

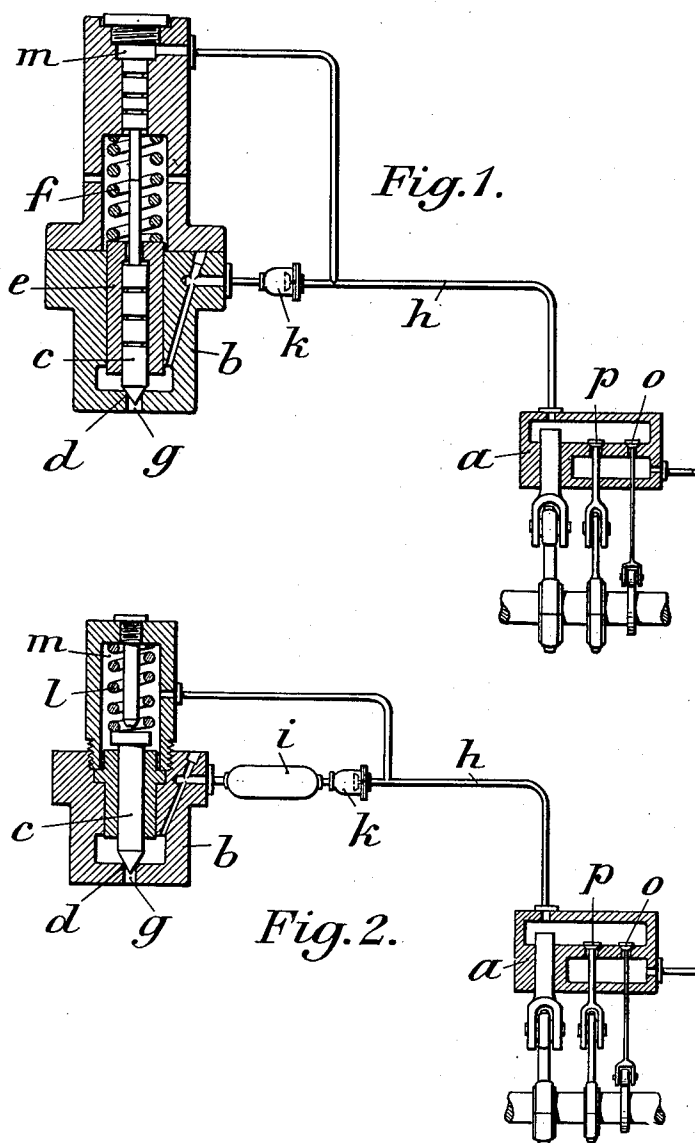
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CONTROL OF FUEL INJECTION MECHANISM FOR INTERNAL COMBUSTION ENGINES

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CONTROL OF FUEL-INJECTION MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

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This invention relates to the control of fuel injection mechanism for internal combustion engines employing airless injection and in particular to apparatus of the kind in which the fuel is accumulated under pressure in a container of which the outlet valve is held in a closed position until the moment when injection is to take place, when it is opened by the action of the fuel itself.

Hitherto, this valve has been held or locked in its closed position by mechanism which has usually been mounted upon the cylinder cover, and the object of this invention is to obviate the need for such mechanical control and to enable the valve controlling means to be disposed at a convenient position on the engine or general installation.

To this end, according to this invention, the fuel outlet valve is locked or maintained in a closed position by means of liquid under pressure, and a portion of the liquid fuel supplied by the pump may be employed for this purpose. In such cases that portion of the fuel which constitutes the liquid fuel charge is supplied to the reservoir or container through a non-return valve and the fuel which holds the valve in its closed position is delivered directly to an operating piston or its equivalent the pressure on which is reduced as by the opening of a relief valve—for example in the pressure chamber of the fuel pump—at the moment when the fuel injection valve is to be opened or released.

Two ways of carrying the invention into practice are diagrammatically illustrated in the accompanying drawings, in which—

Figure 1 shows an arrangement with a fuel accumulating chamber surrounding the fuel injection valve, and

Figure 2 is a modification in which a separate storage or accumulating chamber is provided independently of the housing of the mechanism and in the length of the fuel supply pipe.

In the construction illustrated in Figure 1, the fuel is supplied by the pump *a* to the housing or casing *b* of the fuel injection valve which may be mounted in the head of the internal combustion engine not shown. The injection of fuel takes place in the usual manner through the nozzle *g* when the working piston reaches the required position in its stroke, in the particular example illustrated the sprayer being of the known type

comprising a needle valve *c* having a surface *d* which forms a piston against which the pressure of the fuel accumulated within the casing acts to lift the valve when this valve is released.

The accumulator or storage chamber comprises a piston *e* closely surrounding the needle valve and adapted to be raised by the pressure of the fuel delivered by the pump against the action of the spring *f*.

The fuel injection valve *c* is normally locked in its closed position by the pressure of liquid in a cylinder *m* which contains a piston formed on or connected to the fuel valve *c*. Liquid fuel is directly delivered to the pressure cylinder *m* through the fuel supply pipe *h* from the pump *a*, fuel to the accumulator or fuel storage chamber being delivered through the same pipe but only after passing through a non-return valve *k*.

When fuel is to be admitted into the working cylinder the pressure normally maintaining the needle valve *c* on its seating is released by opening the valve *c* in the pump pressure chamber which reduces or neutralizes the pressure in the cylinder *m* and thus enables the accumulated fuel to lift the needle valve *c*. The quantity of the fuel charge can be regulated in the known manner by altering the timing of the pump suction valve *p*.

The construction illustrated in Figure 2 differs from that illustrated in Figure 1 in that instead of the accumulator or storage chamber for the charge immediately surrounding the needle valve a separate container is arranged in the length of the fuel supply pipe *h*. The storage capacity of this container is determined partly by the elasticity of its walls and partly by the extent to which the fuel itself can be compressed at very high pressures.

The operation of the arrangement shown in Figure 1 is as follows. When the fuel is to be injected into the working cylinder the relief valve *o* in the pressure chamber of the pump is open, thus reducing the pressure which was maintaining the needle valve *c* upon its seat. As a result the liquid fuel which had accumulated around the needle valve and which has already caused the piston *e* to rise against the action of the spring, in the known manner, acts upon the surface *d* of the valve to raise this valve from its seating, whereupon the piston *e* under the

influence of the spring *f* injects a charge of fuel into the working cylinder, the non-return valve *k* preventing any of the charge of oil returning to the pump or flowing into the locking cylinder *m*.

The operation of the construction illustrated in Figure 2 is similar. In that case, however, the spring *l* quickly returns the fuel valve to its seat after allowing the injection of the fuel into the working cylinder as the accumulator chamber *i* is not formed within the injector housing as in the previous construction.

It will be understood that fuel valves of internal combustion engines of the kind described can be remotely controlled in accordance with the present invention and that instead of the locking device being incorporated with the fuel valve as shown the control may be exercised at any point between the pump and the fuel injection valve.

I claim:

1. A liquid fuel injection system comprising an injection valve, a source of liquid fuel under pressure, means for supplying liquid fuel from said source to one end of said valve to maintain it in normally closed position, means for supplying liquid fuel from said source to the other end of said valve, and means for reducing at a predetermined instant the pressure of the liquid supplied to said first named end, whereby said valve is

opened and the liquid fuel supplied to said second named end is discharged therefrom.

2. In a liquid fuel injection system an injection valve comprising a casing, a valve body therein movable to an open and to a closed position, means for supplying liquid fuel under pressure to one end of said valve body to maintain it in normally closed position, and means for supplying liquid fuel under the same pressure to the other end of said valve, whereby when the pressure of the fluid supplied to said first named end is reduced, said valve body is moved to its open position and the liquid fuel supplied to said second named end is discharged therefrom.

3. A liquid fuel injection system comprising an injection valve, a source of liquid fuel under pressure, means for supplying liquid fuel from said source to one end of said valve to maintain it in normally closed position, means for supplying liquid fuel from said source to the other end of said valve and trapping it therein, and means for reducing at a predetermined instant the pressure of said source, whereby the pressure of the liquid fuel trapped in said last named end overbalances the pressure of the liquid fuel supplied to said first named end and causes the opening of said valve.

In testimony whereof I have affixed my signature.

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