Dec. 23, 1930. J. L. ARDERN 1,786,283

AUTOMATIC AIR INLET VALVE FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 4, 1927

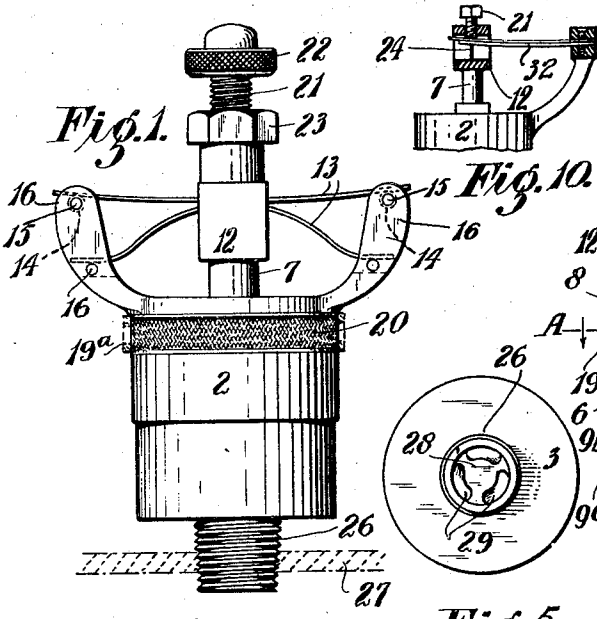


Fig. 1.

Fig. 10.

Fig. 5.

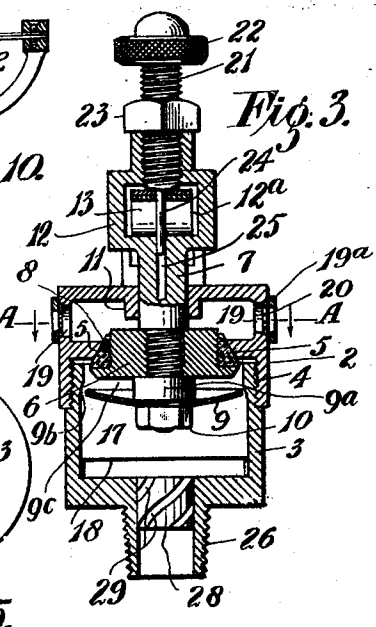


Fig. 3.

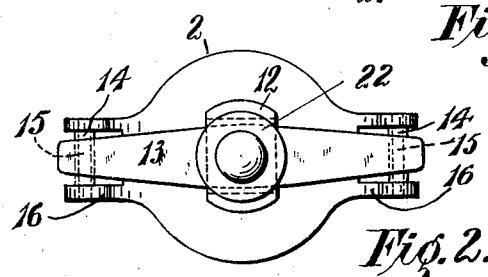


Fig. 2.

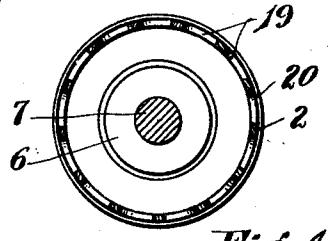


Fig. 4.

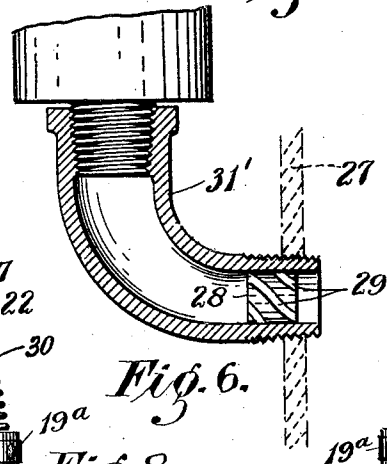


Fig. 6.

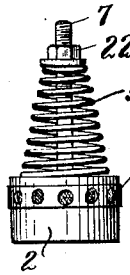


Fig. 8.

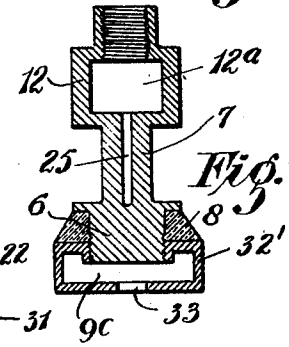


Fig. 7.

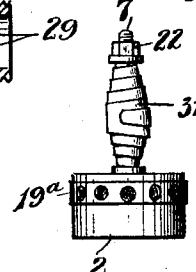


Fig. 9.

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UNITED STATES PATENT OFFICE

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AUTOMATIC AIR-INLET VALVE FOR INTERNAL-COMBUSTION ENGINES

Application filed January 4, 1927, Serial No. 158,931, and in Australia April 15, 1926.

This invention relates to an improved automatic air inlet valve, and more particularly to an air inlet valve which has been devised for attachment to the induction pipe or manifold of internal combustion engines at a point between the throttle of the carburetter and the engine cylinders.

The primary object of the invention is to provide an air inlet valve of simple and efficient construction which will automatically admit a supply of atmospheric air into the engine cylinder or cylinders with the fuel in accordance with the requirements of the engine during running and without manual attention or manipulation. By means of the invention fuel consumption is reduced.

A further object of the invention is to provide means whereby the air entering the induction pipe through said valve is thoroughly mixed with the fuel by creating a swirling or vortical action of the air stream as it enters said induction pipe.

The invention will now be more fully described with reference to the accompanying sheet of drawings wherein

Figure 1 is a view, largely in elevation, of an automatic air inlet valve constructed according to one embodiment of the invention.

Figure 2 is a view in plan of Figure 1.

Figure 3 is a central vertical section of the construction seen in Figure 1.

Figure 4 is a sectional plan taken on lines A—A of Figure 3.

Figure 5 is an inverted plan view of the barrel portion of the valve casing showing a spiral or helix fitted therein and adapted to set up a swirling action of the air as it enters the induction pipe or manifold of the engine.

Figure 6 is a detail view in section of an elbow carrying the spiral or helix and designed for connecting the improved valve to the induction pipe when it is not convenient to attach the valve direct to such pipe.

Figure 7 is a sectional view illustrating an alternate form of valve construction.

Figures 8, 9 and 10 are detail views showing alternate forms and arrangements of springs adapted for normally maintaining the valve in closed position.

In the drawings the numeral 2 designates the upper portion of a main casing and 3 the lower portion of same. The lower portion 3 is furnished with an external screw thread 4 engaging an internal thread that is formed in the upper portion 2 so as to rigidly secure these two parts of the valve casing.

The upper portion 2 of the casing is provided with an internal valve seating 5 to accommodate a spring controlled non-return air inlet valve 6 which is adapted to be opened by the engine suction against the action of a spring as hereinafter described.

It will be understood that any well known or approved type of valve may be employed, a preferred form being shown in Figure 3 where the valve is of conical shape and rigidly but detachably secured to the lower end of a valve stem or spindle 7. This valve is furnished with a jointing ring 8 of fibre, leather or other suitable material which will form an effective air-tight joint with the valve seat 5.

Fitted to the lower end of the valve stem 7 is a concavo-convex disc 9 which is rigidly but detachably secured to the lower end of said valve stem by a nut 10 the diameter of said disc being slightly larger than that of the valve 6 so that a narrow annular air passage 9^b is formed between the edge of the disc and the wall of the valve casing. The disc 9 is preferably secured in the position seen in Figure 3 with its concave side facing the valve 6 from which the disc is spaced by a distance piece 9^a. If desired, however, said disc may be reversed to expose its convex side to the valve in which case the distance piece 9^a is dispensed with, the central part of the disc being held directly against the bottom of the valve by the nut 10.

The purpose of the concavo-convex disc 9, disposed close beneath and concentrically with the valve, is to form a suction chamber or pocket 9^c between said disc and the valve and thus assist the action of the engine suction upon the valve so as to readily and positively open the latter according to the requirements of the engine.

The valve stem or spindle 7 which is slidably supported in a central boss bearing 11, formed in the upper casing portion 2, is furnished at its upper end with an enlargement 12 having a transverse guide opening 12^a through which passes a pair (more or less) of flat metal spring leaves 13. These spring leaves, the side edges of which preferably converge at their outer ends as shown, are supported at their outer ends upon small rollers 14 revolvable upon pins 15 or upon any other suitable supports which may be carried by oppositely disposed lugs 16 that are preferably formed integrally with and project outwardly from the upper portion 2 of the casing.

The flat spring leaves 13 are so arranged that they maintain constant pressure upon the valve stem 7 so as to normally hold the valve 6 in close contact with the valve seat 5. The lower portion 3 of the main casing or body is constructed to form a chamber 17, wherein may be fitted a sheet of finely woven wire gauze 18 of suitable mesh to form a filter which prevents particles of foreign matter from being drawn into the induction pipe with the air.

Atmospheric air is drawn into the upper portion 2 of the casing or body through a series of holes or ports 19 which are preferably, but not necessarily, formed in spaced relationship about the vertical walls of said casing above the valve 5. These air inlet ports 19 are also covered with fine wire gauze 20 to prevent foreign matter entering the valve casing.

The pressure or tension of the spring leaves 13 can be regulated by means of an adjusting screw 21 which is screwed into the upper end of the valve stem 7 and adapted to bear upon the upper spring leaf. This adjusting screw is furnished with a milled head 22 and a lock nut 23 to enable a fine adjustment to be effected so as to regulate the strength of the spring.

The spring leaves 13 are maintained in proper central position by a guide pin 24 which extends from the adjusting screw 21 and passes through a central hole in the spring. This pin is slidably accommodated in a guide hole 25 that is formed in the lower portion of the valve stem 7.

To enable the valve casing to be readily attached to the induction pipe 27 of the engine a screwed nipple 26 extends from the lower portion 3 of the casing or body and is adapted to be screwed into a tapped hole formed in the induction pipe as indicated in Figure 1.

In order that the air passing from the improved valve into the induction pipe will be thoroughly mixed with the combustile fuel therein, a metal plug 28 may be rigidly secured within the nipple 26 and is constructed having a plurality of spirally or helically inclined grooves or passages 29 which cause a swirling or vortical action to be imparted to the air as it enters the induction pipe. The air from the valve is thus thoroughly mixed with the combustible vapor before entering the combustion chamber and any liquid particles of fuel in the induction pipe are broken up by the swirling action of the air entering through the wall of the induction pipe.

In some cases it is not convenient to attach the valve casing direct to the induction pipe as seen in Figure 1, owing for instance, to the proximity of other parts which require that the valve should be disposed at a distance from the induction pipe. In such cases I may provide an elbow 31′ preferably of tapering formation the upper or outer end of which is adapted to be screwed on to the nipple 26 whilst its lower or inner end is screwed into a tapped hole formed in the induction pipe 27 as seen in Figure 6. In this embodiment the plug 28 having the spirally inclined air passages 29 is rigidly secured within the inner end portion of said elbow.

In lieu of the reversible disc 9, the suction chamber 9^c may be formed as shown in Figure 7 by extending the bottom of the valve 6 so as to form a hollow box-like structure 32′ in the side or bottom walls of which are arranged one or more holes or perforations 33 whereby the action of the engine suction within the suction chamber 9^c ensures positive and correct opening of the valve against the action of its controlling spring.

Whilst the valve controlling spring 13 is preferably constructed and arranged as seen in Figures 2 and 3 of the accompanying drawings it will be evident that any other suitable type of spring may be employed for applying the required pressure on the valve 6. For instance, coiled wire spring 30 in Fig. 8, coiled ribbon spring 31 in Fig. 9, and double flat spring 32 in Fig. 10, of the drawings may be utilized to suit circumstances or requirements. In either of these instances the spring may be arranged to press upwardly upon the valve stem 7 which may be fitted with the adjusting nut 22 for varying the strength of the spring as aforesaid.

In order to manually vary the effective area of the air inlet ports 19 in the wall of the valve casing, a circumferentially adjustable ring 19^a may be mounted to turn about said casing as indicated in Figures 1, 3, 8 and 9. This adjustable ring is provided with circumferentially spaced air inlet ports corresponding to the ports 19 in the valve casing so that by turning said ring the latter ports may be opened or closed to any desired extent.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A device for the purpose indicated consisting in the combination of a valve casing having means of connection to the induction

pipe of an internal combustion engine and a passage leading from the interior of said casing through said connecting means, a valve mounted within said casing and adapted to control the admission of air through said passage to the engine, a valve stem passing slidably through the wall of said casing, a plate spring supported externally of the casing and acting upon said valve stem to normally retain the valve in closed position against the action of the engine suction, and screw adjusting means acting upon said plate spring to vary the pressure thereof upon said valve.

2. In a device for the purpose indicated the combination of a valve casing having means of connection to the induction pipe of an internal combustion engine and a passage leading from the interior of said casing through said connecting means, a valve mounted within said casing and adapted to control the admission of air through said passage to the engine, a valve stem passing slidably through the wall of said casing, a plate spring supported externally of the casing and acting upon said valve stem to normally retain the valve in closed position against the action of the engine suction, said plate spring extending transversely through an opening in said valve stem and an adjusting screw engaging said spring within said opening to vary the pressure thereof upon said valve.

3. In a device for the purpose indicated the combination of a valve casing having means of connection to the induction pipe of an internal combustion engine and a passage leading from the interior of said casing through said connecting means, a valve mounted within said casing and adapted to control the admission of air through said passage to the engine, a valve stem passing slidably through the wall of said casing, a spring acting upon said valve stem to normally retain the valve in closed position against the action of the engine suction, said spring comprising a plurality of plate spring leaves supported at their ends upon external lugs carried by said casing, said leaves passing into a transverse opening in said valve stem and screw adjusting means acting upon said spring leaves to vary the pressure thereof upon said valve.

4. In a device for the purpose indicated the combination of a valve casing having means of connection to the induction pipe of an internal combustion engine and a passage leading from the interior of said casing through said connecting means, a valve mounted within said casing and adapted to control the admission of air through said passage to the engine, a valve stem passing slidably through the top of said casing, a spring supported externally of the casing and acting upon said valve stem to normally retain the valve in closed position against the action of the engine suction, said spring comprising a plurality of plate spring leaves freely supported at their opposite ends upon external lugs carried by said casing, said leaves passing transversely through an opening in said valve stem, and an adjusting screw passing axially into the upper end of the valve stem and adapted to engage the upper leaf of said spring within said opening of the valve stem.

5. In a device for the purpose indicated the combination of a valve casing having means of connection to the induction pipe of an internal combustion engine and a passage leading from the interior of said casing through said connecting means, a valve mounted within said casing and adapted to control the admission of air through said passage to the engine, a valve stem passing slidably through the top of said casing, a spring acting upon said valve stem to normally retain the valve in closed position against the action of the engine suction, said spring comprising at least one plate spring leaf freely supported at its end upon an external lug carried by said casing, said leaf passing transversely through an opening in said valve stem, an adjusting screw passing axially into the upper end of the valve stem and adapted to engage said spring within said opening of the valve stem, and a guide pin depending from said adjusting screw and passing through a hole in said plate spring.

6. A device for the purpose indicated comprising in combination a valve casing having a lower section provided with an externally threaded nipple which is adapted for connection to the induction pipe of an internal combustion engine, a passage extending from the interior of said casing through said nipple, an upper section screwed to the top of said lower section of the casing, air inlet ports formed in said upper section, a valve mounted within said casing between said inlet ports and said passage through the nipple, a valve stem passing slidably through the top of said upper section, oppositely disposed lugs upstanding from said upper section externally of the casing, an opening formed transversely through said valve stem, plate spring leaves passing through said opening and supported at their ends upon said lugs, the edges of said leaves converging towards their ends, and an adjusting screw passing axially into the upper end of said stem and adapted to engage at its lower end against said spring.

7. A device for the purpose indicated comprising in combination a valve casing having means of connection to the induction pipe of an internal combustion engine, a passage leading from the interior of said casing through said connecting means, air inlet openings formed in said casing, a valve mounted within said casing between said inlet openings and said passage, a plate spring adapted to normally close said valve against the action of

the engine suction, said spring consisting of at least one leaf extending transversely through a slidable stem of said valve, the edges of said leaf converging from its centre which presses against said valve stem to its ends which are freely supported to move longitudinally, and an adjusting screw adapted to engage the central part of said spring whereby the latter is flexed to vary the spring pressure on said valve.

In testimony whereof I affix my signature.

JAMES LIPTROT ARDERN.