

April 23, 1935.

F. F. W. DOERING

1,998,494

MANIFOLD ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed Sept. 2, 1931

2 Sheets-Sheet 1

Fig. 1.

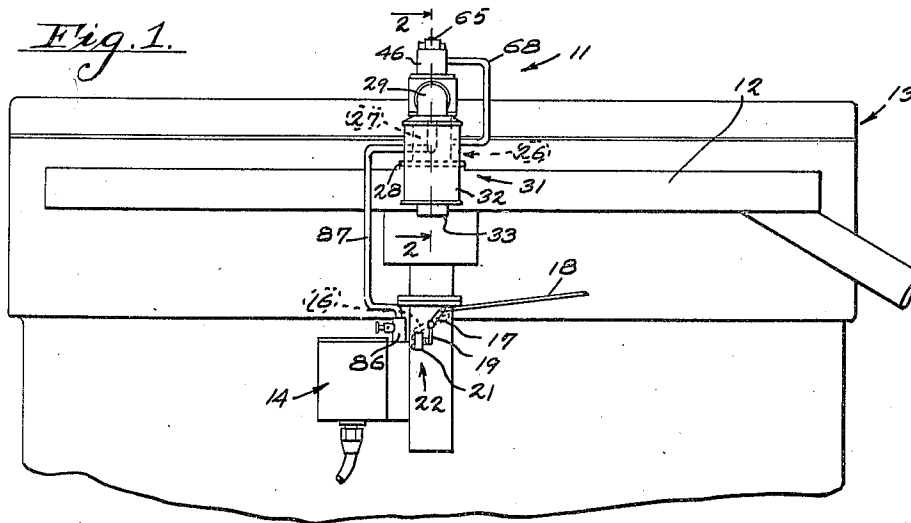


Fig. 3.

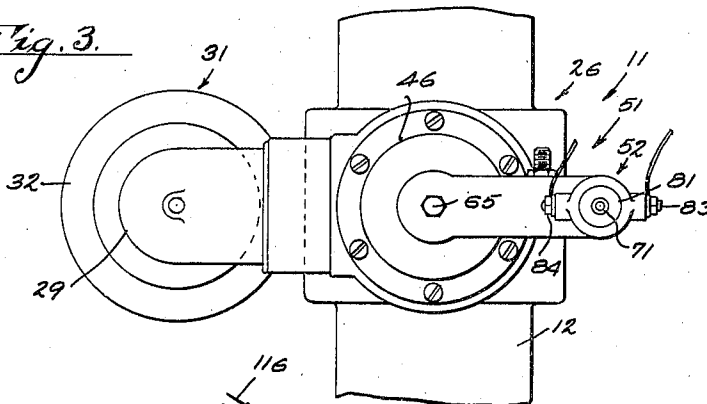
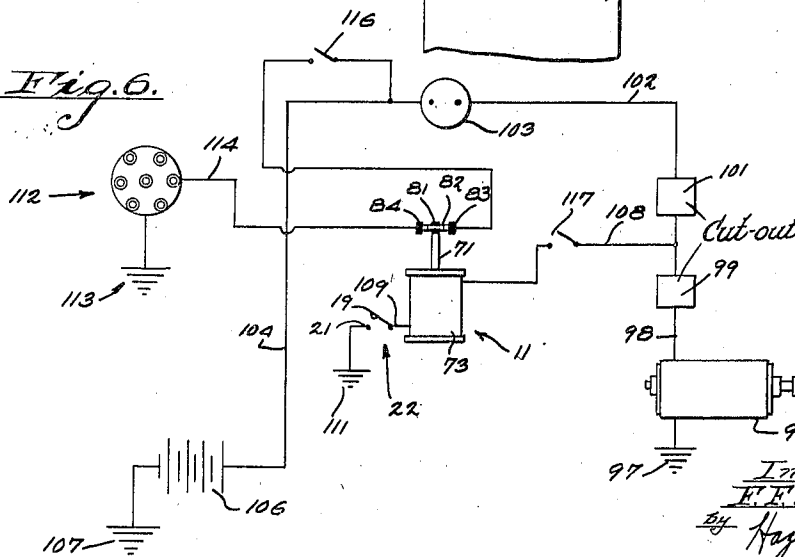


Fig. 6.



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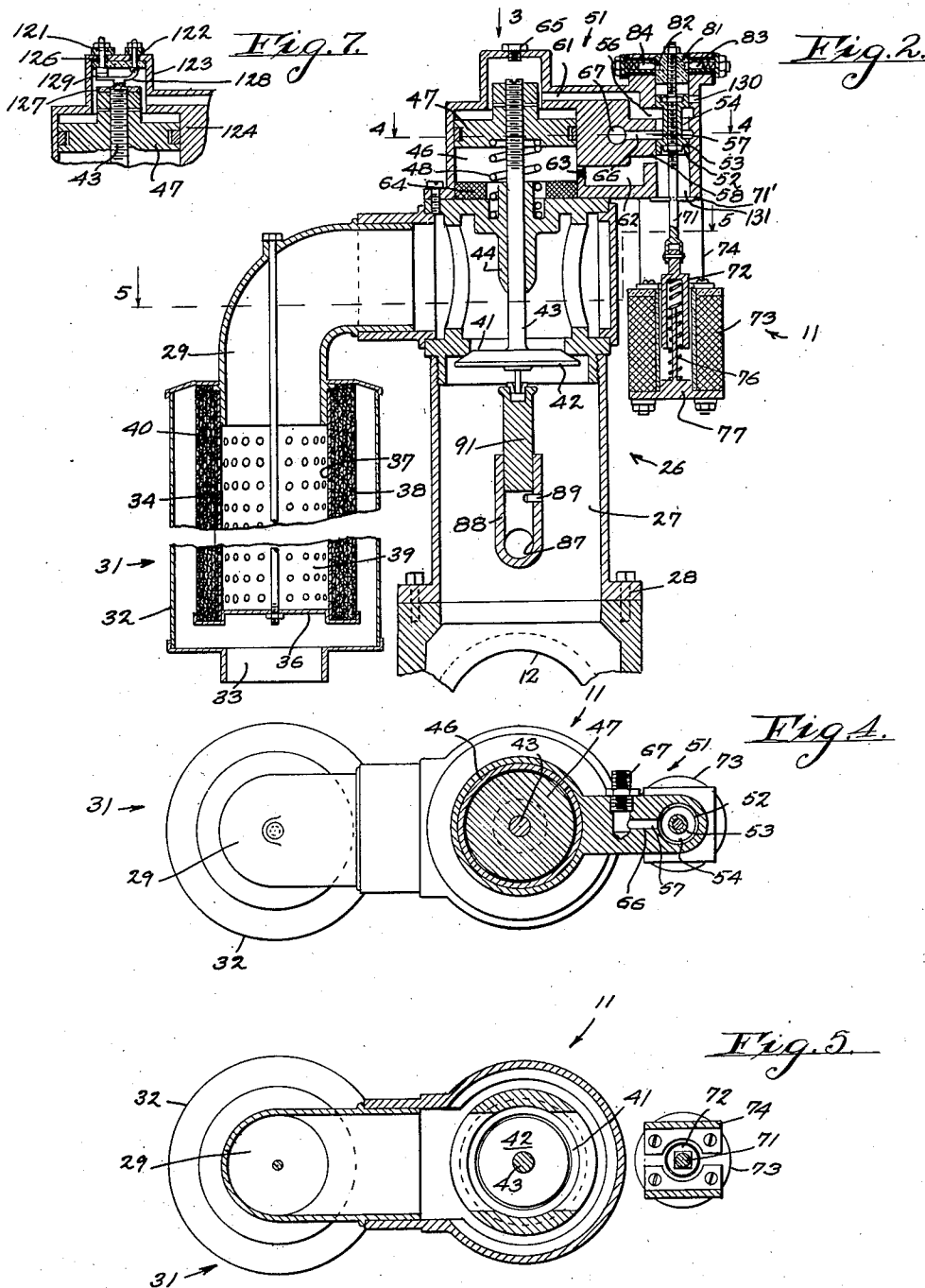
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UNITED STATES PATENT OFFICE

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MANIFOLD ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

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Application September 2, 1931, Serial No. 560,790

14 Claims. (Cl. 123—124)

This invention relates to fuel systems for internal combustion motors, and has for an object the provision of a manifold attachment adapted to establish communication between the interior of the manifold of such a motor, and the atmosphere when the supply of fuel to the motor has been cut off, and during the period of deceleration of the motor to idling speed. The device of the present invention constitutes an improvement over the devices forming the subjects matter of my copending applications, Serial No. 422,331, filed January 21, 1930, now Patent No. 1,923,357, and Serial No. 452,285, filed May 14, 1930, now Patent No. 1,895,789.

In order to facilitate understanding the construction and operation of the device of the present invention, without necessitating reference to my aforesaid copending applications, it should be explained herein that when the supply of fuel from the carburetor to the intake manifold of an internal combustion engine is suddenly and either completely or partially cut off, the motor continues to operate for a material length of time under the momentum of its rotating parts, gradually decreasing its speed until the motor is operating at idling speed, or at the speed which will be maintained by the decreased supply of fuel. During this period of deceleration the motor develops a pumping action, due to the reciprocation of its pistons and the accompanying action of its valves, whereby a very high vacuum is developed within the intake manifold. Moreover, the butterfly valve of the carburetor is incapable of sealing the throat of the carburetor, with the result that during the period of deceleration the jet or jets of the carburetor are subjected to the high vacuum which obtains within the manifold, causing raw or liquid fuel to be drawn through the jets, and by way of the manifold, into the cylinders of the motor. The fuel thus drawn into the cylinders is exceedingly rich, in fact it is too rich to ignite, with the result that it is expelled through the exhaust manifold in the form of a cloud of noxious gases and vapors, which not only are exceedingly objectionable, but which also tend to increase the cost of operation of the motor because of this wastage of fuel. The device of the present invention is designed to take care of this undesirable condition by automatically establishing communication between the interior of the intake manifold and the atmosphere during the period of deceleration of the motor, and thereby relieving the high vacuum which otherwise would obtain therein.

Another object is to provide an auxiliary air inlet as described, adapted to be controlled by an electromagnetic device which is energized by the closing of a switch which accompanies the closing movement of the butterfly valve of the carburetor.

Another object is to provide an auxiliary air inlet of the general character indicated, wherein the auxiliary air inlet valve is moved both to and from its open position by air pressure exerted in opposite directions against a piston when the opposite end of the piston's cylinder is connected to the inlet manifold, thereby utilizing the vacuum within the manifold to cause movement of the auxiliary air inlet valve in both directions.

Another object is to provide means for automatically cutting off the ignition of the motor when the auxiliary air inlet valve is open.

A still further object is to provide means for cutting off the supply of idling fuel from the carburetor to the manifold when the auxiliary valve is open.

A still further object is to provide means for automatically resetting the various parts of the manifold attachment as soon as the period of deceleration of the motor is over, thereby permitting the motor to operate at idling speed.

The invention possesses other objects and advantageous features, some of which, with those enumerated, will be set forth in the following description of the invention's particular embodiments which are illustrated in the drawings accompanying and forming a part of the specification.

Referring to the drawings:

Fig. 1 is a view in side elevation of a motor showing the manner of connecting thereto a carburetor and a manifold attachment embodying the principles of the present invention.

Fig. 2 is a transverse vertical sectional view of my improved carburetor attachment. The plane of section is indicated by the line 2—2 of Fig. 1, and the direction of view by the arrows.

Fig. 3 is a top plan view of the carburetor attachment, the direction of view being indicated by the arrow 3 of Fig. 2.

Fig. 4 is a horizontal sectional view taken upon the line 4—4 of Fig. 2, with the direction of view as indicated.

Fig. 5 is a compound horizontal sectional view taken upon the lines 5—5 of Fig. 2, with the direction of view as indicated.

Fig. 6 is a diagrammatic view showing the electrical connections of the manifold attachment.

Another object is to provide an auxiliary air

Fig. 7 is a detail view in vertical section, showing a slightly modified form of switch for controlling the ignition system of the motor.

Fig. 1 shows my improved manifold attachment, which is indicated in its entirety at 11, operatively mounted upon the intake manifold 12 of a conventional internal combustion engine 13. Any suitable type of carburetor 14 is also connected to the manifold 12, but preferably communicates therewith through a different opening, i. e., the respective entrances of the manifold attachment 11 and the carburetor 14 are independent of each other. In accordance with conventional practice, the carburetor 14 is provided with a butterfly valve 16 which is controlled by a lever 17 connected by any suitable operating mechanism 18 to the throttle and accelerator pedal within the operator's compartment of the vehicle with which the motor 13 is associated. The parts are so arranged that the butterfly valve 16, i. e., the main fuel supply valve of the carburetor 14, is opened by swinging the lever 17 in a counterclockwise direction, as viewed upon Fig. 1, from the position in which it is illustrated upon that figure. The lever 17 is connected to a switch arm 19 adapted to engage a fixed contact 21 when the butterfly valve 16 is closed. These contacts 19 and 21 constitute a switch 22 for controlling the circuit whereby the manifold attachment 11 is operated, it being understood that this switch 22 is adapted to be closed when the butterfly valve 16 is closed.

The manifold attachment 11 comprises a housing 26 having a passage 27 therethrough terminating in a flange 28 whereby the housing 26 may be mounted upon the manifold 12 with the passage 27 communicating at one end with the interior of the manifold. The other end 29 of the passage 27 communicates with the atmosphere, and preferably is provided with an air cleaner 31 in the form of a cylindrical housing 32 having an opening 33 at the bottom, whereby air may enter the housing 32. Within the housing 32 a cylinder 34 is disposed. This cylinder is closed at the bottom as by a plate 36, and comprises spaced inner and outer shells 37 and 38, respectively, each of which is composed of suitable foraminous material such as perforated, cylindrical plates or relatively coarse wire mesh. Between the two shells 37 and 38 a plurality of layers 40 of relatively fine wire mesh are provided, and the bore 39 of the inner shell 37 communicates with the outer end 29 of the passage 27, with the result that all air entering the passage 27 must first pass through the plurality of layers 40 of relatively fine mesh. The outside area of the cylinder 34 is considerably greater than the cross sectional area of the passage 27, with the result that the air passing through the mesh moves relatively slowly, with the result that dust and the like, which would otherwise be carried into the intake manifold and thence into the cylinders of the motor 13, will be strained out of the air by the mesh.

A horizontal valve seat 41 is so arranged within the passage 27 that all air passing therethrough must pass through the valve seat 41. A valve 42 is so associated with the valve seat 41 that it is adapted to seal the passage 27 by moving upwards onto the seat 41, but is adapted to permit unrestricted passage of air into the manifold 12 by moving downwards from the seat. The stem 43 of the valve 42 extends slidably through a guide 44 and into a cylinder 46 arranged above that portion of the passage 27

which is adjacent the valve seat 41. Within the cylinder 46 a piston 47 is reciprocable, this piston being threadedly or otherwise rigidly engaged with the stem 43 of the valve 42. A coil spring 48 is under compression between the bottom of the cylinder 46 and the under surface of the piston 47, with the result that the spring continually urges the piston 47 in that direction which will result in seating the valve 42.

The housing 51 within which the cylinder 46 is formed is also provided with a valve chamber 52 having a slide valve 53 reciprocable therein. Preferably, the valve 53 is cylindrical and has a relatively wide annular groove 54 therein. The valve chamber 52 has upper, middle and lower ports 56, 57 and 58, respectively, and the annular groove 54 of the valve 53 is adapted to establish communication optionally between the middle port 57 and the upper port 56, or with the middle port 57 and the lower port 58, by moving the valve 53 to its upper or lower extreme of movement, respectively. The valve is illustrated upon Fig. 2 in its uppermost position wherein communication is established between the middle port 57 and the upper port 56. The upper port 56 communicates by a passage 61 with the cylinder 46 above the piston 47, whereas the lower port 58 communicates by a passage 62 with the cylinder 46 below the piston 47, but through perforations 63 in the wall of the cylinder 46. The uppermost perforations 63 are either larger or are of a greater number than the lower perforations 63, with the result that as the piston 47 approaches its lower extreme of movement it will cut off the major connection between the lower end of the cylinder 46 and the passage 62, the purpose being to decrease the speed at which the piston 47 is traveling when it reaches its lower extreme of movement.

I prefer that an annular pad 64 of felt or similar material be provided in the lower end of the cylinder 46 encircling the stem 43. This pad not only serves as a cushion to prevent the piston 47 from coming forcibly into engagement with the lower end of the cylinder, but it also serves as a reservoir for lubricant for the walls of the cylinder 46. This lubricant is absorbed by the pad 64, but a portion of the lubricant is squeezed therefrom when the piston 47 engages the upper surface of the pad, with the result that some of the lubricant will be forced between the piston and the cylinder walls and will be carried upwards and thus distributed over the remaining portion of the cylinder walls upon the return stroke of the piston. Oil may be supplied to the interior of the cylinder 46 by removing a threaded plug 65 preferably in the upper end of the cylinder.

The middle port 57 communicates with a passage 66 which leads to the outside of the housing 51 preferably by way of a threaded nipple 67, to which a tube 68 (see Fig. 1) may be connected. This tube 68 leads from the nipple 67 to the passage 27 below the valve seat 41, with the result that the same pressure which exists within the manifold 12 will at all times obtain within the passage 66 and middle port 57.

The slide valve 53 is connected by its stem 71 with the movable armature 72 of a solenoid 73 which is mounted upon suitable brackets 74 below and in axial alignment with the valve chamber 52. When the solenoid 73 is de-energized the armature 72 and valve 53 are retained in their uppermost position by means of a coil spring 76 under compression between the arma-

ture 72 and a plug 77 in the lower end of the solenoid. This solenoid 73 is electrically connected in the circuit which is controlled by the switch 22, as illustrated upon the wiring diagram of Fig. 6. A stop 71' in the shape of a transverse pin and adapted to abut against the lower open end of the valve chamber 52 limits the upward movement of stem 71.

The upper end of the valve stem 71 carries a plug 81 of insulating material, and this plug is provided with an annulus 82 of conducting material adapted to establish electrical connection between opposed brush contacts 83 and 84 when the armature 72 and valve 53 are in their uppermost position. These contacts 83 and 84 are insulated from the housing 51, so that when the armature 72 is drawn downwards electrical connection between the contacts 83 and 84 is disestablished.

Instead of being connected to the manifold 12 in the conventional manner, the idling outlet 86 from the carburetor 14 through which the idling mixture of fuel flows, leads by a conduit 87 into the interior of the passage 27 below the valve seat 41, and terminates within a vertical cylinder 88 therein. The interior of the cylinder 88 communicates with the passage 27 through a relatively small port 89, which, however, is adapted to be closed by means of a plunger 91 when the auxiliary air inlet valve 42 is moved downwards away from its seat 41, it being understood that the plunger 91 is rigidly connected to the valve 42 to be actuated thereby. Hence, whenever the auxiliary air inlet valve 42 is moved to open position, it being understood that this occurs only when the butterfly valve 16 of the carburetor is fully closed, the supply of idling fuel also will be completely cut off, and this feature, taken in conjunction with the fact that the relatively high vacuum within the manifold will be relieved by air flowing through the passage 27, serves to prevent the entrance of any fuel whatsoever into the intake manifold when the valve 42 is open.

Referring now to the wiring diagram upon Fig. 6, the generator for the ignition and lighting system of the automobile with which the motor 13 is associated, is indicated at 96. In accordance with conventional practice, one side of the generator 96 is grounded as at 97. The other side of the generator 96 is connected by a conductor 98 to an automatic cut-out 99 of conventional design, which is adapted automatically to open and break the circuit with which it is associated when the current therethrough falls below a predetermined voltage or tends to move in the opposite direction from that in which the current normally moves. The only change which I have made in the conventional wiring system is to provide an additional cut-out 101 connected in series with the cut-out 99 so that the current from the generator 96 flows through the two cut-outs 99 and 101, thence by a conductor 102 through the ammeter 103, and thence by another conductor 104 to one terminal of a storage battery 106, the other terminal of which is grounded as at 107.

One terminal of the solenoid 73 of the manifold attachment 11 is connected by a conductor 108 into the ignition system between the two cut-outs 99 and 101. The other terminal of the solenoid 73 is connected by a conductor 109 to one contact, say the movable contact 19 of the switch 22, whereas the other contact 21 of the switch 22 is grounded as at 111.

The ignition system of the motor includes a distributor indicated at 112, one side of which is grounded as at 113, and the other side of which is connected by a conductor 114 to the ignition switch 116 accessible to the operator of the vehicle. However, the brush contacts 83 and 84 are interposed into the conductor 114 so that the distributor head 112 cannot receive current except when the brushes 83 and 84 are interconnected by the annulus 82.

Preferably, another manually operable switch 117 is interposed in the conductor 108, this switch 117 also being accessible to the operator of the vehicle, so that he can make the manifold attachment of the present invention either operative or inoperative at will.

Operation

Assuming that the switch 117 is closed, and that the motor 13 is operating under working conditions, i. e., under load and with the butterfly valve 16 moved to either partially or fully opened position, the switch 22 will be open, with the result that the solenoid 73 will be de-energized. Hence, the spring 76 will hold the armature 72 and slide valve 53 elevated. Accordingly, communication will be established between the ports 57 and 56, thereby establishing communication between the upper end of the cylinder 46 and the interior of the intake manifold 12. Inasmuch as a partial vacuum exists within the manifold 12 during operation of the motor, this low pressure within the upper end of the cylinder 46 will permit the pressure of the atmosphere exerted against the lower end of the piston and the spring 48, to force the piston 47 to its upper extreme of movement, thereby pressing the valve 42 onto its seat and preventing the flow of auxiliary air through the passage 27 into the manifold.

It should be explained that the upper end of the valve chamber 52 is in communication with the atmosphere by means of a port 130 in the valve casing 52 and the lower end of the valve casing 52 is open to the atmosphere at 131, and that the valve 53 is short enough to uncover the lower port 58 to the atmosphere at 131 when the upper port 56 is in communication with the middle port 57. Similarly, the upper port 56 communicates with the atmosphere at 130 when the valve 53 is lowered, with the result that atmospheric pressure will be imposed upon the opposite side of the piston 47 from that end of the cylinder 46 which is in communication at any time with the middle port 57.

When the operator of the vehicle wishes to decelerate he closes the butterfly valve 16 by means of the operating mechanism 18. This closes the switch 22, whereupon current will flow from the generator 96 through the solenoid 73, thereby developing sufficient electromagnetic force to draw the armature 72 downwards, opening the port 56 to the atmosphere by port 130 and establishing communication between the middle port 57 and the lower port 58. The partial vacuum thus introduced to the under side of the piston 47 will cause it to be forced downwards by the atmospheric pressure against the upper surface thereof, with the result that the auxiliary air inlet valve 42 will be unseated, permitting air to flow from the atmosphere through the passage 27, and thus into the manifold 12, thereby relieving the vacuum within the manifold to such an extent that raw gas is not sucked through the jets of the carburetor, or the butterfly valve

may be adjusted so that it does close completely, inasmuch as fuel to operate the motor at idling speed is supplied by way of the conduit 87, and hence is not required to pass the butterfly valve.

At the same time, the port 89 whereby idling mixture is normally fed to the manifold, is closed by the plunger 91, with the result that no fuel whatsoever is permitted to reach the explosion chambers of the motor.

At the same time that the valve 53 is drawn downwards, the annular conductor 82 is withdrawn from engagement with the contacts 83 and 84, with the result that the supply of current to the distributor 112 is interrupted. Hence, the combustion of any residual carbureted fuel remaining in the manifold or in the valve chambers of the motor, is prevented, with the result that during the period of deceleration of the motor any such residual carbureted fuel is pumped out of the motor, and its place is taken by fresh, pure air which is supplied to the manifold by way of the passage 27.

As soon the period of deceleration is finished, i. e., when the motor has slowed down to approximately idling speed, the cut-outs 99 and 101 will open automatically, thereby de-energizing the solenoid 73, permitting the valve 53 to return to normal position, whereupon the vacuum of the manifold is again imposed upon the upper side of the piston 47, which causes the auxiliary air inlet valve 42 again to be seated. This movement of the valve 53 also re-establishes interconnection between the contacts 83 and 84, with the result that the distributor 112 is again energized; and as the valve 42 seats, the idling fuel port 89 is uncovered by withdrawal of the plunger 91, with the result that sufficient carbureted fuel is fed to the manifold 12 to keep the motor operating at idling speed, even though the butterfly valve 16 has not been reopened.

It will be observed that the piston 47 is of considerably greater area than the valve 42. This is to prevent the valve from being opened by atmospheric pressure against its upper surface when the vacuum of the manifold is imposed against its under surface, it being understood that substantially the same pressure exists in the upper portion of the cylinder 46 as that which exists within the manifold. However, when the valve 53 is reversed, the vacuum of the manifold is imposed upon the under sides of both the valve 42 and the piston 47, resulting in the immediate opening of the valve 42, whereupon air is permitted to enter the manifold and relieve the vacuum.

It should be explained that the cut-outs 99 and 101 are so regulated that they automatically open and thereby break the associated circuit when the current therethrough is only slightly in excess of that which is produced by the generator 96 when the motor is operating at idling speed. The conductor 108 which leads to the solenoid 73 is connected into the electrical circuit between the two cut-outs 99 and 101, so that the cut-out 99 will break the circuit to the solenoid 73 from the generator 96, whereas the other cut-out 101 will break the circuit from the battery 106 to the solenoid 73.

Fig. 7 shows a slightly modified construction, wherein the switch for controlling energization for the ignition system of the motor is operated by movement of the auxiliary air inlet valve, instead of by the slide valve which controls the pressure within the cylinder. In this construction, a pair of terminals 121 and 122 are mounted

in the head 123 of the cylinder 124, within which the piston 47 operates. The terminals 121 and 122 are mounted in suitable insulation material 126, and electrical communication is adapted to be established between the two terminals 121 and 122 when a block of insulation 127 carried at the upper end of the valve stem 43 moves upwards and engages a conducting finger 128 which is pivoted upon the terminal 122, and by continued upward motion presses the finger 128 into engagement with a contact 129 carried by the other terminal 121.

An advantage of this construction lies in the fact that it would permit re-establishing the ignition circuit for the motor 13, without requiring that the solenoid 73 be deenergized. Under such an arrangement it would be possible to employ a spring 48 to return the piston 47 to normal position, which spring exerts only enough force to return the piston against the partially relieved vacuum within the manifold, which obtains during idling conditions. Under such circumstances, the spring 48 would reseal the valve 42 and reopen the port 89 automatically as soon as the pressure within the manifolds builds up as a result of the decreased pumping action of the motor, and would not require that automatic cut-outs be employed to de-energize the solenoid 73 so as to insure re-establishing the ignition circuit.

It is to be understood that the details of the invention as herein disclosed, are subject to alteration within the spirit or scope of the appended claims.

I claim:

1. An auxiliary air inlet for the inlet manifold of an internal combustion engine, comprising a cylinder, a piston reciprocable therein, an air admission valve operated by said piston, a conduit communicating with said manifold, a valve adapted to connect said conduit with said cylinder optionally upon either side of said piston, and electromagnetic means for operating said valve.

2. An auxiliary air inlet for the inlet manifold of an internal combustion engine, comprising a cylinder, a piston reciprocable therein, an air admission valve operated by said piston, a conduit communicating with said manifold, a valve adapted to connect said conduit with said cylinder optionally upon either side of said piston, and means operative when the supply of fuel to said manifold is interrupted for operating said valve.

3. In combination with the intake manifold of an internal combustion engine, a carburetor adapted to supply fuel to said manifold, a valve adapted to control flow of fuel from said carburetor to said manifold, an auxiliary air inlet valve for said manifold, means operative when said fuel valve is closed for opening said auxiliary valve, the operation of said opening means being dependent also upon the maintenance of a predetermined low pressure within said manifold, and means for cutting off the supply of current to the ignition system of said engine when said auxiliary valve is open.

4. In combination with the intake manifold of an internal combustion engine, a carburetor having a main fuel supply and an idling fuel supply to said manifold, a fuel valve for controlling said main fuel supply, an auxiliary air inlet for said manifold, means operative when said fuel valve is closed for opening said auxiliary valve, means for interrupting said idling fuel

supply when said auxiliary valve is open, means for cutting off the supply of current to the ignition system of said engine when said auxiliary valve is open, and means for closing said auxiliary valve when pressure within said manifold builds up to a predetermined minimum.

5. In a manifold attachment of the class described, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, means for operating said slide valve, and means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means.

6. In a manifold attachment of the class described, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, means operative upon cutting off the supply of fuel to said manifold for operating said slide valve, and means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means.

7. In a manifold attachment of the class described, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, electromagnetic means operative upon cutting off the supply of fuel to said manifold for operating said slide valve, and means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means.

8. In an attachment for a manifold having a carburetor operably connected thereto, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, means operative upon closing the fuel supply valve of said carburetor for operating said slide valve to lower said piston, and means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means.

9. In an attachment for a manifold having a carburetor operably connected thereto, a hous-

ing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, a solenoid having a movable armature connected to said slide valve, a switch adapted to be closed when the fuel supply valve of said carburetor is closed, said switch controlling the supply of current to said solenoid, and means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means.

10. In an attachment for a manifold having a carburetor operably connected thereto, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, means operative upon closing the fuel supply valve of said carburetor for operating said slide valve to lower said piston, means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means, a valve controlling flow of idling fuel from said carburetor to said manifold, and means for closing said idling fuel valve when said auxiliary air valve is open.

11. In an attachment for a manifold having a carburetor operably connected thereto, a housing having a passage therein communicating at one end with the atmosphere and at the other end with the interior of an intake manifold of an internal combustion motor, a cylinder having a piston reciprocable therein, an auxiliary air inlet valve connected to said piston and adapted to open said passage when said piston is lowered, a conduit communicating with the interior of said manifold, a slide valve adapted to connect said conduit optionally with either end of said cylinder, means operative upon closing the fuel supply valve of said carburetor for operating said slide valve to lower said piston, means operative when said motor is running below a predetermined minimum speed for releasing said slide valve operating means, a valve controlling flow of idling fuel from said carburetor to said manifold, means for closing said idling fuel valve when said auxiliary air valve is open, and means operative when said auxiliary air valve is open for cutting off the ignition system of said motor.

12. The combination with an intake manifold of an internal combustion engine provided with an electric ignition circuit, a carburetor adapted to supply fuel to the manifold, a throttle valve adapted to control flow of fuel from the carburetor to the manifold, an auxiliary air inlet valve for said manifold, an idling speed fuel supply to said manifold, means to interrupt the idling speed fuel supply when the auxiliary air inlet valve is opened and the speed of the engine is greater than idling speed, means operative when the throttle valve is closed for opening the

auxiliary air inlet valve, and means operative when the auxiliary air inlet valve is opened for opening the ignition circuit.

13. The combination with an intake manifold
 5 of an internal combustion engine having a generator and a storage battery connected in circuit, a carburetor adapted to supply fuel to said manifold, a throttle valve adapted to control
 10 flow of fuel from the carburetor to said manifold, an auxiliary air inlet valve for said manifold, a pair of spaced cutouts in the circuit connecting the generator with the storage battery, a second electric circuit leading from the
 15 first circuit at a point between the two cutouts, means in said second circuit to open said auxiliary air inlet valve when the throttle valve is in closed position and the current in the first circuit exceeds a predetermined voltage and is
 20 flowing in one direction, means in said second circuit operative to close said auxiliary air inlet valve when the voltage of the current in the first circuit falls below a predetermined amount or
 25 tends to move in the opposite direction, and an idling fuel supply leading from the carburetor to the manifold and operative when the throttle valve is closed and the speed of the engine is at a predetermined minimum.

14. The combination with an intake manifold of an internal combustion engine having a generator and a storage battery connected in circuit, a carburetor adapted to supply fuel to said manifold, a throttle valve adapted to control
 5 flow of fuel from the carburetor to said manifold, an auxiliary air inlet valve for said manifold, a pair of spaced cutouts in the circuit connecting the generator with the storage battery, a second
 10 electric circuit leading from the first circuit at a point between the two cutouts, means in said second circuit to open said auxiliary air inlet valve when the throttle valve is in closed position and the current in the first circuit exceeds a pre-
 15 determined voltage and is flowing in one direction, means in said second circuit operative to close said auxiliary air inlet valve when the voltage of the current in the first circuit falls below a predetermined amount or tends to move in the
 20 opposite direction, and an idling fuel supply leading from the carburetor to said manifold and operated by said auxiliary air inlet valve when the throttle valve is closed and the speed of the engine is at a predetermined minimum.

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