M. R. MATTI.

ARRANGEMENT FOR REVERSING INTERNAL COMBUSTION ENGINES.

APPLICATION FILED SEPT. 9, 1913.

1,130,833.

Patented Mar. 9, 1915.

3 SHEETS—SHEET 1.

Fig. 1.

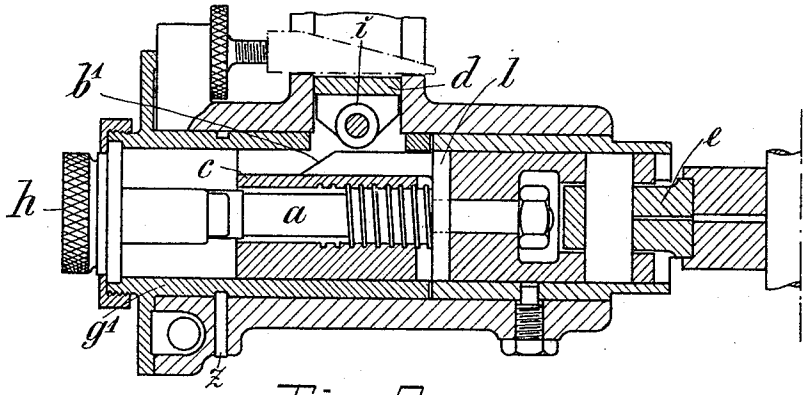
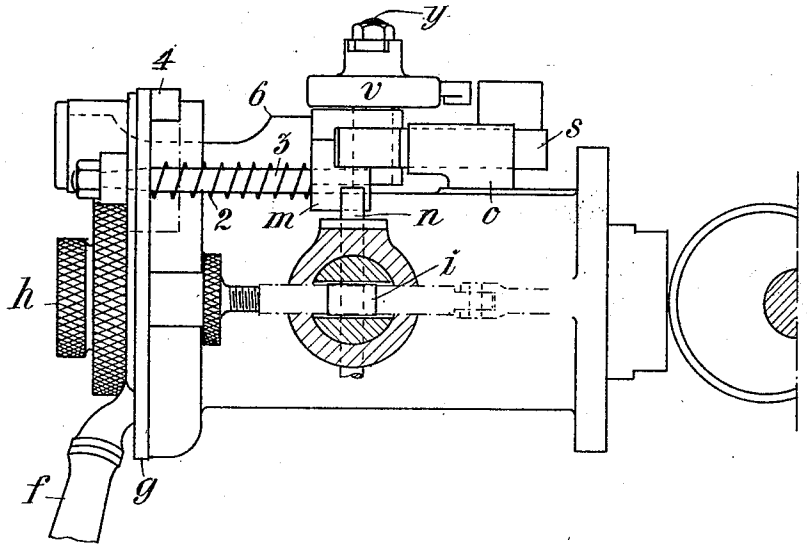


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

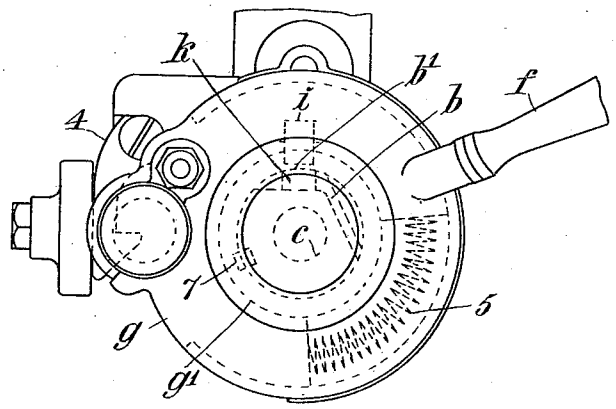
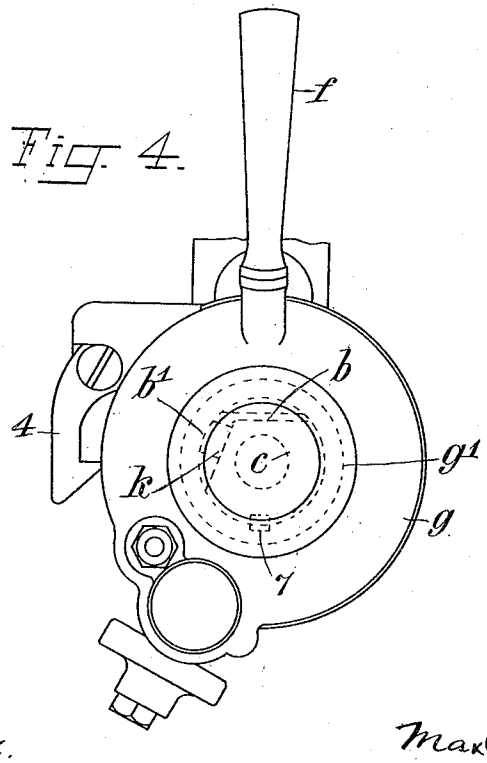


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

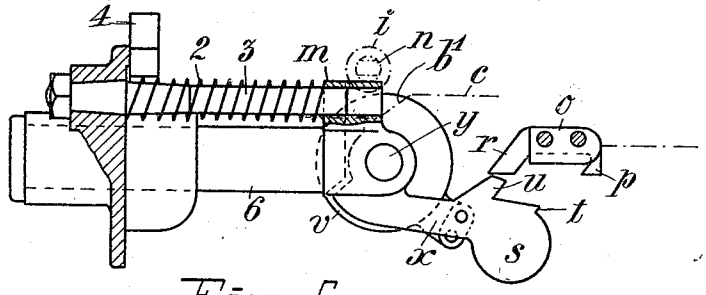


Fig. 6.

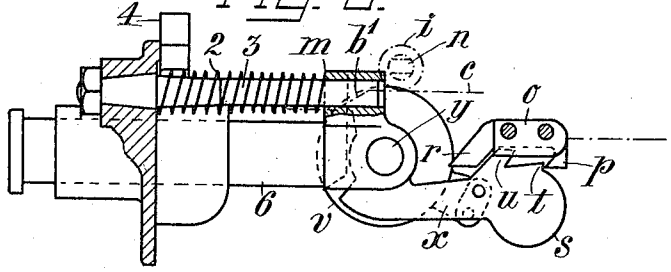


Fig. 7.

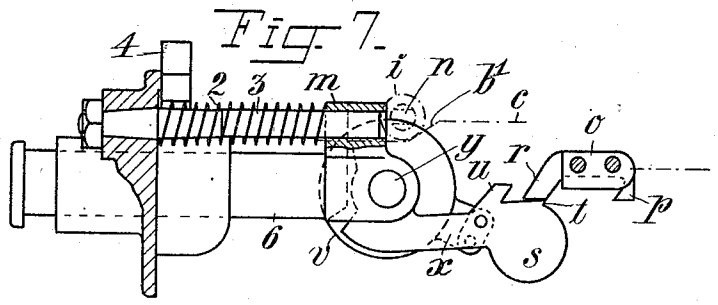
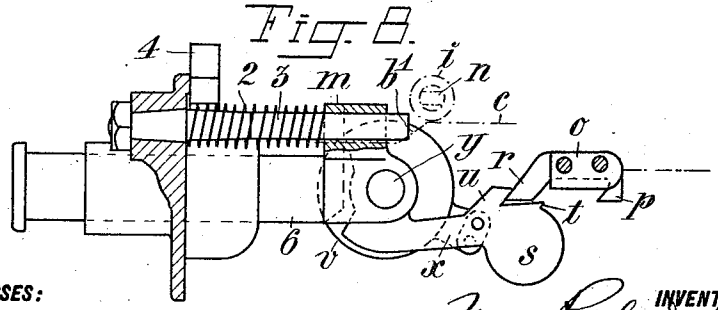


Fig. 8.



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UNITED STATES PATENT OFFICE.

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ARRANGEMENT FOR REVERSING INTERNAL-COMBUSTION ENGINES.

1,130,833. Specification of Letters Patent. Patented Mar. 9, 1915.

Application filed September 9, 1913. Serial No. 788,912.

To all whom it may concern:

Be it known that I, MAX RICHARD MATTI, engineer, citizen of Sweden, residing at Falun, in the Kingdom of Sweden, have invented certain new and useful Improvements in Arrangements for Reversing Internal-Combustion Engines, of which the following is a specification.

My invention has reference to internal combustion engines, and especially to that class of engines provided with a controlling member for varying the feed of fuel to the engine cylinder and provided with means for timing the explosions according to the position of the piston of the engine. When engines of this kind shall be reversed, however, the reversal cannot be effected until the speed of the engine has been considerably decreased. In order to avoid this inconvenience and to make the feed of fuel independent of the time of reversal, my invention provides for a means whereby the action is made entirely automatic in that the reversal of the stroke of the fuel pump is effected only after the speed of the engine, due to a previous interruption of the explosions, has been sufficiently decreased to effectively reverse the engine piston, after which the parts controlling the feed of the fuel return to their normal positions.

In the drawing Figure 1 is a longitudinal section of a constructional form of the regulating device according to my invention, Fig. 2 a plan view thereof partly in section; Figs. 3 and 4 are end-views showing certain parts in different positions, and Figs. 5, 6, 7 and 8 are detail views showing the controlling parts in various positions.

a is a reciprocating rod which may be operated by a cam or an eccentric on the engine shaft and which carries the sleeve c provided with a cam-portion b, which on coming in contact with a roll i secured to a bar d moves the latter as the rod a reciprocates. The rod a is so arranged that it can be turned about its axis for the purpose of varying the position of the sleeve c relative to the rod a, whereby the time of feeding of the fuel and air to the engine cylinder can be varied. To this end the sleeve c is internally threaded so as to engage threads on the rod a, the sleeve c upon the turning of the rod a being guided by a pin 7 entering a longitudinal groove in a sleeve g' surrounding sleeve c. The pin is fixed in the sleeve c.

The end of the rod a is flattened and provided with a scale, and upon the end of the rod is secured a nut h whereby the rod a can be turned to move the sleeve c longitudinally along said rod and thereby vary the time of the feed of the fuel and air during the running of the engine.

For reversing a special cam-piece b' is provided, which is secured to the sleeve c and the rod a in such a manner that it always effects the reversal of the stroke of the pump piston at a precise position of the engine piston, independent of the relative positions of the sleeve c and rod a. For this purpose the cam-piece b' is arranged on a bar k adapted to slide in a corresponding groove of sleeve c. This bar k is also secured to the circumference of a disk l which rotates with but does not slide relative to the rod a. Consequently, if the position of sleeve c and thereby of cam b be changed by the turning of the nut h on the rod a the cam-piece b' will retain its position relative to the rod a so that it will always act on the bar d at exactly the same position of the engine piston.

The longitudinal movement of sleeve g' is prevented by a pin z (Fig. 1), but the sleeve g' can be turned about its axis by a handle f shown in Figs. 2, 3 and 4, the said handle being secured to the sleeve g'.

At normal speed the sleeve g' and handle f will occupy the position shown in Fig. 4. When the engine shall be reversed the sleeve g', by means of the handle f, is turned into the position shown in Fig. 3 and with it the sleeve c, in which position the cam-piece b' will be brought under the roll i on the bar d (Figs. 1 and 3). The sleeve g' is held in this position against the tension of a spring 5 (shown in Fig. 3) by a pawl 4 which engages a notch in a movable piece 6 mounted in a disk g, which disk forms part of the sleeve g'. The notch in said piece 6 is so arranged that when the latter is moved to the position shown in Fig. 8, the pawl 4 is withdrawn from the notch so that the sleeves g' and c will be returned to their original position by the spring 5.

As it is not intended that the cam-piece b' immediately act through the roll i on the bar d after the sleeves g' and c have been turned by the handle f into the position shown in Fig. 3, as in that case a counter-explosion would occur which would endanger the engine, the speed of the latter must first

be decreased. To this end, as the sleeves g' and c are turned into the position shown in Fig. 3, the bar d carrying roll i is lifted, thereby preventing the cam-piece b' from coming in contact with said roll, and furthermore a means is provided to prevent the cam-piece b' from engaging roll i until the speed of the engine has been so far decreased that it can be safely reversed. The device for lifting the bar d is shown in Fig. 2 and consists of a projection m fixed to the movable part g. As sleeves g' and c are turned, the projection m comes in contact with the spindle n of roll i, thereby raising the latter and with it the bar d to such an extent that the cam-piece b' is prevented from engaging the roll i. In this position of the parts the engine will run for a time without a supply of fuel and the speed, therefore, will gradually decrease. When the speed has sufficiently decreased, the reversal can be effected, for which purpose the projection m is withdrawn from under the spindle n of roll i allowing the latter and the bar d to descend, so that the cam-piece b' can engage the roll i.

In Figs. 5 to 8 o indicates a reciprocating member provided with two prongs p and r adapted to be engaged by prongs t and u respectively of a tilting member s, which member is also provided with an arm x. A spring inside a casing v tends to keep the arm x of the tilting member s in the position shown in Figs. 6 to 8. Arm x is fulcrumed on a pivot y on which the casing v inclosing the spring is suspended and the pivot y is mounted in the movable piece 6.

The reciprocating member o is fastened by screws to the same part by which the rod a above mentioned is moved back and forth so that the member o will reciprocate at the same speed as the rod a. As long as this speed is great enough, the prongs t and p will pass each other without having time to catch. As soon, however, as the speed of the engine, and thereby of the reciprocating member o has been sufficiently decreased, the prong p on member o will engage the prong t on the tilting member s, and the movable piece 6 will be moved to the left in Fig. 6, whereby the projection m will be withdrawn from under the roll i on bar d, a spring 2 surrounding a bolt 3 secured to the disk g being at the same time compressed. Upon the next stroke of the pump piston, therefore, the cam-piece b', coming in contact with the roll i of the bar d will cause an especially large quantity of fuel to be fed to the engine, whereby a counter-explosion is effected sufficiently strong to reverse the engine piston. As soon as the engine has thus been reversed, the cam-piece b' returns to its original position, shown in Fig. 4, so that the fuel feed again becomes normal. In order that the said cam-piece b' act only at the time when the reversal of the engine shall take place, the prong r on the reciprocating member o is caused to engage the prong u on the tilting member s upon the next movement of the said member o to the left in Figs. 6 and 7. The movable piece 6 is now moved still farther to the left, the position shown in Fig. 8 being reached approximately at the same time as the reversing stroke of the pump piston is finished. In this position of the movable piece 6 the pawl 4, as above mentioned, is withdrawn, permitting the sleeves g' and c, to be returned to their original positions shown in Fig. 4 by the spring 5. In this position of the parts the cam b is again under the roll i and the operation of the fuel feed pump continues as usual.

In order that the projection m when in the position shown in Fig. 6 or 7 be not moved to the right in said figures, the tension of the springs 2 and 5 is so adjusted as to cause a sufficient friction between the pawl 4 and the movable piece 6 to prevent spring 2 from moving piece 6 to the right in Fig. 6 or 7. As soon, however, as the pawl 4 has released the movable piece 6, which occurs when the latter has been moved to the position shown in Fig. 8, the projection m is moved by spring 2 to the right in Fig. 8, and thereby also the piece 6, while, as has already been stated, the disk g and sleeves g' and c are returned to their normal positions by the spring 5.

It is evident that many changes may be made in the embodiment of my invention as shown in the drawing, without departing thereby from the spirit of my invention. The essential feature of my invention lies in this that the cam whereby the reversal of the engine is effected, is not brought in engagement with the members controlling the feed of the fuel until the speed of the engine has been decreased to such an extent as to permit the reversal of the engine to take place without any danger to the engine, and a further essential feature of my invention is that the feeding of the fuel to the engine cylinder is influenced by said cam-piece only at one single stroke of the fuel pump piston, at which stroke the fuel supply to the engine cylinder is greater than the normal fuel supply.

I claim as my invention:

1. In internal combustion engines the combination with the engine cylinder and the reciprocating piston, of a fuel pump, a reciprocating cam-piece adapted to operate said fuel pump, said cam-piece being arranged to complete the cycle of operation of said fuel pump in both directions of movement of the said reciprocating piston prior to its completing its stroke, and means for reciprocating said cam-piece.

2. In interal combustion engines the com-

bination with the engine cylinder and the reciprocating piston, of a fuel pump, a reciprocating cam-piece adapted to operate said fuel pump, said cam-piece being arranged to complete the cycle of operation of said fuel pump in both directions of movement of the said reciprocating piston prior to its completing its stroke, means for reciprocating said cam-piece, a movable sleeve carrying said cam-piece, a second cam-piece arranged on said sleeve for effecting the reversal of the engine, and means for reciprocating said sleeve.

3. In internal combustion engines the combination with the engine cylinder and the reciprocating piston, of a fuel pump, a reciprocating cam-piece adapted to operate said fuel pump, said cam-piece being arranged to complete the cycle of operation of said fuel pump in both directions of movement of the said reciprocating piston prior to its completing its stroke, means for reciprocating said cam-piece, a movable sleeve carrying said cam-piece, a second cam-piece arranged on said sleeve for effecting the reversal of the engine, means for reciprocating said sleeve, and means for adjusting the position of said second cam-piece relative to said first cam-piece.

4. In internal combustion engines the combination with the engine cylinder and the reciprocating piston, of a fuel pump, a reciprocating cam-piece adapted to operate said fuel pump, said cam-piece being arranged to complete the cycle of operation of said fuel pump in both directions of movement of the said reciprocating piston prior to its completing its stroke, means for reciprocating said cam-piece, a movable sleeve carrying said cam-piece, a second cam-piece arranged on said sleeve for effecting the reversal of the engine, means for reciprocating said sleeve, means for adjusting the position of said second cam-piece relative to said first cam-piece, and a movable projection adapted to prevent said second cam-piece from operating said fuel pump.

5. In internal combustion engines the combination with the engine cylinder and the reciprocating piston, of a fuel pump, a reciprocating cam-piece adapted to operate said fuel pump, said cam-piece being arranged to complete the cycle of operation of said fuel pump in both directions of movement of the said reciprocating piston prior to its completing its stroke, means for reciprocating said cam-piece, a movable sleeve carrying said cam-piece, a second cam-piece arranged on said sleeve for effecting the reversal of the engine, means for reciprocating said sleeve, means for adjusting the position of said second cam-piece relative to said first cam-piece, a movable projection adapted to prevent said second cam-piece from operating said fuel pump, and a tilting member adapted to cooperate with said movable projection, when the speed of the engine has been reduced to withdraw the said projection permitting the said second cam-piece to operate the fuel pump substantially as and for the purpose described.

In testimony whereof I have affixed my signature in presence of two witnesses.

MAX RICHARD MATTI.

Witnesses:
GRETA PRISEE,
HARRY ALBIHN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."