

Oct. 12, 1937.

L. F. BURGER

2,095,915

FUEL PUMP

Filed July 5, 1935

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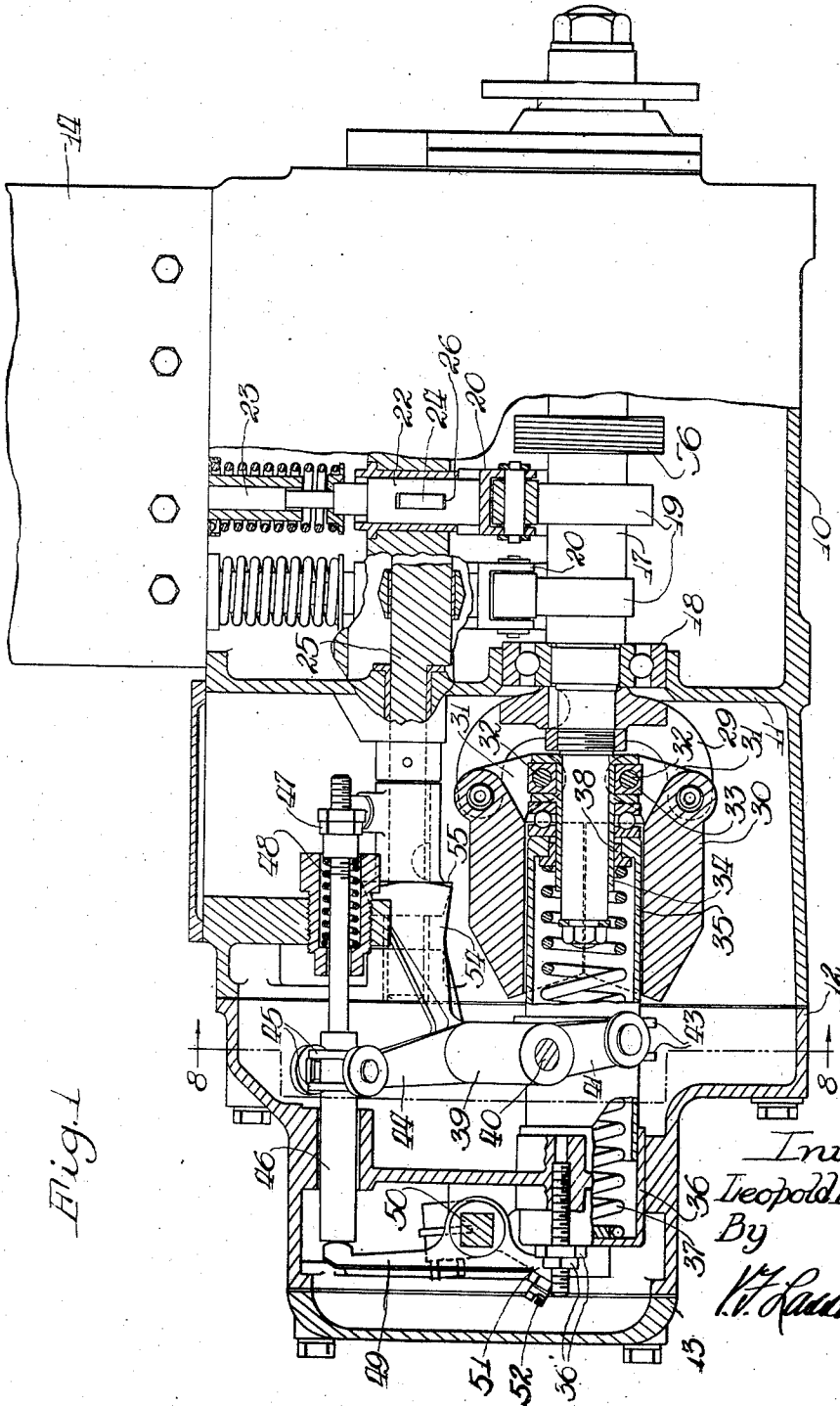


Fig. 1

Inventor
Leopold F. Burger
By
W. H. Luegner
Att'y.

Oct. 12, 1937.

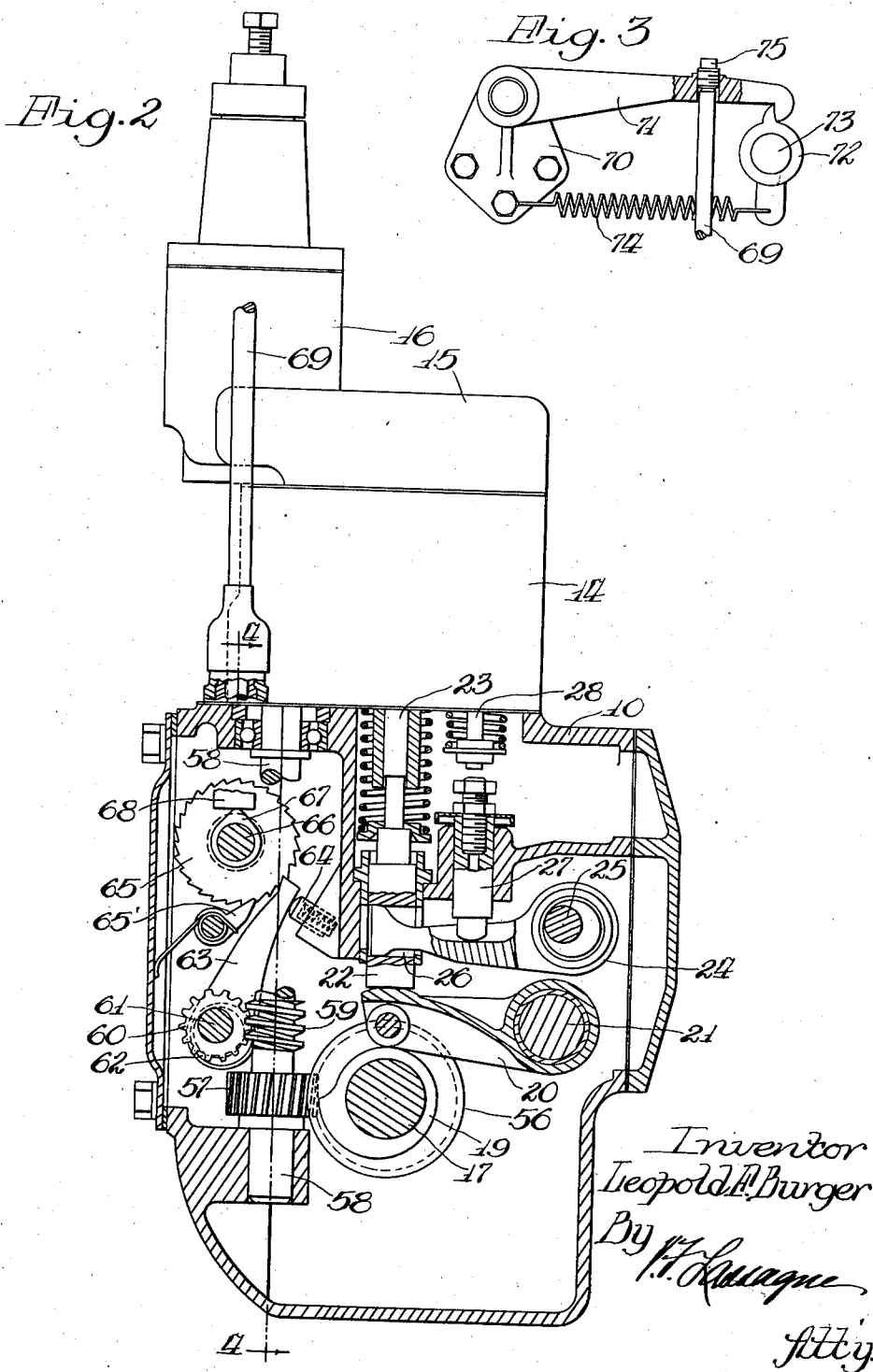
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Fig. 6

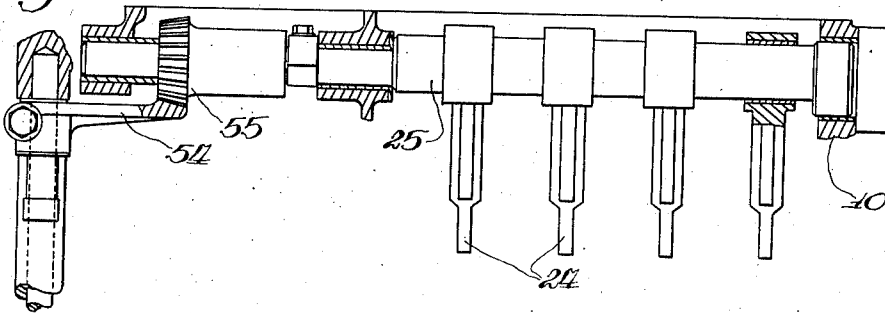


Fig. 5

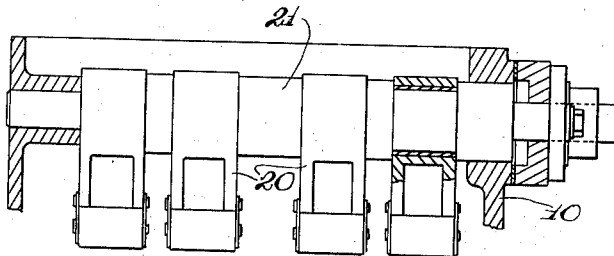
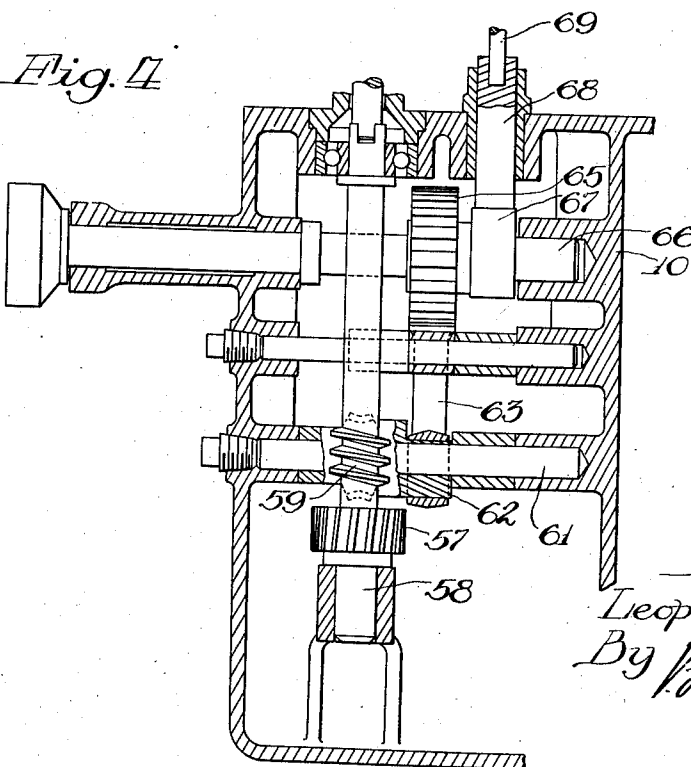


Fig. 4



Inventor
Leopold F. Burger
By *V. L. L. L. L.*

Att'y.

Oct. 12, 1937.

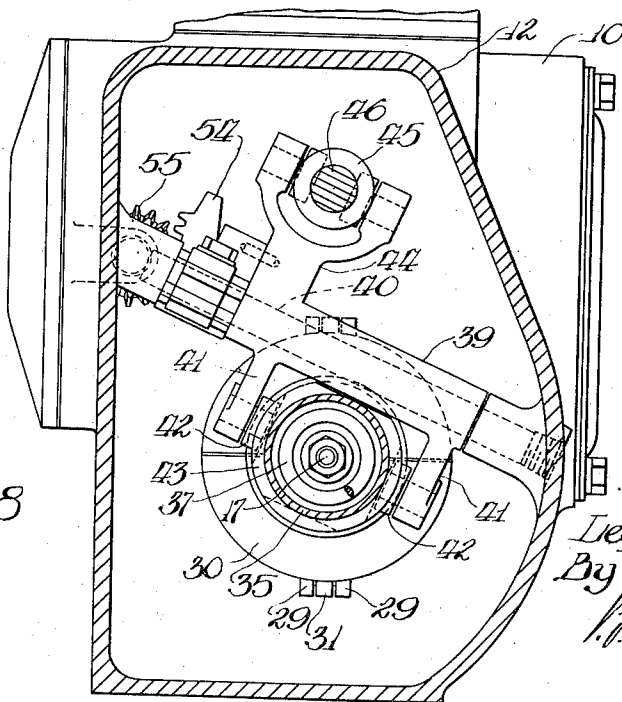
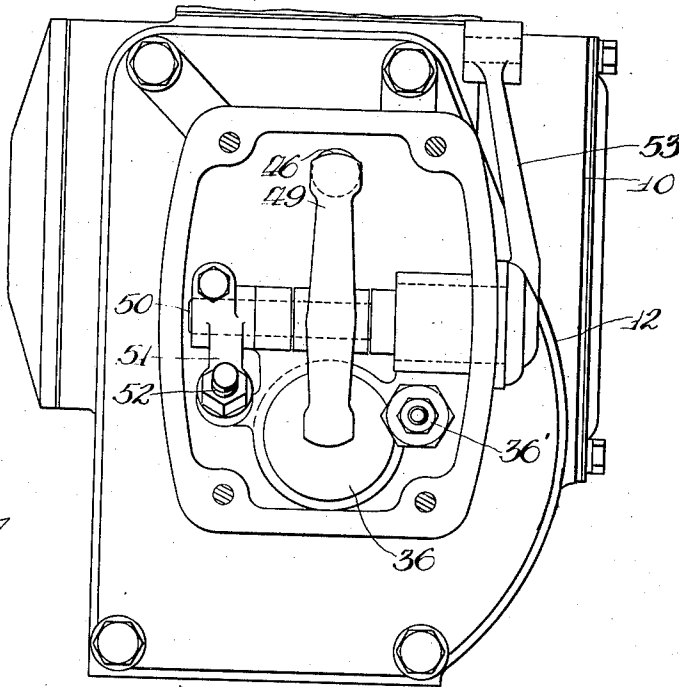
L. F. BURGER

2,095,915

FUEL PUMP.

Filed July 5, 1935

4 Sheets-Sheet 4



Inventor
Leopold F. Burger
By
V. H. McKague
Att'y.

UNITED STATES PATENT OFFICE

2,095,915

FUEL PUMP

Leopold F. Burger, Riverside, Ill., assignor to International Harvester Company, a corporation of New Jersey

Application July 5, 1935, Serial No. 30,001

1 Claim. (Cl. 123—140)

This invention relates to internal combustion engines. More specifically it relates to a pump and control unit for solid injection engines.

In compression ignition engines of the solid injection type, speed regulation is usually accomplished by a centrifugal device operated by the engine. Due to the desirability of placing such a device, usually termed a governor, as close to the means which it regulates as possible, unit constructions have been used, in which the governor is mounted in the pump casing directly on the pump shaft. It is to a construction of this type that the present invention relates.

In the operation of compression ignition engines, starting constitutes a problem whenever, as in the case of a tractor, manual effort must be relied upon to turn the engine for starting. As one method of overcoming this difficulty, such engines have been provided with means for lowering the compression and starting with volatile fuel and spark ignition, such as shown in United States Patent No. 1,225,295. Means have also been developed for automatically shifting from the Otto cycle to the Diesel cycle after a predetermined number of revolutions, as disclosed and claimed in the pending application of Edward A. Johnston Serial No. 557,997, filed August 19, 1931. In the control unit of the present invention, mechanism has been incorporated in the pump casing for operating a control member for shifting the cycle of operation of the engine or for other purposes for which it may be found useful in the operation of an engine.

The principal object of the present invention is to provide an improved control unit for solid injection engines. A more specific object is the provision of a balanced fuel supply governor for solid injection pumps. Another object is the incorporation in a unitary structure of a pump, a control unit therefor, and a control unit for regulating or determining another function of engine operation. These objects and others, which will be apparent from the following detailed description to follow, are accomplished by a device as shown in the drawings, in which:

Figure 1 is a vertical section taken longitudinally of a pump and control unit incorporating the invention, with certain portions broken away in section better to show certain elements, as for example the pump control shaft shown by a second vertical section parallel to the first main section;

Figure 2 is a transverse vertical section of the unit shown in Figure 1;

Figure 3 is an elevational view showing a trip

unit particularly adapted for actuation by the control member shown in Figure 2;

Figure 4 is a section taken on the line 4—4 of Figure 2;

Figure 5 is a plan view of the rocker arms for operating the pump plungers, the bearings being shown in section;

Figure 6 is a plan view of the rocker arms for operating the by-pass valves, the bearings being shown in section, and a portion of the control shaft mechanism;

Figure 7 is an end elevation of the unit shown in Figure 1 with the cover removed; and,

Figure 8 is a vertical transverse section taken on the line 8—8 of Figure 1.

As illustrated, the pump and control unit are housed in a casing 10 divided by a vertical partition 11 into two compartments. An extension housing 12, secured to an open end of the casing, provides additional space for the governor mechanism. A cover plate 13 closes the open end of the housing 12. Above the casing 10, a cylinder block 14 is secured, in which the pump cylinders are mounted. A head 15 is mounted over the block 14 and includes, formed integrally therewith, a pump casing 16.

A pump shaft 17 provided with means for connecting with an engine drive mechanism extends longitudinally of the casing 10, being provided with suitable bearings, one of which is illustrated by the ball bearing assembly 18 mounted in the partition 11. A plurality of spaced cams 19 on the shaft 17 operate rocker arms 20 pivotally mounted on a shaft 21. Said rocker arms engage tappets 22, slidably and non-rotatably mounted in a portion of the casing 10. Said tappets operate the pump plungers 23.

Rocker arms 24 pivotally mounted on eccentrics formed on a shaft 25 are provided with extensions seated in slots 26 formed in the tappets 22. The rocker arms 24 are provided on their upper faces with recesses, in which tappets 27 are seated. Said tappets 27 operate by-pass valves, the stems 28 of which are shown in alignment with the tappets 27.

The pump as illustrated and described up to this point is of a conventional construction now in wide commercial use. Adjustment of the shaft 25 alters the time of by-pass, thereby controlling the effective stroke of the pump plungers and the charges of fuel delivered thereby.

The shaft 17 is provided with a carrier 29 on which governor weights 30 are pivoted on diametrically located, parallel axes. Said weights are substantially arcuate in shape, fitting around

the other parts of the governor mechanism to be hereinafter described. Radially and inwardly extending arms 31, integrally connected with the governor weights, are pivoted by pins 32 to arcuate collars 33. Said collars are fitted in an annular recess formed by spaced collars on a sleeve 34. Said sleeve is slidably mounted on an extension of the shaft 17. By means of a ball bearing assembly provided to reduce friction to a minimum, thrust from the sleeve 34 is transmitted to a sleeve 35 concentric with respect to the sleeve 34 and piloted on said sleeve. The sleeve 35 is slidably fitted into a cup-like member 36, which is in turn slidably fitted in a bore formed in the housing 12. A compression spring 37 abutting the inside of the member 34 abuts a pilot member 38 through which pressure is transmitted in an axial direction on a flange formed on the sleeve 35. It will be understood that by this construction the spring 37 opposes the force developed by centrifugal action on the weights 30.

As a stationary limiting adjustment for the member 36, nuts 36' are threaded on a stud secured to a portion of the housing 12. One of said nuts overlaps the head portion of the member 36, (as shown in Figure 7), thereby limiting outward movement of said member.

A bell crank member 39 is pivotally mounted on a pivot pin 40 extending transversely of the axis of the shaft 17 above said shaft. Said member is provided with spaced, downwardly extending, lever arms 41, which carry members 42 positioned between spaced flanges 43 on the sleeve 35. By means of this construction, reciprocating movement of the sleeve 35 oscillates the bell crank member 39.

The member 39 also carries an upwardly extending lever arm 44, which carries means for engaging spaced flanges 45 mounted on a shaft 46. Said shaft is mounted for reciprocation on an axis parallel to the axis of the pump shaft 17. At its inner end, the shaft 46 is provided with a threaded adjusting member 47, by which the effective compression of a spring 48 may be regulated. Said spring abuts a stop carried by a portion of the casing 10. At its other end the shaft 46 abuts one end of a rocker member 49 rigidly secured to a transverse shaft 50 pivotally mounted in the housing 12 and extending outside of said housing. The other end of the rocker arm 49 abuts the outer end of the member 36, whereby said member may be moved inwardly by the rocking of said arm to increase compression on the spring 37. The shaft 50, which moves with the rocker arm 49, carries an adjusting lever 51 at one end, through which a threaded adjusting member 52 extends. By the adjustment of said member the maximum angular position of the rocker member, acting to increase compression on the spring 37, is limited. Outside the casing, the shaft 50 carries a lever 53 for manual operation to effect speed change of the engine by control of the fuel supplied thereto.

The bell crank member 39 carries integral therewith an extension 54 formed as a sector of a gear, by which rotary motion is transmitted to a gear 55 non-rotatably mounted on the pump control shaft 25.

Intermediate its end the shaft 17 is provided with a worm wheel 56 positioned to engage and drive a worm gear 57 mounted on a vertical shaft 58. Said shaft is carried by the casing 10 and extends upwardly, as shown in Figure 2, above the broken away portion to drive the pump in

the casing 16. This part of the mechanism has not been shown, as it is not involved in the present invention. The shaft 58 carries a worm gear 59, which drives a worm wheel 60 on a transverse shaft 61 carried by the casing 10. Said shaft is provided with an eccentric 62, on which a ratchet member 63 is pivotally mounted. Said ratchet member is spring pressed by a member 64 mounted in a bore formed in a portion of the casing 10 into engagement with a toothed ratchet member 65. A spring pressed latch 65' holds the ratchet member 65 against rotation in an angular direction opposite to the direction in which it is rotated by the ratchet member 63. The member 65 is rigidly carried by a shaft 66, rotatably mounted in the casing 10 and extending outside the casing for manual operation to set the ratchet member 65.

A cam 67 on the shaft 66 is positioned to engage a plunger 68. Said plunger operates a push rod 69, the lower end of which is shown in Figure 4 and the upper end of which is shown best in Figure 2.

To illustrate a use to which the push rod 69 may be put, Figure 3 shows a bracket 70, on which a lever 71 is pivotally mounted, adapted to be secured to an engine block. Said lever has a hooked end adapted to engage a latch formed on a member 72. Said member is mounted on a shaft 73 urged in a clockwise direction by a spring 74. The push rod 69 engages an adjustable member 75 on the lever 71. When said lever is raised, the spring 74 rotates the shaft 73. Said shaft may control any desired function of engine operation, preferably a control for shifting from Otto cycle to Diesel cycle, as disclosed and claimed in the Johnston application previously referred to.

The operation of the trip mechanism will be clear from the description of the parts. The ratchet member 63, continuously driven at a reduced speed from the shaft 17, engages the notches of the ratchet member 65, slowly rotating said member. By means of the hand adjustment provided by the shaft 66 extending outside the casing, the ratchet member 65 may be set with the cam 67 in any desired position. For example, said cam may be set at such an angular position with respect to the plunger 68 that 600 revolutions of the engine will be required to lift the push rod 69 into tripping position with respect to the member 72. The cam may be set at any location from its maximum to a position where the latch will be tripped by a very few engine revolutions. This mechanism is particularly useful in connection with shifting from Otto to Diesel cycle, as previously pointed out. It is a unique construction in that it is combined with a fuel pump in a unit construction.

The operation of the governor for shifting the control shaft 25 and varying the effective length of the pump stroke thereby is conventional in commercial pumps. Applicant, however, has provided an improved balancing means and limiting stops to improve the functioning of the pump, particularly to reduce what is known in governor action as "hunting" or surging. The regulating spring 48, which opposes action of the spring 37, has the function of a secondary control, which can be accurately adjusted to obtain a more uniform governor action. To provide means for varying the range within which the governor operates, a manual control is provided. The lever 53, best shown in Figure 7, is rigidly mounted on the transverse shaft 50. Any suitable manual

operating means may be connected to the lever 53. Referring to Figure 1, manual operation of the shaft 50 in a counter-clockwise direction moves the rocker member 49, which is carried by the shaft, in the same angular direction. The lower end of the member 49 abuts the head portion of the cup member 36. Movement of this member to the right compresses the spring 37 and in effect increases the speed of the engine, as a higher speed is required for the governor weights to compress the spring and to move the bell crank member 39 for effecting a reduction in fuel supply. To limit the increase in speed which can be given to the engine by the manual adjustment, an adjusting stop 52 is provided on a lever 51 carried by the shaft 50. When the stop 52 abuts the end wall of the housing, as shown in Figure 7, the spring cannot be further compressed and the speed of the engine cannot be increased. It is to be understood that, at any manual setting, the governor is effective to maintain the speed for that setting as predetermined by the governor construction and the compression rate of the spring 37 and the auxiliary spring 48.

As the rocker member 49 is moved in a counter-clockwise direction, referring to Figure 1, as above set forth, the shaft 46 is free to move to the left, thereby permitting the bell crank member 39 to rotate in a counter-clockwise direction, whereby the gear sector 54 may rotate the control shaft 25 to a position with increasing amounts of fuel injection.

When the rocker member 49 is manually rotated in a clockwise direction, referring to Figure 1, to reduce the speed of the engine, the cup member 36 moves outwardly to the left until it abuts the stop formed by the nuts 36'. This stop determines the minimum speed at which full governor action is available. For further decreases in speed the member 49 is manually rotated in a clockwise direction to move the shaft 46 to the right, thereby rocking the bell crank member 39 and rotating the control shaft 25 to reduce the amount of fuel injection. By this

manual means the injection of fuel may be reduced to a minimum, or to zero, for stopping the engine, if the by-pass valves are constructed for a zero amount of injection.

By the means above set forth, a governor is provided which is effective to maintain a given speed at any of a wide range of settings. The manual control for changing the effective range also incorporates means for manually reducing the fuel supply for idling or for stopping the engine.

It is to be understood that applicant has shown and described only certain preferred constructions illustrating the principles of his improved pump and control unit and that he claims as his invention all modifications falling within the scope of the appended claim.

What is claimed is:

A governor controlling device for solid injection fuel pumps comprising, in combination with a fuel pump positioned in a housing and with a pump shaft therefor and a shaft parallel to the pump shaft for controlling the effective stroke of the pump, centrifugal governor weights mounted on the pump shaft, a governor reciprocated member positioned in alignment with the pump shaft and adapted to be operated by the governor weights, a spring positioned to abut a portion of said member for counteracting the force of the governor weights, fixed abutment means for adjusting the pressure on said spring, a double bell crank mounted on an axis transverse to the axis of the pump shaft, a lever arm on said crank connected to the governor reciprocated member, a lever connected to the bell crank and operatively connected to the pump control member, a second lever arm carried by the bell crank, a control member operatively connected to said crank for reciprocation thereby, a rocker arm mounted on a shaft transverse to the axis of the pump shaft having an arm engaged by one end of said control member, an adjustable stop carried by said rocker arm, and manually operable means for operating said rocker arm.

LEOPOLD F. BURGER. 45