

C. L. E. MUELLER.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED JULY 3, 1918.

1,360,561.

Patented Nov. 30, 1920.

Fig. 1.

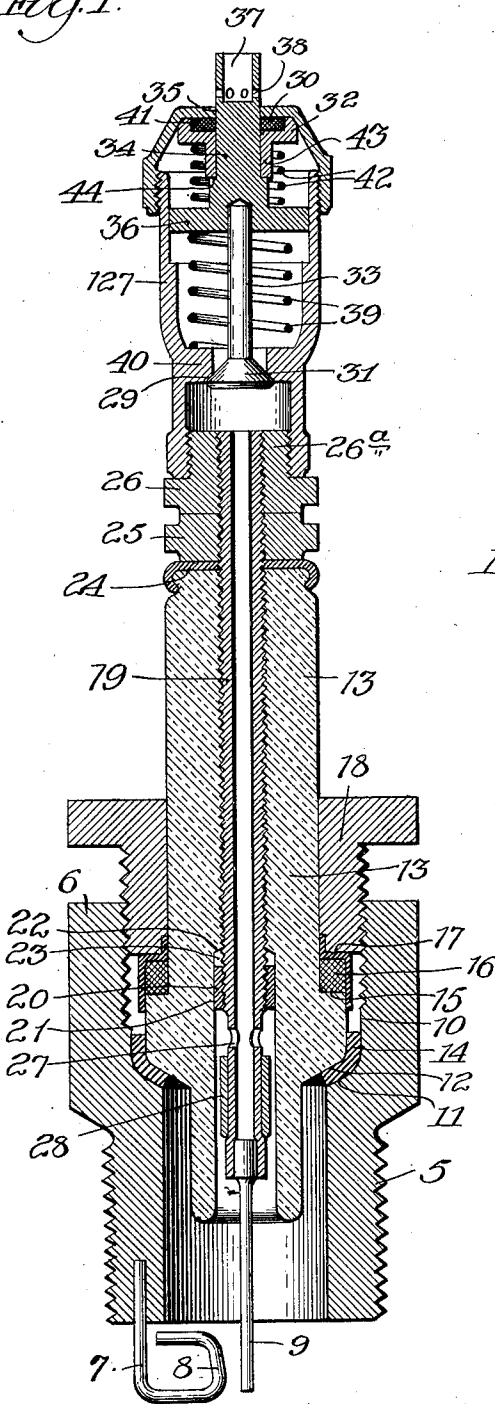


Fig. 2.

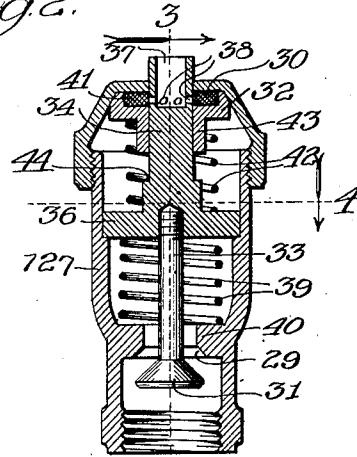


Fig. 3.

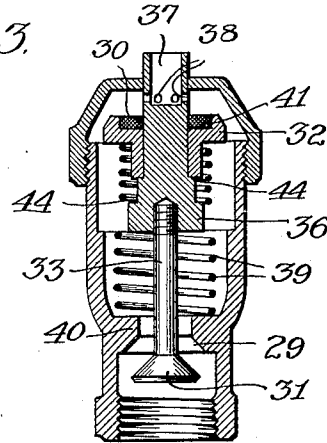
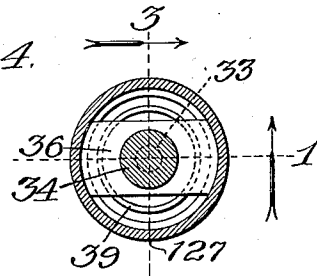


Fig. 4.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,360,561.

Specification of Letters Patent. Patented Nov. 30, 1920.

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To all whom it may concern:

Be it known that I, CURT L. E. MUELLER, a citizen of the United States, residing at Joliet, in the county of Will and State of Illinois, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

One phase of my invention relates to the supplying of air to an internal combustion engine for mixture with the fuel, such as gasoline, and may be utilized in connection with the carbureter direct of an engine, or in connection with the inlet manifold of an engine or in connection with the cylinder of the engine to supply air to the latter, or in connection with a spark-plug, or in any other desirable situation, my object being to provide means controlling the inlet of air, which will operate to preheat the air before its entry into the structure wherein it mixes with the fuel, and in connection with the use of the invention in a spark-plug or in any other location where it is subjected to the exploded charge, to provide against leaks in the structure by accumulations of carbon between the valve and its seat.

Another phase of my present invention relates to spark-plugs equipped with a passage which opens at one end into the interior of the cylinder equipped with the plug and at its opposite end communicates with the atmosphere, the passage being provided with an inwardly-opening valve-device operating to permit air to be sucked through the said passage and into the interior of the engine upon each suction stroke of the piston, it being my object in connection with this feature of my invention, to provide means located at the inner end of the said passage which will permit air to flow through the passage into the interior of the engine, but which will prevent entry of the burnt gases into this passage.

Referring to the accompanying drawings wherein my invention is shown as applied to a spark-plug:

Figure 1 is a view in sectional elevation of a spark-plug embodying my invention, showing the device in normal position, the section being taken at line 1 on Fig. 4 and viewed in the direction of the arrow. Fig. 2 is a similar view of the air-controlling valve structure forming a part of the construction of Fig. 1, the parts of the valve device being shown in one of the positions

assumed thereby during the exertion of suction on the device. Fig. 3 is a similar view, taken at the line 3 on Figs. 2 and 4 and viewed in the direction of the arrows, showing another position assumed by the parts of the device during the operation of the engine; and Fig. 4, a section taken at the line 4 on Fig. 2 and viewed in the direction of the arrow.

The usual metal shell adapted to be screwed at its threaded portion 5 into the spark-plug opening in the head of the cylinder of an internal combustion engine, is represented at 6, the lower inner end of this shell being provided with an electrode, or sparking terminal 7, preferably formed of a piece of wire bent into the shape shown in Fig. 1 to provide a substantially vertically disposed surface 8, for coöperation with the opposed surface of the lower end of the other electrode, or sparking terminal represented at 9. The opening in the upper portion of the shell 6 is of enlarged diameter, as represented at 10, and presents at its lower portion an annular shoulder 11 against which the lower shouldered portion 12 of a tubular member 13 of insulating material, bears, with a gasket 14 interposed between these shoulders.

The member 13 above its shouldered portion 12 is shouldered, as represented at 15, this shoulder supporting a ring 16 of packing material, as for example asbestos with a covering flanged ring 17. The upper end of the shell 6 is internally screw-threaded for receiving a sleeve member 18, which surrounds the member 13 and screws down upon the ring 17, the engagement of the member 18 and the shoulder 11 with the intervening parts as described, serving to hold the member 13 in fixed position longitudinally relative to the member 6.

Extending lengthwise through the member 13 is a tube 19 which is externally screw-threaded throughout its upper portion, as represented. Screwed onto the lower end of the tube 19 is a nut 20 which extends within the enlarged portion 21 of the bore in the member 13 and between which and an annular shoulder 22 in the member 13, a ring 23 of packing is interposed. The upper end of the tube 19 is surrounded by a washer 24, which fits over the top of the member 13, and two nuts 25 and 26 which are screwed upon the upper end of this tube, the lower nut 25 serving, with the nut 20, to firmly hold the

tube 19 in place in the member 13, and this nut, with the nut 26, forming a binding post for attachment thereto of one of the wires leading from a source of sparking current in accordance with common practice. The tube 19 below the nut 20 contains in its side wall, opposed openings 27 which communicate with the space 21 and consequently with the interior of the cylinder of the engine to which the spark-plug is applied. The electrode 9 in the form of a rod, is secured in the lower end of the tube 19, and slidably mounted upon this tube between the nut 21 and its lower expanded extremity, is a sleeve 28 forming a valve for the openings 27.

Surmounting the nut 26 is a plural-valve air-controlling valve-device formed, according to the preferred embodiment of my invention, of a casing 127 which is screwed upon the upper threaded portion 26^a of the nut 26 and contains valve-seats 29 and 30, a pair of valves 31 and 32 cooperating with said seats, respectively, and another valve operating through the upper end of the casing 127 as hereinafter described. The valve proper 31, which is an inwardly-opening check-valve, is provided with a stem 33 rigidly secured to a stem extension 34, which has sliding fit in an opening 35 in the upper end of the casing 127, the lower end of this stem-extension being in the form of a cross-head 36 to guide the valve 31 and its cooperating parts in their movement as hereinafter described, but permitting of the passage of air from the top to the bottom of the casing; and the upper end of this stem-extension being of hollow form as represented at 37, with an opening in its upper end and a series of relatively small openings 38 in its side wall, which open into the hollow part 37, this portion of the stem forming the above-referred-to valve operating through the top of the casing. A spiral spring 39 surrounding the stem 33 and confined between the underside of the cross-head 36 and a partition 40 in the casing 127 and in which the valve-seat 29 is contained, operates normally to hold the valve 31 closed. The valve 32 is slidably mounted on the stem-extension 34 and is normally held at its packed portion 41 against the seat 30, by the action of a coiled spring 42 surrounding the stem-extension 34 and confined between the upper surface of the cross-head 36 and the under surface of the valve 32, the latter being preferably formed with a depending sleeve-extension 43 which opposes an annular shoulder 44 on the stem-extension 34, the spring 42 being weaker than the spring 39. The parts of the structure just described are so constructed and arranged that in the normal positions thereof (Fig. 1), the openings 38 in the stem-extension 34 extend above the underside of the top of the casing 127 and preferably above the casing as

shown, and the springs 42 and 39 exert substantially the same pressure.

In the operation of the engine equipped with the spark-plug, the suction produced in the cylinder of the engine upon its suction-stroke, causes suction to be exerted in the valve-equipped passage in the spark-plug, whereupon the valve 31, together with its stem-extension 34 lowers in the casing (Fig. 2), opening the latter to the suction action referred to, which draws the air from the casing 127 into the passage in the tube 19, thence out through the openings 27 and through the lower end of the spark-plug into the cylinder of the engine. In the lowering of the valve 31 as stated, the spring 39 compresses and the spring 42 elongates, the valve 32 remaining against its seat until the openings 38 are lowered to such a point that air may enter through the portion 37 and into the casing 127 above the valve 32, whereupon the latter becomes unseated against the action of the spring 42 (Fig. 3), due to the partial vacuum created in the casing 127 by the suction action of the engine on the contents of the casing as stated. The duration of the suction of the engine upon the contents of the casing 127 is momentary and the valve 31 and valve working through the top of the casing are so proportioned and the springs so tensioned that the valve 31 closes before any air exterior of the casing, can pass beyond the valve 31 by direct communication of this part of the structure with the atmosphere. In other words, the parts of the valve structure are so proportioned and tensioned that the effect of the suction exerted by the engine on the casing 127, at each suction stroke of the engine, is to open the valve 31 for a sufficient length of time only to cause the air which enters the spark-plug and consequently the cylinder, with each suction stroke, to be air which was introduced into the casing 127 immediately following the previous suction stroke and entering the casing 127 by reason of the reduced pressure created therein in the opening of the valve 31. It will be noted from this that the air which is drawn into the cylinder upon each suction stroke is thus subjected to the heat which is contained in the walls of the valve device and is to a degree preheated before its entry into the main portion of the spark-plug. Furthermore, it may be stated that an additional advantage resulting from my invention is that should particles of carbon become interposed between the valve 31 and the seat 29 of such volume as to render this valve leaky, the disadvantages of direct communication of the cylinder with the atmosphere will nevertheless be overcome.

With each suction stroke of the engine, a charge of air will be drawn through the spark-plug and into the cylinder with the

result of displacing the burned gases in the lower end of the spark-plug and in the adjacent portion of the cylinder, resulting from previous explosions, thus minimizing the accumulation of carbon in the spark-plug and cooling the lower end of the latter to prevent premature ignition, the valve 28 by reason of the force exerted against its lower end, when explosions occur in the cylinder, moving to a position in which it closes the openings 27 and thereby aids in keeping the tube 19 in clean condition.

While it is desirable to employ the valve 32, especially to prevent leakage, this is not essential to the carrying out of my invention as to certain features of the plural valve-device, this valve may be eliminated, and the control of the air effected by the co-operating valve 31 and the valve which is formed on the top of the stem 34.

While I have illustrated my improved valve-device in connection with a spark-plug, I do not wish to be understood as intending to limit it to its use in this connection, nor do I wish to be understood as intending to limit my invention to its embodiment in a valve of this particular construction, it being my intention to claim my invention as fully and completely as the prior state of the art will permit.

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

1. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve-mechanism controlling the inlet of air into said passage under the said suction comprising an inner valve and an outer valve, said valves being independently movable, and means coöperating with said valves and operating to hold said outer valve closed until after said inner valve opens.

2. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve-mechanism controlling the inlet of air into said passage under said suction comprising an inner valve and an outer valve, said valves being independently movable, and spring means coöperating with said valves and operating to hold said outer valve closed until after said inner valve opens.

3. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve-mechanism controlling the inlet of air into said passage under said suction comprising an inner valve and an outer valve, said valves being independently movable, and spring

means coöperating with said valves, said spring coöperating with said inner valve presenting greater resistance than the spring coöperating with said outer valve.

4. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve mechanism controlling the inlet of air into said passage under said suction comprising an inner valve having a hollow extension containing a port in its side wall, a casing coöperating with said valve and through an end of which said extension is slidable, a spring tending to seat said valve, a second valve at the outer end of said casing and when in one position closing said port to the interior of said casing, and a spring forcing said second valve to closed position.

5. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve-mechanism controlling the inlet of air into said passage under the said suction comprising a casing, an inner valve controlling the inner end of said casing, an outer valve in said casing, said valves being independently movable, means operatively connected with said inner valve for opening said casing to the atmosphere beyond said outer valve after said inner valve has opened, and means for forcing said valves to their seats.

6. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve-mechanism controlling the inlet of air into said passage under the said suction comprising a casing, an inner valve controlling the inner end of said casing, the stem of said valve having a shoulder within said casing and provided with a hollow extension containing a port in its side wall, said extension having sliding fit in the outer end of said casing and said port, when said valve is closed, extending out of communication with the interior of said casing, a spring engaging said shoulder for holding said valve to its seat, a second valve slidably engaging said extension and seating against the outer end wall of said casing, and a spring engaging said second valve for releasably holding it to its seat.

7. An internal combustion engine containing a passage in its cylinder wall for communication of the interior of the cylinder with the atmosphere, a normally closed valve device in said passage constructed and arranged to open by the suction action of the engine and permit air to enter said passage and thence pass into said cylinder by said

suction action and prevent escape of air from said passage to the atmosphere, and a second valve located between said first-named valve and the interior of said cylinder and controlling said passage.

8. An internal combustion engine containing a passage in its cylinder wall for communication of the interior of the cylinder with the atmosphere, a valve device in said passage constructed and arranged to open by the suction action of the engine and permit air to enter said passage and thence pass into said cylinder by said suction action and prevent escape of air from said passage to the atmosphere, the inner end of said passage being in the form of a tube having its side wall ported, and an automatically operating valve between the engine cylinder and said last-referred-to opening controlling the latter.

9. An internal combustion engine containing a passage in its cylinder wall for communication of the interior of the cylinder with the atmosphere, a valve device in said passage constructed and arranged to open by the suction action of the engine and permit air to enter said passage and thence pass into said cylinder by said suction action and prevent escape of air from said passage to the atmosphere, the inner end of said passage being in the form of a tube having its side wall ported and a slide-valve on said tube for controlling the ported portion thereof.

10. An internal combustion engine containing a passage in its cylinder wall for communication of the interior of the cylinder with the atmosphere, a valve-device in said passage constructed and arranged to open by the suction action of the engine and permit air to enter said passage and thence pass into said cylinder by said suction action and prevent escape of air from said passage to the atmosphere, the inner end of said passage being in the form of a depending tube with its side wall ported, and a slide-valve mounted on said tube for controlling a ported portion thereof.

11. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in

communication with said space and communicating with the atmosphere, and valve mechanism controlling the inlet of air into said passage under the suction comprising a casing, an inner valve and an outer valve, and means whereby, under the suction action, said outer valve maintains said casing closed to the atmosphere, until after said inner valve opens.

12. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve mechanism controlling the inlet of air into said passage under the suction comprising a casing, an inner valve and an outer valve, operatively connected together, and so arranged as to cause said outer valve to maintain said casing closed to the atmosphere, until after said inner valve opens.

13. In an internal combustion engine, the combination with a space which is subjected intermittently to suction, of a passage in communication with said space and communicating with the atmosphere, and valve mechanism controlling the inlet of air into said passage under the suction comprising a casing, an inner valve having a stem and an outer slide valve formed on said stem and controlling the admission of air to said casing, said valves being so arranged as to cause said outer valve to maintain said casing closed to the atmosphere until after said inner valve opens.

14. An internal combustion engine containing a passage in its cylinder wall for communication of the exterior of the cylinder with the atmosphere, a normally closed, spring controlled, valve device in said passage constructed and arranged to open by the suction action of the engine and permit air to enter said passage and thence pass into said cylinder by said suction action and prevent escape of air from said passage to the atmosphere, and a second valve located between said first-named valve and the interior of said cylinder and controlling said passage.

CURT L. E. MUELLER.