March 4, 1941. J. F. JAWOROWSKI 2,233,534

ROTARY PUMP

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FIG. 1

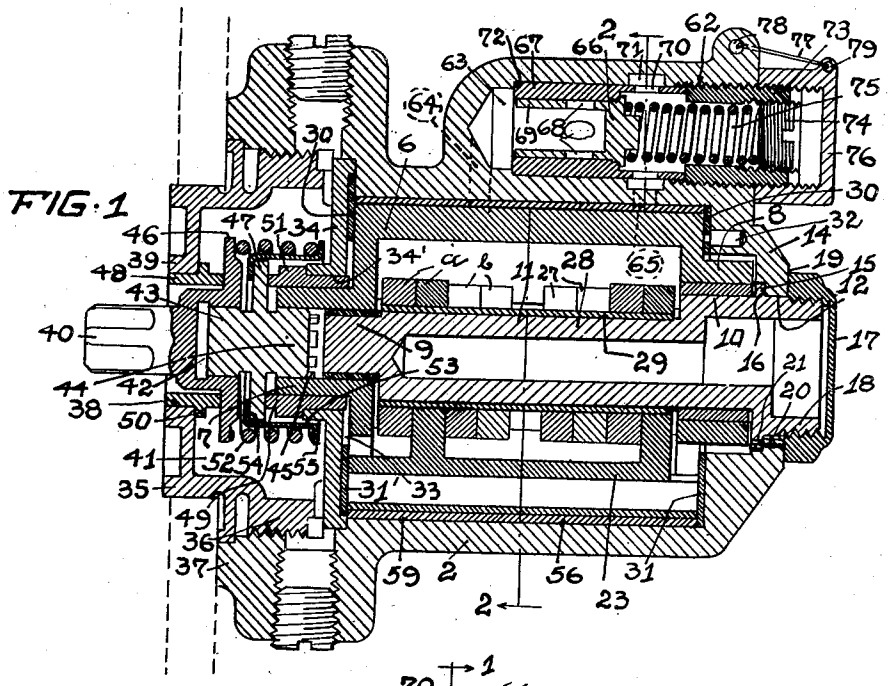
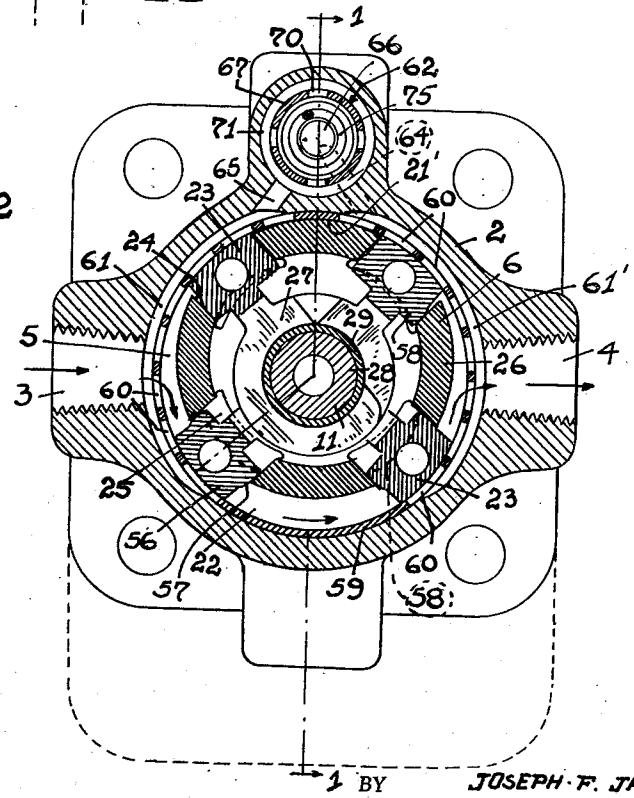


FIG. 2



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FIG. 3

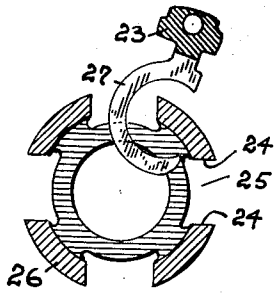


FIG. 4

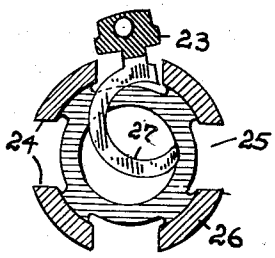


FIG. 5

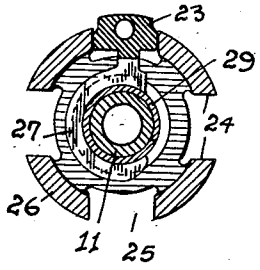


FIG. 6

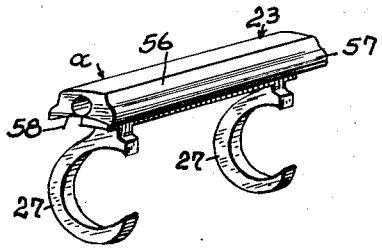


FIG. 7

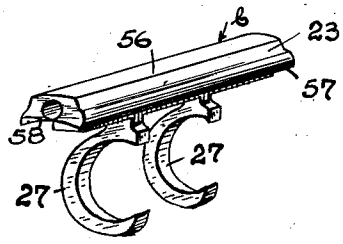
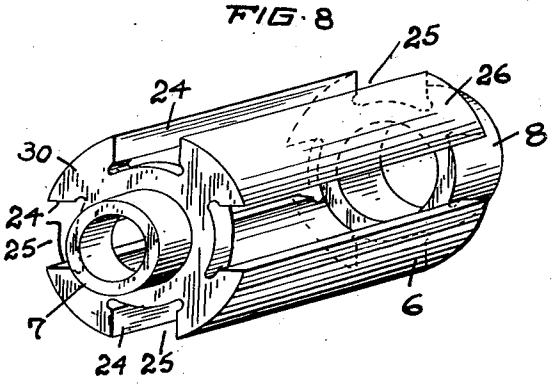


FIG. 8



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UNITED STATES PATENT OFFICE

2,233,534

ROTARY PUMP

Joseph F. Jaworowski, Cleveland, Ohio, assignor of one-fourth to Arthur H. Dettelbach and one-fourth to Sam W. Emerson, both of Cleveland, Ohio

Application August 26, 1938, Serial No. 226,946

5 Claims. (Cl. 103—144)

This invention relates in general to improvements in rotary engines, and more particularly to a pump comprising a cylindrical working chamber in which rotary, hinged piston blades in conjunction with an eccentric, slotted rotor are employed to draw through an inlet into the working chamber, propel such fluid through said chamber and discharge the fluid through an outlet arranged substantially opposite the said inlet.

The general object of the invention is to provide a simple and sturdy pump of the type referred to which can easily be assembled and disassembled and may be constructed at low cost.

In rotary pumps of the type referred to it is essential to mount the piston blades on pivots to permit of proper rocking and sliding action of the blades when carried around by eccentrically mounted rotor members. The mounting of piston blades should be made on sufficiently sized bearings to avoid excessive friction, wear and tear on blades rotated at high speed. It is furthermore essential that the rotor members are made integral and that their opposite ends are properly supported to avoid any and all vibration of said rotor members under excessive strain. These main requirements for rotary pumps are not attained in present day pump structures, which structures either include insufficient bearing portions for the blades or embody a split rotor to permit of blades with properly sized bearing portions being readily extended into and mounted in the hollow chamber of a rotor. Present day constructions are therefore rather unsatisfactory and the latter construction complicates manufacturing of rotors, increases weight and cost of said rotors and also weakens same.

It is another object of the present invention to provide piston blades with specifically shaped, properly sized bearing portions adapted to be readily and easily inserted through the relatively narrow slots in the wall of a rotor without the necessity of splitting said rotor.

With these and incidental objects in view, the invention furthermore consists in certain novel features of construction and combination of parts, the essential elements of which are set forth in the appended claims, and a preferred form of embodiment of the invention is hereinafter shown with reference to the drawings accompanying and forming a part of this specification.

In the drawings:

Fig. 1 is a longitudinal sectional view through a rotary pump embodying the invention, the section being taken on line 1—1 of Fig. 2.

Fig. 2 is a cross-sectional view through the rotary pump shown in Fig. 1, the section being taken on line 2—2 of Fig. 1.

Figs. 3 through 5 are successive diagrammatical views through the rotor of a pump, while one of the piston blades has its bearing portion inserted through one of the slots of the rotor; thus

Fig. 3 shows the bearing portion of a blade partly extended through one slot into the rotor,

Fig. 4 shows the bearing portion of a blade somewhat more extended through one slot into the rotor and the wing portion of the blade about to be inserted into said slot of the rotor, and

Fig. 5 shows the wing portion of the blade in proper working position and the bearing portion mounted upon a bearing sleeve in turn supported upon a stud shaft.

Fig. 6 is a perspective view of one of the reversible piston blades of the one group of blades, and

Fig. 7 is a perspective view of one of the reversible piston blades of the other group of blades.

Fig. 8 is a perspective view of the rotor without blades.

Referring now more specifically to the drawings in which like reference characters designate like parts throughout the several views, the pump comprises a substantially cylindrical, chambered, cast metal body 2, embodying oppositely arranged intake and discharge passages 3 and 4, which communicate with a cylindrical chamber 5 in body 2. This working chamber 5 has eccentrically mounted therein a slotted and chambered integral rotor member 6, the hub portions 7 and 8 of which are rotatably mounted on axially aligned eccentric bearing portions 9 and 10 of a stud shaft 11, which shaft extends through chamber 5 and a circular opening 12 in the front wall 14 of body 2 and is securely clamped to said wall by means of a circular flange 15, engaging the recessed inner face 16 of wall 14, and a cap-like nut member 17 screwed upon the threaded front end 18 of shaft 11 and engaging the outside face 19 of wall 14. A pin 20 in wall 14, fitting a bore 21 in flange 15, effects proper working position of shaft 11 and its eccentric bearing portions 9 and 10 in chamber 5.

The slotted integral rotor member 6, which, as stated above, has its hub portions 7 and 8 mounted on eccentric bearing portions 9 and 10 of stud shaft 11, engages at 21′ the inner face of the

wall of body 2 and forms with said wall a crescent shaped working chamber 22. This chamber is subdivided by four piston blades 23, slidably engaging the parallel side walls 24 of slots 25 in the wall 26 of rotor member 6. The piston blades 23 each embody two hook-shaped bearing portions 27 adapted to be sleeved upon and rotatably engage with the central circular portion 28 of stud shaft 11, which portion 28 is concentrically arranged with respect to chamber 5. Preferably, as shown, the portion 28 of stud shaft 11 has sleeved thereon a tubular bearing member 29 to decrease friction of bearing portion 27 when the blades are rotated with and by rotor member 6. The end faces 30 of rotor member 6 slidably contact with hardened ring-shaped face plates 31, 31', the front face plate 31 being secured to body 2 by means of a pin 32, and the rear face plate 31' being pressed into a recessed portion 33 of a flanged ring-shaped inner cover plate 34, encircling in spaced relation hub 7 of rotor member 6. This inner cover plate closes the rear open end of chamber 5 and is rigidly held in proper position by a flanged outer cover member 35, the circumferential flange 36 of which is extended into and threadedly engaged with the hollow internally threaded rear portion 37 of body 2, and contacts with the inner cover plate 34 thus forcibly holding same in proper position.

A bore 38 in the central portion 39 of cover member 35 permits of a drive member 40 being extended into the chamber 41, which chamber is between inner cover plate 34 and outer cover member 35. Drive member 40 has its inner end 42 centrally bored and internally chamfered to provide a female coupling member which has slidably extended thereinto one end of an externally chamfered male coupling member 43 in the form of a short shaft, the other end 44 of which member 43 is slidably extended into the chamfered bore 45 of inner hub portion 7 of rotor 6, so as to effect a direct coupling between the drive member 40 and rotor 6.

Male coupling member 43 and drive member 40 are utilized for fluid tightly sealing chamber 5 from chamber 41 and fluid tightly sealing the bore 38 in outer cover member 35 through which drive member 40 extends outwardly. For such purpose drive member 40 has its inner end circumferentially flanged as at 46 and male coupling member 43 is formed with a circumferential flange 47 between its opposite ends. Flanges 46 and 47 co-operate with stationary contact elements of bronze, that is, flange 46 co-operates with a stationary contact element 48, snugly fitted in the bore 38 of outer cover member 35, and flange 47 co-operates with the stationary contact element 49, snugly fitted in the flanged opening 34' of inner cover plate 34. Preferably, as shown, circumferential flanges 50 and 51 on the contact elements 48 and 49 effect proper working relation of the preferably hexagonally shaped free ends of the contact elements with respect to the flanges 46 and 47. The flanges 46 and 47 are also utilized to effect a yielding contact of these flanges with their respective contact elements. For such purpose there is arranged between said flanges a compression spring 52, which spring is seated with its one end against the circumferential recessed outer area of flange 46 and with its other end against a flanged tubular member 53, having an inner flange 54, engaging flange 47, and an outer flange 55, seating spring 52. By this arrangement flanges 46 and 47 are yieldingly forced toward their respective contact members, an action, which will readily be permitted as male member 43 is axially shiftably engaged with drive member 40 and hub portion 7 of rotor 6.

The hook-shaped form of the bearing portion 27 on blades 23 permits of these portions being readily and easily inserted into the slots of the rotor, when the blades are tilted in the manner disclosed in Figs. 3 to 5 of the drawings. There are two bearing portions on each blade and these portions are arranged so that the blades can readily be used in reversed position and that a rotor with four blades can be readily assembled from two sets of blades, *a* and *b*, blades of set *a* having their bearing portions arranged in their end zones and blades of the set *b* having their bearing portions arranged more closely to the central portion of the blades, as readily will be seen from an inspection of Figs. 1, 6 and 7. Each of the blades includes a wing portion 56, which extends over the entire length of working chamber 5 and is formed with curved side portions 57 to effect proper sealing of the said wing portions against the side walls 24 of slots 25, when said wing portions oscillate with respect to the rotor due to their rotation around an axis eccentrically arranged with respect to the axis of the rotor. The opposite ends of the wing portions 56 are cut away on curved lines as at 58 to permit of free oscillation of said wing portions with respect to the rotor without interference with hub portion 8.

When the pump is operated by rotation of drive member 40, fluid is drawn through inlet passage 3 into working chamber 5 and discharged therefrom through outlet passage 4. The working chamber 5 is preferably lined with a cylindrical sleeve member 59, having perforations or slots 60 opposite the inlet and outlet passages 3 and 4. In addition, working chamber 5 is provided with recesses 61, 61' to effect a more continuous flow of fluid into and out of the working chamber during the entire intake and discharge stroke of the pump.

It is desirable to keep the discharged fluid under constant pressure in order to discharge a constant volume of fluid when the pump is rotated at constant speed. This desideratum is attained by by-passing part of the pump fluid when its pressure raises over and above a predetermined rate. Such by-passing of excessive pumped fluid at excessive pressures is controlled by a by-pass valve unit 62 mounted in a valve chamber 63 of body 2 just above the line of contact between rotor 6 and sleeve member 60 in chamber 5, which valve chamber communicates with the intake and with the discharge side of the pump by passages 64, 65 respectively. Valve unit 62, which is arranged in valve chamber 63 between passages 64 and 65, embodies a spring pressed, pressure actuated sleeve valve member 66, mounted in a tubular valve housing 67. This sleeve valve member is provided with a plurality of perforations 68, arranged in the sleeve portion 69 of said member, which perforations in predetermined position of said sleeve member permit of fluid, which has entered from the pressure side of chamber 5 through passage 64 into chamber 63, to be fed back into the suction side of chamber 5 by means of perforations 70 in the tubular housing 67, a circular recess 71 in chamber 63 and passage 64. The valve housing, preferably a screw-machined body, is tightly held upon its seat 72 by means of an outwardly threaded tubu-

lar screw member 73, threadedly engaged with the threaded inner wall of chamber 63. The tubular member 73 is provided with inner threads for a screw threaded adjusting member 74, adapted to tension a spring 75, seated against valve member 66 and said adjusting member, thus permitting proper control of the pressure at which valve member 66 opens sufficiently to permit of excessive fluid being bypassed in the manner previously described. A cap 76 threaded upon the extended end of the tubular member 73 seals the front end of the by-pass valve arrangement and may be interlocked with body 2 by a sealing wire 77 locked in perforated ear portions 78, 79 on body 2 and cap 76 respectively.

Having thus described my invention, what I claim is:

1. A rotary pump comprising a chambered housing having a cylindrical working chamber with intake and outlet passages, an integral, chambered rotor within said working chamber embodying a peripheral, longitudinally slotted wall and supporting end walls enclosing the chamber in said rotor, a shaft of substantial cross section in said housing extended through said rotor and mounting same rotatably on its supporting end walls in eccentrical relationship with respect to said working chamber, said shaft including a portion axially aligned with said working chamber, and rotor blades slidably extended through said slots in said rotor into its chamber and pivotally mounted on the said portion of said shaft for concentric rotation in said working chamber, said blades being formed with hook-shaped split bearings larger in diameter than the width of said slots, and said hook-shaped split bearings being proportioned in their wall thickness and shape relative to the width of the rotor slots for extension by tilting through said slots into said rotor chamber.

2. In a rotary pump an integral chambered rotor embodying a longitudinally slotted, peripheral wall and supporting end walls enclosing the rotor chamber, blades slidably extended through the slots in said peripheral wall into said rotor chamber, and shaft means of substantial cross section extended through said rotor and rotatably mounting said rotor and blades in eccentric relationship with respect to each other, said blades being formed with bearings larger in diameter than the width of the rotor slots, and said bearings being partly cut away and proportioned in wall thickness and shape relative to the width of the rotor slots for extension by tilting through said slots into said rotor chamber.

3. In a rotary pump an integral, chambered rotor embodying a longitudinally slotted, peripheral wall and supporting end walls with hub portions enclosing the rotor chamber, blades slidably extended through the rotor slots into its rotor chamber, and shaft means of substantial cross section formed with eccentric portions, said shaft means being extended through said rotor and rotatably mounting said rotor and said blades in eccentric relationship with respect to each other, said blades being formed at their inner ends with bearings larger in diameter than the width of said rotor slots, and said bearings being partly cut away and proportioned in wall thickness and shape relative to the width of the rotor slots for extension by tilting through said slots into said rotor chamber.

4. In a rotary pump an integral, chambered rotor embodying a longitudinally slotted, peripheral wall and supporting end walls with hub portions enclosing the rotor chamber, reversible rotor blades slidably extended through the rotor slots into its rotor chamber, and stud shaft means of substantial cross section extended through said rotor for rotatably mounting same on its hub portion, said stud shaft means including an eccentric portion arranged within said rotor chamber, said rotor blades being formed at their inner ends with bearing portions fitting said eccentric portion, and said bearing portions being larger in diameter than the width of said rotor slots and partly cut away and proportioned in wall thickness and shape relative to the width of the rotor slots for extension by tilting through said slots into said rotor chamber.

5. In a rotary pump having an integral chambered, longitudinally slotted rotor with bearing supporting end walls, a shaft extended through said chambered rotor for rotatably supporting same on its end walls, rotor blades slidably arranged in the slots of said rotor, and bearing means integrally extended from the inner ends of said blades and pivotally connected with said shaft in said chambered rotor, said bearing means being larger in diameter than the width of the slots in said rotor and partly cut away and proportioned in wall thickness and shape relative to the width of the rotor slots for extension by tilting through said slots into said chambered rotor.

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