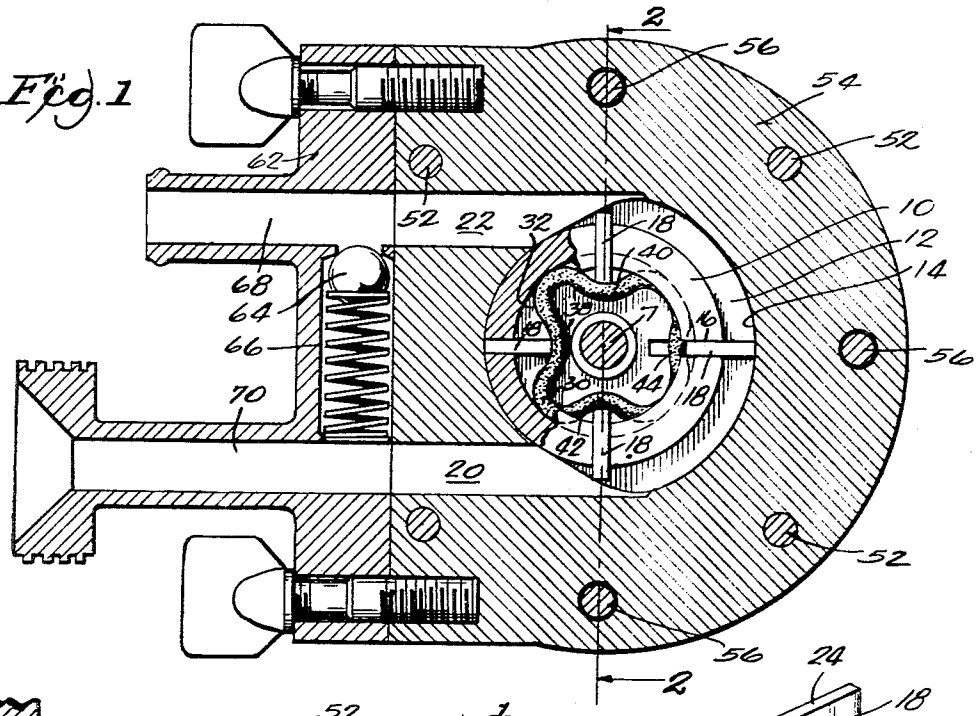
Oct. 21, 1969 C. W. LITTLE, JR 3,473,478

VANE PUMP WITH ANNULAR ELASTOMERIC VANE-PROJECTING SPRINGS

Filed Nov. 9, 1967

Fig. 1



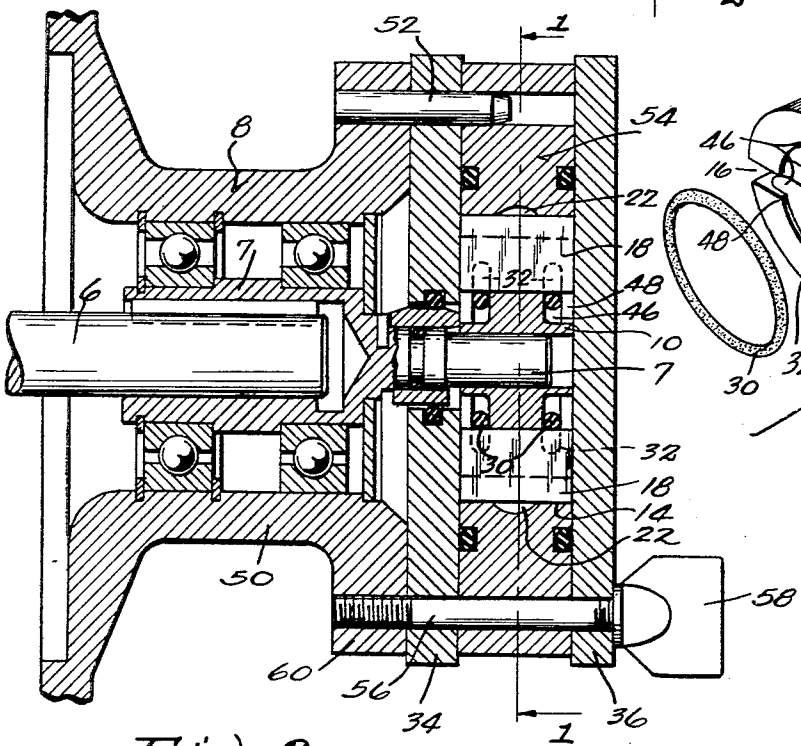


Fig. 2

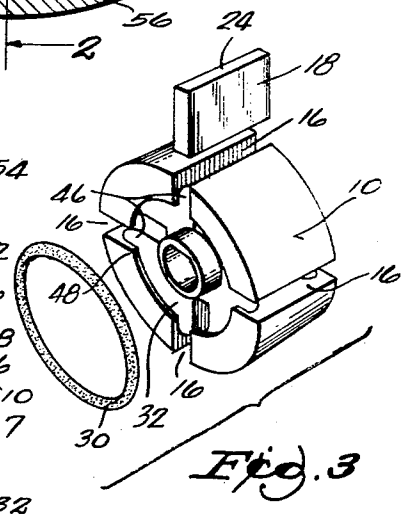


Fig. 3

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VANE PUMP WITH ANNULAR ELASTOMERIC VANE-PROJECTING SPRINGS

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U.S. Cl. 103—136 3 Claims

ABSTRACT OF THE DISCLOSURE

A rotor has slots within which vanes are guided for radial movement. To make the vanes follow the inner peripheral surfaces of the chamber, particularly when sticky or oleaginous materials are being pumped, the vanes are subjected to a radial thrust of one or more centripetally deformable elastomeric annuli confined at each end of the rotor to lie in planes to which the rotor axis is normal, the resilient rings being deformed in the course of vane movement.

BACKGROUND OF THE INVENTION

Some vane pumps are operated at speeds which are sufficient so that centrifugal force on the vanes assures continuous contact of the outer margins of the vanes with the interior contour of the pump body, regardless of viscosity of the materials pumped. In other pumps, leaf or coil springs and camming guides operate the vanes.

None of these expedients as heretofore used has been found acceptable for the instant pump, which is especially designed for handling food products and hence must be easily cleaned. This requires facility in disassembling and reassembling the parts and it requires that the springs used will function dependably even when exposed to materials which might clog coil or leaf springs or resist movement of the vanes.

In the particular embodiment hereinafter disclosed, the vanes are light plastic vanes of low mass and they rotate at speeds of only 1800 r.p.m. Hence the use of radial loading is essential. However, the contour of the pump casing is not a simple circular contour. This makes impractical the use of circular tracks or cams. The small size of the pump and the sanitary requirements make it impractical to use coil, wave or leaf springs, all of which require relatively minute cavities for housing them. Such cavities are not easily cleanable.

The use of the pump in locations remote from large industrial centers requires that the parts be such as to be readily obtainable. This pump uses parts which are available for other purposes and are not specially designed for this one service.

SUMMARY OF THE INVENTION

All of these requirements are met by the instant invention in which the vanes are radially biased outwardly at both ends of the driving rotor by O-rings such as are conventionally used for packing but are here used as elastomeric springs. These O-rings are deformed when the vanes move inwardly, thus developing radial thrust for assisting the outward return of respective vanes. The O-rings may be solid or tubular in cross section. To preclude axial deformation, the springs are preferably confined in cavities formed in the respective ends of the rotor.

The cross section and diametrical sizes of the O-ring and the elastic characteristics of the material of the O-ring are selected to provide adequate radial thrust to hold the several vanes outwardly against the inner periphery of the pump casing and thereby to overcome the stickiness of butter fat and other materials without exerting so great

a force as to cause undue wear on the vanes or the pump body. It will be understood that plural rings may be used instead of single rings at each end of the rotor, if desired.

The elastomeric material of the O-rings may be any natural or synthetic rubber or resin which will withstand deflections of the magnitude here involved without fatigue failure, the material also being impervious and with a surface readiy cleaned to meet sanitary requirements.

The fact that the O-ring is confined in a cavity which requires its vane-displaced portion to be deformed by local deflection rather than by change of form of the entire ring, such as might occur in open space, provides additional vane-restoring stress.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view taken in section on the line 1—1 of FIG. 2 showing a pump embodying my invention, the rotor and vanes being illustrated in end elevation and parts being broken away.

FIG. 2 is a view in axial section on the line 2—2 of FIG. 1.

FIG. 3 is a perspective view of the pump rotor with a vane and spring shown separately.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The pump shaft **6** drives an extension **7** which has bearings in casing **8** and supports rotor **10** in a pump chamber **12**. The inner peripheral wall surface **14** is non-concentric with shaft extension **7** and may be either circular or non-circular, according to pump requirements.

The rotor **10** has generally radial slots at **16** for the radially reciprocable vanes **18**. In the course of rotation of rotor **10**, the inter-vane spaces between the rotor and the pump chamber vary in volume in known manner to receive fluid from inlet port **20** and to discharge it from outlet port **22**.

The material of which the vanes are made may be varied. In a particular pump exemplifying the invention, these vanes are made of light plastic material such as synthetic resin; they have little mass and at nominal operational speeds are on the order of 1800 r.p.m., they do not develop a great deal of centrifugal force such as might be required to hold their outer margins **24** in continuous contact with the wall **14** of the pump casing **8**.

Therefore the action of centrifugal force on the vanes is desirably supplemented by spring means. Because the pump here disclosed is a sanitary pump, where all parts require frequent and thorough cleansing, the spring means acting radially on the vanes **18** comprises elastomeric O-rings **30** which are set in undercut channels **32** at the respective ends of the rotor **10** and are peripherally engaged beneath the ends of the respective vanes. The slots **16** open into channels **32** and the vane ends extend across such channels substantially to end walls **34** and **36**.

The peripheral confinement of the respective O-rings prevents them from overall deformation under the pressure of the vanes as the latter are forced into engagement by camming action of the casing. If overall deformation were possible, the reaction force exerted by the O-ring upon the vanes would be relatively slight. Since, however, the O-rings are confined and cannot assume an elliptical form under centripetal pressure, the deflection is localized and the O-ring is deformed in the immediate vicinity of each respective vane which is exerting pressure on the O-ring. This is clearly shown in FIG. 1 where the vane at the left of the view is causing maximum deflection of O-ring portion **38** and the two vanes at top and bottom are deflecting the O-ring spring **30** to a moderate extent at **40** and **42**, while the spring is deformed very little at **44** where it engages the vane at the right.

The undercutting of channels **32** as best shown at **46** in FIG. 3 leaves flanges **48** which overhang the O-ring springs to hold them in the desired plane and to prevent axial deformation.

While the instant invention is not directly concerned with pump casing design, it will be noted that the casing **8** comprises a bearing section **50** having projecting dowel pins **52** for positioning end wall section **34** and body section **54**. Screws **56** with manually operable wing heads **58** pass successively through end wall section **36**, body section **54**, and end wall section **34** into flange portion **60** of bearing section **50**. Removal of these screws permits complete separation and removal for cleaning of all parts contacted by the fluid pumped. All surfaces will be fully exposed when the sections are separated and the springs and vanes removed.

Use of the bypass fitting **62** with its spring-loaded valve **64** is, of course, optional. As shown, a bypass port **66**, controlled by valve **64**, connects outlet extension **68** to inlet extension **70** to relieve excessive discharge pressure.

I claim:

1. A pump comprising the combination of a rotor having generally radial slots opening to its periphery, vanes mounted for reciprocation in said slots, a casing having a pump chamber with a wall portion which is not concentric with regard to the rotor and which has inlet and outlet ports, the rotor having at its axial ends cavities encircled by undercut channels with which the rotor is provided and which open inwardly into the respective cavities, and an elastomeric O-ring confined in each of the cavities and engaging the inner-ends of said vanes, said vanes extending

axially across portions of the cavities and having portions exposed in said channels, the O-rings having portions engaged in the channels between each successive pair of vanes and externally confined thereby between points of O-ring engagement with said vanes, the said channels holding the respective O-rings substantially in their respective planes during the reciprocation of said vanes.

2. A pump according to claim **1** in which the pump is a sanitary pump and the pump casing comprises a body portion substantially coextensive axially with the rotor and end plates detachably engaging the end surfaces of the body portion of the casing and confining the rotor and the O-rings, the rotor and vanes and O-rings being freely and completely removable and separable for cleaning when at least one of the end plates is removed from the casing.

3. A pump according to claim **1** in which said elastomeric O-rings are substantially corresponding in radius to said cavities except as deformed by said vanes.

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