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CONTROLLING MEANS FOR INTERNAL COMBUSTION ENGINES.

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1,175,813.

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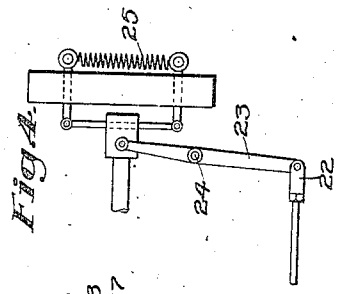

Fig. 4.

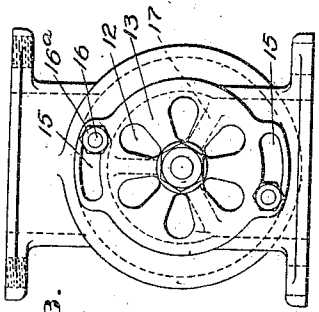

Fig. 3.

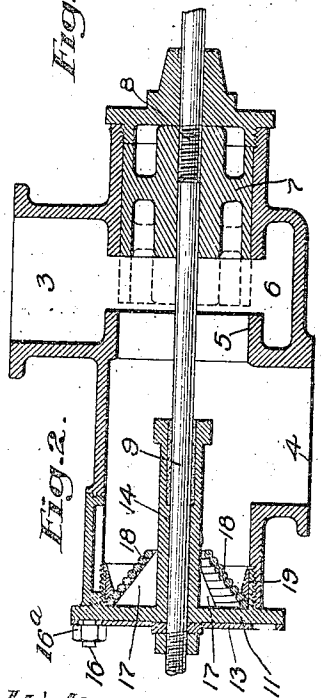

Fig. 2.

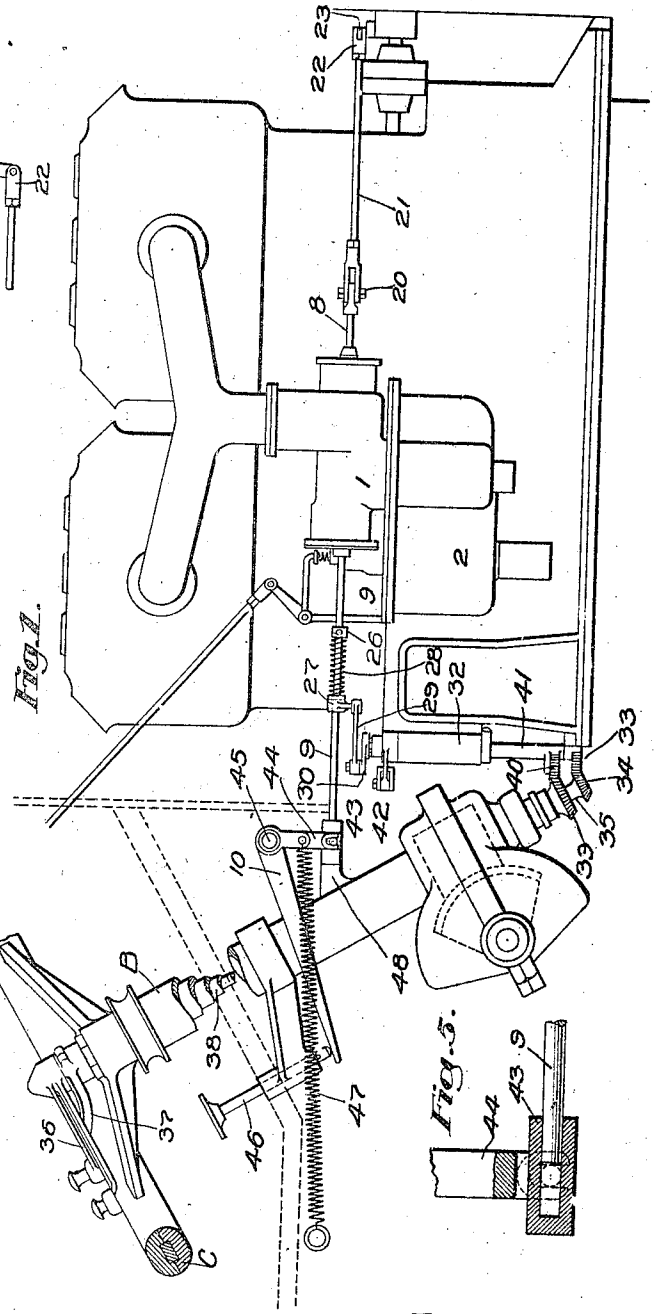

Fig. 1.

Fig. 5.

Witnesses
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UNITED STATES PATENT OFFICE.

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CONTROLLING MEANS FOR INTERNAL-COMBUSTION ENGINES.

1,175,813. Specification of Letters Patent. Patented Mar. 14, 1916.

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To all whom it may concern:

Be it known that I, ANDREW L. RIKER, a citizen of the United States residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented an Improvement in Controlling Means for Internal-Combustion Engines, 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 simple and effective means for controlling engines of the internal combustion type and more particularly to the provision of a novel form or type of automatic air valve for regulating the auxiliary air supply of the engine.

My invention, however, will be best understood and appreciated by reference to the following description, when taken in connection with the accompanying drawings, of one specific embodiment thereof, selected for purposes of illustration, its scope being more particularly pointed out in the appended claims.

In the drawings; Figure 1, shows a system of control embodying one form of my invention and as applied to a partial assemblage of parts upon a motor vehicle; Fig. 2, is a vertical sectional detail of a mixing chamber provided with my automatic air valve; Fig. 3, is an elevation of the left or rear head of the mixing chamber, showing the port openings of the auxiliary air supply; Fig. 4, a detail in plan conventionally representing a speed governor attached to the governor rods shown in Fig. 1, and Fig. 5, is a detail showing the connection of the accelerating lever to the actuating rod.

Referring to the drawings and to the particular embodiment of my invention herein selected for purposes of illustration, I provide a suitable mixing chamber, 1, Fig. 2, which is mounted upon the carbureter 2, Fig. 1, which may be of any suitable or desired construction, but which as here shown is adapted for use with an engine of the multiple cylinder type employed upon motor vehicles. This engine, its carbureter and mixing chamber are all provided with suitable devices for controlling the same which will be fully understood and appreciated by those skilled in the art.

While my invention, as here shown, is especially adapted to the use upon engines of motor vehicles and is described with reference thereto, it will be understood that in many 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 here shown, the engine is supplied with a mixture of gaseous fuel through the admission pipe 3, Fig. 2, leading from the mixing chamber, 1, which is preferably mounted within the casing and directly over the carbureter 2. The carbureter is adapted to receive a supply of liquid fuel from a suitable source (not shown), atomizing or otherwise gasifying the same, and delivering to the mixing chamber 1, through the opening 4 in the under side thereof, a supply of the gasified fuel combined with a suitable quantity of air.

Exit or discharge from the mixing chamber 1 takes place through the port 5, preferably at the right or front end of the former, into the annular chamber 6, which directly communicates with the admission pipe 3 leading to the engine. The port 5, is controlled by a piston valve 7 Fig. 2, mounted to slide longitudinally or lengthwise of said chamber and acting to open or close the port or vary the amount of port opening. This valve is actuated by means of an actuating rod 8, which passes through the head of the mixing chamber and at its opposite end is connected with a speed governor as shown in Fig. 1. When the engine is started, the governor operates to throw the valve rod, 8, and the valve, 7, connected therewith, to partially or wholly close the port 5, according to the speed of the engine.

Extending through the opposite or rear head 11 of the mixing chamber, is an auxiliary valve controlling rod, 9, the inner end of which is adapted to enter and slide in an axial opening in the valve body and abut the opposite end of the actuating rod 8 and thereby to vary the closing movement of the valve 7. The opposite exterior and rear end of said valve regulating rod 9 is connected to a foot controlled accelerating lever 10 by which the rod may be slid inward not only to vary but to limit the port closing movement of the valve 7 and thereby to maintain a desired supply of fuel and independent or irrespective of the action of said governor. For example, the governor may be operated through the speed of the engine, to throw

the valve rod 8, inwardly, to push the valve to the position indicated in dotted lines in Fig. 2 with the end of said rod 8 in engagement by the valve regulating rod 9, which has been set by said foot lever 10 to prevent further inward movement, thus maintaining a fixed port opening between the inner edge of the valve and said port. By this arrangement, means are provided for maintaining a desired supply of fuel and which may be increased or diminished by operating the accelerating lever 10.

For the further air dilution of the fuel mixture which enters the mixing chamber 1, the rear head 11 of the latter Figs. 2 and 3, is provided with an air port having a plurality of openings 12, which normally admit air freely to said chamber. The quantity of air, however, which is admitted through these openings may be varied through the provision of an exterior throttling disk 13, which is provided with openings or apertures which normally coincide or are alined with those of said head 11. This disk is rotatably mounted on the tubular bearing 14 in which the rod 9 slides and its periphery is provided with concentric slots 15, which receive adjusting bolts or screws 16, secured in said head. The screws receive clamping nuts 16^a, adapted to be turned to clamp the plate in position. This construction permits said disk to be rotated or turned and secured in desired position correspondingly to increase or diminish and maintain a desired amount of port opening in said head. Interiorly the bearing 14 is strengthened by means of spider arms 17 connecting the same with the inner face of the disk of said head 11.

An important feature of my invention resides in the novel form of valve provided for normally closing the openings in the ports in the head 11 through which the auxiliary air supply is admitted. As here shown, this valve consists of a spiral coil spring 18 preferably coiled into the form of a truncated cone with its base secured to said head 11 adjacent the threaded connection of the latter with the mixing chamber 1. This spring is removably held in place by a retaining ring 19, which engages the outer coils of the spring, and is secured to the inner surface of the mixing chamber. The inner coil of this coil spring closely embraces the bearing 14 and the intermediate coils or convolutions normally lie close together, or rest in engagement with one another, so that they normally cover the port 12 and prevent the admission of air.

The head 11 is removably secured to the mixing chamber to permit it to be readily removed so that the valve 18 may be removed or secured or one of different strength substituted.

During the running of the engine, the suction produced in the air chamber varies with the increase in engine speed. Upon such increase, the spring 18 is drawn inwardly and its convolutions separate one from another, to permit to pass between them the air which has already passed through the more or less throttled openings 12 in air port. This spring will remain in a more or less extended inner position while the suction is sufficient to overcome its tension during which air is admitted for the further dilution of the fuel mixture. It is obvious that the inward motion of the spring and the amount of separation between the coils and hence the extent of valve opening is automatically regulated by the amount of suction and hence by the speed. In valves of this type, it is highly desirable that the force or the means acting in opposition to the suction of the valve and tending to restore it to and maintain it in its normal or closed position should be of an extremely delicate and sensitive nature, otherwise the valve tends to open too late or not at all, or, when once opened to remain so, or to overthrow beyond the required position. This fault characterizes to a greater or less degree all valves of this type with which I am familiar and which the present construction avoids. In the present embodiment of my invention, the valve itself constitutes the means for restoring it to its normal closed position and is of the desired delicacy both in construction and in operation, yielding readily upon variation in the internal pressure to admit the desired admixture of fresh air and closing instantaneously when the speed of the machine decreases to such usual running conditions that no auxiliary air supply is required. I thus provide an automatic valve structurally providing its own means to permit free opening and closing movement and without the aid of auxiliary springs or other devices to return the valve to its seat.

For connecting the outer or front end of the valve rod 8 with the governor, it is secured by an adjustable turn buckle represented at 20, Fig. 1, to a rod 21, the front forked end of which is in turn jointed at 22, Figs. 1 and 4, to the outer end of a laterally extending lever 23. This lever is fulcrumed at 24 upon the engine casing and has interior connections with a governor of the centrifugal type, conventionally represented at 25, Fig. 4. This governor is driven through suitable gearing from the engine shaft, so that with the changes in the speed of the engine, the lever 23 is oscillated on its fulcrum 24. This movement reciprocates the connected valve rod 8 and its valve 7 to move the latter in one or the other directions relative to and upon its seat in the front end of the mixing chamber and thereby to increase or to diminish the extent of

opening of the port 5 and hence the amount of fuel mixture supplied to the engine.

When the engine is at rest the governor draws the piston valve to the full line position shown in Fig. 2, but as soon as the engine reaches normal speed, the governor throws said valve approximately to the position represented in dotted lines from which position it varies to one side or the other according to the engine speed.

It will be obvious to those skilled in the art, that the movement of the piston valve causes a responsive action of the coil spring valve 18 thus to regulate the auxiliary air supply according to the speed of the engine, increasing said supply with an increase in engine speed and diminishing the same as the speed is diminished.

The valve regulating rod 9, which by its action varies the closing movement of the valve 7 is adapted to be operated by suitable mechanism arranged in position to be readily controlled by the operator.

Referring to the drawings, particularly Fig. 2, said rod has a sliding fit in the head 11 of the mixing chamber and exteriorly to the latter is provided with a collar 26 between which and an adjacent collar 27, loosely mounted on said rod, is a compression spring 28. This spring normally opposes backward movement of said rod 9. After the engine has been started and the valve 7 has been moved to the dotted line position showing Fig. 2, this spring may be made to oppose and regulate the governor movement to an extent dependent upon its compression. That this adjustment may be readily made by the operator, the collar 27 is secured to a link 29 jointed to a horizontal arm 30, the latter being fixedly secured to the upper end of a short shaft, journaled in a bracket 32 and provided at its lower end with a bevel gear 33. This gear meshes with a similar gear 34 upon the lower end of an inclined shaft 35 which passes through the controlling post B and receives at its upper extremity an operating handle 36. This latter may be oscillated to the right or left to rotate the shaft 35 and its gears 34 and 33, to swing the link 30 and to move the collar 27 toward and from the head 11, of the mixing chamber. This movement increases or diminishes the compression of the spring 28 and the yielding force opposed to the movement of the rod 8 as the governor moves the latter inward against the spring controlled regulating rod 9. Any suitable means may be provided for holding the lever 36 in adjusted position, herein partially shown at 37 as a segmental rack upon the end of the controlling post and adapted to be engaged by spring pressed tooth or upon the end of said lever 36.

Under usual working conditions, the action of the spring 28 causes the two rods 8 and 9 to abut in all positions of the valve. Furthermore, by increasing or diminishing the tension or compression of said spring, a higher or lower engine speed respectively, will be required to operate the valve, the latter obviously closing more or less rapidly under the varying tensions of said spring. As stated, the controlling post is provided with the usual steering wheel, which during the operation of the vehicle is held by the operator, so that the hand lever 36 is immediately accessible and readily adjustable. The rack 37, however, being fixed upon the head of the controlling post does not turn with the steering wheel and movement of the latter has no effect upon the valve accelerating rod 9 or the valve controlled thereby. The controlling post B is also provided with a sleeve 38, Fig. 1, within which the shaft 35 rotates. This sleeve at its lower end is provided with a bevel gear 39 Fig. 1, meshed with a segmental gear 40 at the lower end of a sleeve 41, also journaled in the bracket 32. This sleeve carries at its head an actuating lever 42 which shifts the cam shaft (not shown) for varying the action of the ignition cams and advancing or retarding the time of ignition.

For connecting the accelerating rod 9 with the foot actuating lever 10, the following mechanism is provided. Slidably secured at the rear end of the rod 9 is a cap 43 which is adapted to be slid back and forth by a yoke shaped vertical arm 44 of the supporting lever 10, this lever being fulcrumed at 45 and having its rear arm inclined downwardly in position to be conveniently actuated by an accelerating pin 46. The head of this pin extends up through the floor of the carriage where it is presented for convenient actuation by the foot of the operator. Depression of this pin depresses the long arm of the lever 10 causing its vertical arm to be thrown forward and sliding the accelerating rod also forward in position to limit the inward throw of the throttle valve 7, so that a desired port opening may be maintained or to positively slide the valve forward against the action of the governor for temporarily increasing the amount of port opening, and thereby to increase the fuel supply and hence the engine speed. The arm 44 of the accelerating lever 10 is normally retracted by a spring 47 connecting said arm with a stationary part of the frame and normally operating to bring the cap 43 against an abutment 48 on the controlling post, there being provided in this position of the cap a considerable clearance between the inner wall of the same and the end of the actuating rod, so that the latter is free to be moved in one or the other direction, without interfering with the cap, as the throttle valve responds to the control of the governor.

From the foregoing description it will be readily understood by those skilled in the art, that the responsiveness of the auxiliary air supply valve 18 is regulated and controlled by the position and movement of the throttle valve 7, so that the amount of auxiliary air supply to be mixed with the mixed fuel will vary with the speed of the engine or with the speed acceleration produced by varying the amount of port opening at 5.

In operation, the proper adjustment of the governor provides means for maintaining any usual or desired engine speed, which may be increased either for the instant or for any length of time by increasing the compression of the spring 28 through suitable adjustment of the operating lever 36. As the governor slides the throttle valve 7 inwardly, the rod 8 also slides inwardly simultaneously and pushes the abutting rod 9 back against the adjusted compression of the spring 28. By this arrangement, the inward movement of said rods and hence throttle of the said valve is always against and to effect compression of the spring 28, so that the speed or closing movement of said valve may be increased or diminished by adjusting the compression of said spring.

In any adjusted position of the throttle, the suction produced by the operation of the engine will cause the valve 18 to yield inwardly to permit an admixture of fresh air, the amount of opening of said valve and hence the auxiliary air supply depending upon the speed of the engine which as has been stated, is regulated by the amount of throttling. Obviously the auxiliary rod 9 may be adjusted in or out and so that its spring adjusted throttle will be more or less under the control of the governor or under that of the foot controlled actuator, though, as ordinarily adjusted, it is placed in an intermediate position to limit the action of the governor and maintain a desired speed.

By providing the rod 9 with a compression spring 28, which may be adjusted to limit the inward movement of the rod 9 and thereby to limit the inward movement of the valve, means are provided for preventing the governor from causing an overthrow of said valve in speeding up upon starting the machine, and preventing a diminution in the amount of mixed fuel and the auxiliary air supply needed for the most effective working of the engine.

By my invention I have provided a valve that in both its opening and closing movements responds with extreme sensitiveness and delicacy to the movements of the engine piston and the throttle 7 and that, furthermore, operates without any sudden jerk as would occur were it rigid or positively seated against stops, abutments, valve seats or the like. My valve provides its own cushioning means and closes automatically when the suction is not sufficient to maintain it opened.

In practical use, the above type of valve produces marked improvement in the operation of the engine, being practically noiseless, and eliminating the vibration or hammering which has hitherto characterized the valves usually employed for this purpose. The valve 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 proper dilution of the fuel mixture.

By providing the head of the mixing chamber with adjustable port openings and mounting the valve upon its inner face, in the manner described, a very simple construction is provided, enabling the casing to be made at a much less cost than where auxiliary air chambers, valve seats, valves, and spring controlling means therefor are employed.

While I have shown and described my invention with reference to a single preferred embodiment, it will be understood that the same is not limited thereto, nor to the specific details of construction and arrangement herein set forth for purposes of illustration and description only, the same being capable of modification within wide limits without departing from the spirit and scope thereof.

I claim:

1. In an internal combustion engine, the combination of a mixing chamber having a head provided with a plurality of port openings, a throttle plate movably mounted upon said head having openings normally coinciding or alined with those in said head and adapted to be adjusted for moving said openings into or out of coinciding position for varying the admission opening to said chamber, and a coil spring valve secured to the inner face of said head and covering the port openings therein and normally maintained with its coils in contact one with another to prevent the admission of air through said openings but adapted to be drawn inward to separate said coils to admit air.

2. In an internal combustion engine, the combination of an air mixing chamber, a throttle for regulating the amount of fuel supply to the engine, means for normally controlling said throttle, a device comprising a rod slidable through the wall of said air mixing chamber and adapted to engage said throttle for regulating the action thereof, air supply means comprising port means in the wall of the air chamber through which said rod slides and concentric therewith and a conical spiral coil spring seated by its base upon said wall and surrounding said port means and said rod and constituting a closure therefor.

3. In an internal combustion engine, the

combination of an air chamber having a head provided with an interiorly projecting central bearing and one or more openings for the admission of air to said chamber, and a conical coil spring 18 secured by its base upon the inner face of said head 11 and having its spirals in normal contact one with another, and with its inner spiral end normally resting upon said bearing.

4. In a fuel and air supply device for internal combustion engines, an air valve comprising a spiral coil spring, a main intake port, an auxiliary intake port leading inwardly toward and controlled by said valve, and throttle means for said auxiliary intake port.

5. In a fuel and air supply device for internal combustion engines having a main and an auxiliary air intake, an air valve comprising a spiral coil spring, seating means for the successive convolutions of said valve, and throttle means for said auxiliary air intake.

6. In a fuel and air supply device for internal combustion engines, an air valve comprising a spiral coiled spring having a general cone-shaped form, a seat for the base of the spring, a central bearing stem about which the opposite end of the spring is coiled and with relation to which it is free to move axially, and means for securing said base to said seat to secure said spring against axial movement bodily while permitting freedom of movement throughout the remainder of said spring.

7. In a fuel and air supply device for internal combustion engines, an air valve comprising a spiral coiled spring, a main intake port, an auxiliary intake port leading inwardly toward and controlled by said valve, and throttle means for said main intake port.

8. A fuel and air supply device for internal combustion engines having a main and an auxiliary air intake, and an air valve for said auxiliary intake comprising a spiral coil spring and seating means for the successive convolutions of said spring.

9. A fuel and air supply device for internal combustion engines having a main and auxiliary air intake and an air valve for said auxiliary intake comprising a conical coil spring and seating means for the successive convolutions of said spring to engage the same along elements of the cone.

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

ANDREW L. RIKER.

Witnesses:
R. M. YOUNG,
J. A. KINGMAN.