Feb. 24, 1942. S. F. LEMANSKI 2,274,241

INJECTOR FOR INTERNAL COMBUSTION ENGINES

Filed July 15, 1940 2 Sheets-Sheet 1

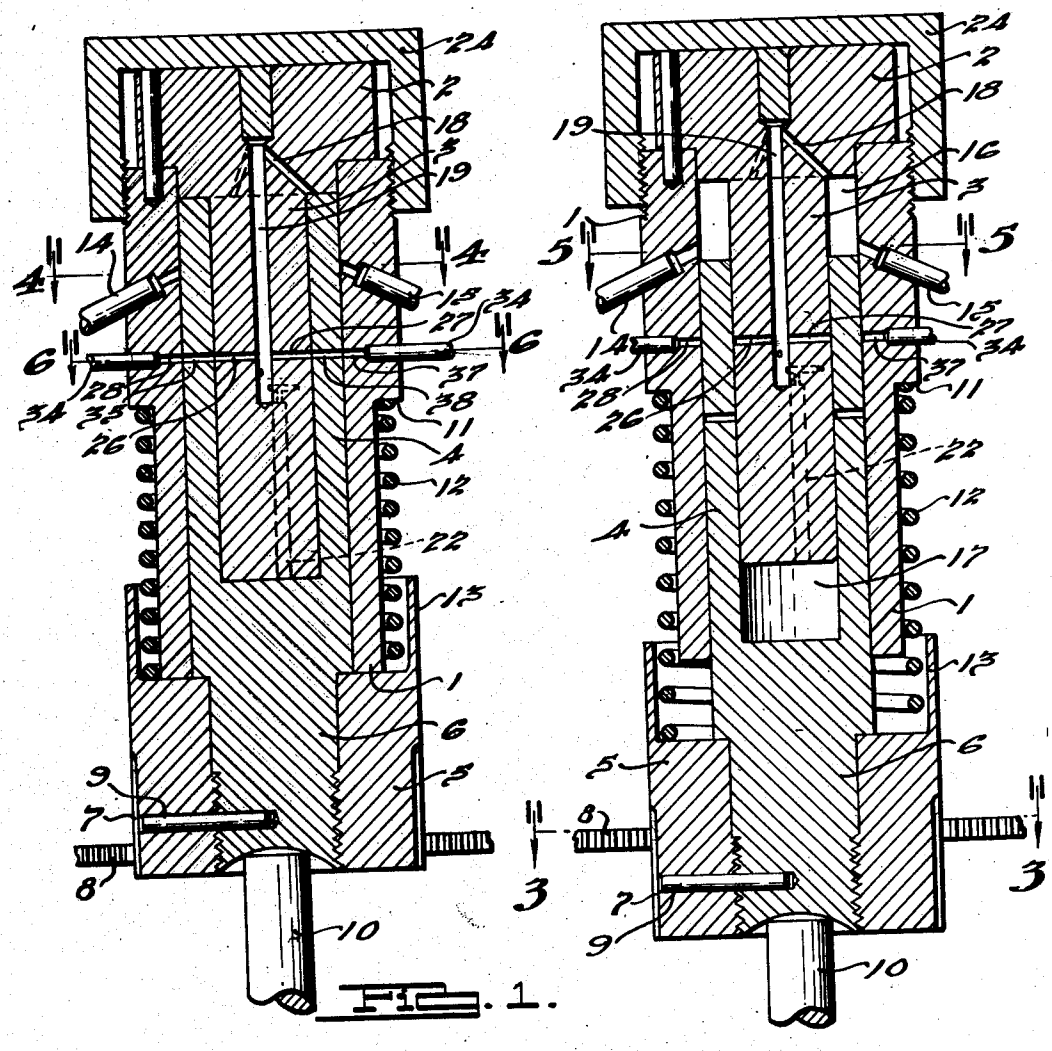


FIG. 1.

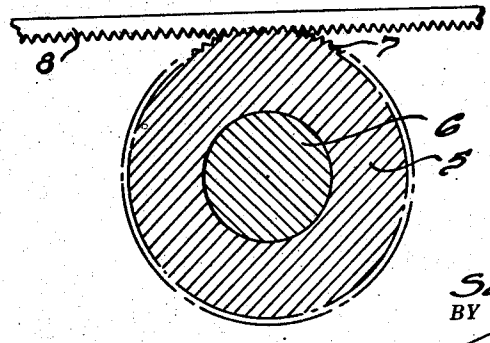


FIG. 3.



FIG. 2.

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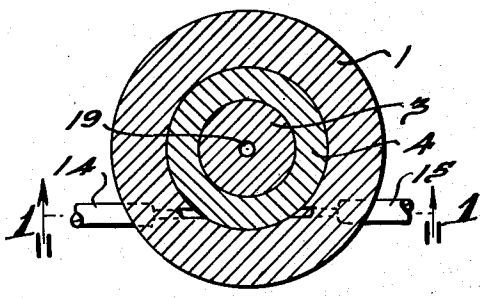


FIG. 4.

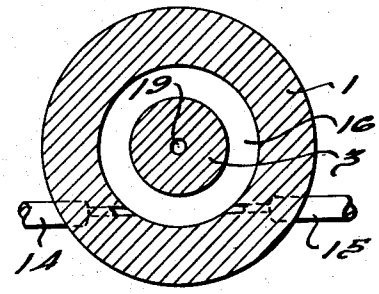


FIG. 5.

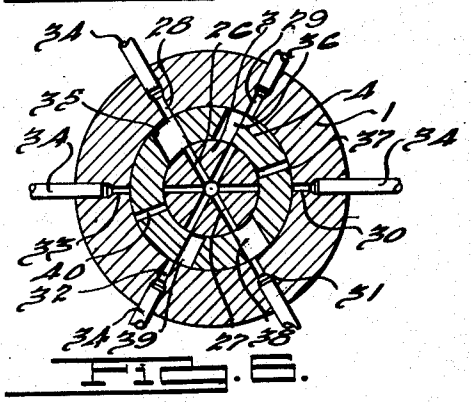


FIG. 6.

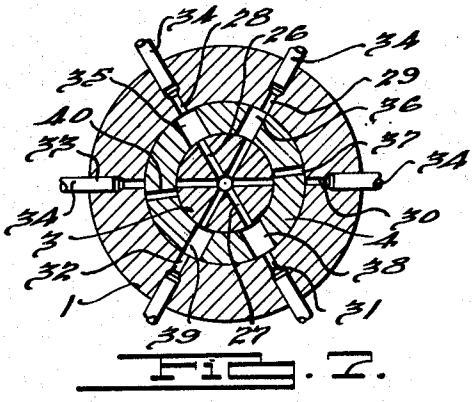


FIG. 7.

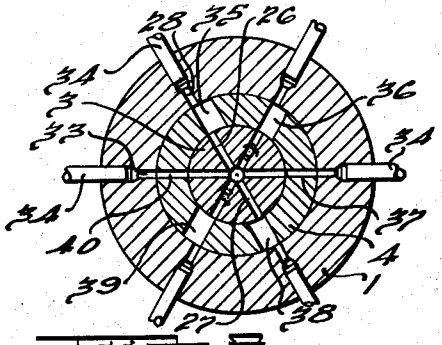


FIG. 8.

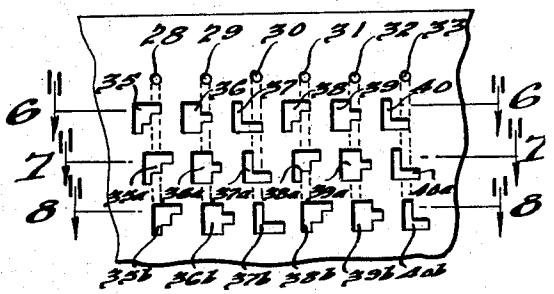


FIG. 10.

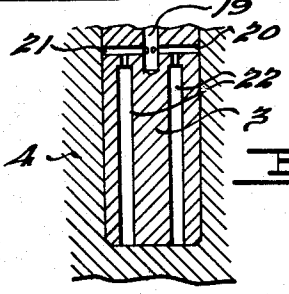


FIG. 9.

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Patented Feb. 24, 1942 2,274,241

UNITED STATES PATENT OFFICE

2,274,241

INJECTOR FOR INTERNAL COMBUSTION ENGINES

Savarian F. Lemanski, Detroit, Mich.

Application July 15, 1940, Serial No. 345,631

3 Claims. (Cl. 103—2)

This invention relates to injectors for internal combustion engines and the object of the invention is to provide an injector arranged to inject an air and fuel mixture into an internal combustion engine at comparatively high pressures.

One of the particular objects of the invention is to provide an injector of simple construction having a single moving part for compressing the fuel mixture.

Another object of the invention is to provide an injector for an internal combustion engine in which the fuel mixture for each cylinder is injected from several jets.

A further object of the invention is to provide an injector having a moving sleeve and providing an arrangement whereby the fuel and air mixture is compressed at two different points.

A further object of the invention is to provide an injector including a sleeve which is turnable and provided with ports arranged to open the discharge apertures two at a time, four at a time or six at a time.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the occompanying drawings in which—

Fig. 1 is a section through a fuel injector at the completion of its stroke taken on approximately line 1—1 of Fig. 4.

Fig. 2 is a similar section showing the sleeve at the beginning of its stroke.

Fig. 3 is a section taken on line 3—3 of Fig. 2.

Fig. 4 is a section taken on line 4—4 of Fig. 1.

Fig. 5 is a section taken on line 5—5 of Fig. 2.

Fig. 6 is a section taken on line 6—6 of Fig. 1 and Fig. 10.

Fig. 7 is a section similar to Fig. 6 taken on line 7—7 of Fig. 10 showing the sleeve advanced one step.

Fig. 8 is a similar section taken on line 8—8 of Fig. 10 showing the sleeve advanced two steps from Fig. 6.

Fig. 9 is a section taken on line 9—9 of Fig. 8.

Fig. 10 is a developed view of the apertures in the sleeve in relation to the ports in the body.

As shown in Figs. 1 and 2, the device comprises a cylindrical body 1 into which a piston member 2 is fitted. This piston member is held in place in the body by the cap 24 threaded onto the end of the body and holding the member 2 in place. This piston member 2 is provided with an extension 3 extending centrally of the bore in the cylindrical body 1. A reciprocating sleeve 4 is provided which fits between the portion 3 and the body 1 and which may move longitudinally of the body 1 as shown in Figs. 1 and 2. At the lower end, a member 5 is threaded onto the end 6 of the sleeve 4 and this nut is provided with a series of teeth 7 into which a rack 8 meshes as shown in Fig. 3. These notches or teeth 7 are cut longitudinally of the exterior of the nut throughout its circumference to allow the member 5 to move up or down in relation to the toothed rack 8. This nut member 5 is secured to the end 6 of the sleeve by the pin 9 so that the member 5 and end 6 are secured together as a unit. The lower end of the sleeve portion 6 is concave in form to receive the upper end of the push rod 10.

The body member 1 is provided with a shoulder 11 and a spring 12 is positioned about the body 1 between the shoulder 11 and the nut member 5. This spring tends to move the nut member 5 and sleeve 4 downwardly as shown in Fig. 2 while the said sleeve may be moved upwardly against the tension of the spring by the push rod 10 shown in Fig. 1. The nut member 5 is provided with an extending flange 13 which partially encloses the lower end of the spring 12 and the body 1 is preferably secured in stationary position, such as by means of a bracket attaching it to the side of the engine with which it is used. At the upper end, the cylindrical body 1 is provided with a pair of inlet conduits 14 and 15. These conduits open into the compression chamber 16 at a tangent as shown in Fig. 5 and in angular opposed relation so that as the sleeve moves downwardly to open the ports in these conduits the jets of liquid fuel and air mixture impinge against each other and produce thorough mixture and turbulence in the compression chamber 16. These ports from the conduits 14 and 15 are opened when the sleeve 4 reaches approximately the bottom of its stroke. As the sleeve 4 moves downwardly the compression chamber 17 shown at the lower end of Fig. 2 is enlarged producing a suction in this compression chamber and drawing the fuel mixture from the compression chamber 16 through the three conduits 18 in the member 2 into the conduit 19 of the extension 3 as will be understood from Fig. 2 and thence through the conduits 20 and 21 shown in Fig. 8 and through the conduits 22 to the chamber 17. As the sleeve again moves upwardly it first closes off the inlet ports 14 and 15 and then begins compression of the fuel and air mixture in the chambers 16 and 17.

As the sleeve 4 returns to the position shown in Fig. 1 the apertures 37 and 40 in the sleeve register with the ports 26 and 27 in the member 3 which communicate with the vertical conduit 19 and the apertures 37 and 40 also register at this time with the outlet ports 28 and 31 in the body 1 as shown in Figs. 1, 6 and 10. The ports in the cylindrical body are provided with outlet conduits or tubes 34 shown in Figs. 1 and 6 which lead to the cylinder of an internal combustion engine to discharge the fuel mixture into the compression chamber. All six of the conduits from the injector lead to a single cylinder (not here shown) and the sleeve 4 with its apertures provides a means for allowing flow through the different conduits 34 into the cylinder. In the position shown in Fig. 6 the radially arranged ports 28 and 31 of the cylindrical body are connected to the radially arranged ports 26 and 27 of the central member 3 by the intervening apertures 37 and 40 in the sleeve 4.

Fig. 10 is a diagrammatic view of the apertures in the sleeve in relation to the ports through which the fuel and air mixture passes to the engine. The ports in the body 1 are represented at the top of Fig. 10 and are numbered 28, 29, 30, 31, 32 and 33. These ports remain stationary while the sleeve is moved vertically to bring the apertures in the sleeve into alignment with these ports. The six apertures in the sleeve are numbered 35, 36, 37, 38, 39 and 40. It will be noted that the apertures 35 and 38 are alike while the apertures 36 and 39 are alike and the apertures 37 and 40 are alike. This top row of apertures in the sleeve is moved upwardly to uncover the ports. As the top row of apertures shown in Fig. 10 is moved upwardly, the apertures 35 and 38 first uncover the ports 28 and 31 allowing the fuel and air mixture to pass through these ports.

As this upward movement is continued, the ports 36 and 39 uncover the ports 29 and 32 and at this point the apertures 35 and 38 have moved beyond their ports so that the flow at this interval is only through the ports 29 and 32. As the sleeve is further moved upwardly the ports 29 and 32 are closed and the ends of the apertures 37 and 40 uncover the ports 30 and 33. It will thus be seen that as the sleeve is moved upwardly two ports are opened and closed at a time until all six ports have been opened in successive pairs. The ports in the sleeve are really duplicates in that the last three ports 38, 39 and 40 are duplicates of the ports 35, 36 and 37.

In the next position it is desired to open four ports at a time instead of two ports at a time. This is accomplished by the ratchet and tooth arrangement shown in Fig. 3 by which the member 5 is turned to turn the sleeve. This advancement of the sleeve advances the ports circumferentially so that the ports take the positions 35*a*, 36*a*, 37*a*, 38*a*, 39*a* and 40*a* shown in the second horizontal row in Fig. 10. In this position, as the sleeve is moved upwardly this second horizontal row of ports is so arranged that the apertures 35*a* and 36*a* uncover the ports 28 and 29 and at the same time the apertures 38*a* and 39*a* uncover the ports 31 and 32. This opens four ports at the same instant and these four ports remain open for two intervals while in the last position as the bottoms of the apertures uncover the ports, the ports 28 and 31 are closed off while the ports 36*a*, 37*a*, 39*a* and 40*a* are open which opens all of the ports but at any instant there are only four ports open.

In the last stage it is desired to open all six of the ports for the full period. This is accomplished by advancing the ratchet arrangement to turn the sleeve and further advance the apertures as shown in the lower horizontal row of apertures in Fig. 10. In this position illustrated by the apertures 35*b*, 36*b*, 37*b*, 38*b*, 39*b* and 40*b* the longest portion of each aperture is in alignment with the ports as illustrated by the vertical dotted lines in Fig. 10. It will be noted in this position that as the sleeve is advanced upwardly all six ports are opened at the same time and remain open for the same length of period which is three times as long a period as the ports are opened by the apertures in the position in the top horizontal line shown in Fig. 10. By this arrangement, the amount of fuel discharged from the injector may be controlled from a position where the ports are opened successively to a position where all of the ports are opened together and for a like period. In the top position the ports are opened successively two by two. In the second horizontal position four ports are opened at a time and in the last position all six ports are opened for the full period.

It is also possible to advance the time of injection by elongating any of the sleeve apertures vertically or to advance the position of the apertures by elongating any of the apertures horizontally or circumferentially of the sleeve.

Another possibility is to use a short stem by eliminating the stem 3 and allowing the sleeve member to act as a piston, in which case, only a single compression chamber would be provided and as this compression chamber is circular in form the inlet jets could discharge into the center of the compression chamber thus formed.

In order to heat the fuel and air mixture before combustion takes place, the inlet or discharge tubes may be encased in a resistance wire wound about the said tubes which will heat the tubes and mixture passing therethrough to increase the speed of combustion. Also, with this construction, different fuels with a wide range of viscosity may be handled without any adjustment of the parts of the injector.

From the foregoing description it becomes evident that the device is very simple and efficient in operation, provides a means for injecting a fuel and air mixture in different stages and provides a device which accomplishes the objects described.

Having thus fully described my invention, its utility and mode of operation, what I claim and desire to secure by Letters Patent of the United States is:

1. In an injector for internal combustion engines, a housing, a piston fixedly mounted in the housing and spaced from the wall thereof, a sleeve movable into the housing and fitting over the piston to provide compression chambers, inlet ports in the housing in communication with one of said chambers, means for moving the sleeve into the housing, the piston being provided with fuel intake and discharge channels and fuel discharge ports in communication with the compression chambers and the sleeve being provided with a multiplicity of discharge ports arranged to align with the piston ports as the sleeve is moved inwardly, means for turning the sleeve to bring a greater or smaller port area into alignment with the piston ports during inward movement of the sleeve, the housing being provided with a pair of discharge ports in fixed alignment with the piston ports and arranged to allow flow of fuel mixture from the piston ports

through the sleeve ports to the discharge ports of the housing.

2. In an injector for internal combustion engines, a housing, said housing being provided with inlet and discharge ports, a piston within the housing and maintained in stationary relation with the housing, a sleeve slidably mounted in the housing and fitting over the piston, the piston being provided with fuel intake and discharge channels and fuel discharge ports, means for moving the sleeve in one direction, a spring tending to move the sleeve in the opposite direction and the movement of the sleeve into the housing placing the fuel therein under pressure, a multiplicity of ports in the sleeve arranged to align with ports in the piston as the sleeve is moved inwardly and means for turning the sleeve to bring two or more ports into simultaneous registration with the ports of the piston as the sleeve is moved inwardly.

3. In an injector for internal combustion engines, a housing, a piston fixedly mounted in the housing, and having fuel intake and discharge channels, a sleeve movable into the housing and fitting over the piston to provide compression chambers, inlet ports in the housing in communication with one of said chambers, means for moving the sleeve into the housing, the piston being provided with fuel discharge ports for said fuel discharge channels and the sleeve being provided with a multiplicity of ports arranged to align with the said piston ports as the sleeve is moved inwardly, means for turning the sleeve to bring a greater or smaller port area into alignment with the piston ports during inward movement of the sleeve and a spring tending to move the sleeve out of the housing.

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