

May 29, 1928.

1,671,399

F. E. BRADY, JR

ROTARY PUMP

Filed April 6, 1925

3 Sheets-Sheet 1

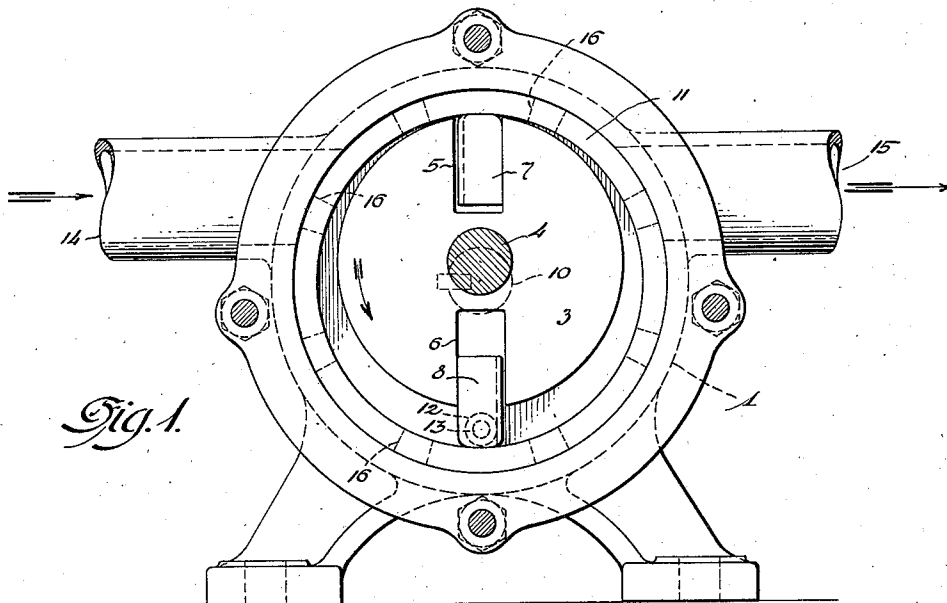


Fig. 1.

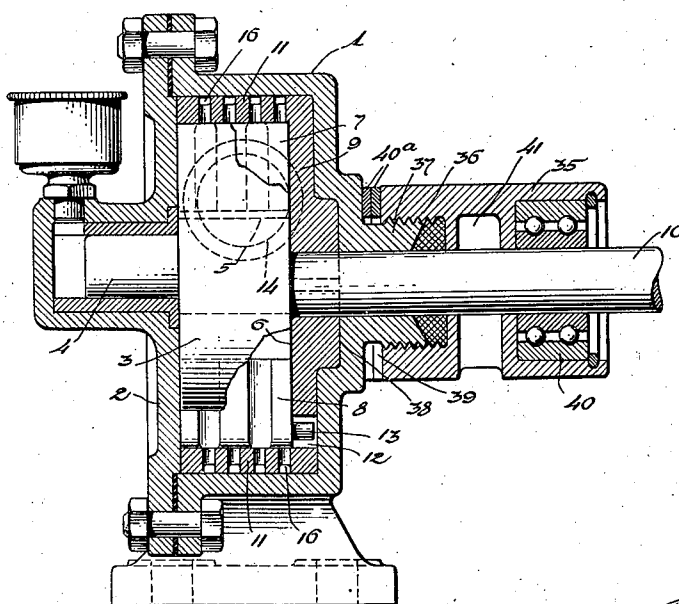


Fig. 2.

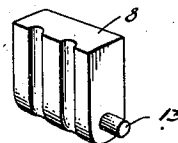


Fig. 3.

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3 Sheets-Sheet 2

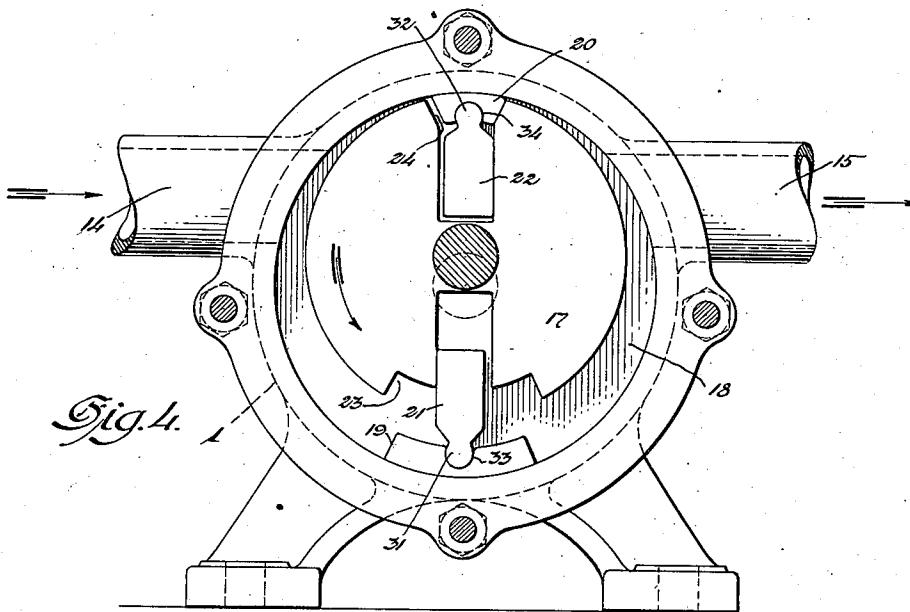


Fig. 4.

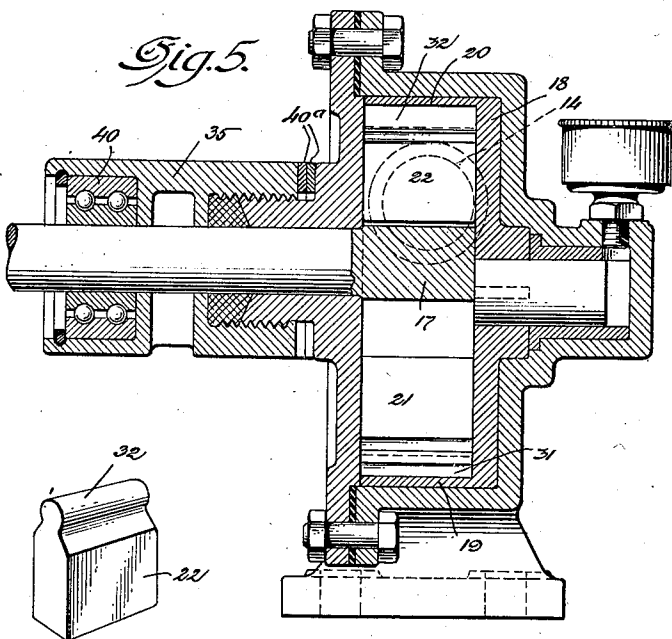


Fig. 5.

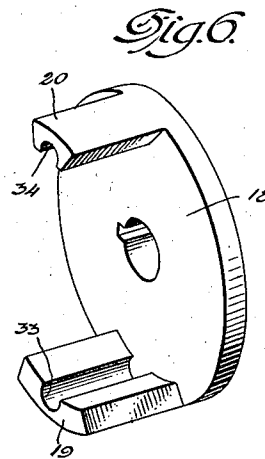


Fig. 6.

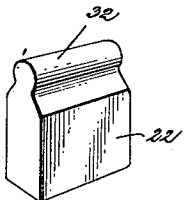


Fig. 7.

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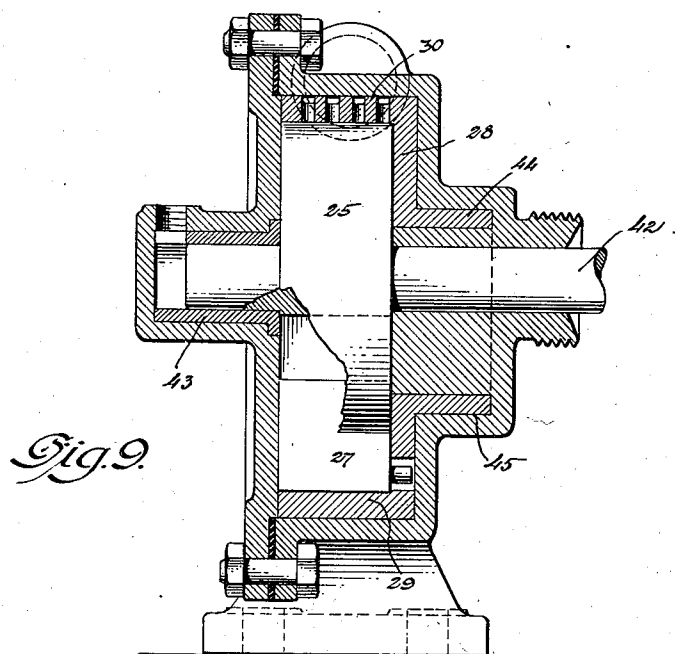
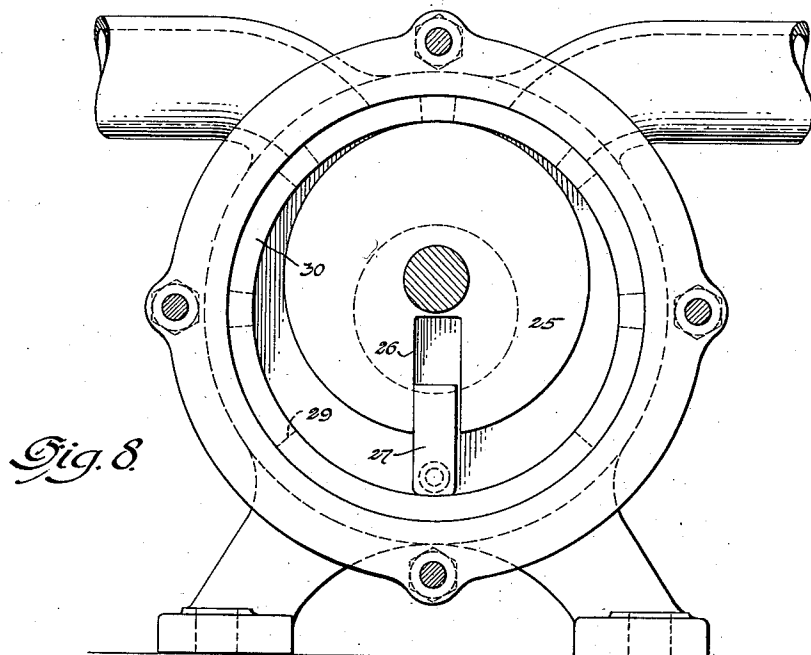
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ROTARY PUMP

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE.

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ROTARY PUMP.

Application filed April 6, 1925. Serial No. 21,001.

This invention relates to rotary pumps of the type wherein a drum rotates within a casing on an axis eccentric thereto and is provided with one or more radially movable wings which serve to divide the crescent shaped space between the drum and the casing into suction and pressure compartments in a manner well known in the art to which this invention appertains.

Such devices are quite effective under suitable conditions of operation, but have the drawback that the friction between the outer ends of the wings and the peripheral wall of the casing offsets to some extent their efficiency. This is especially the case when the pumps are operated at high speeds, due to the fact that the centrifugal force acting on the said wings results in a pressure thereof against the peripheral walls of the casing which pressure increases by the square of the speed. It will therefore be apparent that very definite limitations are placed upon the speed at which such a pump may be operated, and particularly at which it may be operated with any degree of efficiency.

The arrangement however is a simple one and lends itself to use in small pumps where size and simplicity of construction are important factors to be considered, and this type would no doubt be much more universally adopted for small pumps were it not for the fact that to secure appreciable capacity and head it is necessary to operate them at more or less high speeds and the disadvantages pointed out are then met with.

By my present invention I propose to overcome the aforesaid objectionable features to an extent which will render pumps of this type capable of operation at high speeds and therefore applicable for use as high speed rotary pumps, such as in effecting the circulation of cooling liquids in connection with automobiles and similar constructions where compactness, light weight, substantial capacity, and positive action are desirable.

The invention further aims to practically eliminate the setting up of friction in such pumps by the centrifugal action of the wings, by interposing between the outer edges of the wings and the peripheral wall of the casing stops or abutments rotatable

with the wings within the casing and against which the said wings radially bear when in operation.

The invention further contemplates the incorporation in a rotary pump of the said type of a member rotatable with the eccentric drum but on an axis concentric with the casing, said member being provided with abutments extending transversely of the casing and in radial alignment with the said wings, whereby the said wings are prevented at all times from coming into contact with the peripheral wall of the said casing.

Still further objects are to eliminate the necessity of utilizing springs or resilient means for effecting the outward radial movement of the wings, and to ensure the rotation of the abutment carrying rotary members therewith.

The invention still further aims to provide a form of outboard bearing which may be attached directly to that part of the casing of the pump through which the spindle extends and in which the bearing proper is substantially isolated from the stuffing box, so that any water which may leak past the packing of the stuffing box will not become intermingled with oil in the bearing and reduce its lubricating qualities; the arrangement further having the feature that it includes a combination bearing and stuffing box gland with the bearing isolated from the stuffing box and wherein provision is made of adjustment of the stuffing box gland and the maintenance of correct alignment in the bearing.

Furthermore, the device may be readily and cheaply produced by screw machine methods, thus eliminating the costly procedure usually called for in outboard bearings, where the casing of the pump is required to be especially set up for the machining of such bearings.

Still further objects subsidiary to or resulting from the aforesaid objects, or from the construction or operation of the invention as it may be carried into effect, will become apparent as the said invention is hereinafter further disclosed.

In carrying the invention into effect I may provide a casing and a rotor eccentrically mounted therein and having one or more radially movable wings, these ele-

ments being similar to those well known in the art to which this invention appertains, except that the eccentric rotor is not necessarily positioned directly against the peripheral wall of the casing as is usual and the radial wings thereof do not contact with the said peripheral wall, the pump being provided with an additional member rotatable with the said rotor but on a common axis with the casing and having walls or abutments against which the outer ends of the said wings are seated, so that, as the pump is operated, the said abutments prevent contact between the outer ends of the wings and the inner peripheral wall of the casing but at the same time cooperate with the said wings in effectively providing separation of the intake and discharge compartments of the pump.

Suitable means are provided for ensuring the proper synchronizing of the rotation of the rotor and the auxiliary member referred to. A preferred form of bearing for the shaft of the rotor and for the shaft of the auxiliary member, comprises a stuffing box cap or gland substantially extended to house a bearing proper at the outer end thereof and provided with an orifice intermediate of its length which isolates the stuffing box portion from the bearing portion of the device so that, when in use, any leakage of fluid past the stuffing box may readily escape through the opening instead of passing along the shaft to the bearing proper. To ensure proper alignment of the bearing and at the same time admit of adjustment of the stuffing box true shims are interposed between the casing and the inner end of the device so that engagement of the said inner end with said shims will ensure the member being held in true alignment, it being understood that the surface of the casing against which the shims rest is truly machined with that object in view.

All of which is more particularly described and ascertained hereinafter, by way of example, having reference to the accompanying drawings, wherein:—

Figure 1 is an elevation of a rotary pump embodying my invention, the cover plate being removed;

Figure 2 is a transverse vertical section of the same, the rotor being shown partly broken away in sections;

Figure 3 is a detail perspective view of one of the radial wings;

Figure 4 is a similar view to Figure 1 of a modified form of the pump;

Figure 5 is a transverse section of the same;

Figure 6 is a detail perspective view of the rotary disk;

Figure 7 is a detail perspective view of one of the radial wings of the modified form;

Figure 8 is a similar view to Figures 1 and 4 of a further modified construction; and

Figure 9 is a fragmentary transverse section of such further modified form of pump.

Similar characters of reference indicate similar parts in the several figures of the drawings.

Referring first to Figures 1 to 3, 1 is the casing of the pump which includes the cover plate 2, and 3 is a rotor the shaft 4 of which extends through the cover plate of the casing. The said rotor is radially slotted at 5 and 6 and provided with radially movable wings 7 and 8, the axis of the said rotor being eccentric to the axle of the casing as is usual in these types of pumps.

Ordinarily the rotor is located so that it is contiguous to one point of the inner peripheral wall of the casing and the outer ends of the wings bear against and travel around the said inner peripheral wall, which at low speeds is a more or less satisfactory arrangement, but as the speed is increased, the centrifugal force acting on the radial wings increases by the square of the speed, so that at high speeds the pressure of the said wings on the said peripheral wall may be considerable. Consequently the resultant friction between the said wings and the said peripheral wall may absorb power to such an extent as to render the operation of the device at high speeds absolutely impracticable.

By my invention I avoid these conditions in a very simple manner. It will be noted that an auxiliary rotor disk or plate 9 is housed in the casing and is provided with a shaft 10 coaxial therewith and extended therefrom, this rotor disk being of the internal diameter of the said casing and having an annular wall 11 concentric with the peripheral wall of the said casing whereby it forms a rotatable lining therewithin. Incidentally the said annular wall forms an abutment for the outer ends of the wings 7 and 8, and the rotor 3 is eccentrically positioned against the inner surface of the said annular wall.

The said disk is provided with a recess 12 into which a pin or projection 13 on one of the wings extends so that positive rotation of the rotor 3 may be effected by the rotation of the disk 9, or vice-versa, according to which of the shafts, 4 or 10, is used as a driving shaft. It is preferred to operate the pump through the shaft 10 of the auxiliary rotor.

14 and 15 are inlet and outlet passages of the pump, and to admit of their communication with the interior thereof the annular wall 11 of the auxiliary rotor is provided with perforations 16 through which liquid may pass in entering or leaving the pump.

It will be apparent that, as the wings 7

and 8 rotate with the annular wall and not with respect thereto when the pump is in operation, the question of friction between the wings and the wall with which they engage does not enter into the operation of the improved device, and such friction as may occur between the periphery of the annular wall and the inner surface of the peripheral wall of the casing is practically a constant factor and may be reduced to a minimum by the proper mounting and proportioning of the parts. In any case, it is not influenced by centrifugal force in the manner which obtains in the ordinary type of rotary pump hereinbefore referred to.

Of course, a perforated annular wall as shown in the said Figures 1 and 2 imposes certain restrictions on the capacity of the pump due to the fact that the fluid must pass through these perforations to enter and leave the pump, so that to meet such conditions I may utilize the form illustrated in Figures 4 and 5 wherein I arrange the rotor 17 in peripheral abutment with the inner peripheral wall of the casing instead of utilizing a complete annular wall. On the rotary disk 18 of this arrangement I simply use segments 19 and 20 of such wall, which segments form abutments against which the wings 21 and 22 of the rotor impinge. The said rotor is provided with peripheral recesses 23 and 24 which receive the segments 19 and 20 as they alternately pass the point at which the rotor and the casing meet. In this arrangement it will be seen that no interference is offered the passage of fluid into and from the pump, such as is offered by the perforated annular wall 11 of the previously described construction.

Although a plurality of wings have been generally described in connection with this pump, it will be understood that only one wing may be utilized if so desired, as indicated in Figures 8 and 9 wherein the rotor 25 has a single radial slot 26 therein in which the wing 27 is located, 28 being the auxiliary rotor against which the said wing 27 bears, and in this case a substantial segment 29 of the annular wall 30 of the said auxiliary rotor is unperforated so that it will prevent a clear passage being established between the inlet and outlet passages of the pump when the said wing is in an intermediate position between the said passages.

Instead of the wings being independent of the annular wall, or the member against which they radially abut, they may be connected thereto as shown in the said Figures 4, 5, 6 and 7, such as by having their outer ends provided with rounded projections 31 and 32 hingedly entering corresponding recesses 33 and 34 in the said abutments. This arrangement permits the annular swinging of the wings with respect to the abutments

resulting from the eccentric relation of the rotor proper to the auxiliary rotor disk ensuring a positive connection between the said wings and the said disk; but it will be understood that any connection which may be established between the wings and the said disk has its principal utility in the starting of the pump, as, when the pump is operating at high speeds, centrifugal action may be relied on to ensure the synchronized movement of both the wings and the abutment carrying disk and incidentally of the rotor proper.

Much difficulty is often experienced in rotary pumps in preventing water from intermingling with oil in the bearings which greatly reduces the lubricating properties thereof, and to overcome this it has been the practice to provide outboard bearings extending from the casing or from the pump mountings, an arrangement which greatly increases the labor and expense entailed in the production of such pumps. It is very desirable that the bearing be directly attached to the stuffing box through which the shaft of the pump extends, but difficulty has been experienced in ensuring the proper alignment of bearings mounted in this manner. I, therefore, propose to utilize an improved form of pump bearing which includes a tubular housing 35 bored and threaded at one end 36 to form a stuffing box cap adapted to be threaded onto a gland 37 extending from that part of the pump casing through which the shaft extends. The part of the casing surrounding the said flange is provided with a squarely machined surface or shoulder 38. The inner end of the member 35 is also provided with a similarly true shoulder 39 and the outer end of the said member 35 is bored to receive a bearing 40. When the stuffing box cap 36 is applied to the gland 37 the shoulder 39 may engage the shoulder 38 of the casing and ensure the proper coaxial alignment of the bearing 30 with the axis of the shaft, and to secure adjustment of the cap on the gland, shims 40^a may be inserted between the shoulders 38 and 39.

The housing 35 is provided with an orifice 41 intermediate the stuffing box portion 36 and the bearing 40, so that any leakage of fluid past the said stuffing box may escape from the housing through the orifice 41 instead of passing through the bearing 40 and contaminating the lubricant thereof.

In the said Figures 8 and 9 the rotor is shown as having its driving shaft 42 extending outwardly of the casing on one side and journaled in a bearing 43 on the other side, and the auxiliary rotor 28 is provided with a hollow shaft 44 journaled in a circular recess 45 in the end wall of the casing,

through which hollow shaft the driving shaft of the rotor 25 eccentrically extends.

Pumps constructed in accordance with this invention due to the fact that they may be operated at high speeds are capable of substantial fluid displacement relative to their size and lend themselves excellently to use in the cooling system of automobiles or for other purposes where comparatively small pumps are required and due to the substantial reduction of the friction, usually attending pumps of the type referred to, their field of usefulness is considerably increased so that they may be adopted in a great many instances where they have hitherto not been considered feasible due to the disadvantages hereinbefore pointed out.

Herein, and in the claims, the term "synchronized rotation", as applied by the rotor and the rotary plate, is not intended to indicate that such rotation necessarily agrees in speed throughout each revolution, but that an equal number of revolutions are performed, as, where one of the webs is hingedly secured to its abutment and is held in strict radial alignment in the rotor at all times, a respective oscillation between the plate and the rotor varying the relative speed of rotation at different points in the cycle will result, as will be readily understood.

This invention may be developed within the scope of the following claims without departing from the essential features of the said invention, and it is desired that the specification and drawing be read as merely illustrative and not in a limiting sense, except as necessitated by the prior art.

What I claim is:

1. In a rotary pump having a cylindrical casing, a rotor mounted eccentric to the axis thereof, a wing radially slidable in said rotor, a plate interposed between one side of said rotor and the adjacent wall of said casing and rotatable about the axis of said casing said plate actuating said rotor, and an abutment on said plate interposed between the outer end of said wing and the surrounding wall of said casing.

2. A rotary pump according to claim 1,

wherein the outer end of the said wing is hingedly engaged with said abutment.

3. A rotary pump according to claim 1, wherein the periphery of the rotor extends into the path of said abutment and a peripheral recess is provided in said rotor for the accommodation of said abutment when passing between the adjacent points of said rotor and the surrounding wall of said casing.

4. In a rotary pump having a cylindrical casing, a rotatable peripheral lining therein, positive means for rotating said lining, a rotor mounted eccentrically to the axis thereof and rotatable with said lining, a radially slidable wing in said rotor, the outer end of which engages said lining, a hollow shaft on said lining, a journal in said casing, and a driving shaft on said rotor extending eccentrically through said hollow shaft from said casing.

5. In a rotary pump having a cylindrical casing, a rotary member in the form of a plate at one end of said casing and rotatable about the axis thereof, a second rotary member in the form of a rotor eccentric thereto between said plate and an opposed wall of said casing, said rotary members being adapted to synchronized rotation, a radially slidable wing in said rotor, means on said plate interposed between the outer end of said wing and the surrounding wall of said casing, and means by which one of said rotary members may be driven.

6. The combination with a casing having an inlet and outlet port, and a rotor formed with recessed radial slots eccentrically mounted within the casing, of a plate concentrically mounted within the casing and provided with a circular extension formed with a transverse circular groove, wings having rounded heads engageable within the groove of the said extension and adapted to operate within the said radial slots formed in the rotor, and means for operatively connecting the said rotor with the said plate whereby either one may be adapted to drive the other.

In testimony whereof I affix my signature.

FRANCIS E. BRADY, JR.