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2,910,976

TIMING DEVICE FOR FUEL INJECTION PUMP

Filed Feb. 17, 1954

2 Sheets-Sheet 1

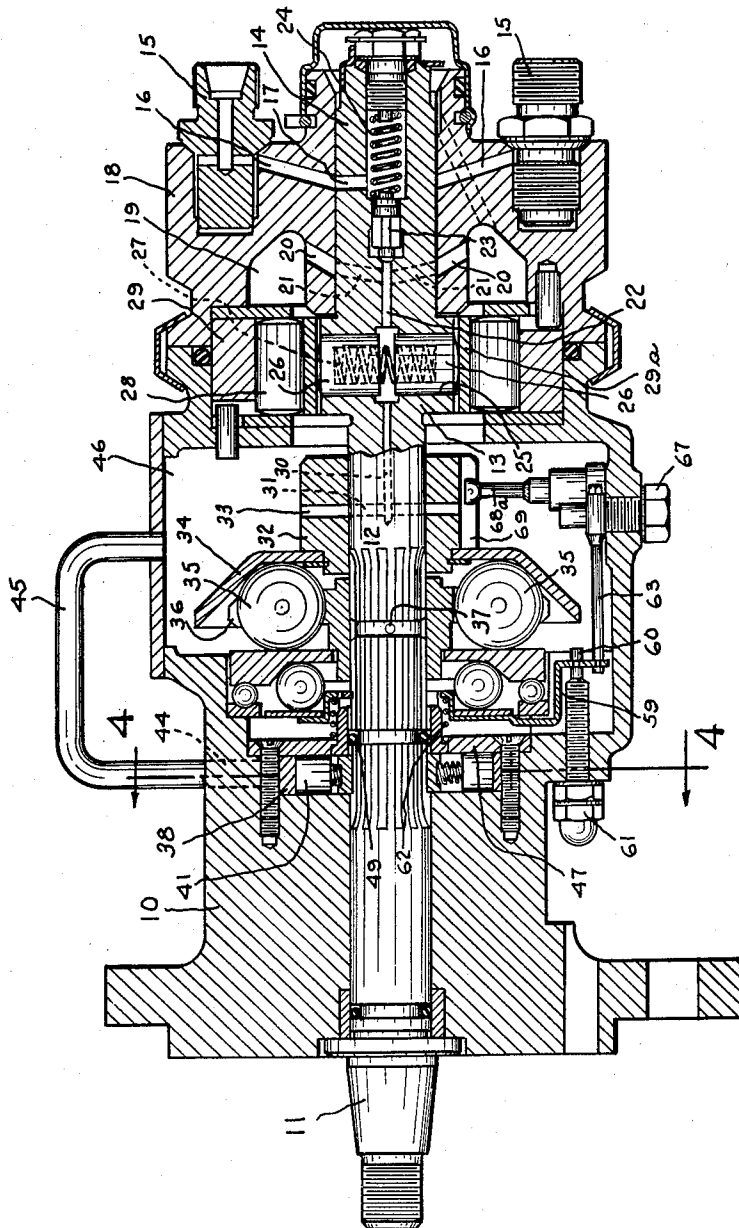


Fig. 1.

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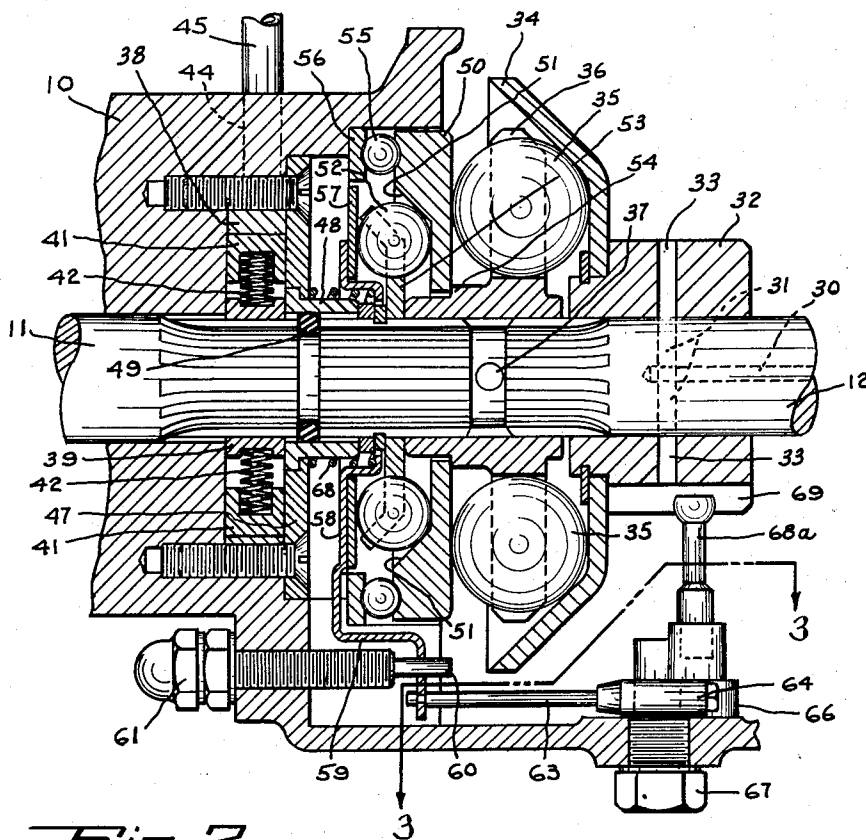


Fig. 2.

Fig. 3.

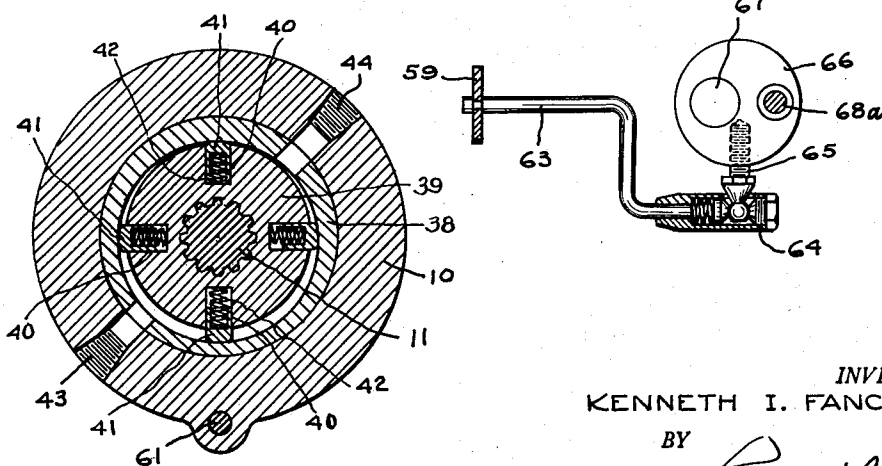


Fig. 4.

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TIMING DEVICE FOR FUEL INJECTION PUMP

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4 Claims. (Cl. 123—140)

This invention relates to fuel injection apparatus and has particular reference to new and improved injection timing means for fuel injection pumps.

An object of the invention is to provide new and improved automatic injection timing means for fuel injection pumps which means are relatively simple and inexpensive and is of the speed sensitive centrifugal type and does not require high pressure hydraulic systems or adjustment of cams.

Another object is to provide a timing arrangement of the type set forth which does not require any external devices such as covers or linkage and thereby avoids possible leakage due to the timing means.

Another object is to provide new and improved timing means of the type set forth which does not require helical splines working against injection pressures.

Another object is to provide a new and improved injection timing means for fuel injection pumps of the spill or bypass type.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts shown and described without departing from the spirit of the invention as the preferred form has been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a longitudinal sectional view of a fuel injection device embodying the invention;

Fig. 2 is a fragmentary sectional view similar to that of Fig. 1, but shown on an enlarged scale;

Fig. 3 is a fragmentary sectional view taken on line 3—3 of Fig. 2, looking in the direction of the arrows; and

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1, looking in the direction of the arrows.

In the drawings and specification the invention has been shown applied to a distributor type fuel injection apparatus wherein the governor, fuel metering means, injection pump and distributor are shown along the same axis.

It will be understood that the invention may be applied to other types of fuel injection apparatus employing the supply or bypass metering systems as well.

In the drawings, the invention has been shown as applied to a fuel injection apparatus of the type set forth in the patent of John N. Humber, Number 2,674,236 issued April 6, 1954 to which patent reference is made for any further details of description of the pump mechanism that may be desired.

The apparatus shown comprises a housing 10 in which is journaled the drive shaft 11 having the fuel metering portion 12, injection pump portion 13 and distributing portion 14 with the outlets 15 surrounding distributing portion 14 and adapted to supply fuel successively to the combustion chambers of an internal combustion engine, or the like.

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Each of the outlets 15 is connected by a port or passage 16 to the distributing portion 14 which has the radial port 17 adapted to be aligned successively with each of the ports 16 on rotation of distributor portion 14.

The hydraulic head 18 is provided with the annular sump 19 adapted to supply fuel through fill ports 20 and radial fill ports 21 in distributor portion 14 which communicate with said fill ports 20 upon rotation of distributor portion 14 to the fuel injection pump.

Ports 21 communicate with axial passage 22 through which fuel flows to the injection pump portion 13 during the suction stroke of plungers or pistons 26 and from which fuel flows from the injection pump portion 13 to the distributor portion 14 during the pumping stroke of the pistons 26. Delivery valve 23 is provided in passage 22 between ports 21 and port 17 and said delivery valve 23 is controlled by delivery valve spring 24 which normally retains valve 23 in closed position until said valve is opened by injection pressure.

In injection pump portion 13 is the transverse or radial bores 25 in which are the opposed pistons 26 between which is positioned the spring 27 for urging said pistons on their suction stroke.

Adjacent the outer ends of the pistons 26 are the rollers 28 and shoes 29 and surrounding the injection pump portion 13 is provided internal cam 29a having opposed lobes being provided for each of the outlets 15.

The fuel metering portion 12 is provided with axial bore 30 and radial ports 31, one of which is provided for each of the outlets 15, and surrounding the metering portion 12 is the fuel passage or spill control sleeve 32 which has the radial ports 33 therethrough, one of which is provided for each of the outlets 15, and which are adapted to allow the bypassing or spilling of fuel to thereby control the timing of injection and the quantity of fuel injected.

Connected to the sleeve 32 is the governor cone 34 which is adapted to be actuated by the governor balls 35 which are rotated by the cage 36 which is secured to shaft 11 by the pin 37 and which, therefore, rotates with shaft 11 and centrifugal force, upon rotation of the shaft urges the balls outwardly to effect adjustment of sleeve 32.

The linkage or control mechanism which manually controls the sleeve 32 and containing the spring opposing the centrifugal force of governor balls 35 is not shown but reference is made to the application referred to above for further details thereof.

In the fuel injection apparatus shown, the fuel supply pump is embodied in the housing 10 although, if desired, a gravity supply could be utilized or an external supply pump utilized, as desired.

The supply pump shown is of the vane type having the eccentric ring 38 within which is positioned the ring 39 keyed to shaft 11 having the pockets 40 in each of which is positioned a vane 41 and spring 42.

The pump has the inlet 43 adapted to be connected to a pipe line from a fuel tank and an outlet 44 which is connected by pipe line 45 to sump 46 in the housing from which fuel flows through openings or ports in the injection pump portion 13 to sump 19.

Thrust plate 47 forms a seal for the side of the supply pump and sleeve 48 and O ring 49 is also provided for sealing the supply pump.

Adjacent governor balls 35 is provided the free floating plate 50 having the inclined raceway or cone 51 against which are positioned the balls 52 in cage 53 which is also splined on shaft 11.

Plate 50 is positioned against shoulder 54 on cage 36 and balls 55 are provided in the raceway formed by member 50 and the raceway 56.

The free floating ring or thrust plate 57 is provided

adjacent balls 52 and is retained in position by annular member 58 which has the projecting lug or finger 59 which has an opening through which extends the projecting end 60 of adjusting screw 61.

Spring 62 normally retains thrust plate or ring 57 in engagement with balls 59.

The projecting lug 59 on the end of annular member 58 is connected to one end of rod 63 which is connected at its opposite end 64 through bolt or stud 65 to pivotal member 66 which is pivotally mounted on a pilot on the end of bolt 67. Pivotal member 66 has the projecting lug 68a extending into the longitudinal slot 69 in the periphery of sleeve 32 whereby longitudinal movement of rod 63 effects rotation of sleeve 32 to change the relation of ports 31 and 33.

In operation, upon rotation of shaft 11, the cam effects reciprocation of plungers 26 and fuel is supplied through port 12 to each of the outlets successively upon rotation of the shaft.

The quantity of fuel injected is controlled by controlling the quantity of fuel bypassed or spilled back into sump 46 through radial ports 31 in the fuel metering portion 12 of shaft 11 and through ports 33 in sleeve 32 during the time said ports 31 and 32 are in communication.

The timing of injection is controlled through control of the relative rotative positions of ports to change the phasing thereof 31 and 33 and the relative positions of these ports is controlled automatically by the timing device in the following manner.

Upon rotation of shaft 11, cage 53 and balls 52 will simultaneously rotate and centrifugal force urges balls 52 outwardly against inclined raceway or cone 50 and this in turn effects axial movement of member 58 which through its lug 59 causes movement of rod 63 which pivots member 66 to thereby rotate sleeve 32.

The extent of possible adjustment is controlled through the positioning of adjusting screw 61 which limits the extent of movement of lug 59 and thereby limits the extent of movement of rod 63. It will thus be seen that the positions of adjusting screw 61 controls the amount of adjustment of the timing device and that screw 61 forms an adjustable stop therefor.

From the foregoing it will be seen that I have provided new and improved, relatively simple and compact automatic timing means for controlling the timing of injection of a bypass type fuel injection pump.

I claim:

1. In a fuel injection pump, a rotatable member having an axial fuel passage and a radial fuel distributing port, fuel quantity control means, a centrifugal governor on said rotatable member and operatively connected to said fuel quantity control means for controlling the quantity of fuel delivered by the pump, timing means for controlling the timing of injection by the pump, said timing means comprising, second separate centrifugally actuated means carried by said rotatable member and adjustable means operatively connected to said second centrifugally actuated means and adapted to be adjusted thereby for controlling the timing of injection by the pump, each of said centrifugally actuated means comprising a stationary member and a movable member with ball members therebetween whereby movement of said movable member is

effected by said ball members upon rotation of said rotatable members.

2. In a fuel injection pump, a rotatable member having an axial fuel passage and a radial fuel distributing port, fuel quantity control means, a centrifugal governor on said rotatable member and operatively connected to said fuel quantity control means for adjusting said fuel quantity control means and thereby controlling the quantity of fuel delivered by the pump, timing means for controlling the timing of injection by the pump, said timing means comprising separate centrifugally actuated means carried by said rotatable member and timing means operatively connected to said second centrifugally actuated means for controlling the timing of injection by the pump, each of said centrifugally actuated means including stationary and movable members and ball members therebetween with said ball members being adapted to be actuated by centrifugal force to effect movement of said movable member relative to said stationary member and said means for adjusting the timing of injection being operatively connected to said movable member and actuated thereby.

3. In a fuel injection pump, a rotatable member having an axial fuel passage, a radial fuel distributing port and a radial fuel bypass port, a sleeve surrounding said bypass port for controlling the bypassing of fuel there-through, first centrifugally actuated means operatively connected to said sleeve for effecting adjustment thereof relative to said bypass port for controlling the quantity of fuel injected by the pump and a second centrifugally actuated member carried by said rotatable member, said second centrifugally actuated member being operatively connected to said sleeve for adjusting said sleeve for controlling the timing of injection by said pump.

4. In a fuel injection pump, a rotatable member having an axial fuel passage, a radial fuel distributing port and a radial fuel bypass port, a sleeve surrounding said bypass port for controlling the bypassing of fuel there-through, first centrifugally actuated means operatively connected to said sleeve for effecting adjustment thereof relative to said bypass port for controlling the quantity of fuel injected by the pump and a second centrifugally actuated means carried by said rotatable member, said second centrifugally actuated member being operatively connected to said sleeve for adjusting said sleeve for controlling the timing of injection by said pump, each of said centrifugally actuated means comprising a stationary member and a movable member with ball members therebetween whereby movement of said movable member is effected by said ball members upon rotation of said rotatable members.

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