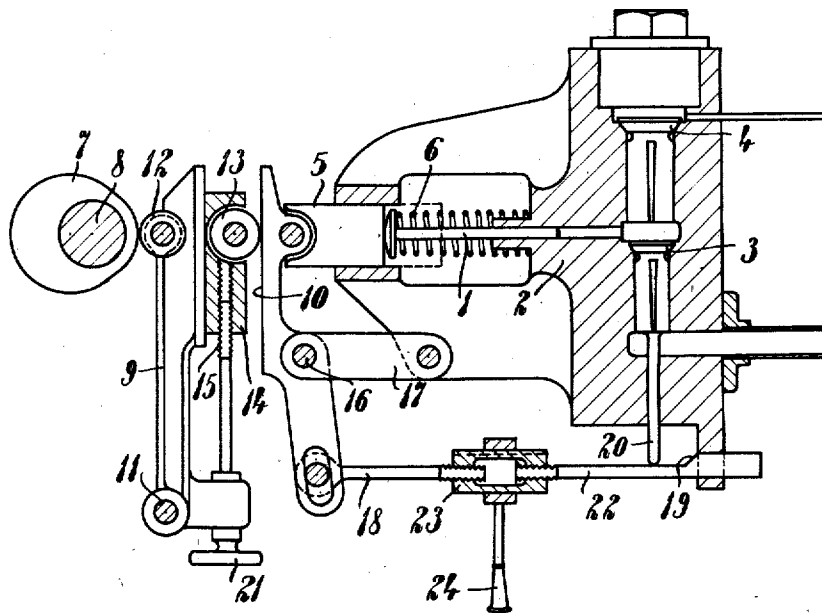


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K. J. E. HESSELMAN
INTERNAL COMBUSTION ENGINE

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE

Application filed July 28, 1922. Serial No. 578,252.

To all whom it may concern:

Be it known that I, KNUT JONAS ELIAS HESSELMAN, a citizen of the Kingdom of Sweden, residing at Saltsjo-Storangen, Sweden, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

In internal combustion engines using direct injection of the fuel the said injection is effected as a rule by means of a pump driven by a cam or the like. In such engines the fuel injection will in the most cases take place at constant speed of the pump relatively to the speed of the engine, that is, during a constant period of time at constant load. When fuel oils having different specific weights are used, an oil having a lower specific weight will emit its quantity of heat more slowly than an oil having a higher specific weight. Therefore, it is desirable in such internal combustion engines to provide means for adjusting the injection period according to the specific weight of the fuel oil as well as according to other qualities of the fuel oil that are of importance for the heat emission.

This invention has for its object to enable such an adjustment in a simple way even in case the engine is running.

The invention is characterized, chiefly, by the combination with a lever of adjustable length controlled by a cam disk, an eccentric or the like and, in turn, controlling the pump plunger, of means to open the suction valve or a by-pass valve between delivery and suction space of the pump after the plunger has completed part of its pressure stroke.

The invention is illustrated in the accompanying drawing which shows a part sectional elevation of one embodiment of the invention.

With reference to the drawing, the numeral 1 designates the plunger and the numeral 2 designates the casing of the fuel supplying pump of an internal combustion engine. The pump casing contains a suction valve 3 and a delivery valve 4. The pump plunger is operated by a sliding block 5 and is restored by a spring 6. The sliding block 5 is operated from a cam 7 carried by the crank shaft 8, and the transmission of power from said cam to said block is effected by two levers 9 and 10. The lever 9 is mounted on a fixed pivot pin 11 and

carries a roller 12 engaging the cam 7, and a roller 13 engaging the lever 10. The roller 13 is mounted in a block 14 carried by the lever 9 and engaging a longitudinally extending guide-way on this lever. The block 14 with the roller 13 may be displaced in said guide-way by means of a screw 15 rotatably mounted in a projection of the lever 9 and provided with a manipulating head 21. The lever 10 is mounted on a journal 16 carried by a link 17 the opposite end of which is pivotally connected to the casing 1. A lower arm of the said lever 10 is connected to a sliding rod 18 to open the suction valve 3 by means of a cam surface 19 engaging the stem 20 of said valve 3.

The construction above described is so designed that at the beginning of the injection the guide-way formed on the lever 9 to be engaged by the block 14 is parallel to the surface of the lever 10 engaged by the roller 13. According as the block 14 with the roller 13 is displaced in the direction away from or towards the pivot 11 of the lever 9 by turning of the screw 15 the operative movement of the sliding block 5 as well as of the plunger 1 (that is the pressure stroke) will take place at a reduced or increased speed. The suction valve 3 is normally closed and the moment of beginning of the injection will thus be controlled exclusively by the cam 7, inasmuch as the position of the roller 13 on the lever 9 is of no importance in this respect. The injection will consequently always begin in one and the same crank position.

By means of the rod 18 and the cam surface 19 the lever 10 opens the suction valve 3 during the delivery stroke after a predetermined movement of the sliding block 5, whether or not said movement takes place at a higher or lower speed. According as the plunger 1 is operated more or less rapidly there will, of course, be obtained a more or less rapid injection of the fuel, that is, the injection will take place under a more or less high pressure. The quantity of fuel delivered, however, will not be changed by this, as the opening of the suction valve and thus the operative length of the pressure stroke of the plunger 1 is fully independent of the position of the roller 13 on the lever 9 and depends only on the position of the plunger.

In order to yet enable an adjustment of

the quantity of fuel injected, that is, of the load, the cam surface 19 may be formed on a separate member 22 which, as shown, is adjustably connected to the rod 18, as by means of a sleeve 23 having oppositely screw-threaded borings engaged by the correspondingly screw-threaded ends of the rods 18 and 22. The sleeve 23 may be rotated to change the relative position of the cam surface 19 by means of a hand lever 24. The rotation of the sleeve 23 may, if desired, be accomplished by the governor. The means for adjusting the relative position of the cam surface 19 may be modified in various ways and, likewise, other parts of the construction constituting the object of this invention may be varied without departing from the principle of the invention. For instance, the lever 10 may be omitted and replaced by a rigid surface on the member 5 in which case a special link connection of the like should be provided between the member 5 or the plunger 1 and the means for opening the suction valve 3. The interruption of the operative pumping stroke may also be effected by opening a by-pass valve between the delivery and suction space instead of the suction valve. The roller 13 may be replaced, for instance, by a cross-head slipper. Furthermore, the moment of beginning of the injection may be determined by the plunger 1 by the aid of means that will close the suction valve 3 in the proper position of the plunger. In such case there is no need for having the guide-way for the block 14 parallel with the contact surface of the lever 10 at the moment of beginning of the injection. In case the suction valve is controlled by the governor, and the above said guide-way on lever 9 and the contact surface of lever 10 are parallel to each other, the movement for controlling the suction valve may be derived from the cross piece of the plunger and may be used for determining not only the beginning but also the termination of the injection without any change of the position of the governor.

What I claim is:—

1. In an internal combustion engine having a fuel supply pump with its plunger, the combination of means comprising a lever system for operating said plunger, said means being adjustable so as to permit variation of the relative speed of operation of the plunger without materially affecting the relative moment of beginning of the injection, with means to cut off the injection after the piston has completed a predetermined part of its discharge stroke.

2. In an internal combustion engine having a fuel supply pump with its plunger, the provision of means for controlling the

fuel injection period, comprising in combination a cam operated lever having a guide-way, an adjustable member on said lever engaging said guide-way, another member engaging the pump plunger, said other member having a contact surface to be engaged by said adjustable member, the arrangement being so designed that the said guide-way and the said contact surface will be parallel to each other at the beginning of the injection stroke, a valve between the delivery and suction space of the pump, means for opening said valve, and a connection between said other member and said opening means to cause said means to open the valve after the plunger has completed a predetermined portion of its pressure stroke.

3. In an internal combustion engine having a fuel supply pump with its plunger, the provision of means for controlling the fuel injection period, comprising in combination a cam operated lever having a guide-way, a sliding block on said lever engaging said guide-way, a screw to displace said block in said guide-way, a roller mounted in said block, and adapted to operate the pump plunger, a valve between the delivery and suction space of the pump, and means to open said valve after the pump plunger has completed a predetermined portion of its pressure stroke.

4. In an internal combustion engine having a fuel supply pump with its plunger, the provision of means for controlling the fuel injection period, comprising in combination a valve between the delivery and suction space of the pump, a cam operated lever, adjustable operating means on said lever, a reciprocating member to be operated by said adjustable means and adapted to engage the pump plunger, another lever pivotally connected to said reciprocating member, and means controlled by said other lever to open said valve.

5. In an internal combustion engine having a fuel supply pump with its plunger, the provision of means for controlling the fuel injection period, comprising in combination a valve between the delivery and suction space of the pump, a cam operated lever, adjustable operating means on said lever, a reciprocating member to be operated by said adjustable means and adapted to engage the pump plunger, another lever pivotally connected to said reciprocating member, and a rectilinearly movable, adjustable cam element controlled by said other lever to open said valve.

In testimony whereof I have signed my name,

KNUT JONAS ELIAS HESSELMAN.