L. H. NASH.

TURBO DISPLACEMENT MOTOR

APPLICATION FILED FEB. 23, 1921.

1,429,044. Patented Sept. 12, 1922.

3 SHEETS—SHEET 1.

Fig. 1.

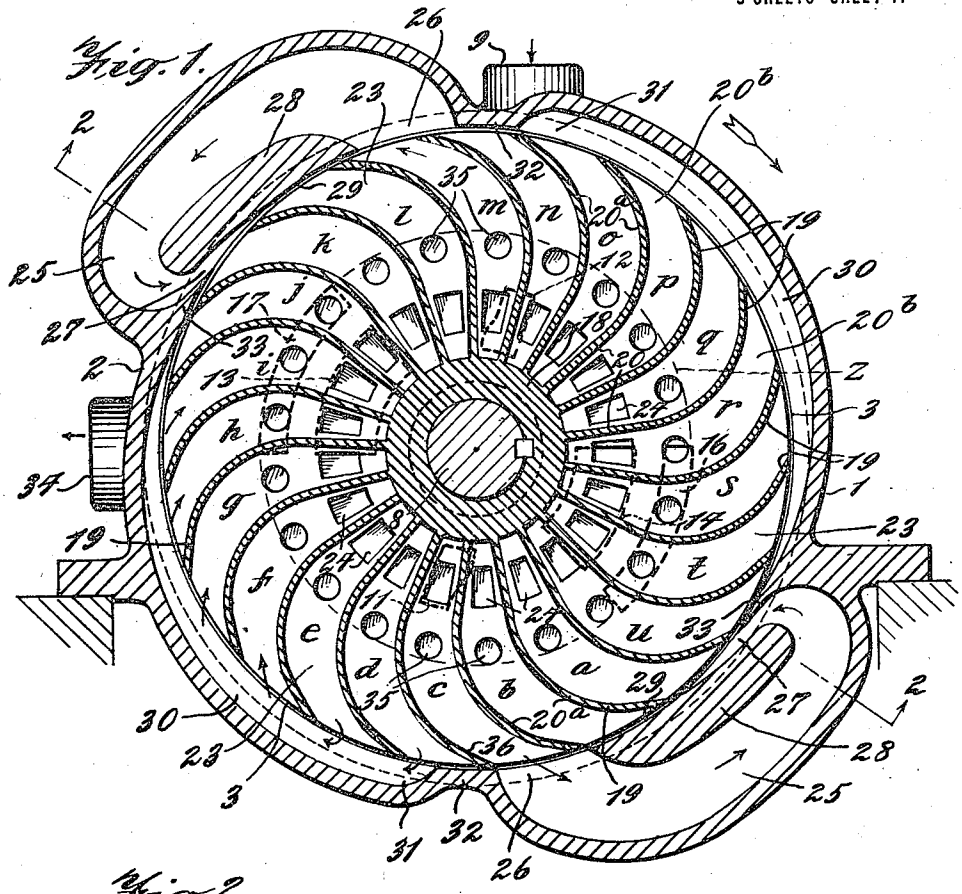
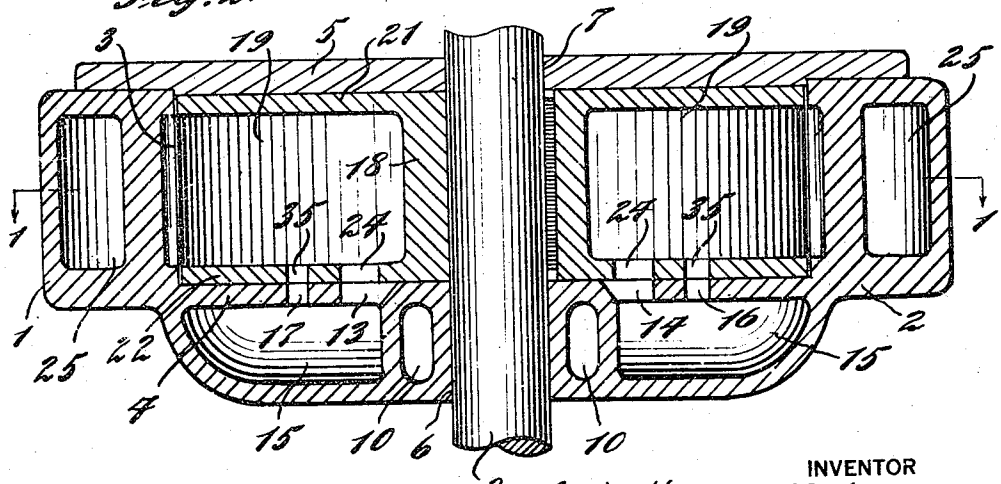


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

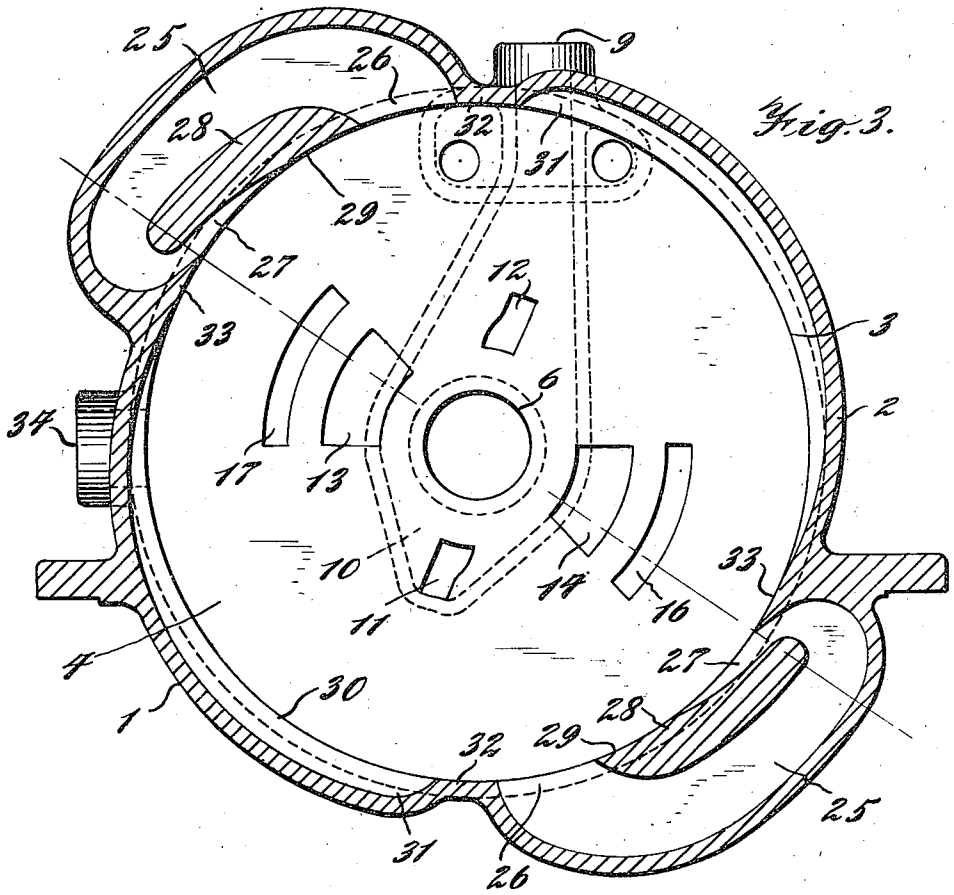
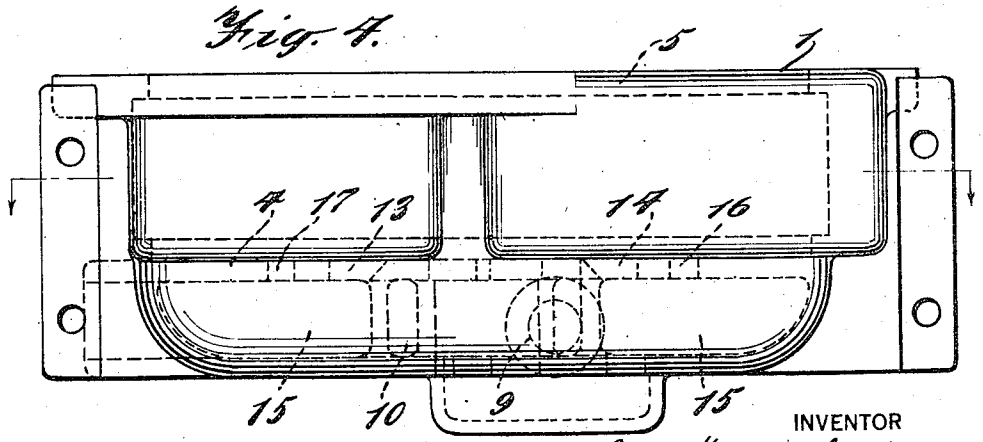



Fig. 4.




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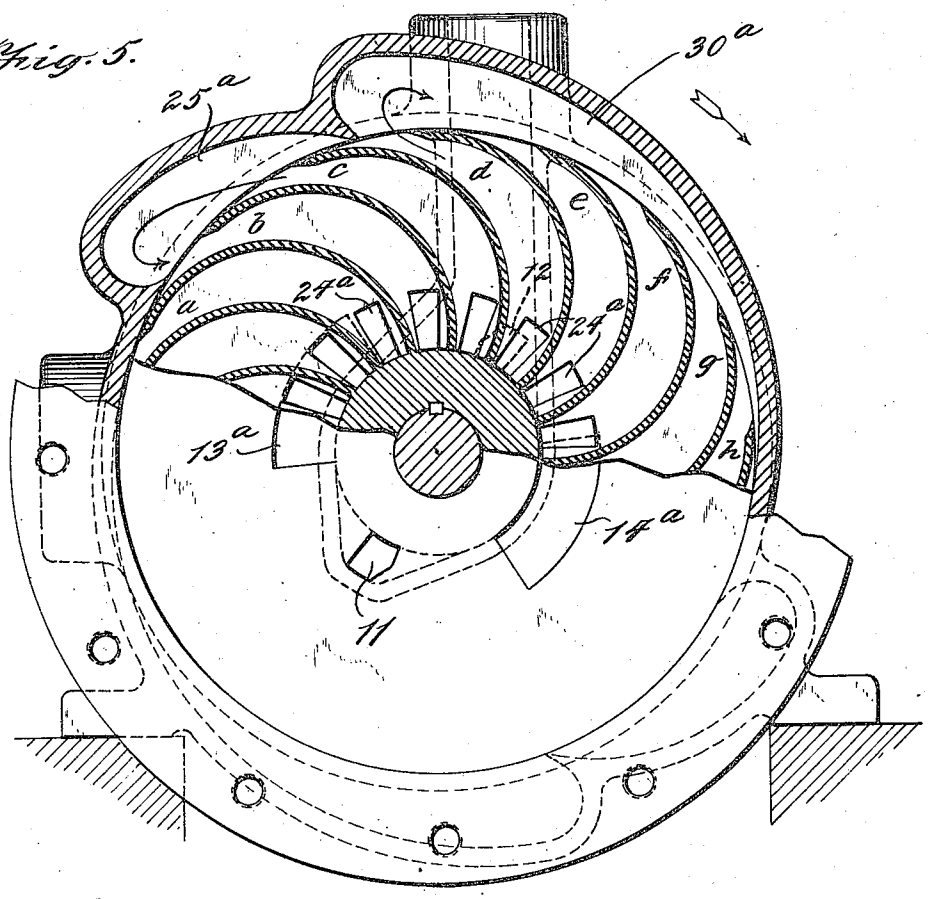
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3 SHEETS—SHEET 3.

Fig. 5.




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Patented Sept. 12, 1922. 1,429,044

# UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF SOUTH NORWALK, CONNECTICUT.

## TURBO DISPLACEMENT MOTOR.

Application filed February 23, 1921. Serial No. 447,285.

*To all whom it may concern:*

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at South Norwalk, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Turbo Displacement Motors, of which the following is a specification.

My invention relates to new and useful improvements in turbo-displacement motors of that character or type including a casing and a chambered rotor, together with a rotating body of liquid which is controlled by suitable means to exert a driving effect upon the rotor.

The invention consists in the improved construction and combination of parts to be more fully described hereinafter, and the novelty of which will be particularly pointed out and distinctly claimed.

I have fully and clearly illustrated certain embodiments of my invention in the accompanying drawings to be taken as a part of this specification, and wherein—

Figure 1 is a cross section through the casing on the line 1—1 of Fig. 2.

Fig. 2 is a cross section on the line 2—2 of Fig. 1.

Fig. 3 is a section on the line 1—1 of Fig. 2 with the rotor removed, and

Fig. 4 is a bottom plan view of the rotor casing, certain ports and chambers being shown in dotted line.

Fig. 5 shows a modification of the invention having different forms of casing passages. The rotor is shown one-half in section, and the case one-half, with the rotor removed.

Referring to the drawings by characters of reference, 1 designates a casing preferably comprising a substantially cylindrical peripheral wall 2 forming a cylindrical internal bore or chamber 3, the same being closed by heads 4, 5 having central openings 6, 7, through which projects a rotor shaft 8. The casing is provided with an inlet 9 receiving steam under pressure, or compressed air, said inlet opening into a duct 10 in the head 4 of the casing, from which duct lead ports 11, 12 located on opposite sides of the rotor shaft, and through which steam or compressed air admitted to the duct 10 flows into the interior of the casing chamber, in a manner and for a purpose to be presently described. The head 4 of the casing is also provided with outlet or exhaust ports 13, 14 communicating with a chamber 15 in said head 4, said ports being preferably arranged on opposite sides of the rotor shaft and between the inlet ports 11, 12, heretofore described. The casing head 4 is also provided with ports 16, 17 located at points radially of the casing outside the ports 13, 14, as clearly shown in full lines in Figs. 2 and 3, and in dotted lines in Figs. 1 and 4.

Arranged within the casing chamber is a rotor keyed, or otherwise rigidly secured to the shaft 8, and consisting of a cylindrical body, including a hub 18 mounted on said shaft 8, and from which hub extends a series of blades 19, said blades extending radially from the hub for a distance, as at 20, and then being directed or curved rearwardly at their outer end portions, as at $20^a$, relative to the direction of rotation so as to form reaction surfaces and orifices $20^b$ between the outer ends of said blades at the periphery of the rotor. The rotor is provided with heads 21, 22 preferably formed integral with the side edges of the said blades 19, and together with the latter provide a plurality of chambers 23 adapted to receive and discharge a liquid piston at their orifices $20^b$, in a manner to be presently described. At the inner ends of these chambers and adjacent the hub are provided combined inlet and outlet ports 24 which are adapted to communicate with the ports 11, 12, 13, 14, heretofore described, to control the inflow and outflow of fluid under pressure, i. e., steam or compressed air, which is supplied through the inlet 9 and passage 10. These ports 24, in the embodiment shown, are located preferably in that head of the rotor which is located adjacent the casing head 4, heretofore described.

The rotor is made to fit the casing at certain points, as will be hereinafter described, so as to divide the casing into passages, to be presently described, adapted to establish communication between the chambers 23 of the rotor, and thus control and direct the force of the liquid piston upon the rotor blades. In the present embodiment I have shown the passages just mentioned in duplicate, and on opposite edges of the casing wall, but I wish it understood that my invention may be embodied in a device in which one, or more than two sets of said passages are employed. I will now describe

the construction and arrangement of said passages: In the peripheral wall 2, preferably of the casing, and in the embodiment shown on opposite sides of the rotor shaft, are two passages 25, 25 independent of each other, and each of which is provided with an entrance 26 communicating with the casing chamber, and said passage being directed from its said entrance rearwardly relative to the direction of rotation of the rotor, and at its extreme rear end portion being reduced or tapered in cross section, and turned and directed forwardly in the direction of rotation of the rotor to form a forwardly delivering jet orifice 27, as clearly shown in Figs. 1 and 3. The entrance 26 and the jet outlet 27 of each passage are separated by a wall or abutment 28, the inner face 29 of which forms part of the cylindrical bore of the casing chamber. The passage 25 is preferably tapered from its inlet 26 toward its outlet 27, so that proper velocity will be imparted to a liquid to produce effective jet action upon the blades of the rotor. It will be noted that in the embodiment shown, the jets 27 are located at points circumferentially of the casing between the fluid pressure inlets 11, 12, heretofore described.

Between the passages 25 and on opposite sides of the rotor, the bore of the casing is provided with recesses 30, said recesses being independent of each other, and the inlet ends 31 of which are located closely adjacent to, but spaced from the inlets 26, heretofore described, by means of a portion 32 of the casing wall which is closely approached by the periphery of the rotor and separates the passage 30 from said inlet 26. The passages 30 taper in depth from their said inlet portion 31 toward the outlet portion thereof, the latter being located adjacent the jets 27, heretofore described, and separated therefrom by a portion 33 of the casing. These passages 30 serve to direct the current of liquid flowing out of a rotor chamber in the direction of rotation of the rotor, and upon the rotor blades forward of the chambers discharging into said passages. The proportion of the passage 30 is important, in that it must be small enough so that the current of liquid flowing through it will travel much faster than the speed of rotation of the rotor, and thus be caused to impinge on the forward blades of the rotor at a greater velocity than that of the rotating rotor.

The inlet ports 11, 12, heretofore described, are so located in the heads as to register with the ports 24 in the rotor chambers to admit fluid under pressure thereto at the proper time, while the outlet ports 13, 14 are so located as to register with said ports 24 at the proper time to discharge the fluid into the discharge chamber or passage 15, from which said discharge fluid is exhausted through the exhaust outlet 34.

In the embodiment shown, the rotor is provided with twenty-one blades, which form twenty-one rotor chambers. Each of these chambers is provided with a port 35, preferably located in the head adjacent the casing head 4, said ports 35 being in circular arrangement about the center of rotation of the rotor, and adapted, during rotation, to register with the ports 16, 17, heretofore described. The casing contains a suitable liquid, which may be water, which liquid acts as a piston, and also acts to transmit power derived from the fluid under pressure to the rotor to drive the latter. An important feature of my invention is the construction and arrangement which maintains the liquid in most effective relation to the casing and rotor parts to produce maximum power effect, according to the particular design of the motor.

I will now describe the operation of the above described embodiment of the invention, and in order that the same will be more readily understood, I have designated each of the rotor chambers with letters *a* to *u*, inclusive: With the parts in the relative positions shown in Fig. 1, the chambers *a* and *b* are substantially full of the liquid contained in the casing, which liquid, as heretofore stated, acts as a piston. The port 24 in the chamber *c* is in register with the open inlet port 11, and steam or compressed air flowing from said inlet port through the port 24 into the chamber *c* exerts its force upon the liquid contained in said chamber, the result being that said liquid is expelled from the chamber and rearwardly through the chamber orifice 20$^b$ at the periphery of the rotor into the inlet 26 leading to the passage 25, said liquid being driven through said passage and through the jet 27 into a wheel chamber located at *a*, thereby filling the chamber *a* with liquid. When the rotor rotates until chamber *a* reaches the position of the chamber *c*, the liquid will in turn be expelled from said chamber *a* in the same manner as heretofore described with reference to chamber *c*, that is, the liquid is successively expelled from the rotor chambers through the passage 25 when the ports 24 at the inner ends of said chambers register with the inlet 11. This operation takes place on both sides of the rotor through the passages 25. In this operation the liquid is not entirely driven from the chamber *c* by the fluid pressure supplied through the inlet 11, but is only driven outward until the inner edge portion of the liquid just clears the port 35, as shown by the dotted line Z (see Fig. 1). The liquid in being expelled from the chamber at point *c* is placed under pressure, and also some velocity, and acts against the forward curved

wall 36 of the chamber *c* to exert force thereon to rotate the rotor. This operation occurs in each of the chambers as they successively pass into communication with the steam inlet 11. The liquid, when expelled from a chamber into the passage 25, is under pressure and velocity, and as it passes toward the jet 27, the velocity of flow is increased until it is expelled from the jet orifice 27 against the forward wall 36 of a chamber or chambers in register with said orifice, thereby serving to exert a driving force upon the rotor. It will thus be seen that a driving force is exerted at two points, namely, upon the forward wall 36 of any chamber in communication with the inlet 26 to the passage 25, and also upon the forward wall 36 of any chamber in register with the outlet of the jet 27. By this operation a dual turbine effect is produced, one force acting outward from the wheel, and the other inward from the casing.

It will also be seen that the liquid which is expelled from a forward chamber, in the direction of rotation, is delivered to a rearward chamber, so that it is always assured that the liquid expelled from a chamber will be delivered in proper quantity to a following chamber, which in turn is to have the liquid expelled therefrom, the result being that a normal or neutral liquid line, as indicated at Z, is maintained, which is advantageous, in that it insures proper supply of water to the turbine structure at all times, in order to produce efficient driving effect.

As heretofore stated, it will be seen that the employment of the ports 16, 17, and 35 in the rotor chambers serve to maintain a normal supply of liquid in the chambers of the rotor during rotation of the latter. It is important that each chamber when it is at point *a* should be completely filled, so that when it reaches the point *c* it will contain sufficient liquid to supply enough to passage 25, to insure filling of a succeeding chamber arriving at the point *a*. This is accomplished by so forming and arranging the passage 25, that it confines the discharge liquid, so that substantially all of the liquid will be delivered at the jet 27 into a chamber to completely fill the same. Furthermore, by insuring a complete filling of a chamber at the location *a*, when said chamber is partially discharged at the location *c*, sufficient liquid will be left in the chamber when it reaches the point *d* to be forced outward by the expansive force of the steam to produce the second or low pressure reaction in passage 30. It will thus be seen that it is important to so arrange and design the passage 25 and the inlet and outlet thereof, that not only will the chambers be completely filled, but when discharged partially at the inlet 26 to said passage, will still retain sufficient liquid to complete the second reaction at the inlet to the passage 30. Any deficiency of liquid at the entrance to the passage 30 will be made up by liquid admitted to the chambers through the passages 35 when they reach the port 16. It will therefore be seen that proper amount of liquid is at all times maintained in the rotor chambers.

When the rotor chamber *c* has moved to the position shown by the chamber designated *d*, the liquid remaining in said chamber is forced outward by the steam or air pressure into the inlet or receiving end portion 31 of the passage 30, and flows through said passage toward the outlet portion thereof and into the chambers *f*, *g*, *h* and *i*, the inward movement of the liquid in these latter named chambers forcing the exhaust products, i. e., the fluid under pressure, out of said chambers through the ports 24 and port 13, into chamber 15 and out through the exhaust 34.

In the operation so far described, it will be seen that chambers at positions *a* and *b* being substantially full of liquid, have the liquid ejected therefrom through the passage 25, to fill the chambers in rear, until the inner surface of the liquid remaining in said chambers *a*, *b* reaches the line Z, and that as soon as these chambers pass into register with the inlet end 31 of the passage 30 this remaining liquid is expelled through the passage 30 into chambers in advance of said chambers *a* and *b*. When the discharge orifice $20^b$ of the rotor chamber *c* passes to the position *d*, the steam acts expansively to expel a portion of the remaining liquid into the passage 30, the liquid acting against the surface 36, and also against the surface $31^a$ of the casing to exert an impelling force upon the rotor to drive the latter. This outward movement of the liquid continues through a portion of the circumference of rotation, the liquid entering the passage 30 and flowing forward in the direction of rotation of the rotor into chambers in advance of those discharging, and acts against the same to exert an impelling force upon those chambers located toward the outlet end of the said passage 30, whereby a dual reaction effect is produced upon the rotor, the first effect being produced upon the chambers discharging into the passage 30, and the second effect being produced upon the chambers receiving liquid from the passage 30. This also results in a proper amount of liquid being maintained in the discharging chambers to effect proper impelling force upon the blades of the rotor.

It is not necessary that the chamber *a* should have free communication with the outlet port 13 while the secondary action is taking place, because a portion of the steam or air remaining in said chamber may be

compressed by the inward motion of the liquid to act as a cushion in very much the same manner as in a simple steam engine.

The line Z may be considered as the average or neutral water line of the advancing chambers as they approach the position of the chamber *t*, and the wheel ports 35 are so located as to allow the water to escape through ports 16, 17 into the outlet chamber 15 if there is too much liquid present in the rotor chamber when the wheel ports come opposite to the ports 16, 17 in the casing. The outlet passage 15 normally contains such an amount of liquid that it will flow back into the wheel chamber through the said ports 16, 17 and 35, if there is not sufficient liquid in that portion of the casing in which the rotor turns. It will thus be seen that the ports 35 serve to regulate or equalize the normal amount of liquid in the rotor chambers. The centrifugal force acting upon the liquid will also to some degree assist in maintaining the normal liquid line in the casing chamber during rotation of the rotor.

It will be seen that the expansive force of the steam or compressed air acts to regulate itself as the power varies, and that when a high pressure of steam or compressed air is used, the wheel chambers will be emptied to a greater degree at the inlet 26 and at the inlet end of the passage 30, than when a low pressure of steam or compressed air is employed. This operates to vary the volume of the piston chamber as the power varies, so that the volume of the steam or compressed air is less, and economy on low pressure is increased.

The inlet ports 11, 12 are each preferably made wide enough to allow the steam or compressed air to flow as far as desired, but when the chamber *c* has passed said port the entrance of the steam is cut off from the rotor chamber, and from this point it will act expansively, as in a simple steam engine. This gives a fixed point of cut-off, so far as the position of the rotor is concerned. I do not, however, confine my invention to a fixed point of cut-off, as any approved form of cut-off device may be used.

When the engine is operating at normal loads, the liquid will approach the position Z in the chamber *u*, and in the first reaction it will fill the chamber *a* and arrive at the chamber *c* again at the level Z. If now the pressure of the steam in chamber *c* is great, a large amount of liquid will be driven through the passage 30, and said chamber will be substantially emptied when it reaches the position of the chambers, say of the chamber *f*, but if the steam or air pressure is low, the amount of liquid expelled will be correspondingly less.

I have shown the device having all the controlling ports in one head, so as to make the operation of the device simple to understand, but I may make these ports in both heads, either in duplicate or separately, some ports being in one head, and other ports in the other head. I have also shown the casing passages 25 and 30 in duplicate, but I may, within the scope of my invention, employ but one each of said passages, or employ any desirable multiple of such passages.

In Fig. 5 of the drawings, I have shown another embodiment of the invention, in which the reaction passages in the casing are modified. In this form the casing is formed with a passage $25^a$, corresponding to the passage 25, heretofore described, the outer wall being gradually curved outwardly from the inlet portion to a point in rear of the inlet, and then curved and directed forwardly at its outlet end, whereby a passage is formed which gradually enlarges from its inlet to its outlet, which passage compels the liquid to flow rearwardly relative to the direction of rotation of the rotor, and then to be directed forwardly upon the turbine structure and into the chambers of the rotor. In this form the element 28 is omitted. As shown, the chamber *c* is in communication with the inlet port 12, and the liquid is beginning to flow out of this chamber in the direction of the arrow into the inlet portion of the passage $25^a$. The chamber *d* is also directing some liquid into the same passage, and another portion of liquid in chamber *d* is being carried around in the direction of rotation of the rotor, as shown by the arrow in chamber $30^a$. It will be seen that at the point where the liquid leaves passage $25^a$ and enters the rotor chamber *b*, there is no orifice, but the liquid is caused to swirl around in the casing passage with a velocity entirely due to the velocity with which it was ejected by the motive agent from the orifices of chambers *c* and *d*. Also the liquid flowing out of chamber *d* passes around the walls of the casing passage $30^a$ corresponding to passage 30, heretofore described, with a velocity due to the force of the current at the orifice of the chamber *d*. Therefore the passage $30^a$ does not necessarily need to be of restricted size, because the current is caused by the velocity acquired in *d*, and not to the restricted size of the passage. After the current has started to flow around the passage $30^a$ under this velocity, it will enter any of the chambers *e*, *f*, *g*, *h*, whenever the conditions of pressure in said chambers will permit of its entrance. This formation of the casing passage $25^a$ permits of a wide variation in the rate of flow out of the discharging rotor passages, and adds very much to the efficiency of the device, because the liquid is free to adapt it-

self to the conditions of velocity at various rates of flow from the rotor orifices. In the form shown in Fig. 5, the individual inlet ports 24ª in the rotors are extended radially far enough to serve both as inlet ports for the motive agent and equalizing ports for the liquid in the chambers. In this form, the separate ports 16 are omitted, but the exhaust ports 13ª, 14ª are made wide enough radially of the rotor to function as exhaust ports, and also in the same manner as said ports 16.

The advantage of the modified form herein shown is that the pressures produced in the liquid by the motive fluid are largely confined within the walls of the rotor, causing the jet to issue from the rotor chamber orifices with the velocity due to the full force of the motive agent. The jet issues from the orifices *c*, *d*, and enters the casing passage 25ª with the velocity equal to the velocity of the jet minus the velocity of the wheel, and it glides around the walls of the passage 25ª, being reversed and carried along these walls so as to re-enter the rotor chambers in a similar manner to that shown in Figs. 1 to 4, inclusive, with the distinction that the jets in the casing are unnecessary. The advantage of this construction is that the rotor does not need to fit the casing chamber with any degree of accuracy, because there is substantially no leakage, this being due to the fact that the liquid in the casing chambers is not subject to pressure, except that due the force of the flowing liquid.

In Fig. 1 the effect of the outward flow turbine is secured, utilizing a part of the pressure of the motive agent, while the balance of this pressure is converted into velocity at an orifice in the casing wall. In the form shown in Fig. 5, the full velocity is imparted to the liquid at the rotor orifice and reacts upon the rotor to drive the latter, after which the liquid under its remaining or unexpended velocity is directed by the casing wall against the rotor to exert a driving effect thereon without employing an orifice in the casing. In both forms, however, there is a combination of both outward and inward turbine action, the liquid flowing outward from the rotor to perform one reaction, and inward from the casing to perform the second reaction.

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

1. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet at its rear portion discharging liquid through said orifices into said chambers successively, and said passage having an inlet at its forward portion into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers.

2. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet at its rear portion discharging liquid through said orifices into said chambers successively, said passage having an inlet at its forward portion into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, and means for admitting motive agent to said chambers when in line with said inlet to expel the liquid from the chambers.

3. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a closed passage in the casing having an outlet at one end discharging liquid through said orifices into said chambers successively, and said passage having an inlet at its other end and forward of said outlet in the direction of rotation, into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers.

4. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, and a second passage in the casing with which a chamber communicates after discharging into said inlet, said last-named passage delivering liquid against the rotor in advance of said inlet.

5. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, means for admitting motive agent to said chambers when in line with said inlet to expel the liquid from the chambers, and a second passage in the casing with which a chamber communicates after discharging into said

inlet, said last-named passage delivering liquid against the rotor in advance of said inlet.

6. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, and said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, each chamber having an inlet port admitting motive agent to the inner portion of each chamber when communicating with said passage inlet, and means for equalizing the amount of liquid in said chambers.

7. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, means for admitting motive agent to said chambers when in line with said inlet to expel the liquid from the chambers, and an equalizing port in each chamber between the inlet port therein and the orifice to the chamber.

8. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, means for admitting motive agent to said chambers when in line with said inlet to expel the liquid from the chambers, a second passage in the casing with which a chamber communicates after discharging into said inlet, said last-named passage delivering liquid against the rotor in advance of said inlet, and an equalizing port in each chamber between the inlet port therein and the orifice to the chamber.

9. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having a discharge orifice, a jet passage in the casing receiving and confining liquid discharged from said orifices successively and directing said liquid forwardly into a rotor chamber approaching the position of a discharging chamber, and means for admitting a motive agent to said chambers to discharge liquid therefrom into said jet passage.

10. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a passage in the casing having an outlet discharging liquid through said orifices into said chambers successively, said passage having an inlet into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, each chamber having an inlet port admitting motive agent to the inner portion of each chamber when communicating with said passage inlet, and ports for controlling the quantity of liquid in said chambers.

11. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having a discharge orifice, said chambers being formed by blades directed rearwardly relative to the direction of rotation, a passage in the casing receiving liquid discharged from said chambers successively and delivering said liquid to a rotor chamber approaching the position of a discharging chamber, a port at the inner end of each chamber for admitting motive agent to discharge liquid therefrom, and equalizing ports located between said inlet ports and the orifices of the chambers, said equalizing ports opening into a liquid-containing chamber.

12. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, means for maintaining a normal liquid supply in said chambers partially filling the latter, a passage in the casing having an outlet for supplying liquid to said partially filled chambers to successively fill the same, an inlet to said passage communicating with said chamber orifices, and means for admitting a motive agent to said chambers successively to drive a portion of said liquid into said passage to be supplied to said partially filled chambers.

13. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, means for maintaining a normal liquid supply in said chambers partially filling the latter, a passage in the casing having an outlet for supplying liquid to said partially filled chambers to successively fill the same, an inlet to said passage communicating with said chamber orifices, means for admitting a motive agent to said chambers successively to drive a portion of said liquid into said passage to be supplied to said partially filled chambers, and a passage

into which the remaining liquid subsequently is driven to impart a driving reaction to said rotor.

14. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having a discharge orifice, a passage in the chamber receiving liquid discharged from said discharge orifices successively and delivering said liquid to a rotor chamber approaching the position of a discharging chamber, and means for subsequently expelling liquid from said chambers successively and directing the same in the direction of rotation of the rotor and against the latter.

15. A motor device consisting of a system of revolving chambers, a casing enclosing said system, a plurality of passages in said casing, one of said passages receiving liquid from said chambers and delivering the same to a chamber in rear of a delivering chamber, and another of said passages receiving liquid from said chambers and delivering the same to a chamber in advance of the delivering chamber.

16. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers receiving and discharging liquid, each chamber having an orifice through which the liquid is received and discharged, means for admitting a motive agent to said chambers to expel liquid therefrom, a passage in the casing receiving discharged liquid from the chambers successively, and directing said liquid in a stream in a direction opposite to the rotation of the rotor, said passage having a forwardly directed discharge at its rear portion delivering the liquid forwardly into rotor chambers in rear of the discharging chambers.

17. In combination, a casing adapted to contain a liquid, a rotor in the casing and including a turbine structure and a plurality of chambers receiving and discharging liquid and each chamber having an orifice through which liquid is received and expelled, means for admitting a motive agent to said chambers to expel liquid therefrom, and a passage in the casing receiving expelled liquid from the chambers successively, said passage having a forwardly directed discharge at its rear portion delivering the liquid forwardly against the turbine structure and into a rotor chamber in rear of a discharging chamber.

18. In combination, a casing adapted to contain a liquid, a rotor in the casing and having a plurality of chambers each having an orifice, a closed passage in the casing having an outlet at one end discharging liquid through said orifices into said chambers successively, and said passage having an inlet at its other end and forward of said outlet in the direction of rotation, into which inlet the liquid supplied to said chambers at said outlet is discharged from said chambers into said passage to supply liquid through said outlet to following chambers, said passage being tapered from its inlet end toward its outlet end.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:
DANIEL H. BLY.
DOUGLAS E. NASH.