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2,263,786

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Filed Aug. 12, 1938

2 Sheets-Sheet 1

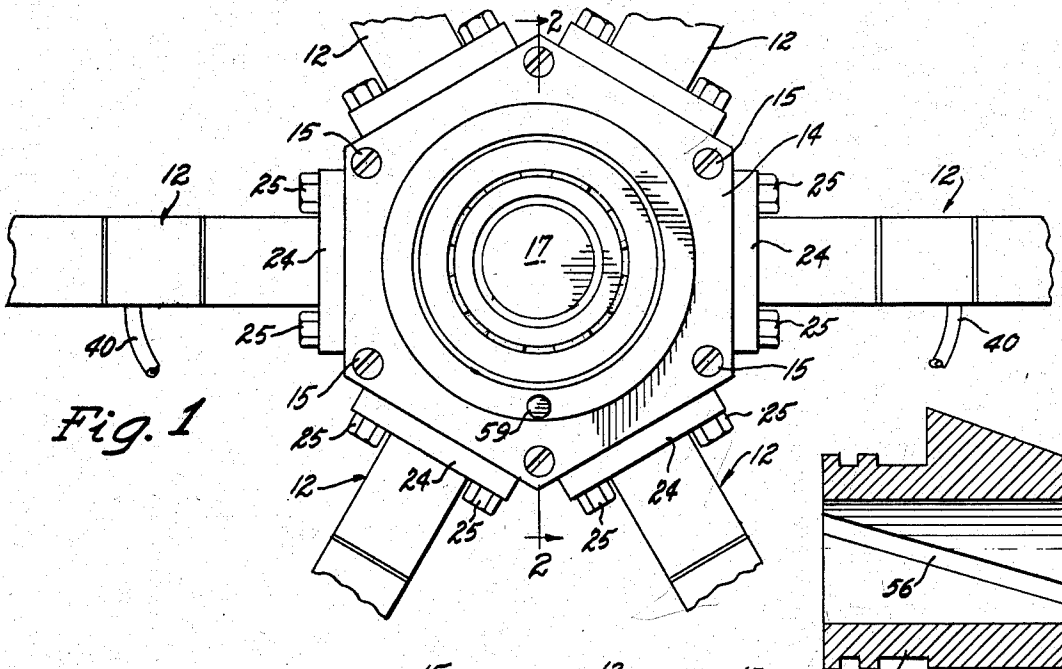


Fig. 1

Fig. 8

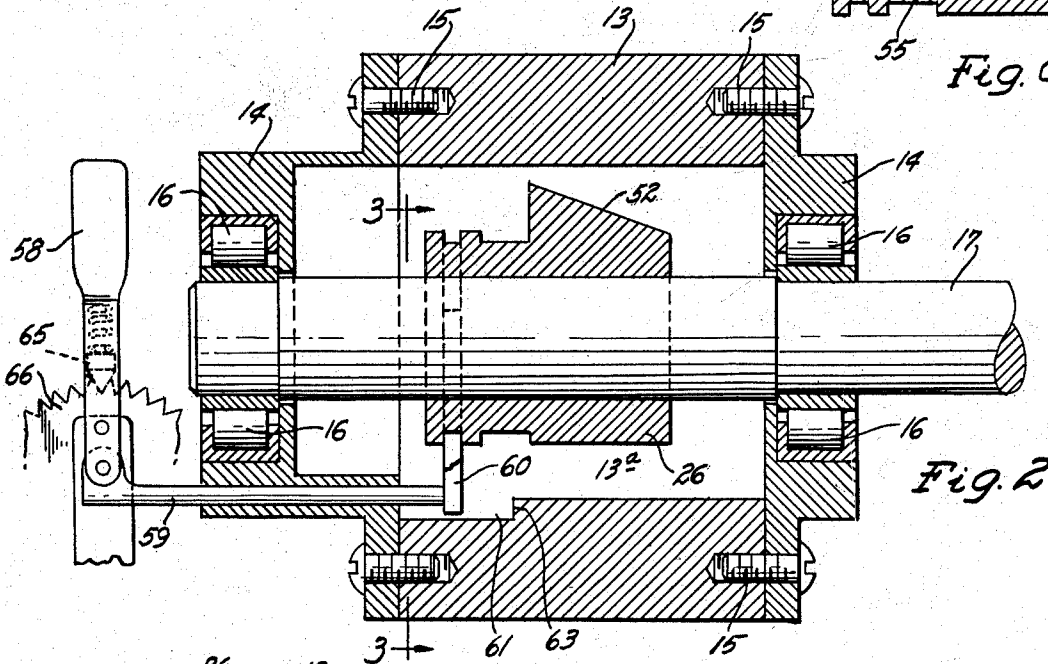


Fig. 2

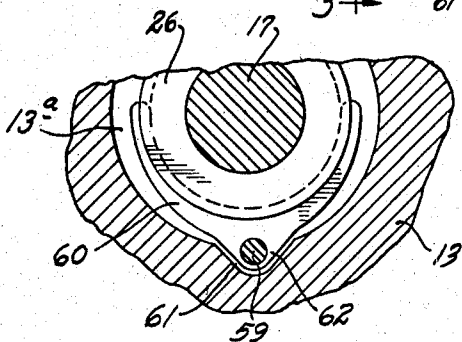


Fig. 3

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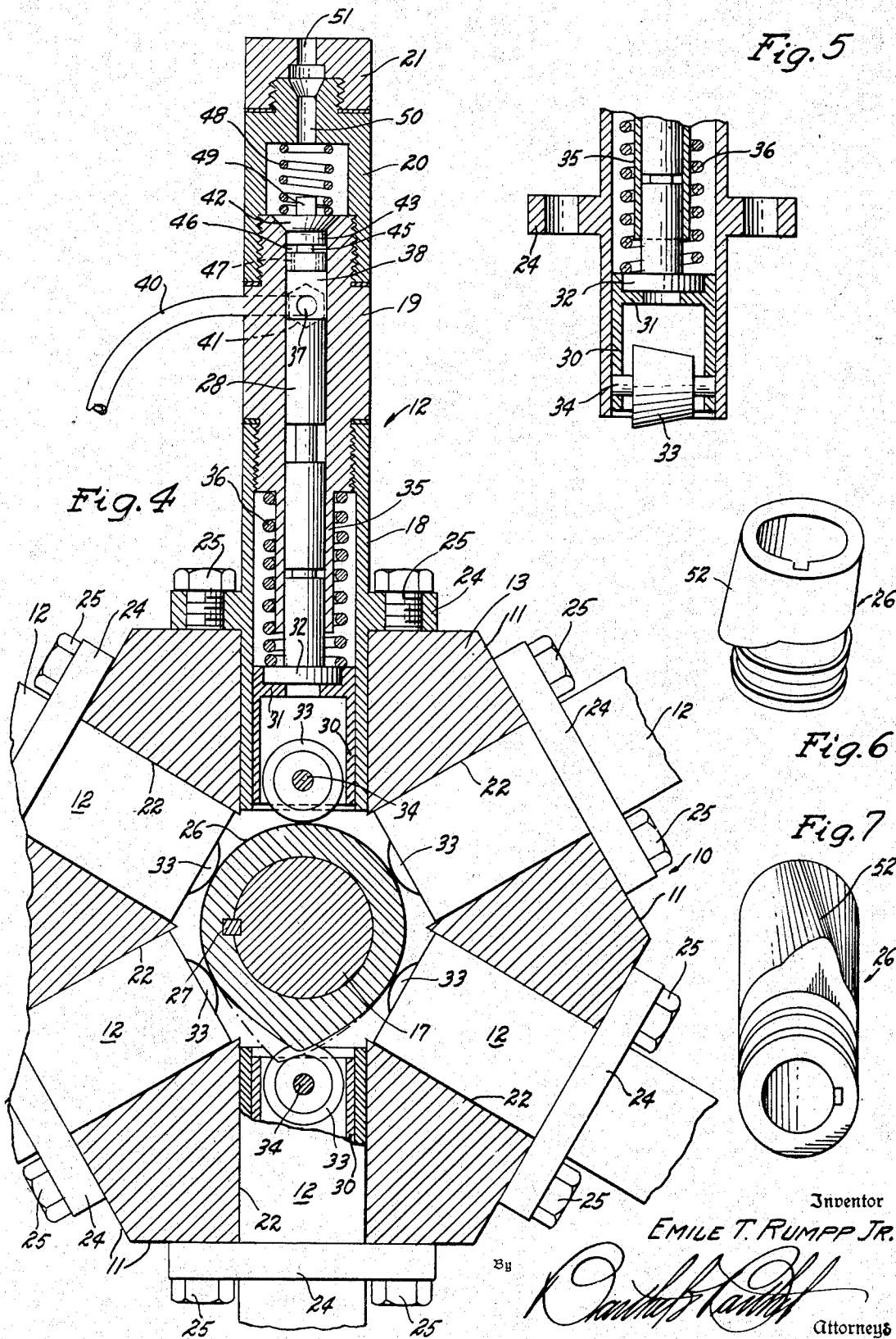
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3 Claims. (Cl. 103-153)

This invention relates generally to pumps and more particularly to liquid fuel pumps for Diesel engines.

It is an object of the present invention to provide a new and improved pump having provisions for controlling the rate of volumetric output of the pump and for correspondingly varying the timing of the pump stroke.

Another object of the invention is to provide a new and improved pump which may easily and quickly be assembled and/or disassembled.

A further object of the invention is to provide a new and improved pump which is efficient in operation, has a minimum of parts and is inexpensive to manufacture.

Other objects of the invention will appear from the following description, taken in connection with the accompanying drawings in which

Figure 1 is a view shown in elevation of a pump mounting and a plurality of pumps embodying my invention;

Fig. 2 is a longitudinal sectional view of the pump mounting and associated structure, taken along the line and in the direction of the arrows 2-2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken along the line 3-3 of Fig. 2;

Fig. 4 is a view in section of the pump mounting and pump, showing one of the pumps in detail;

Fig. 5 is a fragmentary sectional view of one of the pumps;

Figs. 6 and 7 are perspective views of an actuator for the pumps, and

Fig. 8 is a sectional view showing a modified form of pump actuator.

Referring to the drawings by characters of reference, the numeral 10 designates in general, a supporting member or pump mounting which, in the present instance, is hexagonal in form to provide flat mounting surfaces 11 for mounting six pumps 12 thereon. It is to be understood that one or any number of pumps may be employed, as desired, the present pumping unit being adapted for a six cylinder Diesel engine. By providing a hexagonal shaped body or mounting the same may be employed with from one to six pumps thereby obviating the necessity for providing special pump bodies or mountings for use with engines having various numbers of cylinders. To compensate for any irregularities in the forming of the hexagonal mounting in the pump casings, shims (not shown) may be positioned between the casing flanges 24 and the flat mount-

ing surfaces 11 as needed, which shims in effect provide for regulation of the pump strokes to establish a pump stroke common to all of the pumps. The mounting 10 comprises a hollow open ended body 13, having a chamber 13a, the body having its opposite ends closed by removable end walls 14 which may be secured to the body 13 by screws 15 or by other suitable means. In the end walls 14, are provided apertures to receive roller bearings 16 which rotatably support a shaft 17 which extends through the chamber 13a and may be driven or rotated in any suitable manner.

In order to provide a pump which may be easily and quickly assembled and/or disassembled, I provide a sectionally constructed pump casing comprising an inner end, or mounting section 18, an inlet or valve section 19, an outlet section 20 and an outer end section or cap 21, these sections being screwthreaded together providing an elongated tubular casing. The body 13 is provided with a plurality of radially spaced bores 22 which open at their inner ends into the body chamber 13a, and open at their outer ends through the flat outer surfaces 11 of the hexagonal body, the bores 22 being provided to receive end portions of the pump casing sections 18 which are formed intermediate their ends with external flanges 24 to receive screws 25 to secure the pumps rigidly to the body 13.

In order to provide an efficient pump unit and yet one which will be simple in structure and inexpensive to manufacture, I provide the chamber 13a. A single sleeve-like cam actuator 26 is provided on the shaft 17 for successively actuating the pumps 12 in the order of the firing of the cylinders of an engine and the actuator 26 may be keyed, as at 27, to the shaft to rotate therewith. The actuator 26 is also an adjustment member and is arranged to slide on or move longitudinally, or axially of the shaft to various positions of adjustment for purposes hereinafter described. Each of the pumps 12 is provided with a reciprocal plunger 28, which is slidably received and guided in the bore of the casing section 19 and each pump is further provided with a cam follower including a sleeve or tubular member 30 which is slidably received and guided in the inner end portion of the casing section 18. The cam followers operatively connect the pump plungers 28 to the cam actuator 26, the follower sleeve 30 having an internal transverse wall 31 providing a seat to receive an enlarged portion or head 32 formed on the inner end of the pump plunger 28. Each of the follower sleeves car-

ries, adjacent the inner end thereof, a roller 33 the outer surface of which projects beyond the inner end of the sleeve for rolling contact with the outer surface of the cam actuator 26, the use of rollers being preferable to reduce friction between the parts. The rollers 33 are mounted on shafts 34 which have their outer end portions journaled for rotation in diametrically opposite apertures provided in the side wall of the sleeves and, as shown, these rollers are tapered or frusto-conical rollers for a purpose hereinafter described. Surrounding a reduced inner end portion 35 of the casing section 18 of each pump, a helical coil spring 36 acts against the plunger head 32 urging the plunger 28 and the cam follower inwardly, the springs 36 acting to retract the plungers and also acting to maintain the cam follower rollers 33 in contact with the outer surface of the cam actuator 26.

Each of the pumps 12 is provided with an inlet 37 through the side wall of the casing sections 19, the inlet opening into a variable capacity inlet chamber 38 formed in part by the outer end of the reciprocal plunger 28. Fuel, such as oil, may be supplied to each pump from a source of supply through conduits 40 connected to the inlets 37 by suitable fittings 41. The outer end of the casing section 19 is provided with an outwardly facing valve seat cooperable with a pressure responsive conical face valve member 42 having a stem portion 43 which is slidably received and guided in an outer end portion of the inlet chamber or bore of the casing section 19. Intermediate its ends, the valve stem 43 is provided with a reduced portion 45 providing an annular chamber 46 communicating with the inlet chamber 38 via a plurality of small apertures or orifices 47 which extend through the inner end portion of the stem, longitudinally thereof. In the casing section 20, a helical coil spring 48 yieldingly opposes opening of the valve 42, the valve being provided with an extended portion 49 serving to retain the spring in place or limiting side movement of the spring. In the outer end of the casing sections 20 and in the cap 21 are provided aligning orifices 50 and 51 respectively for the discharge of fuel oil from the pump casings and the outlets may be connected to the cylinders of a Diesel engine in any suitable manner.

Referring again to the cam actuator 26, this actuator has a substantially cylindrical outer surface interrupted by a riser portion 52 which extends longitudinally of the sleeve and is inclined to provide for varying the strokes of the pumps on movement of the sleeve longitudinally on the shaft 17. The inclination of the cam actuator may be and preferably is the same as the inclination of the follower roller 33 so that the surfaces thereof will contact in all adjusted positions of the cam actuator. I also form the cam riser portion 52 in this instance so that the high points along the inclined surfaces are on a line angularly disposed with respect to the axis of rotation of the sleeve, to thereby provide a lead so that the timing of the fuel injections to the engine cylinder may be varied simultaneously and in accordance with variation in fuel injections or pump stroke on adjusting the position of the cam actuator 26 along the shaft 17. Simultaneous and corresponding adjustment of the fuel supply and timing may also be had by providing a cam actuator 55, Fig. 8 with an internal spiral keyway 56 to receive a spiral key (not shown) for keying the cam actuator to the shaft

17. In this latter construction, it will be seen that the high points along the inclined riser portion 57 of the cam may be in the same plane as the axis of rotation of the cam since on sliding the cam on the shaft, the cam is rotated by reason of the spiral keyway connection whereby the timing is advanced and/or retarded simultaneously and in accordance with regulation of the pump strokes or quantity of fuel injected.

Referring more particularly to Fig. 2, any suitable means may be provided to adjust the position of the cam actuator along the shaft 17 and in the present instance I have shown a manually operable lever 58 operatively connected by a sliding or reciprocating shaft 59 to a yoke 60 which is positioned in the chamber 13a and engages in an annular slot or recess in the sleeve-like cam actuator 27. As shown more clearly in Fig. 3, the wall of chamber 13 may be recessed as at 61 to receive an end portion 62 of the yoke to prevent rotation of the yoke and the shaft or rod 17 may be slidably received and guided in a bore through the adjacent casing end wall 14. The recess 61 also provides an abutment surface 63, Fig. 2, which together with the opposed inner surface of the adjacent end wall 14 limit adjustment movement of the actuator 27 to extreme positions within the limits of the range of its inclined riser portion. The lever 58 may carry a spring pressed detent 65 adapted to engage in notches of a fixed plate 66 to hold the actuator in adjusted positions. If desired an adjustable variable speed governor (not shown) may be employed to hold the actuator in adjusted position.

In operation, as the cam actuator 26 rotates with the shaft 17, the riser portion 52 of the cam successively engages and moves the cam follower rollers 33 and the pump plungers 28 outwardly against the action of the retracting springs 36. Fuel entering the pump inlet chamber 38 is forced by the pump plungers 28 through the orifice 47 in the valve chamber, the plungers 28, on predetermined outward movement or pumping movement, closing respective inlet ports 37. On closing of the inlet ports, continued outward movement of the plungers builds up pressure unseating the valve 42 against the action of the springs 48, which permits discharge of fuel oil through the aligning orifices 50, 51 from the pump casings from where the fuel may be injected under pressure to the cylinders of a Diesel engine. The stroke of the pumps and therefore the rate of fuel supplied to an engine and the timing of the fuel injections depends upon the position of the adjustable cam actuator 26. It will be seen by reference to Fig. 2 that by means of the lever 58, the actuator 26 may be moved to the right on the shaft 17 with the result that the follower rollers 33 will engage higher on the inclined surface 52 of the actuator thereby increasing the length of the pump strokes and conversely movement of the actuator 26 to the left will decrease the pump stroke. Also by reason of the actuator having a lead, the timing of the fuel injections will be varied, simultaneously and in accordance with changes in the pump strokes on adjusting the position of the actuator 27 longitudinally on the shaft 17. As previously mentioned if the actuator 55 of Fig. 8 is employed, it will be seen that the cam riser portion need not have a lead because of the spiral key connection of the actuator and shaft. When the actuator 55 is moved longitudinally on the shaft, it will be seen that the actuator will be rotated relative to the shaft thereby changing the

position of the cam riser portion angularly and thus changing the timing of the pump operation in accordance with change in the pump stroke.

From the foregoing description it will now be seen that I have provided a new and improved pumping unit which is efficient in operation and inexpensive to manufacture in that it includes but a single cam actuator for successively actuating a plurality of pumps. It will also be seen that I have provided a pump actuator which may be regulated or adjusted so as to vary the pump stroke and also to vary the timing of the pump in accordance with the change of the pump stroke. In addition I have provided a pump having a sectionally constructed casing wherein the parts of the pump are arranged in a new and improved manner to decrease cost of manufacture and facilitate assembly and/or disassembly of the pump.

What I claim is:

1. A pump unit comprising a sectionally constructed casing including tubular end sections and a tubular intermediate section secured together, said intermediate section being externally of and spacing said end sections, an inlet opening into said intermediate section, an outlet leading from said intermediate section into one of said end sections, a pressure responsive valve controlling said outlet, a plunger extending through the other end section and into said intermediate section, means in said other end section for actuating said plunger and a tubular member connected to said plunger, said tubular member being slidably received and guided in said one section and carrying a cam follower member.

2. A pump comprising a sectionally constructed

casing having an end section, an outlet section and an intermediate section secured together, said intermediate section being externally of and spacing said end and outlet sections, an inlet opening into said intermediate section, a plunger slidably received and guided in said intermediate section, an outlet in one end of said intermediate section and opening into said outlet section, a pressure responsive valve controlling said outlet and slidably received and guided in said intermediate section, a coil spring in said end section and operable to move said plunger in one direction and a guide member connected to said plunger in said end section and carrying a cam follower member.

3. A pump comprising a sectionally constructed casing having an end section, an outlet section and an intermediate section secured together, said intermediate section being externally of and spacing said end and outlet sections, an inlet opening into said intermediate section, a plunger slidably received and guided in said intermediate section, an outlet in one end of said intermediate section and opening into said outlet section, a pressure responsive valve controlling said outlet and slidably received and guided in said intermediate section, a hollow piston portion operatively connected to said plunger and slidably received and guided in said end section, a coil spring surrounding said plunger in said end section and acting against said piston portion to move said plunger in one direction, and a cam follower carried by and within said hollow piston portion.

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