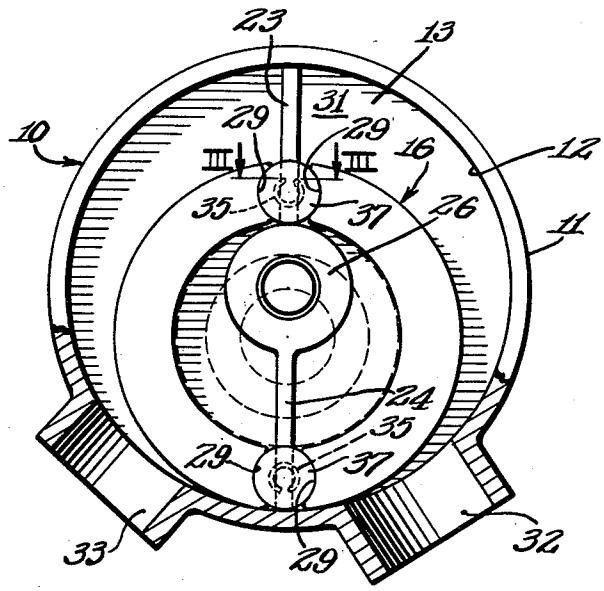
May 25, 1965 D. W. PARTAIN ETAL 3,185,102

VANE PUMP SEALING GLANDS

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Fig. 1



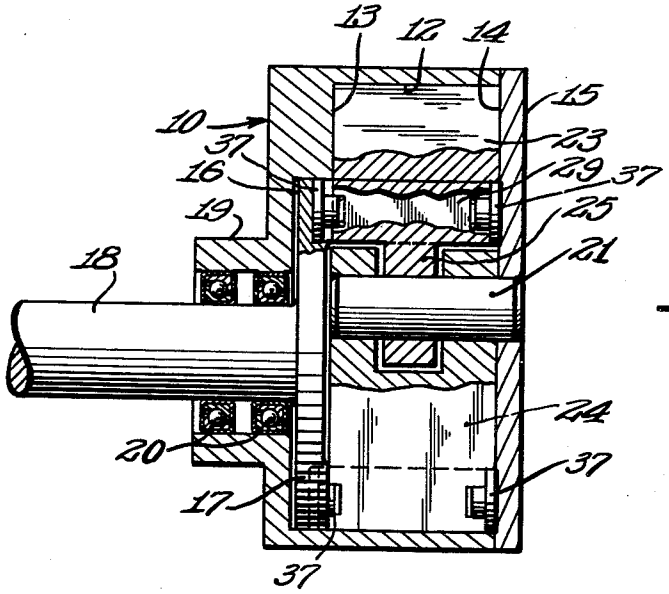


Fig. 2

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VANE PUMP SEALING GLANDS

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Fig. 3

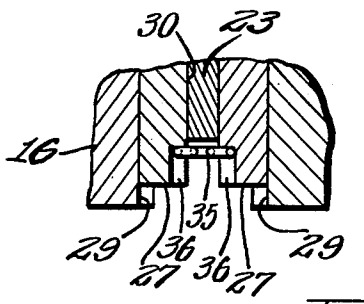


Fig. 5

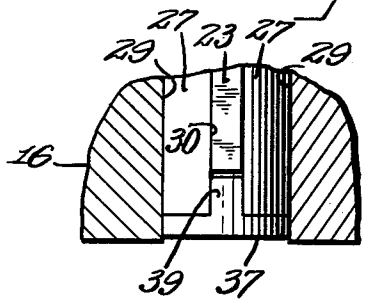


Fig. 4

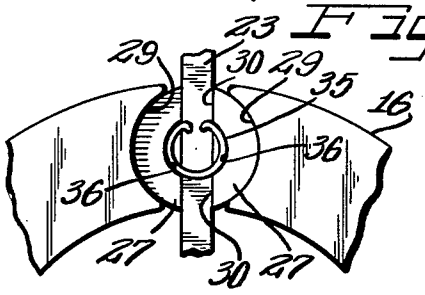


Fig. 6

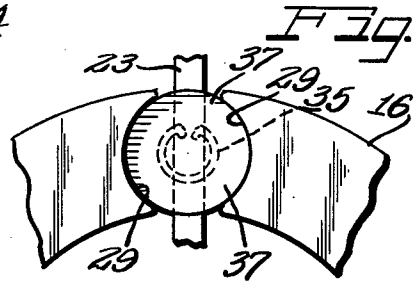


Fig. 7

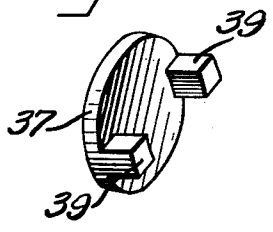


Fig. 8

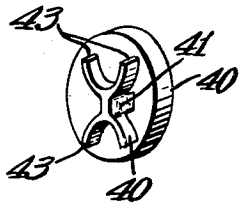


Fig. 9

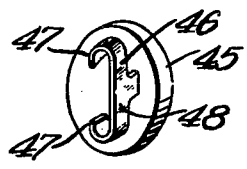


Fig. 11

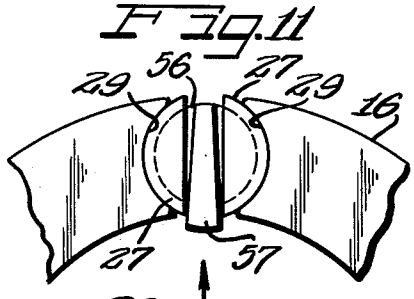


Fig. 10

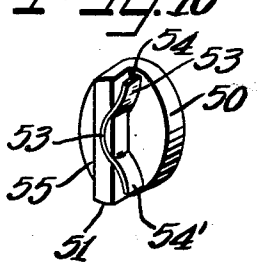
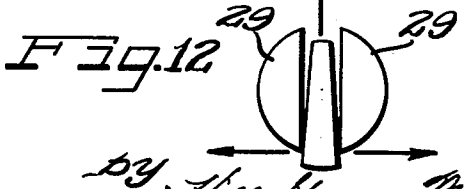


Fig. 12



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3,185,102

VANE PUMP SEALING GLANDS

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Filed Jan. 13, 1964, Ser. No. 337,461
12 Claims. (Cl. 103—144)

This invention relates to improvements in vane pumps and more particularly relates to improvements in the sealing gland structure therefor.

In sliding vane types of pumps in which an annular rotor rotates about an axis eccentric of the axial center line of its housing and the vanes rotate about an axis extending along the axial center line of the housing, the vanes assume varying angles with respect to the rotor. The vanes are guided and sealed by generally semi-cylindrical sealing glands mounted in facing concave recesses in the rotor conforming generally to the form of the glands. These sealing glands seal the pumping chamber of the pump and also guide and seal the vanes for their translational and rotational movement. Such sealing glands are subject to wear particularly on the flat surfaces of the glands as well as the cylindrical surfaces thereof, when the glands have a tight enough fit with the rotor and vanes to seal the pumping chamber from leakage to the interior of the rotor.

It has been found that where a separating force is applied to the sealing glands by loading the glands, forcing the sealing glands into intimate contact with the cylindrical bore in the rotor to uniformly support the sealing glands within the cylindrical bore of the rotor and to relieve the pressure of the flat sides of the glands on the vanes, that the wear on the cylindrical surfaces and flat sides of the sealing glands has been materially reduced without impairing the sealing effectiveness of the glands.

A principal object of the present invention, therefore, is to load the semi-cylindrical sealing glands of a vane pump to provide a separating force on the glands and press the semi-cylindrical surfaces of the glands in intimate contact with the cylindrical bores in the rotor.

Another object of the invention is to reduce the wear on the sealing glands of a vane pump of the type having an annular rotor rotating eccentrically of the pumping chamber by loading the sealing glands by a spring force of sufficient magnitude that the centrifugal force and friction force components will not vary the spacing of the sealing glands with respect to each other when in position in the pump.

A still further object of the invention is to load the sealing glands of a vane pump having an eccentrically rotating annular rotor by springs bearing against opposite ends of the sealing glands and exerting sufficient separating forces on the glands to prevent the centrifugal force and friction force components from forcing the sealing glands against the vanes of the pump.

A still further object of the invention is to provide a loading means for the semi-cylindrical sealing glands of a vane pump having an eccentrically mounted rotor in the form of springs forcing these sealing glands into intimate contact with the concave semi-cylindrical surfaces of the rotor.

A still further object of the invention is to prevent the wear of the semi-cylindrical and flat surfaces of the sealing glands of a vane pump having an eccentrically rotating annular rotor by providing force exerting members at opposite ends of the sealing glands maintaining the sealing glands in intimate contact with the semi-cylindrical recessed portions of the rotor and maintaining the load between the rotor and sealing glands uniformly on the

mating cylindrical surfaces of the rotor and sealing glands throughout the length of the gland.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a fragmentary end view of a vane pump constructed in accordance with the principles of the present invention with one of the end covers removed and with certain parts shown in section;

FIGURE 2 is a fragmentary vertical sectional view taken substantially through a vertical central plane of the pump;

FIGURE 3 is an enlarged detail fragmentary sectional view taken substantially along line III—III of FIGURE 1;

FIGURE 4 is an enlarged partial fragmentary end view of the rotor showing the semi-cylindrical sealing glands recessed therein and forming a guide and seal for the vane and rotor of the pump;

FIGURE 5 is a fragmentary detail view illustrating a modified form in which the invention may be embodied;

FIGURE 6 is an enlarged detail end view somewhat similar to FIGURE 4 and showing still another modified form in which the invention may be embodied;

FIGURE 7 is an enlarged perspective view showing a form of member which may be used to separate the sealing glands and maintain them in intimate contact with their cylindrical recesses in the rotor;

FIGURE 8 is a view showing still another separator for the glands;

FIGURE 9 is a detail perspective view illustrating another form of separator which may be used to separate the glands and maintain them in intimate contact with their recesses in the rotor;

FIGURE 10 shows still another form of separator for the sealing glands;

FIGURE 11 is a diagrammatic view somewhat similar to FIGURE 4, but illustrating the use of a wedge-shaped button for separating the sealing glands with the sliding vane and one wedge-shaped button removed and looking at the wedge from the side of the rotor having the wedge removed; and

FIGURE 12 is a view illustrating the centrifugal load on the sealing button and the force on the seals exerted by the form of the invention illustrated in FIGURE 11.

In the embodiment of the invention illustrated in FIGURES 1 and 2 of the drawings, a rotary vane pump **10** is shown as including a pump casing or housing **11** having an internal cylindrical wall **12** extending between an integrally formed end wall **13** of the pump and a parallel spaced wall **14** formed by a removable end plate **15**.

Within the chamber formed by the cylindrical wall **12** and the end walls **13** and **14**, is an annular rotor **16** mounted for rotatable movement about an axis eccentric of the axis about which the cylindrical wall **12** is struck, on a disk **17** recessed within the end wall **13**. A shaft **18** is shown as being formed integrally with the disk **17** and as extending outwardly through the wall **13** and journalled in the hub **19** on anti-friction bearings **20**. The shaft **18** may be driven from a suitable motor (not shown) in a conventional manner.

Mounted in the end cover **15** of the housing is a stationary shaft **21** extending inwardly of said housing to a position adjacent the disk **17** and concentric with the axis about which the cylindrical wall **12** is struck. The stationary shaft **21** forms a mounting for two oppositely extending sliding vanes **23** and **24**. As shown in FIGURES 1 and 2, the respectively sliding vanes **23** and **24** extend outwardly from the hubs **25** and **26** and are rotatably mounted on the shaft **21** in interleaving relation with respect to each other, to permit independent pivotal movement of the vanes **23** and **24** with respect to each other.

The rotor 16 is shown in FIGURE 1 as having diametrically opposed facing generally semi-cylindrical arcuate recesses 29 therein which may be formed by drilling to form a bore open to opposite sides of the rotor. Generally semi-cylindrical sealing glands 27, 27 are mounted in the arcuate recesses 29, the space between said sealing glands forming a slot 30 for an associated sliding vane. The sealing glands 27, 27 not only serve to seal and form guides for the sliding vanes 23 and 24, but also seal a pumping chamber 31 of the pump extending between the exterior of the rotor 16 and the periphery of the wall 12.

The housing 11 is also provided with an intake port 32, shown in FIGURE 1 as being angularly spaced from the point where the rotor 16 has lapping engagement with the cylindrical wall 12 of the pumping chamber. An outlet port 32 leads from the pumping chamber 31 on the incoming side of the point where the rotor 16 laps the wall of said pumping chamber, and on the opposite side of a diametral line extending through the point of lap of the rotor with the pumping chamber, from the intake port 33.

Referring now in particular to certain novel features of the invention, in FIGURES 3 and 4 of the drawings we have shown a C-type spring 35 seated in facing recessed portions 36 of the sealing glands 27. One spring is provided at each end of the sealing glands. The springs 35 have sufficient force and so load the sealing glands 27, 27 that the centrifugal force of rotation of the rotor 16 will not at any time force the sealing glands against the vane and will distribute the load uniformly along the semi-cylindrical recesses 29 throughout the length of said sealing glands.

In FIGURES 1, 2, 5 and 6 we have shown sealing buttons 37 fitting in the semi-cylindrical recesses 29 and in the space between the sealing glands, to block any air leakage paths through the ends of the sealing glands.

While the buttons 37 are shown as supplementing the C-type springs 35, in many installations where the wear on the cylindrical surfaces of the sealing glands is slight, the sealing buttons can be used in place of the springs 35.

Each sealing button 37 has generally rectangular projections 39 projecting inwardly therefrom and fitting in the spaces between the sealing glands 27. The width of the projections 39 may be slightly greater than the space between the adjacent ends of the sealing glands 27, to space the sealing glands in the recessed portions 29, 29 so that the cylindrical surfaces of the sealing glands are in intimate contact with the recesses 29, 29.

The buttons 37 and projections 39 may be constructed of an elastic material producing the load on the sealing glands by compressing the projections 39, 39. The material may be rubber or one of the well known substitutes for rubber although it need not necessarily be such a material and the buttons may also be constructed from a relatively rigid material such as a plastic material or even metal.

In FIGURES 8, 9 and 10 we have shown variations in the spring means for separating the sealing glands, and the button for blocking up air leakage paths. In FIGURE 8, a button 40 is shown fitting in the recessed portions of the sealing glands and having a generally X-shaped protrusion or spring 41 extending inwardly therefrom having four legs 43 bearing against the plane surface of the sealing glands 27 on opposite sides of the axis of rotation thereof and thereby maintaining the sealing glands in uniform intimate contact with the recessed portions 29, 29.

In FIGURE 9 we have shown another modification of the invention in which a button 45 has a C-shaped spring 46 extending inwardly therefrom. The spring 46 has inturned facing end portions 47 bearing against one sealing gland 27 on opposite sides of the center thereof and also has a plane face 48 bearing against the opposite sealing gland and thereby forcing the two sealing glands into intimate contact with their semi-cylindrical recesses 29, 29.

In the form of the invention illustrated in FIGURE 10 a button 50 has a generally rectangular projection 51 extending inwardly therefrom. The projection 51 forms a mounting for a leaf spring 53 having opposite legs 54 extending therefrom to engage an adjacent sealing gland on opposite sides of its center of pivotal movement and force said sealing gland into intimate contact with the semi-cylindrical recess 29 and also to engage a surface 55 of the projection 51 opposite from the leaf spring 53 with the opposite sealing gland 27 and to exert a force on said sealing gland forcing said sealing gland into intimate contact with its cylindrical recess.

While the sealing buttons and springs as shown in FIGURES 8, 9 and 10 may be made of different materials, it should be understood that the buttons and springs may be made from the same material as single units, as well as from different materials.

In FIGURES 11 and 12 we have shown a sealing button 56 having a wedge shaped rib or protrusion 57 extending inwardly therefrom. The wedge shaped rib may fit between the sealing glands 27, 27 and as the centrifugal force acts on the button 56, the wedge forces the sealing glands apart and into intimate contact with the semi-cylindrical recesses 29, 29. It will be noted that in this form of the invention the diameter of the button 56 is less than the diameter of the bore forming the recesses 29, 29 to accommodate the rib and button to be moved outwardly by centrifugal force to wedge the sealing glands apart into intimate contact with the semi-cylindrical recesses 29, 29.

It may be seen from the foregoing that a simple means has been provided to spring load the sealing glands of a vane type pump, sealing the vanes to the eccentrically rotating rotor of the pump and that the seal is maintained and wear on the sealing glands is reduced by forcing the sealing glands apart into uniform contact with the semi-cylindrical surfaces of the recesses in the rotor containing the sealing glands, and by so loading the sealing glands that the centrifugal and friction force components will at all times maintain the flat surfaces of the sealing glands away from the vanes and maintain the sealing glands in uniform contact with the mating semicylindrical surfaces of the gland receiving recessed portions of the annular rotor of the pump.

While we have herein shown and described several forms in which the invention may be embodied, it should be understood that various other variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

We claim as our invention:

1. In a rotary vane pump, a housing having an interior cylindrical wall and parallel spaced end walls, an annular rotor journalled for rotation within said housing about an axis eccentric of the axial center thereof, a pair of vanes extending radially of the axial center of said housing and mounted for pivotal movement about said axis and having surface contact with said cylindrical wall, sealing glands pivotally mounted in said rotor and having facing flat faces forming slidable guides for said vanes, and means independent of said vanes exerting separating forces on said sealing glands and biasing the facing flat faces of said sealing glands outwardly with respect to said vanes and maintaining said sealing glands into intimate pivotal contact with said rotor.

2. In a rotary vane pump, a housing having an interior cylindrical wall and parallel spaced end walls, an annular rotor journalled for rotation within said housing eccentric at the center thereof, a pair of vanes extending radially of the central axis of said housing and mounted for pivotal movement about said axis, and having surface contact with said cylindrical wall, said rotor having facing semi-cylindrical recessed portions on opposite sides of said vanes, semi-cylindrical sealing glands carried in said recessed portions and having pivotal engagement therewith

and forming slidable guides for said vanes, and yieldable means engaging opposite ends of said sealing glands and exerting separating forces on said sealing glands, biasing said sealing glands outwardly with respect to said vanes and maintaining said sealing glands into intimate contact with said semi-cylindrical recessed portions of said rotor.

3. In a rotary vane pump, a housing having an interior cylindrical wall and parallel spaced end walls, an annular rotor journalled for rotation within said housing eccentric at the center thereof, a pair of vanes extending radially of the central axis of said housing and mounted for pivotal movement about said axis, and having surface contact with said cylindrical wall, said rotor having facing semi-cylindrical recessed portions on opposite sides of said vanes, semi-cylindrical sealing glands carried in said recessed portions and having pivotal engagement therewith and forming slidable guides for said vanes, and springs at opposite ends of said sealing glands loading said sealing glands into intimate contact with said semi-cylindrical recessed portions of said rotor.

4. A rotary vane pump in accordance with claim 3 wherein the springs are generally C-shaped and are recessed in opposite ends of said sealing glands.

5. A rotary vane pump in accordance with claim 3 wherein plugs cover said springs and close opposite end portions of said sealing glands.

6. A rotary vane pump in accordance with claim 3 wherein plugs extend within said recessed portions of said rotor and the springs are mounted on said plugs and exert separating forces on said sealing glands.

7. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said sliding vanes, and plugs recessed in opposite end portions of said rotor and having lugs extending inwardly therein exerting separating forces on said sealing glands and holding said sealing glands in uniformly spaced relation with respect to each other, and in intimate pivotal contact with said rotor.

8. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said sliding vanes, C-shaped springs recessed in opposite end portions of said sealing glands, and plugs closing opposite ends of said sealing glands and having inward projections fitting therebetween.

9. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said sliding vanes, plugs recessed in opposite end portions of said rotor and closing opposite ends of said sealing glands and having inwardly extending resilient projections exerting separating forces on said sealing glands.

10. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said sliding vanes, plugs recessed in opposite end portions of said rotor and closing opposite ends of said sealing glands, and having springs extending inwardly of the under sides thereof yieldably engaging the adjacent faces of opposite sealing glands and exerting separating forces thereon.

11. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said sliding vanes, wedges extending between said sealing glands at opposite ends thereof and having opposite wedging faces converging towards the outer periphery of said rotor and forcing said sealing glands apart and into intimate pivotal contact with said rotor as centrifugal force acts thereon.

12. In a sealing means and in combination with a rotary vane pump having an eccentrically mounted annular rotor and vanes slidably extending through said rotor, and pivotally and slidably moved by rotation of said rotor, sealing glands pivotally mounted in said rotor on opposite sides of said vanes, buttons at opposite ends of said sealing glands and recessed within said rotor and having wedge shaped protrusions extending inwardly therefrom engaging the adjacent faces of opposite sealing glands and converging towards the outer periphery of said rotor and exerting separating forces on said sealing glands as the centrifugal forces act on said buttons and wedges.

References Cited by the Examiner

UNITED STATES PATENTS

1,317,056	9/19	Waagbo	103—144
1,879,405	9/32	Moore	103—144
1,980,726	11/34	Higbee	230—157
2,245,498	6/41	Pringiers	103—144

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