

June 20, 1939.

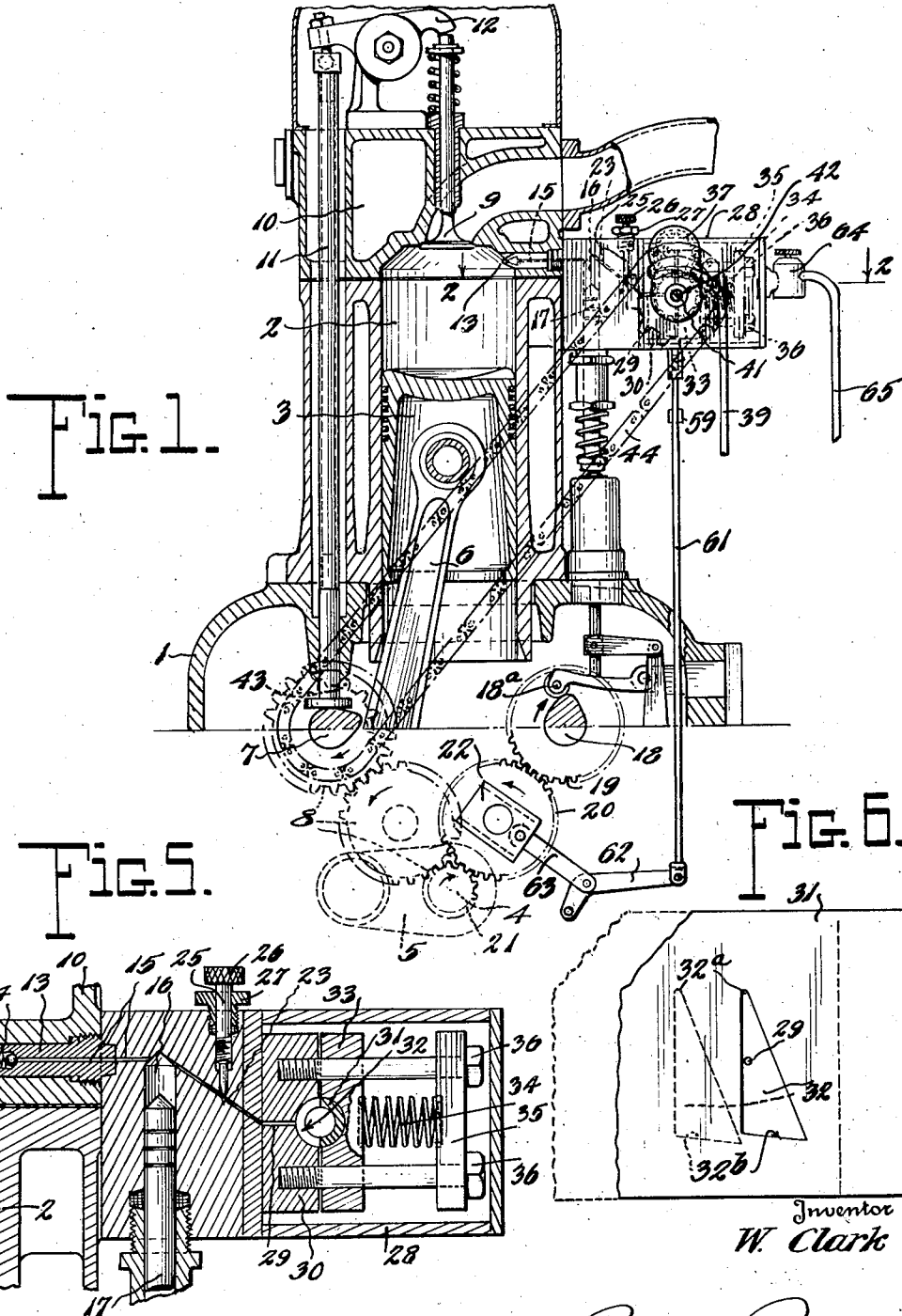
W. CLARK

2,163,458

FUEL FEEDING AND DISTRIBUTING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 28, 1936

2 Sheets-Sheet 1



By

Robb & Robb

Attorneys

June 20, 1939.

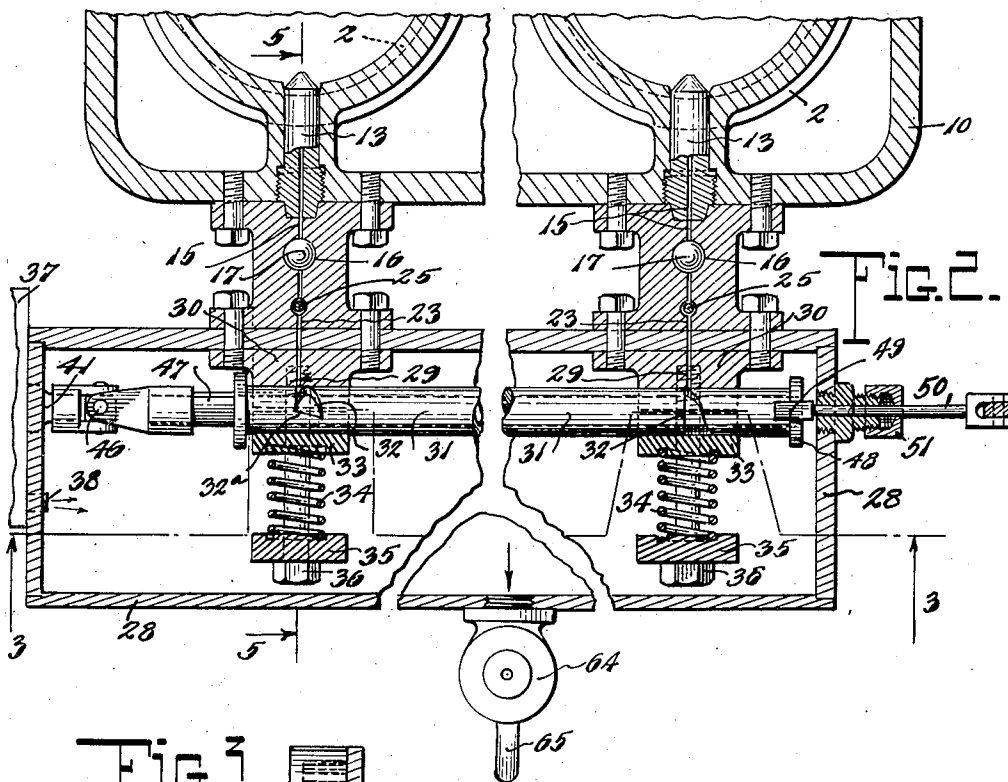
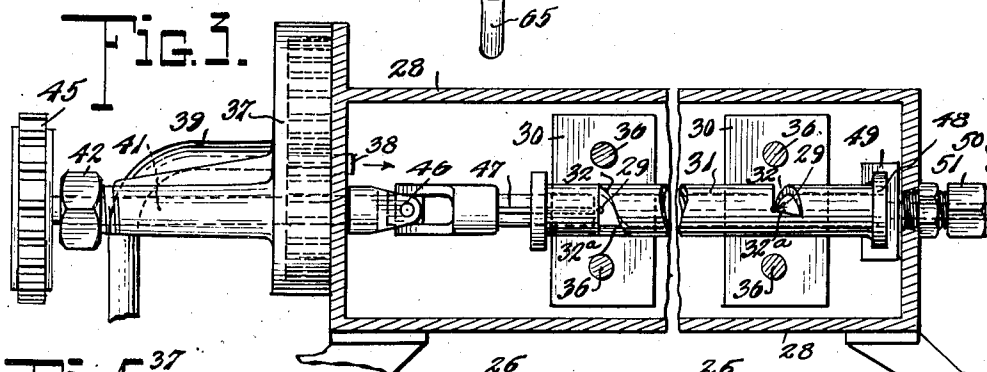
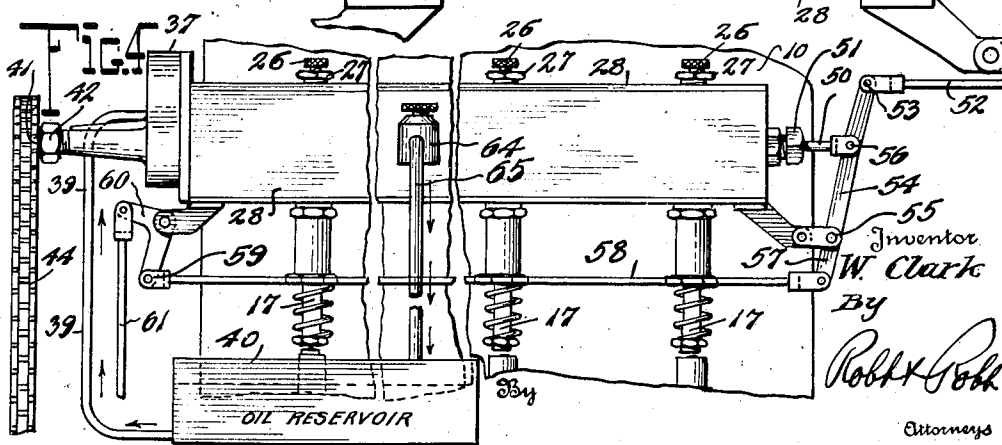
W. CLARK

2,163,458

FUEL FEEDING AND DISTRIBUTING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 28, 1936

2 Sheets-Sheet 2



Inventor
W. Clark

By
Robert R. Clark

Attorneys

UNITED STATES PATENT OFFICE

2,163,458

FUEL FEEDING AND DISTRIBUTING MECHANISM FOR INTERNAL COMBUSTION ENGINES

Wallace Clark, Indianapolis, Ind.

Application December 28, 1936, Serial No. 117,939

13 Claims. (Cl. 123—139)

The present invention relates to improvements in fuel feeding and distributing mechanism for internal combustion engines and in particular to that type utilizing fluid or liquid fuel.

5 In prime movers of this class in general use today, one of the difficult problems which must be dealt with arises from the practice of metering and distributing the fuel to the combustion chamber or chambers under high pressures which precludes accuracy in the metering of the fuel under variable speed conditions or demands.

One of the primary purposes of the present invention is the provision of a construction of fuel feeding means for effecting the distribution and metering of the fuel independently of the high pressure instrumentalities, enabling the distribution and metering to be carried out under low pressure conditions, and thus, without loss of effectiveness due to fast reciprocation motions heretofore employed, also eliminating the necessity for providing special leak-proof joints or glands, check valves, pipes, tubing and the like which complicate and materially increase the cost of construction and operation in mechanisms heretofore employed for this purpose.

Perhaps the most important phase of these improvements is the self-governing action which results from the employment of a shiftable type of rotary control means arranged to admit fuel at an adjustable, predetermined rate to the injector pump whereby feed of the fuel to the injector is varied according to speed and load conditions of the engine.

Thus, in carrying out my invention, I prefer to employ a fuel control and distributing member in the form of a rotary valve operating under low pressure conditions and having both rotary and longitudinal movements to cause a specially shaped feed aperture to feed the fuel in cycles to injector means in proper variable quantities to insure great flexibility or range in both speed and power of the motor, according to the demands made upon the same.

More specifically, it is an objective of my invention to provide a reservoir for the fuel in which the valve member referred to above is mounted for supplying the fuel to said member under low pressure and to multiple cylinders, in the case of multiple cylinder engines, under the control of the injector pumps, in combination with individually adjustable valve means for regulating the rate of flow and quantity of fuel capable of being injected into the cylinders.

A further object of my invention resides in the provision of a low pressure fuel distributing and

metering unit so arranged as to permit of circulation of the fuel supply to and from the source of fuel supply whereby such re-circulation tends to act as a means for cooling the motor while at the same time heating the fuel supply. This heat exchange is an important feature of these improvements.

By virtue of the construction of the fuel distributing and metering means, I am able to utilize in combination therewith a fuel pump for maintaining a sufficient supply of fuel in the reservoir for the rotary valve member of my device, while at the same time maintaining the pressure constant on the fuel in the reservoir and varying this quantity of fuel supplied to the reservoir in proportion to the speed of the engine.

A still further object of my invention is to provide a control means for advancing and retarding the time of injection of fuel into the engine simultaneously with the increase or decrease in the supply of fuel fed to the injector means by the distributing and metering instrumentalities.

Other and further objects and advantages of the invention will be hereinafter set forth and the novel features thereof defined by the appended claims.

In the drawings:

Fig. 1 is a vertical sectional view through a solid fuel injection type of engine embodying my invention, certain of the driving connections between the various rotary parts being somewhat diagrammatically illustrated;

Fig. 2 is a fragmentary horizontal sectional view taken approximately on line 2—2 of Fig. 1;

Fig. 3 is a vertical longitudinal sectional view taken approximately on line 3—3 of Fig. 2, the parts being broken away and the circulating pump being shown in elevation;

Fig. 4 is a fragmentary side elevation of an internal combustion engine having my fuel distributing and injection mechanism applied thereto;

Fig. 5 is a fragmentary vertical cross sectional view taken on the line 5—5 of Fig. 2; and

Fig. 6 is a plan view showing the surface of the rotary valve member developed in a horizontal plane, the dotted lines showing the position of the triangular shaped port with respect to the feeding aperture when the valve employed is shifted to fully cut-off position.

Like reference characters designate corresponding parts in the several figures of the drawings.

Referring more particularly to Fig. 1, 1 designates the base or crankcase of an internal combustion engine having cylinders 2 in which are disposed the pistons 3. A crankshaft 4 is diagrammatically illustrated, having the usual cranks 5 to which the connecting rods 6 are connected in the usual manner.

The engine illustrated is of the 4-cycle type and is provided with the usual valve actuating cam shaft 7 driven by the train of gears 8. The exhaust and air-intake valves 9 are operatively disposed in the cylinder head 10 of the motor and actuated by the usual push rods 11 and rod rocker members 12.

A solid fuel injection nozzle 13 is suitably positioned in the head of this motor, as seen in Fig. 1 and Fig. 5, having the usual spring loaded release valve 14 for preventing flow of fuel from the nozzle after time of the injection. A passage 15 leads from the injection nozzle to the high pressure injector cylinder 16 in which is vertically disposed the high pressure injection plunger 17 operated in proper timed cycle by the cam shaft 18 through the rocker arm 18a. The cam shaft 18 is suitably driven at half the speed of the motor by the two large gears 19, 20 and a smaller gear 21 on the crankshaft of the motor.

The intermediate large gear 20 is preferably disposed on a slidable bearing block 22 mounted in suitable guides on the crank case of the motor. As seen in Fig. 1 of the drawings, actuation of the lock in one direction or the other will vary the time of injection of fuel into the motor. The means for actuating this block will be later described.

A passage 23 inclines downwardly from the top portion of the high pressure injection cylinder to the rotary valve casing 28 and intermediate the length of this passage is disposed a passage-controlling needle valve 25 operable by the knurled thumb nut 26. Suitable packing instrumentalities for this needle valve may be provided if desired, as illustrated at 27.

The passages 23, as seen in Figs. 2 and 5 preferably extend downwardly into the rotary valve casing 28 and register with passages or bores 29 formed in the bearing blocks 30. A rotary sleeve valve 31 is journaled in the bearing blocks 30, as seen in Figs. 2 and 5, and has a plurality of triangular shaped ports 32, later to be described.

The sleeve valve 31 is held in its proper position in the bearing blocks 31 by complementary bearing blocks 33 which are maintained in their cooperative position by the springs 34 having one end thereof engaging the block while the other end of each spring is suitably seated in a recess in the spring-supporting clips 35, retained in position by the studs 36, screwed into the bearing blocks 30. The rotary valve casing 28 is preferably provided with a fuel supply pump 37 of the gear type, having a fuel inlet or supply passage 39 communicating with a source of supply, such as the oil reservoir 40, as seen in Fig. 4.

The fuel supply pump 37 has a discharge port 38 for discharging the fuel into the rotary valve casing 28. Pump 37 is driven by the shaft 41 having a suitable packing gland 42, and operated in timed relation with respect to the crankshaft 4 by the sprocket gear 43 on the cam shaft 7 through the driving chain 44 and the drive gear 45 on the pump shaft 41.

The pump shaft 41, as seen in Figs. 2 and 3

of the drawings, extends into the rotary valve casing 28 and has secured thereto a universal drive connection 46, provided with a splined connection 47, slidably engaging the end of the rotary sleeve valve member 48, thus permitting the valve member to be shifted longitudinally, while at the same time providing a positive drive connection between the pump shaft and the valve.

The opposite end of the valve member has a flanged extremity or collar 48 for receiving the C-shaped actuating bar 49. This bar is fixedly secured to the end of the actuating or valve-shifting rod 50, slidably journaled in the packed bearing member 51. This slidable actuating rod 50 for the rotary valve, as disclosed in Fig. 4, is actuated by any suitable means such as an actuating throttle lever rod 52 extending to a convenient place for actuation by the operator of the engine. This rod 52 is pivoted at 53 to the actuating lever 54 pivoted at 55 to the rotary valve casing and at 56 to the slidable actuating rod 50.

The actuating lever 54 has an extension 57 projecting downwardly beyond the pivot 55 to which an injection period control rod 58 is pivoted. The other end of this injection rod is pivoted at 59 to one arm of a bellcrank 60 carried on a bracket projecting from the valve casing 28. The other arm of the bell crank has pivotally connected thereto a vertical actuating rod 61, extending downwardly and connecting the long arm of a second bell crank 62, as seen in Fig. 1 of the drawings. The other arm of this bell crank is connected to the slidable block 22 for the gear 20 by a link 63.

In order to maintain a comparatively low pressure of fuel within the valve casing 28, as introduced by the fuel pump 37, I preferably provide an adjustable pressure-operated relief valve 64 disposed in the side of the casing 28, having a pipe 65 leading therefrom downwardly into the oil reservoir 40.

The triangular shaped control ports 32 in the sleeve valve 31 are of a peculiar shape, as seen in the drawings. The apex 32a of the triangular port extends in the direction of travel of the valve while the base of the triangle is inclined, as indicated at 32b. With the valve shown in full line position in Fig. 6, the fuel admission passage 29 is shown in register with the maximum length of the opening in the valve member.

In other words, this position illustrates the maximum fuel admission position. As the valve is shifted to the left towards the dotted line position in this figure, the amount of fuel admitted to the injector is reduced while at the same time, due to the inclined edge 32b of the triangular port, the point at which the fuel is cut off is somewhat retarded, while the point at which the fuel is admitted to the injection plunger chamber is also materially retarded.

The flow of fuel through passage 23 will be facilitated by a partial vacuum in the injection cylinder 16 caused by the previous withdrawal of the piston 17.

In the operation of a 4-cycle type of engine, as shown in the drawings, the time for injection of the fuel into the cylinder is about thirty degrees of crankshaft rotation, and allowing for the time necessary for withdrawing the injector plunger, the time for the metering and introduction of the fuel into the injector cylinder could

therefore be over 360° of crankshaft rotation, which is a much greater available time than that allowed by the usual type of injector pump arrangement which requires the metering to also be completed during the thirty degrees of crankshaft rotation.

In handling minute quantities of oil at high speed and at high pressures through small openings, there is usually great difficulty in obtaining any degree of accuracy in the quantity of oil delivered, due to the compressibility of the fuel and the resulting pulsation and delay; also, the mechanically-operated valves usually employed do not function properly at high speeds for accurately metering and delivering the oil to the cylinders of the engine.

By arranging my rotary valve member in close proximity to the injector and utilizing a comparatively long fuel feeding opening or port in the valve members and rotating this valve at a comparatively slow speed or, in other words, half the crankshaft speed, I am able to maintain materially higher engine speeds and at the same time materially increase the metering efficiency of the fuel feeding and distributing means. The movement of the rotary valve member longitudinally gives instant throttling action to reduce or increase the speed of the motor.

As the valve member 31 in Figs. 3 and 6 is shifted to the left by the rod 52 as hereinbefore set forth to decrease the speed of the motor, the inclined wall of the triangular shaped port will uncover the port 29 leading to the injector 17 later, and since the fuel is forced through the opening 29 by the relatively low pressure maintained within the rotary valve casing or reservoir 28, fuel will flow through this passage over a reduced degree of crankshaft rotation and consequently less fuel will be introduced into the injector cylinder 15, with a result that the engine is slowed down. With the slowing down of the engine, an increase in the actual time of registration of the port 32 with the port 29 will occur, which necessarily permits a greater amount of fuel to pass through the port 29 and the engine speed decreases.

However, there will be a certain point at which the engine speed levels off, so to speak, and the engine will operate uniformly at this speed for a particular seating of the valve. It is obvious that should the load on the engine increase, the speed of the engine will be further reduced, but due to the reduction in this speed, the ports 29 and 32 will register for a longer period of actual time and therefore more fuel will be admitted to the injector and consequently the power of the engine will be increased automatically as the speed of the engine is reduced due to the load imposed thereon.

Assuming that the engine is operating under a predetermined load and this load is removed, the engine will then have an initial tendency to speed up or race. However, with my arrangement the speeding up of the engine will cause the ports 29 and 32 to register for a shorter period of actual time with the result that less fuel is fed to the engine thereby automatically governing the speed of the engine within certain ranges.

As the speed of the engine increases or decreases, the fuel pump 37 will correspondingly increase or decrease the amount of fuel fed from the reservoir 40 to the rotary valve casing or reservoir 28. This amount of fuel always is maintained slightly in excess of the amount actually required for the engine. The excess

amount of fuel so furnished maintains a pressure on the fuel within the reservoir 28, certain of this excess being by-passed through the regulatable relief valve 64 and returned to the reservoir 40 via conduit 65.

While I have disclosed the relief valve 64 as being operated by a thumb nut adjusting means, it is contemplated that this valve may be adjusted in conjunction with the valve 31, such as by an actuating means which leads to the throttle lever, not shown, which actuates the rod 52 for shifting the rotary valve 31 to control the speed of the engine. Under these conditions, it is possible to increase the pressure in the reservoir 28 simultaneously as the valve 31 is shifted to increase the length of the operative opening for delivering fuel to the injectors 17. Such an arrangement will maintain the rate of flow through the passages 23 and 29 substantially constant at all engine speeds.

As the valve 31 is shifted to the left to reduce the engine speed, the lever 54, 57 moves the rod 58 to the right and, through the bell crank on the left hand end of the reservoir 28, the rod 61 is lowered rocking the bell crank 62 and thus moving the gear 20 downwardly towards the right and shifting the injector cam to retard the time of fuel injection.

When the valve 31 is shifted to the right to supply more fuel to the engine, gear 22 is shifted upwardly to the left to advance the time of injection and thereby affording automatic control of the time of injection of the fuel into the cylinder in proportion to the quantity and timing of introduction of fuel into the injector cylinder. As the engine is retarded by movement of the valve 31 to the left, the time of introduction of fuel through the port 32 into the injector cylinder is materially retarded and being thus introduced into the injection cylinder at a later period in the crankshaft rotation, the tendency for nozzle leakage is correspondingly reduced.

With the rotary valve casing or reservoir 28 disposed adjacent the cylinders 2 of the engine as before premised, the reservoir will be heated by the engine cylinders, heating the fuel therein. The excess amount of this fuel oil, as supplied to the reservoir 28 from the main tank or reservoir 40 by the fuel pump 37, will be returned to the main tank or reservoir 40. This circulation between the reservoirs 28 and 40 is substantially continuous, while the engine is running and therefore the fuel oil in the tank 40 will be gradually circulated through, and heated within, the rotary valve reservoir 28 causing heating of the oil within the tank 40. This circulation of the oil serves two functions: one, that of dissipating the heat of the engine and, second, that of heating the entire fuel supply to maintain the desired fluidity thereof.

It will be understood that my invention is equally applicable to engines of the two-cycle type and when so used with these engines, certain minor modifications are necessary, such as provision for revolving the rotary valve 31 at crankshaft speed.

The fuel used in my engine preferably possesses lubricating qualities providing sufficient lubrication for the rotary valve, although it is contemplated that supplemental lubrication may be employed for the moving parts, where found necessary.

It will be understood that my invention may be applied to other forms of internal combustion engines than that herein disclosed and for this

reason I do not wish to be restricted to the construction and arrangement illustrated for the purposes of exemplification of the principles of my improvements.

5 Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an internal combustion engine of the class described including a plurality of working
10 cylinders, individual high pressure solid fuel injection means for each cylinder, a single low pressure rotary distributing, metering and supply means for supplying metered quantities of fuel at a low pressure to said high pressure injection
15 means, and individual fuel regulating means for each cylinder intermediate the low pressure distributing, metering and supply means and the high pressure injection means for individually regulating the quantity of fuel delivered by said
20 distributing, metering and supply means to said individual high pressure injection means.

2. A solid fuel injection and distributing mechanism for engines of the class described, comprising a plurality of high pressure injectors, one for
25 each cylinder of the engine, a fuel reservoir, means for supplying fuel under comparatively low pressure to said reservoir and maintaining a substantially constant pressure on the fuel within said reservoir, rotary valve means within said
30 reservoir operable by the engine in a direct ratio with relation to the speed of the engine for discharging variably metered quantities of fuel from said reservoir according to the speed of the engine, means for introducing said discharged
35 quantities of fuel into said high pressure injector means, means for varying the quantity so discharged and simultaneously varying the time of injection operation of the high pressure injection means.

3. A solid fuel injection and distributing mechanism for engines of the class described, comprising a plurality of high pressure injectors, one for each cylinder of the engine, a fuel reservoir,
40 means for supplying fuel under comparatively low pressure to said reservoir and maintaining a substantially constant pressure on the fuel in said reservoir, rotary valve means within said reservoir operable by the engine in a direct ratio with
45 relation to the speed of the engine for discharging variably metered quantities of fuel from said reservoir according to the speed of the engine, means for introducing said discharged quantities of fuel into said high pressure injector means, and means for reducing the quantity of
50 fuel so discharged and simultaneously retarding the period of injection of solid fuel by the high pressure injection means.

4. In an internal combustion engine of the class described, a working cylinder, high pressure injection means for introducing fuel into said cylinder, a main fuel supply tank, a closed fuel distributing reservoir arranged in close proximity to said injector, means for pumping fuel from said supply to said reservoir in excess of the
55 maximum quantity required by the engine and means for maintaining a comparatively low and substantially constant pressure on the fuel in said reservoir comprising an adjustable pressure relief valve and return conduit connecting said
60 reservoir with said supply tank, and rotary valve means within said reservoir operable by the engine for transferring metered quantities of fuel from said reservoir to said injector, said valve means being shiftable longitudinally to vary said
65 metered quantities of fuel.

5. In an internal combustion engine of the class described, a working cylinder, high pressure injection means for introducing fuel into said cylinder, a main fuel supply, a closed fuel distributing reservoir arranged in close proximity to said injector, means for pumping fuel from said supply to said reservoir and for maintaining a comparatively low and substantially constant pressure on the fuel in said reservoir, and rotary valve means within said reservoir operable by the engine for transferring metered quantities of fuel from said reservoir to said injector, said valve means being shiftable longitudinally to vary said metered quantities of fuel, said reservoir having a discharge port and passage leading to said injection means and said rotary valve having a cooperating triangular shaped discharge port arranged with the apex of the triangle pointing in the direction of rotation of the valve, and one side of the triangularly shaped port disposed at right angles to the axis of rotation of the valve, the base of the triangular shaped port declining from said side just mentioned away from the direction of rotation of the valve.

6. In an internal combustion engine of the class described, a working cylinder, high pressure injection means for introducing fuel into said cylinder, a main fuel supply, a closed fuel distributing reservoir arranged in close proximity to said injector, means for pumping fuel from said supply to said reservoir and for maintaining a comparatively low and substantially constant pressure on the fuel in said reservoir, rotary valve means within said reservoir operable by the engine for transferring metered quantities of fuel from said reservoir to said injector, said valve means being shiftable longitudinally to vary said metered quantities of fuel, said reservoir having a discharge port and passage leading to said injection means and said rotary valve having a cooperating triangular shaped discharge port arranged with the apex of the triangle pointing in the direction of rotation of the valve, and one side of the triangularly shaped port disposed at right angles to the axis of rotation of the valve, the base of the triangular shaped port declining from said side just mentioned away from the direction of rotation of the valve, and means for shifting said rotary valve longitudinally to vary the operative area of the triangular shaped port with respect to the discharge port of the reservoir.

7. In an internal combustion engine of the class described, a working cylinder, high pressure injection means for introducing fuel into said cylinder, a main fuel supply, a closed fuel distributing reservoir arranged in close proximity to said injector, means for pumping fuel from said supply to said reservoir and for maintaining a comparatively low and substantially constant pressure on the fuel in said reservoir, rotary valve means within said reservoir operable by the engine for transferring metered quantities of fuel from said reservoir to said injector, said valve means being shiftable longitudinally to vary said metered quantities of fuel, said reservoir having a discharge port and passage leading to said injection means and said rotary valve having a cooperating triangular shaped discharge port arranged with the apex of the triangle pointing in the direction of rotation of the valve, and one side of the triangularly shaped port disposed at right angles to the axis of rotation of the valve, the base of the triangular

shaped port declining from said side just mentioned away from the direction of rotation of the valve, and means for shifting said rotary valve longitudinally to vary the operative area of the triangular shaped port with respect to the discharge port of the reservoir, said means including means for simultaneously varying the time of injection of the high pressure injector to retard the injection period as the valve is shifted to reduce the quantity of fuel metered thereby.

8. In a fuel metering and supply means for liquid fuel injection type engines having high pressure liquid fuel injection means, a fuel supply, a closed reservoir having a port and passage leading therefrom to said high pressure injection means, means for introducing fuel from said supply into said reservoir and maintaining a substantially constant low pressure on the fuel therein, a hollow rotary, and longitudinally slidable valve member within said reservoir having a port in the wall thereof of substantially triangular shaped configuration arranged to register with the aforementioned port of the reservoir during a portion of its rotation for discharging fuel from said reservoir to said injector during said registration, the valve being shiftable longitudinally in one direction to advance the initial period of registration of the two ports and simultaneously advance the time of interruption of the registration of the two ports, and means for shifting the valve.

9. In a fuel metering and supply means for liquid fuel injection type engines having high pressure liquid fuel injection means, a fuel supply, a closed reservoir having a port and passage leading therefrom to said high pressure injection means, means for introducing fuel from said supply into said reservoir and maintaining a substantially constant low pressure on the fuel therein, a hollow rotary longitudinally slidable valve member within said reservoir having a port in the wall thereof of substantially triangular shaped configuration arranged to register with the aforementioned port of the reservoir during a portion of its rotation for discharging fuel from said reservoir to said injection during said registration, the valve being shiftable longitudinally in one direction to advance the initial period of registration of the two ports and simultaneously advance the time of interruption of the registration of the two ports, and means for shifting the valve, said valve being shiftable in the opposite direction to retard the initial period of registration of the two ports and simultaneously retard the point of interruption of the registration of the two ports, and means for simultaneously advancing the period of high pressure injection when the valve is shifted in the first mentioned direction and to retard the period of high pressure injection as the valve is shifted in the other direction.

10. In a multiple cylinder, liquid fuel, internal combustion engine, high pressure, liquid fuel injectors, a liquid fuel distributing mechanism therefor comprising an elongated, hollow, cylindrical valve having spaced ports therein adapted to communicate with the high pressure injectors of the engine, yieldable bearing means for said valve, a reservoir casing enclosing said valve and bearing means and constituting a low pressure

fuel heating chamber and lubricating means for the valve, said reservoir chamber being in communication with the interior and exterior of said cylindrical valve, means for rotating the valve to effect an injection of metered quantities of the fuel at low pressure into the high pressure injectors, pump means for supplying the fuel to said heating chamber, and a pressure operated relief valve in said chamber for maintaining a substantially constant low pressure on the fuel in the chamber.

11. A liquid fuel distributing and metering means for engines of the class described including a fuel supply passage conduit, a high pressure injector means having an inlet and an outlet, a rotary, tubular fuel metering member formed with a delivery port in the wall thereof, said port being adapted to register with the inlet of the high pressure injector means during a minor portion only of the rotation of said member, means for rotating said tubular member in direct ratio to the speed of the engine, and means for uniformly delivering liquid fuel at a substantially constant pressure to the interior of the tubular metering member during the entire rotation thereof.

12. In liquid fuel supply means for internal combustion engines of the class described, a closed casing, having a fuel delivery port to the engine, high pressure fuel injector means in communication with said fuel delivery port, means for uniformly supplying liquid fuel to the casing in excess of the maximum amount required by the engine, relief valve means in the casing for discharging said excess amounts of fuel from the casing and maintaining a substantially constant low pressure within the casing at all engine speeds, a rotary tubular open-ended fuel metering member within the casing having a fuel delivery port in the wall thereof adapted to register with the fuel delivery port in the casing during a minor degree only of its rotation, and means for rotating the rotary fuel metering member in direct ratio to the speed of the engine.

13. In liquid fuel supply means for internal combustion engines of the class described, a high pressure fuel injection means, a closed casing, pump means for uniformly supplying liquid fuel to said casing in excess of the maximum amount required by the engine, relief valve means in the casing for discharging said excess amounts from the casing and maintaining a substantially low constant pressure on the fuel within the casing, a fuel outlet port in said casing in communication with said high pressure fuel injection means, a rotary tubular valve member within the casing having an open end in communication with the interior of the casing, said valve being formed with a fuel delivery port in the wall thereof of triangular configuration adapted to register with the fuel outlet port of the casing during a minor degree of rotation only of the rotary valve member, means for rotating the valve in direct ratio to the speed of the engine, and means for moving the rotary valve longitudinally with respect to said fuel outlet in the casing to vary the effective opening of the triangular port to vary the amount of fuel delivered for a given engine speed.