Dec. 8, 1936. J. W. FITZ GERALD 2,063,087

AUTOMATIC PRIMER FOR INTERNAL COMBUSTION ENGINES

Filed March 12, 1934 2 Sheets-Sheet 1

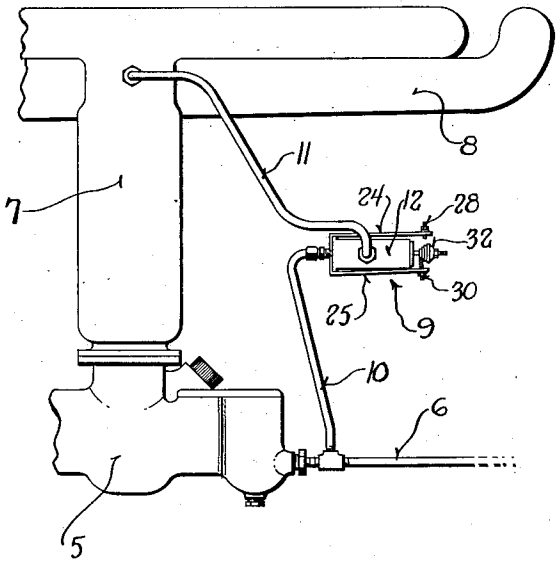
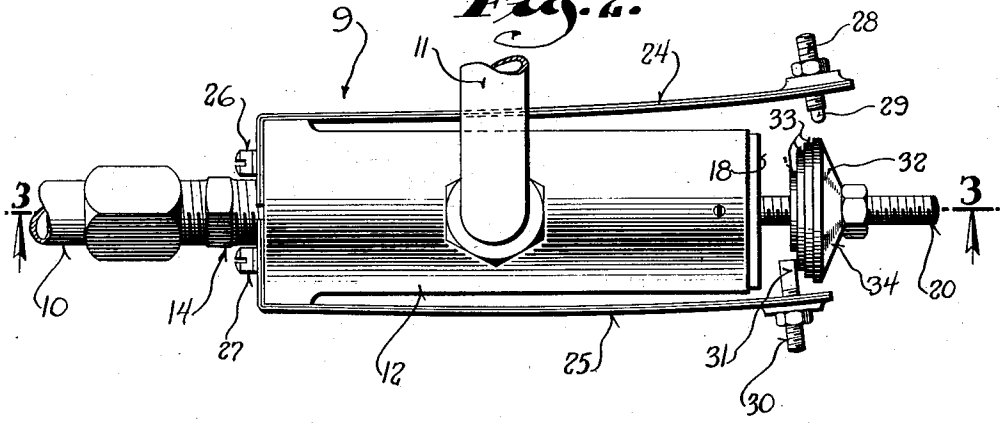


Fig. 1.

Fig. 2.



Inventor
John W. FitzGerald
By Schuyler Jones
Attorney

Dec. 8, 1936. J. W. FITZ GERALD 2,063,087

AUTOMATIC PRIMER FOR INTERNAL COMBUSTION ENGINES

Filed March 12, 1934 2 Sheets-Sheet 2

Fig. 3.

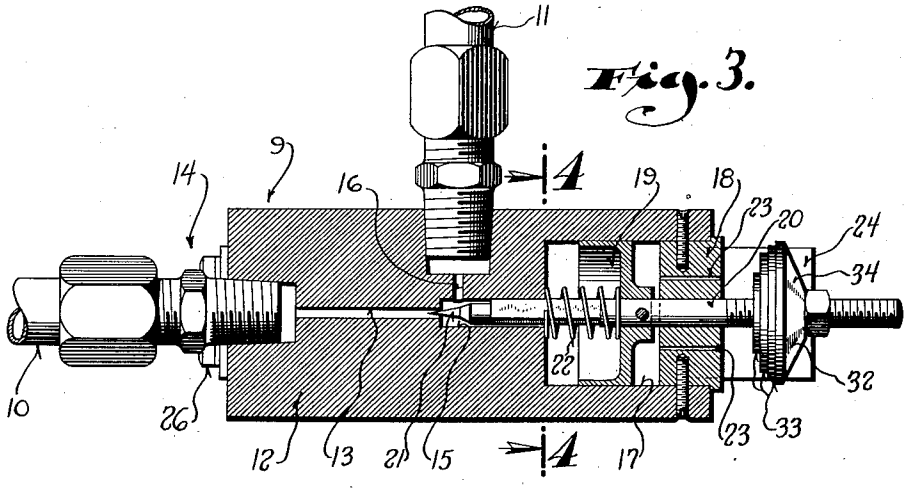


Fig. 4.

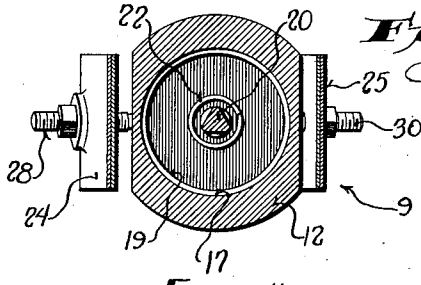
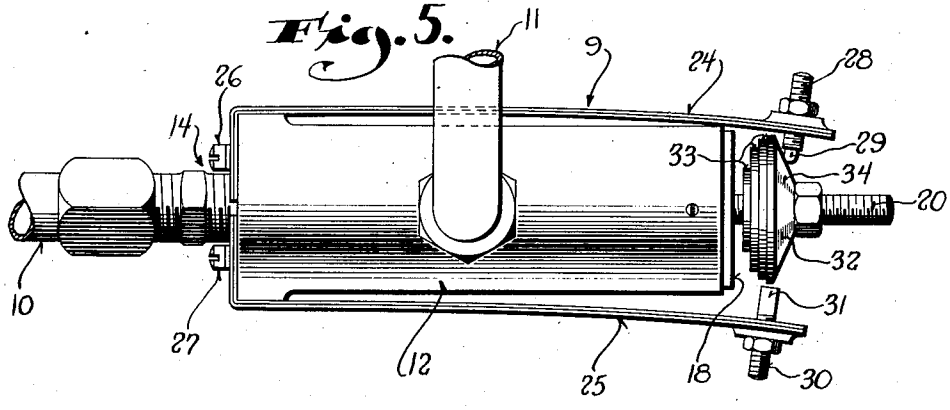


Fig. 5.



Inventor
John W. FitzGerald
By Underhill & Jones
Attorneys

Patented Dec. 8, 1936

2,063,087

UNITED STATES PATENT OFFICE

2,063,087

AUTOMATIC PRIMER FOR INTERNAL COMBUSTION ENGINES

John W. Fitz Gerald, Milwaukee, Wis., assignor to Briggs & Stratton Corporation, Milwaukee, Wis., a corporation of Delaware

Application March 12, 1934, Serial No. 715,133

9 Claims. (Cl. 123—119)

This invention relates to new and useful improvements in primers for internal combustion engines and has as an object to provide an automatic thermally controlled priming device particularly adaptable for automotive vehicle engines.

Another object of this invention is to provide an automatic priming device wherein a valve biased to open position and closed by engine suction, has its opening and closing movements directly controlled by temperature actuated means.

And a further object of this invention is to provide an automatic priming device of the character described, which is extremely simple in construction and positive in operation.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

In the accompanying drawings, I have illustrated one complete example of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 illustrates part of the carburetor and manifolds of an internal combustion engine showing the application of this invention thereto;

Figure 2 is an enlarged side view of the primer showing the position of the thermal control members at cold temperatures;

Figure 3 is a longitudinal section view taken through Figure 2 on the plane of the line 3—3;

Figure 4 is a cross section view taken through Figure 3 on the plane of the line 4—4; and

Figure 5 is a side view similar to Figure 2, showing the thermal control members in their opposite positions towards which they move in response to higher temperatures.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views, the numeral 5 designates the carburetor of an internal combustion engine supplied with fuel by a supply line 6. The outlet of the carburetor connects with an intake manifold indicated generally by the numeral 7, which, as is customary, has a portion thereof juxtapose the exhaust manifold 8.

In accordance with this invention, an automatic priming device, indicated generally by the numeral 9, and mounted in the region of the exhaust manifold, provides a controlled communication between the supply line 6, through ducts 10 and 11 directly to the intake manifold, as clearly shown in Figure 1.

When the engine is cold, as during the starting cycle, the priming device permits a direct communication between the supply line 6 and the intake manifold so that fuel may be drawn directly into the manifold. Upon increase in suction in the intake manifold produced by the engine in operation, the communication between the supply line 6 and the manifold is closed a degree dependent upon the temperature of the engine.

To this end, the priming device comprises a body 12 having an inlet 14 and an outlet 16 with which the ducts 10 and 11 respectively, connect. Leading from the inlet 14 is a small diameter bore 13. At a medial point in the length of the body 12, the bore 13 is abruptly increased in diameter to afford a larger diameter bore 15 with which the outlet 16 communicates through a lateral bore 16'. The outer end of the bore 15 is further abruptly enlarged to provide a comparatively large diameter bore 17, which opens to the adjacent end of the body to be closed by a head 18.

The bores 13, 15 and 16' provide a fuel passage through the body and the bore 17 affords a cylinder within which a piston 19 is slidably disposed.

The piston 19 is fixed to the stem 20 of a needle valve 21, arranged with its point projecting into the bore 13 to completely close the fuel passage. The valve stem 20 is slidably passed through the head 18 to project therebeyond for a purpose to be hereinafter described.

Encircling the stem between the piston and the bottom of the bore 17 is a compression spring 22, which yieldably tends to hold the needle valve open. The action of the spring is opposed by the suction of the engine created within the intake manifold and acting upon the piston 19. To insure communication between the outlet port 16 and the bore or cylinder 17, the inner end of the valve stem is polygonal in cross section, as clearly shown in Figure 4, and to allow free response on the part of the piston to the effects of suction, the head 18 has a plurality of air bleeds 23.

Hence, it will be seen that when the engine is stationary or when it is operating under such conditions that the suction created thereby is insufficient to overcome the force of the spring 22, the needle valve 21 will be held open, permitting

fuel to be drawn directly from the supply line 6 into the intake manifold, but when the effect of suction is increased, its action upon the piston 19 overcomes the spring 22 and closes the needle valve 21 to close the fuel passage and shut off the admission of fuel to the intake manifold.

The admission of the priming fuel to the engine is further controlled by means responsive to variations in the ambient temperature. This means comprises two thermal elements 24 and 25, both preferably formed of strips of bi-metal anchored at one end to the body 12 as at 26 and 27 respectively, to overlie opposite sides thereof with their free ends projecting beyond the adjacent end of the body.

Each of the thermal elements at its free end carries an adjustable stop, the stop 28, which is carried by the member 24 having a rounded nose 29 and the stop 30, which is carried by the member 25 having a square inner end 31. These stops are directed inwardly toward each other to engage a disc 32, adjustably fixed on the extended end of the valve stem. The inner face of this disc is stepped as at 33, and the outer face thereof is inclined to provide a substantially conical surface 34.

When the engine is cold, as during an initial starting cycle, the thermal elements 24 and 25 are flexed to their positions illustrated in Figure 2. At such prevailing temperatures, the member 24 holds the stop 28 entirely away from the disc 32, but the member 25 holds its stop toward the axis of the valve stem engaging its inner end 31 with the stepped inner face 33 of the disc, it being understood that the valve stem is held outwardly under such conditions by the spring 22. Consequently, the valve will be held against closing in response to the effect of suction on the piston 19 until the ambient temperature has raised sufficiently to move the thermal control element 25 outwardly to disengage the end 31 of its stop 30 from the steps of the disc 32 with which it is engaged.

The inward movement of the valve stem to close the needle valve thus progresses step by step as determined by the response of the thermal element 25 to the rising ambient temperature. Concomitantly with the movement of the member 25 to carry its stop away from the disc 32, the thermal element 24 moves its stop 28 inwardly to engage its rounded nose 29 with the conical outer surface 34 of the disc.

This response of the thermal elements continues until a predetermined maximum temperature has been reached at which the member 25 is flexed outwardly to disengage its stop entirely from the disc and permit complete closure of the needle valve. At this time, the member 24 has engaged its stop 28 completely with the conical surface of the disc so that as long as the high ambient temperature obtains, opening of the needle valve is precluded even though the suction of the engine may drop to an extent which normally would permit the spring 22 to function. Obviously, as the ambient temperature drops, the reverse procedure on the part of the thermal control elements 24 and 25 takes place.

As the free end of the control element 24 moves outwardly, carrying its stop 28 toward the outer periphery of the conical surface 34 of the disc 32, the spring 22 forces the valve stem 20 outwardly to maintain the conical surface 34 in engagement with the rounded nose 29 of the stop 28. During this time, the thermal control element 25 flexes inwardly to engage the end 31 of its stop 30 with the stepped portion of the disc 32. The engagement of the stop 30 with the stepped portion of the member 32, however, does not affect the outward projection of the valve stem by its spring 22 as the frictional engagement between the end 31 of the stop and the stepped portion of the disc is insufficient to oppose the action of the spring 22. Consequently, the valve stem moves outwardly at a rate determined by the outward flexure of the control element 24, until the element 24 is moved a distance sufficient to disengage its stop 28 from the disc, whereupon the spring 22 is free to move the valve stem to its outermost position at which the needle valve 21 is entirely open.

It is to be understood that while in Figure 1 the priming device is shown in the region of the exhaust manifold, it may be located adjacent any other part of the engine which is subject to variation in temperature as is required for proper operation of the device.

It is also apparent that by reason of the adjustability of the stops 28 and 30, and the disc 32 on its stem, the device may be readily adjusted to function properly under different operating conditions.

What I claim as my invention is:

1. An automatic priming device of the character described comprising a body having a fuel passage therein, a valve within the body to close said fuel passage, means for yieldingly urging the valve to open position, a valve stem for the valve having a part projecting to the exterior of the body, engine suction operated means within the body and connected with said valve stem to close the valve, and temperature responsive means mounted on the exterior of the body and operably associated with the valve stem to regulate the opening of the valve by its yieldable urging means in accordance with temperature changes in the region in which said body is mounted and to prevent closing of the valve by engine suction until a predetermined ambient temperature has been reached at said region.

2. In an automatic priming device of the character described comprising a body having a fuel passage therethrough, a valve operable within the body to close said passage and to control the admission of fuel into the engine, a valve stem movable with the valve, a spring yieldingly urging the valve open, a piston connected to the stem and operating in a cylinder formed in the body, said cylinder being communicated with a source of engine suction so that the piston is responsive to engine suction to close the valve against the action of the spring, and temperature actuated means operable on the stem in accordance with temperature variations of the engine parts adjacent the device for controlling the opening of the valve by its yieldable urging means and for preventing the closing of the valve by the response of said piston to engine suction until a predetermined ambient temperature has been reached.

3. An automatic priming device of the character described including a valve for controlling the admission of fuel to the engine, a spring to yieldably urge the valve open, engine suction responsive means to close the valve against the action of the spring, and temperature actuated means to control the actuation of the valve comprising a pair of thermal elements movable in opposite directions in response to temperature changes thereat, and a member connected with

the valve and engageable by parts carried by said thermal elements.

4. An automatic priming device of the character described comprising, a valve to control the admission of fuel to an engine, a spring to yieldably urge the valve open, engine suction actuated means to close the valve against the action of said means, and temperature actuated means to control the closing and opening of the valve comprising a member movable with the valve and having surfaces at varying distances from the valve, and thermal elements having stops engageable with said surfaces and movable in opposite directions across said surfaces in response to temperature changes thereat.

5. An automatic priming device of the character described comprising a valve to control the admission of fuel to an engine, means to yieldably urge the valve open, means responsive to a condition of the engine to close the valve, and temperature actuated means to control the opening and closing of the valve comprising, a member connected with the valve to be movable therewith and opposite surfaces each of which has portions at different distances from the valve, and thermal elements having stops to engage said surfaces, engagement between the stop of one thermal element and its respective surface of said member limiting the movement of said member in one direction and engagement between the stop of the other thermal element and its respective surface of said member limiting the movement of said member in the opposite direction so that the opening and closing movements of the valve are limited to distances determined by the degree of engagement of said stops with said surfaces, and said thermal elements moving in opposite directions in response to temperature changes thereat.

6. An automatic priming device of the character described comprising a valve to control the admission of fuel to an engine, a spring to yieldably hold the valve open, engine suction actuated means to close the valve against the action of the spring, and temperature actuated means to control the closing and opening of the valve comprising, a member movable with the valve and having opposite surfaces with portions at progressively different distances from the valve, bi-metallic strips anchored at one end with their free ends disposed adjacent said last designated member and at opposite sides thereof, stops carried by the free ends of said bi-metallic strips to engage the opposite surfaces of said member to limit the movement of said member and consequently the valve to distances determined by the amount of engagement of said stops with the surfaces, and said bi-metallic strips moving in opposite directions in response to temperature changes thereat.

7. An automatic priming device of the character described comprising a body having a fuel passage connectable with a source of fuel and a source of engine suction and having a cylinder bore in communication with said passage, a valve to close said passage and control the admission of fuel to the engine, a stem on the valve extending through the cylinder bore to the exterior of the body, a spring to yieldably urge the valve open, a piston on said stem operating in said cylinder bore and responsive to engine suction to close the valve, a member mounted on said stem exteriorly of the body and having opposite faces with portions at different distances from the valve, and temperature actuated means having stops to engage said surface portions of said member to control the opening and closing of the valve in accordance with changes in temperature at said temperature responsive means.

8. An automatic priming device of the character described comprising a body having a fuel passage connectable with a source of fuel and a source of engine suction and having a cylinder bore in communication with said passage, a valve to close said passage and control the admission of fuel to the engine, a stem on the valve extending through the cylinder bore to the exterior of the body, a spring to yieldably urge the valve open, a piston on said stem operating in said cylinder bore and responsive to engine suction to close the valve, a member mounted on said stem exteriorly of the body and having opposite faces with portions at different distances from the valve, a pair of bi-metallic strips anchored at one end to said body with their free end portions disposed at opposite sides of said member, and stops carried by the free ends of said strips to engage the said surface portions of said member and limit the opening and closing movement of the valve in accordance with temperature conditions at said bi-metallic strips.

9. An automatic priming device of the character described comprising a body having a fuel passage therethrough connectable with a fuel supply and a part of an engine subject to engine suction and having a cylinder bore in communication with said passage, a valve in the body to close said passage and control the admission of fuel to said engine part, a spring yieldably urging the valve open, a stem on the valve projecting to the exterior of said body and passing through said cylinder bore, a piston on said stem operating in said cylinder and responsive to engine suction to close the valve, a member on said stem exteriorly of the body and having one face thereof stepped and its other face inclined, a pair of bi-metallic strips anchored to said body with their free ends arranged at opposite sides of said disc, and stops carried by the free end portions of said strips, one of said stops being engageable with the stepped surface of the disc to limit the closing movement of the valve in accordance with flexure of said strip in response to temperature rises and the stop of the other bi-metallic strip being engageable with the inclined surface of the disc to limit the opening movement of the valve to distances determined by the temperature at said strip

JOHN W. FITZ GERALD.