

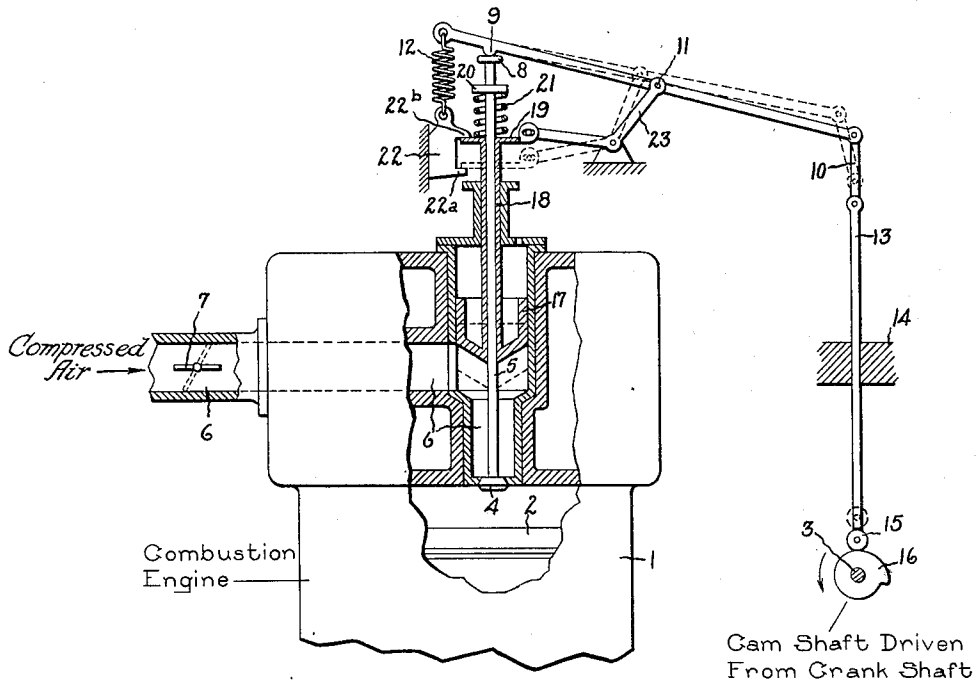
Aug. 29, 1933.

A. RENNER

1,925,003

INTERNAL COMBUSTION ENGINE

Filed Dec. 4, 1931



Inventor:
Alfred Renner,
by *Charles S. Allen*
His Attorney.

UNITED STATES PATENT OFFICE

1,925,003

INTERNAL COMBUSTION ENGINE

Alfred Renner, Berlin-Tegel, Germany, assignor
to General Electric Company, a corporation of
New York

Application December 4, 1931, Serial No. 579,079,
and in Germany December 19, 1930

1 Claim. (Cl. 60—16)

The present invention relates to internal combustion engines and particularly to the mechanism for starting such engines by means of compressed air or like gaseous medium.

5 The object of the invention is to provide an improved arrangement for automatically putting the starting mechanism into operation under action of the supplied compressed air and automatically returning this mechanism to its inoperative position at the end of the starting period.

10 For a consideration of what I believe to be novel and my invention, attention is directed to the following description and claim appended thereto in connection with the accompanying drawing which forms a part of my specification.

15 In the drawing I have shown by way of example a fragmentary view of a combustion engine partly in section and partly diagrammatic, representing a preferred embodiment of my invention.

20 Referring to the drawing, 1 designates a cylinder of a combustion engine, 2 a cylinder piston connected to a crank shaft, not shown; 3 is a cam shaft driven from the crank shaft by any suitable means, not shown, well known in the art, and serving for actuating the fuel supply means and the like for the cylinder. 4 is a starting valve having a stem 5. 6 designates a conduit provided with a valve means 7, in the present instance indicated as a butterfly valve, for conveying compressed air from a suitable source of supply, not indicated, to valve 4 for starting the engine. The upper end of stem 5 is provided with a flange 8 engaging a portion 9 of a lever mechanism. The latter comprises a double arm lever 10 having a variable fulcrum indicated at 11. Provided at the left hand end of the double arm lever 10 is a biasing means indicated as a spring 12 for maintaining engagement between portion 9 and flange 8. The right hand end of the double arm lever is pivoted to a rod 13 extending through a guide 14 and carrying a roller 15 on its lower end. 16 is a starting cam provided on cam shaft 3 for actuating the lever mechanism through the intermediary of the roller 15 during the starting operation. Conduit 6 near valve 4 is provided with a branched conduit forming a cylindrical body in which a pressure piston 17 is slidably arranged. 18 is a hollow stem for the piston surrounding slidably valve stem 5 and being provided with a flange 19. Arranged between flange 19 and a flange 20 of stem 5 is a biasing means 21 indicated as a spring for normally forcing the pressure piston downward, and the valve 4 against its seat. 22 is a stopping means having a lower and an upper shoulder 22a and 22b respec-

tively for limiting the downward and upward movement of the piston. 23 indicates a means for varying the fulcrum 11 of lever 10, in the present instance shown as a fulcrumed bell crank lever having one end pivotally connected to the variable fulcrum 11 of lever 10 and its other end connected to flange 19 of the pressure piston stem. The pressure piston and the fulcrumed bell crank lever form in substance a means for automatically putting the valve operating mechanism, that is, lever 10, rod 13 and cam 15, into operative position under action of the compressed air, and pressure piston 17 itself forms in substance a pressure responsive means subjected to the pressure in conduit 6 for causing the valve operating mechanism to move into operative relation with the cam. The biasing means or spring 21 normally forces valve 4 against its seat, as already stated, and is adapted to return the pressure piston to its normal position at the end of the starting operation whereby the entire valve operating mechanism is also returned to its inoperative position.

The operation of the arrangement is as follows: While the machine is out of operation, valve means 7 is closed as indicated in dotted lines and the pressure piston and the valve operating mechanism are in the position also indicated in dotted lines. In this position the pressure piston partly closes conduit 6, and cam 15 is out of engagement with cam 16. Furthermore, flange 19 engages the lower shoulder 22a of stopping member 22 due to the action of spring 21. If now valve 7 is opened and compressed air or like gaseous medium supplied to valve 4, the pressure of air will cause the piston 17 to move upwardly, whereby the variable fulcrum 11 of double arm lever 10 is moved to the right, due to the turning motion of fulcrumed bell crank lever 23. This causes roller 15 to engage the starting cam 16. As soon as a certain predetermined pressure between the pressure piston and valve 4 is reached, valve member 4 will be forced downwardly whereby compressed air is supplied to cylinder 1. Thus the valve 4 is initially opened by the air pressure on its upper surface. More specifically, the air pressure in cylinder 6 first causes the piston 17 to move upward, thereby putting the valve actuating mechanism into operative position, and thereafter the air pressure causes opening of valve 4. In order to obtain proper actuation of the pressure piston and the starting valve 4 the conduit part into which the piston extends may be made wider than the conduit part near valve 4.

The air supplied to cylinder 1 forces piston 2 downward whereby the crank shaft turns and

causes in the well known manner a corresponding turning movement of cam 16 in the direction indicated by the arrow. This causes a further opening of valve means 4 until roller 15 drops into the notch or depression of the cam whereby valve 4 is closed. The lever mechanism during this operation turns about fulcrum 11. Piston 2 is forced downwardly due to the action of the air pressure until the air is exhausted through an opening or valve, not shown, into the atmosphere. The inertia of the rotating masses, crank shaft and flywheel, not shown, causes the piston to return to its original position whereby the starting cam makes a corresponding turning movement and again gradually causes opening of the starting valve. These cyclic operations are continued until a proper speed of the engine is obtained and combustible fuel supplied to the engine is properly ignited. Valve 7 is then closed. A further opening of valve 4 permits the air between the pressure piston and the valve 4 to escape through the cylinder. The decrease in pressure underneath the pressure piston then permits springs 21 to force the latter downward whereby the fulcrumed bell crank lever turns in counterclockwise direction into the position indicated in dotted lines, thereby moving the fulcrum 11 of lever 10 to the effect that the valve operating mechanism is put out of operation automatically.

If an increase in pressure within the cylinder occurs during the starting operation, for instance, due to preignition, the starting valve 4 may be prevented from opening due to this great increase in pressure. The lever 10 is moved upwardly as far as its right hand end is concerned but the lever is prevented from turning about fulcrum 11. The turning point or fulcrum of the lever in this case is transferred to the portion 9. The lever thereby turns about portion 9 and causes a turning movement of bell crank lever 23 to the effect that piston 17 is forced somewhat downwardly. As soon as proper ignition is obtained the lever mechanism is returned to its normal operating position, and after shutting off

the supply of compressed air the lever is returned to its inoperative position as described above.

With my invention I have accomplished a reliable arrangement for automatically putting a starting valve operating mechanism for a combustion engine in and out of its operative position.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire by Letters Patent of the United States, is:

In combination with a combustion engine having a cylinder, a cam shaft, a starting cam on the shaft, a starting valve for the cylinder, a stem for the starting valve, a conduit including a valve for conducting compressed air to the starting valve for starting the engine, means for automatically actuating the valve means comprising a lever mechanism having a variable fulcrum and a portion engaging the valve stem, biasing means for maintaining engagement between said portion and the stem, a roller for the lever mechanism normally out of engagement with the cam, means for varying the fulcrum of the lever mechanism to cause engagement between the roller and the cam, said last named means including a fulcrumed bell crank lever having one end pivoted to the variable fulcrum of the lever mechanism and a pressure piston extending into the conduit and having a hollow, flanged stem pivoted to the other end of the bell crank lever, the first named valve stem extending slidably through the stem of the pressure piston, stop means for limiting the movement of the pressure piston, a spring surrounding the stem of the starting valve and bearing against said flange for normally forcing the starting valve against its seat and putting the starting mechanism out of its operative position when the conduit valve is closed.

ALFRED RENNER.

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150