O. OHLSSON.

FEEDING MEANS FOR INTERNAL COMBUSTION ENGINES.

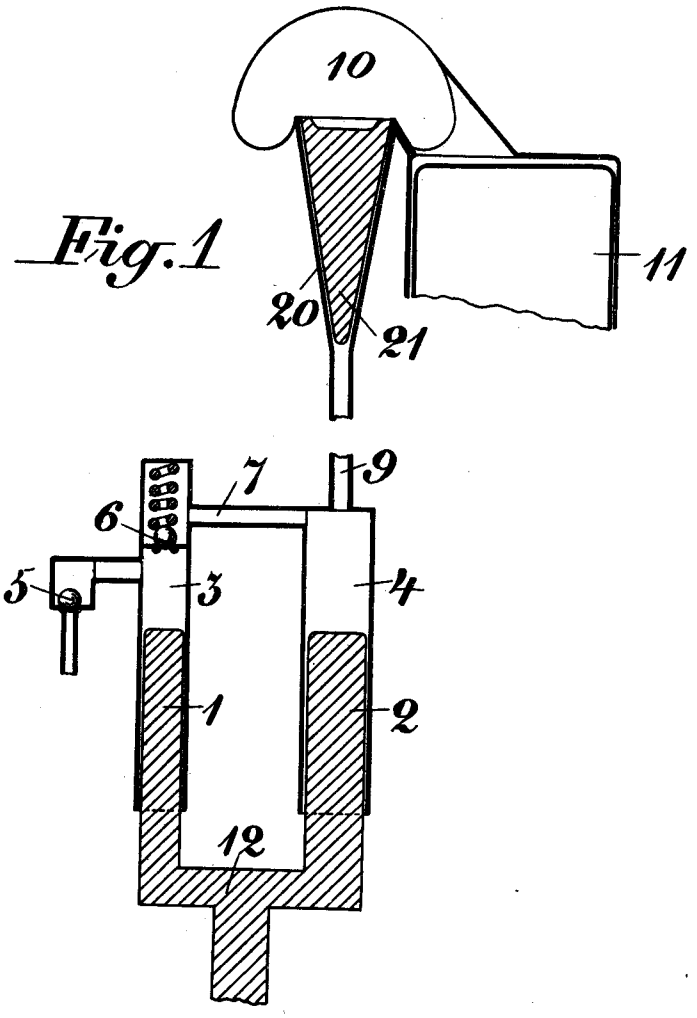
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1,066,939.

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2 SHEETS—SHEET 1.

Fig. 1



Witnesses

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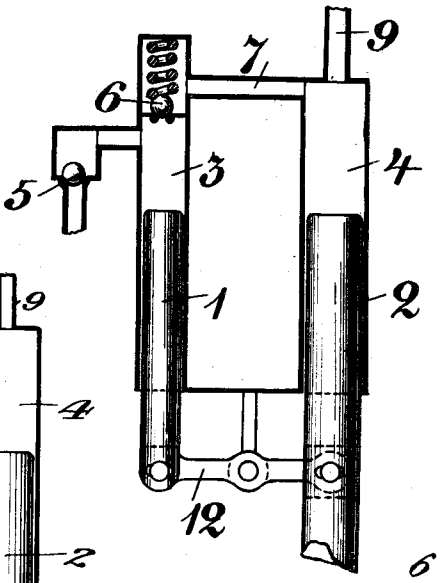
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2 SHEETS—SHEET 2.

Fig. 2



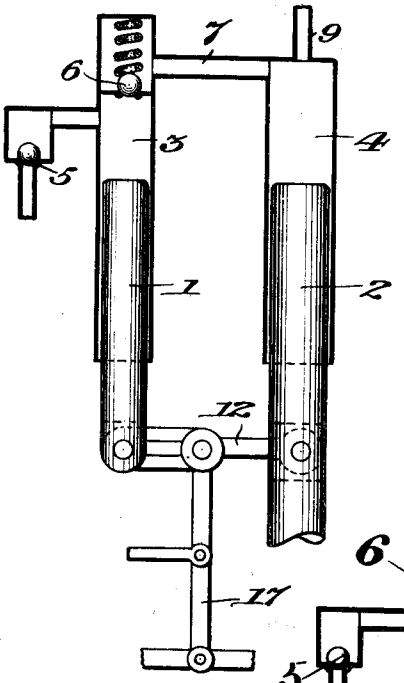


Fig. 4

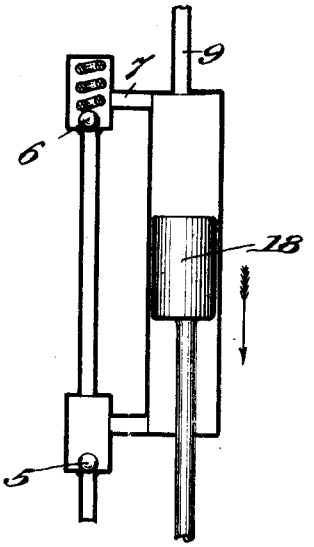
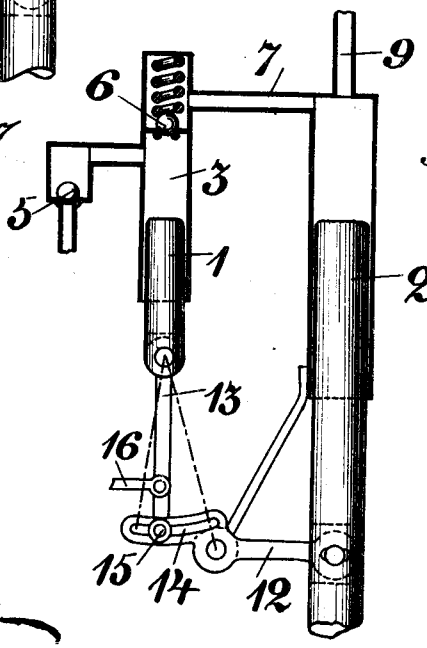


Fig. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

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FEEDING MEANS FOR INTERNAL-COMBUSTION ENGINES.

1,066,939. Specification of Letters Patent. Patented July 8, 1913.

Application filed April 6, 1909. Serial No. 488,204.

To all whom it may concern:

Be it known that I, OLOF OHLSSON, a subject of the King of Sweden, and resident of Södertelje, in the Kingdom of Sweden, have invented certain new and useful Improvements in Feeding Means for Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to means for feeding the fuel into internal combustion engines, and the object of the invention is to procure a great pressure for forcing the fuel into the engine and to facilitate the evaporating of the fuel so that it is effected with great rapidity. The said means are so arranged, that the said great pressure is rapidly reduced at the same moment as the feeding of the quantity of fuel, adapted for the piston stroke, has been effected, so that no injurious after-feeding operation can take place. This is attained by the providing of a special piston in addition to the pump piston in such manner, that the piston last mentioned forces the fuel into the conduit, leading to the working cylinder or to the explosion chamber, and the piston first mentioned effects the feeding operation proper. The said pistons may be advanced either simultaneously or alternately, or a differential piston may be used, which, when moved in one direction, effects one of the said operations, and when moved in the opposite direction effects the other operation. In combination with the said means, preferably when two pistons are used, a device is provided for regulating the fuel quantity fed into the engine at each stroke of the pistons.

Figure 1 in the accompanying drawings is a section of the feeding means and the evaporating device, the pistons being so arranged that they run together. Fig. 2 is a section of the feeding means so arranged that the pistons are advanced alternately. Fig. 3 shows in the same manner the feeding means last mentioned but combined with a device for regulating the quantity of fuel fed into the engine. Fig. 4 shows a modification of the said regulating device. Fig. 5 is a section of the feeding means provided with one piston only.

1 and 2, Fig. 1, are two differential pistons or plungers, working in cylinders 3 and 4 respectively. The liquid fuel is drawn into the cylinder 3 from a tank (not shown), by way of a passage controlled by a valve 5. The said fuel is then forced by the advanced piston through the spring actuated valve 6 and through the passage 7 into the cylinder 4, from which leads the passage 9, which may be considered a continuation of the passage 7, to the explosion chamber 10, which is in free communication with the working cylinder 11. The said pistons 1 and 2 are firmly connected by a cross head 12 and are reciprocated in the ordinary manner by a cam disk or the like, not shown in the drawings. The piston 2 is wider than the piston 1, and the cylinder 4, in which the piston 2 operates, communicates with the chamber 10 through the passage 9. The pistons 1 and 2 are forced forward rapidly immediately before the end of the compression stroke of the working piston in the cylinder 11, so that the quantity of fuel, drawn into the cylinder 3 by the piston 1 during its previous suction stroke, is forced therefrom by way of the conduit formed of passages 7 and 9, and cylinder 4. At the same time the capacity of the said conduit is reduced by the advanced piston 2 which has a greater area than the piston 1, the fuel being thus forced into the chamber 10, subjected to a very high pressure. During the subsequent return stroke of the acting pistons the capacity of the said conduit is rapidly increased by the retraction of piston 2 in cylinder 4, so that a liquid fuel in passage 9 is subjected to a backward suction, whereby the feeding of the charge into the chamber 10 is instantaneously interrupted. Consequently the piston 2 effects an oscillatory movement of the charge forward and backward in the passage 9, or in other words, the operation of said piston 2 intensifies the variations in pressure in the feeding conduit over the variations which would be afforded if only the piston 1 were provided. In this manner the feeding of the fuel is more closely timed to the beginning of the feeding period as well as to the instantaneous interruption of the said period. Consequently, a feeding operation of shorter duration and a more sudden reduction of the pressure in the conduit respectively is effected than by means of one piston. The said feeding period can easily be so shortened and timed, that it is equal to and coincides with that part of the stroke of the working piston, during which the combustion is effected in the most advantageous

manner. In this manner a very nearly complete combustion can be effected during the short period, as the compression is at the maximum. Consequently, the after feeding operation and the after-combustion operation resulting from the same are obviated, which hitherto often take place in internal combustion engines and which cause a great waste of fuel to no useful purpose. Where my improvements are employed the temperature of the igniting means or of the chamber 10 may also be much higher than hitherto, since it is possible to accurately time the supply of the charge to said igniting means or to said chamber.

The pistons or plungers 1 and 2 may be advanced, alternately, as illustrated in Fig. 2. In the said figure the pistons 1 and 2 are connected by a two armed lever 12 swinging on a stationary pin, the piston 2 being besides provided with a pendent extension adapted to be acted upon by an eccentric, cam disk or the like not shown in the drawings. Owing to the fact that the pistons are each connected with an arm of the lever 12, they are advanced alternately in their respective cylinders. As the piston 1 is moved forward, it forces the fuel through the valve 6 and into the conduit afforded by the passages 7 and 9 and the cylinder 4, the capacity of which is increased at the same time by the returning piston 2 in a higher degree, compared with the quantity of fuel fed into the said conduit, owing to the fact that the piston 2 is wider than the piston 1. The device may be modified in such manner that the arms of the lever 12 are of unequal length, so that the stroke of the piston 2 is greater than that of the piston 1. The piston 1 is then returned and the piston 2 advanced, causing the same quantity of fuel to be forcibly passed into the chamber 10, which has previously been fed into the conduit formed of passages 7 and 9 and cylinder 4 by the piston 1, the said conduit being now shut off from the piston 1 by the valve 6. Each of the pistons may evidently be actuated by an eccentric, cam-disk or the like, and the moment, during which the pistons are moved in opposite directions, may be confined to a greater or less part of the piston stroke.

In Fig. 3 the piston 1 is connected with the lever 12 by a link 13 which is pivotally connected with the piston 1 and can be swung longitudinally along one arm of the lever 6, provided for that purpose with a slot 14, engaged by a pin 15 in the said link. The link 13 is adapted to be connected in suitable manner with the centrifugal governor of the engine, the link 16 being provided for that purpose. The stroke of the piston and consequently the quantity of fuel fed into the engine is increased or decreased according as the link 13 is located farther from or nearer to the fulcrum of the lever 12.

In Fig. 4 the fulcrum of the lever 12, is movable in a slot in the lever and fixed in a movable part, preferably a swingable arm 17, connected with the governor.

Fig. 5 shows the feeding device provided with a double-acting piston 16. As the said piston is moved in the direction indicated by the arrow, the fuel previously drawn into the cylinder through the valve 5 is forced from one end of the piston to the other through the valve 6, and as the piston 6 is moved in the opposite direction, the said fuel is forced into the chamber 10. In this construction that surface of the piston which is employed for forcing the fuel into the chamber 10 is given a greater area than the opposite surface which forces the charge through the passage 7, one end of the piston being of greater area than the other so as to insure the desired differential operation.

In the constructions shown in Figs. 2 to 4 inclusive the fuel pump is independent of the pressure in the conduit formed of passages 7 and 9 and cylinder 4, which is the case also in the form shown in Fig. 5. Consequently the said pressure during the combustion period may be of any high rate without interfering with the feeding operation. Owing to the fact that the feeding (through the valve 6) is effected, while there is a low pressure in the conduit, the feeding operation can readily be so regulated as to supply very small quantities of fuel, while the strokes of the piston, forcing the fuel into the engine remain constant.

The evaporating device shown in Fig. 1 is characterized by the conduit 9 being provided with a conical enlargement 20 and by a conical body 21 being mounted in the conical part 20 of the conduit, which body is congruent to the said part and has a rather sharp tip. The liquid fuel passes, when forced into the chamber 10, between the surface of the body 21 and the inner side or wall of the conical enlargement 20 of the conduit. As the forcing of the fuel into the engine is effected while a great pressure is prevailing in the explosion chamber due to the operation of the piston in the working cylinder, as stated above, and the said pressure forces the conical body 21 as a valve body against the wall 20, serving as a valve seat, the liquid will be divided into a thin layer. As the wide ends of the conical surfaces are directed toward the chamber 10 and the liquid is spread in the direction from the tip of the cone *i. e.* practically from one point, the liquid fuel is rapidly divided around the hot conical body 21, so that it is evaporated and consequently enters the chamber 10 exclusively in a gaseous state. This is the more the case as the temperature of the cone increases to-

ward the chamber 10, from which the cone receives its heat. By means of the said arrangement the disadvantage is removed, that the part, which operates as an evaporator, also serves as a receptacle for the fuel, from which the fuel in a liquid state enters the explosion chamber almost uninterruptedly. Owing to this fact a great quantity of fuel is saved. The complete evaporation is, evidently, of great importance also for effecting rapid and complete combustion, as the combustion is dependent upon the intimate mixing of the fuel with the air necessary for the combustion and the mixture is facilitated in the same degree as the fuel is finely divided and brought into a gaseous state as completely as possible upon its entry into the explosion chamber. The evaporator although shown only in Fig. 1, may, evidently, be used also in connection with the forms of the device shown in Figs. 2 to 5 inclusive or in modifications derived from the same.

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

1. In an internal combustion engine the combination of a working cylinder, an explosion chamber, an evaporator consisting of two congruent cones, one mounted in the other affording a passage between them, the inner cone being forced against the outer one by the pressure effected in the working cylinder during the compression stroke and means for forcing the charge between said cones to the explosion chamber.

2. In an internal combustion engine, the combination of a working cylinder, an explosion chamber, a fuel supply conduit in communication with the chamber, a plurality of cylinders interposed in the conduit and in communication one with the other, means for controlling such communication between the cylinders, operatively connected pistons within the cylinders capable of operation in such a manner that the fuel is acted upon first by one of said pistons then by the other piston after the fuel has passed beyond the means for controlling the communication between the cylinders, a lever capable of operation to reciprocate the pistons and a regulating device for changing the length of the lever arm.

3. In an internal combustion engine, the combination of a working cylinder, an explosion chamber in communication with the said cylinder, a fuel supply conduit leading to the said chamber, cylinders interposed in the conduit, pistons mounted to reciprocate in such cylinders to force the fuel through the conduit into the combustion chamber, one of said pistons operating to effect forward and backward movement of the fuel in the conduit whereby a feeding operation of short duration and a sudden reduction of the pressure in the conduit are effected.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

OLOF OHLSSON.

Witnesses:
ANNA SÖDERSTRÖM,
ROBERT APELGREN.