July 2, 1940. P. W. ADLER 2,206,384

METERING PUMP

Filed July 6, 1938

FIG. 1.

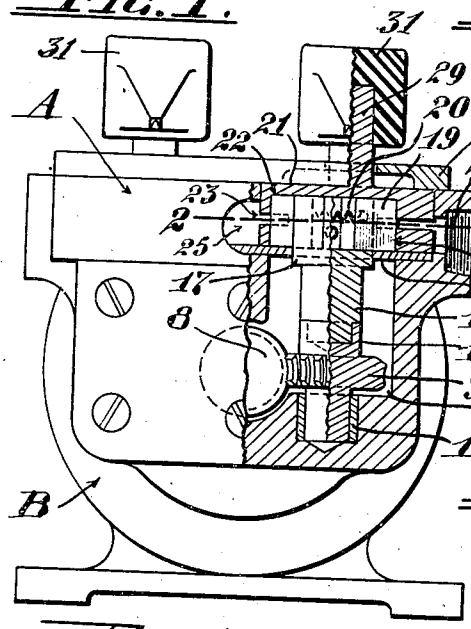


FIG. 2.

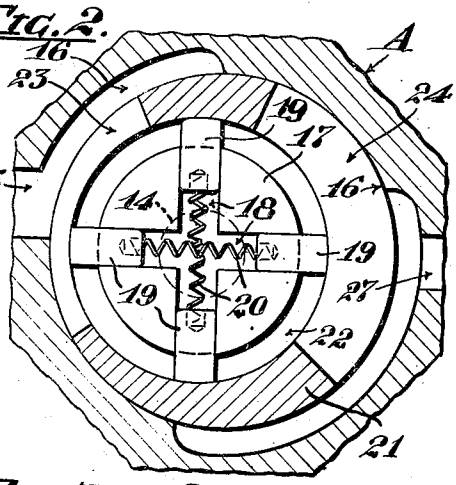


FIG. 3.

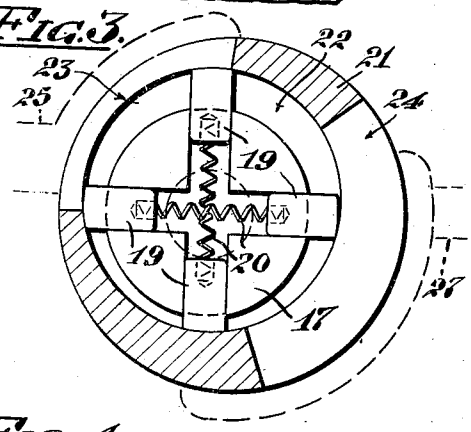


FIG. 5.

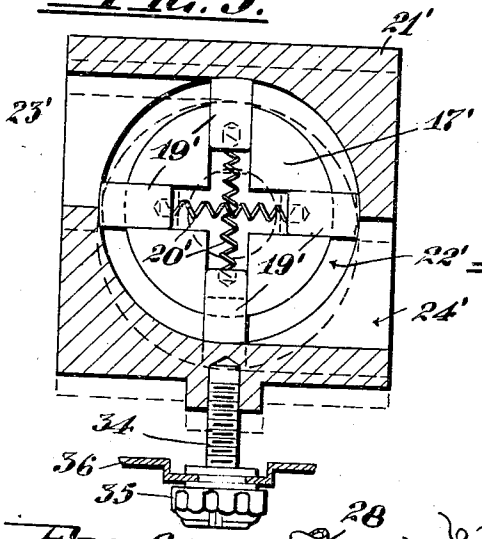


FIG. 4.

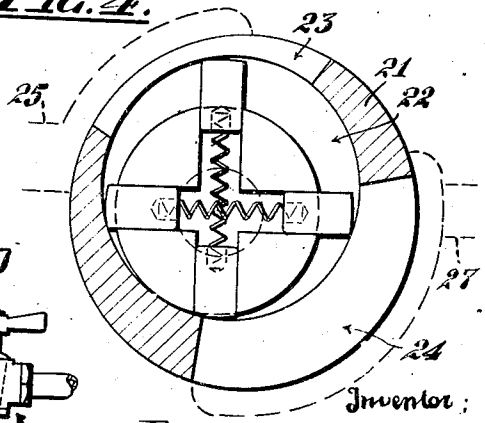
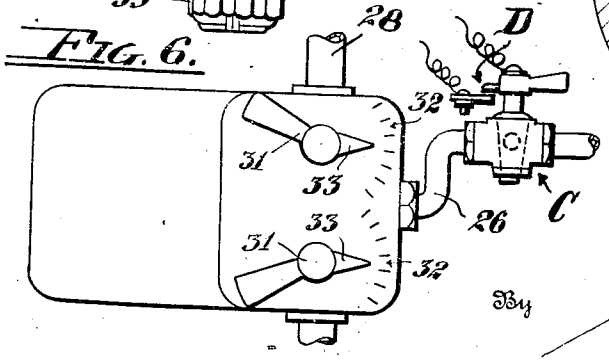


FIG. 6.



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Patented July 2, 1940

2,206,384

UNITED STATES PATENT OFFICE

2,206,384

METERING PUMP

Paul W. Adler, Hollywood, Calif.

Application July 6, 1938, Serial No. 217,696

1 Claim. (Cl. 103—120)

This invention relates to a pump and more particularly pertains to a rotary variable capacity pump.

An object of the invention is to provide a pump which is so constructed and operated that its capacity may be readily and accurately varied by a simple adjustment, whereby the volume and pressure of the fluid output of the pump may be regulated and varied as occasion may require relative to a constant speed of the pumping mechanism and without effecting variation in such speed.

Another object is to provide a variable capacity pump in which the output may be gauged with such accuracy as to obviate the use of flow meters, by-pass valves, supplemental regulating valves, auxiliary speed control, mechanisms, overflows, and similar devices, and whereby use of rheostats, pressure release control valves, and indicating meters as commonly employed in conventional pumps for controlling and indicating the flow of discharge from the pump in any given time is dispensed with.

Another object is to provide a safe, reliable and efficient pump for the metering of various gases or liquids in whatever ratios may be desired.

Another object is to provide a pump embodying a positive out-put control subject to extremely fine vernier action.

A further object is to provide a pump wnich embodies few simple parts so formed and operated as to admit of the production of a pump of extremely small capacity and yet be subject to extremely fine control in the volume of its output from nothing to the maximum of its capacity.

With the foregoing objects in view, together with such other objects and advantages as may subsequently appear, the invention is carried into effect as illustrated by way of example in the accompanying drawing, in which:

Fig. 1 is a view in end elevation partly in vertical section of a duplex rotary pump showing the invention as applied;

Fig. 2 is an enlarged detail in section taken on the line 2—2 of Fig. 1 showing the pump head with the parts arranged in an idling position;

Fig. 3 is a diagram in section similar to Fig. 2 with the parts disposed in an intermediate position in effecting a medium pump output;

Fig. 4 is a diagram in section similar to Fig. 2 showing the parts positioned for maximum pump output;

Fig. 5 is a diagram in section depicting a modified form of the invention;

Fig. 6 is a plan view of the pump structure shown in Fig. 1 as positioned at an angle of ninety degrees relative to the positions shown in Fig. 1, showing the vernier adjustments, and depicting the manner of controlling the operation of the pump.

Referring to the drawing more specifically, A indicates generally a pump casing which may be of any suitable construction, but which is here shown as fitted on the housing B of an electric motor; the casing A being preferably cast integral with the motor housing.

The drive shaft of the motor in the housing B extends into the casing A and is fitted with worm wheel 8 which meshes with a worm 9 on a driven shaft 10 journaled at one end in a bearing 11 mounted in the bottom wall of a chamber 12 formed interiorly of the casing A. As here shown, the pump casing is designed to contain a pair of corresponding pumping mechanisms driven from the worm wheel, only one of which need be shown and described in detail since the parts are complementary.

The upper end of the driven shaft 10 is rigidly connected to an impeller shaft 14 which leads through and is journaled in a septum 15 covering the chamber 12 and separating the latter from a chamber 16 in the upper portion of the casing A. The upper end of the impeller shaft 14 is formed with a cylindrical head 17 constituting a rotor which projects above the septum 15 and is formed with a series of radial slots 18, here shown as four in number, and which slots are spaced equidistant apart around the periphery of the head 17 and interconnect with each other at their inner ends. Slidably mounted in the slots 18 are vanes 19 the inner ends of which terminate in outward spaced relation to the axis of the rotor 10 and which are urged outwardly by springs 20 arranged in the slots 18 and bearing against the inner ends of the vanes.

Encircling the rotor head 17 is a pump housing 21 having a cylindrical recess 22 of a diameter exceeding that of the head 17 and against the annular side wall surface of which the outer ends of the vanes 19 bear primarily under the urge of the springs 20 when the pump is stationary, but which vanes are maintained in intimate sliding contact with the inner periphery of the recess 22 under the action of centrifugal force coupled with the urge of the springs 20 when the pump is in operation in the manner common in rotary pumps of the vane type.

The pump housing 21 is formed on one side thereof with an elongated circumferentially extending slot 23 which constitutes an intake opening and is formed in the side wall portion thereof extending opposite the slot 23 with an elongated slot 24 constituting a discharge opening; the intake opening 23 communicating with the chamber 16 in the housing A and an intake opening 25 in the latter with which is connected a fluid supply pipe 26, and the discharge opening 24 communicating with an outlet opening 27 in the casing A connecting with a conduit 28 leading to any suitable point of discharge.

In carrying out the invention the pump housing 21 is mounted for adjustment relative to the rotor 17 transversely of the latter whereby the cylindrical recess 22 interiorly of the pump housing may be positioned in concentric relation with the axis of the rotor 17, or be disposed in various degrees of eccentricity relative thereto up to a point where the cylindrical side wall of the recess 22 contacts the outer periphery of the rotor 17. This adjustment of the pump housing 21 may be effected either by mounting the housing for rotating movement or mounting it for rectilineal movement.

In the preferred embodiment of the invention the pump housing 21 is mounted for rotary movement as shown in Figs. 1, 2, 3 and 4, and in the modification depicted in Fig. 5 is mounted for rectilineal movement. Where the housing 21 is designed to be rotated it is fitted with a stem 29 which projects through a cap plate 30 on the casing A in axial alignment with the center of the pump housing 21 and is fitted with a handle 31 whereby the stem 29 and the housing 21 may be manually turned around its axis to effect the required adjustment. In the arrangement shown the axis of rotation of the pump housing is eccentric to that of the rotor, and the cylindrical recess 21 is arranged in off-set or eccentric relation to the axis of rotation of the pump housing, so that on rotation of the housing the cylindrical wall of the chamber 22 may be advanced or retracted relative to the periphery of the rotor 17 to and from a position in which the annular walls of the recess and the rotor are in concentric relation to each other, as shown in Fig. 2. To this end the axis of the cylindrical recess and that of the rotor are arranged in correspondingly spaced or off-set relation to the axis of the pump housing. The ends of the intake slot and discharge slots 23 and 24 respectively are so arranged relative to each other and to the radial vanes 19 that, when the pump recess 22 and the rotor are in concentric relation as shown in Fig. 2, rotation of the rotor will effect no pumping action, and such that on progressively shifting the pump housing to bring the side wall of the pump chamber into contact with the rotor the output of the pump will be varied in increasing volume from minimum to maximum according to the extent of eccentricity of the pump recess relative to the rotor.

As a means for enabling adjustment of the pump housing for an indicated pre-determined volumetric discharge, the cap 30 is provided with a graduated scale 32 and a handle 31 is provided with an indicating pointer 33 so associated and arranged relative to the scale 32 as to designate the volumetric output of the pump from nothing to maximum according to the various progressive positions in which the pump housing may be disposed relative to the rotor.

Since a very slight alteration in the relative positions of the pump housing and rotor will effect variations in the pump output the graduations 32 may be arranged to designate extremely fine calibrations.

While the pump structure shown in Figs. 2 to 4 may be employed as a single unit it is here shown in Figs. 1 and 6 as applied in a dual arrangement in which a pair of the pump mechanisms are driven from a single motor through the worm wheel 8, and with the pump unit supplied from a single source of fluid supply through the conduit 26 and discharging through separate discharge conduits 28. With this arrangement, while the worm wheel 8 is driven at a uniform or constant speed, the output of either of the pump units may be varied from nothing to maximum independent of each other.

In the form of the invention shown in Fig. 5 the pump housing indicated at 21' is mounted for rectilineal movement transversely of the rotor 17' to dispose the cylindrical pump recess 22' in various positions of eccentricity relative to the rotor 17', ranging from a concentric position to a point of contact between the pump recess side wall and the rotor. As a means for effecting rectilineal adjustment of the pump housing 21' a threaded stem 34 is screwed into engagement with the pump housing 21' and is affixed to a turnable knob 35 journaled in a stationary wall 36 whereby on rotation of the knob 35 the pump housing 21' will be caused to be advanced or retracted on the threaded stem 34 according to the direction of rotation of the latter. The pump housing 21' is provided with suitably arranged intake and discharge openings 23' and 24' respectively. The rotor 17' is fitted with vanes 19' urged outwardly by springs 20'.

It has been found in practice that no discharge from the pump will occur during operation of the pump when the pump recess and rotor are in concentric relation as shown in Fig. 2 by reason of the revolving or travelling vanes 19 setting up a back pressure in the feed line 26, but it is manifest that in event the rotor 17 is brought to a stop at a point where open communication is afforded between the inlet opening 23 and the side opening 24 a flow of fluid through the pump would be occasioned where the source of fluid supply would be such that gravity flow through the pump might occur. In order to avoid such gravity flow when the pump is stationary the supply conduit 26 is fitted with a conventional cut-off valve C the stem of which is fitted with an electric switch D which is so arranged relative to the valve C and is so connected in the circuit supplying current to the motor B that when the valve C is closed to cut off the supply of liquid through the conduit 26, the switch D will open and cut off the current to the motor, thereby stopping the pump.

The operation of the invention is apparent from the foregoing, it being seen that on rotation of the worm wheel 8 the pump rotor 17 will be revolved such as to cause the vanes 19 to effect a pumping action in a fashion common in rotary pumps of the vane type, and that by varying the extent of eccentricity of the pump recess 22 relative to the pump rotor while the pump is in operation the output of the pump may be varied accordingly from nothing to maximum.

Among the more important applications of a pump of the nature herein described is that of the control of the actual fuel volume and/or pressure in conventional fuel systems now used

in automotive, marine and aero-nautical engines, either those consuming gasoline or the so-called Diesel oil; this application being of particular value where a direct fuel injection system is used as contrasted to the standard carburetion system.

The pump herein set forth also serves to afford an accurate dependable means of metering anti-knock fluid or other liquid into the main fuel line, carburetor or chamber, in order to vary the operating characteristics of the fuel to the operating condition of the engine; a specific application being the injection of anti-knock fluid in aircraft engines when operating at high manifold pressure and for induction into the main fuel supply line in heavy duty motor-coach and transport equipment under certain operating conditions.

A still further application of my invention would be for the control of fuel pressure in certain types of engines whereby the economy of operation is greatly improved by maintaining the minimum practicable fuel pressure. The application of this type of pump to ordinary motor equipment by insertion of a control connected directly to the throttle lever or equivalent, would provide varying operating characteristics as required to obtain maximum performance in the particular range under consideration. The value of the foregoing applications when used in aircraft work is particularly important inasmuch as not only increased operating economy is effected, but also an increase in pay load would automatically be made possible thereby. A still further application of this type of pump is in the combination and mixing of various liquids in varying amounts as required for commercial application which are now often sold by mere metering jets or similar devices in flow meters which are subject to considerable variation in operating conditions.

While I have shown and described specific embodiments of my invention I do not limit myself to the exact details of construction set forth, and the invention embraces such changes, modifications and equivalents of the parts and their formation and arrangement as come within the purview of the appended claim.

I claim:

In a pump, a casing having a pair of chambers, a septum separating said chambers, an impeller shaft leading through and journalled in said septum, a driven shaft in one of said chambers affixed to said impeller shaft, a cylindrical pump housing revolubly mounted in the other of said chambers formed with a recess having a cylindrical side wall, said pump housing seating on said septum with the recess presented thereto, a cap on said casing overlying said pump housing, an adjustment stem on said pump housing projecting axially thereof through said cap adapted to be turned to vary the position of said pump housing around its axis in said casing, a cylindrical rotor in said recess formed unitarily with said impeller shaft and having a series of radial slots leading inwardly from the periphery of the rotor and interconnecting with each other at their inner ends, a vane slidably carried in each of said slots extending between the axis of the rotor and the inner periphery of the recess with its outer end slidably contacting the inner periphery of the recess; the side wall of said recess being formed with elongated circumferentially extending openings in opposed portions thereof, and said casing being formed with inlet and outlet passages with which said openings communicate; and said recess being eccentrically positioned in said housing relative to the axis thereof whereby on rotation of said housing eccentricity of the recess relative to the rotor therein will be varied to vary the pump delivery.

PAUL W. ADLER.