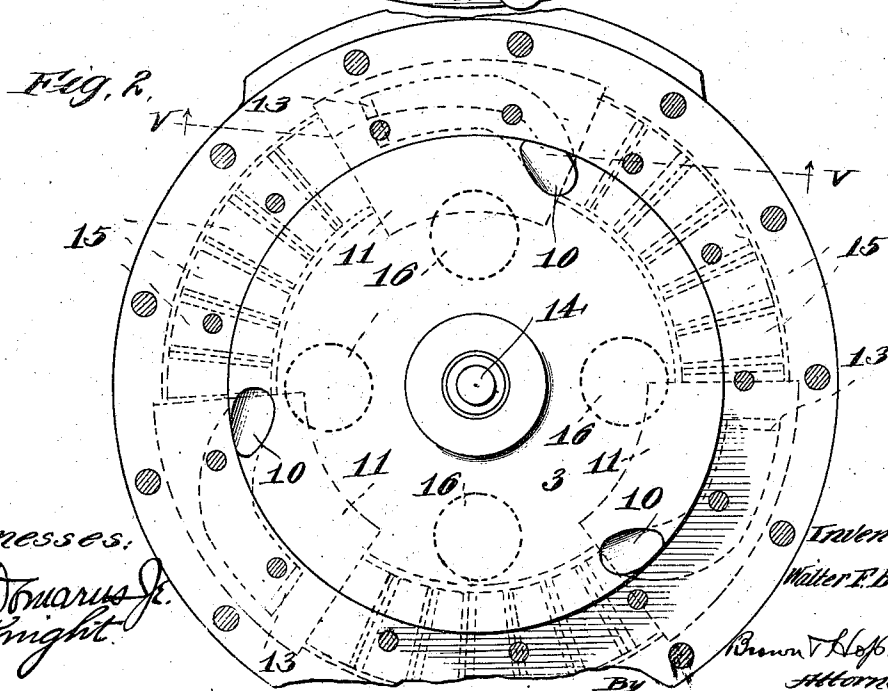
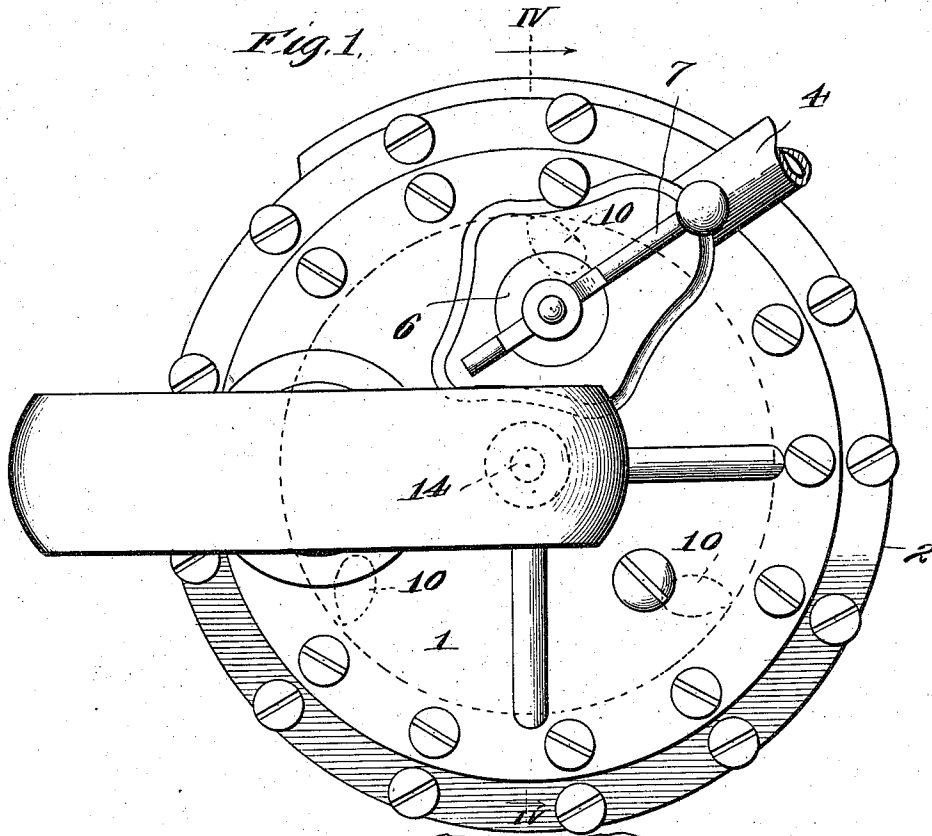


W. F. BORN.
ELASTIC FLUID MOTOR.
APPLICATION FILED MAY 4, 1910.

1,008,781.

Patented Nov. 14, 1911.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 3.

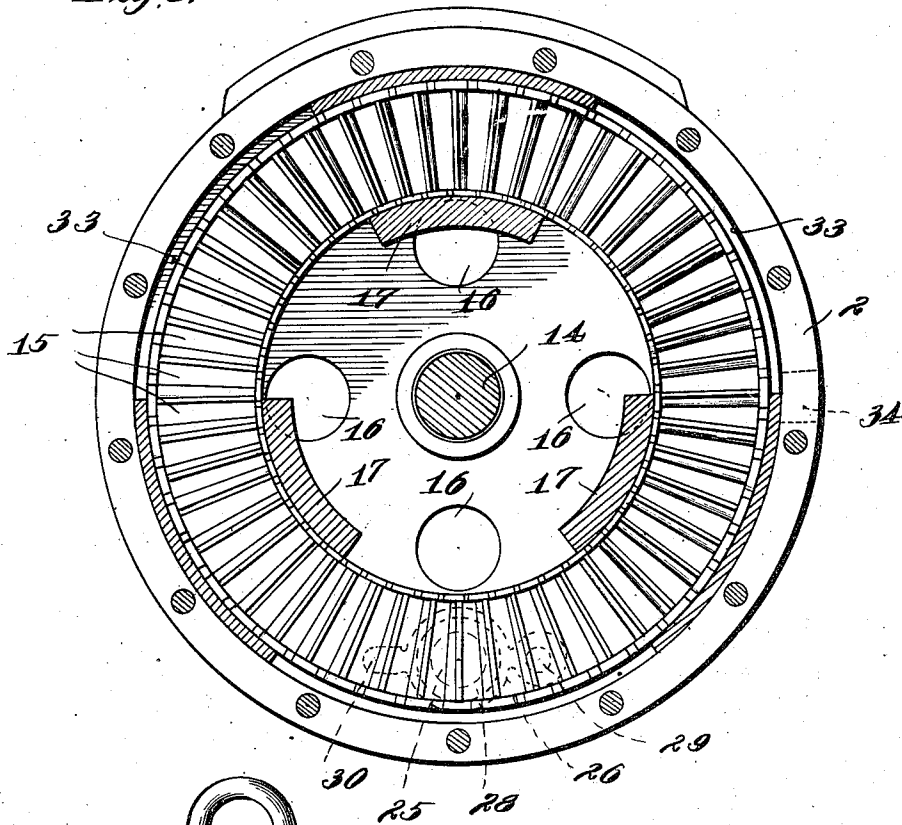
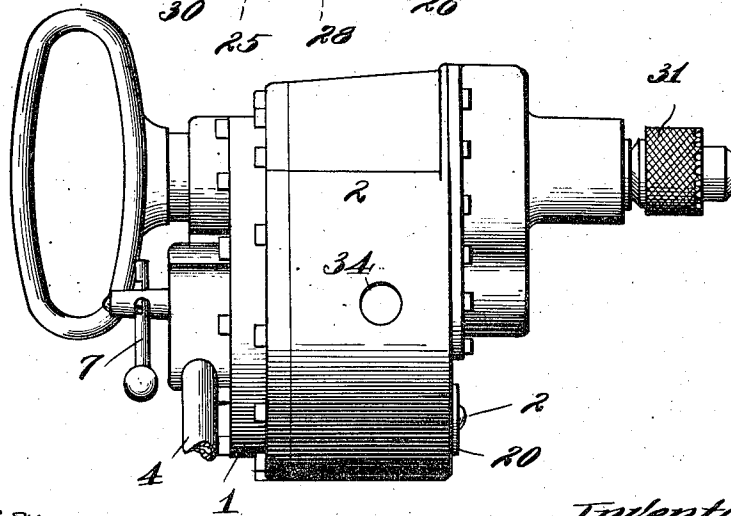


Fig. 6.



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3 SHEETS-SHEET 3.

Fig. 5.

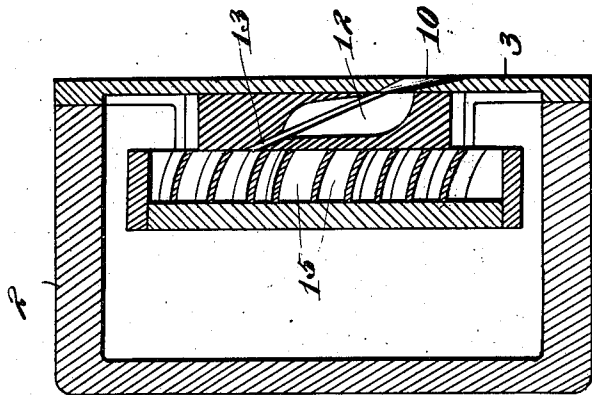
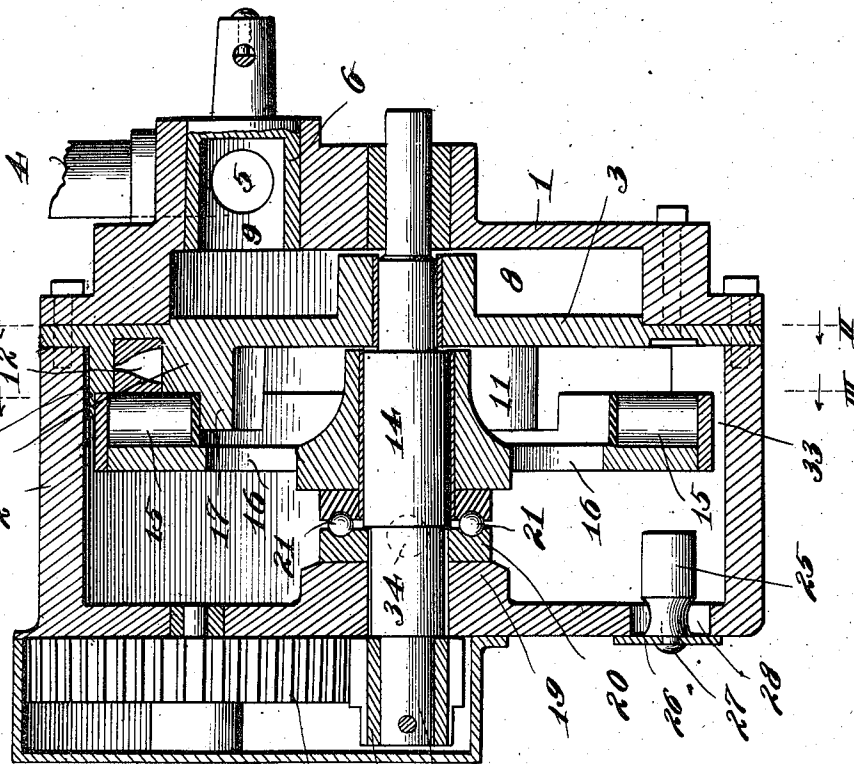


Fig. 4.



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UNITED STATES PATENT OFFICE.

WALTER F. BORN, OF DOWNERS GROVE, ILLINOIS, ASSIGNOR OF FORTY-NINE ONE-HUNDREDTHS TO ROBERT MIEHLE, OF CHICAGO, ILLINOIS.

ELASTIC-FLUID MOTOR.

1,008,781.

Specification of Letters Patent.

Patented Nov. 14, 1911.

Application filed May 4, 1910. Serial No. 559,380.

To all whom it may concern:

Be it known that I, WALTER F. BORN, a citizen of the United States, residing at Downers Grove, in the county of Dupage and State of Illinois, have invented certain new and useful Improvements in Elastic-Fluid Motors, of which the following is a specification.

This invention relates to elastic fluid motors and has for its primary object to provide an improved construction, combination and arrangement of parts in a rotary elastic fluid motor.

One of the objects of this invention is to provide improved means for delivering the elastic fluid to the rotor of the machine.

More specifically, one of the objects is to provide an improved construction and arrangement of nozzles for elastic fluid motors.

Another object is to provide improved packing means for the rotors of machines of this nature.

Another more specific object is to provide improved means for packing the individual cups of the rotor.

Another object is to provide improved means for muffling the exhaust of elastic fluid motors.

Other and further objects will appear in the specification and be specifically pointed out in the appended claims, reference being had to the accompanying drawings showing an exemplification of the invention.

In the drawings—Figure 1 is a top plan view of a motor embodying my improvements. Fig. 2 is a section on the line II—II, Fig. 4. Fig. 3 is a section on the line III—III, Fig. 4. Fig. 4 is a vertical section on the line IV—IV, Fig. 1. Fig. 5 is a section on the line V—V, Fig. 2. Fig. 6 is a general assembly view of the motor complete.

Referring more particularly to the drawings and to the embodiment shown therein, the rotor housing comprises a cap portion 1, and a lower shell or casing 2, said housing being provided with an intermediate partition or wall 3, (see Fig. 4 of the drawings).

As shown best in Figs. 1 and 4 of the drawings, the cap 1 is provided above with an inlet pipe 4 leading to an inlet port 5 in a throttle valve 6, said throttle valve be-

ing provided above with a throttle lever 7 whereby it may be opened or closed at will. Provided between the cap plate 1 and the partition wall 3, is a fluid chamber 8 with which the port 5 of throttle valve 6 communicates by means of a vertical passage 9. Within the partition wall 3, as shown best in Figs. 2 and 5, are provided a plurality of fluid conducting openings 10, which serve as inlets for the nozzles which are provided in portions rigid with the partition wall 3, as will now be more particularly described.

In order to provide nozzles of suitable form and arrangement which will adapt the motor to operate in the manner to be hereinafter pointed out, said nozzles are preferably formed in a plurality of lugs or protuberances 11, integrally formed with the said partition wall 3. As shown most clearly in Fig. 5, said nozzles comprise the inlet openings 10, which are preferably rounded in form leading to a supplemental fluid chamber 12, and a fluid outlet channel 13 which projects the fluid directly into the buckets passing therebeneath when the motor is in operation.

Referring more especially to Figs. 3 and 4 of the drawings, the rotor of the machine comprises a spindle 14 suitably journaled above in the cap 1 and partition wall 3 and below in the lower wall of the casing, and a disk-shaped member provided around its outer periphery with a plurality of laterally opening buckets 15, forming an annulus extending completely around the spindle 14. Between the spindle 14 and the peripheral annulus formed by the buckets 15, the disk of the rotor is provided with a plurality of perforations 16, for a purpose presently to be explained. The lugs or protuberances 11 of the partition wall 3 are each provided with a depending flange 17 within and a second flange 18 without said annulus, said flanges providing means for holding the fluid within the buckets during their passage under the protuberances 11. Each of the buckets 15 is provided with walls inclined rearwardly with reference to their direction of movement so that the fluid entering from the nozzle outlet 13 has imparted thereto as it enters the bucket a whirling movement. Furthermore, as the bucket passes out from under the protuberance or

lug 11, the curved wall directs the fluid rearwardly against the radial end wall of the segmental protuberance 11. The outer wall of the casing 2 is provided with a protuberance 19, which supports an end thrust bearing or race 20 for the ball bearings 21. Without the flat wall of the casing 2 the spindle 14 is provided with a reduced portion 22, upon which is keyed or otherwise rigidly secured a pinion 23 intermeshing with a gear 24, said gear 24 being rigidly secured to the chuck spindle for driving the tool. Projecting inwardly from the inner wall of the casing is a pin 25, preferably round. This pin has for its function to break up the fluid column within the casing in such manner as to muffle the exhaust. Preferably this pin projects from the outer flat wall of the casing, and according to the present embodiment of the invention, is rigidly secured to a leaf or closure 26 by means of a screw 27. Said closure 26 covers an opening 28 in the casing, and as shown in dotted lines in Fig. 3, is pivotally mounted on the outer wall of said casing by means of a pivot screw 29. On the end opposite pivot screw 29 said leaf or closure is provided with a finger grip 30, by means of which the closure may be oscillated on its pivot to adjust the position of the muffling pin 25, and if desired to provide an auxiliary exhaust by uncovering the opening 28 to any desired extent. As shown in Fig. 6, a hand-operated chuck 31 is mounted on the outermost end of the spindle driven by the gear 24. The outer face of this chuck is knurled to permit the same to be adjusted in the usual manner.

Referring more especially to Figs. 3, 4 and 5 of the drawings, the elastic fluid enters the inlet 4 and after going through the port 5 into the fluid chamber 8, passes through the inlet openings 10 of the several nozzles and into the fluid chambers 12, being discharged from said chambers 12 through the outlet nozzles 13 into the buckets 15. Inasmuch as the elastic fluid is delivered to the machine under high pressure it will be evident that during the time in which a vane of the rotor is passing over the outlet 13, said outlet is closed with the result that the dynamic force of the fluid entering through the inlet 10, is converted into pressure to provide a supplementary compression of the fluid. Immediately, the vane closing the outlet 13 having passed said outlet, there is an expanding discharge into the next bucket 15 to very materially intensify the impulse imparted by the motive fluid. In entering one of the buckets 15 which is almost instantly cut off from the fluid supply, the fluid has imparted thereto a whirling motion by reason of the rearwardly inclined disposition of the walls of the buckets 15, and when the bucket has emerged from un-

der the segmental protuberance 11, the inclination of the wall of the bucket causes the fluid to strike rearwardly against the radial end wall of said segmental protuberance. Escaping from the buckets, the fluid now passes through the perforations 16 in the disk portion of the rotor or down through the annular slots 33 between the buckets and the outer cylindrical wall of the casing.

Actual practice with a motor thus constructed demonstrates that the rotor moves axially in a direction toward the nozzles, while in operation. This is a most advantageous and valuable function, because it results in automatic packing of the elements carrying the buckets and the nozzles and keeps them in perfect adjustment at all times without danger of either leakage or excessive pressure and objectionable friction. This tendency of the rotor to thus move axially while in operation toward the pressure which drives it is due to the arrangement of the walls of the buckets at an oblique angle to the axis of the rotor, as better shown in Fig. 5, with their faces at an obtuse angle to the line of discharge from the nozzles, which of course results in the force of the fluid pulling the rotor toward the nozzles. This tendency of the rotor to move axially under the influence of the fluid discharging from the nozzles may be materially aided and governed to a nicety by controlling the exhaust and thereby creating more or less pressure on the side of the rotor opposite that to which the nozzles are presented.

By an inspection of Fig. 4, it will be seen that the extent of the surface of the lower or outer side of the rotor which is exposed to the fluid pressure escaping from the buckets is greater than the surface of the opposite side thereof, since a portion of the latter side is covered by the segmental protuberance under which or against which the buckets are driven. By reason of this difference in area there will therefore be a resulting pressure in favor of the under or outer side of the rotor, and which, though it may not be sufficient in itself to overcome the higher pressure of fluid in the nozzles, nevertheless resists the latter to a sufficient degree to enable the pulling tendency of the fluid resulting from the described angle of impingement against the wall of the bucket to create a preponderance of pressure toward the nozzle and thereby keep the rotor in close working fit with the protuberance in which the nozzle is formed. The wider the exhaust is opened, the less will be the cushion at the lower or outer side of the rotor, and hence a corresponding decrease in the pressure of the rotor against the segmental protuberances. It will also be seen that the fluid which is trapped within one of the

buckets serves to produce an additional packing action about the edges of the buckets.

While the exemplification of the invention shown in the drawings illustrates the embodiment of said invention in a hand tool for driving drills, reamers and the like, it will be readily understood that the combination and arrangement of parts hereinbefore set forth are equally applicable to other machines embodying a rotor and housing therefor.

What I claim is:

1. In an elastic fluid motor, the combination of a rotor provided with buckets opening laterally, thereof and having walls arranged at an oblique angle to its axis, a housing provided with nozzles discharging into said buckets against said walls each at an obtuse angle thereto, said rotor being movable axially, and provided with passages for conducting fluid to the other side of the rotor to resist the tendency of the pressure of the fluid in the nozzles to force the rotor axially away from the nozzles.

2. In an elastic fluid motor, the combination with a housing having nozzles provided in a portion rigid with said housing, said nozzles being provided with discharge orifices arranged in a plane, a rotor having buckets opening laterally and adapted to successively traverse said nozzle orifices, said buckets having walls arranged at an oblique angle to the axis of the rotor and each at an obtuse angle to the line of discharge of the nozzles when in position to receive the discharge from the nozzles whereby such discharge will pull the rotor toward the nozzles.

3. In an elastic fluid motor, the combination of a rotor provided with laterally opening buckets in one face thereof, a housing for said rotor provided with segmental protuberances having faces arranged in a plane parallel with the face of the rotor in which said buckets are formed and fitting in close propinquity thereto, said rotor being movable axially toward said segmental protuberances and said segmental protuberances being provided with nozzles for the discharge of fluid under pressure, the walls of said buckets being arranged at oblique angles to the axis of the rotor and each forming an obtuse angle with the line of discharge from each nozzle as it comes into such line, said buckets being formed on one side of the rotor only whereby the rotor will be free to be moved axially by the glancing action of the fluid discharging against the oblique walls of the buckets.

4. In an elastic fluid motor, the combination of a rotor provided with laterally opened buckets forming an annulus around the periphery thereof and with a perforated web, a housing for said rotor provided with a

projecting portion slidably engaging said annulus and provided with flanges projecting from said portion on either side of said annulus, and a nozzle in said projecting portion.

5. In an elastic fluid motor, the combination of a rotor provided with laterally opened buckets forming an annulus around the periphery thereof and with a perforated web, a housing for said rotor provided with a projecting portion slidably engaging said annulus and provided with flanges projecting from said portion on either side of said annulus, and a nozzle in said projecting portion, said nozzle being provided with inlet and discharge openings and an air compression chamber between said openings.

6. In an elastic fluid motor, the combination of a rotor provided with a plurality of buckets projecting laterally therefrom, a housing for said rotor provided with a plurality of portions with radial end walls, said portions successively closing said buckets, one of said portions being provided with a nozzle.

7. In an elastic fluid motor, the combination of a rotor provided with a plurality of buckets projecting laterally therefrom, a housing for said rotor provided with a plurality of portions with radial end walls, said portions successively closing said buckets, each of said portions being provided with a nozzle inclined in the direction of movement of the buckets.

8. In an elastic fluid motor, the combination of a rotor provided with a plurality of buckets projecting laterally therefrom, each of said buckets being rearwardly inclined, a housing for said rotor provided with a plurality of annular segmental portions with radial end walls, said portions successively closing said buckets and each having a nozzle provided therein.

9. In an elastic fluid motor, the combination of a rotor provided with a plurality of buckets projecting laterally therefrom and provided with rearwardly curved walls, a housing for said rotor provided with a plurality of annular segmental portions with radial end walls, said portions being adapted to successively close said buckets, and each provided with a nozzle, the curved walls of said buckets adapting said buckets to exhaust against the radial end walls of said segmental portions.

10. In an elastic fluid motor, the combination with a rotor provided with buckets on one side, of a housing for said rotor provided with a projection slidably engaging the bucket side of the rotor and cutting off a portion of the area thereof from the fluid pressure in the housing, means for delivering elastic fluid to said buckets, and means whereby the housing on one side of the rotor within the circle described by the buckets

is placed in free communication with the housing on the other side.

11. In an elastic fluid motor, the combination with a rotor provided with buckets on one side, of a housing for said rotor provided with projections slidably engaging the buckets side of the rotor, and cutting off a portion of the area thereof from the fluid pressure in the housing, said housing being further provided with an exhaust port, means for delivering elastic fluid to said buckets, and means within the casing for muffling the exhaust.

12. In an elastic fluid motor, the combination of a housing, a rotor within the housing provided with exhaust passages through and around the rotor, and a projection on the inner wall of the housing for breaking the fluid columns to muffle the exhaust.

13. In an elastic fluid motor, the combination of a housing, a rotor within the housing provided with exhaust passages through and around the rotor, and a pin adjustably mounted on the inner wall of the housing for muffling the exhaust.

14. In an elastic fluid motor, the combination of a housing, a rotor within the housing provided with exhaust passages through and around the rotor, and a pin adjustably mounted on the inner wall of the housing for muffling the exhaust, the wall of said housing being provided with an exhaust port.

15. In an elastic fluid motor, the combination of a rotor and a housing therefor, said housing being provided with an exhaust outlet, and a pin within said housing for muffling the exhaust.

16. In an elastic fluid motor, the combination of a rotor and a housing therefor, said housing being provided with an exhaust outlet and an additional opening, a closure for said opening adapted to adjust the size of said additional opening, and a pin mounted on said closure and projecting through the additional opening for muffling the exhaust.

17. In an elastic fluid motor, the combination of a rotor provided with buckets, of a housing for the rotor provided with a nozzle formed therein, said nozzle comprising a fluid chamber, an inlet leading to said chamber, and a discharge leading from said chamber, said discharge being provided with an orifice of approximately the width of the buckets.

18. In an elastic fluid motor, the combination of a rotor provided with buckets projecting laterally therefrom, a housing for said rotor provided with a partition transverse of the axis of said rotor and forming a fluid chamber above the partition, said partition being provided with depending lugs in slidable engagement with said buckets, said lugs having formed therein nozzles for projecting the fluid into the buckets, each of said nozzles being provided with a secondary fluid chamber.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 1st day of December A. D. 1909.

WALTER F. BORN.

Witnesses:

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C. H. SEEM.