the cam ring contour not spanned by either the inlet recess **33** or the outlet recess **40**, the beveled portion **52** will be subjected to a different pressure than the beveled portion **53**. These pressures, whether discharge or suction, tend to unbalance the vanes. It is not new to admit pressure beneath a vane in an attempt to balance it, but heretofore to my knowledge such ideas have not been carried out to produce truly effective balancing because heretofore the different leading and trailing side pressures have not been taken into account. Usually it is proposed to minimize such differences by bevelling only one side of the vane outer end, in the hope that the other side will not be greatly effected, but where high speed, high pressure pumps are involved, even slight imbalances will have a magnified effect.

In the present pump, as will hereafter be explained, I balance the leading and trailing sides of the vanes separately as follows:

Each cheek plate is provided with radial passages **60** open to the channels **31** as seen in FIGS. 2 and 4, and directing inlet or suction pressure to ports **61** which open to the sides of the cheek plates facing the rotor **18**. Each

cheek plate is also provided with passages **62** as shown in FIG. 4, connecting the arcuate grooves **41** with ports **63** which also open to the sides of the cheek plates facing the rotor **18**. The ports **61** and **63** are disposed the same radial distance from the rotor axis so that they register with the rotor slots **50** beneath both leading and trailing side inner ends **54** and **55** of the vanes **51**.

The ports **61** and **63** are arcuately dimensioned so that both ends **54** and **55** of successive vanes **51** will be subject to, respectively, inlet suction and discharge pressure for the period during which both leading and trailing side bevels **52** and **53** are subject to, respectively, inlet suction and discharge pressure. As the vanes move from these areas, the leading and trailing bevels **52** and **53** will be subjected to different pressures. The inner vane ends **54** and **55** are therefore made subject to corresponding pressures by means of arcuate grooves **64** and **65** connected with the ports **61** respectively at outer and inner radial edges thereof, and arcuate grooves **66** and **67** connected with the ports **63** respectively at outer and inner radial edges thereof.

It will be seen, on reference to FIG. 5, that the leading and trailing side inner ends **54** and **55** of the vanes **51** will be subjected to the same respective pressures as are effective on the leading and trailing side outer bevels **52** and **53** at all times throughout pump operation, thus completely balancing the vanes end to end at all times.

Although I have described only one preferred embodiment of my invention, it will be apparent to anyone skilled in the art that various changes and modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A vane type fluid pump comprising

(a) a housing having a pumping chamber, and an inlet and outlet open to spaced portions of said chamber,

(b) a rotor in said chamber and carrying vanes operable to pump fluid from said inlet to said outlet,

(c) each of said vanes having a beveled outer portion and a stepped inner portion to define outer leading and trailing ends and inner leading and trailing ends, and

(d) means directing pressure from said outlet to said trailing end when said outer trailing end is subjected to outlet pressure, from said outlet to said leading inner end when said leading outer end is subjected to outlet pressure, from said inlet to said inner trailing end when said outer trailing end is subjected to inlet pressure, and from said inlet to said inner leading end when said outer leading end is subjected to inlet pressure.

2. The pump as defined in claim **1** and having cheek plates disposed on opposite faces of said rotor, said pressure directing means comprising passages in said cheek plates registering with spaces under the inner ends of said vanes.

3. The pump as defined in claim **1** and having cheek plates disposed on opposite faces of said rotor, said pressure directing means comprising,

(a) ports in said cheek plates each registering with spaces under both said leading and said trailing inner ends of successive vanes when both said leading and trailing outer ends are subjected to the same pressure, and

(b) arcuate grooves extending from the radially outer and inner edegs of said ports and arranged to register with the spaces in said leading and said trailing inner ends of said vanes when said leading and trailing outer ends are subject to different pressures and to thereby at all times subject the inner ends to pressures corresponding to the pressures effective on the outer ends of said vanes.

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