H. M. STILLMAN.

AIR VALVE.

APPLICATION FILED SEPT. 10, 1906.

1,054,651.

Patented Feb. 25, 1913.

Fig. 1.

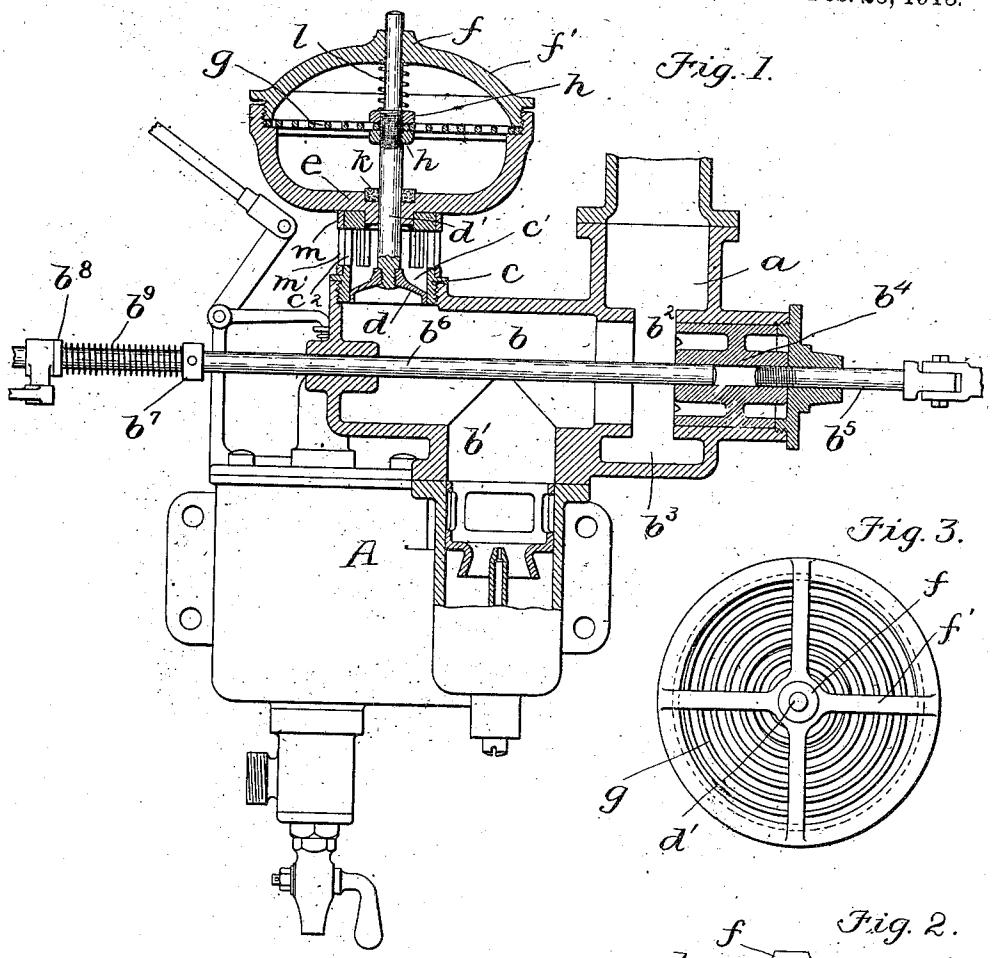


Fig. 3.

Fig. 2.

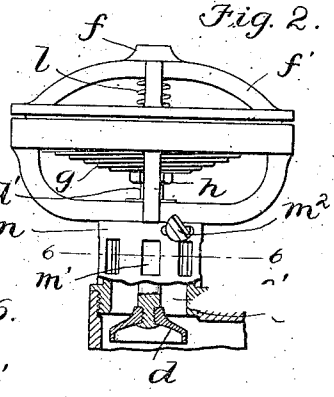


Fig. 4.

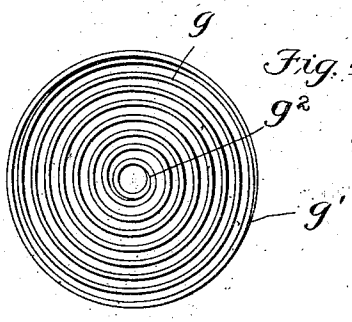
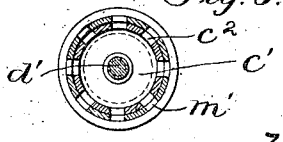


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY M. STILLMAN, OF BRIDGEPORT, CONNECTICUT, ASSIGNOR TO THE LOCOMOBILE COMPANY OF AMERICA, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF WEST VIRGINIA.

AIR-VALVE.

1,054,651. Specification of Letters Patent. Patented Feb. 25, 1913.

Application filed September 10, 1906. Serial No. 333,934.

To all whom it may concern:

Be it known that I, HENRY M. STILLMAN, citizen of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have invented an Improvement in Air-Valves, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to controlling means for internal combustion engines, being especially concerned with the provision of an improved form of an automatic air valve for controlling the auxiliary air supply to the engine.

My invention will be best understood by reference to the following specification when taken in connection with the accompanying illustrations of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings: Figure 1 shows in vertical sectional elevation one form of automatic air valve constructed according to my invention and applied to an ordinary form of carbureter; Fig. 2 shows the air valve in side elevation, partially in section; Fig. 3 is a plan view of a valve; Fig. 4 is a detail showing the spiral controlling spring; Fig. 5, a section taken through the spring wire; and Fig. 6, a section in plan taken on the line 6—6 of Fig. 2.

By referring to the drawings and to the specific embodiment of my invention there shown, there is represented a carbureter A which may be of any suitable type but which herein is constructed for application to the multiple cylinder engine of a motor vehicle and provided with suitable devices for its control in conjunction with the control of the vehicle, all of which will be fully understood and appreciated by those skilled in the art. Since the motor vehicle and engine may be of any suitable or usual construction they are not herein illustrated.

It will, of course, be understood that while my invention has peculiar application to the control of a motor vehicle engine and is best described with reference thereto, in certain of its broad features it is equally applicable to engines employed for other purposes than the propulsion of motor vehicles.

In the disclosed embodiment of my invention the engine is supplied with an explosive mixture of gaseous fuel through the admission pipe a, leading from the gas mixing chamber b, which chamber is formed within a casing mounted directly over the carbureter A. The carbureter may be of any suitable or usual construction but preferably such as is capable of receiving a supply of liquid fuel from a suitable source (not shown) atomizing or otherwise vaporizing the same and delivering to the mixing chamber through the opening b' in the under side thereof a mixture of the vaporized fuel with a suitable quantity of air.

Exit or discharge from the mixing chamber takes place through the port b^2, at one end of the mixing chamber, into the annular chamber b^3 which has direct communication with the admission pipe a. The port b^2 is controlled by the piston valve b^4, slidably mounted lengthwise of the chamber, acting to open or close the port.

The valve has connection at one end with the actuating rod b^5, which passes through the head of the mixing chamber and has connection with a speed governor (not shown). When the engine is at rest the valve moves to or toward the position shown in Fig. 1. When the engine starts the governor weights throw the valve to partially or wholly close the port b^2, according to the engine speed.

At the opposite end of the valve and passing outward through the opposite head of the mixing chamber is the auxiliary actuating rod b^6, which has its inner end loosely mounted in the valve body and its opposite or outer end connected to a foot accelerating lever (not shown). The auxiliary accelerating rod b^6 carries outside the chamber a collar b^7 between which and the adjustably fixed collar b^8 is maintained the compression spring b^9. With the engine running, the rod b^5 abuts against the rod b^6 causing the governor to act also against the spring b^9, the compression of which may be adjustably varied, while the governor control of the valve may at any time be superseded by movement of the foot accelerator lever to force the rod forward and the valve open.

For the further dilution of the mixture entering the mixing chamber b there is provided near the upper end of the cham-

ber an auxiliary air admission opening, through which air is admitted in amounts proportioned to the demands of the engine. For this purpose the valve chamber casting has on its upper side a threaded opening into which is screwed the threaded end of the neck or nipple e. This neck or nipple has an interior cylindrical air chamber or pocket e' and is provided with a plurality of apertures such as the rectangular openings e^2, through which air may be admitted to the mixing chamber from the external atmosphere, passing thence into the mixing chamber as regulated by the cup shaped piston valve d, which normally closes the lower end thereof.

The piston valve d is slidably mounted within the air chamber and is carried by the piston rod d', upon which it may be projected to a greater or less extent out of the air chamber and into the space below (Fig. 2) thereby to admit air to the mixing chamber in greater or less quantities.

The piston rod d' passes upward through the central opening in the casting e, which latter is secured to the upper end of the neck or nipple. At its upper end the piston rod also passes through and is guided by the central supporting portion f of the cap casting f', the latter comprising an annular ring having threaded engagement with the lower casting e and connected to the central portion f by a plurality of ribs or arms.

During operation of the engine, if the speed increases the suction of the lower side of the piston valve d increases correspondingly and the valve tends to open, to admit air for the further dilution of the mixture, the suction and extent of opening being automatically regulated by the speed. In valves of this class it is highly desirable that the force or means acting in opposition to the suction of the valve and tending to restore the valve to its normal or closed position should be of an extremely delicate and sensitive nature. Otherwise the valve tends to stick and open too late or not at all, or, when once open, tends to remain so or to overthrow beyond the required position. This is a fault which I found to a greater or less degree with all prior valves of this class with which I am familiar.

In the present instance, I have provided a restoring medium of the utmost delicacy, the same in the illustrated embodiment of my invention comprising a spring g, coiled in the form of a flat spiral and having its outer coil held fast between the threaded cap f' and a shoulder on the casting e. The inner coil of the spiral is held between upper and lower threaded nuts h, adjustably secured to the piston rod d'.

The spring g, consisting as it does preferably of a number of helical coils of spring wire lying normally in substantially the same plane, offers a most delicate and sensitively responsive opposition to the engine suction upon the valve. While this means for controlling the valve may be varied within wide limits, and in the event of using a spring such as described the same may be fashioned or proportioned in any suitable way, preferably, though not necessarily, the spring is formed of wire having a somewhat flattened or elongated cross section, such as is is shown in Fig. 5, this being found to give elasticity with suitable permanency and delicacy.

To render the springs more easily handled or shipped the extreme outer end of the spring wire is beveled down to a point and brazed or otherwise suitably fastened as at g' to the outer side of the next adjacent coil, and the inner end of the spring wire is also treated in a similar fashion as at g^2. This unites the detached free ends of the spring wire to the body of the spring, rendering it much more compact.

In order to prevent the too sudden movement of the valve there is provided means such as the washer k, of leather or other suitable material, for slightly checking the movement of the piston.

In operation the suction of the engine drawns down the valve, for example as shown in Fig. 2, the gradually increasing resistance of the spring opposing such movement. If the suction is sufficient the valve will move to its limit, that is, until the admission area opened by the valve equals the admission area represented by the apertures e^2. For cushioning the valve on its return movement there is provided the spiral cushioning spring l, held between the upper adjusting nut h and the bottom of the cap casting f', such spring preferably exerting substantially no downward pressure to force the valve below the neutral position shown in Fig. 1 but exerting a suitable cushioning effect when the valve overthrows or moves above the normal position shown on upward or return movement.

It will thus be seen that in both opening and closing the valve is relieved from any sudden shock such as would occur were it caused positively to seat against stops, abutments or the like. In its backward movement it meets the cushioning effect of the spring l and in its downward movement it comes automatically to rest when the limit of suction is reached as above.

In practical use the above type of valve has been found to produce marked improvement in the operation of the engine. In itself it is practically noiseless, eliminating that vibration or hammering which has heretofore been the usual accompaniment of valves of this class. It has also been found

to relieve the engine itself of much of the vibration or hammering which takes place in the crank shaft and other engine parts. It is of especial advantage however in respect to the delicacy with which it automatically operates in response to the speed requirements of the engine for admitting varying quantities of air for the dilution of the mixture.

In the particular embodiment of my invention shown I have indicated means for throttling more or less the admission of air to the air chamber c'. In the present instance this comprises a sleeve m having rectangular perforations m' corresponding to the perforations c^2 in the walls of the air chamber. This sleeve encircles the air chamber and may be adjusted to a position thereon where the two sets of openings register as in Fig. 6, or where the sleeve covers more or less the inner openings. The set screw m^2 may be employed to hold the outer sleeve in fixed position.

While I have shown and described one embodiment of my invention it will be understood that the same is not limited to the particular details herein set forth but that extensive modifications therein and wide deviations therefrom both in the construction of form and relative arrangement of parts may be had without departing from the spirit of the invention.

Claims—

1. In an air and fuel mixing device for internal combustion engines, the combination with an automatically movable air valve, of a flat spiral spring for holding said valve yieldably against movement in either direction lengthwise the axis of the spiral.

2. In an air and fuel mixing device for internal combustion engines, the combination with a receptacle having an air admission passage, of an air valve arranged in said passage to control the admission of air through the same, and a spiral spring yieldably sustaining said valve against movement lengthwise the axis of the spiral, the valve presenting opposing pressure areas to the outside and inside pressures respectively to permit said valve to respond to the suction of the engine and supply air to meet the same.

3. In an air and fuel mixing device for internal combustion engines, an auxiliary air supply valve comprising an admission opening, a piston valve normally closing said opening having one area exposed to the atmosphere and the other to the suction of the engine whereby said valve is withdrawn from said opening on increase of engine speed, and a spiral spring for causing the retraction of said valve within said opening said valve having its opening and closing movement lengthwise the axis of the spiral.

4. In an air and fuel mixing device for internal combustion engines, the combination of a chamber to receive an air supply, an air admission valve for said chamber controlled by air pressure in said chamber and operated by atmospheric pressure, a suitably supported flat spiral spring, and a stem for said valve rigidly fixed to said spring and suspended therefrom said valve having its opening and closing movement lengthwise the axis of the spiral.

5. In an air and fuel mixing device for internal combustion engines the combination with an air admission valve d, the valve stem d' connected therewith, and a spiral governing spring g connected with the said valve stem d' said valve having its opening and closing movement lengthwise the axis of the spiral.

6. In an air and fuel mixing device for internal combustion engines, the combination with an air valve, of a spiral governing spring having a spring member of elongated cross-section said valve having its opening and closing movement lengthwise the axis of the spiral.

7. In an air and fuel mixing device for internal combustion engines, the combination with a chamber to receive an air supply and an air admission valve for said chamber controlled by the difference in pressure between the air within and outside said chamber, said valve having a movement either side of a normal position, and a spiral governing spring for said valve having one end secured thereto and governing the movement of the valve lengthwise the axis of the spiral, said spring tending to restore said valve to its normal position when moved in either direction.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

HENRY M. STILLMAN.

Witnesses:

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