Aug. 15, 1950 E. H. KING 2,518,901

ENGINE PRESSURE ACTUATED INJECTOR

Filed Jan. 15, 1945

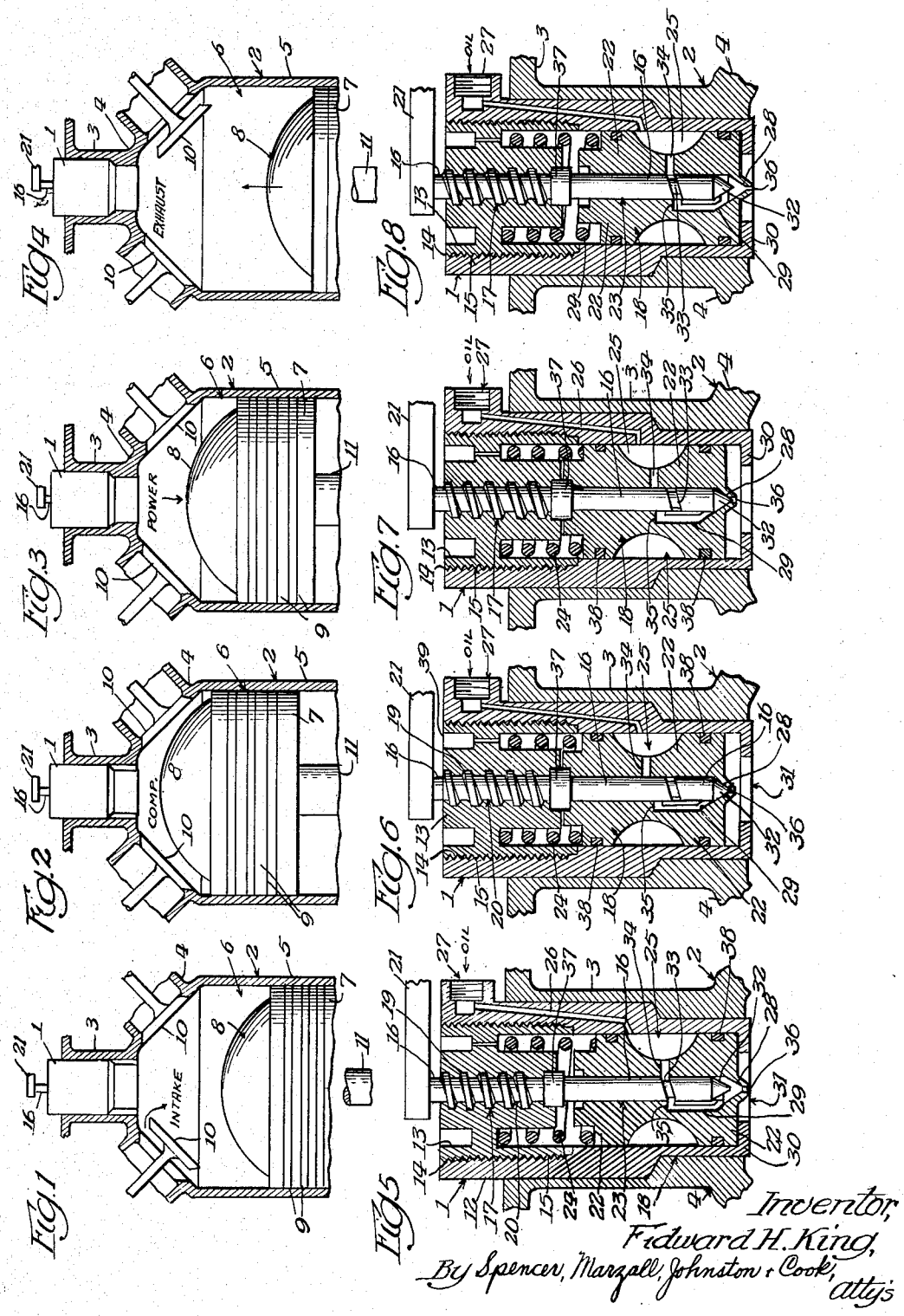


Fig.4 Fig.8 Fig.3 Fig.7 Fig.2 Fig.6 Fig.1 Fig.5

Inventor,
Edward H. King,
By Spencer, Marzall, Johnston & Cook,
attys

Patented Aug. 15, 1950 2,518,901

UNITED STATES PATENT OFFICE

2,518,901

ENGINE PRESSURE ACTUATED INJECTOR

Edward H. King, Oak Park, Ill.

Application January 15, 1945, Serial No. 572,880

4 Claims. (Cl. 299—107.2)

1

This invention relates to an injector for Diesel engines, and its primary object is to provide a new and novel injector of improved form and employ the compression of the cylinder to inject fuel into the cylinder.

Another important object of the invention is to provide a Diesel engine injector of new and improved construction having novel means to adjust the stroke of the injector to effect throttle control.

A further object of the invention is to provide a new and novel arrangement of parts, constructed in a particular manner and adapted for proper operation in accordance with a predetermined sequence of cylinder operation.

Numerous other objects and advantages will be apparent throughout the progress of the specification which follows.

The accompanying drawings illustrate a selected embodiment of the invention, and the views therein are as follows:

Fig. 1 is a detail diagrammatic or schematic sectional view of a cylinder of a Diesel engine to which the injector of the invention is applied, the view showing the positions of the valves and piston during the intake stroke;

Figs. 2 to 4, inclusive, are views similar to Fig. 1 but corresponding to the respective positions the parts assume during the compression, power and exhaust strokes; and

Figs. 5 to 8, inclusive, are detail vertical, sectional views of the improved injector, the views showing the position the parts assume with respect to the cylinder positions of Figs. 1 to 4, inclusive.

The particular injector mechanism herein disclosed for the purpose of illustrating the invention is shown as applied to a four-cycle Diesel engine, but it may, of course, be applied to Diesel engines of other cycles, such as a two-cycle engine, the four-cycle adaptation being chosen merely for the purpose of illustration.

The injector 1 is adapted to be secured operatively, preferably in the top of a Diesel engine 2, the same being mounted in a tubular wall part 3 of the cylinder head 4 and concentrically positioned with respect to the enclosing walls 5 of a cylinder 6. A cylinder piston 7 of the conventional type is mounted for vertical reciprocation in the cylinder 6, the piston 7 being shown with a dome-shaped top 8 and having piston rings 9. Valves 10 of the usual type for the usual purposes are operatively mounted in the cylinder head of each piston, and these valves are operated in the conventional manner and in the usual sequence to conform with the positions of the pistons. The pistons have the usual piston rods 11 which are operatively connected to a crankshaft in any conventional, desirable manner.

2

The injector 1, Figs. 5 to 8, comprises an outer cylindrical casing or housing 12 which is adapted to be mounted in the upstanding cylindrical motor extension 3 in any suitable manner, such as by a press fit. A supporting plug 13 is adapted to be mounted in the casing 12 in any desirable manner, the plug 13 being herein shown as having exterior threads 14 engaging an interiorly threaded part 15 of the housing. A metering pin 16 extends through a central bore 17 in the plug 13 and projects into a chamber 18 at the bottom of the casing or housing 12. The exterior upper part of the metering pin 16 may be provided with threads 19 which engage cooperating threads 20 of the bore 17, whereby vertical, adjustable movement of the pin 16 in the plug 13 may be had. The upper end of the pin 16 projects outwardly of the top of the plug 13 and is operatively connected to operating means 21, which may be of any desired construction and arrangement to effect adequately the purpose intended.

A slidable operating member or valve 22 is mounted in the chamber 18 and has co-operation with the metering pin 16 so as to meter properly a supply of fuel, such as oil, and to permit the fuel to be sprayed in atomized condition into the Diesel cylinder. This valve 22 is slidably mounted in the chamber 18 and, with the inside of the walls of the housing 12, has slidable movement.

The valve member 22 is provided with a central bore 23 into which the metering stem 16 projects, the valve member 22 being adapted to have vertical, slidable movement on the stem 16. A coil spring 24 is provided for urging the valve member normally downwardly, there being an annular recess provided about the lower end of the plug 13 and the upper end of the valve member 22 to receive said spring.

The valve member 23 is provided with an annular recess 25 intermediate its ends, as clearly disclosed in Figs. 5 to 8. This recess 25 forms a chamber for receiving the fuel, there being a fuel line 26 formed in the walls of the casing or housing 12 to supply fluid to the annular recess 25. The upper end of the fuel line 26 terminates into a connection 27 which leads to a suitable supply of fuel, such as oil. The bore 23 in the valve 22 terminates into a restricted tapering end 28 forming a nozzle through which

the atomized fuel is forced into the cylinder. The restricted opening 28 communicates with a passage or reservoir 29, the passage or reservoir 29 in the valve member 22 communicating with the annular recess or chamber 25. Therefore, fuel oil which comes in through the opening 27 will pass through the passage 26 and into the annular recess or chamber 25, where it will be received into the passage or reservoir 29 and forced out of the restricted nozzle end 28. The bottom 30 of the housing 12 is provided with a central opening 31 through which the fuel from the nozzle 28 passes. The opening 31 is of such size as to insure the opening of the valve 22 to a predetermined position when the piston arrives at a predetermined position in its cylinder, whereby the valve will be shifted at the proper time with respect to the ignition. If the opening 31 is relatively small, the movement of the valve 22 is delayed sufficiently to provide correct ignition timing.

The lower end of the metering pin 16 is provided with a conical end 32 which conforms generally to the sloping side walls of the nozzle part 28 so that the nozzle opening 28 may be completely shut off by the tapering end 32 of the metering pin. The metering pin 16 is also provided with a recess 33 which extends thereabout in an inclined plane and is adapted to make communication between a line 34 and the part 35 of the fuel passage or reservoir 29, whereby the fuel in the annular recess or chamber 25 may be directed to the nozzle 28. Fig. 5 discloses the valve 22 in lowered position, whereby fuel in the recess or chamber 25 may flow through the line 34, through the recess 33 in the metering pin, and into the line or reservoir 29 where it will collect in the inclined nozzle part 28, so that when the valve member 22 is in raised position, as shown in Fig. 6, the fuel collected in the nozzle end 28 will be sprayed out of the nozzle opening 36 and into the cylinder.

The slidable valve 22 is therefore provided, permitting fuel to be collected in the inclined orifice 28 of the bore 23, when the valve member 22 is in its lowermost position, as indicated in Fig. 5. The valve member 22, when in its raised position as shown in Fig. 6, will cause the collected fuel in the restricted nozzle part 28 to be forced out of the aperture 36, as clearly shown in Fig. 6.

The improved Diesel engine injector is shown applied to a four-cycle Diesel engine, whereupon the parts will assume the positions shown in Figs. 1 and 5 during the intake stroke of the piston. The valve members 10 are constructed and operated properly so that one valve member 10 will be open, as shown in Fig. 1, for the reception of air into the top of the piston 7. This intake position permits the spring 24 to lower the valve member 22, as shown in Fig. 5, whereupon fuel will pass from the supply connection 27, through the line 26, into the annular recess or compartment 25. The fuel in the chamber 25 will then flow through the line 34 and part 35 of the passage or reservoir 29 and then collect in the cylindrical nozzle end 28.

The next cycle of operation includes the compression stroke, whereupon the piston 7 will rise upwardly in the cylinder, with both valves 10 closed, as shown in Fig. 2. The upward movement of the piston, which comprises the compression stroke, will cause the spring 24 to be compressed somewhat, whereby the valve 22 will be raised by the compression in the cylinder, as shown in Fig. 6, in which position the feed orifice

33 in the metering pin 16 will be out of engagement with the line 34 and the part 35 of the fuel line or reservoir 29, whereupon the fuel which is collected in the inclined side walls of the nozzle part 28 will be forced out through the orifice 36 and sprayed in atomized form into the top of the cyinder. The compression will therefore cause the fuel to become ignited, and an explosion will occur, whereupon the piston 7 will move downwardly, which is the next cycle of operation and which constitutes the power stroke of the piston.

The power stroke permits the parts to be maintained in their relative position, as shown in Fig. 7, and the valves 10 will be in closed position, as shown in Fig. 3, which is the same position as the position shown in Figs. 2 and 6, except that the collected fuel has already been dispensed after the completion of the power stroke.

The next cycle of operation will be the exhaust, whereupon one valve 10 will be closed and the opposite valve 10 will be open, as shown in Fig. 4. The exhaust will also permit the spring 24 to return to its normal position, causing the valve member 22 to again move to the bottom of its downward travel, as shown in Fig. 8, whereupon the annular feed aperture 33 of the metering pin 16 will be in communication with the reservoir 29, the same position as shown in Fig. 5, where the various cycles of operation may be repeated. The upward movement of the valve member 22 is limited by the engagement of its upper end with an enlargement 37 formed on the metering pin 16 immediately below the threads 19.

It will be noted that the opening 36 at the end of the nozzle part is quite small and the viscosity of the fuel as well as its surface tension will prevent the fuel from flowing out of orifice 36 merely by gravity. Likewise, the fuel will not flow through the orifice 36 during the suction stroke because the suction created by the piston is insufficient to overcome the inherent nature of the fuel to remain in the nozzle part. Furthermore, the fuel will not be pushed back through the device during the exhaust stroke because the orifice 36 is so small that a large pressure drop will occur across it and will prevent this action.

The means 21 are adapted to be of any type capable of performing a radius movement of the pin 16, whereby a greater or less amount of fuel may be discharged, depending upon the position of the metering pin. When the metering pin is raised, a greater amount of fuel is adapted to flow through the aperture 36, but when the metering pin 16 is lowered, then a smaller amount of fluid is available. The means for effecting the rotation of this pin is adapted to be a throttle control for effecting a greater or lesser amount of fuel as the motor speed is to be increased or decreased.

The valve member may be provided with seal rings 38, and the top of the plug may be provided with tool receiving openings 39 to permit the plug to be applied or removed from its support.

The invention provides an exceedingly effective and efficient injector motor control by the compression of the cylinder for effecting, in the proper sequence, the atomization of fuel into the cylinder chamber. The parts are strong and durable in construction and may be readily and economically manufactured.

The invention is shown as applied to one cylinder only of a Diesel engine, which may comprise several cylinders. Each of the several cylinders, however, will be equipped with the same injector element, and the operating means 21

will be operatively connected so that the piston and each cylinder will operate properly in its proper sequence.

Changes may be made in the form, construction and arrangement of the parts without departing from the spirit of the invention or sacrificing any of the advantages thereof, and the right is hereby reserved to make all such changes as fairly fall within the scope of the following claims.

The invention is hereby claimed as follows:

1. An injector member adapted for use on a Diesel engine and comprising a casing, a valve slidable in the casing and having a central bore terminating into a discharge orifice, a plug in said casing and having a central bore therein in alignment with the first named bore, a metering pin adjustably mounted in the second named bore and extending into the first named bore, said pin having an end for cooperation with the discharge orifice, said valve member having a recess therein forming a fuel chamber, a fuel passage in the valve leading from the chamber to the central bore in the vlave member, a second fuel passage leading from the bore in the valve to the discharge orifice, and a recess in the pin adapted to make communication between said passages when the valve is in a predetermined position.

2. An injector member adapted for use on a Diesel engine and comprising a casing, a valve slidable in the casing and having a central bore terminating into a discharge orifice, a plug in said casing and having a central bore therein in alignment with the first named bore, a metering pin adjustably mounted in the second named bore and extending into the first named bore, said pin having an end for cooperation with the discharge orifice, said valve member having a recess therein forming a fuel chamber, a fuel passage in the valve leading from the chamber to the central bore in the valve member, a second fuel passage leading from the bore in the valve to the discharge orifice, and a recess in the pin adapted to make communication between said passages when the valve is in a predetermined position, said casing having a fuel passage therein leading to said chamber.

3. An injector member adapted for use on a Diesel engine and comprising a casing, a valve slidable in the casing and having a central bore terminating into a discharge orifice, a plug in said casing and having a central bore therein in alignment with the first named bore, a metering pin adjustably mounted in the second named bore and extending into the first named bore,

said pin having an end for cooperation with the orifice, said valve member having a recess therein forming a fuel chamber, a fuel passage in the valve leading from the chamber to the central bore in the valve member, a second fuel passage leading from the bore in the valve to the orifice, a recess in the pin adapted to make communication between said passages when the valve is in a predetermined position, said casing having a fuel passage therein leading to said chamber, seal rings on the valve to make a seal between the casing and valve, screw threads on the pin and plug to permit vertical movement of the pin in the plug, means connected to the pin to effect rotative movement thereof, spring means between the plug and valve, and screw threads on the plug and casing, said casing having an opening in its bottom through which the fuel is discharged from the orifice.

4. An injector for injecting fuel into a motor cylinder and comprising a casing, a valve member slidably mounted in the casing, a metering pin fastened through said valve member, said valve member having a groove formed exteriorly thereabout and forming a chamber, a fluid inlet through the casing in communication with the chamber, there being a fluid reservoir in the valve member and a fluid line leading from the chamber to the reservoir, a passage carried by the pin and adapted to permit communication between the reservoir and the last named fluid line when the valve member is in a predetermined position with respect to the pin, said pin preventing communication when the valve member is not in the said predetermined position, said reservoir terminating into a tapering end having an aperture, said pin having a tapered end for discharging fluid gathered in the tapered end of the reservoir during movement of the valve member in a predetermined direction.

EDWARD H. KING.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,349,515	Lombard	Aug. 10, 1920
1,622,266	Ake	Mar. 29, 1927
2,037,702	Butler	Apr. 21, 1936
2,135,925	Tuscher	Nov. 8, 1938
2,197,944	Raven	Apr. 23, 1940
2,211,496	Davidson, Jr.	Aug. 13, 1940
2,230,920	Wirtsen	Feb. 4, 1941
2,371,787	Ward	Mar. 20, 1945