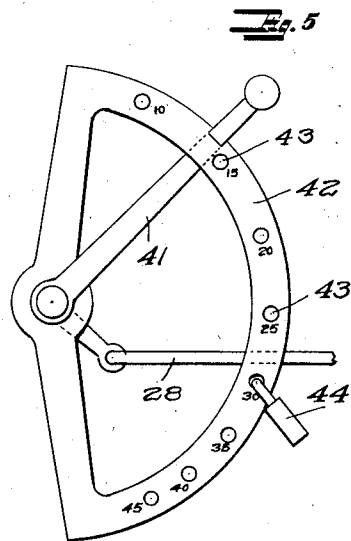
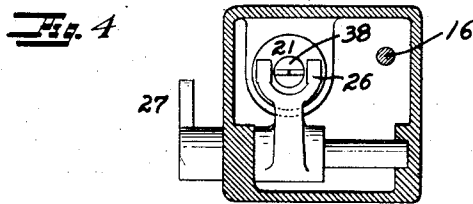
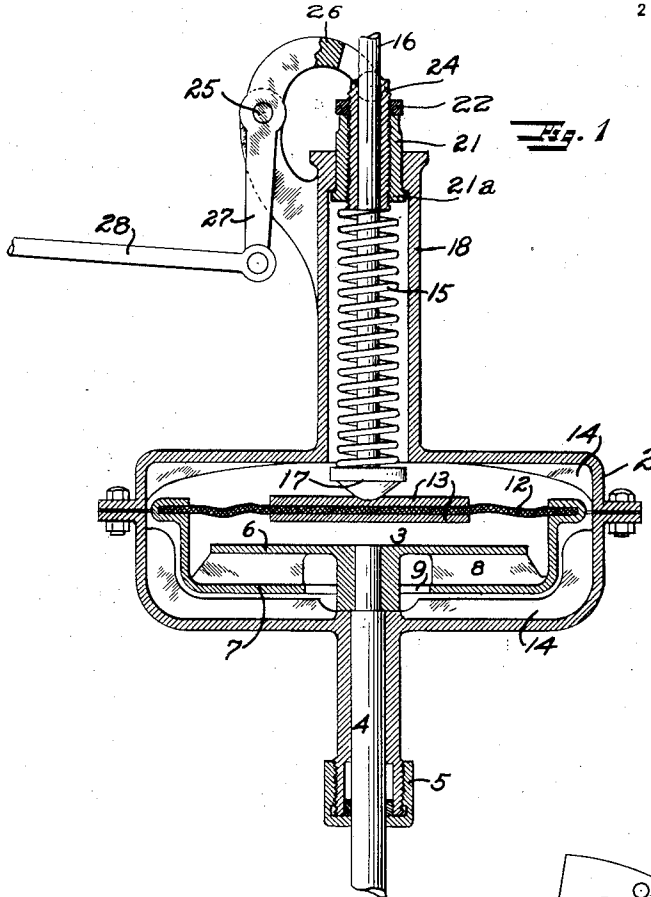


G. C. PHARO.
PRESSURE OPERATED APPARATUS.
APPLICATION FILED DEC. 6, 1915.

1,222,985.

Patented Apr. 17, 1917.

2 SHEETS—SHEET 1.



WITNESS

J. B. Gardner

INVENTOR.

G. C. PHARO

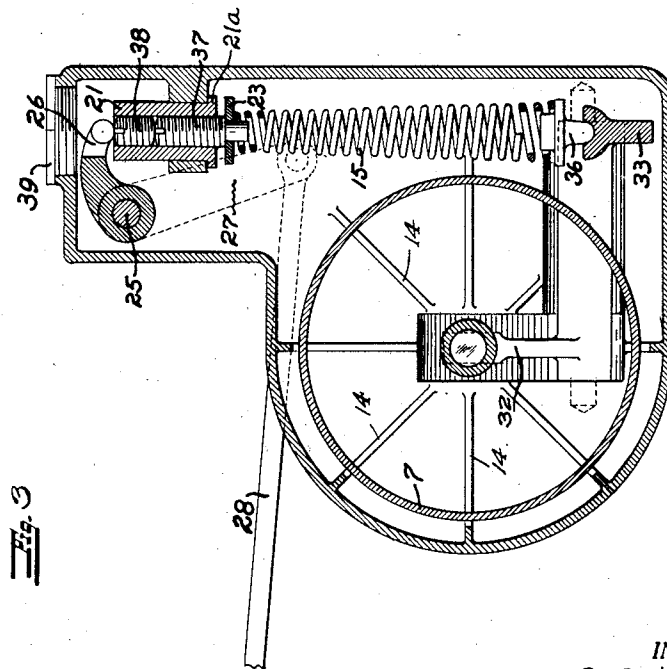
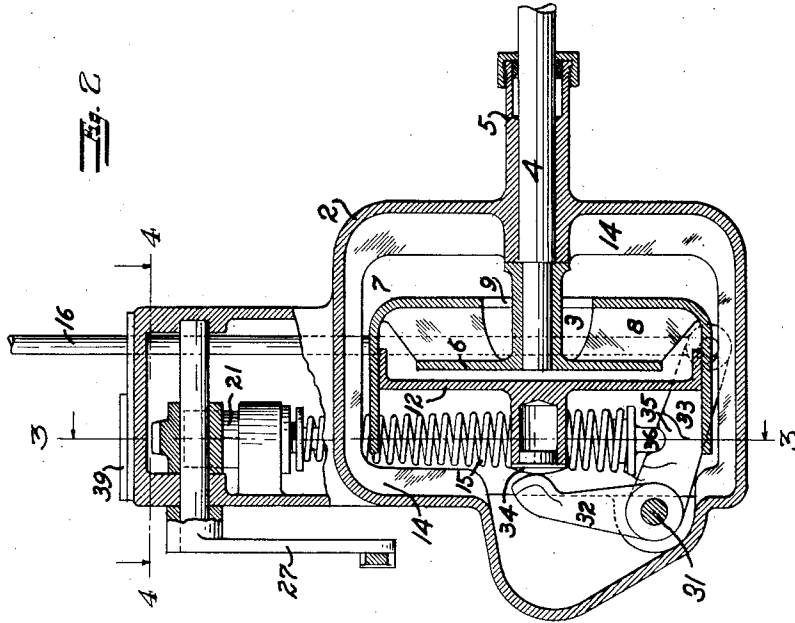
BY *White Frost*

HIS ATTORNEYS.

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WITNESS
J. B. Gardner,

INVENTOR.
G. C. PHARO
BY *White Prost*
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE.

GORDON C. PHARO, OF MARYSVILLE, CALIFORNIA, ASSIGNOR TO PHARO & CHAPMAN,
A COPARTNERSHIP COMPOSED OF GORDON C. PHARO AND RICHARD D. CHAPMAN,
BOTH OF SAN FRANCISCO, CALIFORNIA.

PRESSURE-OPERATED APPARATUS.

1,222,985.

Specification of Letters Patent.

Patented Apr. 17, 1917.

Application filed December 6, 1915. Serial No. 65,259.

To all whom it may concern:

Be it known that I, GORDON C. PHARO, a citizen of the United States of America, and a resident of Marysville, county of Yuba, State of California, have invented a new and useful Pressure-Operated Apparatus, of which the following is a specification.

My invention relates to pressure operated apparatus in which pressure is produced in a chamber by the rotation of an impeller or other device acting on a liquid. A rotating impeller is employed for forcing fluid into a chamber, the pressure of the fluid in the chamber varying with the speed of the impeller.

An object of the invention is to provide a pressure operated apparatus of the class described, which is simple in construction and efficient and sensitive in operation.

Another object of the invention is to provide a pressure operated apparatus in which unbalanced pressures are produced on opposite sides of a movable wall.

Another object of the invention is to provide a pressure operated apparatus having a movable element whose position varies with the speed of the impeller or pressure producing element and means for varying the range of movement of this element at given speeds of the impeller.

The invention possesses other advantageous features, some of which, with the foregoing will be set forth at length in the following description, where I shall fully explain that preferred form of my invention which is illustrated in the drawings accompanying and forming part of the specification. In the drawings I have shown several specific forms of my generic invention, but it is to be understood that I do not limit myself to the showing made by the said drawings and description, as I may adopt other variations within the scope of my invention as set forth in the claims succeeding the description.

Figure 1 is a vertical section of one form of the apparatus of my invention.

Fig. 2 is a vertical section of a modified form of the apparatus of my invention.

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2.

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 2.

Fig. 5 is a view of a portion of the apparatus, showing the control lever and quadrant.

The apparatus possesses a variety of uses and since it includes an element whose position varies with the speed of the impeller or pressure producing element, it may be used as a governor for steam or internal combustion engines, hydraulic apparatus and other devices. It may be employed to control the throttle valve or valve mechanism and in internal combustion engines it may be used to vary the timing of the spark. The apparatus is not injuriously affected by jolts and is, therefore, particularly adaptable for governing the speed or spark of internal combustion engines which drive vehicles. In connection with internal combustion engine driven tractors it has proved valuable, for these vehicles usually operate over rough and broken ground. But it is contemplated that the most useful field of the invention as embodied in the drawings accompanying the present specification, lies in its application to motor trucks or taxicabs where it is applied to limit the range of engine speeds and thus prevent abuse of and undue wear upon the engine and vehicle.

I will first describe the apparatus shown in Fig. 1. This consists of a tight housing 2 adapted to contain a quantity of liquid and preferably circular in form. In the housing is arranged a rotatable impeller 3 secured to the shaft 4, which in this construction is vertical and which projects from the housing through the stuffing box 5. The impeller comprises the imperforate plate 6, a plate 7 and a plurality of vanes 8 lying between the plates. Plate 7 is provided with a central suction inlet 9 and is extended outwardly beyond the periphery of plate 6 and then flanged so that it constitutes a cup or casing in the bottom of which the impeller lies. For convenience, the side of the impeller comprising the plate 7 having the suction inlet 9 therein, will be called the suction side of the impeller to distinguish it from the opposite or discharge side.

Attached to the wall of the casing 7 on the discharge side of the impeller is a movable wall or diaphragm 12. This diaphragm may be of any suitable construction, but I prefer to make it of flexible material such as

leather and to stiffen it at the center by metallic plates 13. The diaphragm closes the casing formed by the plate 7 with a wall movable axially relative to the casing and the impeller, and with the casing 7 provides a closed chamber into which a portion of the liquid in the housing is forced by the rotation of the impeller to produce pressure on the movable wall 12. Since rotation of the liquid contained in the housing will, by its centrifugal force, produce undesirable pressures on the casing in opposition to the pressures created by the impeller, means are provided to prevent or minimize this rotation, in the form of radially disposed vanes 14 arranged on the walls of the housing in proximity to the rotary casing.

Normally, the movable wall 12 is held in the depressed position by a spring 15 surrounding the axially slidable rod 16 and bearing against the shoe 17 in which the rod terminates, and which bears against the stiffening plate 13 preferably seating in a depression therein. Movement of the wall 12 due to unbalanced pressure produced by rotation of the impeller is thus communicated to the rod 16, but is opposed by the action of the spring 15. The rod 16 is connected directly or by any suitable means to the engine valve gear or other mechanism which it is to regulate or operate. Preferably the rod and spring are contained in an extension 18 of the casing 2. The end of the extension is closed by a nipple 21 slidably arranged therein. Threaded into the nipple 21 and forming a bushing between it and the rod 16 is a second nipple 24. The upper ends of both nipples are flattened so that a wrench may be used thereon, and a lock nut 22 permits the nipples to be secured in their relative adjustment. The flange 21^a limits the upward movement of the nipple 21. The housing is filled with oil or other liquid, the viscosity of which partly determines the sensitiveness of the apparatus. When the impeller is rotated, the oil is drawn through the suction inlet 9 in the casing 7 and discharged into the chamber formed by the casing and the movable wall. The oil exerts pressure on the wall of the casing and produces an axial movement of the rod 16, in opposition to the spring 15, the amount of movement varying with the speed of the impeller. The relatively adjustable nipples provide means for varying the amount of movement of the rod at any given speed of the impeller. By turning the nipple 24 in the nipple 21 the tension of the spring is varied, and the rod 16 is moved with greater or less difficulty at the same impeller speed. A light tension on the spring permits the maximum movement of the rod at a given speed of the impeller, while a heavier tension lessens the movement of the rod at the same impeller speed.

Suppose the rod 16 to be connected to the throttle valve of a taxicab or truck engine and the shaft 4 connected to a rotating part of the engine. When the engine is at rest the impeller is also at rest and the movable wall and rod 16 are in the retracted or depressed position. As soon as the engine picks up speed, the speed of rotation of the impeller mounts and at the selected maximum speed of the engine the effort of the movable wall has overcome the resistance of the spring and has operated the rod 16 and its connected mechanism to partly or wholly close the throttle valve. A lessening of the engine speed slows the rotation of the impeller and less pressure is exerted by the movable wall against the spring which therefore tends to return the rod to the retracted position opening the throttle. In practice it is found that the apparatus is very sensitive and that an exceedingly close regulation is had.

Means are also provided by which the tension of the spring may be varied directly by the driver of the vehicle. The structure formed by the two nipples and the lock nut 22 is slidably arranged in the end of the casing extension 18, being normally held in the position shown in the drawings by the upward push of the spring 15. A bell crank lever is pivoted at 25 upon an extension of the casing and bears upon the top of the lock nut 22, the end 26 of the lever being bifurcated so as not to interfere with the rod 16 or the end of the nipple 24. The other arm 27 of the bell crank lever is connected by suitable means including the rod 28 to a lever 41, Fig. 5, placed preferably on the steering wheel of the vehicle so that operation of this lever will rock the bell crank and move the nipple structure, thus varying the tension of the spring which permits a variation of the engine speed. Within certain predetermined limits, then, the engine speed is controlled by the normal operation of the governor and this limit may be varied within predetermined limits at the will of the operator.

The lever 41 is arranged upon a quadrant 42, preferably upon the steering post of the machine. The rim of the quadrant is provided with holes 43 so that a padlock 44 can readily be snapped therethrough to limit the maximum throw of the lever and hence the maximum speed of the engine. Without the padlock inserted in the quadrant rim the lever may be thrown around to compress the spring 15 to the maximum degree and secure the highest speed of the engine, but by locking the padlock at the proper point on the quadrant, the driver of the car is limited to the speed corresponding to the greatest spring tension then possible to produce. For convenience, the apertures in the quadrant may be numbered to correspond with the

speed of the engine when the lever 41 is moved to that point. Fig. 5 shows the padlock inserted in the quadrant to block the further movement of the lever when the speed has reached 30 miles per hour. It will be clear from the above that means are provided whereby the car owner may keep within his control at all times the maximum speed at which the car may be driven by an employee.

In the construction shown in Figs. 2, 3 and 4, which provides for a horizontal driving shaft, the movable wall 12 is formed as a piston slidably arranged in the casing 7 and the motion of the wall is conveyed to the rod 16 through a bell crank lever pivoted at 31 and consisting of the arms 32 and 33. The arm 32 bears against the extension 34 carried by the movable wall. The other arm 33 is connected at its outer end with the rod 16 and intermediate its ends is provided with a socket 35 in which the shoe 36 of the spring 15 seats. The normal tension of the spring is adjusted by means of the screw 37 and lock screw 38 threaded into the nipple 21. The end 26 of the bell crank lever bears directly upon the nipple 21. Preferably a washer 23 is interposed between the end of the screw 37 and the spring 15. All parts are inclosed in the housing and a removable plug 39 gives access to the spring adjustment means.

It will be noted that in each of the constructions shown, the openings in the housing are above the level of the liquid contained therein, except the bearing for the driving shaft 4 of the impeller which is provided with a suitable stuffing box. This arrangement obviates leakage of the liquid in the casing and simplifies the construction of the apparatus. It is obvious that the leather diaphragm may be used in a construction similar to that of Fig. 2 or a piston arranged in a construction like that of Fig. 1.

I claim:

1. In a device of the class described, an impeller having a wall on one side extending longitudinally beyond the opposite side and forming a cylinder, said wall being formed to direct the discharge from said impeller in a direction parallel to its axis of rotation, and a movable wall engaging said cylinder operated by the fluid pressure therein.
2. In a device of the class described, an impeller having an imperforate wall, a second wall spaced from said imperforate wall having a suction inlet therein and extending longitudinally beyond the periphery of said imperforate wall to form a cylinder, whereby the fluid is discharged from said impeller in a direction parallel to the axis, and a movable wall engaging said cylinder.
3. In a device of the class described, a housing, a centrifugally acting impeller in

said housing, a casing attached to the suction side of the impeller and a movable wall engaging said casing.

4. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall engaging said casing and a member adjacent the movable wall adapted to be moved thereby.

5. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller and extending beyond the opposite side, a movable wall engaging said casing and a member in said housing adjacent the movable wall and adapted to be moved thereby.

6. In combination, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall engaging said casing, and means opposing the movement of the movable wall.

7. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, an axially movable wall engaging said casing and rotating therewith, a member adjacent the movable wall adapted to be moved thereby and means opposing the movement of said movable wall.

8. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller and extending beyond the opposite side, a movable wall engaging said casing, a member in said housing movable with said movable wall and means opposing the movement of said member.

9. In combination, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall engaging said casing, a member operable by said movable wall, a spring opposing the movement of the member and means for varying the tension of said spring.

10. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall engaging said casing, a rod extending into said housing and operable by said wall, means opposing the movement of the member and means for varying the degree of opposition.

11. In combination, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall attached to said casing and forming a closed chamber on the discharge side of the impeller, a body of liquid in said housing adapted to be forced into said closed chamber by said impeller to

move said movable wall, and a rod extending into said housing and adapted to be moved by said movable wall.

12. In combination, a housing, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, a movable wall attached to said casing and forming a closed chamber on the discharge side of the impeller, a body of liquid in said housing adapted to be forced into said closed chamber by said impeller to move said movable wall, a mechanism actuating member extending into said housing adapted to be moved by said movable wall and means opposing the movement of the member.

13. In combination, a housing, a centrifugally acting impeller in said housing, a casing attached to the impeller, a movable wall attached to said casing and forming, with the casing, a closed chamber on the discharge side of the impeller, a body of liquid in said housing adapted to be forced into said closed chamber by said impeller to move said movable wall, a valve actuating member extending into said housing adapted to be moved by said movable wall, means for opposing the movement of the member and means for varying the strength of said opposing means.

14. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a wall attached to the suction side of the impeller and forming a casing in which the impeller is disposed and a wall engaging said casing axially movable with respect thereto.

15. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a wall attached to the suction side of the impeller and forming a casing in which the impeller is disposed, a movable wall engaging said casing and a body of liquid in said casing.

16. In a device of the class described, a housing, a centrifugally acting impeller in said housing, a wall attached to the suction side of the impeller and forming a casing in which the impeller is disposed, a movable wall engaging said casing and a body of liquid in said housing adapted to be forced into the impeller containing casing by rotation of the impeller.

17. In combination, a housing containing a body of liquid, a centrifugally acting impeller in said housing, a casing attached to the suction side of the impeller, and a movable wall attached to said casing to form a closed chamber on the discharge side of the impeller, rotation of the impeller causing a difference in pressure in the housing and said chamber.

18. In combination, a housing containing a body of liquid, a centrifugally acting impeller in said housing, a wall attached to

the suction side of the impeller and forming a casing in which the impeller is disposed, a movable wall engaging said casing and forming a closed chamber on the discharge side of the impeller, rotation of the impeller producing a difference in pressure in the housing and said chamber, said movable wall and said casing being movable axially with respect to each other, means opposing said relative movement and mechanism actuating means extending into said housing adapted to be moved by said movable wall.

19. In combination, a housing containing a body of liquid, a centrifugally acting impeller in said housing having a casing attached to the suction side of the impeller and extending beyond the opposite side, a movable wall engaging said casing, means for rotating said impeller and means for preventing the rotation of the liquid in the housing.

20. In combination, a housing containing a body of liquid, a centrifugally acting impeller in said housing having a casing attached to its suction side, a movable wall attached to said casing, rotation of the impeller serving to produce a difference in pressure on opposite sides of said wall, said wall and casing being relatively axially movable due to such difference in pressure, a spring opposing such axial movement and a mechanism actuating rod extending into said housing adapted to be moved by said relative movement.

21. In combination, a housing containing a body of liquid, a centrifugal impeller in said housing having a casing attached to its suction side and extending beyond the discharge side, a movable wall engaging said casing, rotation of the impeller serving to produce a difference in pressure on opposite sides of said wall, said wall and casing being relatively axially movable due to such difference in pressure, a spring opposing such axial movement, means for varying the tension of said spring and a mechanism actuating rod extending into said housing adapted to be moved by said relative movement.

22. In combination, a housing containing a quantity of liquid, a rotatable casing in said housing having a suction inlet and centrifugally acting impeller disposed adjacent said inlet, an axially movable wall closing said casing, rotation of said casing serving to force liquid from said housing into said casing to move said wall, and a valve operating member in said housing adapted to be moved by said wall.

23. In combination, a housing containing a quantity of liquid, a rotatable casing in said housing having a suction inlet and centrifugally acting impeller disposed adjacent said inlet, an axially movable wall closing said casing, a valve operating member in

said housing adapted to be moved by said wall, and means in said housing for preventing the rotation of the liquid therein.

24. In a device of the class described, a housing, a rotatable casing in said housing having a movable wall, a spring opposing the movement of said wall and means for varying the tension of said spring during the operation of said device.

25. In a device of the class described, a housing, a rotatable casing in said housing having a movable wall, a spring opposing the movement of said movable wall, means for adjusting the spring to operate within certain limits and means for varying said limits during the operation of said device.

26. In a device of the class described, a housing, a rotatable casing in said housing having a movable wall, means operative within predetermined limits opposing the movement of said wall and means for varying the degree of opposition to said opposing means.

27. In combination, a housing, a rotatable casing in said housing having a movable wall, a rod operable by said movable wall, a spring opposing the movement of the rod, means for adjusting the tension of said spring in accordance with the normal thrust of said movable wall and means for varying the tension of the spring from the normal adjustment.

28. In a device of the class described, a housing, a rotatable casing in said housing having a movable wall, a spring opposing the movement of said movable wall, means for varying the tension of said spring during the operation of the device and means for blocking the movement of said tension varying means at predetermined points.

29. In a device of the class described, a housing, a rotatable casing in said housing having a movable element, a spring opposing the movement of said movable element, means for adjusting the spring to operate within certain limits, means for varying said limits, and locking means for limiting the action of said limit varying means.

30. In a device of the class described, a housing, a rotatable casing in said housing having a movable element, a spring opposing the movement of said movable element, a control lever for varying the tension of said spring during the operation of the device, a quadrant adjacent said lever and means adapted to be locked at predetermined positions on said quadrant, to limit the throw of said lever.

In testimony whereof, I have hereunto set my hand at San Francisco, California, this 1st day of December 1915.

GORDON C. PHARO.

In presence of—
H. G. PROST.