

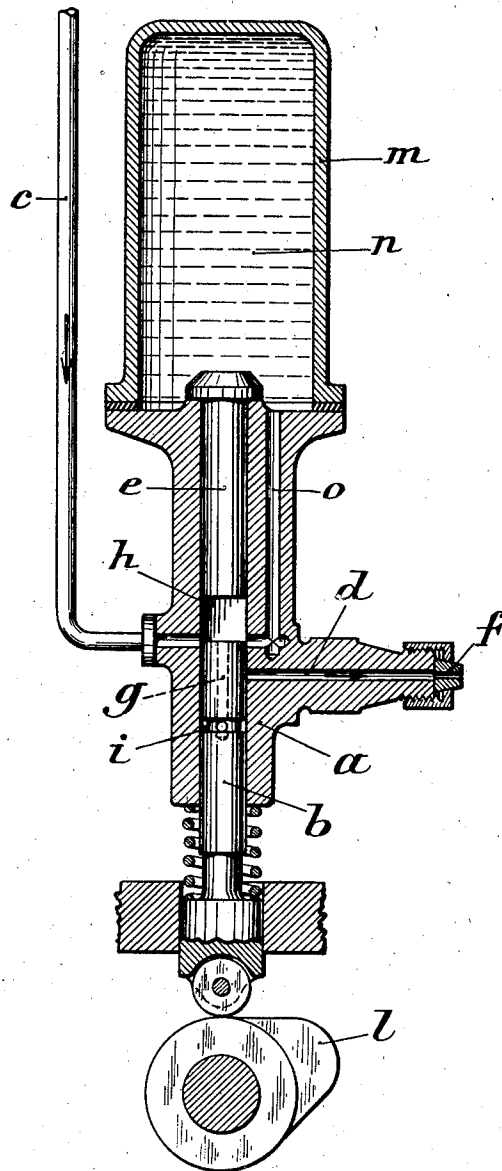
Aug. 13, 1935.

H. STEINER

2,011,165

FUEL INJECTION PUMP FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 12, 1932



INVENTOR:
Hans Steiner
BY
Clemens Davis Martin & Edmonds
ATTORNEY.

UNITED STATES PATENT OFFICE

2,011,165

FUEL INJECTION PUMP FOR INTERNAL COMBUSTION ENGINES

Hans Steiner, Winterthur, Switzerland, assignor
to the firm Sulzer Freres Societe Anonyme
Winterthur, Switzerland

Application August 12, 1932, Serial No. 628,472
In Switzerland August 17, 1931

5 Claims. (Cl. 103—154)

This invention relates to fuel injection pumps for solid or airless injection of fuel in internal combustion engines and of the kind in which injection of the fuel charge is effected by a fuel accumulator forming part of the pump.

This application is a companion of Serial No. 628,471 and Serial No. 628,473, by the same applicant.

In fuel pumps of this type fuel pressures of the nature of several hundred atmospheres have frequently to be dealt with by the accumulator so that when the accumulator piston is loaded by a metal spring this spring has necessarily to be heavy. As a result when the injection port is opened oscillations of the accumulator piston are intensified due to the mass of the spring and the present invention has for its object to overcome this disadvantage.

To this end according to the present invention the accumulator piston is hydraulically loaded so that its movement which injects the fuel takes place as a result of the expansion of the loading liquid. In this way oscillations of the accumulator piston due to the vibrations of a heavy metallic loading spring are obviated.

Preferably the fuel is employed as the loading liquid.

One construction of fuel injection pump according to the present invention is illustrated by way of example in the accompanying drawing. In the construction illustrated the injection pump comprises a cylinder *a* containing a plunger *b* which is reciprocated so as to draw fuel from a supply pipe *c* and deliver the charge through a fuel injection pipe *d* as hereinafter described.

Cooperating with the plunger *b* is an accumulator piston *e* which is hydraulically loaded by a portion *n* of the liquid fuel on which the engine operates, this loading liquid being contained within a chamber *m*. The plunger *b* is moved on its suction stroke by a spring and when the plunger *b* approaches the end of its suction stroke, as shown in the drawing, the plunger partially uncovers the inlet end of the supply pipe *c* so that fuel enters the working chamber *h* of the pump whereupon the plunger *b* moves forward on its compression stroke. As the plunger *b* advances on its compression stroke the inlet end of the supply pipe *c* is closed so that pressure is applied to the fuel charge within the working chamber *h* whereby the accumulator piston *e* moves into the chamber *m* thereby compressing the fuel *n*.

Towards the end of the compression stroke of the plunger *b* a recess *i* therein registers with the injection conduit *d* whereupon the accumu-

lator piston *e* is moved inwards by the expansion of the fuel *n*.

In this way the fuel charge within the working chamber *h* is injected through an axial bore *g* in the plunger *b* to the injection conduit *d* and thence by the nozzle *f* into the working chamber of the engine cylinder. The interior of the chamber *m* communicates with the working chamber *h* through a conduit *o* so that the plunger *b* will, at the beginning of each compression stroke, tend to feed liquid fuel through the conduit *o* to the chamber *m* and thereby make up for any leakage from the container.

It will therefore be seen that in a fuel injection pump embodying the invention oscillation of the accumulator piston due to the sudden closing or opening of the suction and delivery ports of the pump is reduced to a minimum since there is no metallic loading spring of large mass which tends to vibrate and thereby impart oscillation to the accumulator piston.

It will be appreciated that instead of the accumulator piston being loaded by a part of the liquid fuel upon which the engine operates the piston may be loaded by any other suitable liquid, the dimensions of the container for the loading liquid being determined in accordance with the compressibility of the liquid employed.

I claim:

1. In a fuel injection pump for internal combustion engines, a cylinder having a working chamber, a plunger reciprocable in said cylinder, a fuel inlet to the working chamber, a fuel outlet from the working chamber, the passage of fuel through the fuel inlet and the fuel outlet being controlled by said plunger, an accumulator piston also reciprocable in said cylinder, a closed fluid chamber having a volume many times as great as the volumetric displacement of the accumulator piston, said chamber being substantially completely filled with a liquid, and means for causing a displacement of liquid in said chamber on an outward movement of the accumulator piston, whereby said liquid forms an hydraulic spring for loading the accumulator piston.

2. In a fuel injection pump for internal combustion engines, a cylinder having a working chamber, a plunger reciprocable in said cylinder, a fuel inlet to the working chamber, a fuel outlet from the working chamber, the passage of fuel through the fuel inlet and the fuel outlet being controlled by said plunger, an accumulator piston also reciprocable in said cylinder, a closed fluid chamber having a volume many times as great as the volumetric displacement of the ac-

accumulator piston, said chamber being substantially completely filled with a liquid, means for causing a displacement of liquid in said chamber on an outward movement of the accumulator piston, whereby said liquid forms an hydraulic spring for loading the accumulator piston, and a connection between the working chamber and the fluid chamber, said connection being closed by the plunger at the beginning of the compression stroke.

3. In a fuel injection pump for internal combustion engines, a cylinder having a working chamber, a plunger reciprocable in said cylinder, a fuel inlet, a fuel outlet, said plunger having a passage therethrough through which fuel may pass from the working chamber to the fuel outlet when the plunger is in a predetermined position, an accumulator piston also reciprocable in said cylinder, a closed fluid chamber having a volume many times as great as the volumetric displacement of the accumulator piston, said chamber being substantially completely filled with a liquid, and means for causing a displacement of liquid in said chamber on an outward movement of the accumulator piston, whereby said liquid forms an hydraulic spring for loading the accumulator piston.

4. In a fuel injection pump, a cylinder having a working chamber, a plunger reciprocable in said cylinder, a fuel inlet to the working chamber, a

fuel outlet from the working chamber, an accumulator piston responsive to pressure in said working chamber, and a closed fluid chamber having a volume many times as great as the volumetric displacement of the accumulator piston, said chamber being substantially completely filled with a liquid, said accumulator piston causing a displacement of liquid in said chamber on movement of the accumulator piston under influence of pressure in the working chamber, whereby said liquid forms an hydraulic spring for loading the accumulator piston.

5. In a fuel injection pump, a cylinder having a working chamber, a plunger reciprocable in said cylinder, a fuel inlet to the working chamber, a fuel outlet from the working chamber, the passage of fuel through the fuel inlet and fuel outlet being controlled by said plunger, an accumulator piston responsive to pressure in said working chamber, and a closed fluid chamber having a volume many times as great as the volumetric displacement of the accumulator piston, said chamber being substantially completely filled with a liquid, said accumulator piston causing a displacement of liquid in said chamber on movement of the accumulator piston under influence of pressure in the working chamber, whereby said liquid forms an hydraulic spring for loading the accumulator piston.

HANS STEINER.