June 16, 1936. C. W. DAKE 2,044,064

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Filed Nov. 10, 1934 3 Sheets-Sheet 1

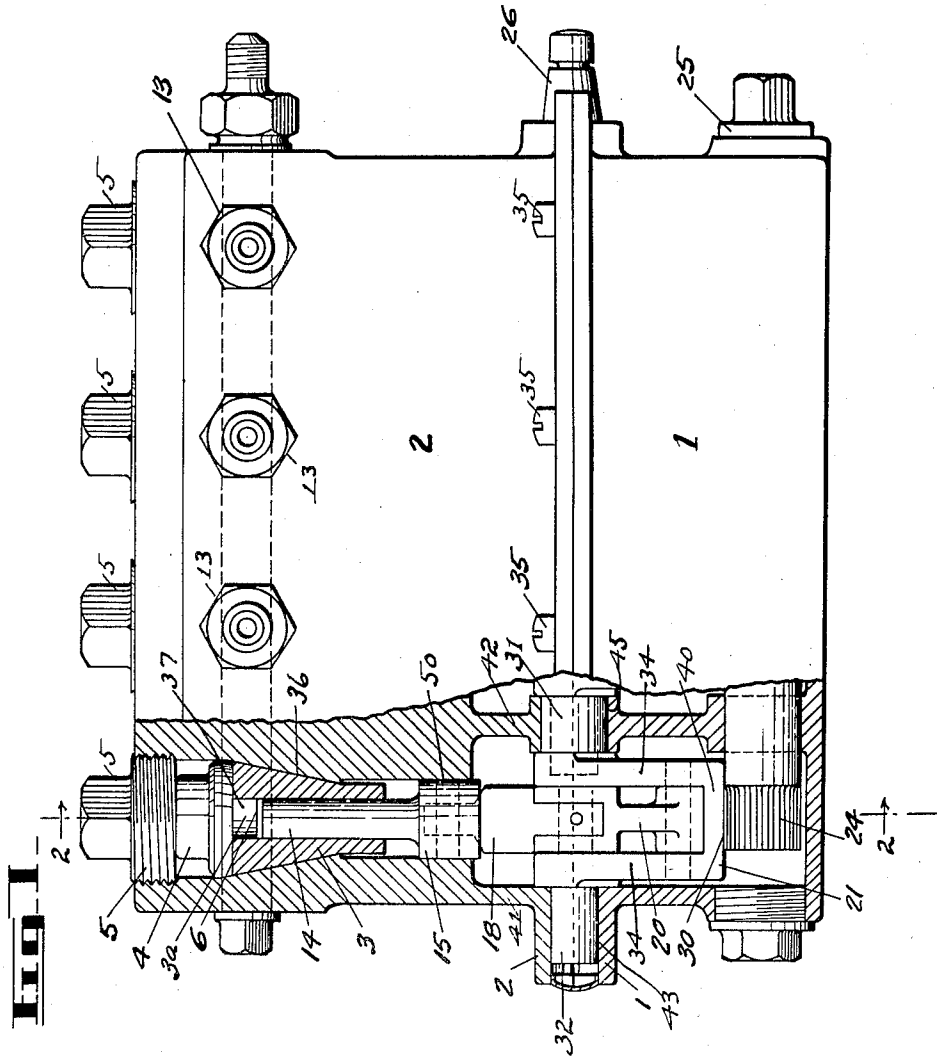


Fig. 1

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Fig. 1

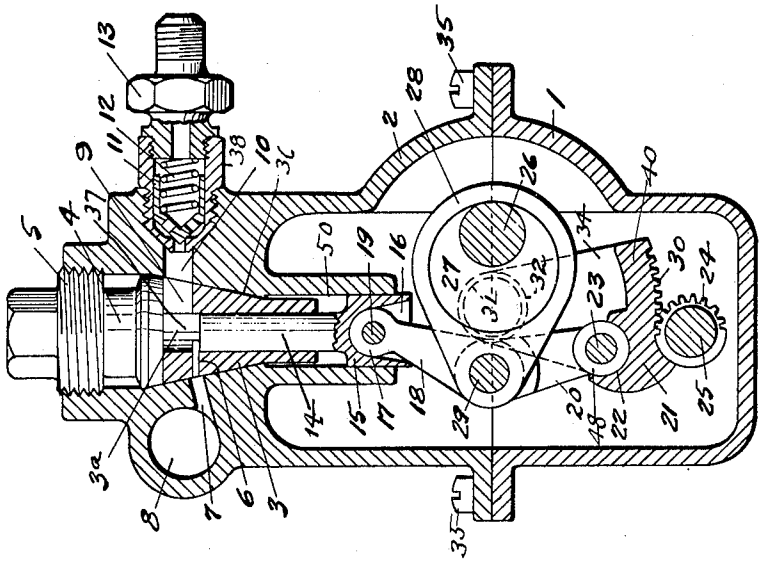
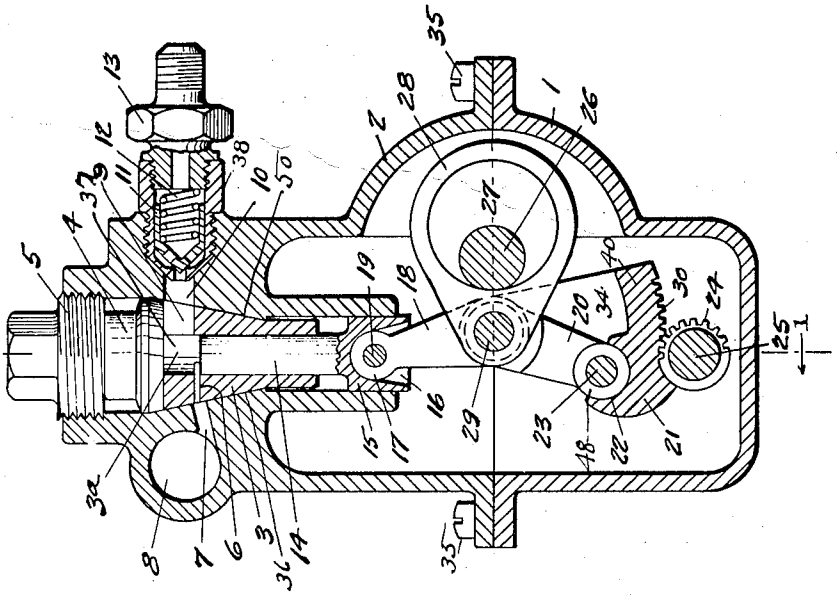


Fig. 2



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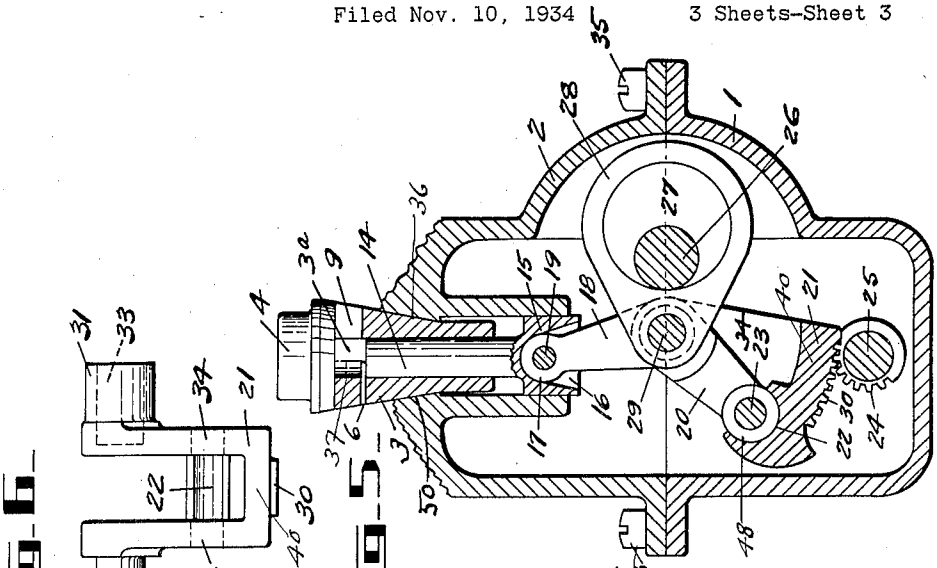


Fig. 6

Fig. 5

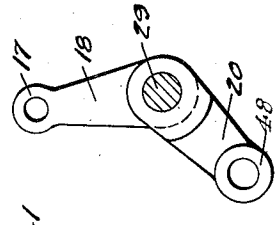


Fig. 7

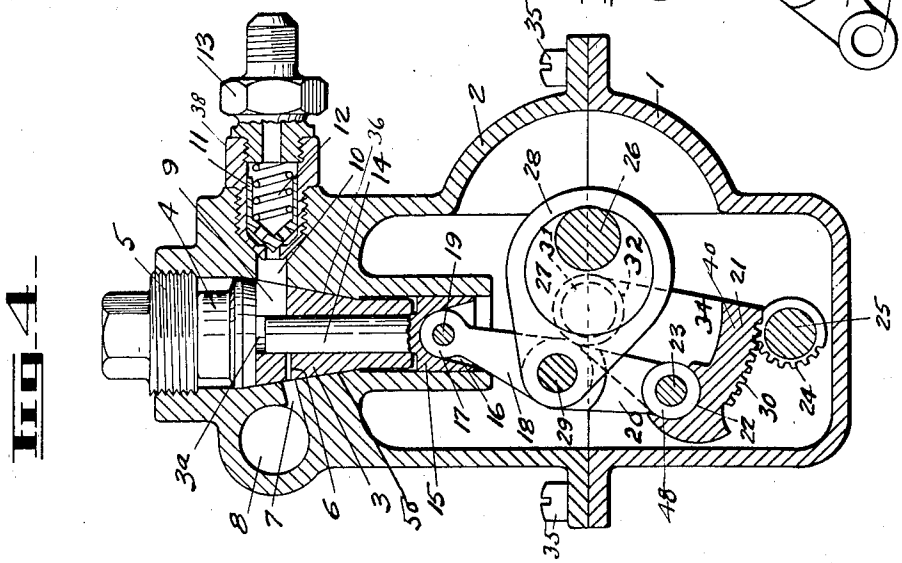


Fig. 4

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Charles W. Dake, Grand Haven, Mich., assignor to Campbell, Wyant and Cannon Foundry Company, North Township, Mich., a corporation of Michigan

Application November 10, 1934, Serial No. 752,389

3 Claims. (Cl. 103—38)

The present invention relates to fuel pumps and particularly to pumps employed for intermittently forcing fluid fuel into the combustion space or chamber of internal combustion engines and especially to engines of the well known Diesel types, and its objects are, generally, to provide an improved pump structure of this character, and more particularly to provide such a structure that shall be simple in construction, composed of parts readily assembled and disassembled, and including operating parts simple in operation, having a minimum liability to disorder and that will exert a very powerful pumping operation to overcome resisting pressures which in Diesel engines at times amount to more than five hundred pounds per square inch; and, further, to provide in such a pump improved adjustable means for accurately regulating the quantity of fluid fuel pumped to the engine. These and other more specific objects hereinafter appearing are attained by, and the invention finds preferable embodiment in the illustrative pump structure particularly described in the body of this specification and illustrated by the accompanying drawings, in which:

Fig. 1 is an elevational side view of the pump structure including its body or housing as arranged for a plurality of pumps as for multiple cylinder engines, this housing being partially sectioned as on line 1—1 of Fig. 2, and illustrating the pump plunger at the suction end of its stroke.

Fig. 2 is a transverse sectional view of the pump on line 2—2 of Figure 1, illustrating the pump adjusted to a no-pumping position, with the pump plunger as it would be at the end of the suction stroke and the toggle links in the suction stroke position.

Fig. 3 is a like view to Figure 2 but with the toggle links in the pump's discharge position and the pump plunger in like position.

Fig. 4 is also a like view of the same but showing its adjustable members adjusted for the maximum quantity of fluid fuel to be pumped, with the pump plunger at the end of the discharge stroke.

Fig. 5 is a like view to Figure 4 but with the pump plunger at the end of the suction stroke, and a portion of the housing broken away.

Fig. 6 is a side view of the yoke member of the means for controlling the stroke of the pump's plunger; and

Fig. 7 is a side view of the toggle links whereby the pump's plunger is reciprocated.

In the embodiment of the invention illustrated by these drawings, the pump structure includes a body or hollow housing comprising a lower member 1 and an upper member 2 detachably connected by the screws 35. The upper member 2 has a bore 50 in whose tapered medial portion 36 is socketed a pumping plunger cage 3 held tightly therein by a plug cap 4 engaging the cage's outer (upper) end, and forced into and held in such engagement by the plug 5 threaded in the outer end of said bore. The cage 3 has a cylindrical bore 3a extending axially therethrough in which slidably bears the reciprocating pumping plunger 14. The pump chamber 37, being the portion of said bore 3a between the plunger 14 and the plug 4, has an intake port 6, narrow in the cage's axial direction and extending to the pump chamber from a communicating passage 7 through the housing's member 2 and leading from the fluid fuel supply chamber or fuel conveying duct 8.

The fluid fuel discharge port 9, outwardly from (above) said intake port and extending oppositely therefrom through said cage, communicates with the combustion space or chamber of an internal combustion engine (not shown) by the passage 10 through the housing member 2, the valve cage 38 threaded into the enlarged outer portion of said passage, and the nipple 13 threaded in this valve cage and exteriorly threaded as shown for connection with said combustion space. This valve cage contains a slidable hollow check valve 11 urged by a helical spring 12 to seated position shown in the views, the tension of the spring being governed by the nipple 13.

The pumping plunger 14 has an enlarged inner (lower) end portion 15 slidably bearing in the correspondingly enlarged innermost portion of the bore 50 and has in its extremity a socket 16. The pumping plunger is operated by a toggle comprising the links or arms 18, 20 whose adjacent ends are connected by the pivot pin 29, the rounded other end 17 of the link 18 turnably bearing in the bottom of the socket 16 of the plunger and being connected therewith by the pivot pin 19, and the rounded other end 48 of link 20 being turnable in the bearing 22 of the yoke 21 (hereinafter described) and being connected therewith by the pivot pin 23. This yoke 21 (particularly well shown in Figure 6) has spaced apart arms 34 connected by a middle portion 40 in which said bearing 22 is formed, said arms being provided with concentric trunnions 31, 32 journalled in bearings in opposite walls of the housing; and, as shown in Figure

1 where a plurality of these pumps are combined in one common housing, the trunnion 32 is journalled in the bearing 43 in the housing's wall 41 while the diametrically larger trunnion 31 is journalled in the bearing 45 in the housing's wall 42, this trunnion 31 having an axial bearing 33 turnably receiving the trunnion 32 of the yoke of the adjacent pump.

Each of these bearings comprises separable upper and lower halves formed in the upper and lower members 2, 1 respectively of the housing or body of the structure.

The pump is driven by the shaft 26, carrying the eccentric or circular cam 27 thereof, and the connecting rod 28 turnably bearing at one end on the periphery of the eccentric and at its other end on the pivot pin 29 which connects the links 18, 20 of the toggle. In order to vary as desired the length of the pumping plunger's stroke and thus the amount of fluid fuel pumped thereby, I provide means for varying the angle between the toggle's links 18, 20. The preferable means for doing this is as shown and includes the gear 24 on shaft 25, meshing with the toothed sector 30 of the yoke 21, which shaft may be turned by a suitable means (not shown) controlled by a governor operated by the driving power of the engine, or it may be turned manually as with a suitable wrench.

This pump operates as follows: When the yoke 21 is turned to the position seen in Figures 2 and 3, the angle between the toggle's arms is very obtuse, i. e., the arms are nearly aligned and the toggle nearly "straightened", so that in the toggle's movement to straightened position the plunger 14 is given a very short stroke which is not sufficient to close the intake port 6 and to force fluid fuel out of the chamber 37; but when the yoke is turned to the position shown in Figures 4 and 5, the angle between the toggle's links at the beginning of the pumping stroke (Figure 5) is much more acute so that by the toggle's movement to a straightened position the plunger 14 is given a longer pumping stroke to pump a maximum amount of fluid fuel. By turning the yoke to intermediate positions other desired strokes and consequent amounts of fluid fuel may be pumped.

In Figure 2 the pump plunger 14 is at the end of the suction stroke, that is, in the suction position, namely, in position to admit fluid fuel from the inlet port 6 to the chamber 37, and as the shaft 26 and eccentric 27 are turned in either direction the pivot 29 will cross a straight line between the pivots 19 and 23, first causing the plunger to move as might be on its discharge stroke as the line between the pivots is straightened and then causing the plunger to be moved back to its original position and as shown in Figure 3, as the line between the pivots is bent by rotating the shaft and eccentric one-half turn. This longitudinal movement of the plunger will take place twice during each revolution of the shaft and eccentric and will be at its greatest height as the pivot 29 passes through a straight line between pivots 19 and 23, but as the longitudinal movement of the plunger caused by the movement of the links when the yoke 21 is adjusted to the position shown in Figures 2 and 3 is not sufficient to any more than close the inlet port 6 no fluid fuel will be forced from the pump.

The action as shown in Figures 4 and 5 is the same as in Figures 2 and 3, excepting the plunger 14 is moved a greater distance on the discharge stroke and does not rise and fall as the shaft is turned at each half revolution, but at the beginning of the discharge stroke the plunger is at its lowest or suction position. At all adjustments for varying the quantity of fluid fuel pumped the plunger is at the same low position uncovering the inlet port at the end of the suction stroke and the movement of the plunger upward on the discharge stroke is varied by varying the position of the yoke 21. The farther the yoke is swung to the position shown in Figures 4 and 5, the greater will be the travel of the pumping plunger and consequent quantity of fluid fuel pumped and the nearer the yoke is swung to the position shown in Figures 2 and 3 the less will be the travel of the plunger and quantity of fuel pumped.

The structural relation of the operating parts with the pump's body or housing is such that the pivotal mounting of the yoke on said body or housing is always coaxial with the pivotal connection 29 of the toggle arms at the beginning of the plunger's discharge stroke.

It will be seen that the toggle's action imparts a very powerful pumping stroke to the plunger 14, and that although the operation of the driving shaft 26, its eccentric cam 27 and the connecting rod 28 remains constant, the length of the plunger's stroke may be varied or adjusted any desired degree by merely moving the yoke 21 by means of the shaft 25 and its gear 24.

The parts of the structure including the parts of the housing and the operative parts within it may be easily assembled and disassembled, particularly as the bearings in which the trunnions 31, 32 turn comprise halves formed in the housing's members 1 and 2; and the journalling of trunnion 32 in the trunnion 31 of an adjacent pump economizes space in such a combined structure as is shown in Figure 1.

Having thus described my invention what I desire to claim is as follows:

1. A pump structure comprising a hollow housing consisting of detachably connected members, one of said members having a bore, a plunger-cage socketed in said bore and having a bore, a reciprocating pumping plunger bearing in the cage's bore, a toggle connected at one end with the plunger for reciprocating the same, a yoke element connected with the other end of the toggle and turnably mounted in bearings comprising separable halves formed in said members respectively, said element being turnable in a direction transverse the axis of the plunger for governing the stroke of the plunger, and driving means connected with the toggle for operating the same.

2. A pump structure comprising a hollow housing, a plurality of pumps in the housing arranged side by side and having reciprocating pumping plungers, toggles connected at one end with the plungers respectively for reciprocating the same, yoke elements connected with the other ends of the toggles respectively and having concentric trunnions turnably mounted in bearings in the housing, one of said trunnions being of larger diameter than the other trunnion of the same yoke element and having an axial bearing removably receiving the diametrically smaller trunnion of the yoke element of the adjacent pump, said yoke elements being turnable in a direction transverse the axes of the plungers for governing the stroke of the plungers respectively, and driving means

connected with the toggles for operating the same.

3. A pump comprising a reciprocating pumping plunger, a toggle for reciprocating the same comprising pivotally connected arms one of said arms being pivotally connected with the plunger, a pivotally mounted yoke element pivotally connected with the other arm and turnable in a direction transverse the axis of the plunger to different positions for governing the stroke of the plunger, the pivotal connection of the arms and the pivotal mounting of the yoke being coaxial at the beginning of the pumping stroke of said plunger, and driving means connected with the toggle for operating the same.

CHARLES W. DAKE.