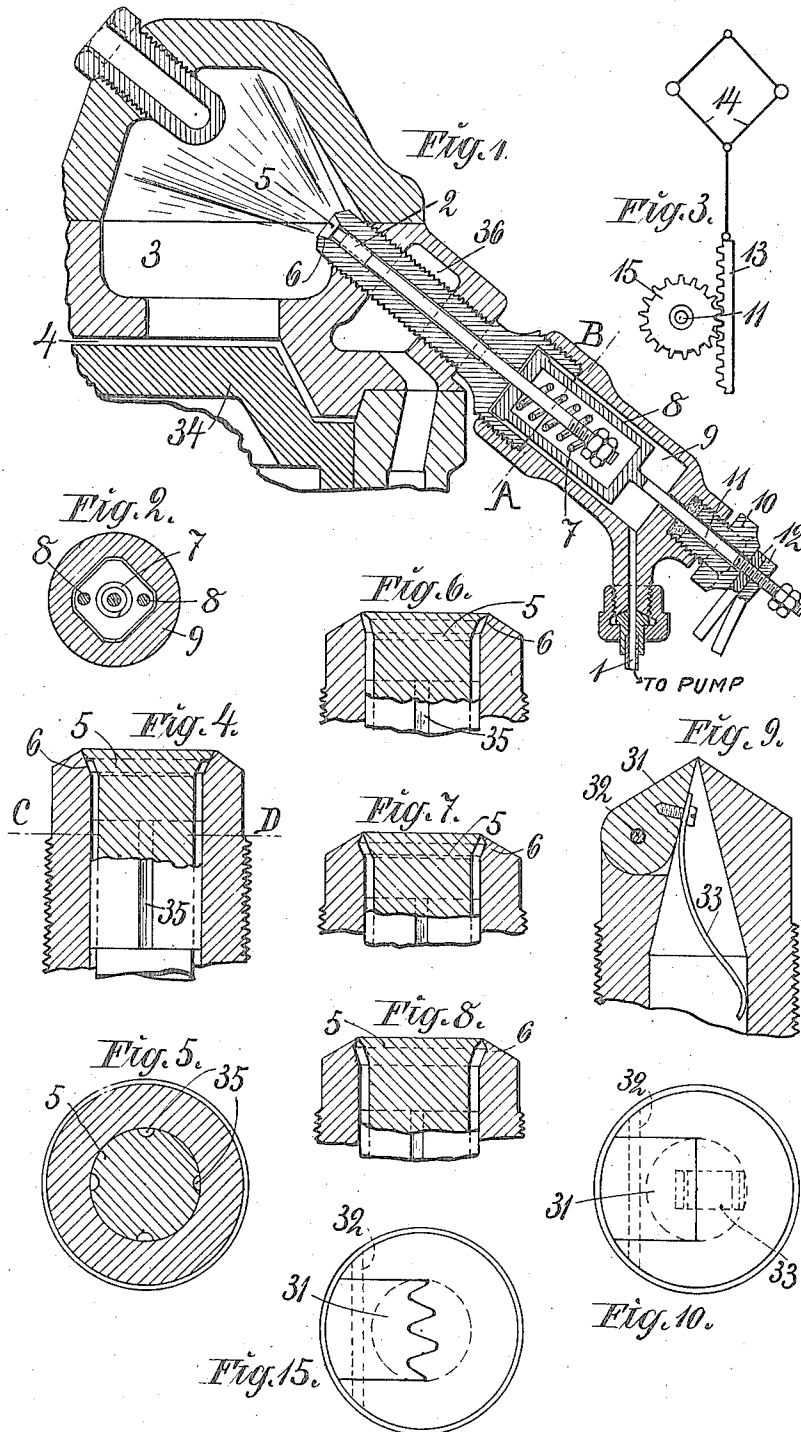


O. OHLSSON
 MEANS FOR REGULATING IGNITION IN INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED APR. 6, 1912.

1,206,359.

Patented Nov. 28, 1916.
 2 SHEETS—SHEET 1.



Witnesses:
 Hyperion Barry
 F. George Barry

Inventor:
 Olof Ohlsson
 By his attorneys
 Brown & Ward

O. OHLSSON.
 MEANS FOR REGULATING IGNITION IN INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED APR. 16, 1912.

1,206,359

Patented Nov. 28, 1916.
 2 SHEETS—SHEET 2.

Fig. 11.

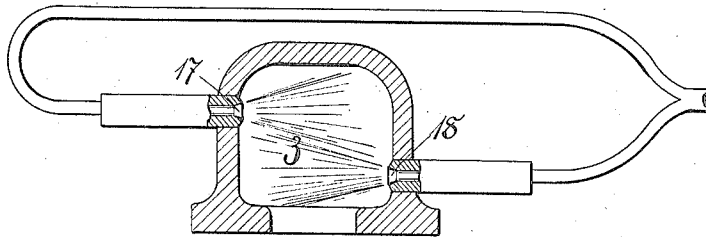


Fig. 12.

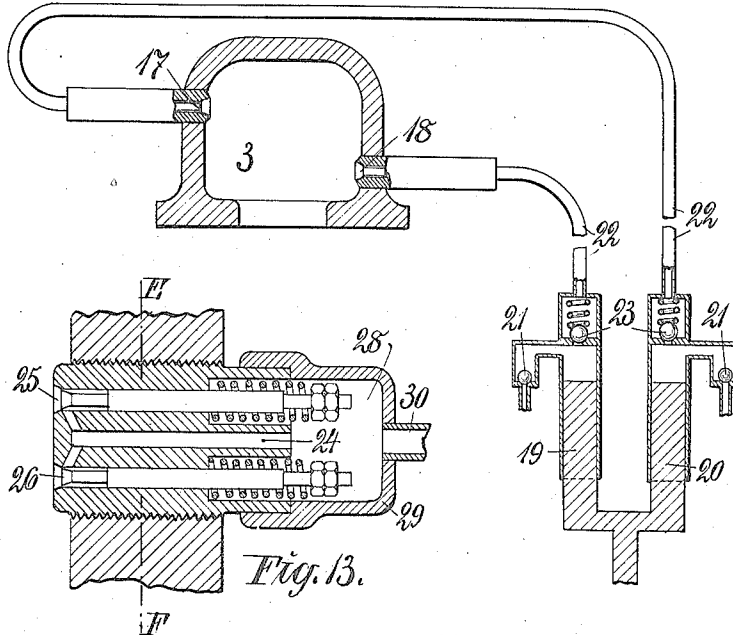


Fig. 13.

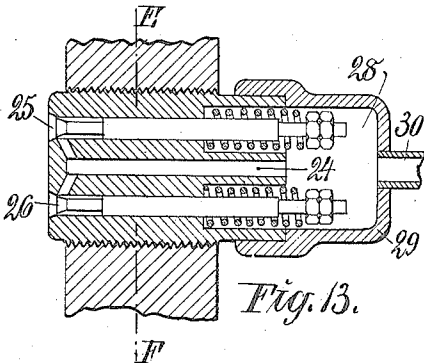
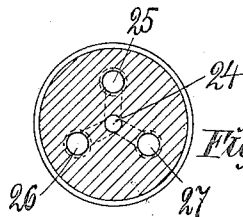


Fig. 14.



Witnesses:
 Hyperion Barry.
 George Barry

Inventor:
 Olof Ohlsson
 by his attorneys
 Brown & Seward

UNITED STATES PATENT OFFICE.

OLOF OHLSSON, OF SÖDERTELJE, SWEDEN.

MEANS FOR REGULATING IGNITION IN INTERNAL-COMBUSTION ENGINES.

1,206,359.

Specification of Letters Patent.

Patented Nov. 28, 1916.

Application filed April 16, 1912. Serial No. 691,124.

To all whom it may concern:

Be it known that I, OLOF OHLSSON, a subject of the King of Sweden, and resident of Skogsgatan 3, Södertelje, in the Kingdom of Sweden, have invented certain new and useful Improvements in Means for Regulating Ignition in Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to means for effecting an ignition as constant as possible of the charges in internal combustion engines, *i. e.* an ignition, which does not take place earlier or later according to the greater or less load of the engine but always is effected at a certain position of the crank, without more fuel being used than is necessary for keeping the engine in motion, when subjected to the less load or when running light. This is of great importance, because loss of fuel otherwise is effected at the small load by incomplete combustion, pitching in the working chamber and so on. Efforts have been made to remove the said fault by external heating of the explosion chamber for counteracting the reducing of the temperature caused by the reduced load, and by delaying the premature ignition by cooling at the full load. The said operations, however, require a continuous control and are of a small advantage as to the consumption of fuel, above referred to. The said fault can not be removed by means adapted to effect a rapid evaporation of the fuel owing to the fact that the evaporation is dependent of the temperature and consequently is greater or less according to the greater or less load. Various experiments have shown, that the necessary regulation can be effected by the liquid fuel, when entering directly into the explosion chamber at the end of the compression stroke being minutely divided in a still greater degree according to the reduction of the load, so that it is spread in the air in the said chamber in the shape of the finest sprinkles, when the engine runs light, but in a less divided state at the full load. As easily understood, the fuel, for gaining the said object, may not be subjected to a previous evaporation. Consequently, this invention consists in the liquid fuel being injected directly into the explosion chamber or forced into the same at a high pressure, effected in the ordinary manner by means of a pump or the like, without

a previous evaporation and without air being added to the same, further in the injection being not effected through an ordinary nozzle, leaving a single, more or less compact jet, but through a valve loaded in a suitable manner (spring actuated) but free in other respects, which valve is so shaped, that it acts like a minutely dividing device (atomizer) and spreader, and in a regulating device being provided in combination with the said means, which device controls the quantity of fuel for each injection, according to the load, and preferably acts by increasing or decreasing the stroke of the pump piston. The said valve is so arranged, that the resistance to the fuel effected by the same can be increased or decreased either manually or automatically by a governor. The engine may be made to operate with so called idle strokes in the ordinary manner, *i. e.* that no fuel is introduced by the pump during one or more strokes of the working piston. Consequently, the said cooperating factors result in the fuel being minutely divided in a greater degree at the less load of the engine and thus being mingled more intimately with the air in the explosion chamber than hitherto, so that the ignition is facilitated, while at the greater load, the greater quantity of fuel, owing to the fact that also the said quantity is not vaporized and the dividing capacity of the divider is limited, being not divided to the same degree, so that premature ignition is obviated.

Experiments, carefully made, have shown, that the delaying of the ignition effected at a small load in engines hitherto used is fully compensated by increasing correspondingly the dividing of the smaller fuel quantity or, in other words, the difference in time between the feeding operation and the ignition, if the fuel is fed in a small quantity but is minutely divided in a high degree, compared with the feeding of the fuel in a greater quantity but minutely divided in a less degree, is none or inconsideable. Consequently, the angle through which the crank is rotated during the said period, is constant or substantially constant in spite of the difference in temperatures, while in the engines hitherto used the difference in temperatures causes great differences in the period between the feeding operation and the ignition at a great load compared with the said period at a small load. Con-

sequently, the dimensions of the valve ought to be so adapted, that the said object is gained, and for that reason the valve, preferably arranged like a circular lift valve, is rendered comparatively small. The minute dividing of the fuel is effected by the same in a liquid state being forced through the narrow slot between the movable valve body and the valve seat, which slot is filled completely by the liquid fuel even at the feeding of the smallest quantity of fuel. In order to increase the effect the valve may be so arranged, that the liquid is forced for instance through the space between a surface, and an edge directed toward the same, or through the space between two edges. Besides, the said valve ought to be so arranged, that the minutely divided liquid can freely disperse in the explosion chamber without being prevented by any surfaces located near the valve. The injection of the fuel may also be effected by two or more valves simultaneously.

In the accompanying drawings Figure 1 is a section of the valve, the explosion chamber and a part of the working cylinder. Fig. 2 is a cross section on the line A to B of Fig. 1. Fig. 3 shows schematically the combination of the valve and governor, mentioned above. Figs. 4 to 10 inclusive and 15 show different forms of the valve on a greater scale. Figs. 6, 7 and 8 are directed to different forms of the channel of the valve; Fig. 6 showing it widened at its outmost end after extending in a straight line; Fig. 7 showing it widened after following a curved line turning its concave face toward the center of the channel so that a sharp edge is formed against which the valve rests, while in Fig. 8, there is shown both this curvature of the valve seat or channel and the valve body itself widened after following the direction of a broken line, so that it may form a sharp edge at its extremity. Fig. 11 shows a part of an engine provided with two valves, having opposite directions, and a supply conduit leading from a common pump. Fig. 12 shows a part of an engine also provided with two valves but with a special conduit and pump for each of the valves. Fig. 13 shows in a section a plurality of valves, three in the drawings, having a common conduit branching to the valves and opening into the same near their seats. Fig. 14 is a section on the line E—F of Fig. 13.

The liquid fuel is forced by the pump through the conduit 1 and the valve 2 into the explosion chamber 3, which communicates at its bottom with the cylinder chamber 4, in which operates the working piston 34. The fuel is minutely divided by the valve 2, the movable part or body 5 of which is forced against the seat 6 in a yielding manner by the spring 7 wound around the

valve spindle. The width of the valve spindle is great with relation to the proper valve body and the bearing surface between the said body and the seat, longitudinally of the spindle, is comparatively short. The object of the said arrangements is to provide a reliable guide for the valve, near its body, so that the body fits snugly to the seat, and to prevent the liquid from evaporating in the valve, so that the liquid will cool the valve, and also to effect a minute dividing of the liquid through the pressure between the valve body and the seat, when passing the body, so that the liquid passes from the valve directly into the chamber 3 in the shape of a more or less fine dust inversely to the quantity of fuel fed into the chamber. Consequently, the dimensions of the valve are so adapted, that its dividing capacity is sufficient for the effecting of such a minute division of the liquid, as, on the whole, may be effected, when a small quantity of fuel, is fed into the chamber, but, otherwise, at a great quantity of fuel, is unable to operate in the same manner in a higher degree than that the liquid passes from the valve into the chamber substantially in the shape of fine sprinkles. Also the ordinary regulating device for effecting so called free strokes may be provided. As many devices for the purpose last mentioned are before known, it is not shown in the drawing. A fork, sleeve 8 or the like is slid on the valve spindle, which, like the spring, is located in a wider chamber 9 of the conduit 1. The shaft 11 of the said fork extends through the cover 10 of the stuffing box of the chamber. A freely accessible adjusting nut 12, provided with a handle, is in screw-threaded engagement with the said shaft 11. One end of the spring bears against nuts screwed on the valve spindle, while its other end bears against the fork. For the increasing or decreasing of the pressure of the valve the nut 12 is adjusted, so that the tension of the spring is increased or decreased respectively. The said adjustment may be effected at any time during the running of the engine. The fork is prevented from rotating by the chamber 9 being square in cross section or in any other suitable manner. Preferably two nuts 12 are provided, one locking the other. Besides, extra nuts may be provided on the shaft 11 determining the limit for the relaxing of the spring. The tension of the spring is indicated on a scale not shown in the drawings. For the effecting of an automatic adjustment the nut 12 may be connected with a governor, preferably a centrifugal governor, by means of a screw gearing, toothed gearing, lever mechanism or the like. Fig. 3 illustrates an example of the said gearing. The rack 13 is moved upward and downward by the centrifugal governor and acts upon the toothed wheel 15, forming the

nut 12. The connection with the governor is preferably so arranged, that it can be brought into or out of operation, so that the adjustment may be effected manually.

5 The shape of the valve 2, which may communicate directly with the working chamber 4, may be varied, as mentioned above. In Fig. 4 the surface bearing against the seat forms a short part of the conical body of the valve. Fig. 5 is a cross section on the line C—D of Fig. 4. Fig. 6 shows the valve body formed to an edge bearing against the seat. In Fig. 7 the seat is formed to an edge and in Fig. 8 both the valve body and the seat are formed to edges, one bearing against the other. In Figs. 9 and 10 the valve is arranged like an expansible nozzle, the exit opening of which consists of a straight slot. The said slot may be curve shaped, Fig. 15, without forming a closed curve. In the drawings one 31 of the side walls of the valve opening is swingable around the shaft 32 and acted upon by a spring 33, keeping the side wall in its closed position. Other arrangements may, however, be used.

In all Figs. 4 to 10 inclusive, which show the valve on an increased scale, the valve has an abrupt end surface alongside of the outermost bearing point of the valve body against the seat, so that the fuel is freely injected into the explosion chamber, as shown in Fig. 1.

35 The arrangement shown in Fig. 13 is easily understood from the above. As the pump piston is advanced, the fuel is forced into the explosion chamber 3 through two valves 17, 18 simultaneously, which valves open into the said chamber in different directions. Each of the said valves operates in the same manner as the valve 5 mentioned above, so that the fuel is minutely divided to a greater or less degree, according as a smaller or greater quantity of fuel is fed into the engine. Also the devices shown in Figs. 12 and 13 operate in the described manner.

In Fig. 12 two pump pistons 19, 20 are connected, which force the fuel through the two valves respectively. During the return stroke of the pistons fuel is sucked from a tank into the cylinders through the valves 21 and is then forced into the conduits 22 through the valves 23. In Figs. 13 and 14 a special passage 24 is provided in the casing of the valve. From the said passage three branches extend in such manner to three valves 25, 26, 27 arranged around the same, that the branches communicate with the valves immediately behind the seats respectively. Owing to the said arrangement the fuel must not move along the valve spindle. Consequently, no such channels as

the channels 35, shown in Fig. 5, must be provided and the chamber provided around the said spindle for the passage of the fuel may be omitted. The valve spindles, however, are contained in the conduit or chamber 28. The arrangement shown in Fig. 13 may be provided also in engines having only one inlet valve or another number of inlet valves than that shown in the drawings. In order to render the valves easily accessible a cap 29 is screwed on the valve casing, to which cap the pipe 30 is connected.

75 The casing of the valve is cooled by a water jacket 36 located as near as possible to the exit opening for the fuel in order to prevent the fuel from evaporating. In addition to the air entering from the work chamber 4 air may be introduced into the explosion chamber through another device than the fuel valve 2, which, as mentioned above, is adapted to minutely divide the fuel within limits, the highest and lowest, corresponding to the lowest and highest temperatures respectively. If the fuel must be minutely divided to a higher degree, which only exceptionally is necessary, this can be effected by adjusting the nut 12. Consequently, an engine arranged as described, may be regulated within wide limits, so that, if the temperature would grow very high owing to a necessary great supply of fuel, the ignition, which would otherwise take place at an earlier moment, is retarded correspondingly, and vice versa, at a small supply of fuel the otherwise retarded ignition is advanced. A quantity of fuel greater than that corresponding to the load must, on the other hand, never be fed into the engine.

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

105 In a device for injecting liquid fuel in internal combustion engines, the combination of a spring actuated inlet valve for the fuel having a substantially sharp edge, a seat for the said valve also having a substantially sharp edge, means for forcing the fuel through the valve with such power that it is able to open the valve, and means for regulating the load of the said spring in such manner that a minute division and spreading of the fuel is effected in a greater degree when a small quantity of fuel is fed in and in a less degree when a greater quantity of fuel is fed in.

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

OLOF OHLSSON.

Witnesses:

GRETA PRIEN,
ROBERT APELGREN.