Feb. 27, 1940. G. H. MEISER 2,191,970

ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed March 20, 1939

Fig. 1

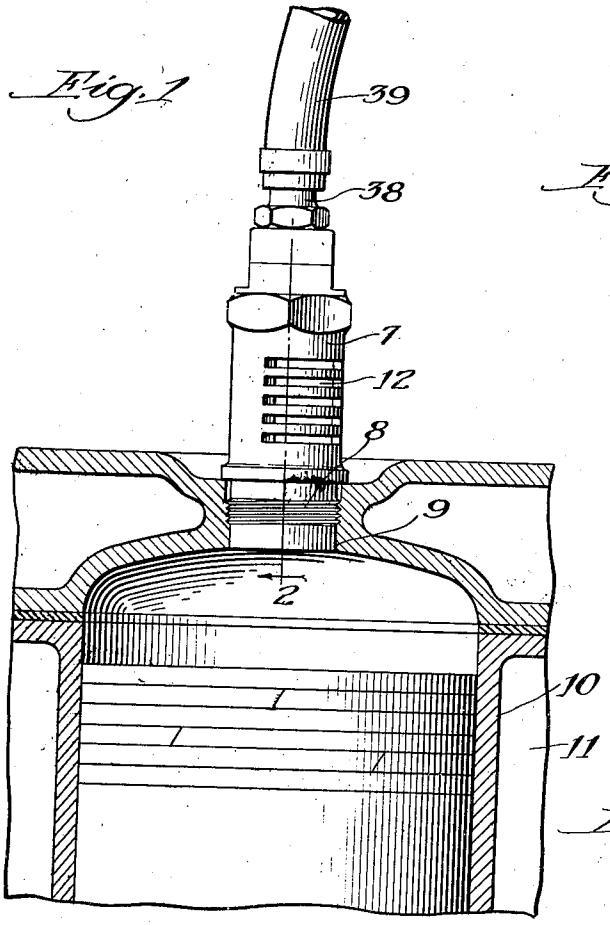


Fig. 2.

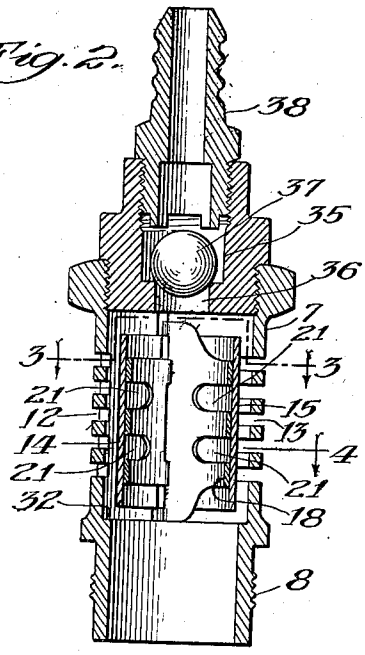


Fig. 3.

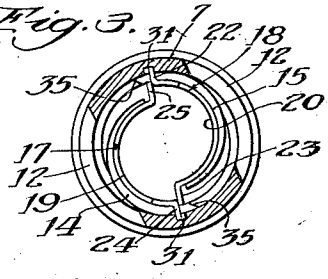


Fig. 4.

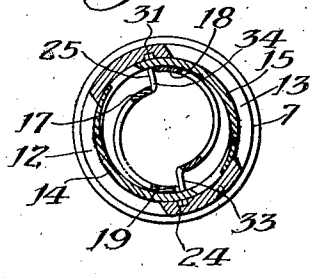


Fig. 5.

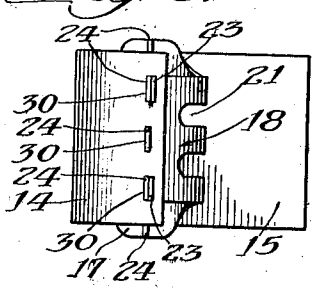
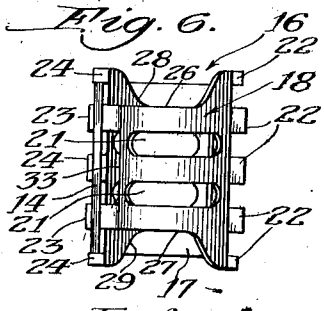


Fig. 6.



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ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

George H. Meiser, Chicago, Ill.

Application March 20, 1939, Serial No. 262,960

12 Claims. (Cl. 277—60)

My invention relates to improvements in attachments for internal combustion engines and, more particularly, an air pump adapted for use in connection with a multi-cylinder internal combustion engine; my attachment being primarily adapted for use in connection with motor vehicles for tire inflation, though as will be understood it may be put to other uses.

Devices of this character require for their use merely the removal of a spark-plug from one of the cylinders of the engine and the insertion of the device into the spark-plug-receiving opening. The engine is then operated with the remaining cylinders and the one having the device attached operates in conjunction therewith to pump air, the air to be pumped being drawn through the device into the cylinder on the suction stroke of the engine and then compressed on the compression stroke and driven out through the device.

As will be understood, it is essential for the pumping of high pressures that the means controlling the flow of air from the atmosphere into the device on the engine suction stroke and the shutting off of this air from the atmosphere on the engine compression stroke be as nearly instantaneously reactive to the engine suction and pressure as possible; in other words, that valve-lag be minimized to as great a degree as possible not only because such lag reduces the efficiency of the pump but because unless practically non-existent on the suction stroke, is apt to result in the pumping of gasoline vapor instead of pure air. By providing against valve lag on the suction stroke thus permitting instantaneous flow of air to the pumping cylinder, and providing for the free flow of sufficient quantities of air through the device, suction produced by the pumping cylinder of the engine may be relieved sufficiently to insure against the drawing of gasoline vapor into the cylinder from the intake of the engine in which vacuum exists.

Furthermore, in the use of the device in the spark-plug-receiving opening of the pumping cylinder the inlet for the air drawn into the pumping cylinder through the device is limited to the size of this opening which is relatively small, and it is therefore necessary, in order that the pumping cylinder pump high pressures without pumping gasoline vapor, that the device permit unrestricted flow of air to the pumping cylinder and that the air inlet valve of the device act without substantial lag in both opening and closing. Restricted flow of air into the device reduces efficiency by reducing the pressure which may be developed and results in the creation of such vacuum in the pumping cylinder, on its suction stroke, as to draw gasoline vapor from the intake of the engine into the pumping cylinder. Valve lag in the drawing of air into the device not only reduces the pressure which may be developed, but also is apt to result in the pumping of gasoline vapors and valve lag on the compression stroke of the pumping cylinder reduces the pressure developed.

Devices of this character for universal application must be adapted for satisfactory operation on engines which operate not only at low, but relatively high, idling speeds. The higher the idling speed of the engine the more necessary the avoidance of valve lag and avoidance of restricted air flow to the air inlet (spark-plug-receiving opening) of the pumping cylinder, for pumping high pressures without the pumping of gasoline vapors.

Certain of my objects are to provide a device of the character described which will operate to insure such free and instantaneous flow of air into the pumping cylinder as to avoid the pumping of gasoline vapor even at relatively high engine-idling speeds; to effect quick shut-off of the device to the atmosphere upon the conclusion of the suction stroke; to provide for the pumping of higher pressures at any usual engine idling speed than hitherto possible and without drawing gasoline vapor into the pumping cylinder; and to accomplish these results by a novel, simple and inexpensive construction of the device.

Another requirement of the device of the character stated is that it shall be adapted for application to use on engines as at present commonly constructed many of which are of such design as to present obstruction to the application thereto of such devices unless the devices are of quite small size; it being another of my objects to provide a device by which the purposes above mentioned may be accomplished and yet will be of such small size as to adapt it for use with engines as at present constructed even when of such design as to require the use of small size devices to avoid obstruction to assembly with the engine.

Referring to the accompanying drawing:

Figure 1 is a view in vertical sectional elevation of one of the cylinders of a multi-cylinder internal combustion engine showing it as equipped with a device embodying my invention.

Figure 2 is an enlarged view in vertical sectional elevation of the device of Fig. 1.

Figure 3 is a plan sectional view of the device, the section being taken at the irregular line 3—3

on Fig. 2 and viewed in the direction of the arrows, this view showing the flap valves of the device in the position they assume upon the engine suction stroke.

Figure 4 is a view like Fig. 3 and of the structure therein shown illustrating the flap valves in the positions they assume on the engine pressure stroke, the section being taken at the line 4 on Fig. 2 and viewed in the direction of the arrow.

Figure 5 is a view in elevation of the structure comprising the flap valves and a valve cage of the preceding figures of the drawing showing one of the flap valves as turned back to expose a detail of the valve cage, the structure being viewed approximately from the front thereof in Figs. 3 and 4; and

Figure 6, a view in side elevation of the structure shown in Fig. 5 with the flap valve at the near side of the structure omitted to illustrate a detail of the valve cage, this view being taken from the right hand side of Fig. 5.

Referring to the construction shown, the device comprises a cylindrical casing 7 provided with external threads 8 adapted to be screwed into the spark-plug-receiving opening 9 of one of the cylinders of a multi-cylinder internal combustion engine, such as the cylinder 10 of the engine represented at 11.

The casing 7 contains diametrically opposed series 12 and 13 of circumferential slots each shown as of a length slightly greater than one-fourth of the circumference of the casing, these slots forming air inlets for a purpose hereinafter explained. The air inlets 12 and 13 are controlled by check valves in the form of flap valves 14 and 15, these valves being preferably made of a rubber-like material having the necessary qualities to meet the conditions of use in connection with an internal combustion engine, such as is well known in the art; the material known in the art as "Neoprene" being admirably suited for my purpose.

The valves 14 and 15 are held in position by a cage or retainer 16 comprising two separate sections 17 and 18 of identical shape and form.

The sections 17 and 18 are of arcuate form presenting the arcuate portions 19 and 20, respectively, which describe arcs of considerably less radii than the radius of the inner cylindrical surface of the casing 7, the portions 19 and 20 being apertured as indicated at 21.

Extending along one longitudinal edge of the section 18 is a series of outwardly bent lugs 22 shown as five in number and equidistantly spaced, and along the opposite edge of this section is a series of outwardly bent lugs 23 of considerably greater length than the lugs 22 as shown, the lugs 23 being circumferentially alined with the ones of the lugs 22 next adjacent the terminal ones of the series thereof. The section 17 is similarly provided with lugs at its opposite longitudinal edges, these lugs being represented at 24 and 25 and corresponding with the lugs 22 and 23, respectively.

The upper and lower edge portions of the section 18 are cut away from the terminal ones of the lug 22 to the lugs 23 as indicated at 26 and 27; the upper and lower edges of the section 17 being similarly cut away from the terminal ones of its lugs 24 to the lugs 25 as represented at 28 and 29.

The sections 17 and 18, preferably made of sheet metal, are so positioned that the long lugs 23 and 25 register, respectively, with those of the lugs 24 and 22 which are next adjacent to the terminal ones of the lugs 22 and 24, as shown, the outer ends of these registering lugs being flush with each other.

The flap valves 14 and 15 are formed from separate sheets of the desired material these valves being apertured along one edge as represented at 30 of the flap 14 shown in Fig. 5, to receive the lugs 23 and 25 and the intermediate ones of the lugs 22 and 24. The flap valves are thus held at vertical marginal portions thereof against shifting lengthwise and circumferentially of the cage and present portions opposite the air inlets 12 and 13 freely movable into and out of a position for closing these air inlets; the free portions of these valves extending from their connections with the cage in the same direction, namely, circumferentially of the casing.

The cage is so positioned in the casing 7 as to cause its arcuate members 19 and 20 to span the series of slots 12 and 13 as shown, with the flap valves 14 and 15 interposed therebetween. In this position of the parts the lugs 22—25 on the cage extend into diametrically opposed vertical grooves 31 in the upper part of the casing 7. These grooves extend through the upper end of the casing and in assembling the parts the lugs on the cage are entered into the upper ends of these grooves and the cage, together with the flap valves thereon, slid in these grooves to a position in which the cage bears at its lower edge against an inner flange 32 in the casing at the upper end of its reduced portion.

The relative positioning of the sections 17 and 18 as above described causes these sections between the lugs 23 on the one section and the lugs 25 on the other section, to present slots 33 and 34 at opposite sides of the cage which extend throughout the greater portion of the length of the cage. The slots 33 and 34 are located adjacent the free edge portions of the flap valves 15 and 14, respectively, the flap valves being of such size that they do not cover these slots when these valves are in a position in which they are displaced from the air inlets 12 and 13, namely, on the suction stroke of the engine.

The parts are so proportioned as shown that when the flap valves 14 and 15 are displaced from the air inlets 12 and 13 as shown in Figs. 2 and 3, the greater portion of the lower edge of the cage will be spaced from the casing, as shown, thus affording passages through which air drawn into the device through the inlets 12 and 13 may pass downwardly, without obstruction, into the casing 7 directly to a position below the cage and thence to the engine cylinder; air also passing from the air inlets 12 and 13 through the slots 33 and 34 into the cage and discharging through its open bottom into the casing below the cage. The recessing of the cage as indicated at 26 and 28 also provides a passage for air from the casing 7 into the cage at its upper end.

The upper end of the casing 7 is closed by a cap 35 screwed into the casing 7 and having a centrally disposed air outlet 36 controlled by a ball-check 37, the upper end of the cap being provided with a nipple 38 adapted for attachment to the end of a flexible hose shown at 39.

In the use of the device the casing 7 is screwed into a spark-plug-receiving opening as above described. When the engine is operated the piston in the cylinder to which the device is attached operates to draw air into the casing 7 through the openings 12 and 13 and expel it at a high pressure through the opening 36 into the hose 39.

The flap valves 14 and 15 being supported at

marginal portions as above described are thus free to move at their portions opposing the air inlets 12 and 13 and without any interference between them and any frictional resistance, thus rendering them very sensitive in action.

Furthermore, provision is provided by the construction shown and described, for the free, substantially unobstructed flow of the air from the air inlets 12 and 13 into the interior of the lower end of the casing 7 and in such volume as to prevent the vacuum produced on the suction stroke of the piston of the pumping cylinder from becoming sufficiently effective on the gas intake of the engine as to draw gasoline into this cylinder.

In this connection it will be noted that the valves 14 and 15 extend at their free portions in the same direction, namely, in the construction shown in clockwise direction (Fig. 4); the fixed edges of these valves contacting with the side wall of the casing 7. Thus portions of the air entering the casing 7 are directed from the opposite sides of the casing in the same direction circumferentially by the free portions of the valves 14 and 15, toward the respective slots 34 and 33 which causes the air to freely swirl in the cage without obstruction and without baffling, such as would result were the two streams to abut, and flow out of the lower end of the cage; the longitudinal edges of the flap valves 14 and 15 adjacent their connections with the cage, being beveled as indicated at 35 to reduce to the minimum the baffling of the air in its movement to the slots 33 and 34.

In the particular construction shown the cage 16 not only serves as a support for the flap valves but also as a means for limiting inward movement of the free edge portions thereof on the suction stroke of the pumping cylinder serving to permit the flap valves to move inwardly sufficiently far for effecting the desired air flow through the device but preventing flapping or fluttering of the flap valves as would occur in case no such stops were provided and which would manifestly be objectionable.

The sensitivity of the flap valves is effective not only as a factor in developing a high degree of efficiency in the pumping of air, permitting high pressures to be developed, but also as a factor in preventing the pumping of gasoline.

As will be understood, when the flap valves are displaced inwardly against the cage 16 on the suction stroke of the pumping cylinder, the openings 21 become covered by the flap valves and thus the latter are quickly forced into a position in which they cover the air inlets 12 and 13, by the action of the air directed against these valves, upon the beginning of the compression stroke of the pumping cylinder, contributing to the pumping of high pressures.

While I have illustrated and described a particular embodiment of my invention I do not wish to be understood as intending to limit it thereto as the same may be variously modified and altered without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. A device of the character described comprising a casing having air inlets in its side wall, a valve cage in said casing and spaced from the side wall of said casing, flap valves interposed between said casing and cage and held in place at marginal edge portions thereof extending generally in the direction of the length of the device and closely adjacent said casing and each presenting a free portion, said free portions extending in the same direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said cage having openings adjacent to, to extend beyond, the free portions of said flap valves to which the flap valves direct air entering the casing through said air inlets, the longitudinal edges of said flap valves adjacent the portions thereof at which they are held in place being beveled to deflect inwardly air impinging against them.

2. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing formed of separate non-symmetrical, outwardly convex sections of the same form and size associated in mutually reversed relation to provide with the casing a curved wedge-shaped valve chamber, and a flap valve between said casing and cage, secured in place at one of its longitudinal edge portions and presenting a free portion in said chamber cooperating with said air inlet.

3. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing formed of separate sections and presenting registering lateral lugs at adjacent edges thereof, and a flap valve between said casing and cage and apertured to receive said lugs.

4. A device of the character described comprising a casing having an air inlet in its side wall and grooves on the inner surface of its side wall extending generally lengthwise of said casing and through one end thereof, a valve cage in said casing having lateral lugs, and a flap valve between said casing and cage, said cage being slidable at said lugs in said grooves to assembled position therein.

5. A device of the character described comprising a casing having an air inlet in its side wall and grooves on the inner surface of its side wall extending generally lengthwise of said casing and through one end thereof, a valve cage in said casing formed of separate sections presenting registering lateral lugs at adjacent edges thereof, and a flap valve between said casing and cage, said cage being slidable at said lugs in said grooves to assembled position in said casing.

6. A device of the character described comprising a casing having an air inlet in its side wall and grooves on the inner surface of its side wall extending generally lengthwise of said casing and through one end thereof, a valve cage in said casing formed of separate sections presenting registering lateral lugs at adjacent edges thereof, and a flap valve between said casing and cage apertured to receive said lugs, said cage being slidable at said lugs in said grooves to assembled position in said casing.

7. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing presenting edges extending generally lengthwise thereof, said edges having registering lugs of different lengths affording an opening therebetween in said cage, and a flap valve between said casing and cage for controlling said air inlet, said opening being adjacent to, but beyond, the free portion of said flap valve.

8. A device of the character described comprising a casing having air inlets in its side wall, a valve cage in said casing formed of separate sections the joints between them extending generally lengthwise of the device, the longitu-

dinal edges of each section having outwardly laterally extending lugs, those at one edge being longer than those at the other edge, the longer of said lugs registering with the shorter ones thereof affording openings in said cage between said longer lugs, and flap valves between said casing and cage and held in place at marginal edge portions thereof extending generally in the direction of the length of the device and closely adjacent said casing and each presenting a free portion, said free portions extending in the same direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said openings being located, respectively, adjacent the free portions of said flap valves, whereby said flap valves direct to said openings air entering the casing through said air inlets.

9. A device of the character described comprising a casing having air inlets in its side wall, a valve cage in said casing formed of separate sections the joints between them extending generally lengthwise of the device, the longitudinal edges of each section having outwardly laterally extending lugs, those at one edge being longer than those at the other edge, the longer of said lugs registering with the shorter ones thereof affording openings in said cage between said longer lugs, and flap valves between said casing and cage and having slots at marginal edge portions thereof extending generally lengthwise of the device into which certain of said lugs extend, said flap valves extending closely adjacent said casing at their held edges, each of said flap valves presenting a free portion, said free portions extending in the same direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said openings being located, respectively, adjacent the free portions of said flap valves, whereby said flap valves direct to said openings air entering the casing through said air inlets.

10. A device of the character described comprising a casing having air inlets in its side wall at opposite sides of the casing, the inner surface of said side wall having grooves extending generally lengthwise of said casing and through one end thereof, a valve cage in said casing formed of separate sections, the longitudinal edges of said valve-cage-sections having outwardly laterally extending lugs, those at one edge being longer than those at the other edge, the longer of said lugs registering with the shorter ones thereof affording openings in said cage between said longer lugs, and flap valves between said casing and cage and having slots at marginal edge portions thereof extending generally lengthwise of the device into which said lugs extend, said flap valves extending closely adjacent said casing at their held ends, said free portions extending in the same direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said openings being located, respectively, adjacent the free portions of said flap valves, whereby said flap valves direct to said openings air entering the casing through said air inlets, said cage being slidable at said lugs in said grooves to assembled position in the casing.

11. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing presenting edges extending generally lengthwise thereof, said edges having lugs of different lengths with their outer edges substantially flush affording a radial opening between the longer ones of said lugs communicating with the interior of the cage, and a flap valve between said casing and cage for controlling said air inlet, said opening being adjacent to, but beyond the free portion of said flap valve.

12. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing formed in separate sections, said sections each formed with lugs projecting at an edge thereof, and a flap valve formed with openings engaging the lugs of each of said sections to hold said sections in assembly, and acting to control said inlet.

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