Feb. 27, 1940. G. H. MEISER 2,191,968

ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed July 11, 1938 2 Sheets-Sheet 1

Fig. 1.

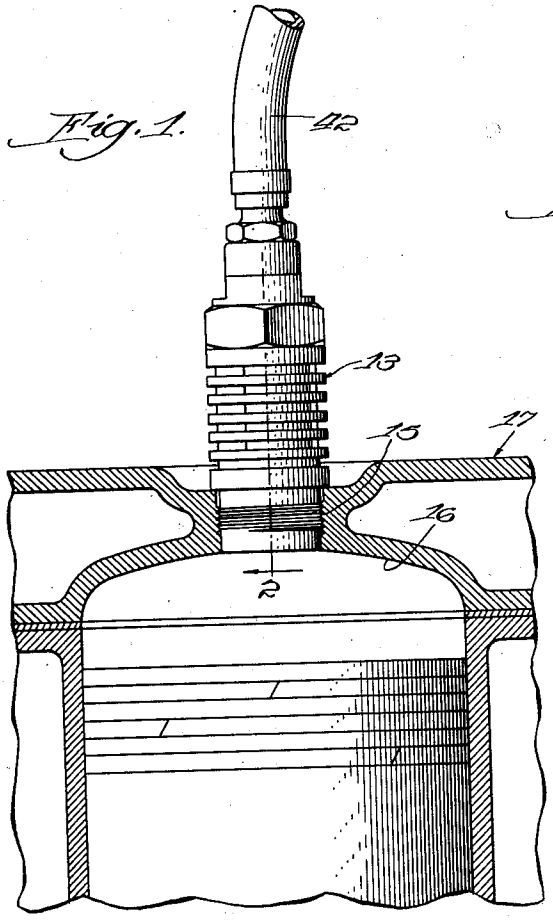


Fig. 2.

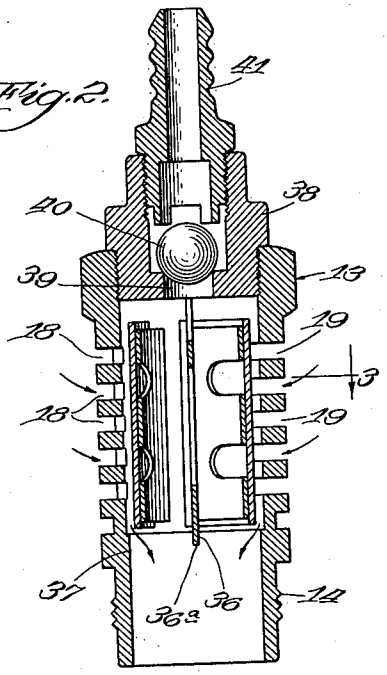


Fig. 3.

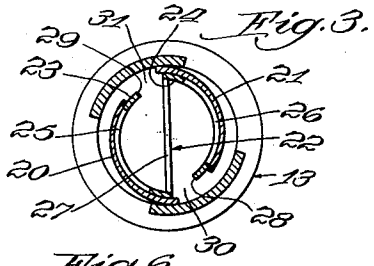


Fig. 4.

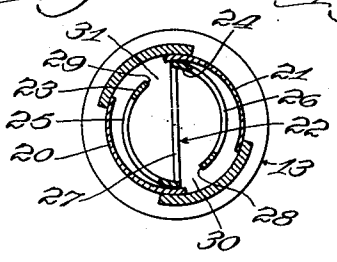


Fig. 5.

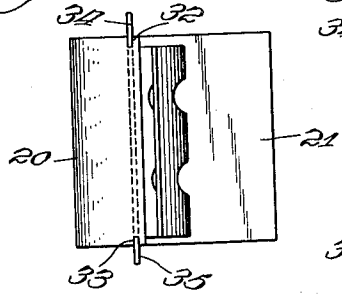
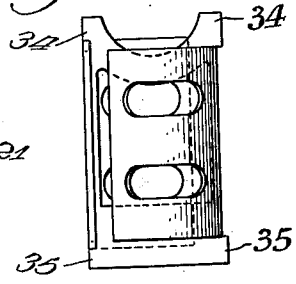


Fig. 6.



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ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

Filed July 11, 1938 2 Sheets-Sheet 2

Fig. 7.

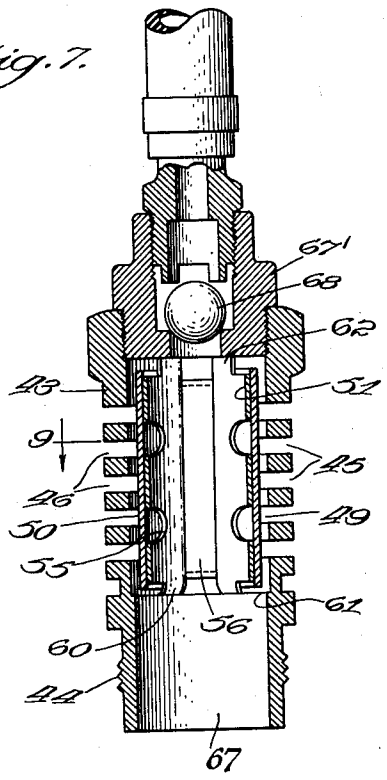


Fig. 8.

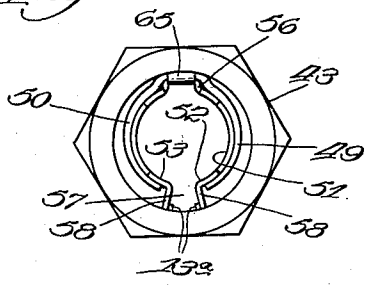


Fig. 9.

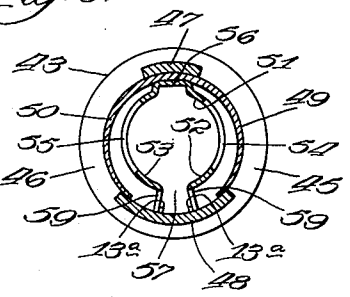


Fig. 10.

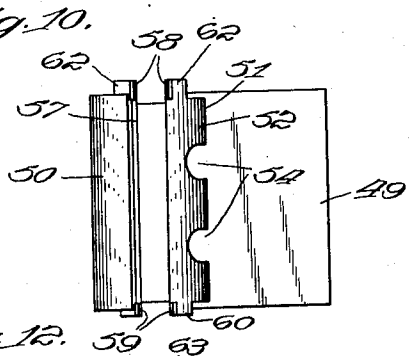


Fig. 11.

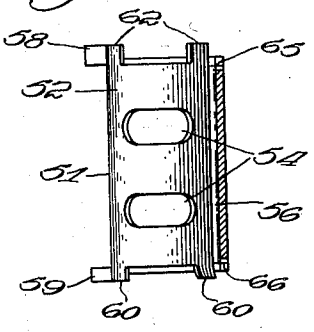
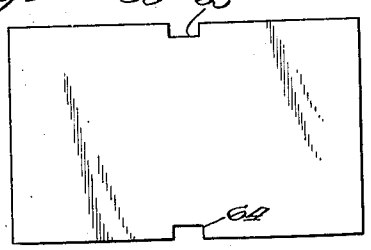


Fig. 12.



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Patented Feb. 27, 1940

2,191,968

UNITED STATES PATENT OFFICE

2,191,968

ATTACHMENT FOR INTERNAL COMBUSTION ENGINES

George H. Meiser, Chicago, Ill.

Application July 11, 1938, Serial No. 218,705

15 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 controling 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 of 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 device.

Another requirement of a 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 as hitherto provided on account of their necessarily large 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 much smaller size than such devices as hitherto provided, adapting it to be used on engines of such designs that former devices could not be used.

Referring to the accompanying drawings:

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 line 3 on Fig. 2

and viewed in the direction of the arrow, 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.

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

Figure 6 is 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. 3.

Figure 7 is a view like Fig. 2 of another form in which the device may be provided.

Figure 8 is a bottom plan view of the device of Fig. 7.

Figure 9 is a plan section taken at the line 9 on Fig. 7 and viewed in the direction of the arrow.

Figure 10 is a view in elevation of the internal structure of the device of Fig. 7 and composed of flap valves and a valve cage, one of the flap valves being turned backwardly.

Figure 11 is a view in side elevation partly sectional of the structure shown in Fig. 10, the structure being viewed in this figure from the right-hand side of Fig. 10; and

Figure 12, a face view of the sheet of material from which the flap valves of Figs. 7–11 are formed.

Referring to the construction shown in Figs. 1–6, inclusive, the device comprises a cylindrical casing 13 having its lower end somewhat reduced in diameter and provided with external threads 14 adapted to be screwed into the spark-plug-receiving opening 15 of one of the cylinders of a multi-cylinder internal combustion engine, such as the cylinder 16 of the engine represented at 17. The casing 13 contains diametrically opposed series 18 and 19 of circumferential slots each shown of a length slightly greater than one-quarter of the circumference of the casing, these slots forming air inlets for the purpose hereinafter explained.

The air inlets 18 and 19 are controlled by check valves in the form of flap valves 20 and 21, these valves being preferably made of a rubberlike 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 20 and 21 are held in position by a cage or retainer 22 comprising arcuate portions 23 and 24 shown as having openings 25 and 26 therein and spaced from the side of the casing 13, and a central partition-forming skeleton plate member 27 connected at its opposite edges with the adjacent edges of the members 23 and 24 and projecting above and below the members 23 and 24, the other edges 28 and 29 of the members 23 and 24 being spaced from the adjacent edges of the partition 27 to cause the cage to present slots 30 and 31 extending lengthwise of the cage throughout the greater portion of its length—in the construction shown throughout the full length of the cage and the length of the series of air inlets 18 and 19. Preferably the members forming the cage are made of sheet metal and may, if desired, be formed of a single sheet thereof stamped or pressed into the desired shape.

The flap valves 20 and 21 are shown as formed of separate sheets of the desired material each of which is slotted at its upper and lower edges adjacent a lateral edge thereof, as represented at 32 and 33 of the flap valve 20 in Fig. 5, into which slots lateral projections 34 and 35 on the top and bottom, respectively, of the partition forming member 27 extend as shown of the flap valve 20 for holding the flap valves against shifting lengthwise and circumferentially of the cage. Thus each flap valve is held at a vertical marginal portion to present a portion opposite the air inlets freely movable into and out of valve-closing position.

The notched portions 32 and 33 of the sheets and solid portions of the cage are disposed in registration with solid portions of the casing against which the sheets are clamped by the cage, the sheets in practice being provided of such thickness as to place them in compression upon inserting them in position on the cage into the casing.

The cage is so positioned in the casing 13 as to cause its arcuate members 23 and 24 to span the series of slots 18 and 19 as shown with the flap valves 20 and 21 interposed therebetween. In this position of the parts the lower projections 35 on the cage extend into diametrically-opposed vertical grooves (one of which is represented at 36) in the upper part of the lower reduced internal diameter portion 37 of the casing 13, to prevent rotation of the cage, the cage being confined between the lower end walls 36a of the grooves 36 and a check-valved equipped removable cap hereafter described.

The parts are so proportioned as shown that when the flap valves 20 and 21 are displaced from the air inlets 18 and 19 as shown in Figs. 2 and 3, the lower edges of the arcuate members 23 and 24 and the flap valves are spaced from the casing 13 thus affording passages through which air drawn into the device through the inlets 18 and 19 may pass downwardly, without obstruction, into the casing 13 below the cage and thence to the engine cylinder; air also passing from these air inlets through the slots 30 and 31 into the cage and discharging through its open bottom into the casing below the cage.

The upper end of the casing 13 is closed by a cap 38, hereinbefore referred to, screwed into the casing 13 and having a centrally disposed air outlet 39 controlled by a ball check 40, the upper end of the cap being provided with a nipple 41 adapted for attachment to the end of a flexible hose shown at 42.

In the use of the device the casing 13 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 13 through the openings 18 and 19 and expel it at high pressure through the opening 39 into the hose 42.

The flap valves 20 and 21 being supported at marginal portions as described are thus free to move at their portions opposing the air inlets 18 and 19 and without any interference between them and any frictional resistance, thus rendering them very sensitive in action. Furthermore, provision is afforded by the construction shown and described for the free, substantially unobstructed flow of the air from the air inlets 18 and 19 into the interior of the lower end of the casing

13 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 20 and 21 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 13. Thus portions of the air entering the casing 13 are directed from opposite sides of the casing 13 in the same direction circumferentially by the free portions of the valves 20 and 21, toward the respective slots 31 and 30 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.

In the particular construction shown the cage 22 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.

The construction shown in Figs. 7 to 12, inclusive, is directed to the accomplishment of the purposes above stated in connection with the device of the preceding figures of the drawings and operates on the same general principle.

In this construction the casing of the device, represented at 43 and adapted to be screwed at its lower threaded portion 44 into the spark-plug receiving opening of the pumping cylinder of an internal combustion engine, is provided at its side wall with series of air inlets 45 and 46 extending circumferentially about the casing and disposed in non-diametrically registering position and each of a length slightly less than one-third of the circumference of the casing, the solid portions of the casing between these inlets being represented at 47 and 48.

The device also comprises flap valves 49 and 50 of flexible material, as for example in the case of the flap valves 20 and 21, which span the openings 45 and 46, respectively, and are located at the outer side of a cage or retainer 51 which is located in the casing 43 and serves to hold the flap valves 49 and 50 at vertical marginal edge portions thereof, leaving the remaining portions of the valves free to move into and out of a position for closing the air inlets 45 and 46.

The cage in this construction is shown as formed from a single sheet of metal bent to provide arcuate portions 52 and 53 apertured as represented at 54 and 55, respectively, and an outwardly deflected connecting portion 56, the free edges of the sheet being spaced apart to provide a slot 57 extending throughout the greater portion of the length of the cage—in the particular construction shown throughout the full length of the cage and the air inlets 45 and 46.

The arcuate portions 52 and 53 are spaced from the side wall of the casing 43 as shown and the spaced apart edges of the arcuate portions 52 and 53 are provided at their upper and lower ends with outwardly extending projections 58 and 59 which contact the side wall of the casing 43.

The lower edge of the cage 51 is cut away at intervals to afford legs 60 outwardly bent at which the cage seats at its lower end on the ledge portion 61 of the casing. The upper edge of the cage is similarly recessed to provide upwardly extending projections 62 which oppose the cap of the device hereinafter described and which serves, when applied to position, to prevent outward movement of the cage.

The cage is so positioned in the casing 13 as to cause its arcuate members 52 and 53 to span the series of slots 45 and 46 as shown, with the flap valves 49 and 50 interposed therebetween. In this position of the parts the lower ones of the projections 59 cooperate with positioning means on the casing shown as comprising spaced apart projections 13a on the interior of the casing 13 which extend between the projections 59 as shown. The projections 13a also serve to hold the cage in the open condition shown, preventing the free edge portions of the cage from moving toward each other.

The flap valves 49 and 50 in this construction are shown as formed of a single sheet of the desired material with its upper and lower edges notched between its lateral edges, as represented at 63 and 64, respectively. The upper and lower ends of the deformed portion 56 of the cage are provided with outwardly bent projections 65 and 66, respectively, which extend into the notches 63 and 64 of the sheet, in the assembled position of the parts, preventing lengthwise and circumferential displacement of the flap valves relative to the cage. The notched portion of the sheet and the deformed portion 56 of the cage are disposed in registration with the solid portion 47 of the casing against which the sheet is clamped by the cage, the sheet in practice being provided of such thickness as to place it in compression upon inserting it in position on the cage, into the casing, the slot 57 of the cage being in registration with, but in spaced relation to, the solid portion 48 of the casing.

The cap above referred to is represented at 67' it being of the same construction as the cap 38 and similarly equipped with a ball check 68 as explained of the cap 38.

When the flap valves 49 and 50 are displaced from the air inlets 45 and 46 as shown in Fig. 7, the lower ends of these valves and also the lower end of the cage are spaced from the casing 43 affording free, unobstructed, passages for air from the air inlets 45 and 46 to the space 67 in the casing 43 below the cage, permitting air to flow from these air inlets into this portion of the casing. The slot 57 is also in communication with the air inlets 45 and 46 affording a passage for air from these air inlets through the side of the cage and out through its open bottom into the lower portion of the casing thereby providing for the free flow of a large volume of air into the lower part 67 of the casing 43 and thence to the pumping cylinder and serving as a factor in preventing the pumping of gasoline as explained of the construction in the preceding figures of the drawings, the adaptability of the flap valves for free movement and without frictional resistance, rendering them very sensitive in action to the end of performing the purpose explained above in connection with the flap valves 20 and 21.

While I have illustrated and described certain

embodiments 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 and the invention embodied in other forms of structure 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 having lateral projections at its upper and lower ends, and a flexible sheet member between said casing and cage and having slots in its upper and lower edges between its side-edges into which said projections extend, the portions of said sheet at opposite sides of said slots being free to move crosswise of the device into and out of a position for closing said air inlets.

2. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom and having a slot extending throughout the greater portion of the length of said cage, and a flap valve between said casing and cage for controlling said air inlet, said slot being beyond said flap valve, whereby a portion of the air drawn into said casing passes through said slot into said cage for discharge through an end thereof.

3. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom and having substantially diametrically opposed slots extending throughout the greater portion of the length of said cage, and flap valves between said casing and cage for controlling said air inlet, said slots being beyond said flap valves, whereby a portion of the air drawn into said casing passes through said slots into said cage for discharge through an end thereof.

4. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom and formed of arcuate side walls and a central partition connected at its opposite edges with adjacent edges of said side walls, respectively, the other edges of said side walls being spaced from said partition to provide slots extending lengthwise of the device and flap valves between said casing and cage for controlling said air inlets.

5. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom, said cage comprising a side-wall-forming portion having a single slot extending lengthwise of the cage, and a flap valve between said casing and cage for controlling said air inlet, said slot being beyond said valve, whereby a portion of the air drawn into said casing passes through said slot into said cage for discharge through an end thereof.

6. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom, said cage being formed of a sheet of metal bent to form the side wall of the cage, with its terminal edges spaced apart to form a slot extending lengthwise of the cage, and a flap valve between said casing and cage for controlling said air inlet, said slot being beyond said valve, whereby a portion of the air drawn into said casing passes through said slot into said cage for discharge through an end thereof.

7. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing open at its bottom, said cage being spaced from said casing at its side wall and at its lower end, said cage having a slot extending throughout the greater portion of the length of said cage, and a flap valve between said casing and cage for controlling said air inlet, said valve being beyond said slot, whereby a portion of the air drawn into said casing passes into the space between said cage and casing and thence downwardly at the interior of said cage below the latter and another portion of the air passes through said slot into said cage and discharges through the bottom thereof.

8. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing, a flap valve interposed between said casing and cage and secured in place on said cage at a marginal portion thereof and presenting a free portion cooperating with said air inlet, and means for positioning said cage with said flap valve thereon in a predetermined position in said casing angularly about its axis to insure registration of said flap-valve with said air inlet in the assembling of the parts of the device.

9. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom, said cage having a slot extending continuously from end to end thereof, whereby a portion of the air drawn into said casing passes through said slot into said cage for discharge through an end thereof, a flap valve between said casing and cage for controlling said air inlet, and positioning means for said cage engageable by portions of said cage at opposite sides of said slot and preventing collapsing of said cage.

10. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing having lateral projections at its upper and lower ends, and a flexible sheet member between said casing and cage and having slots in its upper and lower edges between its side edges into which said projections extend.

11. 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 rotary 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, but extending beyond the free portions of said flap valves to which the flap valves direct air entering the casing through said air inlets.

12. 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 secured 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 rotary direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said cage having openings extending generally lengthwise of the device throughout the greater portion of the

length of the casing and disposed adjacent to, but extending beyond the free portions of said flap valves to which the flap valves direct air entering the casing through said air inlets.

13. A device of the character described comprising a casing having an air inlet in its side wall, a valve cage in said casing and spaced therefrom and having a slot extending throughout the greater portion of the length of said cage, and also having an opening to one side of said slot, and a flap valve between said casing and cage for controlling said air inlet and adapted to extend across said opening when said air inlet is open, said slot being beyond said flap valve, whereby a portion of the air drawn into said casing passes through said slot into said cage for discharge through an end thereof.

14. 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 secured 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 rotary 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 but extending beyond the free portions of said flap valves to which the flap valves direct air entering the casing through said air inlets, said cage having other openings across which the flap valves extend and which are covered by said valves when said air inlet is open.

15. 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 valve cage having generally arcuate shaped portions each extending at one edge closely adjacent those portions of said flap valves at which said flap valves are held in place and each spaced beyond said edge from the adjacent flap valve, said free portions extending in the same rotary direction and adapted to move crosswise of the device into and out of a position for closing said air inlets, said cage having openings between said edge of each of said arcuate portions and the opposite edges of said arcuate portions and adjacent to, but extending beyond the free portions of said flap valves to which the flap valves direct air entering the casing through said air inlets.

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