Nov. 17, 1942. W. O. BEHRENS 2,302,411

PUMP

Filed Oct. 23, 1940

Fig. 1

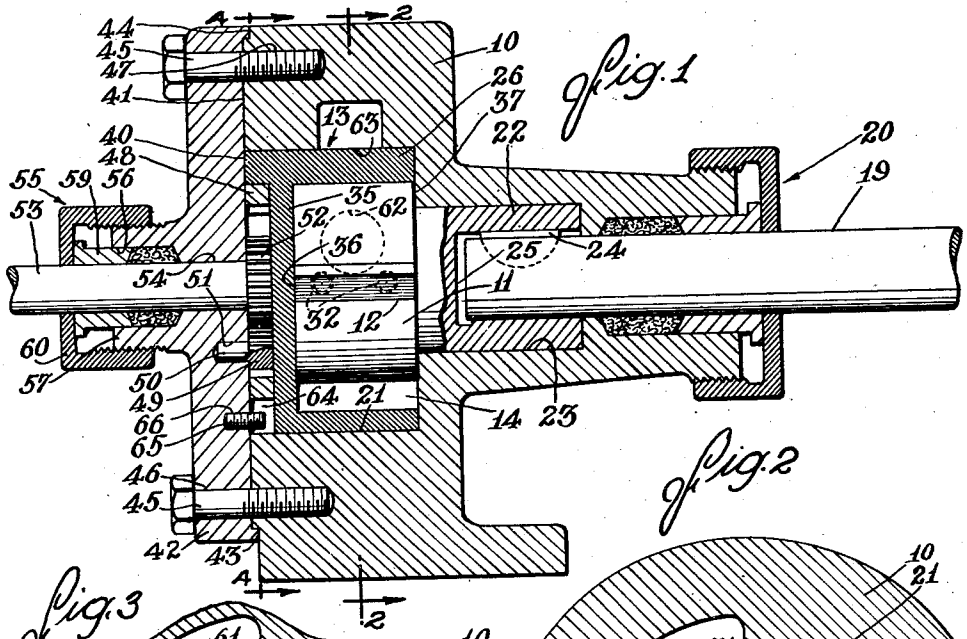



Fig. 2

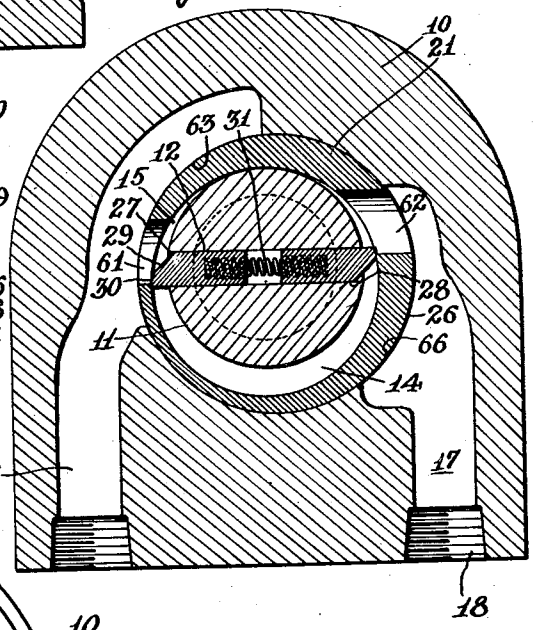



Fig. 3

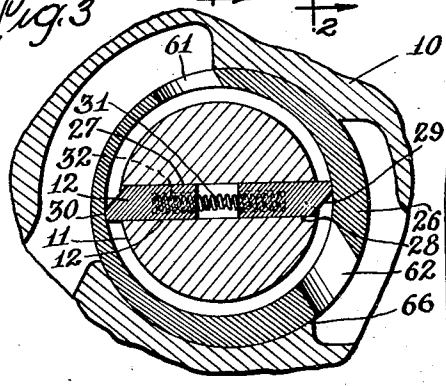
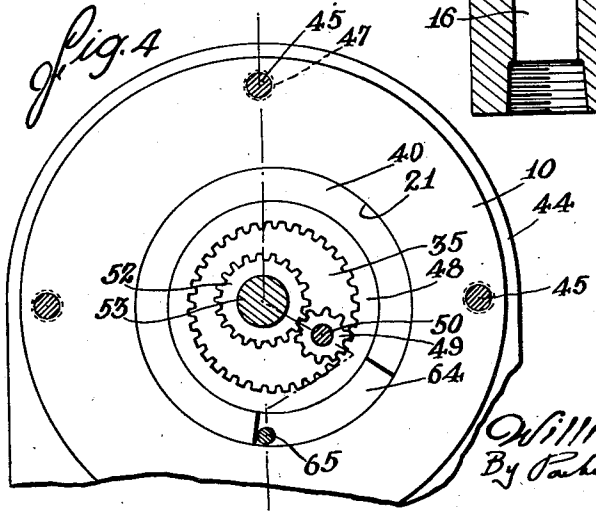



Fig. 4




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Patented Nov. 17, 1942 2,302,411

# UNITED STATES PATENT OFFICE

2,302,411

## PUMP

William O. Behrens, Harvey, Ill.

Application October 23, 1940, Serial No. 362,354

1 Claim. (Cl. 103—120)

The invention relates to pumps and more particularly to the type embodying a vane carrying rotor peripherally confined by a relatively eccentric pump chamber.

Generally stated, it is an object of the invention to provide a novel pump of the type indicated having one or all of the following attributes: (*a*) Simplicity of construction with consequent low cost of production, (*b*) ruggedness of construction and consequent ability to withstand rough usage and long wear, (*c*) simple adjustability capable of effecting variable capacity under constant speed conditions and/or constant capacity under variable speed conditions during operation of the pump, and (*d*) simplicity and directness of fluid intake and outlet passage construction with a consequent reduction in the resistance to the flow and emulsification tendency of the fluid.

Further objects and advantages of the invention will become apparent as the following description proceeds taken in connection with the accompanying drawing in which:

Figure 1 is a vertical longitudinal sectional view of a pump embodying the features of the invention.

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1 and showing the pump chamber in its position of maximum eccentricity.

Fig. 3 is a fragmentary view similar to Fig. 2 with the pump chamber in its position of zero or minimum eccentricity.

Fig. 4 is a vertical sectional view of the pump taken on the line 4—4 of Fig. 1.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawing and will herein describe in detail, the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claim.

Briefly, the illustrative form of pump disclosed herein includes a casing 10 in which is mounted a rotor 11 carrying a series of pump vanes or blades 12, two being illustrated in the instant embodiment, adapted for engagement with the inner surface of an eccentric pump chamber 13. The vanes divide the space between the rotor and the chamber into pumping compartments 14 and 15 which communicate, through suitable intake and outlet passages, generally indicated at 16 and 17, respectively, with a source of fluid supply (not shown) and a delivery outlet 18. A shaft 19 is arranged for driving the rotor and projects from the right hand end of the casing 10 (Fig. 1) through a packing gland 20.

As will be well understood by those skilled in the art to which the present invention relates, the degree of eccentricity between the vane carrying rotor 11 and its peripherally confining chamber 13, determines the capacity of the pump. Under many circumstances, it is desirable to provide a simple and easy means for adjusting pumping capacity while the pump is in operation to the end that fluid may be delivered in variable quantities without interrupting the operation of the pump or the mechanism with which it may be associated. By way of illustration, such a variable capacity pump might well be associated with a fuel oil burner of the type requiring a specific, yet variable quantity of fuel at any given time. In an assembly of the type mentioned, it is not only desirable but essential that means be provided for varying the delivery of fuel easily and simply without interrupting the operation of the burner. In short, such a fuel pump performs the function of metering a specific quantity of fuel to the burner which quantity may be adjusted in accordance with the demand at any particular time. As another exemplary application of the present invention, wherein simple and accurate regulation of the quantity of fuel delivered is desirable, the pump may be applied to any one of a number of well known hydraulic pressure operated devices such as transmissions requiring a constant or variable fluid delivery. Moreover, the aspects of the present invention in the main are adaptable for utilization in connection with internal combustion engines of the Diesel type wherein the pump might serve the purpose and function of an accelerator or throttle for controlling the feed of fuel to the engine.

To this end I have provided an extremely simple means for adjusting the volume capacity of the pumping compartments by changing the relative eccentricity between the vane carrying rotor 11 and the pump chamber 13.

Thus, in the instant illustrative embodiment of the invention, the vane carrying portion 11 of the rotor is supported for rotation within a relatively eccentric bore 21 in the casing and has a spindle portion 22 integral therewith and journaled in a centrally located bore 23 opening to the bore 21, the drive shaft 19 being keyed, as at 24, in a counterbore 25 in the spindle portion 22. The pump chamber casing 13 is formed with an external diameter substantially equal to the diameter of the eccentric bore 21 so that it may be slidably fitted therein and is provided with an eccentric sleeve portion 26 which, when the parts are assembled, is positioned in eccentric peripherally spaced relation to the external circle of revolution of the rotor. Radial slots 27 and 28 are formed in the rotor to slidably receive the pump vanes 12 which project radially outwardly therefrom for sliding engagement with the internal surface of the sleeve

portion 26. The outer end of each vane is formed with a beveled edge 29 terminating in a flat portion 30 which forms a fluid sealing relation with the inner periphery of the eccentric sleeve 26. Means for urging the vanes into constant sealing engagement with the sleeve during rotation of the rotor comprises, in the present instance, a pair of compression springs 31 seated within oppositely disposed bores 32 formed in the inner opposed ends of the vanes. During operation of the rotor, the vanes slide radially in and out in the slots of the rotor and are maintained in constant fluid sealing relation with the peripherally spaced and relatively eccentric sleeve portion of the pump chamber. The pumping compartments thus formed are completed by a disk portion 35 of the sleeve extending diametrically thereof at its left end (as seen in Fig. 1) and with the inner wall of which the lateral edges 36 of the rotor vanes have constant running engagement. At its opposite side the pump chamber is closed by the end wall 37 of the eccentric bore 21.

It will be apparent that the eccentric sleeve is eccentrically mounted in peripherally spaced relation to the vane carrying rotor so that upon rotation of the sleeve from one position (shown in Fig. 2) in which the degree of relative eccentricity is maximum, to another position (shown in Fig. 3) in which there is no relative eccentricity between the sleeve and the rotor, the capacity of the pumping compartments varies from maximum to zero. Furthermore, such rotary adjustment of the sleeve may be easily and efficiently accomplished (by means now to be described) without in any way affecting the operation of the pump other than to vary its capacity.

The eccentric sleeve 26 is provided with an annular end flange 40 peripherally continuous therewith and terminating flush with the end wall 41 of the casing 10. An end plate 42 provided with a positioning side flange 43 for cooperation with a complementary annular groove 44 in the end wall of the casing, is secured to the casing as by bolts 45, extending through drilled holes 46 in the end plate and screw threaded, as at 47, in the casing. On the internal surface of the end flange 40 an internal gear 48 is secured, in the present instance by a press fit, and is meshed with an idler gear 49 rigid on a stud 50 suitably journaled for rotation in a bore 51 in the end plate. The idler gear 49 meshes with a pinion 52 rigid on the end of a shaft 53 journaled as at 54 centrally of the end plate 42. Suitable oil sealing means for preventing leakage along the shaft 53 in the present instance comprises a packing gland, generally indicated at 55. A counterbore 56 is formed centrally of a hub portion 57 on the end plate and provides an annular space about the shaft filled with a suitable packing material. The packing material is compressed by a bushing 59 on the shaft, adapted for actuation by a nut 60 threaded on the hub. Obviously when the shaft is revolved by any suitable manual or automatic control means, rotary motion is imparted to the sleeve to increase or decrease the pumping capacity of the chambers in the manner heretofore set forth.

Means are provided for limiting the extent of rotation of the adjusting sleeve 26 to the desired range, in the present instance approximately 60°, between maximum and minimum or zero eccentricity (Figs. 2 and 3). To this end a segmental slot 64 is formed in the flange 40 opening to the end plate 42. A projection 65 is formed on the internal wall of the end plate for cooperation with the segmental slot and limits rotation of the sleeve by abutment with the ends of the slot. This projection is shown herein as a set screw, screw threaded in the casing.

The pump chambers are provided with a port construction for effecting fluid communication between the intake and outlet pasages 16 and 17 and the pump compartments 14 and 15, alternately, in any position of rotary adjustment of the sleeve within its range of movement. Referring particularly to Fig. 2 of the drawing, it will be noted that as the eccentric sleeve 26 is rotated, the axis of symmetry of the eccentric pumping compartment area is rotated in conformity therewith. Accordingly, intake and outlet ports 61 and 62 are formed in opposite sides of the sleeve and in positions appropriate relative to the axis of symmetry of the pump compartment area, for effecting maximum pumping efficiency. These positions will always be maintained regardless of the rotary adjustment of the sleeve. Corresponding intake and outlet openings 63 and 66 are cored with the passages 16 and 17 in the casing for communication with the ports 61 and 62. These openings are enlarged and positioned to open in the inner peripheral surface of the casing so that they will communicate with the ports 61 and 62 regardless of the adjusted position of the sleeve 26 within its limited range as determined by the ends of the segmental slot 64.

It will be apparent from a consideration of the foregoing that I have provided a novel and useful hydraulic unit which is simple, sturdy and readily adjustable as to capacity during operation and which at the same time is extremely efficient in operation in that the novel port and passage construction is arranged to minimize the resistance to fluid passage therethrough.

I claim as my invention:

A rotary pump comprising, in combination, a casing, a rotor journaled within said casing, a shaft for driving said rotor and projecting from one side of said casing, an eccentric sleeve eccentrically mounted within said casing in peripherally-spaced relation to said rotor, vanes movably mounted in said rotor and projecting therefrom for sliding contact with the inner periphery of said sleeve, an internal gear formed on said sleeve, a shaft journaled in and projecting from the opposite side of said casing in coaxial alinement with the rotor shaft, a pinion on said last-mentioned shaft, an idler gear drivingly connected between said pinion and said internal gear, a segmental slot opening from one side of said sleeve, a stop projection on said casing cooperating with said slot to limit the range of rotational adjustment of said sleeve, an intake and an outlet port in said sleeve, and elongated intake and outlet ports in said casing adapted for communication with the first-mentioned intake and outlet ports, respectively, in any position of adjustment of said sleeve within said range.

WILLIAM O. BEHRENS.