Oct. 24, 1944. W. R. HAMMOND 2,360,833

ROTARY PUMP

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FIG. 1.

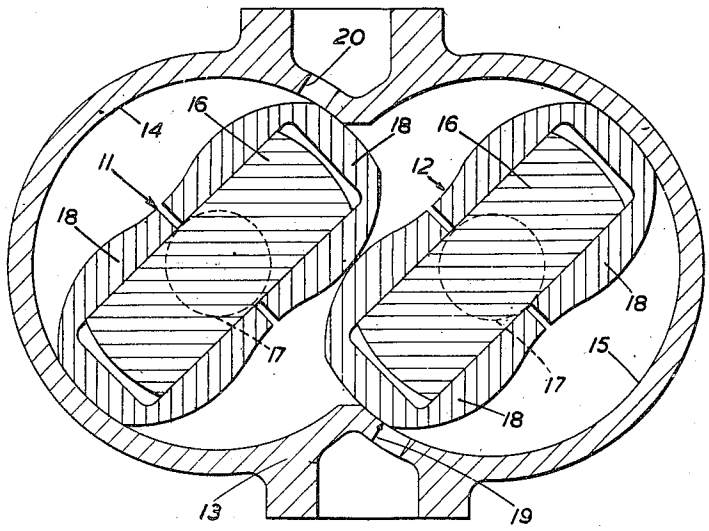
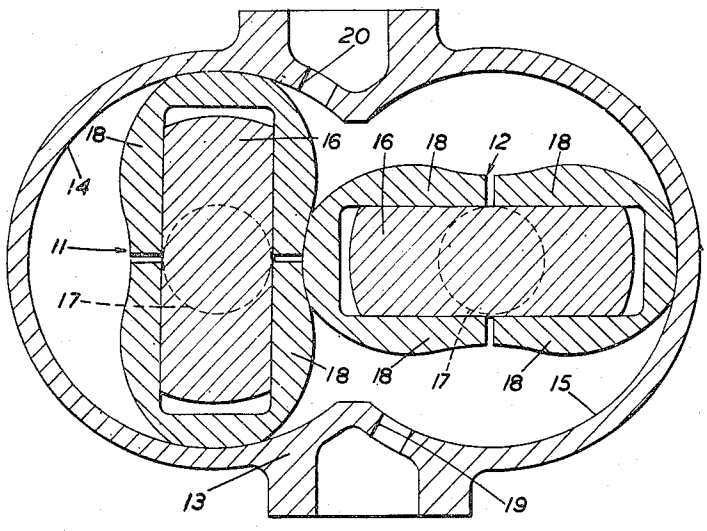


FIG. 2.



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ROTARY PUMP

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3 Claims. (Cl. 103—126)

This invention relates to rotary pumps, and is particularly applicable to such pumps as have rotors in the form of rotary pistons or impellers each comprising two or more radial lobes or other vanes.

The primary object of the invention is to provide an improved rotary piston or impeller (hereinafter termed the rotor) having novel means for ensuring leakage-proof co-operation between the extremities of the lobes or vanes of the rotor and the intreior surface of the casing within which the rotor rotates, or between those extremities and a coacting rotor, leakage between these co-operating parts due to wear or faulty fitting being prevented without the need for the provision of resilient packing or other auxiliary sealing means at the extremities of the lobes or vanes.

In a rotary pump according to the invention, the lobe or other vane of a pumping rotor has its outer extremity formed as a sliding member so arranged in relation to the rotor shaft that when the rotor is rotated the said extremity tends to slide radially outwards under the influence of centrifugal force, being thus caused to press either upon the inner surface of part of the pump casing or upon the surface of another pumping rotor, and thus to maintain between itself and the other surface the requisite leakage-proof contact, the said sliding member being of substantially U-shaped cross-section having two opposite inside plane surfaces parallel one to the other, which surfaces are adapted to slide to and fro radially upon two corresponding parallel surfaces associated with the rotor shaft.

A rotor may conveniently be so formed that the said lobe or other vane is duplicated, one such lobe being arranged on each of two diamertically opposite sides of the rotor shaft, the outer extremity of each lobe being formed as a sliding member, so that the two sliding members tend during the rotor's rotation to move radially outwards in opposite directions.

Other features of the invention will be particularly described hereinafter, and set forth in the appended claims.

In order that the invention may be clearly understood and readily carried into effect, one embodiment of it will now be fully described with reference to the accompanying drawing, in which—

Figure 1 represents in sectional elevation more or less diagrammatically a rotary pump containing two rotors shown as at a certain stage in their rotary movement relative one to the other; and

Figure 2 represents the same, but shows the said two rotors as at a different stage in their movement.

In the pump here shown, two rotors indicated generally by the reference numerals 11 and 12 are housed within a casing 13. Viewed in cross-section as illustrated, the interior surface of the casing 13 with which the rotors 11 and 12 make contact appears substantially as two part-circles juxtaposed and joined, a part-circular surface 14 being juxtaposed beside a part-circular surface 15, the cavity bounded by one of these surfaces being arranged to open into the cavity bounded by the other surface so that these two cavities combine to form one larger cavity in which the rotors 11 and 12 are adapted to coact. Thus the casing 13 is formed generally as two juxtaposed part-cylinders opening laterally one into the other. The rotors 11, 12 are formed generally as two composite beams disposed longitudinally parallel with the casing 13, the rotor 11 being axially concentric with the part-circular surface 14, and the rotor 12 axially concentric with the part-circular surface 15.

In each of the rotors 11, 12 the basic element is what may be termed a rotor block 16 of substantially rectangular oblong cross-section rotatably supported upon a pair of cylindrical journals 17 which are concentric with the axis of the rotor block 16 and which in turn are supported in normal manner in bearings (not shown) contained in the end cover or end covers of the casing 13. This construction 16, 17 may be regarded as a rotor shaft which for part of its length is flattened and enlarged to substantially rectangular oblong cross-section.

As an alternative to such a construction, in which the journals 17 constitute the equivalent of a driving shaft, a continuous cylindrical driving shaft may be used, each rotor block 16 being suitably bored longitudinally and centrally to receive such a rotor shaft.

It may be advantageous to arrange that the rotor block 16 is hollowed to reduce its weight.

In combination with each rotor block 16 two sliding members 18 are provided, each being of substantially U-shaped cross-section, somewhat like a channel beam, and of a length equal to the length of the rotor block 16. The inner surfaces of the two sides of each U-shaped sliding member 18 are parallel, and adapted to make sliding contact simultaneously with the two larger parallel sides of the rotor block 16, so that the sliding members 18 are adapted to slide radially to and fro.

With this arrangement, it will be obvious that if the rotor block 16 is rotated, both of the sliding members 13 that are in combination therewith will tend during this rotation to move radially outwards in opposite directions.

In the operation of the pump, the rotors 11 and 12 have to rotate in opposite directions. It is, of course, easy to obtain such rotation: for example by arranging that the ends of both rotor shafts 17 project beyond one end of the casing 13 and each is fitted with a suitable spur-wheel, the two spur-wheels being arranged to engage with one another, that is to say being in mesh, and one rotor shaft 17 being suitably driven at its opposite end. The rotors 11, 12 are thus driven simultaneously in opposite directions. Instead of spur-wheels, other suitable gearing may be employed.

The two rotors 11, 12 are so formed that if they are suitably disposed relatively one to the other and are driven in opposite directions, their peripheral surfaces remain in contact for the whole or substantially the whole of their cycles of movement. Such a formation may be achieved by using rotors with sliding members whose conformation is such that in cross-section they appear substantially as gear-teeth, as shown in the drawing.

It is unnecessary to describe or illustrate the whole of the construction of the pump, which construction is largely in accordance with known practice. Mention is here made, however, of the fact that it is found convenient to use, in combination with the invention, lubricating arrangements that facilitate two-directional running, allowing for reversal of direction of the rotors by reversal of direction of the main drive of the pump. Thus two oil delivery ports may be provided, each being located either in the pump casing or in an end cover, one on the suction side and one on the pressure side. The two oil delivery ports may be joined by a connecting pipe with which an oil feed pipe makes a T junction. At each oil delivery port a ball or other suitable valve may be provided at the point of exit from the said connecting pipe, the arrangement being such that when the pump is driven in one direction the valve on the suction side is opened to admit oil to the pump and the valve on the pressure side is closed, whilst if the drive is reversed the valve just mentioned (now on the pressure side) is closed and the other (now on the suction side) is opened to admit oil to the pump.

The suction and delivery ports for the medium that is being pumped may be arranged either in the cylindrical periphery of the pump or in the end covers. In the example illustrated two ports 19, 20 are provided, traversing the pump casing 13, each of these orifices serving alternatively as a suction port or a delivery port in accordance with the direction of rotation of the rotors 11, 12.

Pumps made in accordance with the invention are applicable for use as vacuum pumps, as air compressors, or as pumps for oil, water or other fluids; and they can be made exceptionally small and light for the pumping capacities obtainable.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a rotary pump having a casing with an inner wall surface curved in transverse cross-section and inlet and outlet ports, a rotor shaft in said casing, and a vane on said rotor shaft, said rotor shaft having a rectangular portion in cross-section defining an opposed pair of substantially parallel surfaces thereon extending substantially throughout its rectangular portion, said vane being substantially U-shaped in cross-section and having two opposite inside plane surfaces substantially parallel with each other and with the parallel surfaces on the rotor shaft, said inside plane surfaces being adapted to slide radially upon the parallel surfaces on the rotor shaft under the influence of centrifugal force when the shaft is rotated whereby to engage the outer end of the vane against the inner wall surface of the casing, said sliding movement of said vane being unrestricted to insure a tight fitting engagement between the outer end of the vane against the inner wall surface of the casing.

2. In a rotary pump having a casing with an inner wall surface curved in transverse cross-section and inlet and outlet ports, a rotor shaft in said casing, a rotor block on said rotor shaft rotating with said rotor, said rotor block being of substantially rectangular oblong cross-section and having its two larger surfaces substantially parallel throughout their length, and a vane on said rotor, said vane being substantially U-shaped in cross-section and having two opposite inside plane surfaces substantially parallel with each other and with the parallel surfaces on the member, said inside plane surfaces being adapted to slide radially upon the parallel surfaces on the member under the influence of centrifugal force when the member is rotated with the rotor shaft whereby to engage the outer end of the vane against the inner wall surface of the casing, said sliding movement of said vane being unrestricted to the extent of insuring a tight fitting engagement between the outer end of said vane against the inner wall surface of said casing.

3. In the combination claimed in claim 1, a second vane substantially similar to the first and slidably mounted on said rotor block so that the end thereof extends radially opposite the end of the first-mentioned vane.

4. In a rotary pump, a casing having a pair of inner wall surfaces forming two portions having their axes parallel to one another and, in cross section, defining parts of intersecting circles, said casing having inlet and outlet ports, a rotor shaft mounted axially in each portion, each shaft having a rotor block, said rotor blocks having an opposed pair of substantially parallel surfaces thereon extending substantially throughout the length of said blocks, and a vane for each rotor block, each of said vanes being substantially U-shaped in cross section and having two opposite inside plane surfaces substantially parallel with each other and with the parallel surfaces on the respective rotor blocks, said inside plane surfaces being adapted to slide radially on the respective rotor blocks under the influence of centrifugal force when the shafts are rotated whereby to engage the ends of the vanes against the inner wall surfaces of the respective portions, said sliding movement of each of said vanes being unrestricted to insure tight fitting engagements between the outer end of said vanes against the inner wall surfaces of said casing.

5. In a rotary pump, a casing having a pair of inner wall surfaces forming two portions having their axes parallel to one another and, in cross-section, defining parts of intersecting circles, said casing having inlet and outlet ports, a rotor shaft mounted axially in each portion

each shaft having a portion of substantially rectangular oblong cross-section, said portion having its two larger side surfaces parallel substantially throughout their length, a pair of oppositely extending substantially U-shaped vanes slidably mounted on each rotor, each of said vanes having two opposite inside plane surfaces substantially parallel with each other and with the parallel surfaces on the respective rotor shaft, said vanes being adapted to slide radially outward on the rotor shafts when the shafts are rotated whereby the ends of the vanes engage against the inner wall surfaces of the respective portions, said sliding movement of each of said vanes being unrestricted to insure tight fitting engagement between the outer end of said vanes against the inner wall surfaces of said casing.

6. The combination claimed in claim 5, each U-shaped vane constituting in cross-section a bight portion and leg portions and in which the opposite inside surfaces are on the legs; the outer leg surfaces being reentrant whereby the combined oppositely directed vanes on one rotor shaft form concave intermediate portions for cooperating with the vanes on the other rotor shaft.

7. The combination claimed in claim 5, the outer surface of each U-shaped vane constituting, in cross-section, a convexly curved bight portion and reentrant leg portions whereby the combined oppositely directed vanes on one rotor shaft form concave intermediate portions for cooperating with the bight portion on the other rotor shaft, said vanes being so dimensioned and arranged that the peripheral surfaces of the vanes on one rotor shaft remain in contact with those on the other shaft for the major parts of their cycles of movement.

8. A rotary pump according to claim 1, in which the said rotor shaft, for part of its length, is flattened so as to be of substantially rctangular oblong cross-section having its two larger side surfaces parallel, upon which surfaces the said inside plane parallel surfaces of the said vane are adapted to slide.

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