

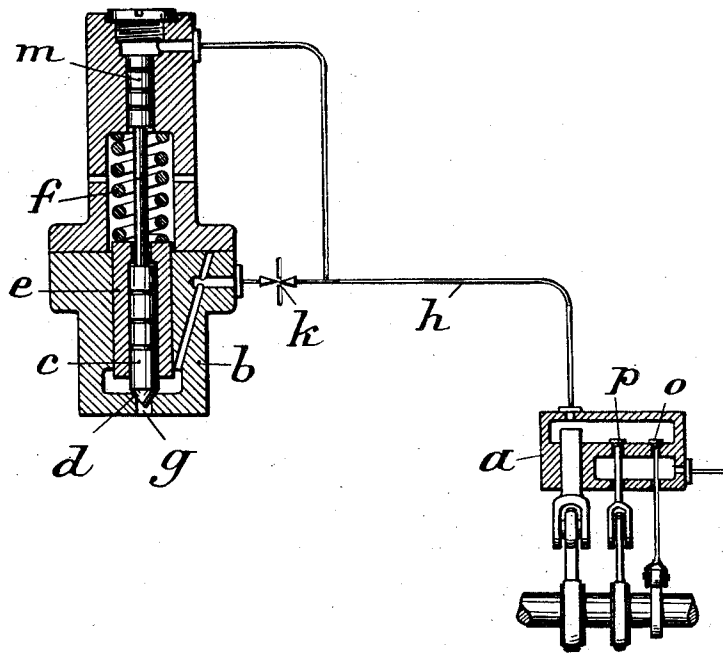
March 22, 1932.

E. VON SALIS

1,850,250

CONTROL OF FUEL INJECTION MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 3, 1929



INVENTOR:

Eduard von Salis

BY

Pennie Davis Martin & Edmonds
ATTORNEY

UNITED STATES PATENT OFFICE

EDUARD VON SALIS, OF WINTERTHUR, SWITZERLAND, ASSIGNOR TO THE FIRM SULZER
FRERES SOCIETE ANONYME, OF WINTERTHUR, SWITZERLAND

CONTROL OF FUEL INJECTION MECHANISM FOR INTERNAL COMBUSTION ENGINES

Application filed August 3, 1929, Serial No. 383,306, and in Switzerland August 11, 1928.

This invention relates to an improvement in or modification of the invention claimed in the present applicant's prior specification, now United States Patent 1,701,089, which
5 relates to apparatus for controlling the 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
10 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 the branch conduit connecting the
15 accumulator to the fuel supply pipe has been provided with a non-return or check valve so that fuel is prevented from returning from the accumulator to the fuel pipe when pressure is removed from the fuel in the supply
20 pipe. Experience has proved that such non-return or check valves do not always work in a perfectly reliable manner at the pressure involved, which in the case of these engines amounted to several hundred atmospheres, and the object of the invention is to
25 obviate the disadvantages which result.

According to this invention a throttle valve is substituted for the check or non-return valve in the branch pipe between the accumulator and the fuel injection device. It is
30 true that the employment of such a valve results in a small quantity of fuel returning to the fuel supply pipe, but the quantity is so small and the time in which return flow can take place is so short, that for practical purposes it is negligible and in any event it is
35 counteracted by correspondingly increasing the output of the fuel pump.

One construction according to this invention is diagrammatically illustrated by way of example in the accompanying drawing.

In the construction illustrated, fuel is supplied by the pump *a* to the housing or casing *b* of the fuel injection valve which may
45 be mounted in the head of the internal combustion engine (not shown). The injection of fuel takes place in the usual manner when the engine piston is in the desired position in its stroke. The injection device in the example illustrated comprises 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, thus permitting fuel to be injected through the opening *g*. 55

The accumulator comprises an annular piston *e* closely surrounding and with a shoulder resting on the needle valve *c* and adapted to be raised by the pressure of the fuel delivered by the pump against the action of a spring *f*. The fuel valve is normally locked in its closed position by the pressure of liquid on a piston *m* which bears against the needle valve. Liquid fuel is directly delivered to
60 the piston *m* through a fuel supply pipe *h* from the pump *a* and the accumulator is connected through a throttle controlled opening *k* to the fuel supply pipe. 65

The pump is provided, in addition to the
70 suction valve *p*, with a check valve *o* which is opened by a control gear, not illustrated, as soon as injection has to begin, that is, only during the pressure stroke of pump *a*. During the delivery stroke of the pump a charge
75 of fuel passes into the accumulator through the throttle opening *k* and simultaneously pressure is exerted upon the locking piston *m* of the needle valve. Against the action of the spring *f* the charge of fuel lifts the
80 annular piston *e* away from the needle valve *c*, but the needle valve remains closed under the action of the locking piston *m*. When the fuel is to be admitted into the working cylinder of the engine, pressure normally
85 maintaining the needle valve *c* on its seating is released by opening the valve *c* in the pump pressure chamber thus reducing or neutralizing the pressure in the cylinder *m* so enabling the accumulated fuel to lift the needle
90 valve *c* which will be raised by the action of the fuel, held back by the throttle valve at *k* and maintained under pressure by the annular piston. Valve *o* is opened only during
95 the pressure stroke of the pump *a*. The annular piston will descend simultaneously with the injection of fuel into the engine cylinder and will thus positively force out and discharge the fuel in the accumulator through opening *g*, and return the needle 100

valve to its closed position by which means the injecting operation is brought to an end.

The throttle controlled opening k it is true allows some fuel to return into the pipe k but the quantity which thus returns is so small owing to the short time during which the valve is open that it can be ignored or it can be counteracted by correspondingly increasing the output of the pump. Owing to the accumulator being connected to the fuel supply pipe through a throttle controlled opening instead of a non-return valve as hitherto, the whole operation of locking the injecting device, accumulating the fuel and actually injecting the fuel can be controlled from a distance by the use of a single movable control member and in this way the operation of the engine can be rendered more reliable.

It will be understood that some other form of accumulator may be employed and that other constructional details may be varied without departing from this invention.

I claim:

1. A liquid-fuel injecting system, comprising an injection valve having an accumulator-piston therearound, a compression member tending to hold the accumulator-piston against rising, a source of fuel under pressure, means for supplying fuel from said source to one end of said injection valve to normally maintain it closed, means for supplying fuel from said source to the other end of the valve, means for reducing the pressure of the fuel supplied to the first named end of the valve to cause the valve to rise and to permit the accumulator-piston to be forced down by the compression member, and means in the supply means to the second named valve end for reducing the cross-sectional area thereof and thus restricting the return flow of fuel therethrough during reduction in pressure on the first named end.

2. A liquid-fuel injection system, comprising an injection valve having an accumulator-piston therearound, a compression member tending to hold the accumulator-piston against rising, a source of fuel under pressure, means for supplying fuel from said source to one end of said injection valve to normally maintain it closed, means for supplying fuel from said source to the other end of the valve, means for reducing the pressure of the fuel supplied to the first named end of the valve to cause the valve to rise and to permit the accumulator-piston to be forced down by the compression member, and means for throttling the fuel tending to flow away from said second end when the pressure on the first end is reduced, to thereby maintain substantially constant the pressure acting on said second named end.

3. A liquid-fuel injection system, comprising an injection valve having an accumulator-piston therearound, a compression member tending to hold the accumulator-piston

against rising, a source of fuel under pressure, means for supplying fuel from said source to one end of said injection valve to normally maintain it closed, means for supplying fuel from said source to the other end of the valve, means for reducing the pressure of the fuel supplied to the first named end of the valve to cause the valve to rise and to permit the accumulator-piston to be forced down by the compression member, and a throttle-valve in the supply pipe leading to said second named end operable to maintain substantially constant, during the reduction of pressure on the first end, the pressure acting on said second named end.

In testimony whereof I have affixed my signature.

EDUARD VON SALIS.