Aug. 9, 1938. J. W. DOW 2,126,623

ENGINE FUEL INJECTOR

Filed July 21, 1937

Fig.1.

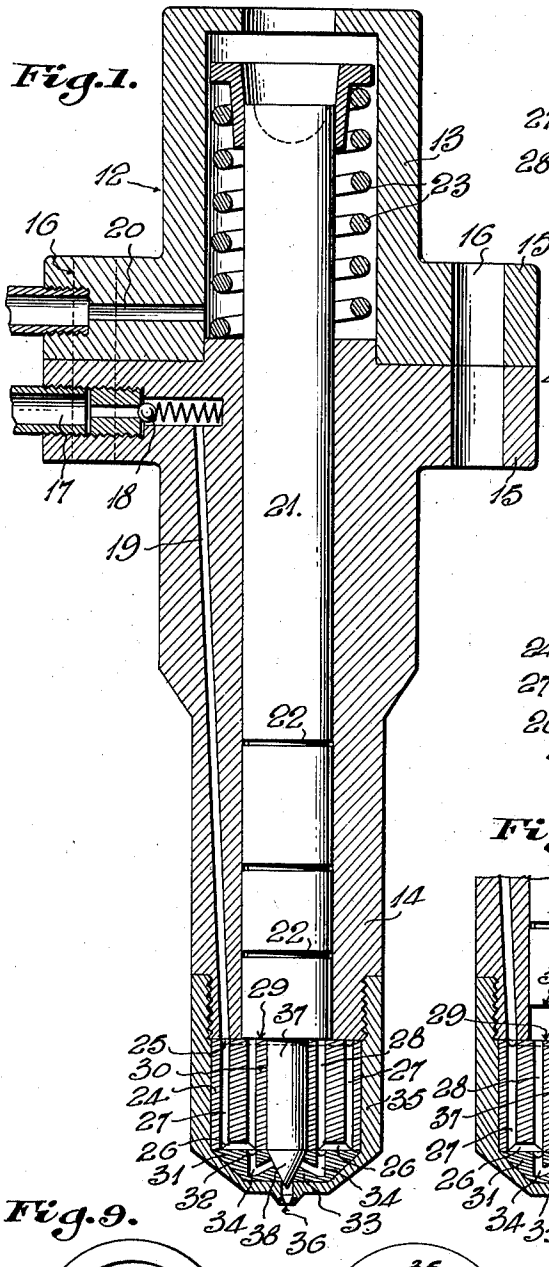


Fig.4.

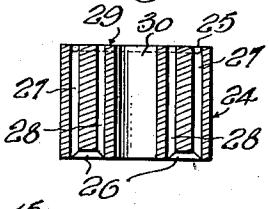


Fig.6.

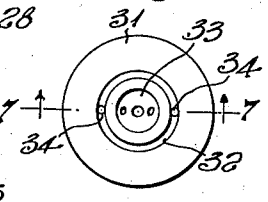


Fig.3.

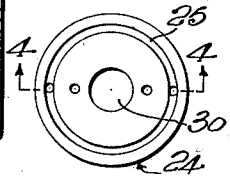


Fig.7.

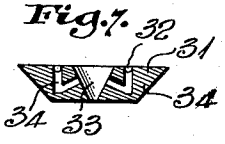


Fig.5.

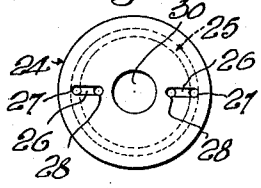


Fig.8.

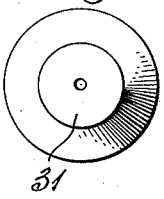


Fig.2.

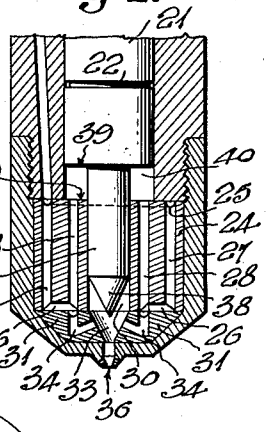


Fig.11.

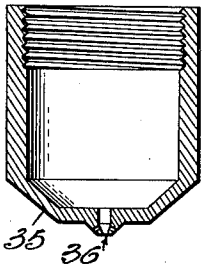
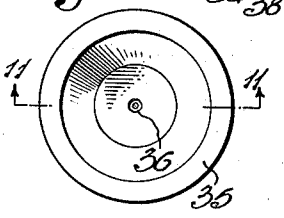


Fig.9.



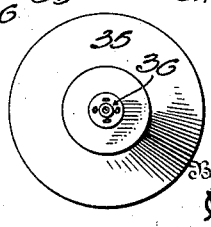


Fig.10.

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ENGINE FUEL INJECTOR

John W. Dow, Sioux City, Iowa

Application July 21, 1937, Serial No. 154,904

8 Claims. (Cl. 299—107.4)

The invention relates to improvements in fuel injectors for engines of the Diesel type and it aims to provide a new and improved injector in which novel provision is made for retaining and heating the fuel fed from the fuel pump, and for moving this fuel in such manner that it shall become highly heated before discharge.

A further object is to provide a novel sectional construction which may be readily assembled without danger of fuel ports moving out of conducting relation with each other, may be readily disassembled and cleaned, and may be easily reassembled without danger of disarranging any parts.

Another object is to provide an improved injector in which a shoulder on the plunger coacts with a shoulder in the cylinder in which said plunger slides, in forming an expansible and contractible chamber which receives fuel upon ascent of the plunger and discharges the fuel upon plunger descent, and in which said plunger is provided with an extension projecting below its shoulder and acting as a cut-off when the plunger is fully lowered.

With the foregoing and minor objects in view, the invention resides in the novel subject matter hereinafter described and claimed, description being accomplished by reference to the accompanying drawing.

Fig. 1 is a vertical longitudinal sectional view through an injector constructed in accordance with the invention, the plunger being shown in completely lowered position.

Fig. 2 is a fragmentary view similar to the lower end of Fig. 1 but showing the plunger raised.

Fig. 3 is an upper end view of a cylindrical block in which a number of the fuel ports are formed.

Fig. 4 is a vertical sectional view on line 4—4 of Fig. 3.

Fig. 5 is a lower end elevation of the block shown in Figs. 3 and 4.

Fig. 6 is an upper side elevation of a ring which abuts the lower end of the above mentioned block, said ring being provided with fuel ports and with an inverted conical central opening which coacts with the extension on the lower end of the plunger.

Fig. 7 is a sectional view on line 7—7 of Fig. 6.

Fig. 8 is a lower side elevation of the ring shown in Figs. 6 and 7.

Fig. 9 is an upper end elevation of the cap which secures the above-mentioned cylindrical block and ring to the cylinder or tubular casing of the injector.

Fig. 10 is a lower end elevation of this cap.

Fig. 11 is a sectional view on line 11—11 of Fig. 9.

A preferred construction has been illustrated and will be specifically described, with the understanding however, that within the scope of the invention as claimed, variations may be made. Furthermore, while such terms as "upper" and "lower" will be employed in describing and claiming the invention, it is to be understood that such terms are for convenience only and that the injector may be used in horizontal position instead of vertical position, if desired.

A tubular casing 12 is provided, preferably formed from upper and lower sections 13 and 14 provided with abutting flanges 15, said flanges having alined openings 16 through which to pass bolts or the like to secure the casing to an engine cylinder.

The lower section 14 of the casing 12 is provided with an inlet 17 for fuel supplied by means of a fuel pump (not shown), said inlet or some other suitable portion of the fuel supply means being provided with a check valve 18. The casing section 14 is also provided with a fuel supply port 19 which extends in the present disclosure, from the check valve 18 to the lower end of said section.

The upper section 13 of the casing 12 is provided with a suitable drain 20 for any fuel leaking past the plunger 21, but to prevent excessive leakage, said plunger is provided with grooves 22 which catch some of the oil, or sealing rings (not shown) could be employed.

The plunger 21 is raised by a suitable spring 23 housed in the upper section 13 of the casing 12, and is depressed by a rocker arm or the like (not shown) operated in the usual way from the engine crank shaft.

A cylindrical block 24 is disposed at the lower end of the casing 12, the upper end of said block being in contact with the lower end of said casing and being provided with an annular groove 25 which communicates with the lower end of the port 19, no matter to what position the block 24 may be turned. The lower end of this block 24 is provided with any desired number of substantially radial grooves 26. Outer longitudinal ports 27 are formed through the block 24 from the annular groove 25 to the outer ends of the radial grooves 26, and inner longitudinal ports 28 are formed in said block, the lower ends of said ports 28 being in communication with the inner ends of the grooves 26. The upper ends of the ports 28 open through the upper end of the

block 24, said upper end projecting inwardly from the inner periphery of the casing section 14 and constituting an upwardly facing shoulder 29. A central bore 30 extends through the block 24 and opens through both the upper and lower ends thereof, the diameter of said bore 30 being considerably less than the internal diameter of the casing section 14.

A ring 31 is disposed under the block 24, the upper side of said ring being in contact with the lower end of said block and being provided with an annular groove 32 communicating with the lower ends of the ports 28. The ring 31 is formed with a central valve seat preferably in the form of an inverted conical opening 33 which communicates with the bore 30 of the block 24, and said ring is provided also with a suitable number of ports 34 which extend from the groove 32 to the opening 33.

A cap 35 is threaded or otherwise secured upon the lower end of the casing section 14 and snugly contains the ring 31 and the block 24, the bottom of said cap being provided with fuel spray means 36 communicating with the lower end of the opening 33. When threading the cap onto the casing section 14, it is not necessary that the ports 27 occupy any predetermined positions in order to properly receive the fuel from the supply port 19, due to the provision of the annular groove 25 in the upper end of the block 24. Similarly, it is not necessary that the ports 34 occupy any particular positions to receive fuel from the ports 28, as hereinafter described, due to the provision of the annular groove 32 in the upper side of the ring 31. There is thus no danger of assembling the parts with any of the ports out of conducting relation with each other.

The plunger 21 is provided with a reduced extension 37 at its lower end, said extension being slidable in the bore 30 of the block 24 and having a valve portion preferably in the form of an inverted conical lower end 38 which seats in the inverted conical opening 33 of the ring 31 when the plunger is fully lowered. At the upper end of the extension 37, the plunger is provided with a downwardly facing shoulder 39 which is cooperable with the shoulder 29 formed by the upper end of the block 24, in forming an expansible and contractible fuel chamber 40. Upon ascent of the plunger 21 (see Fig. 2), fuel enters the chamber 40 from the ports 28 of the block 24, being supplied to said ports 28 by means of the port 19, groove 25, ports 27 and grooves 26. Upon descent of the plunger, the fuel from the chamber 40 is discharged through the ports 28, through the ports 34, through the opening 33, and through the fuel spray means 36. All of the ports are of course always full of fuel and the latter is therefore effectively heated. Moreover, by entering the chamber 40 in the manner above described, the fuel becomes still further heated in the tip of the injector, and the heating continues as the fuel is discharged into the engine cylinders. The plunger 21 of course rises during the compression strokes of the engine and some of the hot compressed air from the engine cylinder enters through the fuel spray means 36, coming in contact with some of the fuel and also performing a heating function, and at the height of compression, or other suitable moment according to the timing of the engine, the plunger descends, injecting a charge of fuel and the hot air which has entered under the plunger end 38, into the cylinder.

It will be seen from the foregoing that novel and inexpensive provision has been made for carrying out the objects of the invention, and while preferred details of construction have been shown, attention is again invited to the possibility of making variations within the scope of the invention as claimed.

I claim:—

1. An engine fuel injector comprising an elongated cylinder the bore of which is formed with a reduced lower end portion to provide an upwardly facing shoulder, said reduced bore portion having an inverted conical lower end and the cylinder being formed with fuel spray means communicating with said inverted conical lower end of said reduced bore portion, said cylinder being provided with a port from said shoulder to said inverted conical lower end of said reduced bore portion and being also provided with a longitudinal fuel supply port which discharges into the first named port; and a plunger slidable in said bore of said cylinder and having an extension slidable in said reduced bore portion, the lower end of said extension being of inverted conical form to seat in said inverted conical lower end of said reduced bore portion when the plunger is fully lowered, said plunger having a downwardly facing shoulder above said upwardly facing shoulder of said cylinder and cooperable therewith in forming an expansible and contractible fuel chamber which receives fuel from the upper end of said first named port when the plunger ascends, the fuel being discharged from said chamber through said first named port, through said inverted conical lower end of said reduced bore portion, and through said fuel spray means when said plunger descends.

2. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lower end; a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing, said block being provided with an outer longitudinal port and with an inner longitudinal port, the lower ends of these ports being in communication with each other, the upper end of said outer port being in communication with said fuel supply port of said tubular casing, the upper end of said inner port being open at the upper end of said block between said central bore and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said ring having a central inverted conical opening communicating with said central bore, said ring being formed with a fuel port from its upper side to said inverted conical opening, the upper end of this port being in communication with the lower end of said inner port of said block; a cap secured to said lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means communicating with the lower end of said inverted conical opening of said ring; and a plunger slidable in said tubular casing and having a downward extension slidable in said bore of said block, the lower end of said extension being of inverted conical form to seat in said inverted conical opening of said ring when the plunger is fully lowered, said plunger having a shoulder disposed over said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner port of said block when the plunger ascends, the fuel being dis-

charged from said chamber through said inner port of said block, through said port and inverted conical opening of said ring, and through said fuel spray means of said cap when said plunger descends.

3. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lower end; a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing and having an annular groove communicating with said fuel supply port, the lower end of said block being formed with substantially radial grooves, said block being provided with outer longitudinal ports extending from said annular groove to the outer ends of said radial grooves and being provided also with inner longitudinal ports from the inner ends of said radial grooves to the upper end of the block, the upper ends of said inner ports being disposed between said bore of the block and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said ring having an inverted conical central opening communicating with the lower end of said bore of said block, said ring being formed with ports from its upper side to said inverted conical opening, the upper ends of these ports being in communication with said inner ports of said block; a cap secured to the lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means communicating with the lower end of said inverted conical opening of said ring; and a plunger slidable in said tubular casing and having a downward extension slidable in said bore of said block, the lower end of said extension being of inverted conical form to seat in said inverted conical opening of said ring when the plunger is fully lowered, said plunger having a shoulder disposed over said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner ports of said block when the plunger ascends, the fuel being discharged from said chamber through said inner ports of said block, through said ports and inverted conical opening of said ring, and through said fuel spray means of said cap when said plunger descends.

4. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lower end; a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing and having an annular groove communicating with said fuel supply port, the lower end of said block being formed with substantially radial grooves, said block being provided with outer longitudinal ports extending from said annular groove to the outer ends of said radial grooves and being provided also with inner longitudinal ports from the inner ends of said radial grooves to the upper end of the block, the upper ends of said inner ports being disposed between said bore of the block and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said upper side of said ring being provided with an annular groove communicating with said inner ports of said block, said ring having a central inverted conical opening and ports leading to this opening from said annular groove of said ring, said inverted conical opening being in communication with the lower end of said bore of said block; a cap secured to the lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means communicating with the lower end of said inverted conical opening of said ring; and a plunger slidable in said tubular casing and having an extension slidable in said bore of said block, the lower end of said extension being of inverted conical form to seat in said inverted conical opening of said ring when the plunger is fully lowered, said plunger being provided with a shoulder over said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner ports of said block when the plunger ascends, the fuel being discharged from said chamber through said inner ports of said block, through said annular groove, ports and inverted conical opening of said ring, and through said fuel spray means of said cap when said plunger descends.

5. An engine fuel injector comprising an elongated cylinder, the bore of which is formed with a reduced lower end portion to provide an upwardly facing shoulder, said reduced bore portion having a valve seat at its lower end and the cylinder being formed with fuel spray means opening through said valve seat, said cylinder being provided with a port from said shoulder to said valve seat and being also provided with a longitudinal fuel supply port which discharges into the first named port; and a plunger slidable in said bore of said cylinder and having an extension slidable in said reduced bore portion, the lower end of said extension being provided with a valve portion to coact with said valve seat when the plunger is fully lowered, said plunger having a downwardly facing shoulder above said upwardly facing shoulder of said cylinder and cooperable therewith in forming an expansible and contractible fuel chamber which receives fuel from the upper end of said first named port when the plunger ascends, the fuel being discharged from said chamber through said first named port and through said fuel spray means when said plunger descends.

6. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lowered end, a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing, said block being provided with an outer longitudinal port and with an inner longitudinal port, the lower ends of these ports being in communication with each other, the upper end of said outer port being in communication with said fuel supply port of said tubular casing, the upper end of said inner port being open at the upper end of said block between said central bore and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said ring having a central valve seat at the lower end of said central bore, said ring being formed with a fuel port from its upper side to said valve seat, the upper end of said port being in communication with the lower end of said inner port of said block; a cap secured to said lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means open at said valve seat; and a plunger slidable in said tubular casing and having a

downward extension slidable in said bore of said block, the lower end of said extension being provided with a valve portion to coact with said seat when the plunger is fully lowered, said plunger having a shoulder disposed above said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner port of said block when the plunger ascends, the fuel being discharged from said chamber through said inner port of said block, through said port of said ring, and through said fuel spray means of said cap when said plunger descends.

7. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lower end; a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing and having an annular groove communicating with said fuel supply port, the lower end of said block being formed with substantially radial grooves, said block being provided with outer longitudinal ports extending from said annular groove to the outer ends of said radial grooves and being provided also with inner longitudinal ports from the inner ends of said radial grooves to the upper end of the block, the upper ends of said inner ports being disposed between said bore of the block and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said ring having a valve seat at the lower end of said bore of said block, said ring being formed with ports from its upper side to said valve seat, the upper ends of these ports being in communication with said inner ports of said block; a cap secured to the lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means open at said valve seat; and a plunger slidable in said tubular casing and having a downward extension slidable in said bore of said block, the lower end of said extension being provided with a valve portion to coact with said valve seat when the plunger is fully lowered, said plunger having a shoulder disposed over said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner ports of said block when the plunger ascends, the fuel being discharged from said chamber through said inner ports of said block, through said ports of said ring, and through said fuel spray means of said cap when said plunger descends.

8. An engine fuel injector comprising a tubular casing having a fuel supply port opening through its lower end; a cylindrical block having a central bore of less diameter than the interior of said tubular casing, the upper end of said block being disposed against the lower end of said tubular casing and having an annular groove communicating with said fuel supply port, the lower end of said block being formed with substantially radial grooves, said block being provided with outer longitudinal ports extending from said annular groove to the outer ends of said radial grooves and being provided also with inner longitudinal ports from the inner ends of said radial grooves to the upper end of said block, the upper ends of said inner ports being disposed between said bore of the block and the inner periphery of said tubular casing; a ring having its upper side disposed against the lower end of said block, said upper side of said ring being provided with an annular groove communicating with said inner ports of said block, said ring having a central valve seat and ports leading to this seat from said annular groove of said ring, said valve seat being disposed at the lower end of said bore of said block; a cap secured to the lower end of said tubular casing and containing said ring and said block, said cap having fuel spray means open at said valve seat; and a plunger slidable in said tubular casing and having an extension slidable in said bore of said block, the lower end of said extension being provided with a valve for coaction with said valve seat when the plunger is fully lowered, said plunger being provided with a shoulder over said block and cooperable with the upper end of the latter in forming an expansible and contractible fuel chamber which receives fuel from said inner ports of said block when the plunger ascends, the fuel being discharged from said chamber through said inner ports of said block, through said annular groove and ports of said ring, and through said fuel spray means of said cap when said plunger descends.

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