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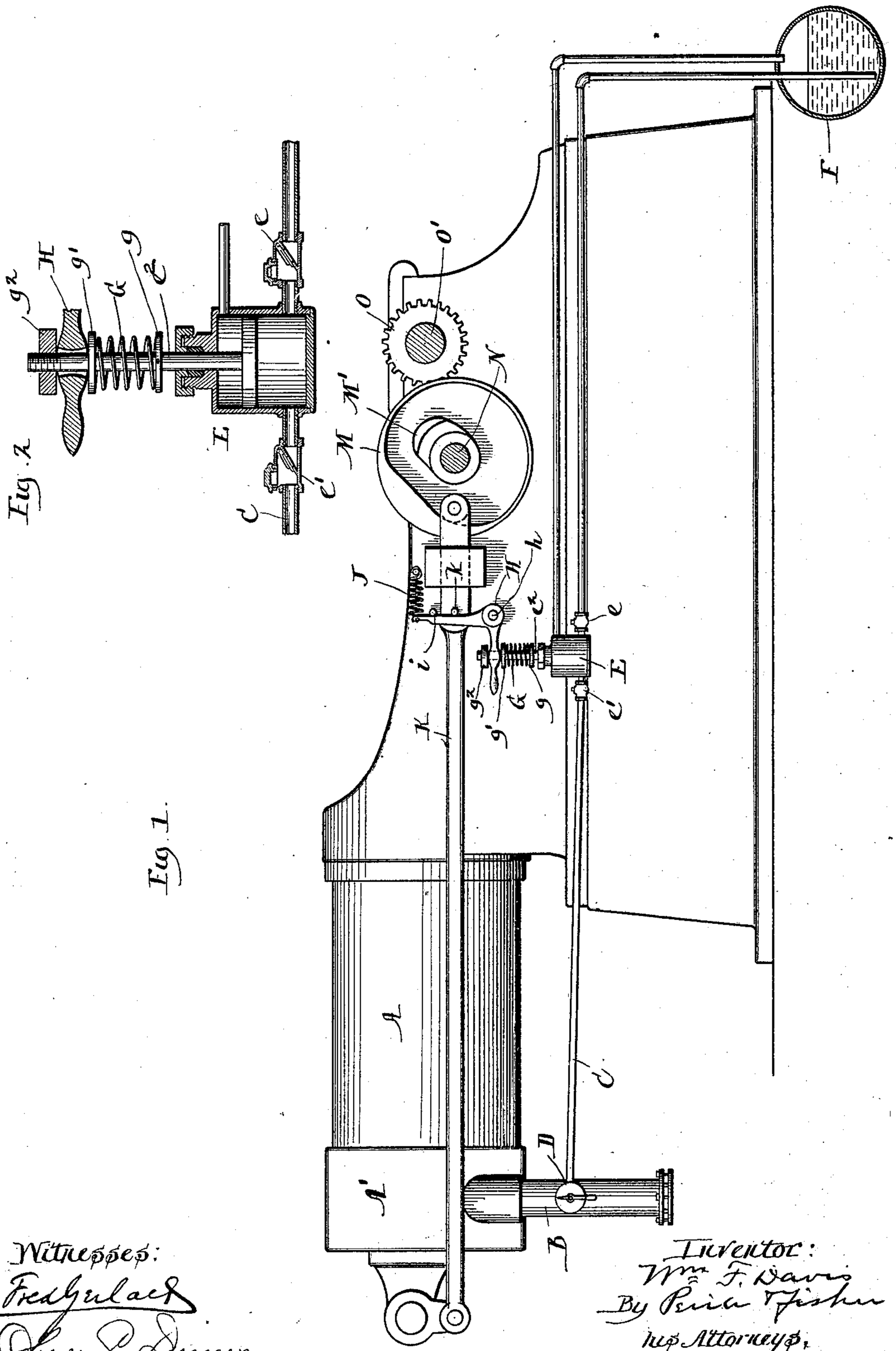
W. F. DAVIS.

OIL SUPPLYING DEVICE FOR EXPLOSIVE ENGINES.

(Application filed July 8, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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OIL-SUPPLYING DEVICE FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 685,032, dated October 22, 1901.

Application filed July 8, 1899. Serial No. 723,125. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. DAVIS, a resident of Waterloo, in the county of Blackhawk, State of Iowa, have invented certain new and useful Improvements in Explosive-Engines, of which I declare the following to be a full, clear, and exact description.

My present invention has relation more particularly to that class of explosive-engines in which gasolene or like volatile liquid is employed as a fuel. The object of the invention is to provide a simple and effective means for delivering the charges of the liquid fuel to the engine. It has long been a common practice to supply the liquid fuel to explosive-engines by means of a pump acting constantly to force the fuel to the engine, the amount of fuel admitted being controlled by means of a suitable mechanically-operated admission-valve. This prior construction and as well also the construction commonly known as the "gravity feed" are objectionable because of the wastage and danger incident to the leakage of the fuel.

This invention comprises means whereby the liquid fuel is fed to the engine through a supply-pipe in which is interposed a pump the piston of which is driven by a shifter through the medium of a spring, the movement of the shifter being so timed with respect to the operation of the admission-valve that it exerts its pressure through the medium of the spring and the pump-piston upon the liquid fuel during the injection period and relieves the fuel-supply within the pump from pressure between the periods of injection.

The invention further consists in providing the fuel-supply pipe with a pump in combination with a shifter for periodically actuating the pump-piston to expel the liquid fuel from the pump, a spring interposed between said shifter and said piston, and a manually-controllable throttle-valve interposed in the fuel-supply pipe intermediate the pump and the admission-valve chamber, whereby the amount of fuel delivered to the valve-chamber may be increased, diminished, or cut off while the uniform action of said shifter is permitted.

The invention consists also in various other features of improvement, all of which are hereinafter described, illustrated in the accompanying drawings, and particularly pointed out by the claims at the end of this specification.

Figure 1 is a view in side elevation of an explosive-engine embodying my invention. Fig. 2 is a view in vertical section through the pump-cylinder and certain of the adjacent parts, other parts being shown in elevation.

A designates the cylinder of the engine, that is supported upon a suitable base. In the construction of engine shown (although this is not essential to the invention) the valve-chamber is shown as contained in the cylinder-head A′, and to this chamber air will be admitted by a suitable air-admission pipe B. To this admission-pipe B leads an oil-supply pipe C, and the extent of oil or fuel admitted from the pipe C to the air-pipe B is controlled by a regulating-valve D, that will be operated by hand, this valve serving to enable the amount of fuel to be delivered to the air-pipe B to be exactly controlled. In the fuel-supply pipe C is interposed a pump E, by which oil is drawn from a reservoir F, and at opposite sides of the pump suitable check-valves e and e' are arranged in the fuel-supply pipe, these valves serving to prevent the backflow of oil from the pump to the reservoir and from the regulating-valve to the pump. Around the stem e^2 of the piston of the pump E is placed a coil-spring G, the lower end of this spring bearing upon a collar or offset g, that is fixed to the piston-stem e^2, while the upper end of the spring bears against a washer g', that is movably sustained upon the stem e^2. The stem e^2 of the pump-piston passes through one end of a bell-crank lever H, and the outer end of the stem is furnished with a nut g^2 to retain the stem in operative relation to this bell-crank lever. The lever H is suitably pivoted, as at h, to the stud projecting from some fixed part of the engine-frame, and the upper arm of the lever H extends in position to be engaged by some moving part of the engine.

In the construction shown there is a stop-pin i, projecting from the fixed part of the engine-frame, to limit the backward movement of the bell-crank lever H, and the lever H will be drawn normally toward the stop-pin i by a suitable spring J, connected thereto and to the engine-frame. The lever H has

its upper arm extending in proximity to the valve-rod K, whereby the admission and exhaust valves of the engine are controlled, and from the valve-rod K projects a stud *k*, that will contact with and shift the elbow-lever H as the rod K is operated. Any suitable or familiar means may be employed for operating the valve-controlling rod K; but in the accompanying drawings I have shown this rod as operated by the cams M and M′ at the side of a cam-wheel that is revolubly mounted upon the secondary shaft N of the engine. The cam-wheel M is shown as driven by a gear-wheel O from the main shaft O′, the gearing being in the proportion of two to one, so that the speed of the cam-wheel is correspondingly reduced.

Preferably a fuel-return pipe is extended from the upper part of the pump-cylinder E above the piston to the oil tank or reservoir F, the purpose of this pipe being to return to the reservoir any oil that may have passed above the piston. Manifestly, however, this return-pipe is not essential if care be taken to insure an accurate fit of the piston in the cylinder, and where such return-pipe is not employed it is necessary only to provide the upper end of the pump-cylinder with a suitable vent. I have not deemed it necessary to illustrate in the accompanying drawings the valve mechanism within the cylinder-head A′, since such mechanism forms no part of the invention to be claimed herein; but it will be understood that at each two revolutions of the main drive-shaft the valve mechanism within the cylinder-head is operated to admit to the cylinder of the engine the supply of gasolene and air and to allow the exhaust from the cylinder of the spent gases.

From the foregoing description it will be seen that at each operation of the valve-rod K the elbow-lever H will be turned about its pivot-point in such manner as to compress or to throw "on tension" the spring G, and as this spring is interposed between the elbow-lever and the stem of the pump-piston the force of the lever will be exerted through the spring in driving the piston downward to expel the liquid fuel from the pump through the supply-pipe C, the controlling-valve D, and to the air-delivery pipe B. As soon, however, as the valve-rod K, having made its forward movement, is reversed the elbow-lever H will be drawn backward by the spring J, thereby relieving the pressure upon the spring G and at the same time lifting the piston of the pump E by engaging nut g^2. The elbow-lever (or other shifter mechanism that is interposed between the moving part of the engine and the pump) will be so constructed and arranged with respect to the valve-rod K that the spring G will be thrown on tension during the time only that the charge of liquid fuel is to be injected into the air-pipe B; but at other times the spring G will be off tension, and consequently the pump will exert no pressure for forcing the liquid fuel through the supply-pipe. By thus driving the pump with the spring and with mechanism adapted to throw said spring on tension during the time only that the fuel is to be injected and insuring that the spring shall be off tension and the pump out of action during the remaining period it is plain that the flow of fuel through the supply-pipe C to the air-pipe B will occur only at the time when said fuel is required to be admitted to the air-pipe, and hence the danger of leakage or wastage of fuel is avoided. With prior constructions, in which the pump is under constant operation and in which the pump-piston is reciprocated more than once for each injection of the charge, it is necessary to employ some mechanically-operated valve mechanism to prevent the delivery of liquid fuel to the engine at other times than during the injection period; but with my present construction the necessity of such mechanically-controlled valve mechanism is entirely obviated.

While I have described what I regard as the preferred embodiment of my invention, it is manifest that the precise details of construction above set out may be varied by the skilled mechanic without departure from the invention. Thus, for example, without dedeparting from the broad spirit of the invention any other suitable shifter mechanism may be employed for compressing the spring G and causing it to exert its force upon the pump-piston instead of the elbow-lever H and the valve-rod K.

I am aware that it has been heretofore proposed to feed liquid fuel to the engine by means of a pump the piston of which is operated by a shifter that is actuated to draw outward the pump-piston by a cam and to force in the pump-piston by a coil-spring. Such prior construction, however, does not embody my present invention, for the reason, among others, that the shifter does not place the spring on tension during the time of injection, but, on the contrary, this spring is placed on tension before the injection period begins, and consequently the spring grows weaker as the injection proceeds, with the result that the latter part of the charge of air injected receives less fuel than the earlier part of the charge. I am also aware that it has been heretofore proposed to provide the pump whereby liquid fuel is delivered to the engine with spring and weight mechanism for exerting a constant pressure upon the piston of the pump, but with such prior construction it was necessary to provide means to automatically cut off the constant flow of fuel to the engine, and for this reason, as well as others, such prior construction does not embody my present invention. By providing the fuel-delivery pipe with a manually-controllable valve the operator is enabled to set the valve so that the pump shall deliver any desired charge at each stroke and

is also enabled when water gets into the gasolene to instantly open wide the valve, so as to permit the free escape of the water before the speed of the engine is materially reduced. So, also, by providing the manually-controllable valve in combination with a pump the speed of the engine can be readily regulated, since by restricting the charge of liquid fuel through the valve the amount of fuel delivered to the engine at each operation of the pump will be comparatively small, notwithstanding the uniform operation of the pump. So, also, when the engine is to be stopped this can be effected by instantly closing the throttle-valve completely, when the shifter that operates the pump will merely compress the spring intermediate it and the pump-piston without effecting any discharge of the fuel.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an explosive-engine, the combination with a fuel-supply pipe, of a fuel-pump, a fixed projection upon the pump-piston rod, a shifter for operating said pump engaging said projection, a cushion-spring intermediate said shifter and the pump-piston, said shifter being arranged to actuate said pump through the medium of said spring during the forcing stroke and as the charge is being injected and by engaging said projection during the return or suction stroke and means for operating said shifter once for every power-stroke of the engine.

2. In explosive-engines, the combination with a fuel-supply pipe, of a fuel-pump, a fixed projection upon the pump-piston rod, a shifter for operating said pump engaging said projection, a cushion-spring intermediate said shifter and said pump-piston, said shifter being arranged to actuate said pump through the medium of said spring during the forcing stroke of the pump and as the charge is being injected, and by engaging said projection during the return or suction stroke of the pump, valve mechanism for the engine arranged to operate said shifter once for every power-stroke of the engine and a controlling throttle-valve interposed in the fuel-supply pipe between the pump and the engine.

3. In explosive-engines, the combination with a fuel-supply pipe, of a fuel-pump, a fixed projection on the pump-piston rod, a shifter for operating said pump engaging said projection, a spring connected to said shifter for holding the latter in its normal position, a cushion-spring intermediate said shifter and the pump-piston, said shifter being arranged to actuate said pump through the medium of said cushion-spring during the forcing stroke and as the charge is being injected and by engaging said projection during the return or suction stroke, a valve-rod for said engine arranged to operate said shifter once for every power-stroke of the engine and a throttle-valve interposed in said fuel-supply pipe between the pump and the engine.

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