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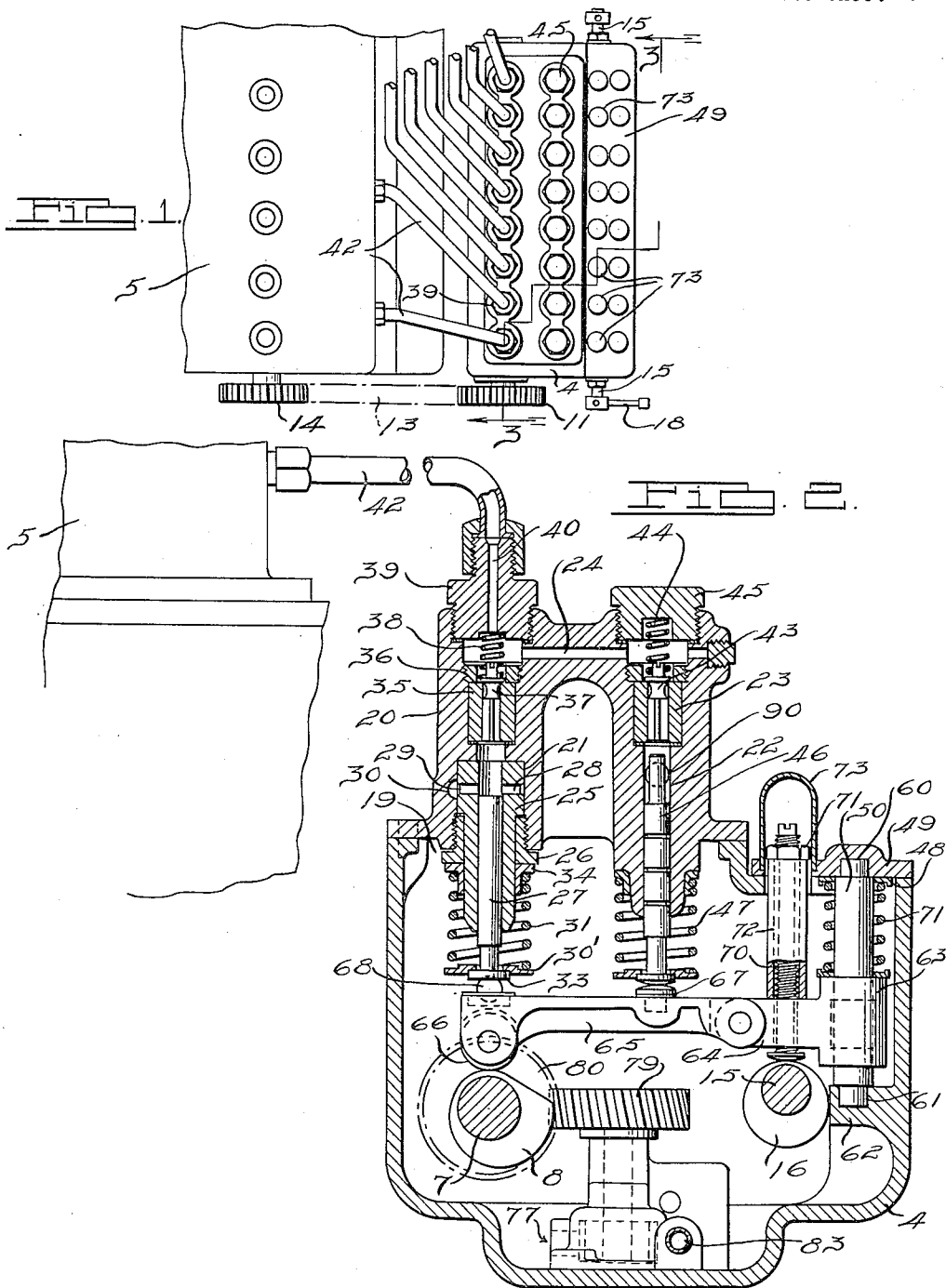
H. T. THOMAS

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FUEL FEED MECHANISM

Filed Nov. 22, 1930

2 Sheets-Sheet 1



INVENTOR
Horace T. Thomas.

BY

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Harnes, Dickey, Pines & Hann
ATTORNEYS.

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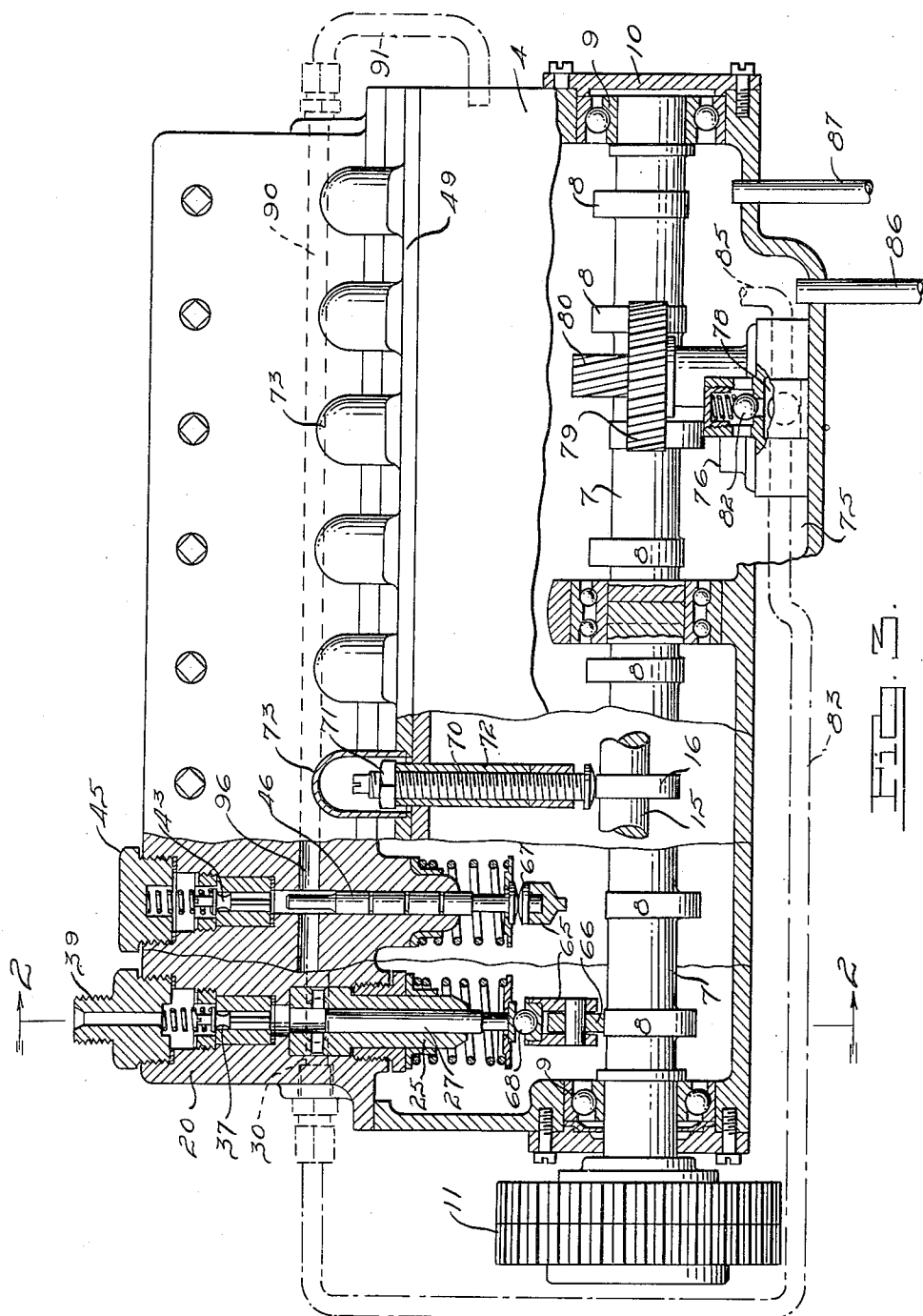
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ATTORNEYS.

UNITED STATES PATENT OFFICE

HORACE T. THOMAS, OF LANSING, MICHIGAN, ASSIGNOR TO REO MOTOR CAR COMPANY,
A CORPORATION OF MICHIGAN

FUEL FEED MECHANISM

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This invention relates to improvements in multiple high pressure fuel pumps for Diesel engines and the like, where a small quantity of fuel is forced into each of the cylinders against high compression.

General objects of the invention are to supply an even, controlled distribution of oil to the cylinders of the engine; and this is accomplished more especially by supplying a constant and equalized supply of fuel oil to the intake of each of the high pressure pumps, and by providing a differential adjustment for each pump, which may be changed or adjusted while the engine is running, so that identical operation may be obtained in each cylinder.

Other objects are to provide a simple arrangement for maintaining the same and equalized conditions in the supply of the oil to the intake of each of the pumps, and to provide a simple arrangement for effecting the differential adjustment, which can be readily set or adjusted while the engine is running.

Other objects and advantages will become apparent in the following description, with reference to the accompanying drawings, in which an illustrative embodiment of my invention is shown.

Fig. 1 is a plan view of the fuel supply device showing a portion of the engine to which the device is connected.

Fig. 2 is a cross section of the fuel pump taken on the line 2—2 of Fig. 3, a diagrammatic representation of the connection to the engine also being shown.

Fig. 3 is a side elevation of the device with parts broken away and parts shown in section at different vertical planes.

In the embodiment shown, I provide a shaft housing 4 which may be mounted at one side of the engine 5, and in one side of which is rotatably mounted a cam shaft 7 having cams 8 in suitable bearings 9 mounted in the end walls of the housing. At the rear end the shaft is covered by a plate 10, and at the front end the shaft projects through the housing and carries a gear or sprocket 11 which is connected with the timing gear or sprocket 13 on the engine shaft 14 so that the

shaft is driven at the proper speed and timing relation with the engine. At the opposite side of the housing and parallel with the cam 7 is positioned an eccentric shaft 15 having eccentric cams 16. The shaft 15 is, rotatably supported in the end walls of the housing, and may be set in any desired position, as, for example, by means of a hand controlled lever 18 secured to one end of the shaft as shown in Fig. 1 for the purpose of illustration.

Over an opening 19 in the top of the housing 4 is bolted the head member 20 which is provided with a row of bores 21 for the high pressure pump, directly above the cam shaft 7, and a row of bores 22 for the shut-off control valve 23, one bore 22 being provided for each bore 21 and connected thereto by a transverse passage 24 in the upper portion of the head 20. In the lower end of the bores 21 is inserted the piston sleeve 25, locked in place by means of the gland nut 26, in which is slidably mounted the plunger piston 27. Near the upper end of the sleeve 25 and above the end of the piston 27 when the piston is in lowermost position, are provided inlet ports 28 which communicate from the bore of the sleeve to a circumferential groove 29 around the sleeve, and supply communication to the common intake or supply passage 30 which extends longitudinally in the head 20.

The piston 27 is pressed downwardly by the piston spring 31 which is compressed between the spring seat 30', which is located on the enlarged end 33 of the piston 27, and the sleeve member 34 which abuts against the lower end of the nut 26. In the upper portion of the bore 21 is inserted the hollow valve seat 35, locked in place by the threaded collar 36, in which is seated the check valve 37, the valve being pressed downwardly by means of the closure spring 38 which abuts against the inner end of the cap nut 39 which is threaded into the upper end of the bore 21. Communication from the passage 40 which extends through the nut 39, to the corresponding cylinder is provided by the pipe 42.

In the bore 22 and below the passage 24 is similarly mounted a shut-off or by-pass

valve 43 which is pressed to closed position by means of the spring 44 which seats in the cap nut 45, threaded in the upper end of the bore 22. In the reduced lower portion of the bore 22 is slidably mounted the valve opening plunger 46 which has a spring 47, similar to the spring 31, for pressing the plunger downwardly. A second opening 48, in the opposite side of the upper portion of the housing 4, is covered by means of a plate 49; and in alignment with each the pairs of bores 21 and 22 is mounted a shaft 50. The shafts 50 are reduced at the ends which are engaged in pockets 60 and 61 provided in the cover plate 49 and a shelf 62, formed in the housing, respectively.

On each shaft 50 is slidably mounted a fulcrum block 63 having an arm 64 projecting over the corresponding eccentric 16. The cam lever 65, for each pump, is pivoted to the arm 64 while in the outer end of the lever is provided a roller 66 which rides on the corresponding pump cam 8. At the medial portion, the lever is provided with a hardened button 67 for contacting with the lower end of the plunger 46, and a ball 68 is inserted between the outer end of the lever and the lower end of the piston 27.

The provision for differential adjustment of the action of each individual shut-off valve is made by threading a long screw 70 through the arm 64 for contacting with the eccentric 16. The lower end of the screw is urged into contact with the eccentric by the spring 71, which encircles the shaft 50 and which is compressed between the hub of the fulcrum member 63 and the cover plate 49. The upper end of the screw 70 projects through an aperture provided in the cover plate and is provided with a nut 71 which locks against a spacer sleeve 72 placed on the screw above the arm 64. This renders the screw and nut readily accessible from the exterior of the device, and the exposed end is normally covered by a thimble 73 which is inserted in the aperture preventing the escape of oil from the housing.

In a sump depression 75 provided in the bottom of the housing, is mounted a gear pump 76 having an inlet 77 to the interior of the housing, and an outlet passage 78. The pump is constantly driven by the gear 79 which meshes with the gear 80 from the cam shaft 7. For controlling the pressure from the pump, a release valve 82, of well known construction, is provided in the outlet passage and allows the escape of oil back into the housing when the valve is opened by excessive pressure. The discharge passage 78 of the pump is connected in any suitable manner, as by the pipe 83, shown diagrammatically in Fig. 3, to the high pressure pump intake passage 30; and the connection 85 may also be made from the outlet of the pump to suitable lubrication conduits (not

shown) for supplying oil to the cams and bearings so that the pump may serve a dual purpose.

The fuel oil is constantly supplied to the housing through the pump connection pipe 86, and controlled by the overflow pipe 87 for maintaining a substantially constant level of oil in the housing. The oil in the housing is at atmospheric or low pressure which may vary appreciably, but the oil is pumped or relayed from the housing and supplied to each of the intakes of the high pressure pumps at a positive, predetermined, and equalized pressure so that the intake conditions are substantially the same for each pump.

In operation each piston is drawn down by its spring until the end is below the cross passages 28 and a charge of oil is supplied under pressure above the piston. As the cam is rotated, the piston is raised, forcing the oil up to lift and pass the valve 37; and then the oil is forced through the pipe 42 into the corresponding cylinder at high pressure. At a predetermined place in the travel of the piston, which is determined by the spacing between the upper end of the plunger 42 and the valve 43, the valve 43 is opened and the injection of the oil into the cylinder is stopped by by-passing the oil from the pump past the opened valve 43 into the discharge passage 90, which is common to all of the bores 22 and which may be connected back into the housing by the pipe 91, as shown diagrammatically in Fig. 3, for returning the excess oil to the pump.

It is now manifest that by turning the control shaft 15, to change the positions of all of the fulcrum blocks simultaneously, the time at which the plungers contact with the valves and stop the discharge may be regulated to determine the amount of fuel supplied to the cylinders; and that differential adjustment of the amount of fuel supplied to each cylinder may be readily had by removing the thimble 73 and loosening the lock nut 71 and suitably adjusting the screw 70. This may readily be accomplished while the engine is running and the relative conditions are easily determinable. The uniform distribution of the oil under pressure to the pumps equalize the action of the pumps so that the differential adjustment can compensate for difference which may occur in the cylinders.

By supplying the oil under pressure to the intakes of the high pressure pump the effects of expansion during the suction stroke, as of trapped air, is eliminated, and the full charge of oil is positively fed into the space above the piston at each stroke.

While I have shown but one illustrative embodiment of my invention, it is to be understood that many alterations and omissions may be made without departing from the

spirit of the same, as defined by the following claims.

I claim:

1. In a high pressure fuel pump, a housing
 5 having a fuel pump and a valve for controlling the volume of the pump discharge, a cam shaft rotatable in the housing, a fulcrum block slidably mounted in the housing, a cam lever for opening the valve pivoted in the
 10 block and riding on the cam shaft, a central shaft having an eccentric, an adjusting screw threaded through the block and a spring pressing on the block to hold the end of the screw in contact with the eccentric so that
 15 general adjustment of the pump may be accomplished by rocking the central shaft and differential adjustment by changing the setting of the screw.

2. The combination in a device of the class
 20 described of a cam shaft, an eccentric shaft, a fuel injecting pump, a valve controlling a by-pass from the pump, a slidably mounted fulcrum block, a lever pivoted in the block and having its swing end bearing on the cam
 25 shaft for operating the pump, a plunger for opening the valve and operated by the medial portion of the lever, a screw threaded through the block, and a spring pressing on the block for holding the end of the screw in
 30 contact with the eccentric shaft.

3. The combination in a device of the class described of a plurality of pump plungers arranged in line, a cam shaft extending under
 35 said plungers, a plurality of levers each having one end thereof interposed between one of said plungers and said cam shaft, a plurality of relief valves each having one end thereof engaged with an intermediate portion
 40 of one of said levers, a block slidable in the plane of movement of each plunger and corresponding valve and along a line transverse to the length of the corresponding lever, a cam shaft below said blocks, a tappet carried by each of said blocks for adjustment
 45 in the direction of movement thereof, spring means constantly urging each of said tappets into constant engagement with the second mentioned cam shaft, and means pivotally connecting each of said levers to the corresponding
 50 block.

4. The combination in a device of the class described of a casing having a plurality of pump plungers arranged in line therein, a
 55 cam shaft extending under said plunger, a plurality of levers each having one end thereof interposed between one of said plungers and said cam shaft, a plurality of relief valves each having one end thereof engaged with an intermediate portion of one of said
 60 levers, a block slidable in the plane of movement of each plunger and corresponding valve and along a line transverse to the length of the corresponding lever, a cam shaft below said blocks, a tappet carried by
 65 each of said blocks for adjustment in the di-

rection of movement thereof, spring means constantly urging each of said tappets into constant engagement with the second mentioned cam shaft, and means pivotally connecting each of said levers to the corresponding block, said tappets each projecting
 70 through a wall of said casing whereby to permit independent adjustment thereof relative to said blocks without disturbing said casing.

5. In a fuel pump mechanism, in combination, a casing, a pump plunger, a relief valve and a guide post arranged approximately in co-planar relation within said casing, a block
 80 slidable on said post, a cam shaft proximate to said block, a tappet threaded in said block, spring means co-operating with said block to constantly urge said tappet into engagement with said cam shaft, a second cam
 85 shaft proximate to said plunger, and a lever having one end thereof pivoted to said block and the opposite end interposed between said plunger and said second cam shaft, said relief valve engaging said lever between the
 90 ends thereof.

HORACE T. THOMAS.

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