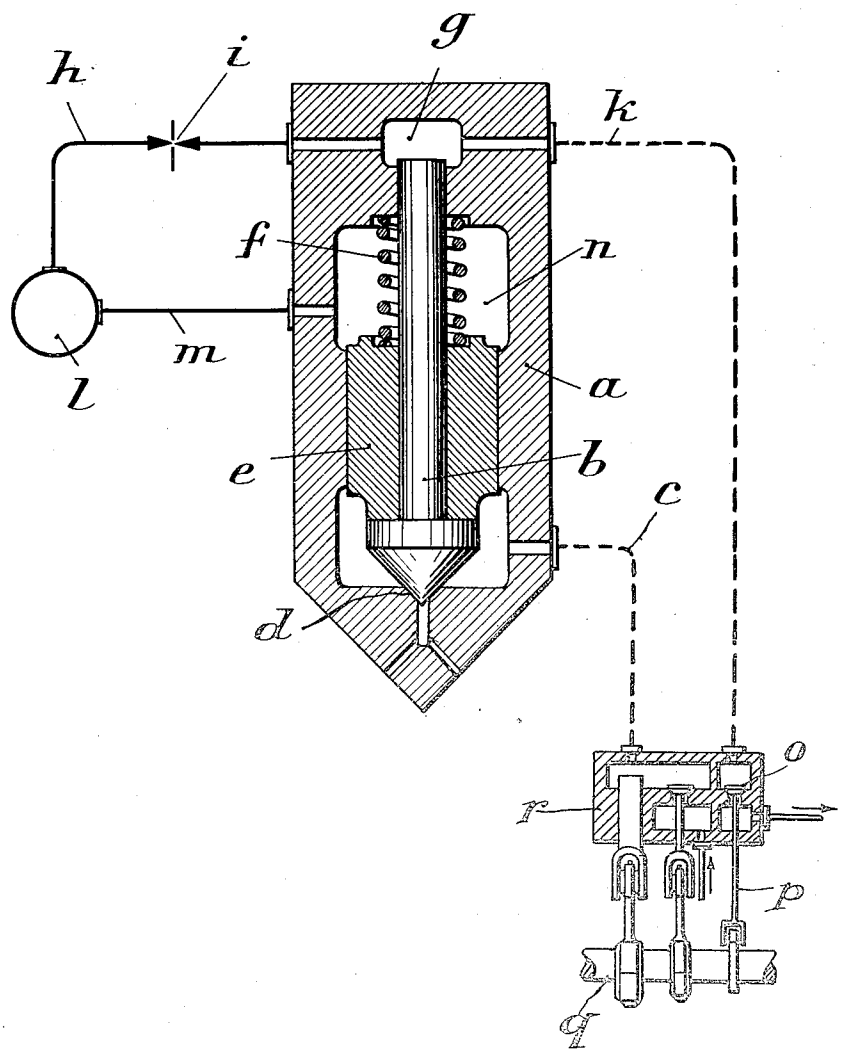
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FUEL INJECTION DEVICE FOR INTERNAL COMBUSTION ENGINES

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INVENTOR:
Eduard von Salis
BY
Pennie Davis Marvin & Edmonds
ATTORNEY.

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EDUARD VON SALIS, OF WINTERTHUR, SWITZERLAND, ASSIGNOR TO THE FIRM SULZER FRÈRES SOCIÉTÉ ANONYME, OF WINTERTHUR, SWITZERLAND

FUEL INJECTION DEVICE FOR INTERNAL COMBUSTION ENGINES

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This invention relates to fuel injection devices for internal combustion engines and in particular to apparatus of the kind in which fuel is accumulated in a charge accumulator having an outlet valve which is held in a closed position until the moment at which injection is to take place when it is opened by the action of the fuel itself.

According to this invention a medium independent of the fuel is supplied under pressure through a throttle valve to a pressure chamber in which it acts on the fuel injection valve so as to maintain the latter in a closed position except when the pressure in this chamber is released by means of an outlet valve or the like. The independent pressure medium in addition to locking the fuel injection valve may be employed to load the annular plunger by which the fuel is injected after the fuel valve has opened.

One construction of apparatus according to this invention is illustrated, somewhat diagrammatically, by way of example in the accompanying drawing, the device shown being that suitable for use with an internal combustion engine in which the fuel is injected at the ignition dead centre position of the engine piston.

The device comprises a valve casing *a* containing an injection valve *b* and supplied with fuel through a pipe *c*. The injection valve *b* is provided at its lower end with a conical head *d* forming a piston against which the pressure of the fuel accumulated within the casing acts to lift the fuel injection valve when this is released.

The charge accumulator or storage chamber comprises an annular piston *e* closely surrounding the injection valve *b* and movable relatively thereto, the annular piston normally resting on a shoulder at the lower end of the injection valve *b*. The annular piston *e* is adapted to be raised against the action of a compression spring *f* by the fuel supplied to the accumulator. The upper end of the injection valve *b* is formed as a piston and this is arranged to project into a pressure chamber *g* provided in the upper part of the casing *a*. The chamber *g* is on one side connected through a throttle valve *i* and pipe *h* to an independent receiver *l* and on the other side through a pipe *k* provided with an outlet controlled by a gear which opens the outlet when fuel injection is to commence. The receiver *l* is supplied with pressure medium independently of the fuel pump a working pressure being constantly maintained in the receiver. Fuel supplied through the pipe *c* passes into the accumulator by lifting the annular piston *e* and compressing the spring *f*. Medium under pressure from the receiver *l* passes through the throttle valve *i* into the chamber *g* and so locks the fuel injection valve *b* on its seat.

Assuming that at this point the engine piston arrives at its ignition dead centre, the control gear opens the outlet pipe *k* and thus releases the pressure in the chamber *g*. The injection valve *b* is now no longer held down on its seat but is free to move upwards and does so under the action of the fuel in the charge accumulator.

The annular piston *e* now descends and injects the fuel in the accumulator into the engine cylinder. At the end of the injection stroke the annular piston *e* reengages the shoulder on the injection valve *b* and thus replaces the latter on its seat, injection being at this point completed.

During the injection stroke the throttle valve *i* will allow a certain quantity of pressure medium to pass from the receiver *l* to the chamber *g* but this quantity will not be appreciable as the control opening at *i* is small as compared with that of the outlet in the pipe *k*.

It will be readily seen that as the chamber *g* is in communication through a throttle valve with a constant supply of medium maintained at working pressure the injection valve can be maintained in its closed position for the desired period, the fuel can be accumulated, and injection can be controlled by a single member disposed, if desired, at a distance from the injection device, this resulting in increased reliability of working.

The receiver *l* is in communicaiton through a pipe *m* with the chamber *n* in the casing *a* which contains the spring *f*. With this ar-

rangement the spring *f* is assisted by the pressure medium in the receiver *l* and the dimensions of the spring may be reduced accordingly, this being particularly advantageous where a limited space is available for housing the spring. Further, by suitably dimensioning the annular piston *e* the spring *f* may be dispensed with, the pressure medium alone serving to actuate the piston *e*.

It will be appreciated that the construction above described is given by way of example only and may be modified within certain limits without departing from the spirit of the invention. For example, in place of the charge accumulator described any other suitable type or construction of charge accumulator may be employed.

I claim:

1. In a fuel injection device for internal combustion engines the combination with a valve casing, of a fuel injection valve, means for supplying the fuel under pressure to the exit-end of the injection valve, a receiver with a fluid under pressure, a pressure chamber at the other end of the injection valve, a pipe for supplying the fluid from the receiver through the pressure chamber to an outlet in the valve casing, a throttle valve in this pipe between the receiver and the pressure chamber, a valve closing the outlet in the valve casing and means for opening the outlet when fuel injection is to commence.

2. In a fuel injection device for internal combustion engines the combination with a valve casing, of a fuel injection valve, means for supplying the fuel under pressure to the exit-end of the injection valve, a receiver with a fluid under pressure, a pressure chamber at the other end of the injection valve, a pipe for supplying the fluid from the receiver through the pressure chamber to an outlet in the valve casing, a throttle valve in this pipe between the receiver and the pressure chamber, a valve closing the outlet in the valve casing, means for opening the outlet when fuel injection is to commence, an auxiliary pressure applying member for closing the injection valve and means for supplying the fluid from the receiver to the said auxiliary pressure applying member.

3. In a fuel injection device for internal combustion engines the combination with a valve casing, of a fuel injection valve, means for supplying the fuel under pressure to the exit-end of the injection valve, a receiver with a fluid under pressure, a pressure chamber at the other end of the injection valve, a pipe for supplying the fluid from the receiver through the pressure chamber to an outlet in the valve casing, a throttle valve in this pipe between the receiver and the pressure chamber, a valve closing the outlet in the valve casing, means for opening the outlet when fuel injection is to commence, a loading piston on the fuel injection valve, a spring for holding the loading piston against a shoulder at the exit-end of the injection valve and means for supplying the fluid from the receiver to the side of the loading piston loaded by the spring.

In testimony whereof I have affixed my signature.

EDUARD VON SALIS.