K. J. E. HESSELMAN.

FUEL PUMP FOR REVERSIBLE INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAY 18, 1908.

906,022.

Patented Dec. 8, 1908.

2 SHEETS—SHEET 1.

Fig. 1.

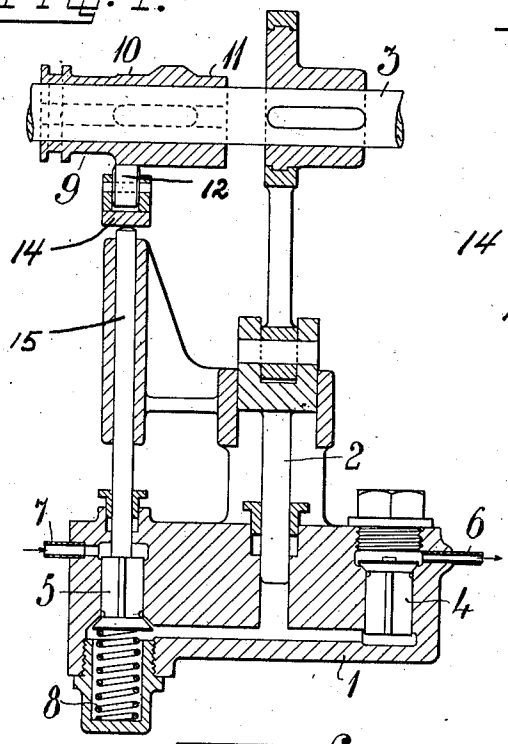


Fig. 2.

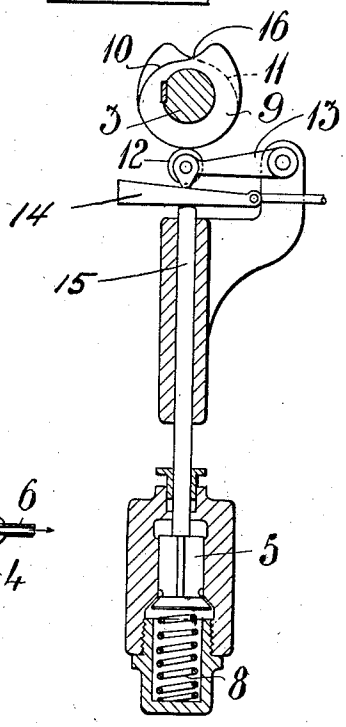


Fig. 6.

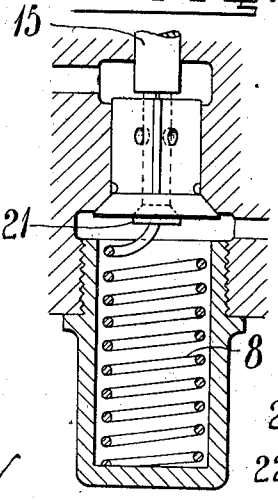
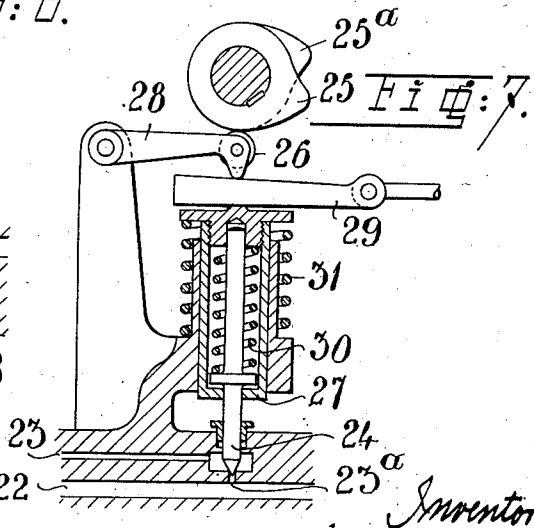


Fig. 7.



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2 SHEETS—SHEET 2.

Fig. 3.

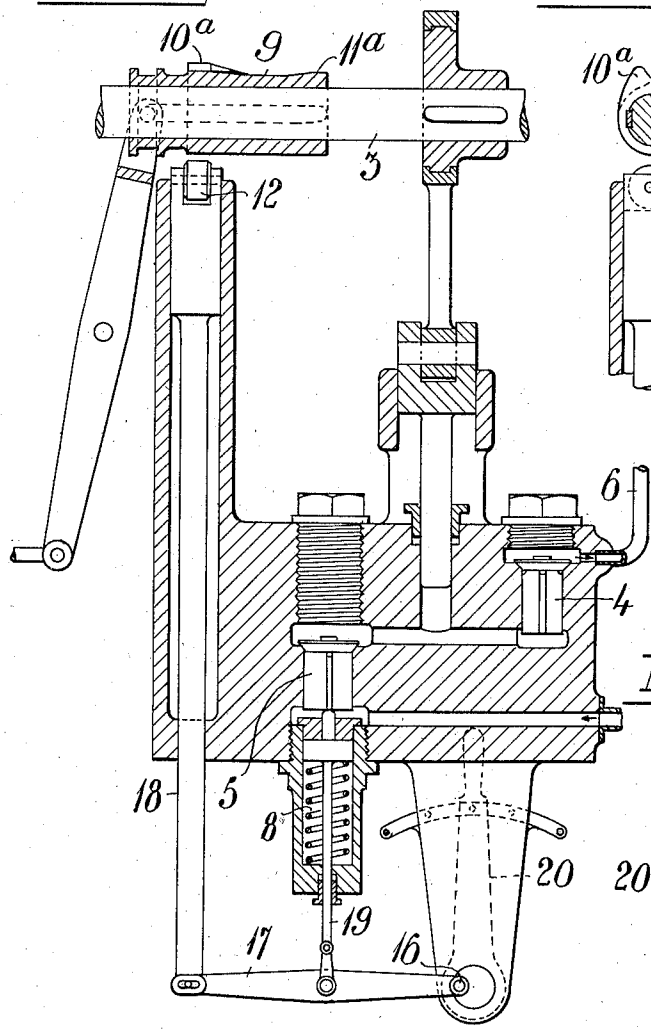


Fig. 4.

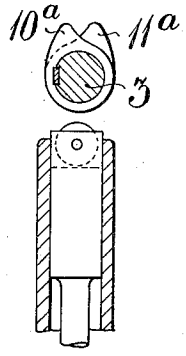


Fig. 5.

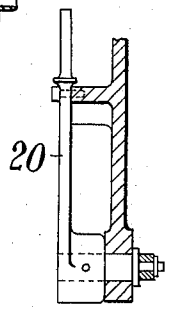


Fig. 8.

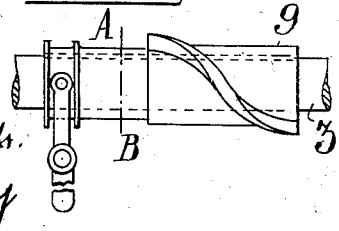


Fig. 7.



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UNITED STATES PATENT OFFICE.

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FUEL-PUMP FOR REVERSIBLE INTERNAL-COMBUSTION ENGINES.

No. 906,022. Specification of Letters Patent. Patented Dec. 8, 1908.

Application filed May 18, 1908. Serial No. 433,496.

To all whom it may concern:

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

This invention relates to improvements in fuel-pumps for reversible internal combustion engines.

In reversible internal combustion engines it is generally necessary to cut off the supply of fuel when the engine is to be reversed. This will easily be understood from the following reasoning. A reversible explosive engine runs "ahead". When "astern" is ordered, the machinist immediately adjusts the controlling means of the engine for the new direction of rotation, but on account of the inertia the engine will make some few revolutions "ahead" before he changes its direction of rotation. If fuel be supplied to the engine during the said revolutions several complications can occur, the results of which depend on the construction of the engine. For instance, it may happen that the products of combustion escape through the air-inlet ports. In some cases the engine is actually working during the said revolutions, which obviously delays the maneuver. The greatest danger is, however, found in such engines where the fuel is supplied to the engine chiefly during the first part of a period of a cycle. If such an engine rotates in a direction opposite to that for which the controlling means are adjusted, the fuel will be supplied during the compression-stroke, whereby counter-explosions can effect pressures which are sufficient to spoil the engine. As a rule it is in the most cases not sufficient to disconnect the fuel-pump before the reversal of the engine, but it is necessary to so construct the said pump that it will automatically cease to supply fuel to the engine when the controlling means are adjusted for a new direction of rotation.

The object of the present invention is to provide such an arrangement of the oil-pump.

The invention consists, principally, in the combination with the fuel-pump of means for keeping the suction valve (or valves or a corresponding valve or valves) of the pump open during the whole pressure stroke of the pump or the greater part thereof when the engine runs in a direction opposite to that for which the controlling means of the engine are adjusted, all as will be more particularly explained herebelow and pointed out in the claims.

In the accompanying drawing I have shown two forms of my invention. Figures 1 and 2 show two sections of the one form at right angles to each other. Fig. 3 is a sectional view of the other form. Fig. 4 is a section at right angle to the section in Fig. 3 of a part of the second construction form. Fig. 5 is a side-view of a hand-lever shown in Fig. 3. Figs. 6, 7, 8 and 9 show details.

Referring to Fig. 1, 1 indicates the pump-casing, 2 the pump-plunger and 3 a shaft which drives the pump-plunger by means of an eccentric or the like. The shaft 3 may be the crank-shaft or any other shaft driven therefrom by means of a suitable gearing so as to change its direction of rotation at the same time as the engine is reversed.

4 indicates the pressure-valve of the oil-pump and 5 the suction-valve thereof.

6 is the pressure-pipe of the pump and 7 the suction-pipe. A spring 8 tends to press the suction-valve 5 against its seat. On the shaft 3 is provided a sleeve 9 which is slidable on the shaft but not rotatable on the same and has on its circumference two recesses 10 and 11, by means of which the suction valve obtains the desired movement, this movement being transmitted to the valve by means of a roller 12 journaled on a pivoted arm 13, a wedge 14 and a pin 15. The one recess is active in the one direction of rotation and the other in the opposite direction, and both recesses have such shape that the path of the roller 12 declines slowly counted in the ordinary direction of rotation for each cam to the lowest point 16 from which the path rises rapidly to the circumference of the sleeve

The device described above works in the following manner. When the plunger 2 rises from its lowermost position it sucks fuel through the suction valve 5 which is kept open by the pin 15, the roller 12 engaging the cylindrical part of the sleeve 9. During the downward stroke the plunger 2 presses the fuel back through the suction valve 5, until the roller 12 engaging the recess 10 (or 11) permits the spring 8 to close the said valve. When this is done the remaining fuel is forced out through the pressure valve 4. The suction valve 5 is closed earlier or later

according to the position of the wedge 14 and the shape of the recesses 10 and 11. When the plunger 2 again rises the suction valve 5 is opened by the roller leaving the recess 10 (or 11) at the rear end thereof counted in direction of rotation of the shaft 3. The working will obviously be the same when the shaft 3 rotates in the opposite direction and the recess 11 is placed opposite the roller 12. If, however, the shaft 3 rotates in the last mentioned direction and the recess 10 is opposite the roller 12, the pump will not deliver any fuel or it will deliver only a very small quantity thereof to the engine, this depending thereon that the suction valve 5 is kept open during the whole pressure stroke of the plunger or during the greater part thereof and the spring 8 is given opportunity to close the suction valve immediately before, at or after the end of the pressure stroke according to the shape of the recess and the position of the wedge. The latter may be adjusted manually or by a governor or both.

The form shown in Figs. 3, 4 and 5 differs from that described above in that the sleeve 9 is provided with cams 10^a and 11^a and that the spring 8 actuating the suction valve 5 tends to keep the latter open, the cams being adapted to close the said valve at the desired moments, and further in that the control of quantity of fuel supplied to the engine is accomplished by means of an eccentrically located pin 16 forming the pivot of a lever 17 which is pivotally connected to a longitudinally movable rod 18, supporting at its upper end a roller 12 actuated by the sleeve 9 and the cams 10^a and 11^a thereon. To the said lever 17 is connected a pin 19, or the like, the upper end of which actuates the suction valve 5 under the action of the spring 8. When the rod 18 is pressed down by one of the cams 10^a, 11^a, also the pin 19 moves downwards and compresses the spring 8 thus permitting the suction valve to reach its seat. The eccentrically located pin 16 may be adjusted by means of a hand-lever 20 on the pivot of which the said pin 16 is provided, or such adjustment may be accomplished automatically by a governor or both manually and automatically.

The most important practical difference between the form shown in Figs. 1 and 2 and that shown in Figs. 3–5 consists, however, in that, when in the former the sleeve 9 is adjusted from the one position to the other, the suction valve 5 is opened (if the adjustment takes place during a pressure-stroke of the pump) when the roller 12 engages the cylindrical part of the sleeve, the pump thus immediately ceasing to deliver fuel, which is not the case in the latter form unless the spring 8 is strong enough to overcome the pressure in the pump-casing.

In the form shown in Figs. 3–5 the action of the pump obviously may be controlled by means of a wedge between the rod 18 and the sleeve 9 instead of by the pin 16. The spring 8 in Fig. 3 may, if desired, be arranged to act directly upon the lever 17.

In cases where great pressures are effected in the pump it may be necessary to provide a relief valve for the suction valve of the pump. Such a device is shown in Fig. 6. A relief valve 21 is here provided in the suction valve 5, and both are actuated by the pin or rod 15 in such a manner that the unloading-valve 21 is kept open somewhat longer than the suction-valve 5 and is opened somewhat earlier than the latter, so that the suction valve thus will be unloaded. A corresponding device may be used in the form shown in Figs. 3–5.

Instead of having the excess of fuel flow back through the suction valve, one may provide a separate channel through which the said excess flows back, as is illustrated in Fig. 7. A channel 22 is in communication with the pressure-chamber of the pump, while another channel 23 is in connection with the suction chamber or any other chamber for taking up the fuel flowing back. A port 23^a connects the two channels 22 and 23 with each other and can be closed by means of a needle valve 24 or the like. A cam 25 or 25^a acts upon a roller 26 which transmits the motion to a hollow sliding piece 27 by means of a lever 28 and a wedge 29. When the sliding piece 27 moves downwards under the action of the cam 25 or 25^a the valve 24 is first closed by means of a spring 30, whereupon the sliding piece continues its downward movement a distance that is depending on the shape of the cam 25 or 25^a. When the latter has passed the roller 26 a spring 31 raises the sliding piece 27 and thereby also the valve 24 so that the port 23^a is opened. Also in this case any other controlling member may be substituted for the wedge 29, and the latter may be adjusted manually or by means of a governor.

Finally it may be pointed out that the control of the quantity of fuel delivered by the pump may be accomplished by means of one or two helical cams 32 provided on the shaft 9 as is illustrated in Figs. 8 and 9 (Fig. 9 being a section on line A—B in Fig. 8).

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

1. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said, first-mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and

provided with two devices, one for each direction of rotation of the engine, and connected with and adapted to operate the suction valve of the fuel pump.

2. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, a relief valve in said suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said, first-mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft, and provided with two devices, one for each direction of rotation of the engine, and connected with and adapted to operate the suction valve of the fuel pump.

3. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, a plunger, a suction chamber, a pressure chamber, a chamber 22 communicating with the suction and pressure chambers, a chamber 23, a port connecting said chambers 22 and 23, a valve controlling said port, and means for operating said valve, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said, first-mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and provided with two devices, one for each direction of rotation of the engine, and connected with and adapted to operate the suction valve of the fuel pump.

4. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said, first-mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and provided with two devices, one for each direction of rotation of the engine and connected with and adapted to operate the suction valve of the fuel pump through a connection including adjustable means for determining the time at which the suction valve is closed.

5. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a plunger, a suction valve, and controlling means, of means controlled by the shaft for keeping the suction valve open during the major portion of the stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted.

6. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said first mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and provided with two cams displaced in relation to each other and connected with the suction valve through a lever and pin.

7. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said first mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and provided with two cams displaced in relation to each other and connected with the suction valve through a lever and pin, the pivot of the lever being adjustable.

8. The combination with a fuel pump for reversible internal combustion engines, comprising a shaft, a suction valve, and a plunger, of means for keeping the suction valve open during the major portion of the pressure stroke of the plunger, when the engine runs in a direction opposite to that for which the controlling means are adjusted; the said first-mentioned means comprising a sleeve mounted on the shaft and slidable but not rotatable in relation to said shaft and provided with two devices, one for each direction of rotation of the engine, and connected with and adapted to operate the suction valve of the fuel pump, the said connection intermediate the sleeve and the suction valve including an adjustable wedge, for the purpose set forth.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

KNUT JONAS ELIAS HESSELMAN.

Witnesses:
ERNEST DELMAR,
JOHN DELMAR.