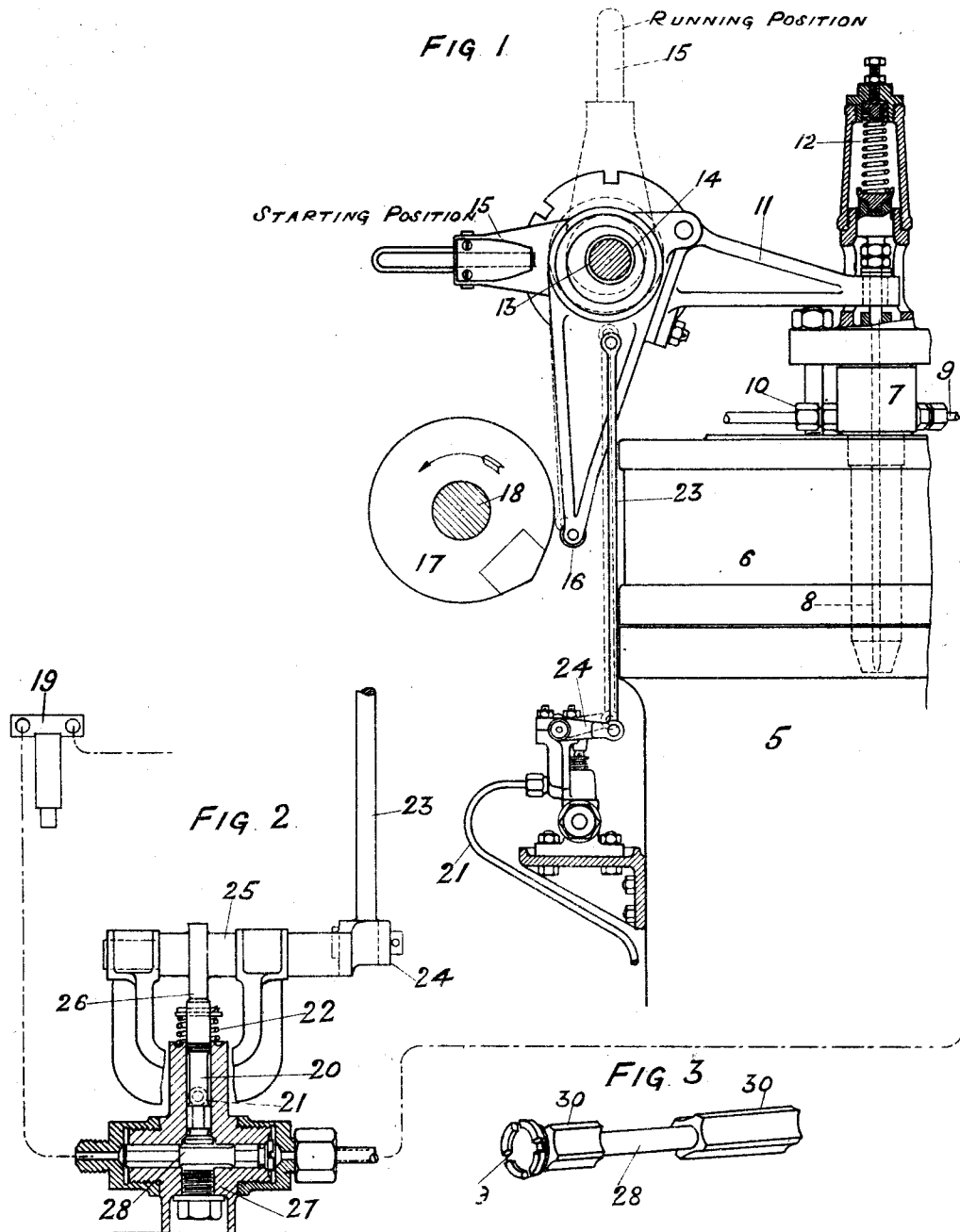


C. DAY & G. E. WINDELER.
 STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED JUNE 13, 1912.

1,049,815.

Patented Jan. 7, 1913.



WITNESSES

Marcus L. Byng.
J. Ellis Glen

INVENTORS

CHARLES DAY
 GEORGE E. WINDELER

BY *Wm. D. Dain*
 ATTORNEY.

UNITED STATES PATENT OFFICE.

CHARLES DAY AND GEORGE E. WINDELER, OF STOCKPORT, ENGLAND, ASSIGNORS TO
GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

1,049,815.

Specification of Letters Patent.

Patented Jan. 7, 1913.

Application filed June 13, 1912. Serial No. 703,397.

To all whom it may concern:

Be it known that we, CHARLES DAY and GEORGE E. WINDELER, subjects of the King of Great Britain, and residing at Stockport, county of Chester, England, have invented certain new and useful Improvements in Starting Mechanism for Internal-Combustion Engines, of which the following is a specification.

10. The present invention relates to the type of apparatus forming the subject matter of English Patent 6,890 of 1908 to William P. Sillince and ourselves, and is an improvement thereon.

15. With internal combustion engines operating on the constant pressure plan wherein pure air is heated by compression in the cylinder and combustion chamber to a temperature above the igniting temperature of the fuel, it is necessary to inject the fuel, such as crude oil, into the combustion chamber by means of a blast of air. This blast commonly has a pressure of about 900 pounds per square inch for the larger size engines but it may be slightly more or less. The fuel is delivered by its pump to the pulverizer or device for spraying fuel into the cylinder at a pressure somewhat greater than the blast pressure, and said latter pressure exists substantially at all times in the pulverizer, and opposes the fuel pump pressure. The direct admission of fuel and its blast of air to the combustion chamber is under the control of a needle valve that moves in response to cam control. It is customary to start these engines by a compressed gas, such as high pressure air for example.

20. If in starting the engine as an air motor, fuel is allowed to accumulate in the pulverizer from successive pump strokes by reason of the needle valve being prevented from opening, there will be an abnormally heavy charge admitted the first time said valve opens and its piston and cylinder produce power. In many instances this has been the cause of destructive results. The structure illustrated in said patent overcomes this objection and the movement of the starting lever to the starting position automatically opens a by-pass valve which by-passes the fuel delivered by the pump to a suitable atmospheric pressure receptacle and

prevents it from being delivered to the pulverizer. The instant, however, that the by-pass valve of the patent is opened it permits air from the high pressure blast to blow through the pulverizer and its oil carrying pipe and discharge oil and high pressure air through the by-pass.

The object of the present invention is to provide means for preventing the blast of air from acting in the manner specified above. To accomplish this a normally open valve is provided between the blast and the by-pass opening which automatically closes whenever the by-pass valve is opened and the blast tends to drive oil through it.

In the accompanying drawing which illustrates one of the embodiments of our invention, Figure 1 is a partial view in elevation of an engine fitted with our improved mechanism; Fig. 2 is a view partially in section showing the by-pass valve which is actuated by the starting lever and the blast actuated valve, and Fig. 3 is a perspective view of the blast actuated valve.

5 indicates one of the cylinders of an engine and 6 the head thereof. Mounted in the head is a pulverizer 7 of suitable construction for discharging the fuel into the combustion space of the cylinder. In the pulverizer is a needle valve 8 which controls the admission of fuel and the blast of air to the cylinder. Fuel is admitted to the pulverizer by the pipe 9 and the blast of air is admitted by the pipe 10, said pipe being connected to any suitable source of supply such as a compressor or storage tank. The needle valve is opened at the proper periods by the bell-crank lever 11 and is closed by the compression spring 12.

13 indicates a fixed spindle that is carried in suitable brackets. Sleeved on the spindle is an eccentric 14 which is fastened to the starting handle 15. The handle and the eccentric are so arranged that when the handle is moved to the position shown in full lines it throws the roller 16 out of engagement with the cam 17 mounted on the shaft 18. This means that the cam is free to rotate without raising the needle valve. This position of the parts is known as the starting position. The running position is shown in dotted lines, and it will be observed that the

roller 16 carried by the lower arm of the bell-crank lever is in contact with the periphery of the cam 17, and hence the needle valve will be opened once for each revolution of the camshaft, said shaft in a four-cycle engine running at one half the speed of the main shaft.

In order, to prevent fuel from being discharged by the fuel pump 19 into the pulverizer 7 when the parts are in the starting position, a by-pass valve 20 is provided that controls the by-pass port 21. This valve is normally pressed against its seat by the coiled compression spring 22. As it is necessary to open the valve at the same time the handle 15 is moved to the starting position, the valve actuator is connected to and moved by the handle. In the present instance the upper end of rod 23 is connected to the lower part of the bell-crank lever 11 and the lower end of the rod is connected to an arm 24 that is mounted on a rock shaft 25. On the rock shaft is a tappet 26 which is arranged to press on the end of the by-pass valve stem and open it. In Fig. 1 it will be noted that the turning of the starting handle 15 moves the bell-crank lever 11 bodily either up or down, as the case may be, and this movement is utilized to actuate the by-pass valve.

The chamber in the pulverizer is always subjected to the pressure of the blast of air issuing from the pipe 10. When the by-pass valve 20 is open there is a tendency for high pressure air to flow from the pipe 10 through the pulverizer and by way of pipe 9 to the interior of the valve casing 27 containing the by-pass valve. Obviously if there is nothing to prevent this, the air from the blast in blowing through the pipe 9 will discharge all of the oil therein through the by-pass port 21. In addition to this it means a loss of air and the noise due to the discharging of such high pressure fluid is very objectionable. To prevent this action from taking place, a valve 28 is provided and located in the valve casing 27, its axis being perpendicular to that of the valve 20 in the present embodiment. The valve is best shown in Fig. 3 and is provided with a head having a beveled face that engages with its seat. In the head are small passages or notches 29 through which the fuel normally flows in passing from the pump 19 to the pulverizer. The passage of fuel in this manner holds the valve off of its seat. The valve is also provided with guides 30 and a reduced portion between them to facilitate the passage of fuel through the by-pass. As before stated the valve 28 is normally open, but just as soon as the by-pass valve is opened and the pressure on the left hand side of the valve 28 is reduced, the blast pressure from the pipe 10 acting on the column of fuel in the pipe 9 closes the valve

28. After the engine is well started, the starting lever 15 is thrown to the dotted line position when the parts operate in their normal manner. We have not illustrated the valve which admits air to the cylinder for the purpose of starting, and which is commonly known as the starting valve, nor the mechanism for operating it, since it seems unnecessary to an understanding of our invention.

The invention has been described in connection with a four-stroke cycle engine, but it can also be used with engines having different numbers of strokes per cycle.

In accordance with the provisions of the patent statutes, we have set forth what we believe to be the best embodiment of our invention; but it is to be understood that the drawing is only illustrative and that our invention can be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States is:—

1. An internal combustion engine in combination with a source of fuel supply under pressure, a blast means for discharging fuel into the engine, means for by-passing fuel and preventing it from entering the engine while starting, and means preventing the blast means from discharging through the by-pass when it is open.

2. An internal combustion engine in combination with a source of fuel supply under pressure, an air blast means for introducing fuel into the engine, means located between the source of pressure and the engine for by-passing the fuel when the engine is started, and a valve that automatically closes when subjected to the blast pressure and prevents air from being discharged through the by-pass.

3. An internal combustion engine in combination with a fuel pump, a pulverizer into which the pump discharges, an air blast means that communicates with the pulverizer and normally discharges fuel into the engine, a valve controlling the admission of fuel and air to the engine, a by-pass valve located between the pump and the pulverizer, and a valve located between the by-pass and the pulverizer which is normally held open by the fuel passing it and which closes when the air blast tends to discharge through it.

4. An internal combustion engine provided with a fuel pump, a pulverizer, a needle valve, a lever for actuating it, a cam for moving the lever, a by-pass for the fuel pump, a means for moving the lever out of the path of the cam and also opening the by-pass valve, an air blast for discharging fuel from the pulverizer into the engine, and an automatic valve that closes when the air blast tends to discharge through the by-pass.

5. An internal combustion engine in com-

75

80

85

90

100

105

110

115

12

12

130

5 bination with a valve casing through which fuel flows to the engine, a self-closing by-pass valve in said casing, means forming a part of the engine for opening it, and a second valve also in said casing and opened by the fuel as it flows toward the engine and closed by the fuel as it tends to flow from the engine through the by-pass.

In witness whereof we have hereunto set our hands this 23rd day of May, 1912.

CHARLES DAY. [L. S.]
GEORGE E. WINDELER. [L. S.]

Witnesses:

ALEX. F. MACDONALD,
JOHN W. GILL.