No. 883,750. PATENTED APR. 7, 1908.

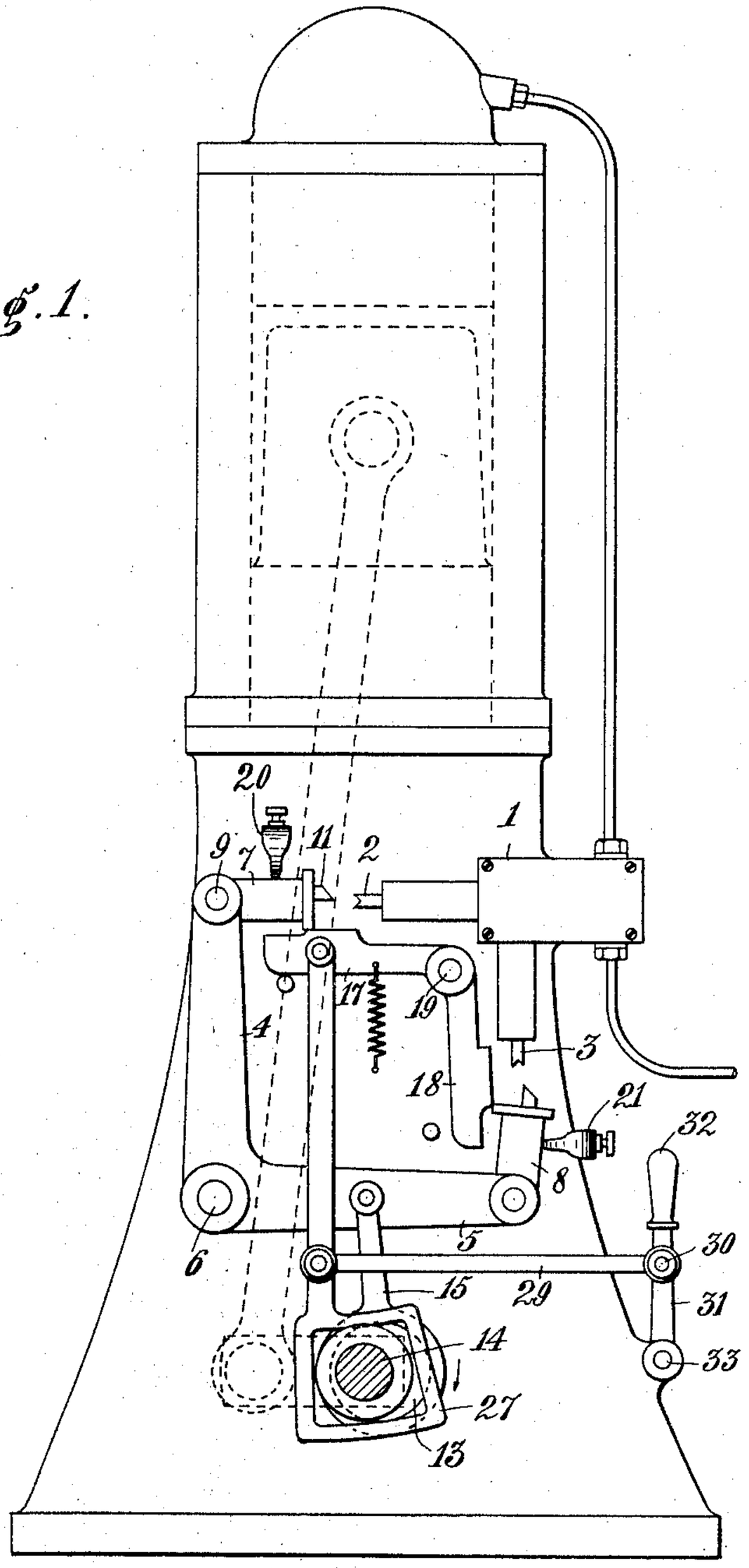
E. A. RUNDLÖF.

REVERSING DEVICE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JUNE 7, 1907.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

August Söderberg

Emil Wahlberg.

Inventor

Erik A. Rundlöf

by Cooper and Dale

Atty

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2 SHEETS—SHEET 2.

Fig. 2.

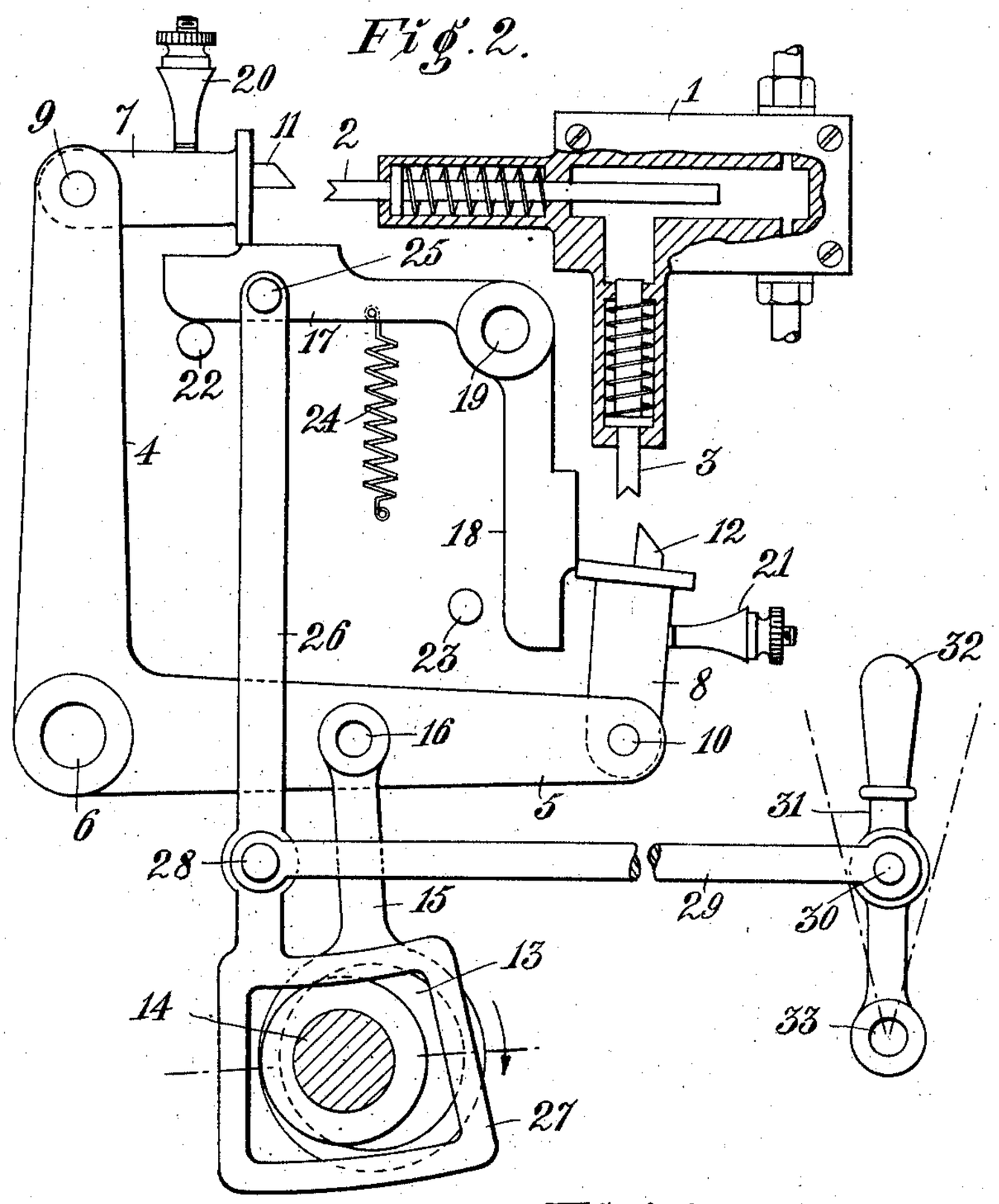


Fig. 3.

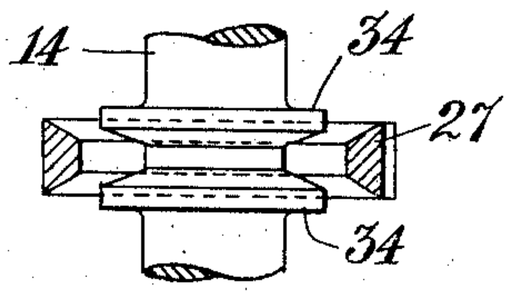


Fig. 4.

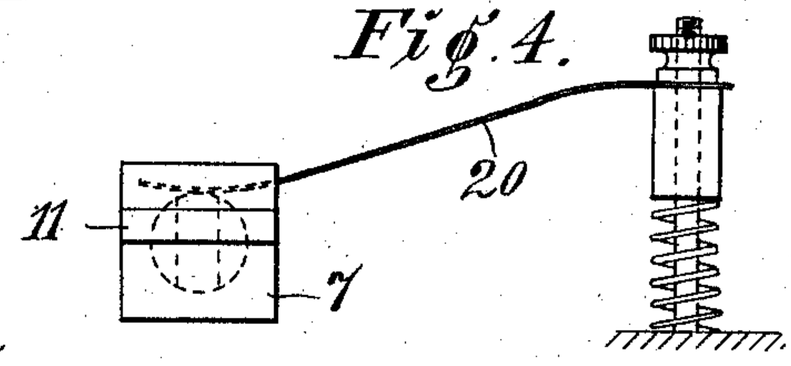
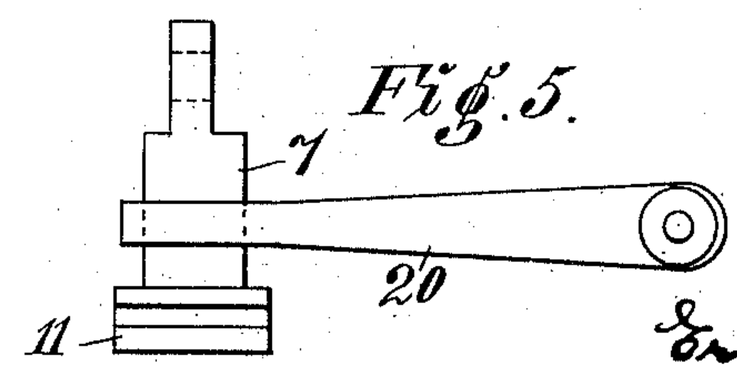


Fig. 5.



Witnesses
August Lönnberg
Emil Wahlberg

Inventor
Erik A. Rundlöf
by Cleveland & Co
Atty

UNITED STATES PATENT OFFICE.

ERIK ANTON RUNDLOF, OF STOCKSUND, SWEDEN.

REVERSING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

No. 883,750. Specification of Letters Patent. Patented April 7, 1908.

Application filed June 7, 1907. Serial No. 377,702.

To all whom it may concern.

Be it known that I, ERIK ANTON RUNDLÖF, a subject of the King of Sweden, and resident of Stocksund, in the Kingdom of Sweden, have invented new and useful Improvements in Reversing Devices for Internal-Combustion Engines, of which the following is a specification, reference being had to the drawings accompanying and forming a part hereof.

This invention relates to devices for reversing the direction of movement in internal combustion engines.

The invention consists, chiefly, in providing the engine, in addition to the feeding mechanism periodically effecting the explosions during the normal running, also with an auxiliary arrangement to be thrown into action instead of the former one, said latter arrangement being connected to the engine in such a manner as to cause the explosions to take place, when the piston moves inwardly, toward the explosion chamber, the two feeding devices being so arranged relatively to each other that, when the one is thrown into action, the other is simultaneously automatically thrown out of action, and vice versa. Furthermore, the shaft of the engine may be connected to the two feeding mechanisms in such a manner that the auxiliary feeding mechanism can be thrown into action by the said connection and be automatically thrown out of action thereby, as soon as the engine has changed its direction of movement.

In the accompanying drawings I have shown a convenient form of a reversing arrangement embodying my invention to be used in connection with internal combustion engines for liquid fuel, said reversing arrangement being controlled for instance by a weight regulator of any well known kind, said regulator striking, at and below a certain speed of the engine, a piston and causing the same to move into the fuel pump.

Figure 1 is a side-elevation of a petroleum motor provided with a reversing device according to this invention. Fig. 2 shows the reversing device on a larger scale, the pump casing being shown partly in section. Figs. 3 to 5 show details.

Referring to the drawings, 1 represents an oil pump having two pistons 2 and 3, the one 2 adapted to work during normal conditions, when the engine is running in one or the other direction, while the other 3 is used for reversing.

4 and 5 are two levers rigidly connected to each other, said levers being pivoted on a common fulcrum 6. Each lever 4 and 5 carries a weight 7 and 8, respectively, each mounted on a pivot pin 9 or 10, respectively, carried by the said lever. Each of the weights 7 and 8 is provided with a tooth 11 or 12, respectively, adapted to catch in a notch, or the like, in the piston 2 or 3, respectively.

13 is an eccentric, or the like, fixed on a shaft 14 mechanically connected to the shaft of the engine. The eccentric 13 is connected, by means of an eccentric-rod 15 to one of the said levers, for instance by a pin 16 entering a corresponding socket at the end of the rod 15.

17 and 18 are two regulator planes or arms rigidly connected to each other, said arms being suitably pivoted on a common pivot pin 19; and 20 and 21 are two springs. The weight 7 is kept by the spring 20 in contact with the arm 17, and the weight 8 is kept by the spring 21 in contact with the arm 18.

22 is an abutment, for instance a pin, on which the arm 17 normally bears, and 23 is another similar abutment on which the arm 18 bears, when the corresponding feeding mechanism working during reversal is operative.

24 is a spring tending to keep the arm 17 in its normal position bearing on the abutment 22, as shown in Fig. 1. The arm 18 is then kept away from the abutment 23 in such a position as to prevent the tooth 12 of the weight 8 from striking the piston 3.

Journaled on a pin 25 on the one arm, in the embodiment illustrated the arm 17, is a rod 26, or the like, extending downwardly to the shaft 14. The said rod is suitably provided with a frame 27, or the like, surrounding the shaft 14, and the rod 26, or the frame 27, is provided with an arrangement by which the frame 27 can be held against the shaft 14.

28 is a pivot pin on the rod 26, and mounted on the said pin is a rod 29 connected to a lever or hand-spike 31 by another pivot pin 30 situated between a handle 32 suitably provided on the lever 31 and the pin 33 on which the lever 31 is pivoted. The shaft is advantageously provided with one or more friction disks against which the rod 26, or the

frame 27, can be pressed, the edges of the frame being suitably formed tapering inwardly so as to correspond with the friction disks 34.

The described mechanism works in the following manner: The engine is supposed to run in such a direction as to cause the shaft 14 to rotate in the direction of the arrow (Fig. 1). The shaft 14 may be the engine shaft proper or another shaft, or the like, mechanically connected to the engine shaft. During the normal running of the engine the feeding mechanism appertaining to the pump piston 2 is in action. It works in known manner, the eccentric 13, or the like, imparting to the lever 4 a rocking motion by which the weight 7 is reciprocated on the arm 17. The mechanisms for feeding the fuel work in well known manner so that the action of the same need not be described. The feeding mechanism for reversal is, in the arrangement illustrated, of the same construction and acts in the same manner as that working in normal running but should suitably be adjusted to work at a speed suitable for reversal, independently of the speed for which the feeding mechanism operating during normal running is adjusted.

The reversal of the direction of movement of the engine takes place in the following manner: The hand-spike 31 is thrown to the right so that the left edge of the frame 27 is thrown into engagement with the friction disk 34 (or the friction disks) on the shaft 14, whereby the frame and the rod 26 are lifted by the shaft. On account thereof the arm 17 is lifted from the abutment 22, and at the same time the arm 18 is moved from the position illustrated toward the abutment 23. The action of this shifting of the two arms 17 and 18 is first of all that the weight 7 is raised, so that its tooth 11 cannot strike the piston 2, and that the weight 8 takes up such a position as to be able to strike the corresponding pump piston. The feeding mechanism working during normal running is, thus, thrown out of action, and the feeding mechanism working particularly for reversal is thrown into action.

The fact that the one mechanism works for forward and the other for backward movement will be evident on considering that the weights 7 and 8, in one and the same position of the engine, take up opposite end positions. When the weight 7 is in the end position in which it keeps the piston 2 pressed inwardly (right end position in the drawing) the working piston of the engine is at that end of the cylinder next to the explosion chamber, whence it will be driven out by the explosion of the fuel just injected. When the piston has arrived at the other end of the cylinder, the shaft 14 has made half a revolution, and the weight 8 is thus in the end position in which it will press the corresponding pump piston 3 inwardly, in case the reversing arrangement is allowed to work. Hence, supposing this to be the case, the pump piston 3 feeds fuel into the cylinder, when moving inwardly; the fuel now explodes, before the working piston has reached its innermost position, and thus stops the piston, which is driven backward so that the engine begins to move in the opposite direction.

When, after the shifting of the lever 31 toward the right, the engine commences to rotate in the opposite direction, the frame 27 with the rod 26 is obviously moved downwardly. On account thereof the arms 17 and 18 are automatically shifted, so that the weight 7 is again made operative instead of the weight 8. The explosions will therefore again take place at the normal time, *i. e.* at the inner point of turning, so that the engine is continually driven in the direction obtained after reversal. If the machine is to be again reversed, the lever 31 is thrown to the left, so that the right edge of the frame 27 is brought into engagement with the friction disks.

The described reversing arrangement can be modified in several ways without departing from the spirit of my invention. The two feeding mechanisms, that for normal running and that for reversal, may, for instance, be arranged in such a manner as to operate the same pump piston or a corresponding arrangement. They can also be so arranged as to be driven from different eccentrics, or instead of by eccentrics they may be driven by cams or any other similar device. It is not essential that the two feeding mechanisms be guided by arms, or the like, set at an angle to each other. The particular details may, if desired, be replaced by arrangements working in the same manner. The essential feature is that the whole works in such a manner that the two feeding mechanisms are operative in different positions of the engine, so that the one mechanism causes the engine to run in one or the other direction and the other mechanism causes the direction of movement of the engine to be reversed, whereby the arrangement is, preferably, such that the feeding mechanism used for reversal is automatically thrown out of action and the feeding mechanism used for normal running is, at the same time, automatically thrown into action, when the direction of movement of the engine has been reversed.

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 cylinder, a piston movable therein, an explosion chamber situated in the said cylinder, a feeding mechanism periodically effecting the fuel introductions during normal running of the engine in any direc-

tion, an auxiliary feeding mechanism adapted for reversing the direction of movement of the engine, said latter mechanism being so connected to the engine as to cause the feeding to take place at such a time that the explosion is effected, when the piston moves inwardly, toward the explosion chamber, and a connection between the two feeding mechanisms whereby the said mechanisms can be alternately thrown into or out of action, substantially as and for the purpose set forth.

2. In an internal combustion engine the combination of a cylinder, a piston movable therein, an explosion chamber situated in the said cylinder, a feeding mechanism periodically effecting the fuel introductions during normal running of the engine in any direction, an auxiliary feeding mechanism adapted for reversing the direction of movement of the engine, said latter mechanism being so connected to the engine as to cause the feeding to take place at such a time that the explosion is effected when the piston moves inwardly, toward the explosion chamber, a connection between the two feeding mechanisms whereby the said mechanisms can be alternately thrown into or out of action, and a connection interposed between the said combined feeding mechanisms and some movable part of the engine in such a manner that the said latter connection, when causing the feeding mechanism designed for reversal to operate, immediately after reversing the direction of movement of the engine automatically throws the said latter feeding mechanism out of action again, at the same time as the feeding mechanism designed for the normal forward or backward running is thrown into action, substantially as and for the purpose set forth.

3. In an internal combustion engine the combination of a cylinder, a piston movable therein, an explosion chamber situated in the said cylinder, two arms set at an angle to each other and mounted to swing on a common pivot, two weights each carried by one of the said arms, one of the said weights being designed for periodically effecting the fuel introductions during normal running of the engine in any direction, whereas the other weight is designed for reversing the direction of movement of the engine, two regulator planes connected to each other and pivoted on a common fulcrum, each plane coöperating with one of the two weights, said planes being so located relatively to each other that, when the one plane is in operative position, the other plane keeps the other weight out of operative position, and a connection interposed between the regulator planes and some movable part of the engine in such a manner that the said connection, when causing the weight designed for reversal to operate, immediately after reversing the direction of movement of the engine automatically throws the said latter weight out of action again, at the same time as the weight designed for the normal forward or backward running is thrown into action, substantially as and for the purpose set forth.

4. In an internal combustion engine the combination of a cylinder, a piston movable therein, an explosion chamber situated in the said cylinder, two arms set at an angle to each other and mounted to swing on a common pivot, two weights each carried by one of the said arms, one of the said weights being designed for periodically effecting the fuel introductions during normal running of the engine in any direction, whereas the other weight is designed for reversing the direction of movement of the engine, two regulator planes connected to each other and pivoted on a common fulcrum, each plane coöperating with one of the two weights, said planes being so located relatively to each other that, when the one plane is in operative position, the other plane keeps the other weight out of operative position, a frame connected to the said regulator planes, a friction disk fastened to a movable shaft of the engine, said disk being inclosed by the said frame, the latter having such a shape that it can be moved relatively to the said disk so that one or the other of the sides of the frame opposite each other can be pressed against the friction disk and, thereby, cause the frame to be moved in one or the other direction and, thereby, one or the other regulator plane to be brought into operative position, and a lever connected to the said frame for moving one or the other side thereof into contact with the said friction disk, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERIK ANTON RUNDLÖF.

Witnesses:

FREDR. NORDSJD,

AUG. SÖRENSEN.