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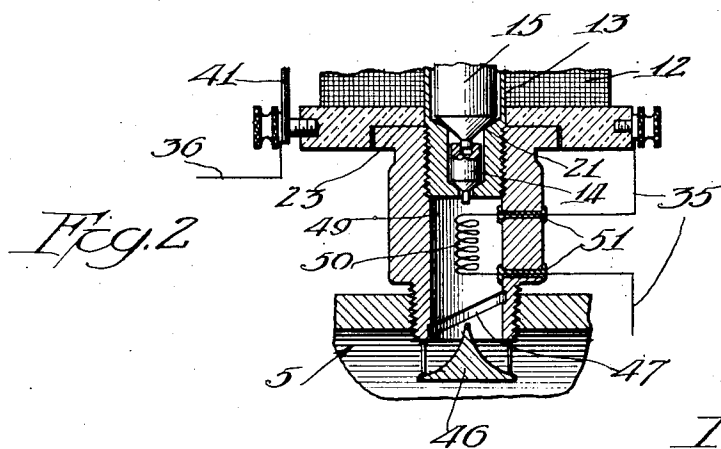
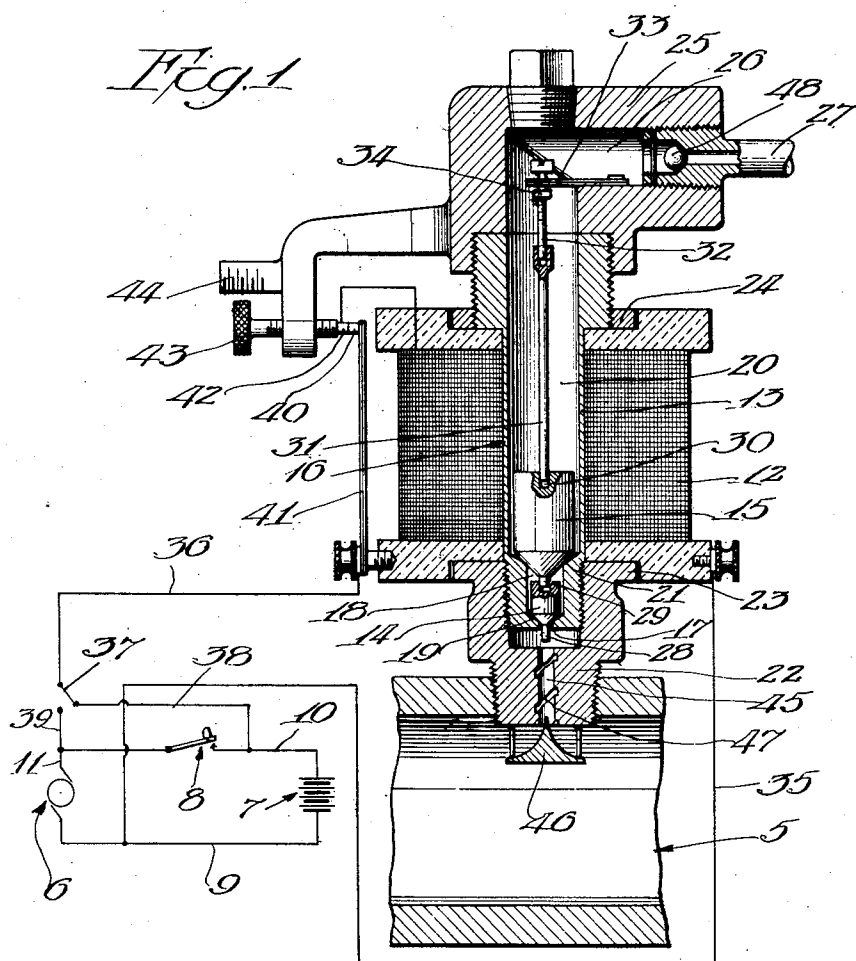
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D. ROESCH

PRIMING DEVICE FOR INTERNAL COMBUSTION ENGINES

Filed Oct. 30, 1920

2 sheets-sheet 1



Inventor:

Daniel Roesch

By *L. L. L.*

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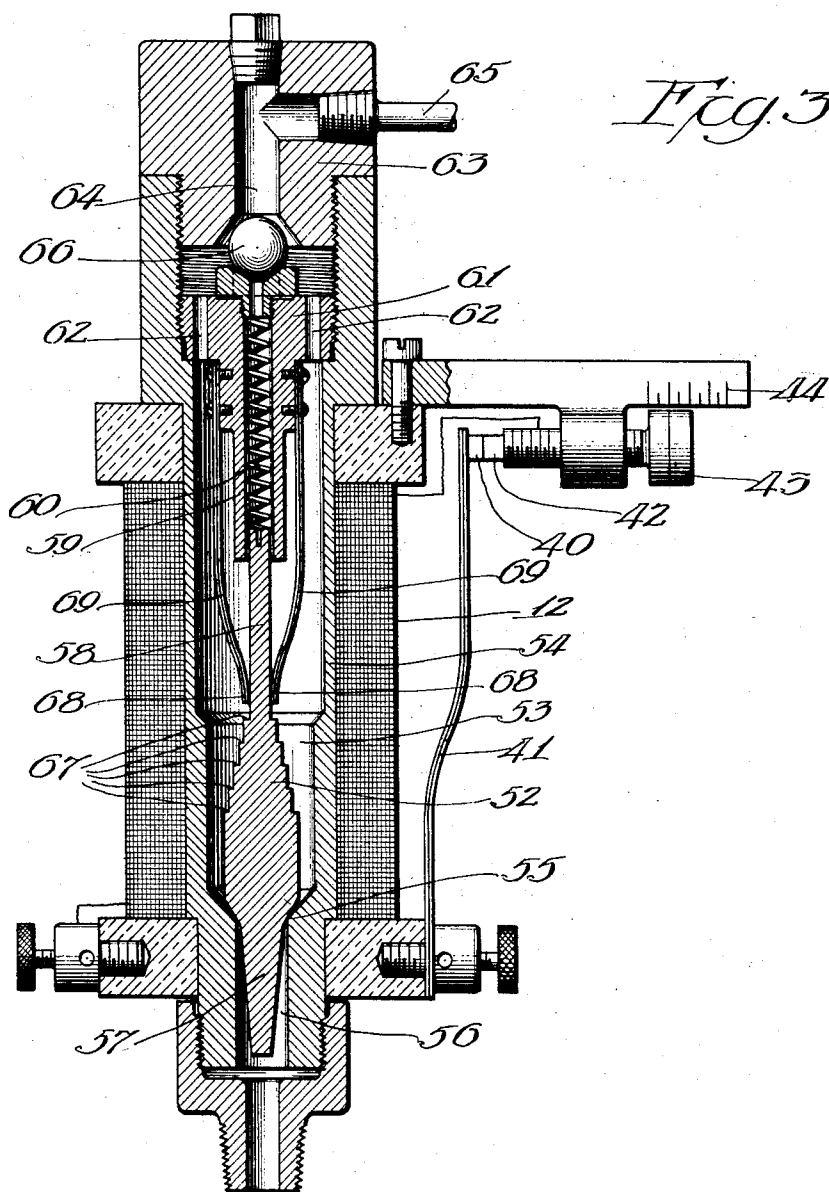
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2 sheets-sheet 2



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UNITED STATES PATENT OFFICE.

DANIEL ROESCH, OF CHICAGO, ILLINOIS.

PRIMING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

Application filed October 30, 1920. Serial No. 420,651.

To all whom it may concern:

Be it known that I, DANIEL ROESCH, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Priming Devices for Internal-Combustion Engines, of which the following is a specification.

The present invention has to do with certain improvements in priming devices for internal combustion engines. These devices are used for causing an injection of raw gas into the cylinders during the starting operation so as to facilitate the ignition while the motor is yet cold.

One of the objects of the invention is to associate the priming device with the starting mechanism so that the operation of starting the engine will automatically bring the priming mechanism into operation without further thought or effort on the part of the driver. In particular, an object of this feature of the invention is to associate the priming device with the electric circuit of an electrically operated starting mechanism.

Another feature of the invention has to do with the provision of an arrangement such that when the starting mechanism is used with the hot motor, the priming device will not be brought into operation; since when the motor is started up while still hot it is unnecessary and disadvantageous to make use of the primer. More particularly, another feature in this connection is to make possible this result in conjunction with electric starters.

Another feature of the invention has to do with the provision of an arrangement such that the delivery of raw gas to the engine by the primer will be more or less regulated by the temperature of the engine; the arrangement being such as to allow a more rapid introduction of priming gas when the engine is dead cold than when the engine is warm, the operation being graduated more or less by the exact temperature of the engine.

Still another feature of the invention has to do with the provision of an arrangement such that during the priming operation the primer itself will be warmed up so as to more fully vaporize the gas and place it in a better condition for delivery to the engine. In this connection a further ob-

ject is to generate the heat used for this purpose by the electric current which serves to operate the primer itself.

Another object is to provide suitable control devices in the electric circuit so that the primer may be caused to operate either automatically at the same time that the starter is operated, or independently at the will of the operator of the engine.

Another object of the invention is to provide a very simple and convenient form of priming device, and one which shall be self-contained with the exception of the necessary wires or other connections to connect it with the starting mechanism. In this connection, a further object is to construct the priming device as a unitary structure of simple form and which can be readily attached to the proper point on the motor.

Another object of the invention is to provide a priming device of such construction that it may be used either independently for the delivery of raw gas directly to the manifold or the cylinders, or in conjunction with a device known as a master-primer.

Other objects and uses of the invention will appear from a detailed description of the same which consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings:

Figure 1 shows a cross section through a convenient form of priming device embodying the features of the present invention, showing the manner in which it may be attached to the intake manifold of the engine; showing diagrammatically a simple set of electrical connections for associating it with the starting system;

Fig. 2 shows a fragmentary view of the lower portion of the primer of Fig. 1, associated with a "master primer;" and

Fig. 3 shows diagrammatically a modified form of priming device and connections embodying the features of the present invention.

I will first describe the arrangement shown in Fig. 1. As therein illustrated the priming device is attached to the gas intake manifold 5 which leads to the cylinders of the engine; and in order to simplify the illustration and description, I have not complicated the drawing by illustrating the

cylinders to which said manifold 5 is connected. However, the use of intake manifolds is well understood in the art and the manifold 5 may be of any desired construction.

I have also illustrated the starting motor diagrammatically at the point 6, the battery diagrammatically at the point 7, and the starting switch diagrammatically at the point 8. The wires 9, 10, and 11, represent the connections between the battery and the starting motor under the control of the starting switch 8.

The particular construction of primer 15 illustrated in Fig. 1 is electrically operated. It includes a solenoid 12 mounted upon a spool 13 and in position to act upon one or more valves 14 and 15 so as to raise said valves when the solenoid is energized to thereby permit a delivery of raw fuel to the intake manifold.

A convenient form of construction is that illustrated in the drawing in which both of the valves 14 and 15 are used, and in which both of these valves are of the needle type. For this purpose the spool 16 which passes through the solenoid 12 is provided with a vertical bore, the lower end 17 of which is relatively small and serves as a discharge orifice, the central portion 18 of which bore is enlarged with a seat 19 for the lower needle valve 14, and the upper portion 20 of which bore is still further enlarged and has a seat 21 for the lower end of the needle valve 15. The lower portion of the spool 16 is threaded to receive a nipple 22 which may be tapped into the manifold 5, and the upper portion of said nipple is provided with a flange 23 which serves to support the spool 13.

The upper portion of the spool 16 is also threaded and receives a washer 24 which clamps against the upper portion of the solenoid. The fitting 25 is threaded onto the upper end of the spool, said fitting having a bore 26 which communicates with the fuel line 27 and which bore delivers fuel to the bore 20. The fuel line 27 may be connected to any source of fuel for starting purposes, such as the engine fuel tank, engine fuel line, vacuum tank, carburetter float chamber, or a special container provided for that purpose. In the latter case the fuel used for priming may be different from that on which the engine normally operates. For example, if the engine is intended to operate on kerosene, the line 27 might be connected to a special tank so as to prime by the use of gasoline, acetylene, high test gasoline, or other fuel.

It will be noted that the lower end of the needle valve 14 is provided with a guide pin 28 working in the bore 17. This guide pin is smaller than the bore so that the fuel may readily flow past it.

The needle valve 15 is provided on its lower end with a guide pin 29 working in a socket in the outer portion of the needle valve 14; and the upper end of the needle valve 15 is in turn provided with a socket 30. A guide pin 31 works in the socket 30, and the upper end of said guide pin 31 works in conjunction with an adjustment and limit pin 32. This pin 32 passes through a guide arm 33 the inner end of which is attached to the fitting 25.

The amount of fuel which it may be desirable to introduce in the priming operation will depend largely upon the temperature of the engine. When the engine is hot, it will ordinarily be unnecessary to use the priming device at all. When the engine is started dead cold, the full effect of the priming device should be available; and when the engine is started at some intermediate temperature an intermediate amount of priming action should be secured.

I have made provision for securing a regulated amount of priming action in the present case. This is done by forming the arm 33 as a compound arm of two materials having different co-efficients of thermal expansion so that the said arm will deflect with change of temperature. The arrangement is such that when the arm is dead cold its outer or free end stands in raised position; and as the arm becomes warmer this outer end moves progressively downwards. The stop lug 34 is placed on the pin 32, there being allowed a certain amount of play above said stop. When the needle valves rise their movement is ultimately limited by the engagement of the stop 34 with the arm 33, and it is evident that the amount of opening will in this way be regulated according to the temperature of the device.

The needle valves 14 and 15 are both made of magnetic material such as soft iron. The excitation of the solenoid will therefore tend to raise them since they are both located below the center of pull of the solenoid. The priming operation is thus brought about by exciting the solenoid in any suitable manner. This may be done either as an entirely independent operation under the control of the driver, or automatically in conjunction with the starting operation. In the arrangement illustrated the wires 35 and 36 are provided for delivering current to the solenoid. One of these wires connects to the lead 9 coming from the battery, and the other connects to a switch 37 which may be thrown into either off position, or into either of two operative positions. In the position illustrated, the switch 37 makes connection with the wire 38 joining to the lead 10 so that the operation of the solenoid will be independent of the operation of the starting switch 8. When thrown into the other position the switch 37 connects to a wire 39 which connects to the

lead 11 so that in such position the delivery of current to the solenoid is simultaneous with the starting operation.

of sufficient heat to materially assist in vaporizing the priming fuel.

It may sometimes be desirable to use what is known as a "master primer" in conjunction with the device of the present invention. By the term "master primer," I mean a heating device whose purpose is primarily to heat the fuel and vaporize a portion of it.

In Fig. 2 I have shown a very convenient arrangement combining such master primer with the primer of the present invention. As therein illustrated the fixture 22 is provided with a relatively large bore 49 within which is a wire 50 of metal so that upon the passage of current of proper volume through said wire it will become very hot and greatly assist in the vaporizing action. The current for this wire 50 may be derived from any suitable source. In the arrangement illustrated the wire 50 is placed in series with the wire 35 which connects to the solenoid, so that the wire 50 is heated up simultaneously with the operation of the primer and not otherwise. The wire 50 has its leads brought through the insulating bushings 51 in the sides of the fitting 22.

In Fig. 3 I have shown a modified form of primer which however also embodies the features of the present invention. In this case there is shown only a single valve member 52 working within the chamber 53 of the shell 54. The lower portion of the shell is provided with a valve seat 55 which leads to the fuel delivery passage 56. The solenoid 12 is placed on the shell 54 and when electrically energized serves to raise the magnetic valve 52.

The lower portion of the valve is provided with a tapered stem 57 so that the amount of opening created will depend upon the amount of lift of the valve. The upper end of the valve is provided with a stem 58 working in a socket of a guide member 59, a spring 60 normally holding the valve in the lowered position. The guide 59 is carried by a nut member 61 threaded onto the upper end of the shell member 54, a series of openings 62 allowing the fuel to pass through the nut member 61.

A fixture 63 threads onto the upper end of the shell member 54, said fixture 63 having a bore 64 connected to the fuel line 65. A ball check valve 66 is carried by the nut member 61, and when excessive pressure suddenly occurs within the primer, said ball check valve will rise and prevent the communication of said pressure to the line 65.

The valve member 52 is provided with a series of shoulders 67 at positions graduated from its center outwards and also graduated as to elevation. One or more stop members 68 are provided for engagement with one or the other of the shoulders 66 depending upon the position of such stop members 68. By moving the stop member

When the motor is so hot that the use of the priming device is unnecessary, it will be unnecessary to deliver current to the solenoid simultaneously with the starting operation. I have therefore placed a temperature controlled switch 40 in series with the lead 36. Said temperature controlled switch includes a compound bar 41 made of two metals having different temperature coefficients, so that when the primer is warmed up to a point where its use is no longer necessary, said bar 41 will deflect inwards and carry the contact 40 away from a stationary contact 42, thereby opening the circuit. The contact 42 is adjustable in position by means of the thumb screw 43 working adjacent to a fixed scale 44 which may be provided with graduations suitable to inform the operator as to the approximate position in which this screw should be set for different temperature conditions. These graduations may be in terms of the outdoor temperature so that the driver can set the thumb screw 43 to different positions according to the temperature changes and according to the seasons.

The fuel delivered by the primer passes through the bore 45 of the fitting 22 and is discharged into the manifold. In order to spread the fuel and secure a better priming action, I have provided a deflector 46 beneath the lower end of the passage 45, and have also provided a series of spiral grooves 47 within said passage. These grooves will impart a whirling action to the priming fuel and will materially assist to thoroughly incorporate it into the gas within the manifold.

It sometimes happens that a back fire will take place causing a sudden rise of pressure within the intake manifold 5. In order to prevent the transmission of such unusual pressure to the source of fuel supply to which the line 27 is connected, and in order to prevent such pressure from ejecting all of the fuel from the primer, I have placed a check valve 48 in a suitable position to prevent the backward movement of fuel when the pressure in the manifold 5 exceeds the pressure in the line 27.

When there is a flow of current through the solenoid 12, heat is generated. By making the wall 13 relatively thin and of relatively good heat conducting material such as brass or copper, the heat generated in the coil will be transmitted promptly to the priming fuel and will materially assist in some cases the use of a solenoid of such proportions that it will not only effectively serve its purpose of opening the priming valves, but will also serve for the generation

outwardly it will allow the valve member to rise to a higher position. By thermally controlling the position of the stop members 68 according to temperature of the primer, the amount of opening of the valve may be automatically graduated. This I accomplish by forming the stop members 68 at the lower ends of a pair of thermal members 69 in the form of compound bars formed of two materials having different temperature coefficients of expansion. The arrangement is such that when the primer is dead cold the bars 69 deflect their lower ends outwardly, whereas as they warm up said bars move their lower ends inwardly until finally when the primer is hot said lower ends are in a position to engage the uppermost one of the series of shoulders 67.

If desired, a thermal switch 40 may be used in conjunction with the present form of primer, said thermal switch 40 operating in a manner similar to that of the switch 40 of the arrangement shown in Fig. 1.

While I have herein illustrated and described only certain arrangements embodying the features of the present invention, still it will be understood that I do not limit myself to the said arrangements except as I may do so in the claims.

I claim:

1. An automatic cut-out device for the purpose specified, comprising in combination a solenoid having a central longitudinally extending passage with a valve seat at its lower end, a fuel delivery connection at the upper end of said passage, a fuel discharge connection at the lower end of said passage and below said valve seat, a vertically movable valve working against said valve seat, an armature working in said passage and connected to said valve, and adapted to be raised to raise the valve when the solenoid is energized, a check valve between the aforesaid passage and the fuel delivery connection to prevent backward movement of fuel from the passage into the fuel delivery connection, means for limiting the opening movement of the valve under the influence of the solenoid, and temperature actuated means for adjusting said limiting means according to the temperature of the device, whereby when the device is cold the valve may open fully, and whereby as the device becomes warmer the opening of the valve is limited more and more to thereby reduce the priming effect as the device becomes warmer, substantially as described.

2. An automatic cut-out device for the purpose specified, comprising in combination a solenoid having a central longitudinally extending passage with a valve seat at its lower end, a fuel delivery connection at the upper end of said passage, a fuel discharge connection at the lower end of said passage and below said valve seat, a verti-

cally movable valve working against said valve seat, an armature working in said passage and connected to said valve, and adapted to raise the valve when the solenoid is energized, means for limiting the opening movement of the valve under the influence of the solenoid, and temperature actuated means for adjusting said limiting means according to the temperature of the device, whereby when the device is cold the valve may fully open, and whereby as the device becomes warmer the opening of the valve is limited more and more to thereby reduce the priming effect as the device becomes warmer, substantially as described.

3. An automatic priming device for the purpose specified, comprising in combination a solenoid having a central longitudinally extending passage with a valve seat at its lower end, a vertically movable valve working against said valve seat, an armature working in said passage and connected to said valve, and adapted to raise said valve when the solenoid is energized, means for limiting the opening movement of the valve under the influence of the solenoid, and temperature actuated means for adjusting said limiting means according to the temperature of the device, whereby when the device is cold the valve may fully open, and whereby as the device becomes warmer the opening of the valve is limited more and more to thereby reduce the priming effect as the device becomes warmer, substantially as described.

4. An automatic priming device for the purpose specified, comprising in combination a solenoid having a central longitudinally extending passage with a valve seat at one end, a vertically movable valve working against said valve seat, an armature working in said passage and connected to said valve, and adapted to move said valve away from said valve seat when the solenoid is energized, means for limiting the opening movement of said valve under the influence of said solenoid, and temperature actuated means for adjusting said limiting means according to the temperature of the device, whereby when the device is cold the valve may fully open, and whereby as the device becomes warmer the opening of the valve is limited more and more to thereby reduce the priming effect as the device becomes warmer, substantially as described.

5. An automatic priming device for the purpose specified, comprising in combination a solenoid having a longitudinally extending passage with a valve seat at one end, a valve working against said valve seat, an armature working in said passage and connected to said valve, and adapted to move said valve away from said valve seat when the solenoid is energized, means for limiting the opening movement of said valve

under the influence of said solenoid, and temperature actuated means for adjusting said limiting means according to the temperature of the device, whereby when the device is cold the valve may fully open, and whereby as the device becomes warmer the opening of the valve is limited more and more to thereby reduce the priming effect as the device becomes warmer, substantially as described.

6. An automatic priming device for the purpose specified, comprising in combination a solenoid, a passage through which fuel may flow for priming purposes, a valve in said passage, an armature in position to be influenced by said solenoid, a connection from said armature to said valve, whereby when the solenoid is energized the armature tends to move the valve away from its seat to allow fuel to flow through the passage, and temperature actuated means for limiting the movement of the valve away from its seat as aforesaid, whereby as the temperature of the device rises the opening movement of the valve is limited more and more, substantially as described.

7. An automatic priming device for the purpose specified, comprising in combination a solenoid, a passage through which fuel may flow for priming purposes, a valve in said passage, an armature in position to be influenced by the solenoid, a connection from said armature to said valve, whereby

when the solenoid is energized the armature tends to move the valve away from its seat to allow fuel to flow through the passage, temperature actuated means for limiting the movement of the valve away from its seat as aforesaid, whereby as the temperature of the device rises the opening movement of the valve is limited more and more, and temperature actuated means for opening the circuit supplying current to the solenoid when the temperature of the device exceeds a predetermined limit, substantially as described.

8. An automatic priming device for the purpose specified, including a valve for controlling the admission of fuel to the engine, means under the control of the operator for opening said valve for priming purposes, and temperature actuated means for regulating the amount of fuel delivered by the priming device when the valve is opened, substantially as described.

9. An automatic priming device for the purpose specified, including a valve for controlling the admission of fuel to the engine, means under the control of the operator for opening said valve, and temperature actuated means operable according to the temperature of a selected part of the engine for rendering inoperative said opening means, substantially as described.

DANIEL ROESCH.