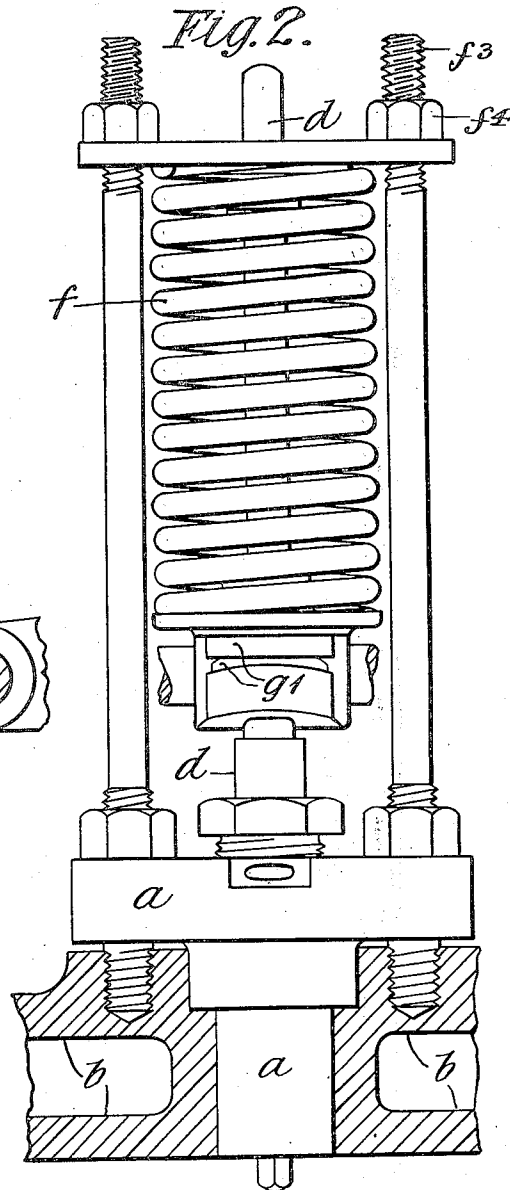
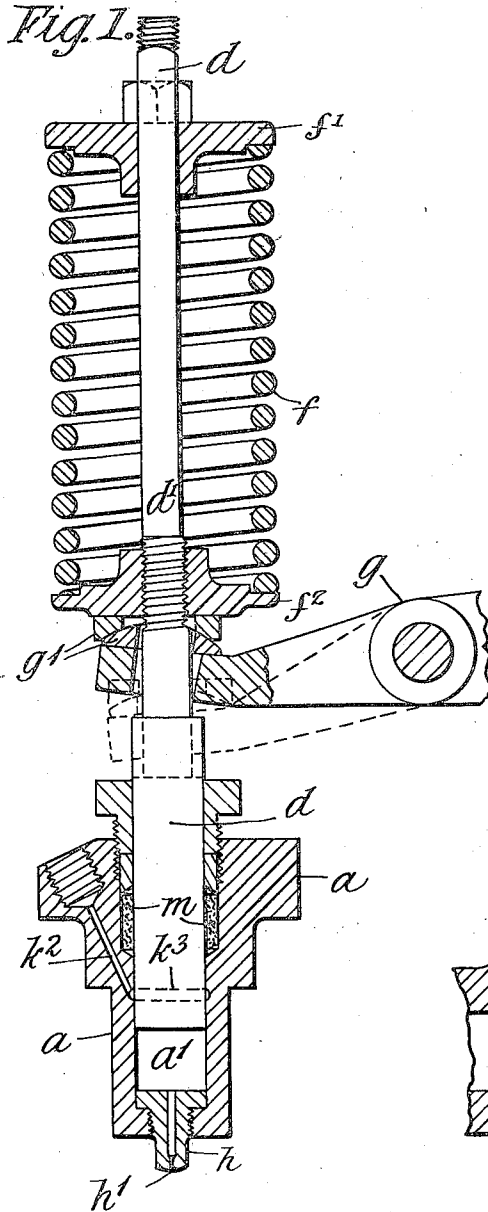


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MEANS FOR INTRODUCING OIL OR LIQUID FUEL CHARGES
INTO INTERNAL COMBUSTION ENGINES
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UNITED STATES PATENT OFFICE.

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MEANS FOR INTRODUCING OIL OR LIQUID-FUEL CHARGES INTO INTERNAL-COMBUSTION ENGINES.

Application filed January 30, 1923, Serial No. 615,921, and in Germany December 27, 1922.

This invention has reference to means for introducing oil-fuel charges into internal-combustion engines, either of the Diesel type in which the charge is introduced into the cylinder under extremely high pressure, or ordinary petrol or paraffin engines.

The invention relates more particularly to arrangements of the kind in which a portion of the air compressed by the main piston in the engine cylinder, is introduced into a small compressor or charge injector, where it is further compressed to form the charge for each explosion separately as required, thus obviating the use of carburettors and like devices.

A feature of the invention is that the compressor rod or plunger operates uniformly or acts as it were independently of the engine instead of being operated thereby and so depending on the latter for the speed of its stroke. In other words it makes its complete forward stroke just at the instant the injection is required and always works at practically the same rate no matter how slowly the engine may be working.

To this end the said rod or plunger is actuated by a spring arrangement and a timing cam, so as to give the necessary higher compression to enable the air to inject or carry the oil-fuel charge into the cylinder at the required moment.

A further feature of the invention is that the rod or plunger of the charge-injector works in a small and very strong cylindrical block or hollow plug fitted in the cylinder cover. This hollow block or plug forms the casing or body of the injector device and its chamber or bore communicates directly with the working cylinder by only very short passages or ducts. Means are also provided to supply the charge of oil to said injector chamber under suitable pressure.

The arrangement is such that at each cycle the said rod or plunger is raised by a cam through a suitable adjustable lever arrangement and so compresses the spring. At the moment the charge of fuel oil is to be injected into the cylinder, the plunger is released by the cam, and being thus free, the rod or plunger is forced by the reaction of its powerful spring completely to the other end of the chamber or bore of the injector device. Under this action the extra-compressed or "injection" air in the device is

driven into the working cylinder and carries the oil along with it, the latter being sprayed or atomized as it is forced into the cylinder, and mixing with the compressed air already therein (due to the return stroke of the working piston) forms the explosive charge.

The oil pump is of course adjusted to give the necessary pressure to deliver the required quantity of oil necessary to form each charge.

The hollow block or plug which forms the body of the charge-injector device may, like an ordinary valve body or casing, be provided with any suitable means for fixing it in the cylinder cover.

By means of the invention great simplicity and economy are attained since the charge is always formed in one uniform way, the force of the compressor rod or plunger being constant no matter how slowly the engine may be running. Moreover when the engine is a small one and running light, the device avoids the waste of oil such as occurs with ordinary carburettors for petrol engines. In addition to this by using a direct connection with very short passages between the injector and the cylinder, it is ensured that the whole charge passes instantly into the latter, without any appreciable proportion being left behind in intermediate ports or passages or even in the injector device itself.

In order that the invention may be clearly understood and readily carried into effect reference will now be had by way of example to the accompanying diagrammatic drawings in which:

Fig. 1 is a vertical central section of the improved charge injector.

Fig. 2 is a side view from a point at right angles to Fig. 1.

a is the hollow block or plug which forms the body of the charge-injector device and is adapted to be secured in the engine cylinder in any convenient way, for instance in the top or cover *b*, preferably opposite the centre of the piston.

d is the compressor rod or plunger by which the extra-compression is set up inside the chamber or cavity *a'* of the device at the moment injection is required.

This rod or plunger (which is reduced in diameter at its upper end *d'*) is acted on

by a spring f which tends to force it downwards. It is also coupled to the end of a cam-actuated lever g worked from a suitable cam on the timing shaft or otherwise.

5 In the example shown the spring f is arranged between a top-yoke f^1 and a bottom plate f^2 working like a nut on the spindle d^1 . To adjust the spring f , the said top yoke f^1 is acted on by nuts f^4 working on
10 the screw-threaded ends of the side rods f^3 .

To allow freedom for the angular motion of the lever g , the nut f^2 at the top of the rod d rests upon a pair of washers g^1 which are dished into each other, or have their
15 adjacent faces made concave and convex as shown, so as to swivel easily. Moreover a fair amount of play or gap is left between the reduced end of the rod and the hole or eye through which it passes.

20 The compression rod or plunger d works through a stuffing-box m in the top of the hollow plug a , and as mentioned a powerful spring f , such as a spiral spring adjusted by a screw device f^1 , acts on the top or rear
25 end of the rod. In some cases however a pneumatic spring or vacuum chamber may be used instead of an ordinary or metal spring.

The arrangement is such that at a suitable
30 part of the cycle when there is no appreciable counter-pressure in the cylinder, a charge of oil is forced by the oil pump through a supply duct k^2 into the annular groove k^3 . When the engine piston makes its
35 compression stroke, it is arranged to compress the air in the cylinder to say 500 lbs. per square inch and part of this air finds its way into the cavity a^1 , the plunger d being raised by its cam counter to the spring
40 f . The cam is timed to release the plunger immediately the compression stroke is finished. Under the sudden action of the spring therefore the plunger immediately gives an extra compression to the small body of
45 injector air in a^1 at the moment the injection is required, and forces the same out (as before mentioned) through the oil re-

ceiver k^1 so carrying the said oil forward into the cylinder to form the working charge.

The cavity or chamber a^1 communicates directly with the working cylinder through a fine orifice or duct h^1 in nipple h . The oil in this case is fed under high pressure through a pipe k^1 and duct k^2 into an an-
55 nular groove k^3 surrounding the plunger d , and flows or percolates past the latter as a thin film down the wall of the cavity a^1 , enough clearance being left around d for this purpose. At each stroke of the said
60 plunger enough oil is ejected through the orifice h^1 to form the charge, and owing to the heat this oil is already partly vapourized or is on the point of becoming so. Moreover on account of the sudden extra
65 compression, the temperature of the injecting air is practically at the ignition point or even beyond it.

It will be seen that the rod or plunger d always operates uniformly and completely
70 at the instant of ignition, the speed and extent of its stroke being unaffected by the speed of the engine itself.

Obviously the arrangements can be modified in various ways in carrying the in-
75 vention into practice without departing from the general nature thereof.

I claim:

A liquid-fuel injecting arrangement of the kind referred to, in which the charge is
80 formed and injected by a single plunger, working independently in a super-compression chamber (a^1) mounted directly on the cylinder, the connection with the cylinder
85 being through one or more very short and direct passages in the end of the chamber (a^1) and the liquid fuel being fed under high pressure into an annular channel (k^3) surrounding the plunger so as to form a film
90 on the surface of the hot cylinder which is easily and instantly vapourized, substantially as described.

In testimony whereof I affix my signature.
SIMON DOKK OLSEN.