B. R. PLANCHE.

ROTARY MACHINE.

APPLICATION FILED NOV. 27, 1918.

1,340,625.

Patented May 18, 1920.

3 SHEETS—SHEET 1.

Fig. 1

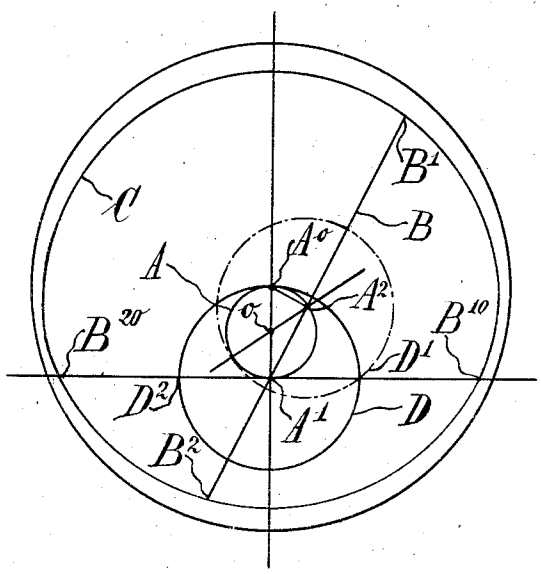
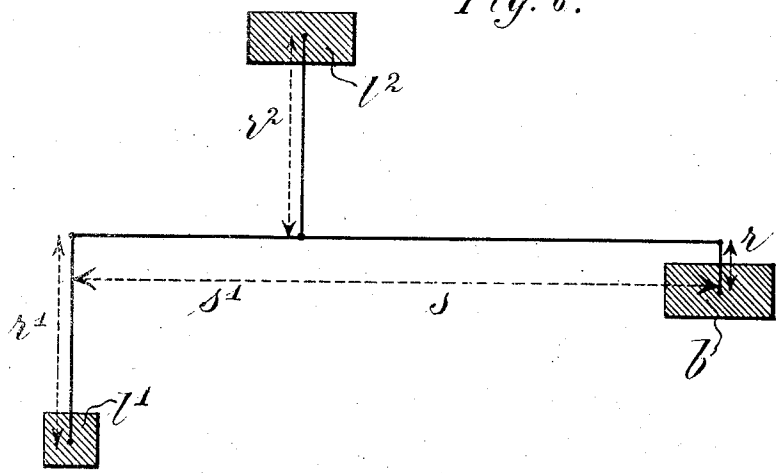



Fig. 6.




Witnesses:

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3 SHEETS—SHEET 2.

Fig. 2.

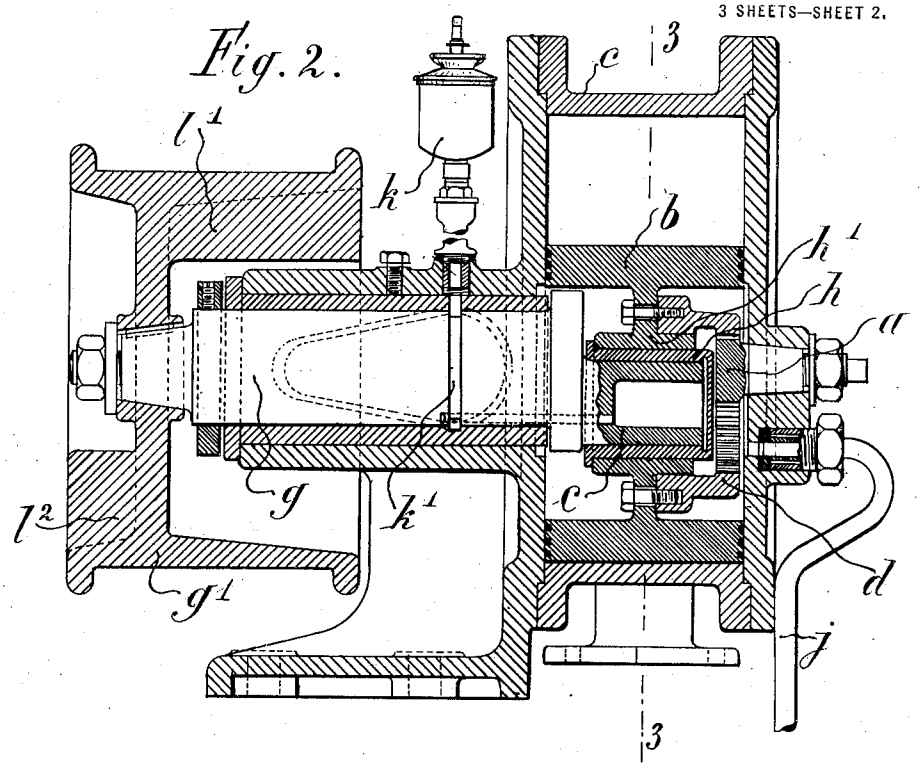
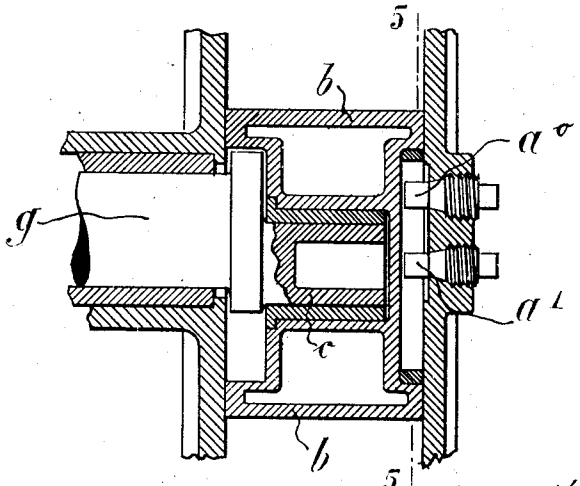



Fig. 4.




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3 SHEETS—SHEET 3.

Fig. 3.

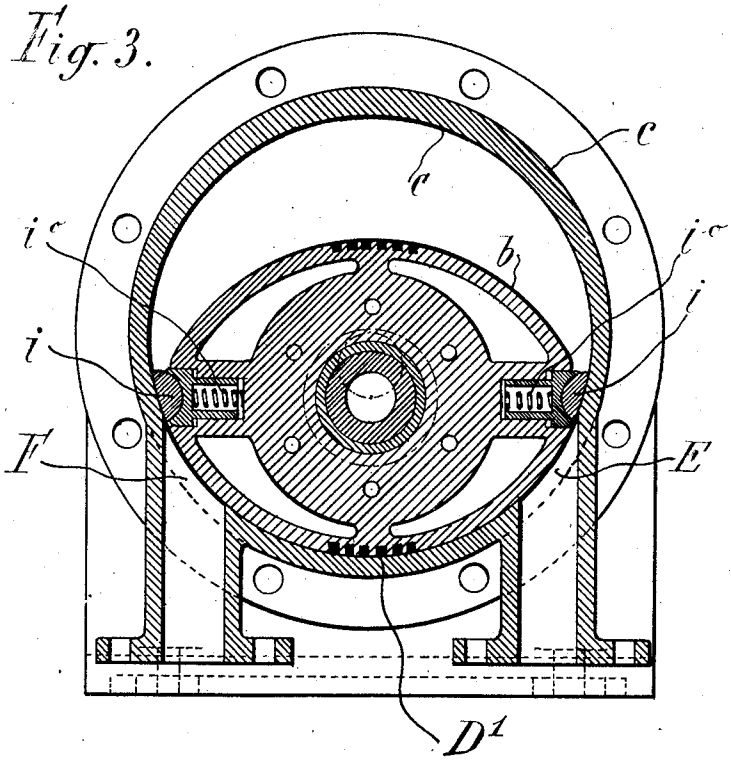
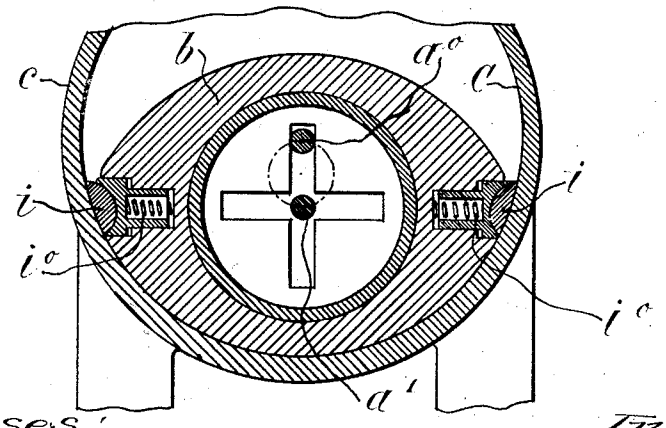



Fig. 5.




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# UNITED STATES PATENT OFFICE.

BENJAMIN RENÉ PLANCHE, OF VILLEFRANCHE-SUR-SAÔNE, FRANCE.

## ROTARY MACHINE.

1,340,625. Specification of Letters Patent. Patented May 18, 1920.

Application filed November 27, 1918. Serial No. 264,311.

*To all whom it may concern:*

Be it known that I, BENJAMIN RENÉ PLANCHE, citizen of the French Republic, residing at Villefranche-sur-Saône, Department of Rhône, France, have invented certain new and useful Improvements in Rotary Machines, of which the following is a specification.

This invention relates to rotary machines such as pumps and engines.

It has for its chief object to enable machines of the kind in question to be built so that they should be of a simpler construction, as well as better in working than hitherto.

It consists, chiefly also, in using, for constituting machines of the kind in question, a cylinder having for its base a circle conchoid, a blade of a length equal to the height of the said conchoid, mounted in the interior of the said cylinder, and means for moving the said blade in the interior of the said cylinder in such a manner that its ends should always remain in contact with the inner wall of the said cylinder.

Apart from this principal arrangement, it comprises certain other arrangements more explicitly referred to hereinafter.

It relates more particularly to certain methods of carrying out the said arrangements, and more particularly still, by way of new industrial products, to machines of the kind in question comprising application of the said arrangements, as well as to special elements suitable for building them.

It will be in any case clearly understood from the following description as well as from the accompanying drawing which, of course, is given merely by way of example.

Figure 1 of the said drawing is a diagram explaining the theory of rotary machines built according to the invention.

Figs. 2 and 3 show respectively in longitudinal section and in section on line 3—3 of Fig. 2 a rotary pump according to a first method of carrying out the invention.

Figs. 4 and 5 show respectively in longitudinal section and in section on line 5—5 of Fig. 4, a rotary pump built according to a second method of carrying out the invention.

Fig. 6 finally gives a diagram explaining the balancing of rotary machines according to the invention.

According to the invention, and more particularly according to those of the methods of carrying it out, to which refers more particularly the drawing, when it is intended to build for instance a rotary pump, the proceeding is as follows or in a similar manner.

It is known that if, given a circumference A with the center O, a straight line B intersecting the said circumference in a second point $A^2$ is rotated about a point A′ of the said circumference, and if on the said straight line, at each side of the point $A^2$, are drawn two equal lengths, greater than the diameter of the circumference A, on the said straight line will be obtained two points B′ $B^2$, the place of which will be a circle conchoid C.

In order to force the points B′ and $B^2$ to describe the said conchoid, it is sufficient to rotate the point $A^2$, center of the said straight line, at a constant angular speed about the center O, so that it should describe the circumference A, and at the same time to rotate the said straight line at half the angular speed about the said point $A^2$. In order to obtain in practice the said two movements, the following properties should be utilized.

If the position $B^{10}$, $B^{20}$ of the said straight line is considered, for which the points $A^1$ and $A^2$ coincide (tangents at the point $A^1$), and if a circumference D is traced, of a radius equal to twice the radius of the circumference A and having its center at $A^1$, the said circumference will be tangent to the circumference A at a point $A^0$, diametrically opposite the point $A^1$, and will intersect the straight line $D^1$, $D^2$ at two points $D^1$, $D^2$. If, after having secured the straight line at $D^1$ and $D^2$ to the said circumference, the latter is caused to roll on the circumference A, it could be easily proved that the said straight line will be constantly passing through the point $A^1$ and will intersect the circumference at another point $A^2$; and that the angular speed will be double the angular speed of the straight line itself about the point $A^2$.

It is therefore possible, by this first means, to cause the points $B^1$ and $B^2$ of the straight line to describe the conchoid, by rotating the point $A^2$ about the center O, and at the same time by causing the circumference D to roll on the circumference A.

It is also possible to utilize, as a second means, the fact that the straight line $A^0$, $A^2$ is perpendicular to the straight line $B^1$,

$B^2$, and to cause the point $A^2$ to describe the circumference A, by forcing the straight line $B^1$, $B^2$ to pass through the point A, and a perpendicular to the said straight line, to pass through the point $A^0$.

On examining, on the other hand, the two portions of the surface, situated in the interior of the conchoid and separated by the straight line $B^1$, $B^2$, it will be clearly seen that these two portions are equal to each other when the straight line passes through the points $A^1$ and $A^0$, and that, starting from the position in question, when the straight line is rotated, one of the said surfaces will increase, while the other will decrease, until the moment when the straight line reaches the position perpendicular to the preceding one, that is to say, the position $B^{10}$, $B^{20}$ in which one of the surfaces will be a maximum and the other a minimum; the minimum surface will then begin to increase, and the maximum surface decrease, until the straight line, having been rotated through 360°, returns to its position $B^{10}$, $B^{20}$.

This having been stated, in order to build a pump based on the above mentioned principles, a cylinder *c* is built, the inner wall of which has the shape of the circle conchoid C generated with the circumference A with the center O as a base, and closed at its two ends by a flat cover. In the said cylinder is provided an inlet port E and an exhaust port F, in such a manner that (when the straight line $B^1$, $B^2$ occupies the position $B^{10}$ $B^{20}$ in which it divides the surface in the interior of the conchoid into two portions, one a maximum, and the other a minimum) these ports open into the portion of the minimum section, and each close to one of the ends of the straight line $B^{10}$, $B^{20}$.

In the interior of the cylinder is provided a blade *b* of a length equal to that of the straight line $B^1$, $B^2$, the width of the said blade being made equal to the length of the generatrices of the cylinder; the said blade is given in cross section such a spindle shape that, when the central axis of the blade occupies the position $B^{10}$, $B^{20}$, the outer surface of the blade should be tangent to the wall of the cylinder in the center $D^1$ of the portion of the conchoid, comprised between the points $B^{10}$, $B^{20}$, at the same side as the ports E, F, so that any communication between the said two ports should be closed.

And afterward, for insuring movements of the blade, is used one of the means already indicated.

For instance, if it is desired to utilize the first of the said means, a driving shaft *g* is arranged, as shown in Figs. 2 and 3, in such a manner that its axis passes through the center O of the circle A and is parallel to the axis of the cylinder. The said shaft is supported in one of the covers of the cylinder *c* and extended in the interior of the said cylinder by an eccentric crank pin *o*, the distance of the axis of which from the axis of the shaft *g* is equal to the radius of the circle A. On the said crank pin is mounted loose a sleeve *h* forming one piece with a central side *h'* connecting together the two walls of the hollow blade *b*; which arrangement forces the center of the blade to describe the circumference A. A toothed pinion *a* is mounted in the casing adjacent the sleeve *h* and with the said toothed pinion is caused to mesh a ring *d* with inner teeth, with a pitch circle of a diameter twice the circumference A, and the said ring is secured to the hub *h'*, which arrangement corresponds to the rolling of the circumference D on the circumference A.

Owing to this drive, when the shaft *g* is rotating, the blade *b* will move in the interior of the cylinder *c* and draw the fluid through the port E, and discharge it through the port F.

Regulation of the original position of the blade is insured by slightly rotating the pinion *a* about its axis.

If afterward it is desired to utilize the second of the said means, the proceeding will be identical, with the difference that, as shown in Figs. 4 and 5, the pinion *a* is replaced by two spindles $a^0$ $a^1$ arranged symmetrically of the axis of the shaft *g* and at a distance from the said axis, equal to the radius of the circumference A, and the ring *d* is replaced by a disk in which are provided two grooves normal to each other, the axes of which coincide with the axes of the blade, the two spindles $a^0$ $a^1$ being introduced into the said grooves.

And either the proceeding is as described, or, and still better, the whole, or part, of the following arrangements are utilized:

At the ends of the blade *b* which come into contact with the inner wall of the cylinder, are mounted two tips *i* which, at one side, are semi-cylindrical, and at the other fit the shape of the wall of the cylinder. These tips engage with a recess provided for the purpose at the end of the blade *b*; their width is equal to that of the blade, and they are pressed against the wall of the cylinder by means of two small springs $i^0$. Their only object is to insure a tight joint. The center of rotation of the said tips is situated close to the end of the axis of the blade, so that they have merely to pivot about their center of rotation during the movement of the blade, without undergoing any movement in the direction of the axis of the blade.

A tight joint in the other moving parts of the machine is obtained by means of grooves; besides, any fluid that may get into the interior of the blade, is discharged through a pipe *j*, so that the pressure in the interior of the said blade will be practically equal to the atmospheric pressure.

Lubrication is insured by a lubricator $k$ which discharges into a groove $k'$ in communication with the interior of the crank pin $o$. From the said crank pin, the oil passes, under the action of centrifugal force, right to the ends of the blade through orifices provided for the purpose in the hub $h'$. During the whole of its travel, the oil lubricates, through orifices and suitable small grooves, the various moving parts.

The balancing of the moving masses is insured by mounting on the driving shaft $g$ a pulley $g'$ and providing the pulley in question with two masses $l'$, $l^2$, arranged in such a manner that the couple of forces and the resulting strain which they produce, should be equal and opposite to the couple and to the resulting force produced by centrifugal force acting on the eccentric blade arranged at the end of the shaft $g$.

In order to insure equilibrium, it is necessary as shown in Fig. 6: on the one hand, that the algebraic sum of the moments of the masses $l'$ $l^2$ relatively to the axis of the shaft $g$, should be equal to the amount, relatively to the same axis, of the mass of the blade.

$$l'r' - l^2.r^2 = b.r,$$

and on the other hand, that the moment of the mass $l'$ relatively to the plane perpendicular to the axis $g$ and passing through the center of gravity of the mass $l^2$, should be equal to the moment relatively to the same plane of the mass of the blade $l'r's' = brs$.

It goes without saying that the invention is by no means limited to those of the methods of carrying it out, or of applying it, which have been more particularly described, but comprises on the contrary any modifications.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A rotary machine of the character described comprising a cylinder having a base in the form of a conchoid of a circle, a piston of length equal to the height of said conchoid, said piston being rotatably mounted in its center upon a spindle mounted eccentrically on the shaft of the machine, one of the sides of said piston being provided with two grooves normal with respect to each other, in which are mounted two fixed fingers or spindles, one of which has its axis in line with the axis of the crank shaft and the other is in the central plane of the conchoid, the distance between said spindles being equal to the eccentricity of the axis on which the blade is mounted.

2. A rotary machine of the character described comprising a cylinder having a base in the form of a conchoid of a circle, a piston of length equal to the height of said conchoid, means for moving said piston in such manner that its ends shall always be in contact with the inner wall of said cylinder, the center of said piston describing a circumference and being at the same time on a perpendicular to the blade passing through a fixed point of said circumference, a drive shaft for said piston, a pulley on said drive shaft and compensating means carried by and mounted on said pulley for maintaining the equilibrium of said piston and shaft.

3. A rotary machine of the character described comprising a cylinder having a base in the form of a conchoid of a circle, a piston of length equal to the height of said conchoid, means for moving said piston in such manner that its ends shall always be in contact with the inner wall of said cylinder, the center of said piston describing a circumference and being at the same time on a perpendicular to the blade passing through a fixed point of said circumference, and means for lubricating the interior parts of said piston.

In testimony whereof I have hereunto set my hand.

BENJAMIN RENÉ PLANCHE.