Dec. 19, 1950 H. HOGEMAN 2,534,553

FUEL INJECTION APPARATUS

Filed Nov. 13, 1948 2 Sheets-Sheet 1

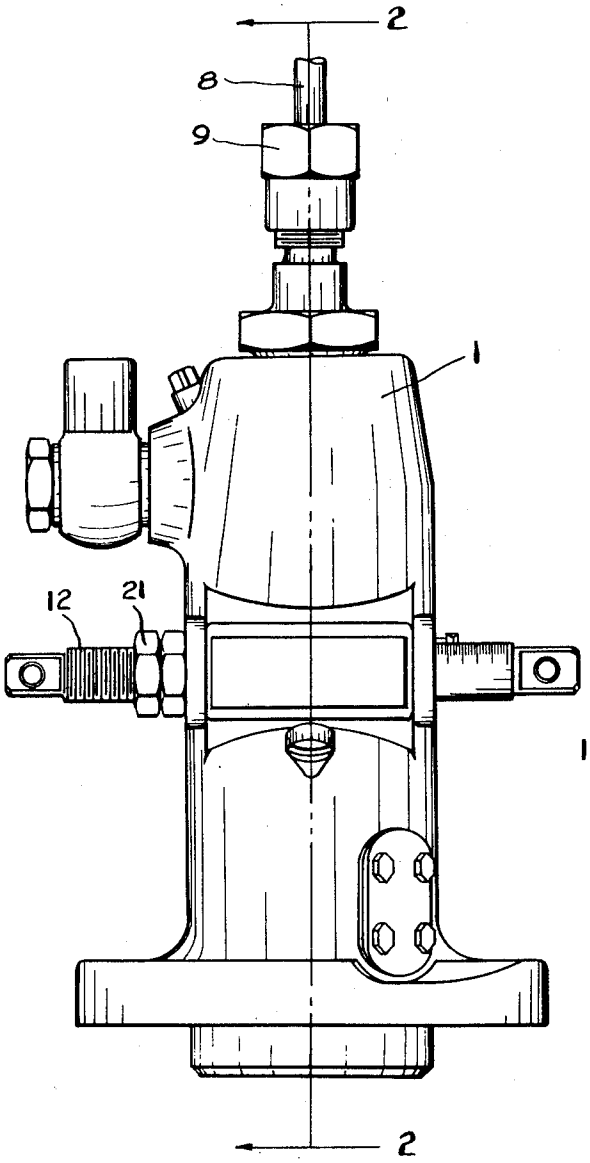



Fig. 1.

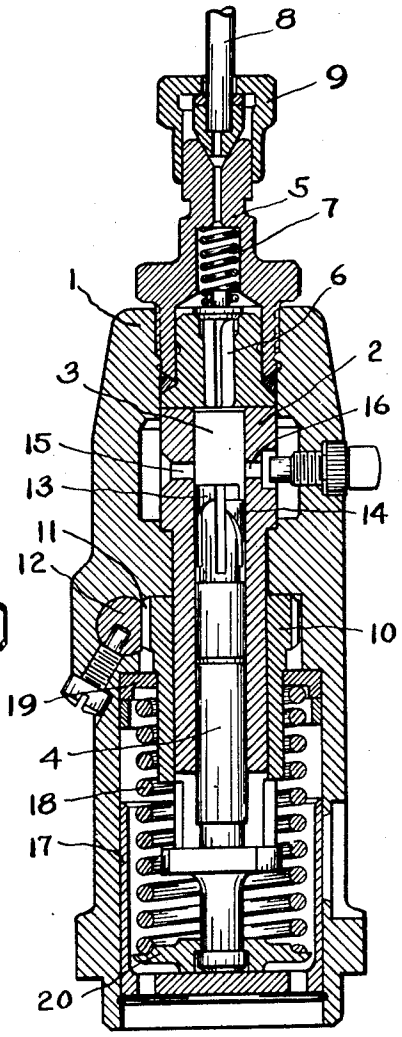



Fig. 2.

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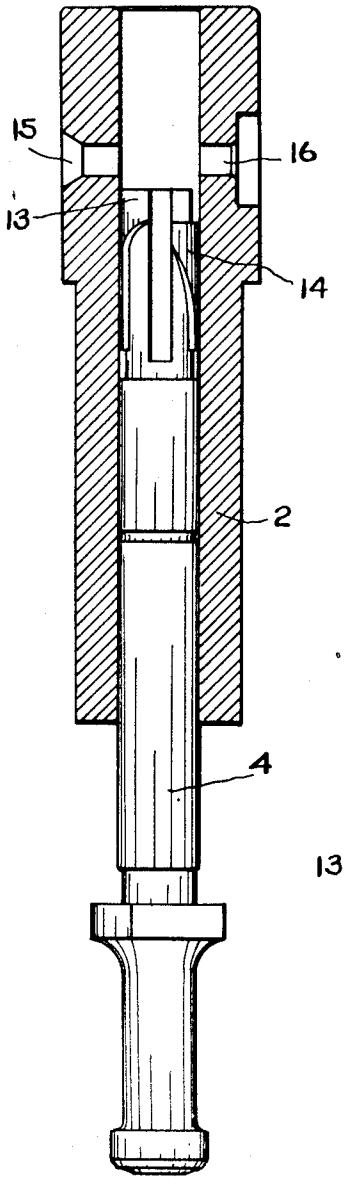



Fig. 3.

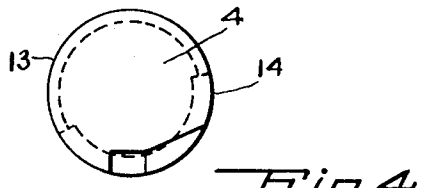



Fig. 4.

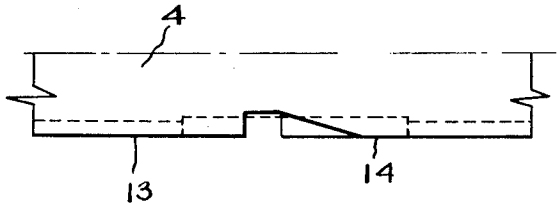



Fig. 6.

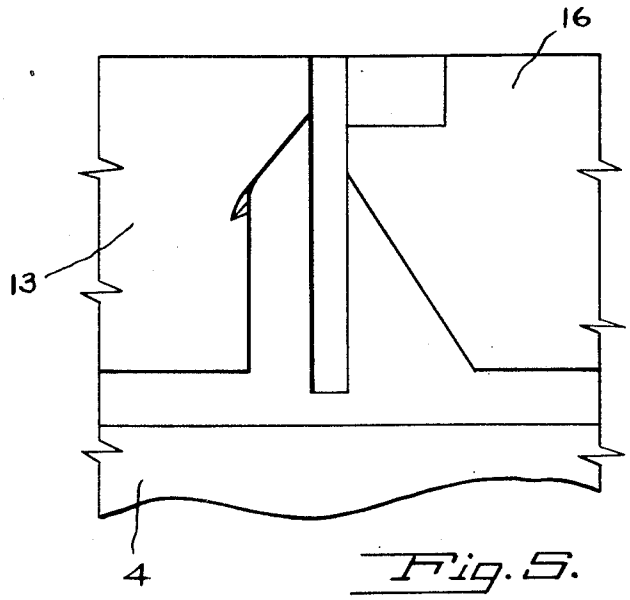



Fig. 5.

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# UNITED STATES PATENT OFFICE

2,534,553

## FUEL INJECTION APPARATUS

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Application November 13, 1948, Serial No. 59,857

3 Claims. (Cl. 103—41)

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This invention relates to fuel injection apparatus and has particular reference to such apparatus adapted for use on an engine using various types of fuels.

An object of the invention is to provide fuel injection apparatus which is capable of use on an engine utilizing a multiplicity of fuels.

Another object of the invention is to provide a fuel injection pump which is adapted for providing injection adapted to the particular fuel utilized in the engine.

Another object of the invention is to provide a new and improved plunger for a fuel injection pump, which plunger is adapted to be adjusted to suit the injection characteristics required for engines utilizing various fuels.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings. It will be understood that changes may be made in the details of construction and arrangement of parts shown and described, as the preferred form has been given by way of illustration only.

Referring to the drawings:

Fig. 1 is a side view of a fuel injection pump embodying the invention;

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

Fig. 3 is a sectional view on an enlarged scale of the plunger and barrel mechanism of the pump;

Fig. 4 is a top or plan view of the plunger shown in Fig. 3;

Fig. 5 is a development of the metering portion of the plunger shown in Figs. 2, 3 and 4; and

Fig. 6 is a top or plan view of the development of the plunger shown in Fig. 5.

With certain types of internal combustion engines it is desirable to have fuel injection equipment which may be easily and quickly adapted for the injection of various types of fuels. For example, in many places natural gas is available during certain parts of the year and at those times it is desirable to operate such engines with such natural gas as a fuel, but with the use of small quantities of fuel oil for pilot injection as the fuel oil may be ignited by compression which is not the case with the natural gas. Also, at certain times the supply of natural gas is not available and at such times it is desirable that the fuel injection equipment be easily and quickly adaptable to inject only fuel oil into the combustion chamber of the engine for operation of the engine only on said fuel.

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It is, therefore, the principal object of this invention to provide fuel injection apparatus which may be easily and quickly adapted for injection of pilot quantities of fuel where the engine is to be operated on natural gas or other similar fuel and which may be easily and quickly adapted for injection of the usual fuel oil quantities where the engine is to be run on such fuel oil and which injection apparatus, in addition to being easily and quickly adaptable for either form of injection, is also relatively simple and economical in construction yet efficient in operation.

Referring more particularly to the drawings wherein similar reference characters designate corresponding parts throughout the several views, the fuel injection apparatus shown embodying the invention comprises the pump housing 1 having the barrel 2 with the bore 3 in which is mounted the pumping plunger 4.

Secured to the pump housing 1 in alignment with the barrel 2 is the delivery valve holder 5 adapted to contain the delivery valve 6 and the delivery valve operating spring 7 and said delivery valve holder 5 is adapted to be connected to a fuel outlet 8 by the coupling 9.

Surrounding the lower portion of the barrel 2 is the control sleeve 10 which has a toothed portion 11 in engagement with a corresponding toothed portion on the control rack 12 whereupon adjustment of the control rack 12 will adjust the relative positions of the helices 13 and 14 on the plunger 4 relative to the fill opening 15 and fill and spill opening 16 in the barrel 2.

The pump is provided with the usual slidable plunger guide 17 which contains the coil spring 18 having its opposite ends on the spring seats 19 and 20 in the usual manner.

The plunger 4 is provided with the helices 13 and 14 as stated above, the helix 13 being adapted for use where the fuel injection apparatus is used for injecting a pilot quantity of fuel oil where the main fuel employed is a fuel such as natural gas. As described above, this pilot quantity of fuel is employed in order to ignite the natural gas as the fuel oil is ignitable by compression, whereas the natural gas is not, and thus the igniting of the pilot quantity of fuel oil serves to ignite the charge of natural gas. In such cases separate apparatus is employed for injecting a desired quantity of natural gas into the combustion chamber and the fuel injection pump shown serves only to inject the pilot quantity of fuel oil. To adapt the plunger 4 for pilot injection of fuel oil, the control rack 12 is moved

which causes movement or rotation of the plunger 4 to desired position. The lock nut 21 on the control rack 12 may be so positioned as to allow quick adjustment of the control rack to desired position for desired pilot quantity injection.

When the supply of natural gas is insufficient or for some other reason it is desired to operate the engine on fuel oil, the control rack 12 is moved in the opposite direction to such position that the fuel oil delivery is sufficient to supplement or replace the natural gas in which case the helix 14 on the plunger 4 is employed.

The helices 13 and 14 cooperate with the fill and spill opening 16 in the usual manner.

It will be noted that the helices 13 and 14 are on opposite sides of a bypass opening or groove and are located at different levels on the plunger 4, that is, the helix 14 is positioned at a distance from the upper surface of the plunger. It has been found that by so positioning the helix 14, that good engine operation may be obtained when the engine is operated with natural gas and pilot injection, that is, the ignition delay requires an advance in timing of the pilot fuel oil quantity.

In Fig. 4 is shown a top view of the plunger and in Fig. 5 is shown a development of the helices 13 and 14 and Fig. 6 shows a top view thereof.

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

Having described my invention, I claim:

1. In a device of the character described, a pump housing having a bore therein, a plunger mounted in said bore for reciprocation therein, fill and spill means communicating with said bore, said plunger having fuel metering means on the opposite sides thereof and means whereby either of said fuel metering means may be positioned in operative position relative to said fill and spill means, said fuel metering means being located at different levels on said plunger.



2. In a device of the character described, a pump housing having a bore therein, a plunger mounted in said bore for reciprocation therein, fill and spill means communicating with said bore, said plunger having fuel metering means on the opposite sides thereof and means whereby either of said fuel metering means may be positioned in operative position relative to said fill and spill means, said fuel metering means being located at different distances relative to the upper edge of said plunger.

3. In a device of the character described, a pump housing having a bore therein, a plunger mounted in said bore for reciprocation therein, fill and spill means communicating with said bore, said plunger having fuel metering means on the opposite sides thereof and means whereby either of said fuel metering means may be positioned in operative position relative to said fill and spill means, said plunger being adapted to be easily and quickly adjusted whereby either of said fuel metering means may be adjusted to operative position relative to said fill and spill means and said fuel metering means being so positioned on said plunger as to control the timing of the injection of fuel quantities by said pump.

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