June 12, 1934. C. A. PETERSON 1,962,152

METHOD OF FORMING SLOTS IN ROTORS OF ROTARY PUMPS

Filed Sept. 28, 1931 2 Sheets-Sheet 1

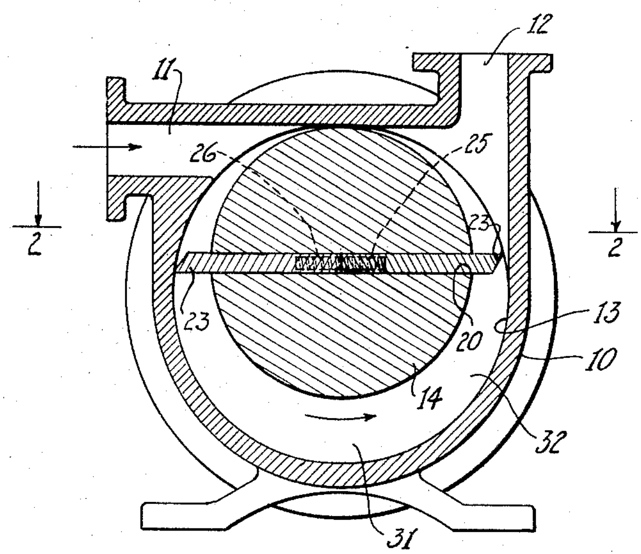

Fig. 1

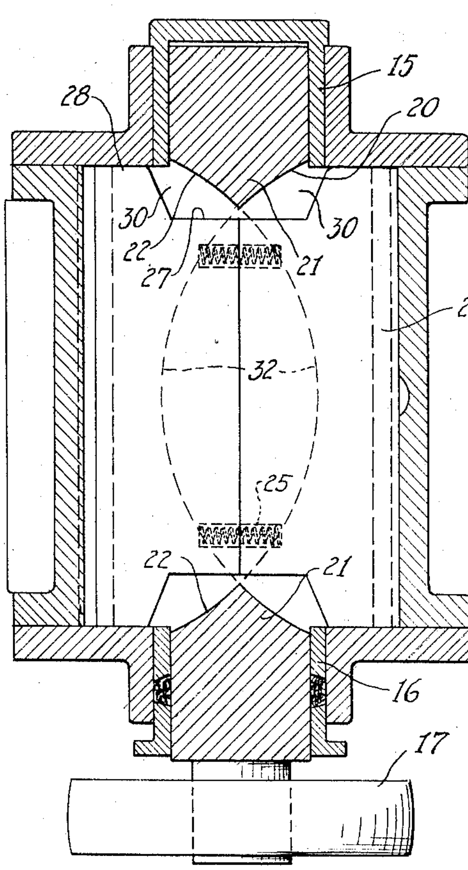

Fig. 2

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Filed Sept. 28, 1931 2 Sheets-Sheet 2

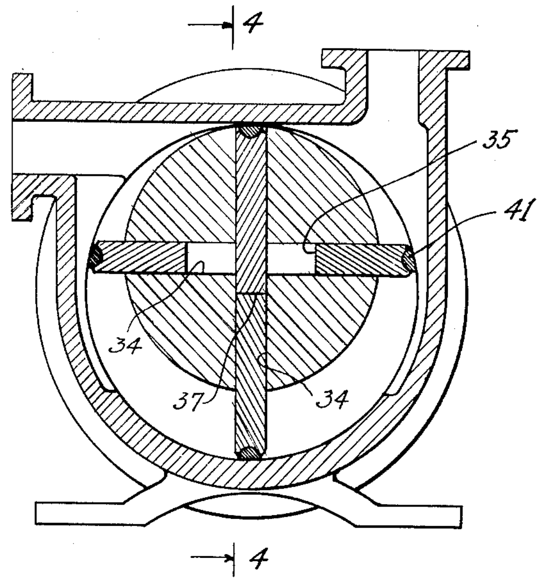


Fig. 3

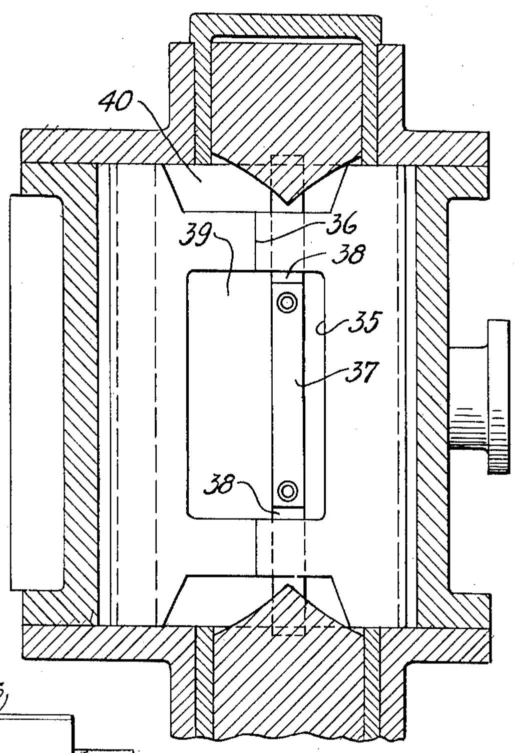
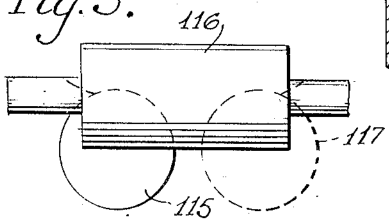


Fig. 4

Fig. 5.



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Patented June 12, 1934

1,962,152

UNITED STATES PATENT OFFICE

1,962,152

METHOD OF FORMING SLOTS IN ROTORS OF ROTARY PUMPS

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Application September 28, 1931, Serial No. 565,430

3 Claims. (Cl. 29—23.5)

This invention relates to rotary pumps and has for its object providing improvements in certain types of rotary pumps, so as to increase the efficiency of the pumps, and to otherwise improve the operation of the pumps, and to allow the application of a method in manufacturing the pumps which greatly decreases the expense of manufacturing.

Of the accompanying drawings, Fig. 1 is a vertical, transverse, sectional view of a pump which embodies the features of my invention; Fig. 2 is a longitudinal, sectional view thereof; Figs. 3 and 4 are corresponding views of a modified form of the pump; and Fig. 5 illustrates one method of machining the rotor.

It has been common to provide rotary pumps comprising a casing having an inner chamber with an eccentrically mounted rotor therein, the rotor having vanes or blades slidably mounted therein with the outer edges of the blades in sliding coaction with the surface of the bore. As the rotor rotates, the projecting blades force a liquid or a gas through pipes from a source of supply to the point where the fluid is to be used.

In pumps of this nature, the general arrangement of providing slots for the blades in the rotor has necessitated a large rotor diameter relative to the maximum projecting portion of the blade, which gives to the blade's center of mass and to its outer edge a high velocity relative to the pumping capacity, and, as a consequence, causes excessive wear and vibration.

The pump which I provide comprises a materially modified arrangement of the blades and slots for the blades, in order to decrease the wear and vibration and to increase the efficiency of the pump and to improve its operation otherwise, as well as to decrease materially the labor required to manufacture the same. My invention in part relates also to two-blade as well as to four-blade pumps. In either case, the arrangement is such as to allow an improved method of forming the slots which otherwise would be impractical.

The pump comprises a casing 10 which may be of any ordinary type, having a fluid inlet 11 and a fluid outlet 12 communicating with the bore 13. Positioned in the bore is a rotor 14, the ends of which are mounted in bearings 15 and 16. Any suitable means, such as the pulley 17, may be used for operating the rotor.

In this preferred form of the pump, the rotor is provided with a slot 20 which extends longitudinally through the rotor from adjacent one bearing to the other. The rotor, however, is provided with projecting portions 21 extending inwardly into the slot, so that the inner portions of the ends of the slots are formed substantially as indicated, so as to provide the slanting portions 22.

Mounted within the slot are two blade sections 23 which together form a blade reaching substantially from one surface of the bore to the other and passing through the axis of rotation of the rotor. In order to provide a bore surface which will allow the use of a split blade extending from one surface to the other and through the center of the axis of rotation for every angular position of the rotor, the bore is not made cylindrical, but it varies therefrom more or less to meet the needs in a manner, however, that is not a necessary part of this invention. When the bore is properly formed, the distance between the outer edges of the split blade will continue uniform as the blade rotates with its edges in contact with the bore. However, to provide for any departure from the exact curve of the bore required, or for any wear that may occur in the bore, and in order to insure snug contact between the edges of the blades and the surface of the bore, means are desirable for forcing the sections outwardly against the surface. Ordinarily, the means provided for this purpose comprises springs, and I have shown herein springs 25 which may be used, if desired, for this purpose, the springs being positioned in recesses 26 in the adjacent edges of the blades.

However, to assist in properly pressing the outer edges of the sections against the surface, I provide the portions 21 projecting into the slot 20, and the ends of the sections are cut away so as to leave the recesses 27 with the outer portions 28 extending to the outer ends of the bore of the casing.

In operation, the split blade, as the rotor rotates, is continually moving transversely of the rotor. The centrifugal force of the sections tends at all times to force the blades outwardly against the surface, so as to make a snug contact and prevent leakage of the fluid beyond the blade as it rotates from the inlet to the outlet. However, as stated above, a spring is at times used to assist. As the blade moves in the slot, the chambers 30 are filled with the fluid that is being operated on, usually a liquid, and this fluid must surge from one chamber to the adjacent chamber more or less as the rotor rotates. This surging is accomplished by the projection 28 being forced inwardly by the surface of the bore and, thus, driving the liquid from the adjacent chamber 30 to the opposite chamber. As a consequence of this, during the process, the liquid is continually pressing outwardly the blade which is moving inwardly and, thus, the blade section is held more snugly against the surface.

It will be seen that, when the blade section is in the position 31, it will, as it rotates, begin to be forced inwardly by the surface of the bore, and from that position until it reaches the outlet 12 this inward forcing will continue, so that, during this passage, the pressure against the surface will be increased by the action of the liquid in the adjacent chamber 30. And it is at this time that the greater pressure is required as the portion of the bore 31 in front of the moving blade is continually decreasing in width, and also the liquid is being forced outwardly through the smaller outlet 12. Also the stream of liquid flowing into the opposite chamber 30 against the outwardly moving projection 28 tends to press that section against the bore surface.

Also, by properly forming the slot in the rotor, the machining thereof is simplified. For instance, if the outer end of the slot is made straight from one side to the other, as has been done, it is necessary to use a suitable tool, such as a broach, for forming the ends of the slot, even though the greater portion thereof may be milled out, and this broaching increases materially the work required to form the slot. But, when the slots are formed as indicated, the entire slot may be formed by milling inwardly from the opposite sides of the rotor, the milling cutter being so formed as to pass entirely beyond the central portion of the rotor, as indicated by the dotted lines 32.

It will thus be seen that I have provided a rotor for a rotary pump which, if used with or without the springs 26, will provide a snug contact between the outer edges of the blade sections and the bore of the casing, and that the pressure of the edge against the surface will increase along the portions of the surface where greater pressure is desirable. Also the shape of the slots is such as to materially decrease the machining required.

While I have shown, in Figs. 1 and 2, a single split blade, yet, by properly forming the blades, two or more split blades may be used. This I have illustrated in Figs. 3 and 4. In this case, the blades are formed at the end substantially as is described with reference to Figs. 1 and 2, and the slots in which the blades play are formed substantially the same. However, there are two slots 34 and a split blade playing in each. Recesses 35 are formed in the inner edges of one pair of blade sections, thus providing projections 36 so as to bring the inner edges of these projecting portions in contact. The other pair of sections are provided with projecting portions 37 and recesses 38, so that the projecting portions 37 may come in contact and, at the same time, play freely in the chambers 39 formed by the recesses 35.

The action of the liquid, as it surges in the chambers 40 from one side to the other in the axis of the rotor, is substantially the same as hereinabove described. And also a somewhat similar action is produced by the surging of the liquid in the chambers 39.

It has been common to provide packings 41 on the outer edges of the blade sections, so as to assist in providing snug contact between the sections of the bore surface, and it is to be understood that these packings may be used with any of the modifications of my pump, as in other cases, although they are not a necessary part of my invention.

By the use of my invention, a larger sliding area is provided for the blades, as all of the slots extend through the rotor, so that there is less binding tendency and the rotor can be smaller and run at higher speeds. Also, pressing contact is continuously provided for between the outer edges of the blades and the surface of the casing bore. This is accomplished if desired without springs, it being understood that the springs are not a necessary part of my invention. And not only is there ample passageway for the liquid to surge from one side of the axis of rotation of the rotor to the other, but also the shape of the slots and blades is such as to provide the desired outward pressure on the blades.

Further, the forming of the slots is such as to allow them to be fully formed by passing a flat cylindrical cutter, successively, from opposite surfaces of the rotor and inwardly beyond the axis a sufficient distance without moving the cutter longitudinally at all. This leaves the projections 21 at each end of the slots, which materially strengthens the rotor.

The slot, however, may be formed by passing the milling cutter longitudinally, as well as transversely, so as to provide an elongated slot with a cutter of relatively small radius. In this event also, the projections 21 will be substantially the same as shown in the various figures. Fig. 5 illustrates the method of forming these slots. The cutter 115 is passed inwardly of the rotor 116 until of sufficient depth, such as is indicated, and it is then passed parallel with the axis to the position indicated by the dotted lines 117.

When the slots are formed by milling, with or without the longitudinal movement of the cutter, a narrower slot may be formed than is practical by broaching or by other means. The slot may be as narrow as may be desired, depending only on the width of the cutter. As a consequence, a narrower sliding blade can be used in the pump, thus decreasing the mass of the blades. The reduction in mass of the blades decreases the power required to operate, and decreases the wear and the noise and, in general, increases the efficiency of the pump. Also, with narrower blades, the edge of contact with the bore may be made sharper at the forward edge, as the angle formed by the forward surface of the blade and the tangent to the bore will be larger than with wider blades. This sharper edge increases the sealing effect by reducing the back pressure on the blade as this reduces the tendency of the fluid to press between the blade edge and the bore surface. The sharp forward edge also is more effective in removing foreign particles from the pump chamber.

I claim as my invention:

1. A method of forming slots for the sliding blades of rotors of rotary pumps consisting in passing a rotating disc-shaped cutting tool through the central portion of the periphery of the rotor, with the axis of the cutter at right angles to the axis of the rotor, in passing the cutter in this manner inwardly until the periphery thereof passes beyond the axis of the rotor; in then withdrawing the cutter and passing it through the periphery of the rotor beginning at a point diametrically opposite the point previously entered, and then again passing the cutter inwardly beyond the axis of the rotor.

2. A method of forming slots as claimed in

claim 1, and in then passing the cutter successively and inwardly in the same manner beginning at diametrically opposite points of the periphery, each point midway of the previously entered points.

3. A method of forming slots for the sliding blades of rotors of rotary pumps consisting in passing a flat circular rotating machine cutter into the body of the rotor, parallel with the axis of the rotor and adjacent one end thereof until the cutter passes beyond the axis of the rotor; in then passing the cutter parallel with said axis, to a point adjacent the other end of the rotor; and in then repeating the process beginning at a point diametrically opposite the previous point of beginning or ending.

CARL A. PETERSON.