J. NIELSEN.

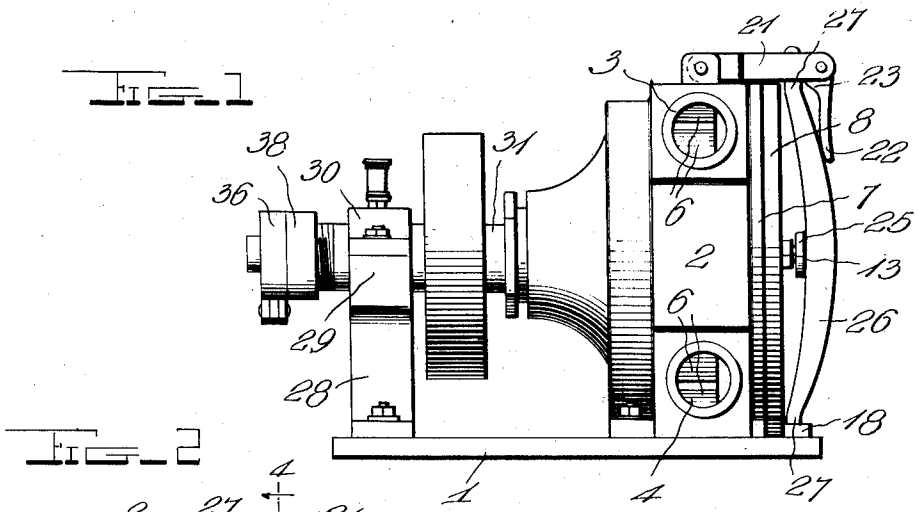
ROTARY ENGINE.

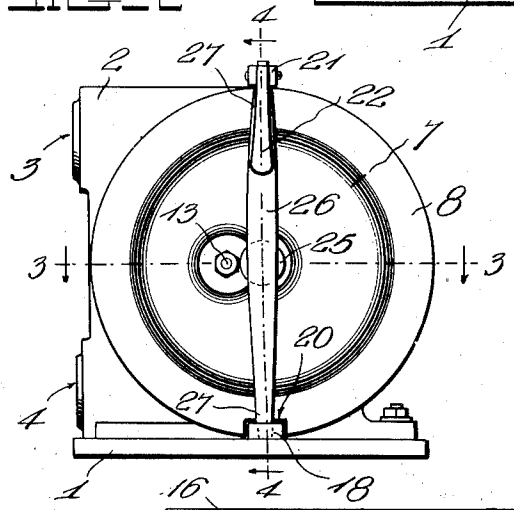
APPLICATION FILED AUG. 18, 1911.

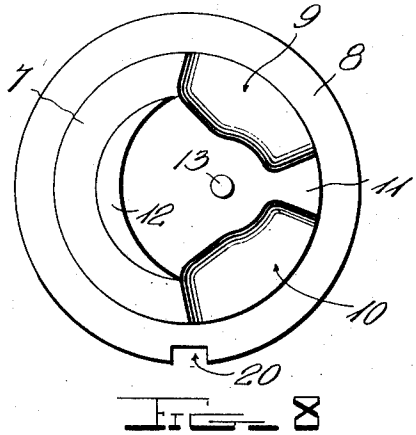
1,042,951.

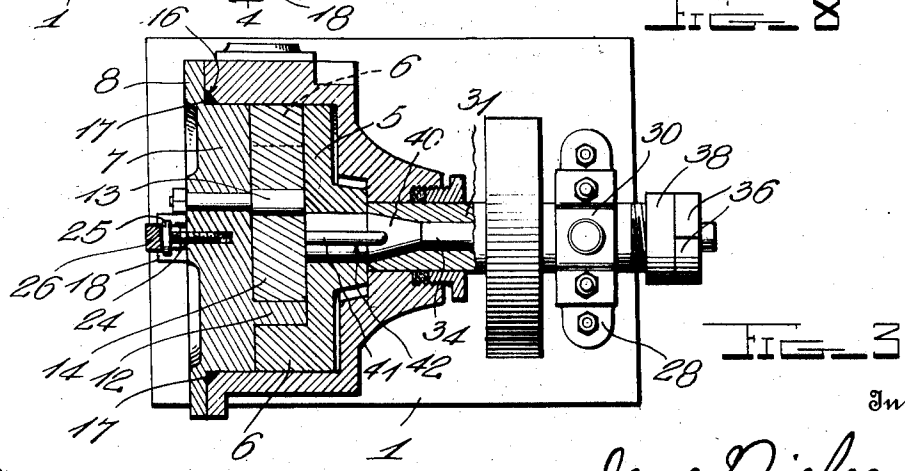
Patented Oct. 29, 1912.

3 SHEETS—SHEET 1.









Witnesses

E. Hamilton

V. K. Gardner.

Inventor

Jens Nielsen

By William W. Deane

his Attorney

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3 SHEETS—SHEET 2.

FIG. 6

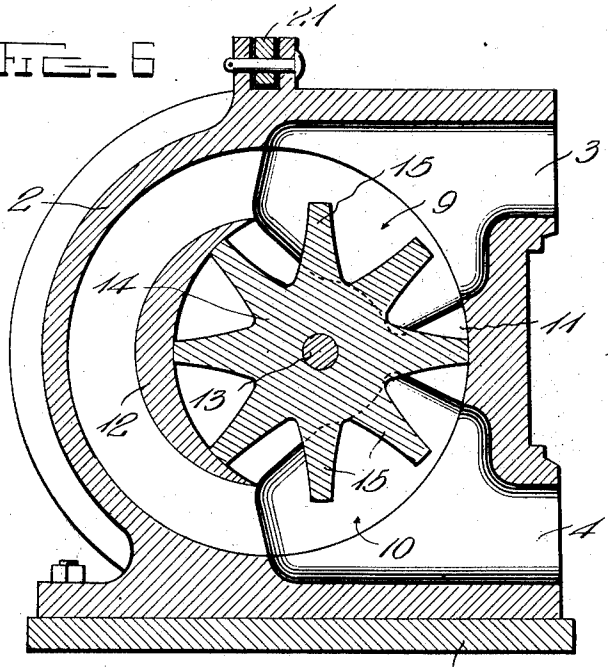


FIG. 7

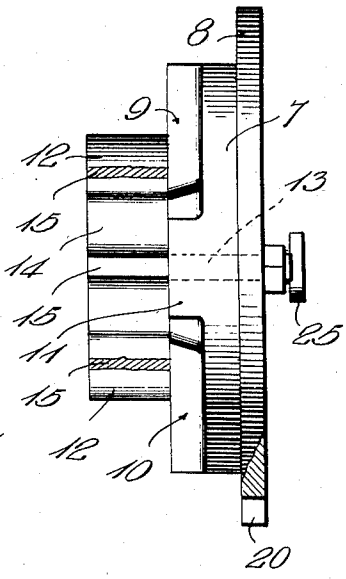
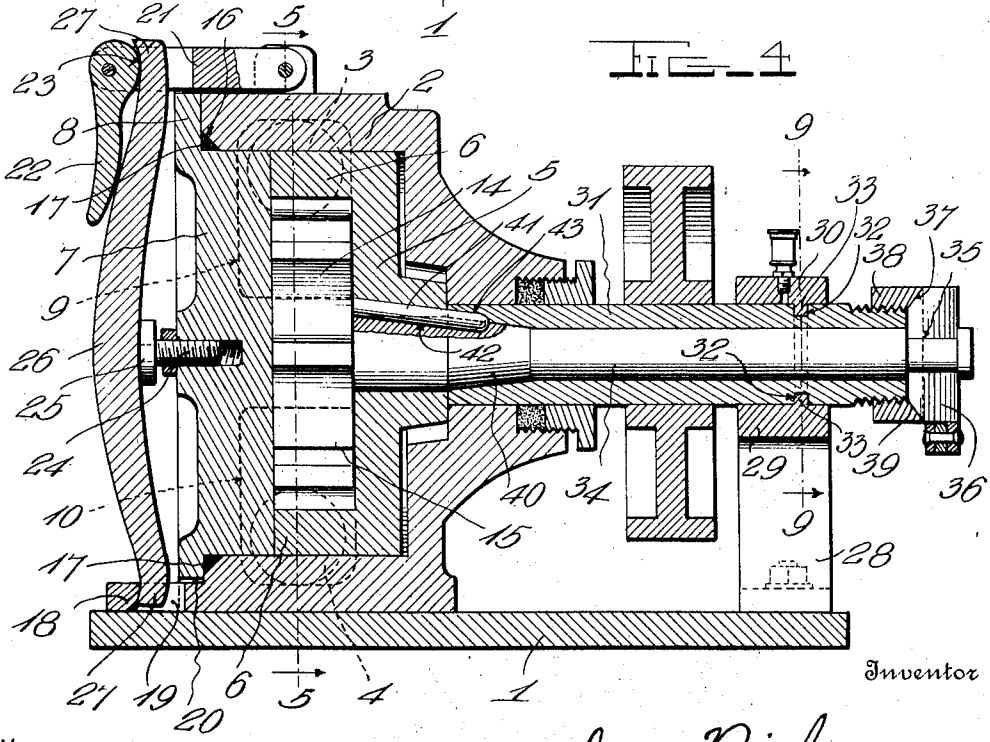


FIG. 4



Witnesses

T. T. Gardner.

Inventor

Jens Nielsen

By William A. Deane

his Attorney

J. NIELSEN.

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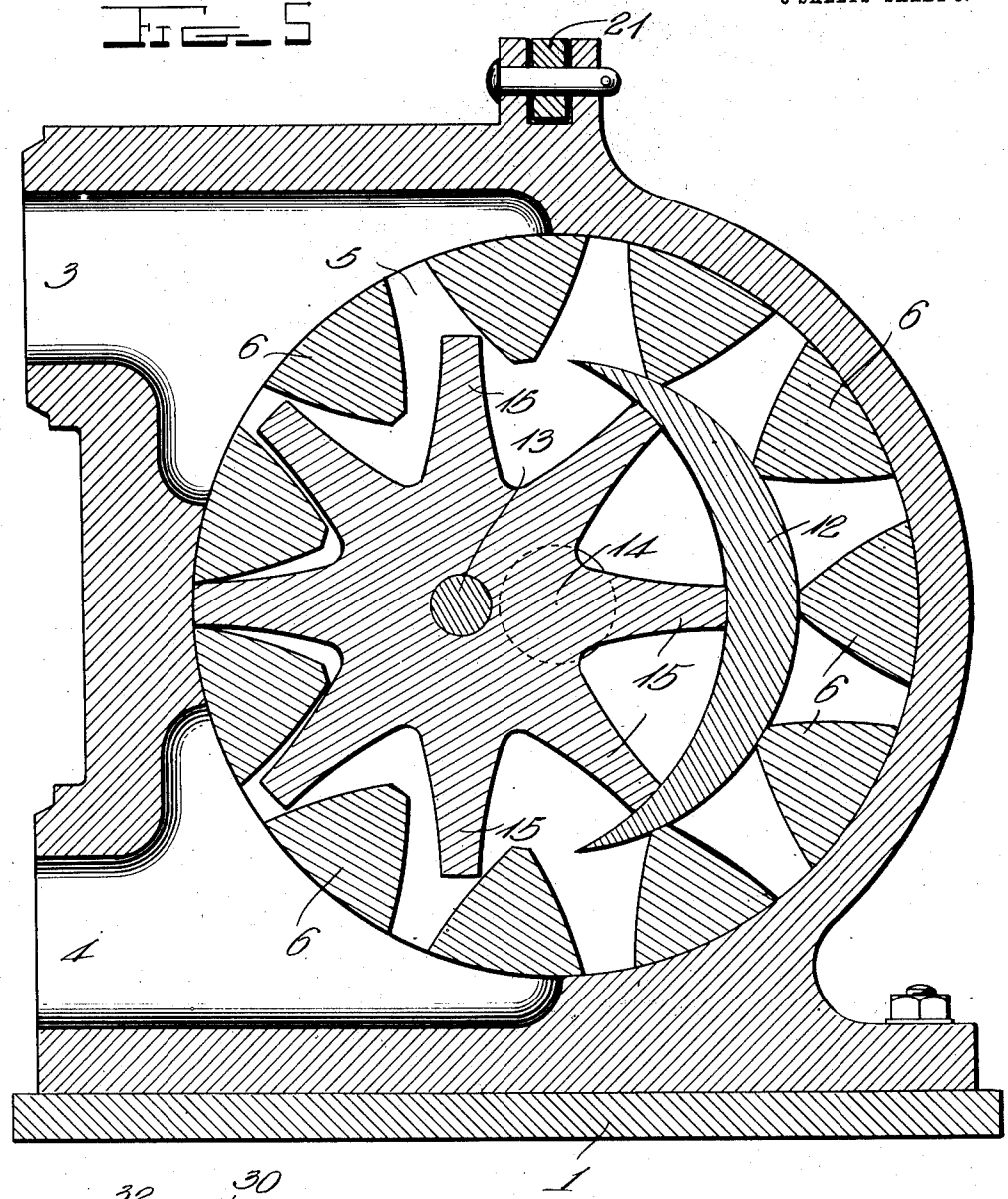
3 SHEETS—SHEET 3.

FIG. 5



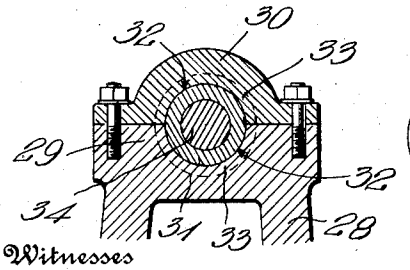


FIG. 9

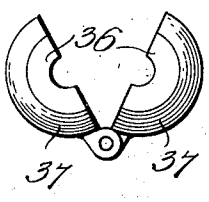


FIG. 10

Witnesses

V. K. Gardner.

Inventor

Jens Nielsen

By William W. Deane

his Attorney

UNITED STATES PATENT OFFICE.

JENS NIELSEN, OF CEDAR FALLS, IOWA.

ROTARY ENGINE.

1,042,951. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed August 18, 1911. Serial No. 644,839.

To all whom it may concern.

Be it known that I, JENS NIELSEN, citizen of the United States, residing at Cedar Falls, in the county of Blackhawk and State of Iowa, have invented certain new and useful Improvements in Rotary Engines or Pumps, of which the following is a specification.

This invention has relation to rotary engines or pumps and has for its object to provide a mechanism especially adapted to be used as an engine or rotor, but which at the same time may be conveniently and economically operated as a pump to advantage under conditions as will be hereinafter explained.

The device is an improvement upon the structure shown in my prior patent for rotary engine #947,670, issued January 25, 1910, and employs several features in common with the structure shown in the said patent but the improvements in details are such that I provide an engine having a high percentage of efficiency, accompanied with durability and capacity for performing hard service. At the same time the simplicity of the structure is preserved and but a few parts are employed.

In the present invention an all metal part machine is disclosed which renders the machine adaptable to be transformed from an engine to a pump and vice versa.

In brief the structure includes a circular casing one side or end of which is closed by a detachable head with mechanism of peculiar design and arrangement adapted to hold the said head in position against the casing. A crescent shaped partition is located within the casing and is supported by the head. The opposite side or end in which the rotor shaft has a bearing may be integral with the circular casing or made separate and fastened to it. A rotor is journaled within the casing and is provided upon its innermost face with a series of spaced vanes the spaces between which extend completely from the ends of the vanes to the face of the rotor, thereby providing ample passageway for the escape of the fluid pressure after it has performed its work within the casing. The said casing is also provided with inlet and exhaust ports which open around the ends of the said vanes and which also open against the peripheral sides of the same.

The structure also includes a wheel having peripheral teeth of peculiar configuration which are adapted to coöperate with the vanes between the inlet and exhaust ports of the casing in such manner as to present a complete barrier against the direct passage of the fluid pressure from the inlet port to the exhaust port and compelling the same to pass around the vanes and the teeth of the said wheel in a manner to utilize the expansion and the impact force of the said fluid pressure. As a pump of this structure it is especially adapted to be used in the capacity of a sanitary pump, that is, one used for moving milk, cream or other fluids where it is necessary to clean the parts frequently, and to do this thoroughly by separating the parts. In such a pump it is preferable to have the minimum number of parts and furthermore the parts should be so assembled that they may be easily and quickly taken apart and put together and at the same time should be securely held together when the device is operating as a pump.

In order that the parts may be readily separable, a double or sleeved shaft is provided consisting of an inner shaft fastened at its flared end in the rotor, and an outer shaft or sleeve which has bearing in the fast head or end of the casing and also in an outside bearing stand. The sleeve slidably receives the shaft but is restrained from separate rotary movement in the sleeve by a key inserted in a groove formed in the rotor, the shaft and the sleeve. This groove and key is placed at an angle to the axis of the shaft. One or more grooves and keys may be employed. In the bearing stand a thrust-bearing mechanism is provided for holding the sleeve against longitudinal movement when separated from the shaft. The pulley or other means for applying power to operate the structure as a pump is mounted on the sleeve.

A locking device of peculiar arrangement is mounted upon the shaft and engages the sleeve and serves to keep the end thereof in close contact with the outermost wall of the

rotor. Therefore it will be seen that by separating the parts of this locking device the rotor and its shaft may be readily removed from the sleeve for cleaning or other purposes while the sleeve remains in the bearings and is not disturbed in its relation with respect to the casing.

For a full understanding of the invention reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a side elevation of the machine; Fig. 2 is a front end view of the same; Fig. 3 is a horizontal sectional view of the same on the line 3—3 of Fig. 2; Fig. 4 is a central, vertical longitudinal sectional view of the same cut on the line 4—4 of Fig. 3; Fig. 5 is a transverse sectional view of the same cut on the line 5—5 of Fig. 4, looking in the direction indicated by the arrow; Fig. 6 is a similar view, taken on the same plane, but looking in the opposite direction, the vanes of the rotor being omitted to more clearly illustrate the construction of the removable head; Fig. 7 is an edge view of the removable head; Fig. 8 is an inside face view thereof; Fig. 9 is a detail transverse section on the line 9—9 of Fig. 4; and Fig. 10 is a detail view of a clip partly open.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The machine includes a base 1 upon which is mounted a casing 2. This casing is provided with an upper port 3 and a lower port 4. Either of these ports may be the induction port or either of the ports may be the exhaust port, but for the purpose of clearly describing the structure and operation of the machine, the uppermost port 3 will be referred to as the induction or inlet port, while the lowermost port 4 will be referred to as the exhaust port. This will be followed in the description of the machine whether it is used as an engine or a pump.

A rotor 5 is journaled in the casing 2 and fits snugly within the inner surface of the peripheral wall thereof. This rotor is provided upon its innermost face and at its periphery with a series of spaced vanes 6, the spaces between the said vanes extending entirely from the ends thereof to the innermost face of the rotor so that they have the appearance of standing out directly from the face of the rotor and not standing away from a flange provided upon the rotor as has heretofore been the practice, and which is clearly shown in my prior Patent #751,196 dated February 2, 1904. This feature in conjunction with other operating features, as will be explained hereinafter, are very essential to the proper operation of the machine as an engine or pump. The inner face of the rotor 5 is in the same vertical plane as the sides of the ports 3 and 4 which are nearest the closed side of the casing 2, and the opposite sides of the said ports 3 and 4 are located somewhat beyond a vertical plane in which the ends of the vanes 6 lie so that the said ports 3 and 4 open around the ends and peripheral sides of the said vanes when the vanes are positioned transversely across the said ports.

One side of the casing 2 is closed by a head 7. When the machine is used as an engine or common pump this head may be secured in position by bolts or other securing devices in any usual or appropriate manner, but when the machine is used as a pump for a special purpose, it is preferable to have the head readily detachable from the casing 2, and therefore a specially designed securing means is provided for holding the head and this means will be explained hereinafter.

The head 7 is of peculiar configuration, its peripheral portion being adapted to fit snugly within the casing 2, and the said head is provided with a circumferential flange 8 which bears directly against the side of the casing 2. It is through this flange that the securing bolts (when used) are tapped when it is desired to permanently connect the head with the casing. The head 7 is provided in its inner side portion with a recess 9 which registers with the side of the upper or inlet port 3 and the said head 7 is also provided with a recess 10 which registers with the lower or exhaust port 4. These recesses 9 and 10 in reality form continuations of the respective ports with which they register and therefore the openings or passageways of the fluid is more completely extended around the ends of the vanes 6 when the said vanes are transversely across the ports 3 and 4. Between the recesses 9 and 10, the head 7 is solid forming an abutment 11, Figs 6, 7 and 8 and this abutment is approximately wedge-shaped and in side elevation is of such dimension approximately equal to the dimensions of spaces between the teeth of a wheel which is located within the casing and which will be explained hereinafter. A crescent shaped partition 12 is carried by the head 7. This partition is located within the series of vanes 6 and its outermost surface bears snugly against the inner portions of the said vanes, but the partition is located within the casing 2 at the opposite side of the center thereof from the ports 3 and 4, Fig. 5. A spindle 13 is mounted upon the head 7 and extends inwardly from the inner side thereof and a wheel 14 is journaled upon the said spindle. The said wheel is provided upon its periphery with a series of radially disposed teeth 15, and these teeth are provided with slightly concaved sides which taper from the bases of the teeth to the apices thereof and it is the space between these teeth that are of the same di-

mensions approximately as the dimension in side elevation of the abutment 11 hereinbefore described.

The teeth 15 are of such length that they fit snugly against the innermost side of the crescent shaped partition 12 and at the opposite side of the wheel they are flush with the peripheral edge of the head 7, and at the upper and lower portions of the wheel the said teeth 15 project to a considerable extent beyond the innermost edges of the recesses 9 and 10. These teeth 15 are also adapted to fit snugly in the outer portions of the spaces between the vanes 6 at that side of the rotor 5 which is at the abutment between the ports 3 and 4, but the vanes 6 are of such configuration and the radial depth of the spaces between the teeth 15 so much longer into the wheel 14 than the radial depth of the vanes 6 that these do at no time completely fill the spaces between the teeth 15 at their inner ends, so that fluid which is confined between the teeth and the vanes at the abutment may readily move from one side of a vane 6 to the other side thereof, thereby avoiding obstruction and preventing what is generally known as a "water hammer". The upper and lower ends of the ports 3 and 4 respectively terminate approximately at the ends of the crescent shaped partition 12 as do also the ends of the recesses 9 and 10 which are remote from the outer ends of the ports 3 and 4.

The sides of the vanes 6 are of arcuate configuration and the arcuate sides of each vane are coincident with or lie in the same arcs as the arcuate sides of other vanes of the series. This is provided in order that the said vanes may fit properly against the teeth 15 without completely closing against the same at the opposite sides of the teeth when the wheel 14 is rotating and therefore it follows that the arc of the curvature of the sides of the vanes 6 is not the same as the curvature of the concavities at the sides of the teeth 15.

The casing 2 is provided at its open side with an annular recess 16 in which is located a packing 17 of rubber or other suitable material. When the head 7 is in position this recess 16 forms a three cornered groove very serviceable for holding said packing against the side of the casing 2.

The brief description of the operation of the parts hereinbefore described as an engine is as follows: Presuming that a fluid under pressure is permitted to enter the casing 2 through the port 3, the said fluid impinges against the vanes 6 at the uppermost part of the rotor 5 and against the teeth 15 at the uppermost part of the wheel 14. The circular casing 2, the head 7, the face of the rotor 5 and the hub of the wheel 14 forms an annular channel narrowest at the abutment and widest at the opposite side where the crescent partition divides this wide channel into two channels that converge at the abutment. In the inner channel the teeth 15 move and in the outer the vanes 6. The teeth and the vances intermesh at the abutment, thus offering there only half the resistance to the fluid that they do at the crescent partition where the fluid acts separately upon the teeth and upon the vanes. At the same time the enlargements at the inner end of the port 3 provided at the recess 9 are sufficient to subject the rotor and its parts and the wheel and its parts to a sufficient head of the fluid under pressure. The force of impact and the expansion of the said fluid will rotate the upper portion of the rotor 5 and also the wheel 14 away from the inlet port 3 and toward the exhaust port 4. As the vanes 6 and the teeth 15 pass across the exhaust port 4, the fluid is exhausted from the casing 2 through the said port. As the vanes and teeth intermesh at the abutment thereby (almost completely) closing the converged channels, the fluid must leave the spaces between the vanes and the spaces between the teeth and thus the rotor 5 and the wheel 14 working in unison are maintained in a contiuous state of rotation. If the fluid under pressure was admitted at the lowermost port 4 and exhausted at the uppermost port 3, the operation just above described would be reversed, but this operation would be the same in effect. By having the teeth 15 and the vanes 6 of the peculiar configuration and relative sizes stated, all jerking or bumping motion or tendency of the parts is eliminated when the engine is running at high speed. In engines where these objectionable features are present it is usually due to excessive friction or water hammers, the fluid being impinged or caught between the teeth and vanes of the two moving parts and trapped in such manner that it cannot pass freely from one side of the parts to the other, and any material increase in speed is always attended with more or less jerking or bumping motion.

In the preferred form of the structure as a special pump, a block 18 is mounted upon the casing 2 near the base 1 and may or may not be integral with the same. The said block is provided with a recess 19. In this form the head 7 is not bolted to the side of the casing 2, but the head is of the same configuration as hereinbefore described and fits snugly against the side of the casing 2. The flange of the head is provided with a recess 20 which snugly receives the inner portion of the block 18. A slotted link 21 is pivoted upon the upper side of the casing 2 and a lever 22 is pivoted within the slot of the said link 21. This lever 22 is provided with a cam end 23. The head 7 is provided at its center on the outside with a tension screw 24 threaded in the

head 7, and having a head 25 for the closing bar to force against said screw 24 being provided with a lock nut under head 25 to hold it fast in the proper position. A bar 26 is provided with curved ends 27 the said ends being of the same configuration and dimensions. One end of the bar 26 is inserted in the recess 19 of the block 18 and the other end of the said bar is inserted in the slot of the link 21 behind the cam end 23 of the lever 22. Consequently when the said lever 22 is swung down against the bar 26, the deep portion of the cam end 23 is brought against the upper end of the bar 26 and the intermediate portion of the said bar is forced against the head 25 of the tension screw 24, and the said screw together with the head 7 is forced toward the casing 2, and the head 7 is securely held in position against the casing. By swinging the lever 22 so that the shallow portion of the cam end 23 is brought opposite the upper end of the bar 26, the link 21 may be swung up so that the slot therein is carried above the upper end of the bar 26 when the said bar may be readily lifted out of the recess 19 in the block 18, and when this is done the head 7 may be removed from against the side of the casing 2.

A standard 28 is mounted upon the base 1 at the closed side of the casing 2 and is provided at its upper end with a bearing 29. The upper portion of the bearing 29 is closed by a cap 30. A sleeve 31 is journaled in the closed end portion of the casing 2 and in the bearing 29, and is provided with an annular groove 32 which is located under the cap 30. A thrust flange 33 is provided in the bearing 29 and cap 30 which enters the groove 32 whereby the sleeve 31 is restrained against longitudinal movement. A shaft 34 is slidably received within the sleeve 31 and is provided with a grooved end 35 which projects beyond the outer end of the sleeve 31. A clip 36 is formed of two sections hingedly connected together which are adapted to close within the groove 35 of the shaft 34, and the said clip is provided with a conical inner face 37. A nut 38 is screw threaded upon the outer end of the sleeve 31 and is provided with a conical recess 39 which receives the conical face 37 of the said clip. The inner end portion of the shaft 34 is flared as at 40 and the sleeve 31 is closely fitted to said flared part of the shaft 34 and the rotor 5 hereinbefore described is mounted at the said flared portion of the said shaft. A key 41 passes through the hub of the rotor 5 and extends along a groove 42 provided in the flared portion 40 of the shaft 34. The said key 41 is disposed at an acute angle to the axis of the shaft 34. The outermost end portion of the said key 41 also enters a recess 43 provided in the inner end of the sleeve 31. Therefore it will be seen that when the nut 38 is turned so that it is worked toward the outer end of the sleeve 31, its outer face bearing against the inner face of the clip 36 will move the shaft 34 longitudinally in the sleeve 31, so that the outer side of the rotor 5 is brought in close contact with the inner end of the sleeve and the key 41 is securely seated in the recess 43 provided at the inner end of the said sleeve. When it is desired to remove the rotor for cleaning or other purposes it is necessary only to turn the nut 38 upon the sleeve 31 so that it is worked away from the outer end thereof and when the conical recess 39 provided in the said nut passes beyond the conical face 37 of the clip 36, the sections of the said clip may be swung apart so that the clip may be removed from the grooved end 35 of the shaft 34. Then after the head 7 has been removed from the casing 2 as hereinbefore described, the rotor 5 and the shaft 34 may be slipped out of the casing and the sleeve 31. Thus the parts are separated and may be readily cleaned and at the same time the sleeve maintains its relative position with relation to the casing and the key 41 is so positioned that it effectually holds the rotor and the shaft in a predetermined relative position and also holds these parts in proper position with relation to the sleeve when the parts are assembled. At the same time the disposition of the key is such that the rotor and the shaft may be readily removed in the manner as above described.

Having thus described the invention what I claim as new is:

1. A rotary machine comprising a casing, a rotor journaled therein and having spaced vanes located at its side, said casing having inlet and outlet ports the inner ends of which extend around the ends and the peripheral sides of the vanes.

2. A rotary machine comprising a casing, a rotor journaled therein and carrying at its side spaced vanes, and a wheel journaled in the casing, within the set of vanes and having peripheral teeth adapted to receive the vanes between them, said casing having inlet and outlet ports and also having a head disposed alongside said wheel and containing recesses extending to said ports and equipped with an auxiliary abutment that separates said recesses and is opposed to the side of the toothed portion of the wheel.

3. A rotary machine comprising a casing, a rotor journaled therein and having at its side a series of spaced vanes, said casing having inlet and exhaust ports, a wheel journaled in the casing and having peripheral teeth, the sides of which are concave and which taper from their roots to their apices.

4. A rotary machine comprising a casing, having inlet and exhaust ports, a rotor

journaled therein and having at its side spaced vanes, the openings between which extend to the face of the rotor, said vanes having arcuate sides, the curvature of the sides of one vane being coincident with the curvature of the sides of other vanes in the series.

5. A rotary machine comprising a casing, having inlet and exhaust ports, a rotor journaled therein and having at its side a series of spaced vanes, said casing including a detachable head and an annular groove three cornered in cross section, and a packing interposed between said head and the said casing and located in said groove.

6. A rotary machine comprising a casing, a shaft journaled in the casing and having a flared end, a rotor mounted at the flared end of the shaft and located within the casing, a key passing through the rotor and set in a groove in the flared end of the shaft and a sleeve slidably receiving the shaft and engaging the flared part of the shaft and the said key whereby the sleeve is constrained to rotate in unison with the shaft.

7. A rotary machine comprising a casing, a shaft journaled therein, a rotor mounted upon the shaft and located within the casing, a sleeve slidably mounted upon the shaft and a key passing through the rotor and entering the shaft and the sleeve and located at an angle to the axis of the shaft.

8. A rotary machine comprising a casing, a shaft journaled therein, a rotor mounted upon the shaft and located within the casing, a sleeve slidably mounted upon the shaft and bearing against the rotor, said shaft having a reduced part near the outer end, a clip located upon the reduced portion of the shaft and having a conical inner face, and a nut screw-threaded upon the sleeve and having a conical recess which receives the conical face of the clip.

9. A rotary machine comprising a casing mounted upon a base, a detachable head closing one side of the casing, a rotor journaled in the casing, means for securing the head in position against the casing consisting of a clamp bar having curved end portions of the same configuration, means for confining one end of the bar at the base of the casing, a link pivotally mounted at the top of the casing, and an eccentric lever fulcrumed in the link and adapted to engage the other end of the bar to force the same against the head.

10. A rotary machine comprising a casing, a base supporting the same, a rotor journaled in the casing, a block located upon the casing near the base and having an opening, said casing having a detachable head provided at its edge with a recess adapted to receive the block, a bar resting at its end in the opening in the block, and means for securing the other end of the bar whereby the head is held against the casing.

11. A rotary machine comprising a casing, a rotor journaled therein, a head closing one side of the casing, means for holding the head in position against the casing comprising a bar, means for securing the lower end of the bar, a slotted link pivoted to the upper end of the casing, a lever fulcrumed in the slot of said link and having an eccentric end, said slotted link adapted to receive the upper end of the bar whereby the bar is locked in position against the head when the said lever is swung.

12. A rotary machine comprising a casing, a base supporting the same, a block located upon the casing near the base and having an opening, a rotor journaled in the casing, a head closing the side of the casing and provided with a peripheral flange which in turn is provided with a recess which receives the block and a locking mechanism for holding the head against the casing including a bar adapted to enter the recess in the block and means for securing the upper end of the bar to the upper portion of the casing.

13. A rotary machine comprising a casing, a rotor journaled therein, a head adapted to close the side of the casing and having at its outer side an adjustable tension member, a bar extending transversely across the head and bearing at its intermediate portion against the said member, and means for confining the ends of the bar.

14. A rotary machine comprising a casing, a rotor journaled therein and carrying at its side spaced vanes, and a wheel journaled in the casing within the set of vanes and having peripheral teeth adapted to receive the vanes between them; the said casing having inlet and outlet ports and also having a head arranged at the opposite side of the wheel, with reference to the rotor, and carrying an abutment that lies in a plane alongside the plane of movement of the wheel and in position to close the interdental spaces of the wheel at the opposite side of the wheel, with reference to the rotor, said head also having recesses at opposite sides of the abutment and between the ports and the abutment.

15. A rotary machine comprising a casing, a rotor journaled therein and carrying at its side spaced vanes, and a wheel journaled in the casing within the set of vanes and having peripheral teeth adapted to receive the vanes between them; the said casing having inlet and outlet ports and a portion, located between the ports and opposed to the periphery of the wheel, and a crescent-shaped partition arranged at the opposite side of the machine center to the ports and said portion and also having an abutment that lies in a plane alongside the plane of move-

ment of the wheel and in position to close the interdental spaces of the wheel at the opposite side of the wheel, with reference to the rotor, and further having recesses intermediate the ports and said abutment.

16. A rotary machine comprising a casing, a rotor journaled therein and having at its side a series of spaced vanes, said casing having inlet and outlet ports and said vanes having arcuate sides, and a wheel journaled in the casing, and positioned within the series of spaced vanes and alongside the major part of the rotor, and having teeth and also having interdental spaces larger and also deeper in a radial direction than the vanes.

17. A rotary machine comprising a casing, a rotor journaled therein and having at its side a series of spaced vanes, said casing having inlet and outlet ports, and a wheel journaled in the casing, and positioned within the series of spaced vanes and alongside the major part of the rotor, and having teeth and also having interdental spaces larger and also deeper in a radial direction than the vanes.

In testimony whereof I affix my signature in presence of two witnesses.

JENS NIELSEN.

Witnesses:
J. H. MYERS,
BERDINE SEVERIN.