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TWO-CYCLE ENGINE CONTROL

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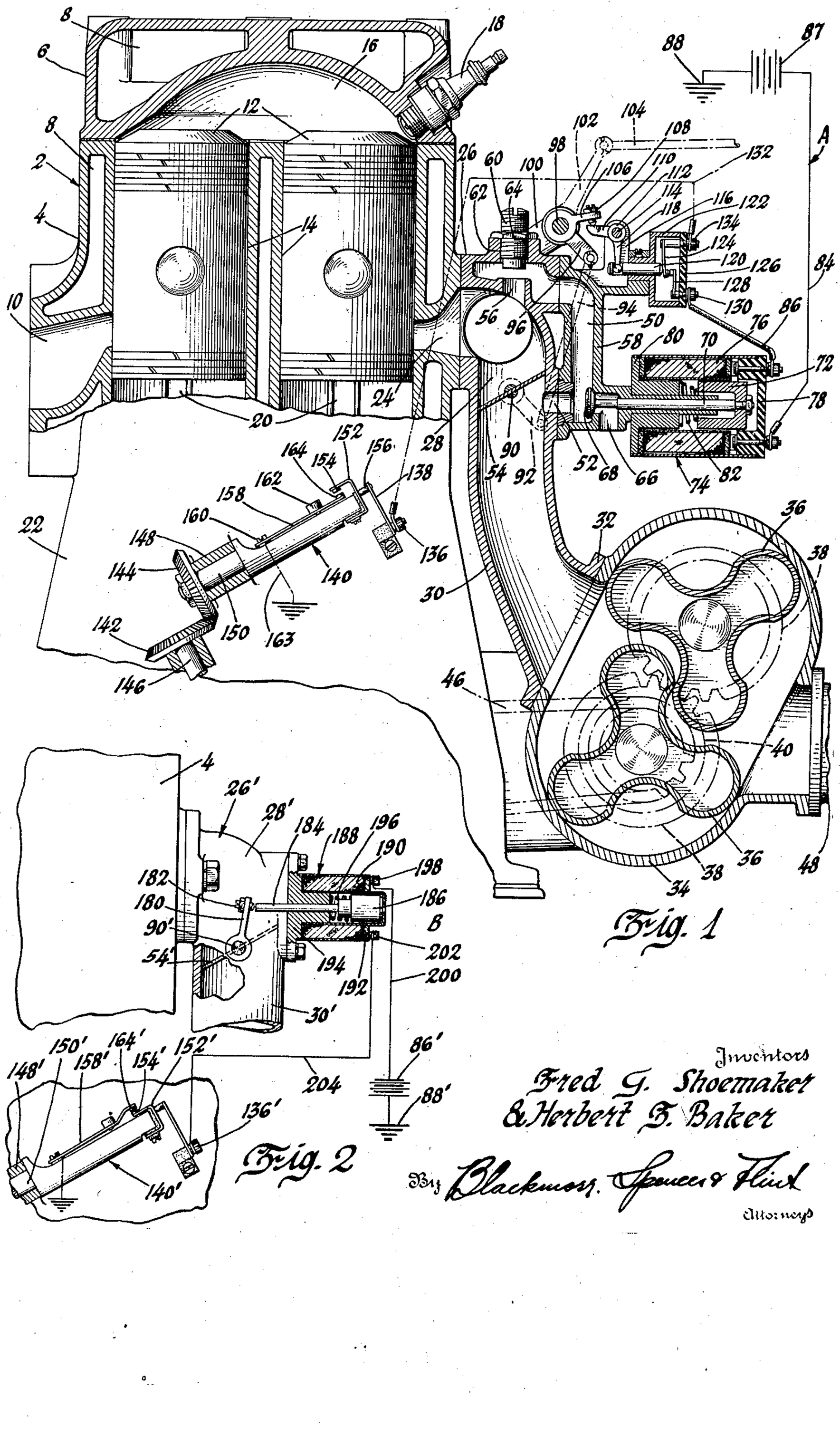

Fig. 1

Fig. 2

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TWO-CYCLE ENGINE CONTROL

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This invention relates to two-cycle internal combustion engines and has particular reference to a means for preventing the ingress of carbureted fuel to the firing chamber during the deceleration period of the engine and to allow the passage of carbureted fuel to the cylinders after the engine has slowed down to a good idling speed.

In the building of a two-cycle engine for use on automotive vehicles some difficulty has been experienced in obtaining a good idling operation of the engine where the vehicle is suddenly to be brought to a stop necessitating a slowing down of the engine. As soon as it is desired to slow down the engine the throttle is moved toward closed position to prevent further access of fuel to the engine. In ordinary two-cycle engines the throttle has been allowed to remain open slightly so that when the engine has sufficiently slowed down the slight crack of the throttle will allow good idling. This partially open position of the throttle during deceleration was objectionable for the reason that it allowed the passage of a small amount of fuel past the throttle during the deceleration period of the engine. While this amount was not sufficient to give a firing for each descent of the piston, nevertheless after two or three strokes there would be sufficient fuel in the firing chamber to form a firing charge and there would be an objectionable firing when it was desired to decelerate. To obviate this difficulty and yet to allow for proper idling when the engine has sufficiently decelerated, the structure of the present invention was devised. In accordance with the invention, when it is desired to decelerate the engine the throttle is immediately fully closed to prevent any further access of carbureted fuel. It is, however, impracticable to make a perfectly tight closure with a butterfly valve and there is always a slight leakage at the valve edge. To prevent this small amount of leakage gas from arriving at the cylinders, a passage to the atmosphere is opened simultaneously with the closing of the throttle. A valve to open the passage is operated at the same time the throttle is closed. This valve is to open the passage to vent the cylinders and cause the leakage gas to flow to the atmosphere instead of to the cylinders. When the engine has slowed down to a good idling speed, a centrifugal governor will cause the operation of the valve to close the vent to the atmosphere and to open a bypass passage around the throttle valve to allow a limited amount of carbureted mixture sufficient for good idling to pass to the cylinders. This condition will continue until it is desired to accelerate the vehicle when the throttle valve is reopened to allow the engine to function in the usual way.

On the drawing

Figure 1 is a sectional view through one cylinder of a multi-cylinder two-cycle internal combustion engine, showing the invention applied.

Figure 2 is a view of a modification.

Referring to the drawing, the numeral 2 indicates a two-cycle internal combustion engine as a whole. The engine may have any number of cylinders, the drawing showing a section through but one of these cylinders. The engine block is indicated at 4, and the removable engine head at 6. The water circulating system is indicated at 8 while 10 indicates the exhaust passages of the engine. Pistons are shown at 12 and operate in cylinders 14 which are of U-type and have the common combustion chamber 16 which has the usual spark plug 18 to ignite the mixture. The pistons 12 are connected by the connecting rods 20 to the crank shaft (not shown) operating in the crank case 22. The usual intake port is indicated at 24.

The parts so far described are conventional, and per se form no part of the invention.

At the intake side of the engine block 4 there is mounted the manifold system indicated as a whole at 26. The manifold system comprises the inlet manifold 28 having the riser 30 connected at 32 to a blower 34 of any suitable type shown as comprising the two three-toothed members 36 driven by the connected gears 38. On the shaft of the lower gear 38 there is mounted a second gear 40 driven by a belt 46 from the crank shaft of the engine in the well known way. The carburetor (not shown) is connected at 48 to the inlet to the blower.

The manifold system 26 further comprises the bypass passage 50 which has an entrance 52 into the riser 30 of the manifold at the lower or blower side of the throttle 54. The passage 50 delivers at the outlet 56 on the engine side of the throttle 54. The major portion of the passage is formed in a separate member 58 secured to the manifold 28 in any suitable way.

A suitable screw threaded element 60 is threaded into an opening 62 in the manifold 28 immediately above the outlet 56. The purpose of the element 60 is to regulate the size of the exit opening 56 of the passage 50. A lock nut 64 is used to secure the element 60 in adjusted position.

The passage 50 has an opening or outlet 66 which opens to the atmosphere. The opening 66 and the entrance 52 to the passage 50 face each other and are controlled by a common valve 68.

The valve 68 has an elongated slidable stem 70 to the end of which there is secured a piston 72 which also forms the core of a solenoid 74. The solenoid has the helix or winding 76, suitably mounted, and an insulated head 78. A block 80 which may or may not, as desired, be of insulated material, forms the end portion of the solenoid 74 and serves to mount the solenoid on the member 58. A coil spring 82 is positioned between core piston 72 and the block 80 and constantly urges the valve and piston to the position shown in Figure 1.

Suitable wires 84 and 86 of an electric circuit A allow for the passage of current through the winding of the solenoid. The wire 84 receives its current from a suitable battery or other source indicated at 87, one of the terminals of the battery being connected to ground as at 88.

From the structure shown it is to be noted that the valve 68 is capable of closing one only of the passages 52 and 66 at a time. In other words, the valve 68 is either in the position shown in Figure 1, or at the other extremity of its stroke to close the manifold entrance 52 to the passage 50.

The throttle valve 54 is mounted on the usual shaft 90 which has a lever 92 secured thereto outside the riser 30. A link 94 is connected at one end to the lever 92 and at its other end to a lever 96 rigidly secured to a shaft 98 turnably mounted in a support 100 secured to the manifold 28. The shaft 98 has secured thereto a lever 102 which has connected thereto a link 104 for the usual manual operation of the throttle 54. If desired, the lever 102 may be secured to the shaft 90.

The shaft 98 has secured thereto an arm 106 having the screw 108 secured in the end thereof to form an adjustment for the operation of the arm 110 of a bell crank lever 112 pivotally mounted at 114 on a support 116. The other arm 118 of the bell crank lever has a ball end which operates in a slot in a sliding pin 120. The pin 120 operates a spring contact finger 124 and slides axially in a casing 122 suitably held on the element 58. The contact finger 124 is suitably mounted on a plate of insulating material 126 and is adapted to make contact with a second spring contact finger 128 likewise mounted on the insulating plate 126. The wire 86 of the circuit is connected to the contact 130 of the spring finger 128 while a wire 132 is connected to the contact 134 of the spring finger 124.

The wire 132 leads to a contact 136 of a contact finger 138, a part of a centrifugal governor indicated as a whole at 140. The centrifugal governor is operated in any suitable way such as by the gears 142 and 144 from the engine. One of the gears 142 has a shaft 146 which is operated in any desired way from the crank shaft. The other gear 144 is mounted in the bearing 148 and has secured thereto a shaft 150 which rotates the governor 140. The shaft 150 has secured to its outer extremity a spring contact finger 152 having the contact 154. The contact 156 of the spring finger 138 is always in contact with the spring finger 152 and rests on the finger on the axis of the shaft 150. A third spring contact finger 158 is secured at one end by a screw 160 to the governor and has a weight 162 secured to the finger adjacent the other end. A lead 163 connects the finger 158 to ground. A contact 164 on the finger 158 is adapted to make with the contact 154 on the finger 152 when the governor attains a sufficiently high speed.

The purpose of the electrical contact between the fingers 124 and 128 is to make the electrical circuit indicated as a whole at A when the throttle is in fully closed position only as shown in Figure 1. When the throttle is fully closed (or in the position of the parts shown in Figure 1) the arm 106 will move the bell crank lever 112 to push the pin 124 to the right to make contact between the ends of the fingers 124 and 128. With the governor rotating at sufficiently high speed, the contact at 154 and 164 likewise will be made to complete the circuit. This will energize the solenoid 74 and cause the core or piston 72 to be drawn to the left to move the valve 68 from the position shown in Figure 1 to a position which closes the entrance 52 to the bypass passage 50 and opens the opening 66 to the atmosphere. When the speed of the engine drops and the governor 140 is slowed down, the weight 162 will pull the contact 164 away from the contact 154 to break the circuit and deenergize the solenoid and cause the spring 82 to push the piston 72 to the right to return the valve to the position shown in Figure 1. For positions of the throttle other than the closing position, the arm 106 will be swung in a counter-clockwise position to allow the spring finger 124 to throw the pin 120 and lever arm 118 to the left to break the electrical connection between the contact fingers 124 and 128. This will keep the circuit A open at all times and hold the solenoid piston 72 and the valve 68 in the position shown in Figure 1. It is therefore evident that the solenoid and valve 68 are operative to close the entrance 52 to the bypass passage when the throttle is in closed position only.

Considering the position of the parts shown in Figure 1, this is the position which corresponds to the normal idling of the engine. The engine speed is such that the contact at 154, 164 of the centrifugal governor is open. The operation of the blower will force the carbureted fuel up the riser 30 but as the throttle 54 is in closed position, the normal passage of carbureted fuel into the engine will be prevented. However, as the bypass passage 50 is open it will allow a sufficient quantity of mixture to pass through the entrance 52 up the passage 50 and from the outlet 56 to the firing chamber 16 to allow good idling of the engine. If it is desired to increase the speed of the engine, the operator steps on the accelerator pedal to operate the rod 104 to open the throttle. This immediately breaks the electrical connection at contact fingers 124, 128 because of the movement of the arm 106, and this break in the circuit A will assure that the solenoid will be retained in the position shown in Figure 1, for as the engine speeds up the centrifugal governor will again make a connection between the contacts 154 and 164 to close the circuit at this point. As the throttle opens, the carbureted air may pass up the riser to the firing chamber in the usual way. The bypass passage 50, however, is still open and carbureted fuel may pass therethrough to the firing chamber but this is no disadvantage inasmuch as there is no desire now to restrict any flow of passage to the cylinder. The engine will be speeded up and operated at the desired rate of speed for the vehicle. Should the operator sight a traffic light in the distance which is just turning to halt the traffic in the direction in which he is moving, he will remove his foot from the accelerator pedal to allow the engine to slow down. The removal of the foot from the accelerator pedal will at once fully close the throttle and make the contact at 124, 128 to close the circuit. The solenoid now is energized and moves the valve 68

to the left to close the entrance to the bypass passage 50 and open the exit or opening to the atmosphere. The closing of the throttle valve 54 and the operation of the valve 68 effectively will prevent any entrance of carbureted fuel to the firing chamber and the opening of the air vent at 66 will relieve the cylinders of any undue pressure or compression and allow the engine easily to slow down for idling. The slowing down of the engine, of course, will slow down the speed of the centrifugal governor and when the governor speed corresponds to a good idling speed of the engine, the contacts at 154, 164 will be broken to break the circuit to deenergize the solenoid to allow the spring 82 in the solenoid to move the piston 72 and valve 68 to the right to open the entrance 52 to the passage 50 and close the vent 66 to the atmosphere. This arrangement of parts will now open the bypass passage 50 and allow the entrance of sufficient carbureted fuel to give good idling of the engine.

In Figure 2 there is shown a modification of the invention in which the bypass passage 50 is eliminated. The engine block is indicated at 26'. The manifold system has the manifold 28' and the riser 30' with which there is connected the usual blower and carburetor. The throttle valve is indicated at 54' mounted on the usual shaft 90'. The shaft 90' has the usual lever secured thereto exteriorly of the manifold 28' in order that the throttle valve may be manually operated. There is secured to the shaft 90' an arm 180 which has an adjustable screw 182 secured to the end thereof. The end of the screw is separated from and adapted to contact with the end of a sliding rod 184 secured to a piston 186 forming the core of a solenoid 188. The solenoid has the usual helix or winding 190 and one end of the solenoid is closed by the plate 192 of insulating material while the other end is closed by the block 194 which may or may not be of insulating material. A spring 196 is provided in the solenoid between the piston 186 and the end of the block 194 and constantly urges the piston to the position shown in Figure 2. The solenoid has the contact 198 to which there is connected the wire 200 of the electric circuit B. The contact 198 receives its current from the battery 86' one side of which is connected to ground at 88'. A second contact 202 on the solenoid has connected thereto a wire 204 leading to a contact 136' on a centrifugal governor 140'. The governor 140' distinguishes from the governor 140 in Figure 1 in that the contacts 154' and 164' on the spring contact fingers 152' and 158' are broken at higher governor speeds and made at lower governor speeds.

The operation of the structure of Figure 2 is as follows: considering that the speed of the vehicle is at what is termed higher speeds and the operator of the vehicle finds it necessary to slow down, he will raise his foot from the accelerator pedal which will cause the throttle valve 54' to assume the closed position shown in Figure 2. The speed of the governor, however, still maintains the contacts 154', 164' separated so that the spring 196 will keep the piston 186 and rod 184 in the position shown in Figure 2. When the engine speed reaches a speed equivalent to good idling, the contacts at 154' and 164' will be made to complete the circuit B to energize the solenoid 188 to cause it to pull the piston 186 to the left to cause the rod 184 to operate the lever 180 to crack the throttle 54' sufficiently to allow the passage of enough carbureted mixture to give a good idling speed to the engine.

We claim:

1. In a two-cycle internal combustion engine having an interrelated manifold, blower, and throttle, manually operable means to operate the throttle, an electric circuit, a contact in said circuit operated by the throttle operating means, said contact being closed when the throttle is in closed position only, a carbureted fuel passage to allow carbureted fuel to pass around the throttle when the throttle is in closed position, said passage having an opening to the atmosphere, a valve to control said passage, a solenoid in said circuit to operate said valve to closed position or release it for movement to opened position, and a governor in the circuit operated by the engine and maintaining said circuit closed at engine speeds above idling speed when the throttle is closed to cause said solenoid to keep said passage closed to the carbureted fuel and open to atmosphere to prevent carbureted fuel from entering the firing chamber and to allow in easy working of the pistons.

2. In a two-cycle internal combustion engine, an interrelated blower, manifold system, and throttle, a passage in the manifold system around the throttle, said passage being open to the atmosphere, a valve in the passage adapted to close the passage either to the atmosphere or to the manifold on the blower side of the throttle, means to operate said valve to close the opening to the atmosphere during any open position of the throttle and close the manifold opening during full throttle closed position for engine speeds above ordinary idling speed, and means operated by the speed of the engine to control said first-named means.

3. In a two-cycle internal combustion engine, an interrelated blower, manifold system, and throttle, a passage in the manifold system around the throttle, said passage being open to the atmosphere, a valve in the passage adapted to close the passage either to the atmosphere or to the manifold on the blower side of the throttle, a solenoid to operate the valve, an electric circuit of which the solenoid is a part, a throttle operated switch in the circuit, said switch being closed when the throttle is closed only, a second switch in the circuit, a governor operated by the engine to close the second switch at engine speeds above idling speed only to energize the solenoid to cause the solenoid to operate the valve to open the opening to the atmosphere when the throttle is closed, said governor opening the switch at idling engine speed to break the circuit to deenergize the solenoid to cause the solenoid to release the valve to close the opening to the atmosphere when the throttle is closed.

4. In a two-cycle internal combustion engine having an interrelated blower, manifold system, and throttle, a carbureted fuel passage in the manifold system around the throttle to allow the engine to idle when the throttle is closed, said passage having an opening to the atmosphere, a valve controlling both said opening and the manifold entrance to the passage, said valve always being in a position to close one of said openings only, and means to control the position of the valve in accordance with the speed of the engine.

5. In a two-cycle internal combustion engine having an interrelated blower, manifold system, and throttle, a carbureted fuel passage in the manifold system around the throttle to allow the

engine to idle when the throttle is closed, said passage having an opening to the atmosphere, a valve controlling both said opening and the manifold entrance to the passage, said valve always being in a position to close one of said openings only, and means to control the position of the valve in accordance with the speed of the engine and the position of the throttle.

6. In a two-cycle internal combustion engine having an interrelated blower, manifold system, and throttle, a carbureted fuel passage in the manifold system around the throttle to allow the engine to idle when the throttle is closed, said passage having an opening to the atmosphere, a valve controlling both said opening and the manifold entrance to the passage, said valve always being in a position to close one of said openings only at a time, and means including a governor to control the position of the valve in accordance with the speed of the engine and the position of the throttle.

7. In a two-cycle internal combustion engine having an interrelated blower, manifold system, and throttle, a carbureted fuel passage in the manifold system around the throttle to allow the engine to idle when the throttle is closed, said passage having an opening to the atmosphere, a valve controlling both said opening and the manifold entrance to the passage, said valve always being in a position to close one of said openings only, and means including a solenoid to control the position of the valve in accordance with the speed of the engine and the position of the throttle.

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