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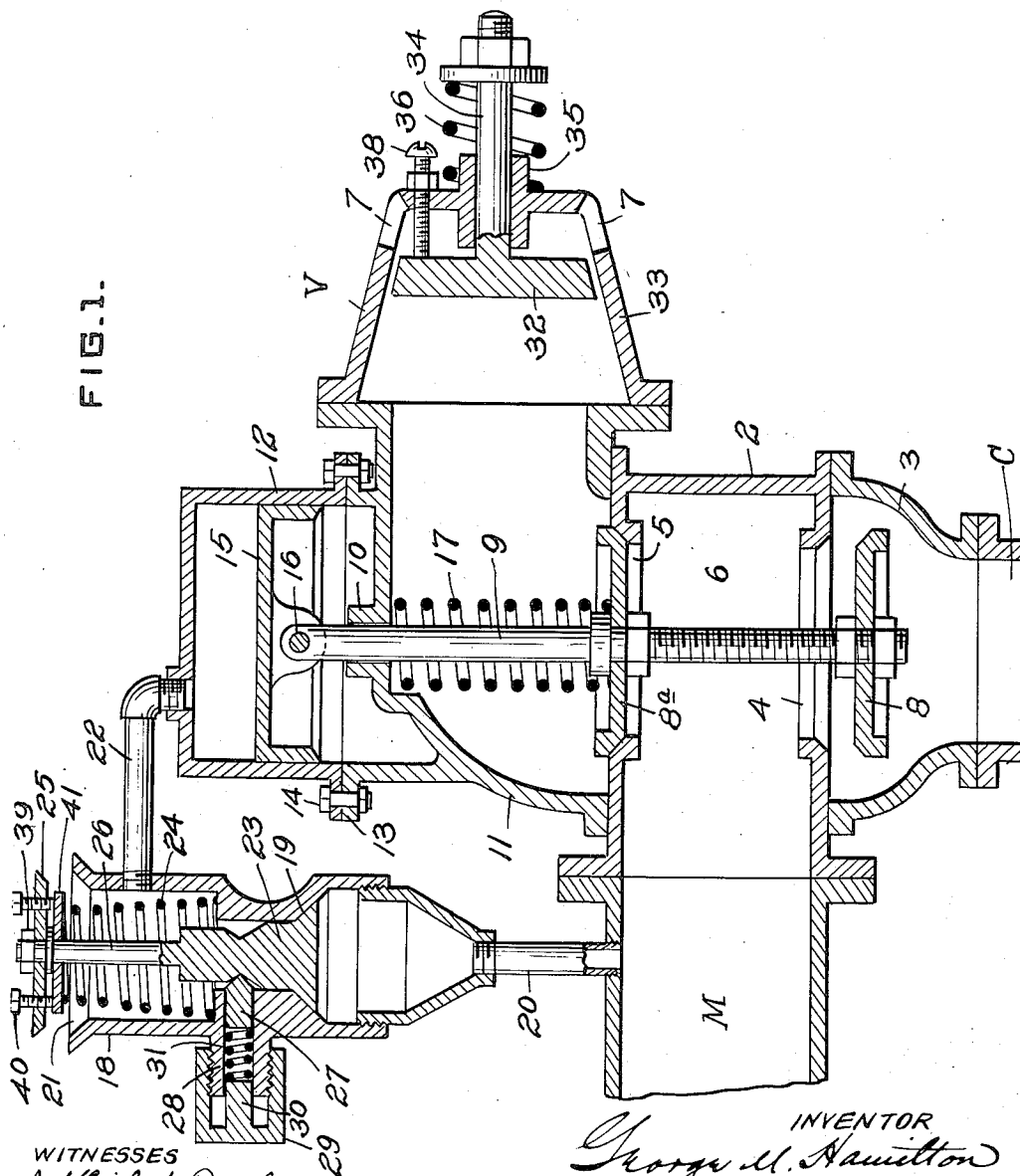
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FUEL CONTROL MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 27, 1920

2 Sheets-Sheet 1



WITNESSES
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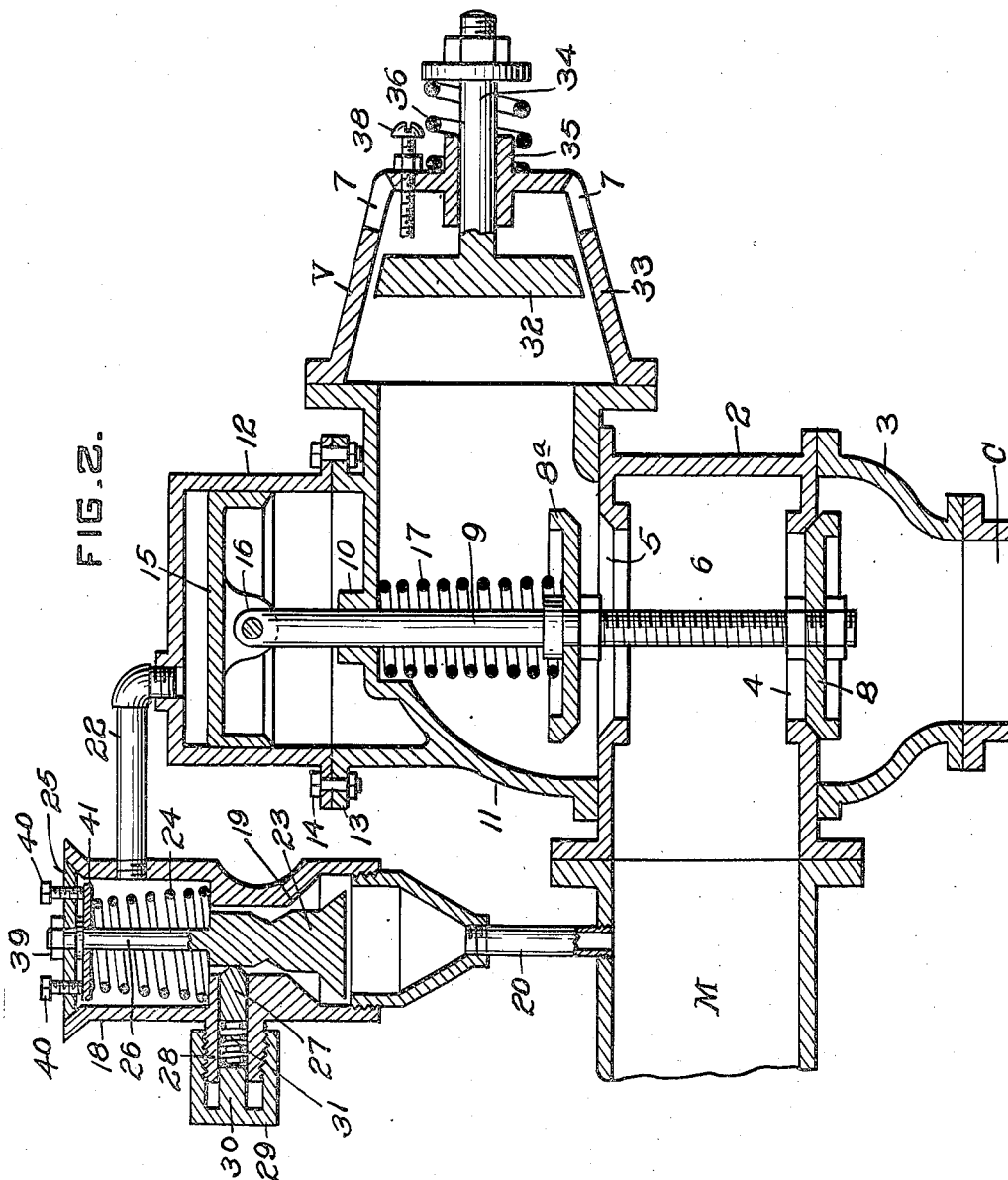
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WITNESSES

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UNITED STATES PATENT OFFICE.

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FUEL-CONTROL MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

Application filed December 27, 1920. Serial No. 433,238.

To all whom it may concern:

Be it known that I, GEORGE M. HAMILTON, a citizen of the United States, residing at Oakmont, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Fuel-Control Mechanism for Internal-Combustion Engines, of which the following is a specification.

My invention is an improvement in internal combustion engines, and particularly in the motors of this type as used on automobiles or similar self-propelled vehicles.

It has in view to provide means for cutting off the fuel supply to the explosion chamber or chambers of the engine at times when the car is running upon its own momentum, as in coasting, and for simultaneously reducing the vacuum of the cylinders, and increasing the compression and resulting resistance.

Primarily, it has in view to effect a corresponding economy in the use of the explosive fuel at such times as the engine is operating by motion transmitted to it from the traction wheels and connected gearing.

Ordinarily, in such cases, the conduit between the fuel supply, as a carburetor, and the explosion chambers of the cylinder or cylinders is normally more or less open, so that when the engine is itself being operated by the turning over of the crank shaft and corresponding actuation of the plungers, there is an undesired suction of the fuel and a wasting thereof through the ordinary exhaust passages, whether the explosive mixture be ignited or not.

My invention has in view not only to provide means for cutting off the communication between the fuel supply and the explosion chamber or chambers at such times as propelling power is not needed and at the same time opening communication from the cylinder or cylinders to the atmosphere so as to ensure an ample supply of air with resulting higher compression and a lower vacuum in the cylinders, but to effect such operation automatically through mechanism controlled by the conditions of the engine itself and its manifold.

Also, to provide means which are sufficiently sensitive to the varying conditions of suction (i. e. vacuum) as exerted through the manifold and which will maintain a slight but positive overbalance, whereby to

promptly respond to varying conditions to open or close the fuel supply, and with a controlled accompanying air supply to the manifold.

The invention not only contemplates the simultaneous closing of the fuel supply and opening of the circulation to the atmosphere, and vice versa, and regulating valve mechanism, but also the operation and control of the valve mechanism through means directly affected by the vacuum conditions in the manifold, through a vacuum actuated plunger having an area proportioned to that of the circulation controlling valves, in connection with a co-acting spring; also air supply mechanism operable both automatically and by manipulation for modifying the manifold conditions.

The principal feature of improvement in the present invention is a regulating valve mechanism for the air and gas control plunger whereby its casing is put in communication with the atmosphere or with the manifold suction, which valve mechanism is directly affected by the vacuum conditions in the manifold. Said mechanism utilizes a check valve for opening and closing circulation to and from the plunger casing having a temporary holding device and a connected air valve and spring, subject to the manifold conditions at all times.

The present invention is somewhat similar in purpose and operation to that disclosed in my prior application filed July 13, 1920, Serial No. 396,028.

It provides a construction in which a common chamber, open to the manifold, is placed in communication with the carburetor or with the atmosphere alternately by means of a double regulating valve and stem connected with a suction plunger in a cylinder communicating with the manifold, and a counteracting spring, operable in connection with the controlled air supply mechanism and subject to the manifold conditions at all times.

In the drawings, which illustrate one preferred embodiment of the invention,

Fig. 1 is a vertical sectional view through a valve mechanism interposed between the fuel supply and the manifold leading to the engine, adapted to establish fuel circulation or air circulation therewith, and showing the fuel supply valve open; and

Fig. 2 is a similar view, showing the con-

trolling valves reversed with the carburetor valve closed and communication with the manifold open to the atmosphere.

In the drawings, C represents the upper portion of a carburetor or other fuel supply device of any well known construction. The manifold M, also of ordinary type, leads to the explosion chamber or chambers of one or more cylinders communicating therewith by the usual lateral ports. Between the carburetor and the manifold is inserted my improved regulating device which consists of a suitable casing 2 of any convenient form having direct communication with the carburetor C by an intervening conduit 3, having a valve seated opening 4 leading into the interior chamber 6 of casing 2.

At its opposite side is a valve seated opening 5 communicating with the atmosphere by ports 7 of an air inlet valve V, the construction of which will be described later.

Opening and closing valves 8 and 8^a, provided with suitable seating faces on their contacting sides, are adapted to seat upon and close either opening 4 or 5, in which case, the other opening provides for free inward passage of either fuel mixture or air.

Valves 8 and 8^a are mounted on the lower end of a valve stem 9 which extends upwardly through a suitable bearing 10 in the middle upper portion of a chambered air inlet casing 11. Said casing is mounted on casing 2 and is in open communication with air inlet valve V, as shown.

A plunger casing or cylinder 12 is mounted above casing 11 and in fixed centralized position with valve stem 9 by suitable supporting and securing interfitting engagement therewith, as by flanges 13 and bolts 14. A plunger or piston 15 is secured by connection 16 to the upper end of stem 9 for transmitting movement from one to the other. Cylinder 12, as shown, is single acting, for retraction of plunger 15 by suction of the vacuum of the manifold, and return movement upon the termination or diminution thereof. To assist the latter, I provide a spring 17 surrounding stem 9 and opposing upward movement of air valve 8^a and the plunger 15.

Between manifold M and the plunger casing 12 is interposed a valve casing 18 having a valve seated port 19 leading by conduit 20 to the manifold, a port 21 opening to the atmosphere, and a conduit 22 connecting the plunger casing with valve casing 18 at the other side of its port 19, for suction or air respectively, depending on the closing or opening of port 19.

A spring-retracted suction-actuated check valve 23 within casing 18 is adapted to open and close to control the suction through pipes 20 and 22 under vacuum of the manifold, and to open casing 12 to the atmosphere when the suction is reduced. It

seats against port 19 in normal closed position by action of a spring 24 which is located between a shouldered bearing in the casing and the under side of an air valve 25, secured as shown to the upper end of an extended stem 26. Valve 25 seats upon and closes port 21 when valve 23 is opened under suction, as in Fig. 2, opening suction communication to the casing 12 to effect closing of fuel valve 8 and opening of air valve 8^a, with respect to the manifold. Valve 23 seats positively against the seat of port 19 and extends upwardly by a cylindrical body portion of the casing 18, so that it must be lowered appreciably before air valve 25 is closed and circulation is established between casing 12 and the manifold. The area of valve 25 is materially greater than the effective cross sectional area of valve 23 so as to compensate, under suction, for the opposing pressure of spring 24, as hereinafter described.

Above this cylindrical body portion, the diameter is sufficiently reduced to allow for circulation, and around the middle of the valve 23 is an annular somewhat blunt shaped groove 26. A holding pin 27 with a corresponding interfitting tip is mounted in a bearing 28 in the side of the casing with an adjusting cap 29 threaded thereon having an inwardly extending stud 30. Between the stud and the end of pin 27 is a spring 31 so that inward pressure of the pin can be accurately adjusted.

Air inlet valve V is constructed to admit air in an amount varying with the suction of the manifold under the restraining effect of a retracting spring. To this end, it is provided with a controlling gate member 32 within a casing 33 in open communication with the interior of casing 2 through port 5 through casing 11 to which casing 23 is secured. Gate 32 has a stem 34 extending outwardly through bearing 35 in the end of the casing beyond air ports 7, and a retracting spring 36 is interposed between the casing and a washer 37 held upon the outer end of the stem. The action of the spring is to normally tend to close the gate 32 to reduce the air supply to a minimum.

To this end, a variable leakage space is provided between the gate 32 and casing 33 by one or more set screws 38 which may be adjusted as desired to admit a minimum amount of air when the valve is retracted.

The operation is as follows. Springs 24 and 31 are adjusted to such a tension as to hold valve 23 to its seat until the vacuum in manifold M rises above its normal amount, as when the engine is propelling the car or is idling.

When the momentum of the car commences to turn over the engine, it will cause an increase in vacuum which will withdraw valve 23 from its seat, at the same time forcing

ing stem 27 back from holding engagement with groove 26, the valve assuming the position of Fig. 2, as it is not retarded by the stem. In such position, valve 25 closes air port 21 and provides a continuous suction passage between plunger casing 12 and the manifold. If, for instance, the area of valve 25 is say five times the effective area of valve 23, then valve 25 will remain closed as long as the vacuum in the manifold is not reduced below one-fifth of that vacuum which is required to open valve 23, as for instance, a reduction of the vacuum from ten to two pounds. Under such conditions, plunger 15 will rise, closing fuel valve 8 and opening air valve 8^a, with a resulting flow of air to the manifold as controlled by valve V.

When valve 25 is seated, it is, of course, subject to vacuum suction, so that when the vacuum does drop sufficiently low, spring 24 will then re-act against valve 25 and open it, at the same time closing valve 23 which destroys the suction on plunger 15. Thereupon, fuel valve 8 will open and air valve 8^a will close, providing for normal supply of fuel to the engine.

When valve 23 is closing, the action of stem 27 has very little effect on its movement because of its blunt taper, and the valve will retain a positive seat as long as the vacuum in the manifold is not higher than a useful one. By reason of its construction, the cylindrical extension of the valve immediately above its seating face provides for a substantially tight closure, with very slight leakage during the portion of its movement which effects a disconnection of the pin from annular groove 26, thereby ensuring the complete operation of closing air valve 25 before the vacuum is reduced sufficiently to allow spring 24 to re-act.

This action is assisted by the current of air passing around valve 23 towards the manifold.

During movement of valve 23 away from its seat, such as corresponds to the extent of the inclined face of groove 26, during which time the inclined end of pin 27 is in wedging engagement with the face of the groove, the pressure of the pin terminal will tend to reseat the valve upon reduction of the vacuum.

When the valve, however, has moved sufficiently far to entirely disengage the groove and pin, and it is merely pressing by its top against the upper cylindrical face of the valve stem, then such reseating action becomes terminated, and the valve is much more subject to the action of the vacuum because of the absence of any wedging action of the pin.

As shown, air valve 25 is secured to stem 26 by nut 39 and has set screws 40 engaging a spring plate 41 providing for proper adjustment of spring 24. Cap 29 by its

threaded engagement with bearing 28 provides for adjustment of the pressure of spring 31 by stud 30, and by these adjustments it will be seen that the operation of the circulation controlling valve 23 may be easily and accurately regulated to conform to the running conditions of the engine etc., for each particular installation.

The construction and operation will be readily understood from the foregoing description. It effects a very material economy in fuel, and at the same time, effectually prevents the formation of carbon in the cylinders.

Various changes or modifications may be made by the skilled mechanic in design, proportions, or other details, or application to any particular type or form of carburetor, manifold, or other conditions of installation, and I therefore do not desire to be limited to the exact construction shown.

What I claim is:

1. In an internal combustion engine, the combination with the intake conduit, of a valve controlled communication therewith leading to the fuel supply and to the atmosphere respectively, alternately acting valves therefor having a plunger stem and plunger, a plunger casing, and means providing suction communication between the intake conduit and the plunger casing provided with a suction actuated circulation controlling valve having an air valve adapted to open or close the plunger casing to the atmosphere.

2. In an internal combustion engine, the combination with the intake conduit, of a valve controlled communication therewith leading to the fuel supply and to the atmosphere respectively, alternately acting valves therefor having a plunger stem and plunger, a plunger casing, and means providing suction communication between the intake conduit and the plunger casing provided with a suction actuated circulation controlling valve having an air valve adapted to open or close the plunger casing to the atmosphere, and a retracting spring therefor.

3. In valve mechanism of the class described having a valve actuating plunger and a casing therefor, the combination with the plunger casing and an engine manifold, of a communicating valve casing having an intervening valve seat and an air inlet opening, a circulation controlling valve in said valve casing, a valve for the air inlet opening, and a spring tending to open the air inlet valve upon closure of the circulation controlling valve.

4. A circulation controlling valve comprising a casing having an air inlet opening, circulation connections at each side of an intermediate valve seated opening, and a suction actuated valve in said opening provided with a valve for said air inlet opening, and a retracting spring therefor.

5 5. A circulation controlling valve comprising a casing having an air inlet opening, circulation connections at each side of an intermediate valve seated opening, a suction
10 actuated valve in said opening provided with a valve for said air inlet opening having a holding notch, and a laterally movable holding key therefor.

10 6. A circulation controlling valve comprising a casing having an air inlet opening, circulation connections at each side of an intermediate valve seated opening, a suction
15 actuated valve in said opening provided with a valve for said air inlet opening having a holding notch, and a laterally movable holding key therefor having a wedge shaped terminal and a pressing spring.

20 7. In combination, a valve casing having at one end an air inlet port and a shouldered chamber, a circulation conduit connected
25 therewith, a middle valve seated port, another circulation conduit at the other side of said port, a valve operable to open and close the middle port having an air valve for the
30 air inlet port, and a retracting spring within the shouldered chamber engaging the air valve.

8. In combination, a valve casing having

at one end an air inlet port and a shouldered chamber, a circulation conduit connected
30 therewith, a middle valve seated port, another circulation conduit at the other side of said port, a valve operable to open and close the middle port having an air valve
35 for the air inlet port of greater effective area than that of the middle port valve, and a retracting spring within the shouldered chamber engaging the air valve.

9. In combination, a valve casing having
40 at one end an air inlet port and a shouldered chamber, a circulation conduit connected therewith, a middle valve seated port, another circulation conduit at the other side
45 of said port, a valve operable to open and close the middle port having an air valve for the air inlet port and an annular wedging
notch around its middle portion, a holding
50 stud mounted for lateral movement in the side of the casing having a co-acting wedging terminal, and a threaded adjusting device and spring for controlling the pressure of the holding stud.

In testimony whereof I hereunto affix my signature.

GEORGE M. HAMILTON.