

June 3, 1952

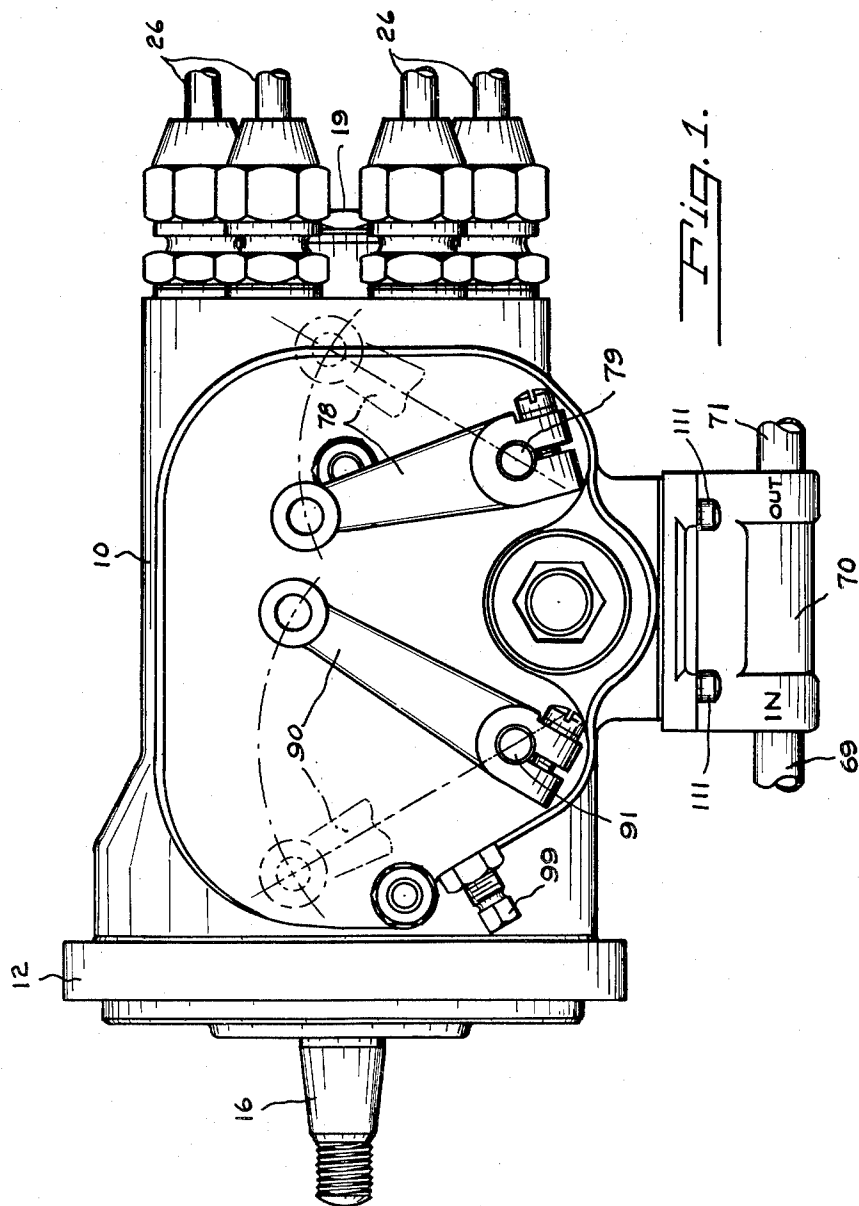
F. S. COE

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FUEL PUMP

Filed May 17, 1949

6 Sheets-Sheet 1



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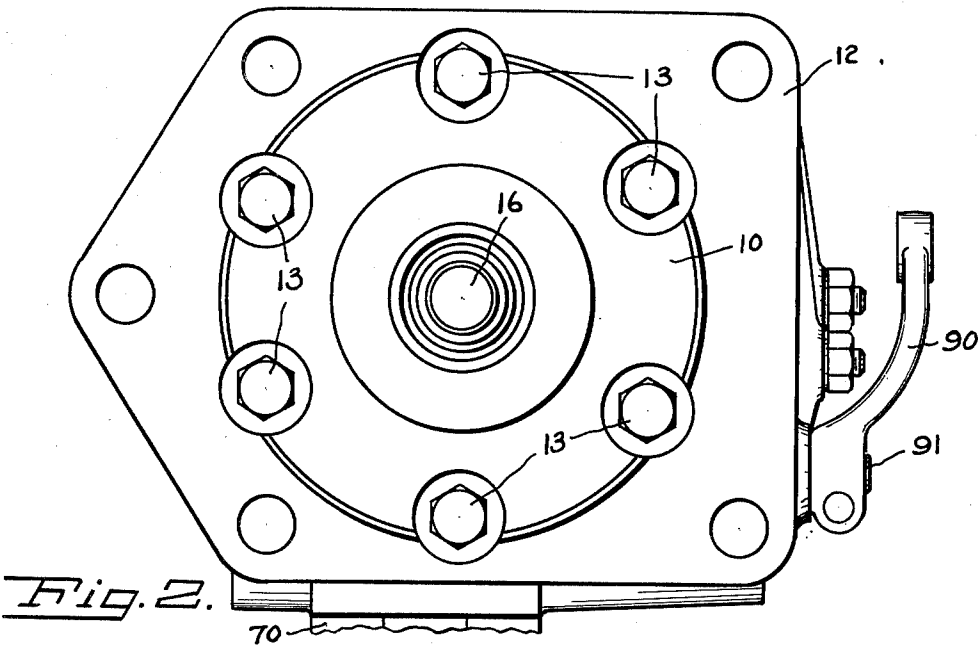
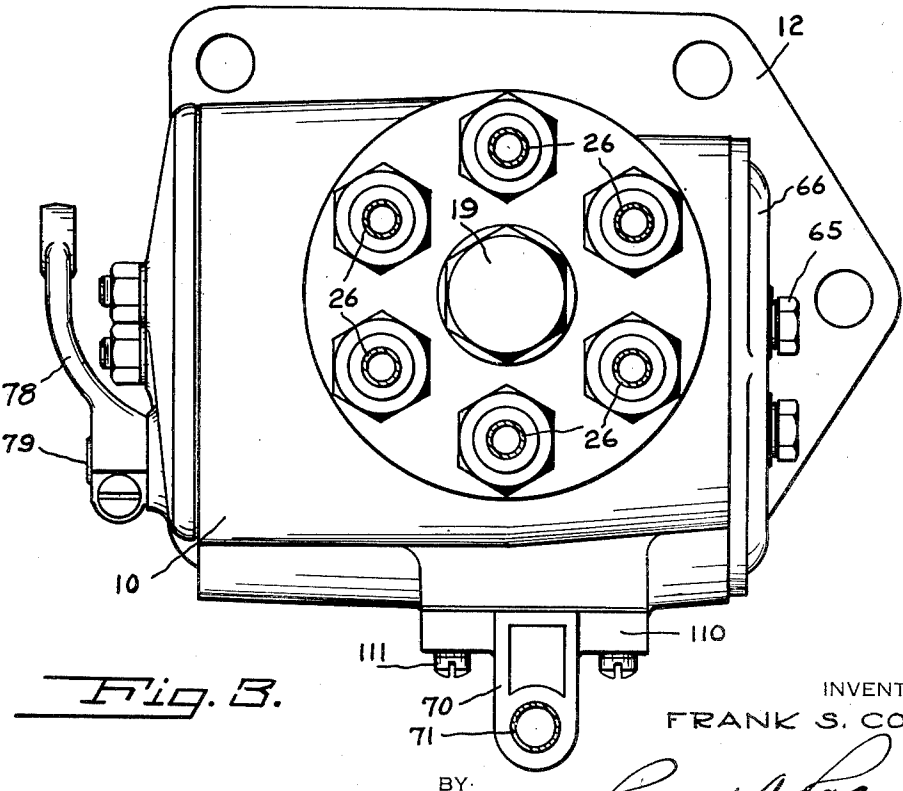
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Fig.11.

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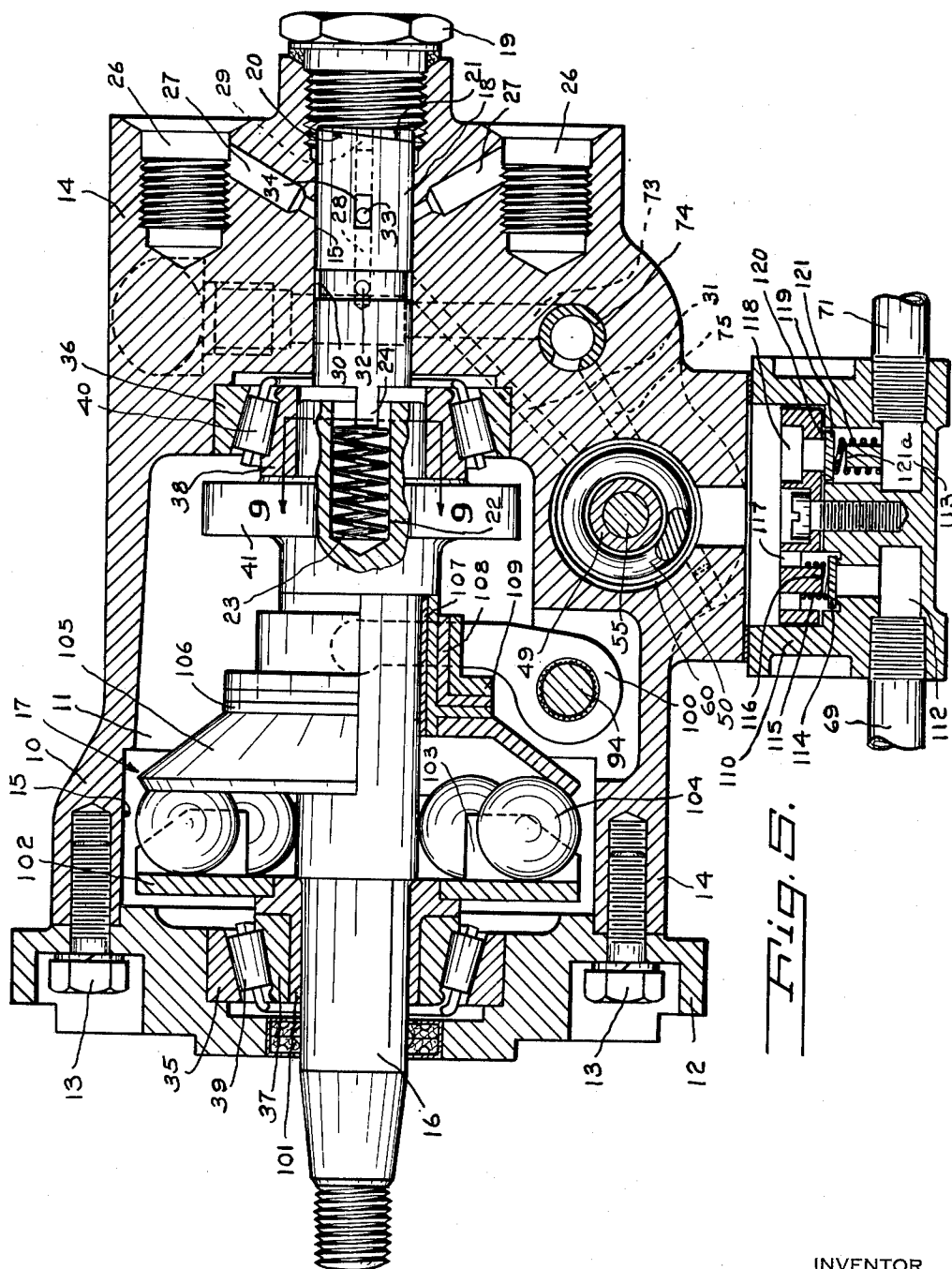


Fig. 5.

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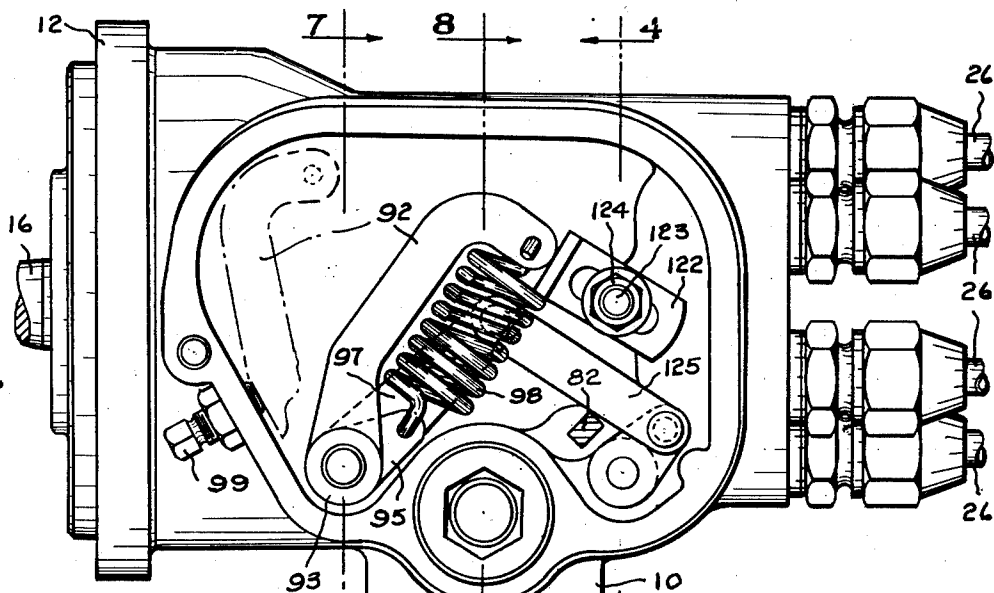


Fig. 6.

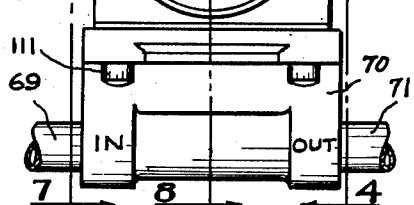
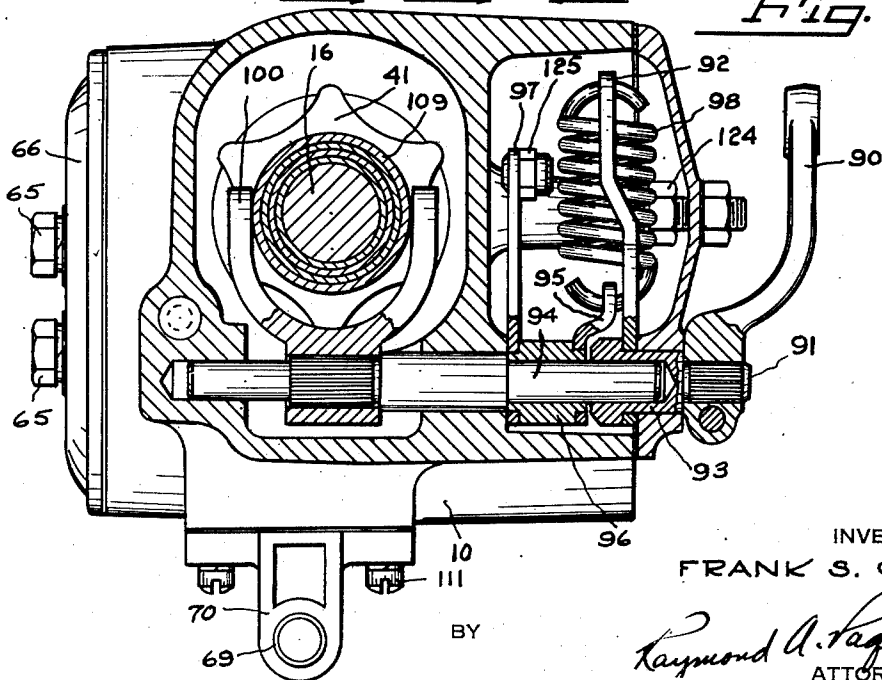


Fig. 7.



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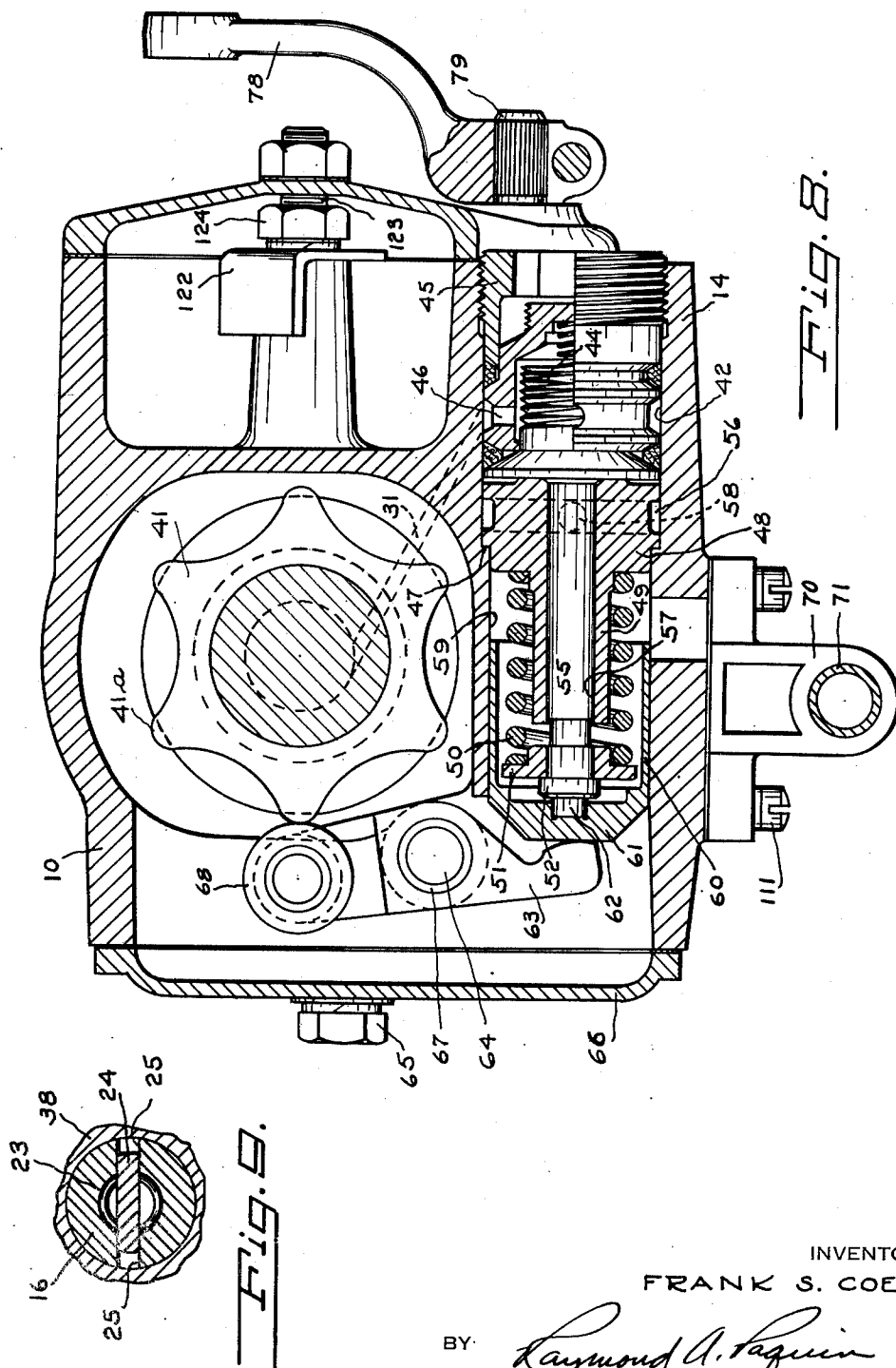
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2,599,522

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Filed May 17, 1949

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UNITED STATES PATENT OFFICE

2,599,522

FUEL PUMP

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9 Claims. (Cl. 103—2)

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This invention relates to fuel supply apparatus for internal combustion engines or the like and has particular reference to a new and improved apparatus which is relatively compact, simple and economical in construction and efficient in operation.

An object of the invention is to provide a new and improved fuel supply unit of the type set forth which includes a fuel supply pump, fuel injection pump and governor and which also includes distributor means for distributing the fuel pumped by said fuel injection pump to the various combustion chambers of an internal combustion engine or the like.

Another object of the invention is to provide a combined fuel supply and fuel injection pump.

Another object of the invention is to provide a device of the type set forth wherein the supply pump, injection pump, governor and distributor are all actuated by the pump camshaft.

Another object of the invention is to provide a device of the type set forth wherein the supply pump, injection pump and governor are all contained within a single housing of simplified, relatively economical construction.

Another object of the invention is to provide new and improved fuel distributing means for a device of the type set forth.

Another object of the invention is to provide a fuel supply apparatus of the type set forth which is relatively simple to assemble and wherein provision has been made to prevent excessive wear and to allow replacement of the parts which may become worn in use.

Another object of the invention is to provide a new and improved governor for a fuel injection pump, which governor is relatively simple and economical in construction, yet efficient in operation.

Another object of the invention is to provide simplified control means for a fuel supply apparatus of the type set forth.

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

Referring to the drawings:

Fig. 1 is a top or plan view of a fuel supply apparatus embodying the invention;

Fig. 2 is an end view of the drive end of the apparatus shown in Fig. 1;

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Fig. 3 is an end view of the outlet end thereof;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 6, looking in the direction of the arrows;

Fig. 5 is a sectional view taken on line 5—5 of

Fig. 4, looking in the direction of the arrows;

Fig. 6 is a view similar to Fig. 1, with the cover and operating lever removed;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6, looking in the direction of the arrows;

Fig. 8 is a sectional view taken on line 8—8 of Fig. 6, looking in the direction of the arrows;

Fig. 9 is a sectional view taken on line 9—9 of Fig. 5, looking in the direction of the arrows.

Fig. 10 is a sectional view of the delivery valve arrangement; and

Fig. 11 is a sectional view taken on line 11—11 of Fig. 10 looking in the direction of the arrows.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, the device shown embodying the invention comprises a housing 10, having a hollow portion 11, and an open end, and is adapted to have the cover 12 secured thereto by bolts or the like 13 to close said open end. Said cover also serves as a mounting flange for mounting the apparatus on an engine.

Adjacent the opposite end of the housing 10 from the open end is the integral body portion 14 through which is provided the bore 15 extending through the body portion 14 from the hollow interior 11.

The cover 12 is provided with an opening which is aligned with the bore 15 and through said opening extends the camshaft 16, which is journaled in said cover and said body 14, and on which is supported the governor mechanism, indicated generally at 17, and the end of said camshaft 16 which is within said portion 11 of said housing 10 is operatively connected the fuel distributor 18 which is mounted for rotation and slight reciprocation within the bore 15.

The end of the bore 15 is closed by the threaded plug 19 which is threaded into the end of said bore 15 and said plug 19 is provided at its inner end with the tapered face 20 which engages a tapered face 21 on the adjacent end of distributor 18 and upon rotation of said distributor 18, said tapered faces 20 and 21 cause slight reciprocation of said distributor 18, thereby distributing any wear that may occur, evenly over the adjoining surfaces of the bore 15 and distributor 18 and thereby preventing undue wear at any particular point on said surfaces.

The camshaft 16 is provided with the bore 22 in the end thereof adjacent said distributor 18,

in which bore is positioned the coil spring 23 which engages the end of the key 24 on the end of distributor 18 which key extends into diametrically opposite slots 25 on the sides of said bore 22 in the camshaft with said slots 25 and key 24 formed very slightly off center as shown in Fig. 9 whereby said key 24 can only be positioned in said slots 25 with said parts in such relative position as to properly time said distributor 18 relative to the injection pump.

The coil spring 23 in bore 22 resiliently urges said tapered surfaces 21 on the distributor 18 and 20 on the plug 19 into engagement while allowing axial movement of said distributor 18 in said bore 15 as previously described.

The body 14 is provided with a series of outlets 26 each adapted to be coupled to a pipe line, not shown, for connection to the various combustion chambers or cylinders of an internal combustion engine or the like and each of said outlets is connected by a duct 27 with said bore 15, to allow the passage of fuel from said bore to each of said outlets 26 successively upon rotation of said distributor 18 as hereinafter described. The distributor 18 is provided with the axial duct 28 which has its end closed by the plug 29. The distributor 18 is provided with the peripheral supply groove 30 which is adapted to receive fuel from the fuel injection pump through duct 31 and said fuel then passes from said groove 30 through opening or port 32 which connects said groove 30 with said axial duct 28 and said fuel passes through said duct 28 to opening or port 33 which is adapted to communicate with each of the ducts 27 successively. The opening or port 33 is provided with the elongated slot or groove 34 to allow communication between opening 33 and ducts 27 regardless of the axial movement of distributor 18 by reason of tapered faces 20 and 21 as previously described.

The bearing race 35 is pressed into a groove on the inner side and surrounding the opening in cover 12 and bearing race 36 is pressed into a groove in the body 14 adjacent said hollow portion 11 in alignment with race 35, and the bearing races 37 and 38 are provided on camshaft 16 and the rollers 39 and 40 are provided between races 35 and 37, and 36 and 38 respectively for mounting the camshaft 16 for rotation.

Camshaft 16 is provided with cam 41 for actuating the fuel injection and fuel supply pumps as shown in Fig. 8 and the number of lobes 41a on said cam 41 depends upon the number of combustion chambers to be supplied, there usually being one lobe 41a for each combustion chamber.

In the body 14 and crosswise to the bore 15 for distributor 18 is provided a bore 42 for the fuel supply and injection pumps. This bore 42 is connected by duct 31 with bore 15 for distributor 18.

Within bore 42 is positioned delivery valve 43 which is retained in position by delivery valve holder 44 which is retained in position by threaded plug 45. The delivery valve holder 44 has a duct 46 through which fuel which passes through delivery valve 43 may pass to duct 31.

Also within bore 42 and seated on flange 47 is the hardened steel barrel member 48 for the fuel injection pump and this barrel member 58 is provided with an integral reduced extension 49 surrounding which is positioned the coil spring 59 which is seated at one end on the barrel member 48 and has its opposite end engaging a spring seat 51 which engages flange 52 adjacent the end of plunger 55 which is mounted for reciprocation in a bore 57 which extends through barrel member 48 and reduced extension 49.

The barrel member 48 is provided with peripheral groove 56 which communicates with bore 57 through port 58 which extends through said barrel member 48.

Within the reduced portion 59 of bore 42 is positioned tappet 60 which also functions as fuel supply pump.

Tappet 60 has the end or cap portion 61 in an opening in which is positioned the end 62 of plunger 55.

Rocker arm 63 is pivotally mounted by pin 64 on body portion 14 and said pin 64 is locked in place on said body portion 14 by screw 65 which also serves to secure cover plate 66 on housing 10. The rocker arm is provided with roller 68 which engages said cam 41 and cam lobes 41a upon rotation of camshaft 16, and the bronze bushing 67 surrounding pin 64.

Fuel is supplied the supply pump through pipe line 69 which is adapted to supply fuel from a fuel supply tank, not shown, to valve 70, and fuel pumped by said supply pump passes through said valve 70 to pipe line 71 which is connected to a filter, not shown, to inlet 72 from which said fuel passes through duct 73, through control valve 74 and duct 75 to peripheral groove 56 from which it passes through port 58 to bore 57 of the fuel injection pump.

Valve 70 comprises a body 110 secured to housing 10 by screws or the like 111 and said body comprises an inlet passage 112 connected to fuel supply line 69 and an outlet passage 113 connected to fuel line 71. In the inlet fuel passage is provided an inwardly opening check valve comprising valve member 114 which is retained on its seat by spring 115 and valve stop 116 is provided for controlling the opening movement of valve member 114 and passages 117 allow fuel passing said valve member to reach the supply pump. The outlet passage 118 communicates with the supply pump and an outwardly opening valve member 119 is provided with seat 120, spring 121 and stop 121a.

Control valve 74 comprises a hollow portion in shaft 76 and port 77 which connects said hollow portion with duct 75. When shaft 76 is rotated the port 77 can be moved out of alignment with duct 75 to shut off the supply of fuel to the combustion chambers and thereby stop the running of the engine or the supply of fuel can be regulated or controlled by controlling the quantity of fuel passing through valve 74 and port 77 to duct 75 by regulating the effective opening or size of port 77 through which fuel may pass to duct 75 by pivoting or rotating said shaft 76 to thereby pivot or rotate port 7.

Shaft 76 is adapted to be pivoted or rotated by shut-off lever 78 which is shown in running position in full lines in Fig. 1, which is splined on shaft 79 which extends into the housing through cover plate 66a which is retained in position on housing 10 by bolts 80 and nuts 81. Shaft 49 has the dog 82 at its inner end and is provided with coil spring 83 which has one end 84 engaging a pin 85 which extends through cover plate 66a and its opposite end 86 engages dog 82 to thereby normally retain lever 78 in running position. When lever 78 is moved to shut-off position, dog 82 engages set screw 87 which is threaded into arm 88 which is brazed or otherwise secured to shaft 76 and therefore dog 82 picks up arm 88 and pivots the same thereby moving port 77 out of alignment with duct 75 and thereby shutting off the supply of fuel.

Any fuel not passing through a pressure regu-

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lating valve 74 is bypassed through check valve which also controls the fuel pressure to the fuel injection pump and this bypassed fuel goes through outlet 89 and is returned to the fuel supply tank by a pipe line, not shown.

Quantity control lever 90, which is shown in idling position in full lines in Fig. 1, and in dotted lines in maximum delivery position, is splined on shaft 91 which extends through cover plate 66a and has spring control arm 92 secured thereto as by brazing. Shaft 91 has the enlarged inner end 93 which is hollowed out to receive the end of shaft 94 to which is secured the bushing 96 to which is secured the spring support 95 and operating lever 97 by brazing or other suitable means.

Coil spring 98 has its opposite ends secured to spring support 95 on shaft 94 which is journaled in the body 14, and arm 92 on shaft 91 whereby movement of lever 90 sets the pressure of spring 98 for controlling the quantity of fuel to be delivered.

Set screw 99 is provided for adjusting the maximum delivery of the pump and this screw is adapted to be engaged by arm 92 when maximum delivery is reached, as shown in Fig. 6 in dotted lines.

On shaft 94 is splined the forked governor control member 100 as shown in Figs. 5 and 7.

The governor which is designated generally as 17, comprises a collar 101 which is pressed on camshaft 16 and which carries inner bearing race 37, and also carries the flat disc 102 which is provided with the spaced separators 103 for the steel balls 104 and therefore rotation of shaft 16 and disc 102 causes rotation of balls 104. On the side of the balls opposite disc 102 is provided tapered disc 105 which is brazed to collar 106 which is pressed on bronze bushing 107.

On collar 106 is provided the free bronze bushing 108 which is pressed into the thrust collar 109.

The adjustable stop member 122 is provided for adjusting the idling speed and by means of bolt 123 and nut 124 the position of stop member 122 may be adjusted to thereby adjust the limit of movement of spring setting arm 92 and thereby adjust the idling speed.

Operating lever 97 is pivotally connected with link 125 which in turn is pivotally connected with arm 88 on shaft 76 whereby the operator can adjust the fuel quantity by adjusting control lever 90 which adjusts the tension of spring 98 by adjusting the position of spring setting or loading lever 92 and the spring tension acting through spring support 95, shaft 94, operating lever 97, link 125, arm 88 and shaft 76 adjusts control valve 74.

Should more fuel be supplied than is desired, the speed of camshaft 16 is increased thereby causing the governor to override spring 98 through the action of tapered disc 105 which forces thrust collar 109 against forked governor control member 100 which is splined on shaft 94 thereby adjusting operating lever 97 and valve 74 to control the quantity of fuel delivered.

The operation of the device is as follows:

Fuel flows from a supply tank through pipe line 69, valve 70 and passage 117 to the fuel supply pump which pumps said fuel through outlet passage 118, and valve 70 from which it passes through pipe line 71 to inlet 72 from which it passes through valve 74 and duct 75 to the fuel injection pump. The fuel is pumped under relatively high pressure by said fuel injection pump and then flows through discharge or delivery valve 43 and duct 31 to the supply groove 30 of

rotary distributor 18. The fuel then enters axial duct 28 through port 32 and is distributed through port 33 to the ducts 27 and outlets 26 to the respective combustion chambers.

The fuel supply is controlled by shut-off lever 78 and quantity control lever 90 and the quantity is automatically maintained by the governor 17.

The pressure of the fuel supplied the fuel injection pump can be controlled by the check valve in the bypass line and fuel not supplied the fuel injection pump is bypassed through said check valve, outlet 89 and a pipe line not shown, and returned to the fuel supply tank.

It is pointed out that, if desired, a separate fuel supply pump may be employed instead of the combined fuel supply and fuel injection pump shown and described. In such case supply line 69 and delivery line 71 could be connected to such separate supply pump.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

Having described my invention, I claim:

1. In a device of the character described, a housing, a camshaft extending into said housing, a fuel distributor in said housing and operatively connected to said camshaft, the axes of said camshaft and said distributor member being substantially in alignment, a plurality of outlets adapted to communicate successively with said distributor, a fuel injection pump in said housing, the axis of said fuel injection pump being substantially normal to the axes of said camshaft and said distributor, a fuel passageway from said fuel injection pump to said distributor and means operatively connecting said camshaft and said fuel injection pump and cam means engaging said distributor for effecting continuous reciprocation of said distributor during the rotation thereof, said distributor having an axial fuel passageway communicating with said passageway from said fuel injection pump and a port communicating with said axial passageway and adapted to communicate successively with each of said outlets upon rotation of said distributor.

2. In a device of the character described, a housing, a camshaft extending into said housing, a fuel distributor in said housing and operatively connected to said camshaft, the axes of said camshaft and said distributor member being substantially in alignment, a plurality of outlets adapted to communicate successively with said distributor, a fuel injection pump in said housing, the axis of said fuel injection pump being substantially normal to the axes of said camshaft and said distributor, a fuel passageway from said fuel injection pump to said distributor and means operatively connecting said camshaft and said fuel injection pump and cam means engaging an end of said distributor for effecting continuous reciprocation of said distributor during the rotation thereof, said distributor having an axial fuel passageway communicating with said passageway from said fuel injection pump and a port communicating with said axial passageway and communicating successively with each of said outlets upon rotation of said distributor.

3. In a device of the character described, a housing, a camshaft having a portion in said housing, a bore in said housing in alignment with said camshaft, a distributor member in said bore, said distributor member being operatively connected to said camshaft, cam means for continuously reciprocating said distributor member upon

rotation of said camshaft, a plurality of outlets communicating with said distributor member for supplying fuel to the combustion chambers of an internal combustion engine or the like, a fuel injection pump in said housing, the axis of said fuel injection pump being substantially normal to the axis of said camshaft and a fuel passageway between said injection pump and distributor, a fuel supply pump and a fuel passageway from said fuel supply pump to said fuel injection pump and a throttle valve in said passageway.

4. In a device of the character described, a housing, a camshaft having a portion in said housing, a bore in said housing in alignment with said camshaft, a distributor member in said bore, said distributor member being operatively connected to said camshaft, cam means for continuously reciprocating said distributor during the rotation thereof, a plurality of outlets communicating with said distributor member for supplying fuel to the combustion chambers of an internal combustion engine or the like, and a single plunger fuel injection pump in said housing, the axis of said fuel injection pump being substantially normal to the axis of said camshaft, a cam on said camshaft, a rocker arm actuated by said cam and operating said injection pump, and a fuel passageway between said injection pump and distributor, a throttle valve and a governor in said housing connected to said throttle valve for thereby controlling the supply of fuel to said injection pump.

5. In a device of the character described, a housing, a camshaft having a portion in said housing, a bore in said housing in alignment with said camshaft, a distributor member in said bore, said distributor member being operatively connected to said camshaft, a plurality of outlets communicating with said distributor member for supplying fuel to the combustion chambers of an internal combustion engine or the like, and a fuel injection pump in said housing, the axis of said fuel injection pump being substantially normal to the axis of said camshaft and a fuel passageway between said injection pump and distributor, a throttle valve in said housing and a governor in said housing for controlling the supply of fuel to said injection pump, said governor including a plurality of ball members surrounding said camshaft and rotatable therewith and a slidable member on said camshaft and adapted to be actuated by said ball members, said governor being connected to said throttle valve for controlling the same and cam means for continuously reciprocating said distributor during the rotation thereof.

6. In a fuel pumping and distributing apparatus, a housing having a bore and a plurality of discharge passages communicating therewith, a drive shaft, a distributor member in said bore, said distributor member being in alignment with and operatively connected to said shaft and forming in effect a continuation of said shaft and adapted to be rotated thereby, a fuel supply pump and a fuel injection pump in said housing, said fuel injection pump comprising a bore normal to the axis of said shaft and distributor and reciprocable piston means in said bore, the axis of said piston means being normal to the axis of said shaft and distributor, cam means for effecting reciprocation of said piston means upon rotation of said shaft, a fuel path connecting said fuel supply pump and said fuel injection pump, an adjustable control valve in said housing in the fuel path between said fuel supply pump and

said fuel injection pump and controlling the quantity of fuel passing from said supply pump to said injection pump, a fuel path between said fuel injection pump and said distributor, said distributor being effectively one piece and having an axial duct and radial inlet and discharge ports communicating therewith, said inlet and discharge ports being in longitudinally spaced relation and said inlet port communicating with said fuel path from said fuel injection pump and said discharge port communicating with said discharge passages in said housing successively upon rotation of said distributor.

7. In a fuel pumping and distributing apparatus, a housing having a bore and a plurality of discharge passages communicating therewith, a drive shaft, a distributor member in said bore, said distributor member being in alignment with and operatively connected to said shaft and forming in effect a continuation of said shaft and adapted to be rotated thereby, a fuel supply pump and a fuel injection pump in said housing, said fuel injection pump comprising a bore normal to the axis of said shaft and distributor and reciprocable piston means in said bore, the axis of said piston means being normal to the axis of said shaft and distributor, cam means for effecting reciprocation of said piston means upon rotation of said shaft, a fuel path connecting said fuel supply pump and said fuel injection pump, an adjustable control valve in said housing in the fuel path between said fuel supply pump and said fuel injection pump and controlling the quantity of fuel passing from said supply pump to said injection pump, a fuel path between said fuel injection pump and said distributor, said distributor being effectively one piece and having an axial duct and radial inlet and discharge ports communicating therewith, said inlet and discharge ports being in longitudinally spaced relation and said inlet port communicating with said fuel path from said fuel injection pump and said discharge port communicating with said discharge passages in said housing successively upon rotation of said distributor and a governor connected to said control valve for controlling the adjustment thereof.

8. In a fuel pumping and distributing apparatus, a housing having a bore and a plurality of discharge passages communicating therewith, a drive shaft, a distributor member in said bore, said distributor member being in alignment with and operatively connected to said shaft and forming in effect a continuation of said shaft and adapted to be rotated thereby, a fuel supply pump and a fuel injection pump in said housing, said fuel injection pump comprising a bore normal to the axis of said shaft and distributor and reciprocable piston means in said bore, the axis of said piston means being normal to the axis of said shaft and distributor, cam means for effecting reciprocation of said piston means upon rotation of said shaft, a fuel path connecting said fuel supply pump and said fuel injection pump, a rotary control valve in said housing in the fuel path between said fuel supply pump and said fuel injection pump and controlling the quantity of fuel passing from said supply pump to said injection pump, a fuel path between said fuel injection pump and said distributor, said distributor being effectively one piece and having an axial duct and radial inlet and discharge ports communicating therewith, said inlet and discharge ports being in longitudinally spaced relation and said inlet duct communicating with said fuel path

from said fuel injection pump and said discharge port communicating with said discharge passages in said housing successively upon rotation of said distributor.

9. In a fuel pumping and distributing apparatus, a housing having a bore and a plurality of discharge passages communicating therewith, a drive shaft, a distributor member in said bore, said distributor member being in alignment with and operatively connected to said shaft and forming in effect a continuation of said shaft and adapted to be rotated thereby, a fuel supply pump and a fuel injection pump in said housing, said fuel injection pump comprising a bore normal to the axis of said shaft and distributor and reciprocable piston means in said bore, the axis of said piston means being normal to the axis of said shaft and distributor, cam means for effecting reciprocation of said piston means upon rotation of said shaft, a fuel path connecting said fuel supply pump and said fuel injection pump, a rotary control valve in said housing in the fuel path between said fuel supply pump and said fuel injection pump and controlling the quantity of fuel passing from said supply pump to said injection pump, a fuel path between said fuel injection pump and said distributor, said distributor being effectively one piece and having an axial duct and radial inlet and discharge ports communicating therewith, said inlet and discharge ports being in longitudinally spaced relation and

said inlet duct communicating with said fuel path from said fuel injection pump and said discharge duct communicating with said discharge passages in said housing successively upon rotation of said distributor and a governor connected to said rotary control valve for controlling the rotation thereof.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

	Number	Name	Date
15	1,760,237	Iverson	May 27, 1930
	1,791,600	Onions	Feb. 10, 1931
	1,880,799	Chandler	Oct. 4, 1932
	2,052,737	Zubaty	Sept. 1, 1936
20	2,161,507	Egersdorfer	June 6, 1939
	2,243,861	Hautzenroeder	June 3, 1941
	2,282,429	Russell	May 12, 1942
	2,446,497	Thomas	Aug. 3, 1948
	2,465,784	Berlyn	Mar. 29, 1949
25	2,519,733	Beard	Aug. 22, 1950
	2,544,561	Meyer	Mar. 6, 1951

FOREIGN PATENTS

	Number	Country	Date
30	707,553	France	1931