

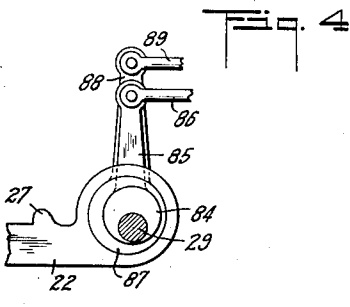
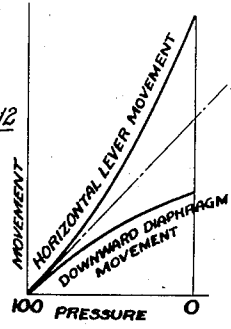
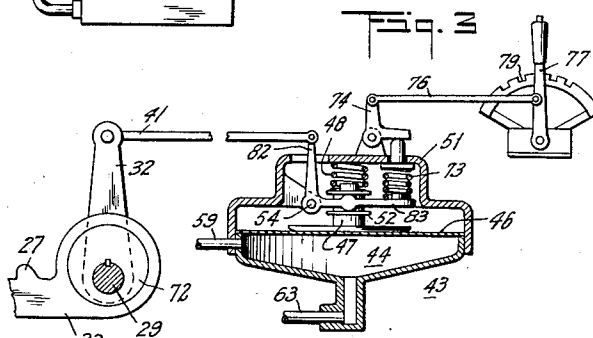
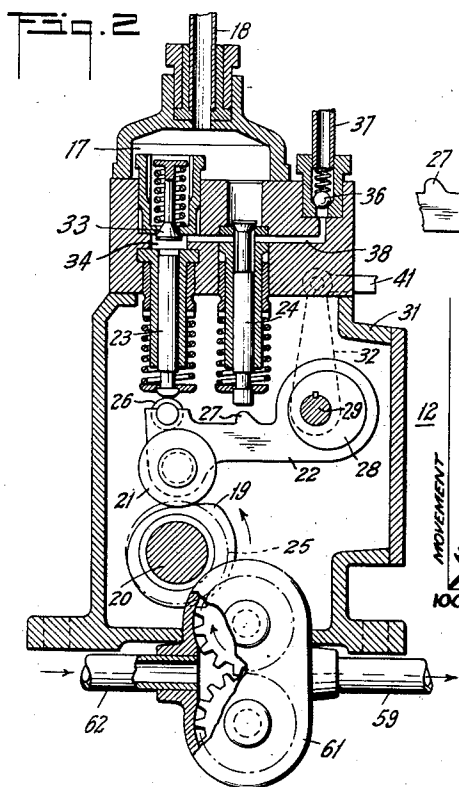
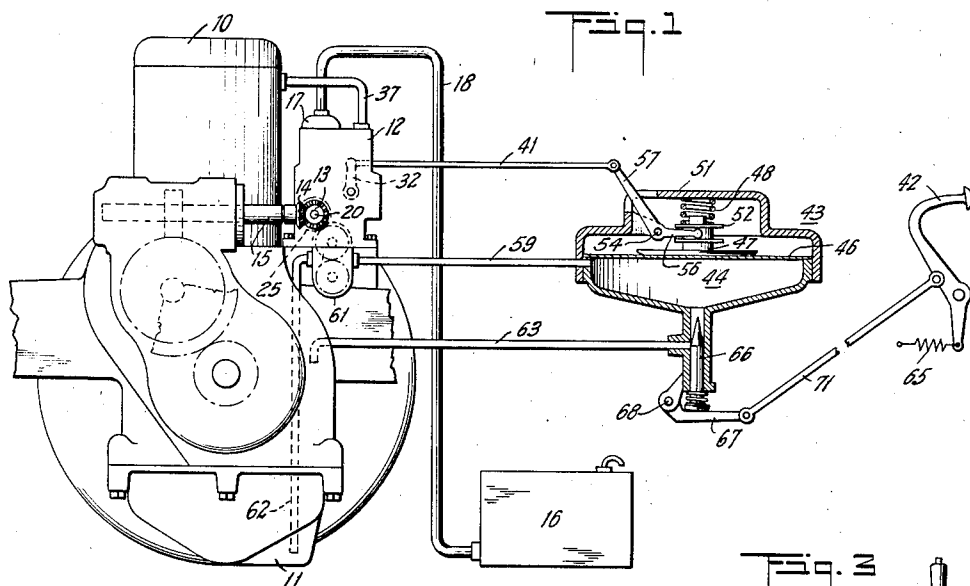
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F. C. MOCK

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FUEL FEED CONTROL

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INVENTOR.
Frank C. Mock
BY
Warren T. Hunt
ATTORNEY.

UNITED STATES PATENT OFFICE

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FUEL FEED CONTROL

Frank C. Möck, Montclair, N. J., assignor, by
mesne assignments, to Eclipse Aviation Corpo-
ration, East Orange, N. J., a corporation of
New Jersey

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2 Claims. (Cl. 264—14)

This invention relates to internal combustion engines, and more particularly to a fuel control therefor.

An object of the invention is to provide a hydraulic governor for a fuel injection engine.

Another object of the invention is to provide a manually controlled hydraulic governor for an engine.

Another object of the invention is to provide a diaphragm governor with a device to compensate for the inherent non-uniform movement of the diaphragm in accordance with variations in pressure.

Other objects and features of the invention will be apparent from the following description, in connection with which certain preferred forms of the invention have been illustrated in the accompanying drawing, in which:

Fig. 1 is a somewhat diagrammatic view illustrating the fuel governor as applied to an internal combustion engine;

Fig. 2 is an enlarged vertical section of the fuel pump illustrated in Fig. 1;

Fig. 3 is a sectional view of a somewhat different form of invention; and,

Fig. 4 is a view showing an eccentric arrangement whereby the amount and time of fuel injection may be simultaneously varied.

Fig. 5 is a diagrammatic showing of the relative movements of the lever and diaphragm in the form of the invention shown in Fig. 1.

In the drawing, 10 is an internal combustion engine having a crankcase 11 adapted to contain a supply of oil. Fuel pump 12 may be of any desired type and is preferably driven in timed relation to the engine by means of gears 13 and 14 and shaft 15. The fuel is derived from a supply tank 16 from which it is led to the pump intake chamber 17 by a pipe 18.

The operative mechanism of pump 12 comprises an engine driven cam 19 secured to shaft 20 which contacts with a roller 21 of lever 22 to reciprocate spring loaded plunger 23 and spring loaded relief valve 24; a roller 26 being provided to contact with the lower end of the plunger 23 and a nose or projection 27 being adapted to contact with the lower end of the relief valve 24. Lever 22 is pivotally mounted upon an eccentric 28 secured to shaft 29 that is rotatable in the pump casing 31 by a lever 32.

In the operation of the pump, downward movement of spring loaded plunger 23 draws a charge of fuel from chamber 17 past check valve 33 into the cylinder 34. Continued rotation of the cam 19 causes the nose thereof to contact with

roller 21 and rotate lever 22 in a clockwise direction to force plunger 23 upwardly and deliver fuel into passage 38 and past check valve 36 to the engine by means of pipe 37. The fuel delivery continues until nose 27 contacts the lower end of relief valve 24, whereupon the valve is lifted from its seat and fuel is by-passed from passage-way 38 to the compartment 17 in the intake side of the pump.

It may be readily seen from the above that the inception of fuel delivery is determined by the position of roller 21 with respect to cam 19, and the quantity of fuel injection is determined by the opening of valve 24.

In the form of pump illustrated in Fig. 2, the eccentric 28 is preferably positioned with its center to the right of the center of shaft 29 and in a horizontal line therewith. In this arrangement of the eccentric, rotation of lever 32 in either direction raises or lowers lever 22 and varies the clearance between lug 27 and the lower end of the relief valve 24 which results in the opening of the relief valve at an earlier or later point in the pump cycle, and a corresponding variation of the quantity of fuel delivered at each reciprocation of the plunger. It is recognized that, in addition to the vertical movement of lever 22, there is also a slight lateral movement which changes the relative position of roller 21 to the cam 19, but the extent of such movement is slight as compared to the vertical movement and the major effect of rotation is to vary the amount of fuel. If desired, eccentric 28 may be given some other arrangement with respect to its shaft 29, whereby the ratio of vertical and lateral movements is somewhat different.

Although the movement of lever 32 may be performed by a manual operation, for example by connecting rod 41 direct to the manually operated pedal 42, it is preferred to interpose a governor therebetween which is generally designated by 43. The governor is preferably of the hydraulic type which is particularly adaptable for engine control in that the available force for actuating the fuel pump control may be considerably increased by a proper selection of movable member area whereby the actuating force is a product of the unit pressure by the area of the movable member upon which the pressure acts.

In the form of governor illustrated in Fig. 1, 44 is a fluid container having its top wall preferably in the form of a diaphragm 46 to which is attached a stem 47 about which is a spring 48 coacting between housing 51 and collar 52 to urge the diaphragm 46 to its lower position. A bell-

crank pivotally mounted on housing 51 at 54 has one of its arms 56 interposed between the opposite faces of collar 52. The other arm 57 of the bell-crank is operatively connected to fuel pump lever 32 by the rod 41.

It is well known that the movement of a diaphragm is not proportional to the pressure and that the rate of deflection decreases with the amount of deflection. For this reason arm 57 is arranged parallel to the diaphragm and arm 56 is arranged at an obtuse angle to arm 57. As the arm 56 is moved downwardly by action of diaphragm 46, the lateral component of arm 47 will increase at a greater rate than the lateral component of the arm 56 and thereby move rod 41 at a rate substantially proportional to pressure.

The diaphragm is shown in the position it normally assumes at the maximum engine speed at which the engine is operated. In other words, when the pressure within chamber 44 is at a maximum, the diaphragm is in its horizontal position. Any decrease in pressure from maximum will result in downward movement of the diaphragm from the horizontal position and cause a clockwise rotation of lever 57. It will be noted from Fig. 5 that the rate of downward movement of diaphragm 46 from its horizontal position decreases with a decrease in pressure within chamber 44, whereas the rate of horizontal movement of the lever arm 57 increases as it nears the vertical position. It is realized that a horizontal movement curve of lever 57 for the full 360 degrees of rotation will be a sine curve, but the maximum movement of diaphragm 46 is so slight that at all possible downward movements the lever 57 moves between the position shown in Fig. 1 and the vertical and includes only that portion of the movement curve for the full 360 degree movement which is shown in Fig. 5. It may be readily noted from the figure that the variations in the two curves from a straight line substantially neutralize each other and that therefore the movement of rod 41 in a horizontal direction is substantially proportional to pressure within the chamber 44.

A pipe 59 connects the governor container 44 to an oil pump 61 of any suitable design, which is also preferably driven by the engine through shaft 20 and gear 25 thereon, and derives its oil supply from the engine sump 11 by means of intake pipe 62. Container 44 is preferably supplied with an oil return pipe 63, the opening 64 of which is controlled by a spring loaded tapered valve 66 having its lower end contacting members 67 pivotally mounted on the governor at 68 which is moved in a manner to vary the position of valve 66 by means of rod 71 that is actuated by manually operable pedal 42 normally urged toward the right by spring 65. Pump 61 is preferably of the gear type as disclosed in Fig. 2, whereby the oil flow is substantially constant per engine revolution. The foregoing arrangement has been found to be preferable, but if desired, any other suitable arrangement of lever or linkage arrangement may be used to give the desired result.

If it should be desired to vary the time of injection at a greater rate than the quantity of injection, it is preferred to position the eccentric as shown in Fig. 3, whereby the center of the eccentric 72 is on a vertical line above the center of shaft 29, by which arrangement the angular movement causes the lever 22 to be moved laterally to a greater extent than it is moved vertically and thereby change the angular position of 21 with reference to cam 19 for advancing or retard-

ing the cycle of upward movement of plunger 23.

In this form of the invention, the container 44 is provided with an outlet having a constant opening, and the resistance of spring 48 is augmented by a second spring 73 which may be varied by a lever 74 pivotally mounted on the governor and connected by rod 76 to a manually operable lever 77 adapted to be locked into position by any suitable means adapted to engage notches 79. Bell-crank arm 82 is preferably arranged in a vertical position, but it is understood that this is optional and if desired the arm may be given any other inclination with respect to its other arm 83.

If it should be desired to have a combined actuation for the time and quantity controls, the lever 22 may be mounted on a double eccentric, as illustrated in Fig. 4. In this form of control, eccentric 84 is adapted to change the time of injection through lever 85 and rod 86 connected to a governor of the type disclosed in either Fig. 1 or Fig. 3. Eccentric 87 is adapted to control the amount of fuel injection by lever 88 and rod 89 connected to another hydraulic governor, such as has been described above.

In the operation of the form of the invention illustrated in Figs. 1 and 2, assuming that the engine is running and that pedal 42 is maintained in a constant position, the fluid pressure within container 44 will have some predetermined value and lever 32 of the fuel pump will assume a position to deliver the quantity of fuel necessary for the particular engine speed. If for any reason the load on the engine is increased, as it slows down the pressure within container 44 will decrease and cause lever 32 to rotate the eccentric 28 clockwise to increase the fuel quantity sufficiently to maintain the engine speed substantially constant.

If it is desired to increase the engine speed, pedal 42 is depressed and moves valve 66 downwardly to increase the outlet area and reduce the pressure within the chamber 44, whereby eccentric 28 will be moved in a clockwise direction and increase the amount of fuel to that sufficient for a correspondingly higher engine speed. It will be understood that by a proper selection of governor parts the engine will continue to operate at a substantially constant speed irrespective of load so long as the position of pedal 42 is not changed.

In the operation of the form shown in Fig. 3, clockwise rotation of lever 77 increases the spring pressure upon diaphragm 46, whereby the fluid pressure beneath the diaphragm is overcome and eccentric 72 is moved in a clockwise direction to move roller 21 toward the nose of cam 19 to advance the time of fuel injection.

It is understood that various changes may be made without departing from the spirit of the invention; for example, various arrangements of the lever inter-connecting the governor with the fuel pump may be employed, and also it is realized that it is not essential as to which form of the governor described is used to operate the eccentrics controlling the amount and time of injection. Other changes will be apparent to those skilled in the art, and the invention is, therefore, regarded as not limited to the forms illustrated and described, or otherwise, except by the terms of the following claims:

What is claimed is:

1. In a governor for an engine, a housing enclosing a chamber, a diaphragm forming a chamber wall, means for supplying fluid pressure to the chamber, a cap member secured to the housing above the chamber having an atmospheric open-

ing, a member having spaced flanges contacting the diaphragm, a spring coacting between the cap member and the collar to press the same against the diaphragm, and a bell crank having arms inclined to each other at an angle other than a right angle, said bell crank being pivotally mounted interiorly of the cap member and having one arm arranged between the flanges and the other arm extending through said opening and adapted to be connected to an engine control, one of said arms being parallel to the face of the diaphragm.

2. In a governor for an engine, a housing enclosing a chamber, a diaphragm forming a chamber wall, means for supplying fluid pressure to the chamber, a cap member secured to the housing above the chamber having an atmospheric open-

ing, a member having spaced flanges contacting the diaphragm, a spring coacting between the cap member and the collar to press the same against the diaphragm, a bell crank having arms inclined to each other at an angle other than a right angle, said bell crank being pivotally mounted interiorly of the cap member and having one arm arranged between the flanges and the other arm extending through said opening and adapted to be connected to an engine control, one of said arms being parallel to the face of the diaphragm, an outlet, and a manually controlled tapered valve for controlling the outlet and varying the pressure within the chamber.

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