J. SAUER.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED MAY 16, 1910.

1,049,925. Patented Jan. 7, 1913.

Fig. 2

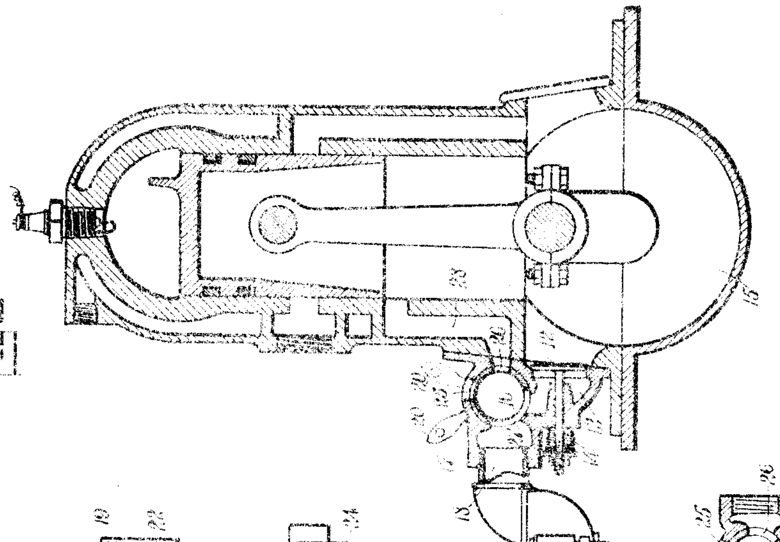


Fig. 4

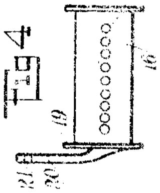


Fig. 3

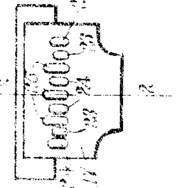
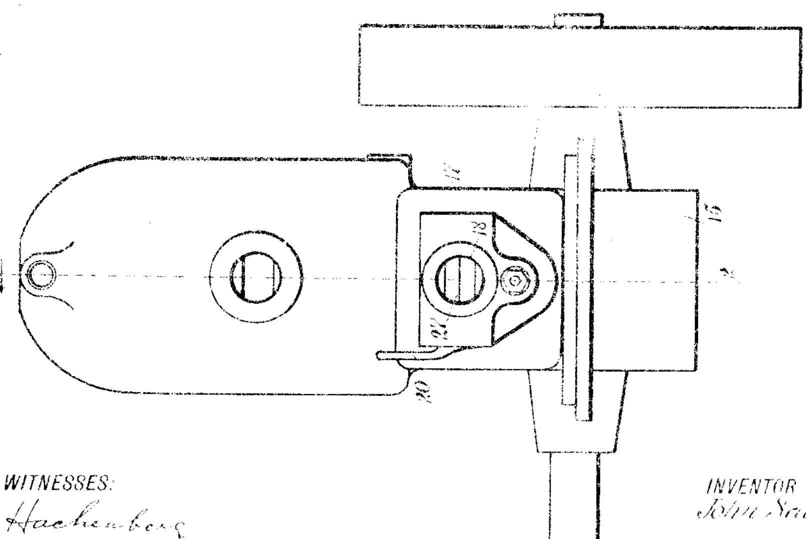


Fig. 5

Fig. 1



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INTERNAL-COMBUSTION ENGINE.

1,049,925. Specification of Letters Patent. Patented Jan. 7, 1913.
Application filed May 16, 1910. Serial No. 561,668.

To all whom it may concern:

Be it known that I, John Sauer, a citizen of the United States, and a resident of the city of New York, East Williamsburgh, borough of Queens, in the county of Queens and State of New York, have invented a new and Improved Internal-Combustion Engine, of which the following is a full, clear, and exact description.

Among the principal objects which the present invention has in view are: to provide controlling means for regulating the explosive mixture delivered to the explosion chamber of an engine of the character set forth; to provide controlling means whereby the proportions of the ingredients in the explosive mixture can be kept constant; to provide a valve for admitting auxiliary air to an engine of the character set forth, said valve being interposed between the intake of said engine and the carbureter thereof; and to provide a housing for the intake valve employed by me in the present invention.

One embodiment of the present invention is disclosed by the structure illustrated in the accompanying drawings, in which like characters of reference denote corresponding parts in all the views, and in which—

Figure 1 is a side elevation of an engine of the character set forth, constructed and arranged in accordance with the present invention; Fig. 2 is a vertical section of the same, taken on the line 2—2 in Fig. 1; Fig. 3 is a top view of the valve housing for the engine, constructed in accordance with the present invention; Fig. 4 is a top view of a cylindrical valve mounted within the housing shown in Fig. 3; and Fig. 5 is a longitudinal section of a modified form of the housing, showing the adaptation of the present invention to engines already supplied with an intake valve housing.

The numeral 10 is employed to designate a carbureter for gasolene or oil engines of any known and suitable type. The needle valve controlling screw 11 is that which has been employed in the art heretofore to vary the gas supply to meet the various conditions under which the engine is worked in the course of its operation. The objection to this adjustment of the screw 11 has been well known to all mechanics employed in operating engines of the type shown. Further, it is impossible to carefully and accurately adjust the carbureter to meet the requirements due to the variation in speed of the motor by the means provided for the adjustment of the air supply as at present used. From the inability to properly regulate the carbureter and supply thereof there has arisen a set of difficulties known as the "carbureter troubles." It is to avoid these troubles in large measure that I have herein provided a valve, the use of which may be employed to increase or diminish the engine suction on the carbureter, and to admix with the gasified oil a proper proportion of atmospheric air, and thereby produce perfect explosive effects when varying the speed of the engine.

In the drawings, and particularly in Fig. 2 thereof, is shown an intake valve 12, the arrangement and construction whereof is in accord with the best practice of the present day. The seat of the said valve is provided at the delivery end of a passage 13, usually in open communication with the delivery side of the carbureter 10. The stem of the valve 12 is passed through suitable bearings therefor, and at the outside of the casing is provided a spring 14, the operation of which is to seat the valve 12. It is against the tension of the spring 14 that the suction within the compression chamber 15 operates. It will be seen that when the carbureter and the feed thereof are set for delivery of the necessary quantity of oil or gasolene for the consumption adjusted to the number of revolutions per minute of the engine, that an unnatural feed is enforced on the said carbureter when the rate of speed is accelerated. Also, it will be seen that as the spring 14 is adjusted and set for operation at a certain number of revolutions per minute of the crank shaft of the engine, an imperfect action of the said valve is produced by the acceleration of the revolutions, because either by the failure of the proper suction to move the valve 12, or to the fact that the successive suctions are closely joined, the valve does not properly seat, by all of which there is caused an inaccuracy and difficulty of operation, due to the failure to intake to the explosive chamber gas from the carbureter, or in a delivery under pressure of air downward through the carbureter, due to the partially opened valve 12 at the time of the beginning of the compression stroke of the compressor. These difficulties are overcome in the present invention by the interposition of a cylindrical valve 16, mounted in the casing 17, and between the outlet passage 13 and a delivery pipe 18 of the carbureter 10. In the casing 17 is provided a transverse smooth bore opening for the valve 16. The valve 16 is cylindrical in shape to fit the said bore opening, and is provided with end flanges 19 and 19 overlying the side of the casing 17, and forming guide members for the operation of the valve 16. On the end of the valve 16 is a crank handle 20, the upper end whereof is sometimes provided with a perforation 21 to receive in holding relation the end of a cable whereby the said crank handle may be operated from a distance, manually, or mechanically by a governor.

The cylindrical valve 16 is provided with a line of perforations 22, 22. The perforations 22 are duplicated in size and design, and are disposed in such arrangement that when mounted in the casing 17 they aline with perforations 23, 24 and 25. The perforations 23, 24 and 25 have the same transverse dimension, and are arranged on the same base line. The said perforations, however, are elongated and are formed to distinct and separate lengths. The perforations 23, 23 are the shortest in length, the perforations 25, 25 are the longest in length, and the perforations 24, 24 are in length intermediate the perforations 23 and 25. By this arrangement it will be seen that as the perforations 22, 22 are carried past the congregated perforations 23, 24 and 25, a variation in the passages between the interior of the valve 16 and the surrounding atmosphere is effected. As, for example, when the perforations 22, 22 are placed in apposition with the perforations 23, 24 and 25, and at the base line thereof, then the largest passage area is provided for the entrance from the surrounding atmosphere to the interior of the said valve. When, however, the valve 16 is moved so that the perforations 22, 22 are removed from alinement with the perforations 23, 23, then the passage is reduced by the area of the perforations 23, 23. When, again, the valve is shifted to move the perforations 22, 22 out of apposition with the perforations 24, 24, then the area is limited to the area of the perforations alined with the perforations 25, 25.

The valve 16 is provided with side openings 26 and 27. The opening 26 is shaped to correspond to a passage 28, formed in the engine for introduction therein of a supplementary supply of air or explosive mixture to the compression chamber when the full amount has not been supplied by the opening of the valve 12, and in fast moving pistons the operation of the valve 12 is apt to be inefficient to supply the full amount of explosive mixture in answer to the suction of the rising piston.

The opening 27 is shaped and disposed as shown in the drawings, and particularly in Fig. 2 thereof, to open the communication between the delivery passage 13 and the delivery pipe 18. Extended between the openings 26 and 27 is a section of circular wall adapted to close the passage between the passage 13 and the pipe 18 when the valve 16 is moved to the position shown in dotted lines, by the handle 20. This closure of the communication between the passages 13 and 18 is subsequent to the closing of the perforations 22 and operates to cut off the fuel supply of the engine.

In the type of engine illustrated in the drawings, the under side of the piston is employed to compress the explosive mixture within the crank casing, which is constructed in air tight form for that purpose. The crank casing is provided with a cylindrical raceway in which the piston rod swings about the crank of the driving shaft. The piston in this type of engine is usually provided with elongated side walls suitably packed, and is further provided at the upper end with a baffling wall or projection adapted to be alined with the intake port of the engine. The intake port is closed by the elongated wall of the piston, and is opened by the piston passing below or to one side of the said port. The intake port is in open communication with the compression or crank chamber, and the mixture in the passage is under the pressure of the gases within the said pressure or crank chamber. As is usual with engines of this type, the exhaust port is likewise closed and opened by the piston and the elongated side wall thereof, and as a rule simultaneously with or previous to the opening of the inlet port into the explosive chamber.

With an engine of the type described, the explosion is produced with reference to the compression in the explosive chamber of the explosive mixture, the explosion usually occurring at the instant of passage of the crank over the dead center on the power stroke side. The rise of the piston on the return stroke produces a rarefaction or vacuum within the crank chamber, which opens the valve 12 and sucks from the carbureter 10 the necessary explosive mixture. It will be understood that at the beginning and the ending of the return stroke of the piston the movement of the same is slowed, and the vacuum therefore caused within the chamber 15, is the slightest. In the quarter part of the return stroke of the piston the rarefaction is greatest, and it is then that the valve 12 is widest opened and the greatest suction is produced upon the carbureter and the valve therein. As a rule, this type of engine suffers from the fact that during the slow periods above referred to the valve 12 does not supply sufficient mixture to fill the chamber 15. It is to supply this shortage that the passage 28 is provided. The passage 28 opens into the chamber 15 at the upper end of the stroke of the lower edge of the piston of the engine. Any rarefaction of the mixture in the chamber 15 is thereby relieved directly through the unchecked passage 28 communicating with the carbureter 10. It will be noted that with the beginning of the power stroke the passage 28 is cut off and the imprisoned mixture within the chamber 15 is compressed by the fall of the piston, until the upper edge, or the head thereof, passes below the intake port of the engine, permitting the escape of the mixture from the chamber 15 into the explosive chamber thereof.

The supply of air through the perforations 22, 22, and 23, 24, and 25, is within the control of the operator. By the operation of valve 16 the excess suction pressure of the engine on the carbureter may be relieved by reason of the fact that the perforations 22 being open, the suction operates to draw air therethrough. It may also be stated that by the employment and manipulation of the valve 16 when constructed, arranged and disposed as shown in the drawings, the above-mentioned "carbureter troubles" are entirely and completely overcome. When an engine is equipped with a valve 16 and casing 17, the manipulation of the screw 11 is dispensed with.

In conclusion it will be understood that if the carbureter be set to give the correct mixture of air and gasolene when the engine is operating at the first or lowest speed, the proper mixture will be continuously maintained at the higher and maximum rates of speed. The usual practice is to set the needle valve of a carbureter to give the proper mixture for the normal speed. In most carbureters it is impossible without difficulty, to vary the supply of gasolene through the needle valve. As the result of this action, the proper mixture of gasolene and air in the explosive fuel is not supplied at either the maximum or minimum speeds of the engine. The usual result is that the mixture becomes at the low speeds so thin or poor in gasolene as to "misfire", while at the high speeds the increment of suction produced by the more rapid action of the piston draws a non-calculable amount of gasolene past the needle valve and over-enriches the fuel or floods the engine. It will be understood that the perforations 23, 24 and 25 formed in the valve casing, are calculated to add to the fuel mixture, the necessary air, to maintain the proportions of air and gasolene in the fuel at higher rates of speed of the engine. Thus, as the valve 16 is rotated to a more fully opened position, the number and size of the perforations 23, 24 and 25 are increased to admit air within said valve. The perforations are shaped to form passages proportionate to the excess of gasolene drawn by the higher speeds of the engine piston and are calculated to maintain constant the mixture during the various speeds of the engine.

In the modified form shown in Fig. 5, a pipe casing 29 is employed, and in the said casing is formed the equivalent of the cylindrical bore provided in the casing 17 for the valve 16. This form may be used in either the two-cycle or in the four-cycle type of engine.

It will be understood that the valve 16 operates in the double capacity of a throttle valve and an enriching valve, that is to say, by means of the perforations 22 and the elongated slots 23, 24 and 25, the atmospheric air admitted for mixing with the explosive fuel, is controlled, being limited or increased as and simultaneously with the opening of the passage 28 and the passage 13.

It will be understood that when the handle 20 is moved so that the perforations 22 are moved past the end of the slots 25, the wall of the cylindrical valve 16 has closed the passage 28, while the portion of the wall which, in the full opened position of the valve extends between the passage 28 and the passage 13, has been moved over the passage 13 to nearly close the same. In this position the engine, when running at slow speed, is taking the richest fuel direct from the valve 10, but in a diminished quantity. It is well understood that as the engine increases in speed the suction is likewise increased, and if not otherwise provided for, the increased suction would draw an excess supply from the carbureter 10. It is to relieve this suction pressure on the carbureter and to reduce the richness of the gas that the valve 16 is provided. This is accomplished by the operator gradually opening the valve by means of the handle 20 as the engine gathers speed. It will also be understood that as the valve 16 is rotated, the passage from the pipe 18 to the pipe 13 is increased in proportion as the passage from the valve 16 to the passage 28 is increased, and also it will be understood that as the inlet of the two passages is thus increased, the supply of atmospheric air through the perforations 22 is proportionally increased.

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

1. An internal combustion engine embodying a cylinder having an explosion chamber; an intake port for said chamber; a cylindrical piston having elongated walls

adapted to close and open said intake port and to operate as a compressor; a crank case forming a compression chamber in conjunction with said piston, said compression chamber being in open communication with said explosion chamber through said intake port; a carbureter; a housing interposed between said carbureter and said compression chamber, said housing having a fuel delivery passage connecting said compression chamber and said carbureter; a spring seated valve disposed in said fuel delivery passage; a valve chamber formed in said housing having an air passage communicating with the surrounding atmosphere, said chamber having an auxiliary passage connecting said valve chamber and said compression chamber, said passage entering said compression chamber near the limit of the return stroke of said piston to be uncovered thereby at approximately the end of the return stroke of the said piston; and a manually operated valve mounted in said valve chamber, said valve having a plurality of closure members to control the admission of air to said chamber.

2. An internal combustion engine comprising a crank shaft, a cylinder having an explosion chamber; a cylindrical piston therein; a piston rod pivotally connected to a crank shaft; a crank casing for said shaft and piston rod adapted to form a compression chamber; a delivery duct connecting said compression chamber and cylinder having unrestricted delivery opening adapted to be closed by said piston; a fuel intake duct opening into said compression chamber below the path of said piston; an auxiliary duct opening into said compression chamber below the said piston when the same is at the limit of its inward stroke; a carbureter; a valve chamber interposed between and in communication with said fuel intake duct, said auxiliary duct, and said carbureter, said valve chamber having ports in communication with the surrounding atmosphere; and a valve mounted in said valve chamber arranged to control the opening into the said valve chamber of said fuel intake duct, said auxiliary duct and said ports opening to the atmosphere.

3. An internal combustion engine comprising a crank shaft, a cylinder having an explosion chamber; a cylindrical piston therein; a piston rod pivotally connected to a crank shaft; a crank casing for said shaft and piston rod adapted to form a compression chamber; a delivery duct connecting said compression chamber and cylinder having unrestricted delivery opening adapted to be closed by said piston; a fuel intake duct opening into said compression chamber below the path of said piston; an auxiliary duct opening into said compression chamber below the said piston when the same is at the limit of its inward stroke; a carbureter; a valve chamber interposed between and in communication with said fuel intake duct, said auxiliary duct and said carbureter, said valve chamber having ports in communication with the surrounding atmosphere; and a rotary valve manually operable in said valve chamber, said valve being adjustable to open said ducts and ports to maintain constant the mixture of the explosive fuel supply.

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

JOHN SAUER.

Witnesses:
Wm. A. Fluhr,
Max E. Brunke.