H. J. GEAKE.

AUXILIARY EXHAUST PORT.

APPLICATION FILED JULY 8, 1919.

1,394,411. Patented Oct. 18, 1921.

Fig. 1

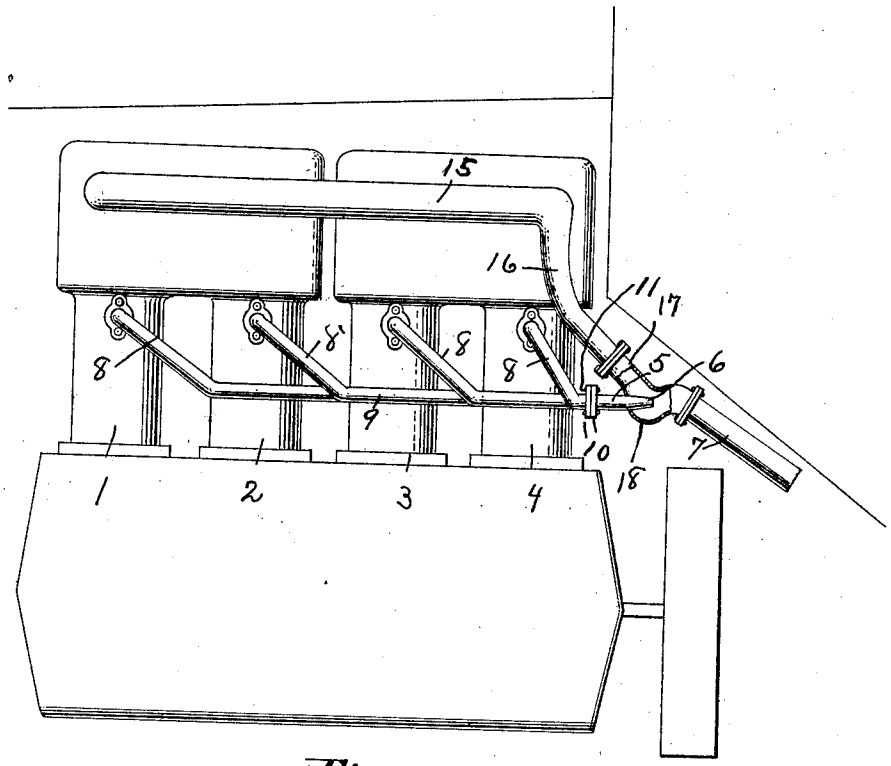


Fig. 2

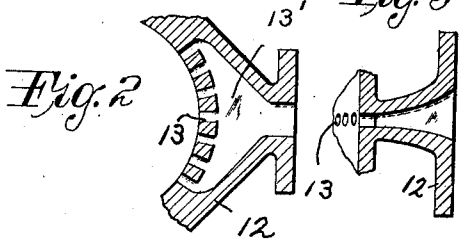


Fig. 3

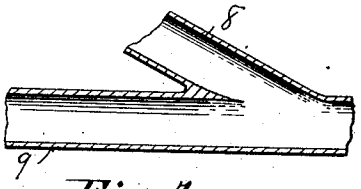


Fig. 4

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AUXILIARY EXHAUST-PORT.

1,394,411. Specification of Letters Patent. Patented Oct. 18, 1921.

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To all whom it may concern:

Be it known that I, HARRY J. GEAKE, a subject of the King of England, residing at Victoria, B. C., Canada, have invented certain new and useful Improvements in Auxiliary Exhaust-Ports; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in gas engines, and especially in the provision of an auxiliary exhaust port acting in conjunction with an exhaust gas ejector fitment.

The invention consists in the locating of an auxiliary exhaust port and timed as to actuation, so that it may be opened approximately 150 degrees of a sector of a circle, a sector equaling 180 degrees, or one-half of a circle, and representing one-half of one revolution of a crank shaft of a four stroke cycle, multi-cylinder engine, the 180 degree sector representing also the travel of the crank from dead center to dead center through one stroke of the piston.

Heretofore, in standard practice, the total volume of the exhaust gases have been discharged into a single common manifold known as the exhaust gas header. With this arrangement, when a piston has completed the power stroke to a point where the exhaust valve of the firing cylinder opens to and communicates with the gas header, the waste gases of combustion will have a pressure of substantially 40 lbs. to the square inch. Hence, on the down stroke of the piston in the first cylinder, piston in the second cylinder will be on the up exhaust stroke, and it will be readily seen that under these conditions there will be a back pressure in the common exhaust header against which the second cylinder is now exhausting its burnt gases, will be held up and create a condition of pressures which are adverse to the free scavengering action necessary for the complete evacuation of the burnt gas contents of the second cylinder. This condition will have the direct effect of lessening the scavengering efficiency per stroke per cylinder, with a resultant decrease in the volumetric capacity available for the reception of the fresh gas charge, caused by the incomplete evacuation of the gases from the cylinder which is exhausting its burnt gases, hence the consequent decrease of the maximum power output.

The present invention has for its purpose the object to overcome these adverse conditions and render more efficient internal combustion engines.

The invention comprises various details of construction, combination and arrangement of parts which will be hereinafter fully described, shown in the accompanying drawings and then specifically defined in the appended claims.

I illustrate my invention in the accompanying drawings which, with the numerals of reference marked thereon, form a part of this application, and in which:

Figure 1 is an elevation showing the application of my invention, and

Figs. 2 to 4 are enlarged detail sectional views of parts of the apparatus.

Reference now being had to the details of the drawings by numerals:

1, 2, 3, and 4 designate respectively the cylinders of four engines, and 15 designates a standard exhaust header, adapted to communicate with the exhaust ports of the several cylinders, and leading from said exhaust header is a pipe 16 suitably coupled to a shell 17 and which in turn is connected to a pipe 7 comprising the main exhaust to a muffler (not shown). Said shell, it will be noted, has a dished or chambered portion, the wall of which is perforated to receive the nozzle 5 which in turn is connected to the pipe 9 through the medium of the flanges 10. Said pipe 9 has branches 8 leading therefrom and comprise the auxiliary means whereby exhaust passes from the cylinders after the piston has made a partial stroke to the auxiliary header or pipe 9.

Upon reference to Figs. 2 and 3 will be seen detail views of the exhaust port outlet provided with a series of perforations 13 leading through the chambered portion 13′ previous to making exit to the auxiliary exhaust header.

To demonstrate the principle and action, and assuming the four cylinder engine is equipped with my improved apparatus, the firing order of the cylinders will be 1, 3, 4 and 2, cylinder #1 firing and making the power stroke through the 180 degree sector of the circle representing the crank travel

through one stroke of the piston. The auxiliary exhaust port opening at 150 degrees of stroke being represented by the 180 degree sector.

At the specified point at the opening of the auxiliary exhaust port, the gases of the exploded charge are approximately 40–50 lbs. per square inch pressure, which is a much higher pressure than at a later stage of the exhaust conditions, when the cylinder is nearly scavenged of its burnt gases. Advantage is taken of the higher gas pressures at the point of initial release through the auxiliary exhaust port, caused by the opening of the latter. The exhaust gases which are discharged through the auxiliary port pass through the auxiliary exhaust header to the gas ejector fitment. This portion of the volume of the exhaust gases which are released by opening of the auxiliary exhaust port at the then higher pressure than the final terminal exhaust pressure, is used in the ejector fitment to create a partial vacuum in that branch of the main exhaust pipe that is joined to and communicates with said gas ejector fitment at one end and the standard exhaust gas header at the other end. By and due to this partial vacuum, created in the main exhaust gas header, the cylinder (#2 in the present instance) that is exhausting into and through the gas header has the specified high back pressure (due to the common exhausting condition as previously detailed) removed, and an inductive effect (due to the action of said exhaust gas ejector fitment creating a partial vacuum in the standard exhaust gas header) is exerted upon the gases which are being exhausted from that cylinder, the piston of which is then at the exhaust stroke of its cycle at the same period of time that the piston which is at the suction stroke of its cycle (in this particular case the piston in cylinder 4) when said piston comes down to a position whereby the auxiliary exhaust port opens, communication will be established between the auxiliary exhaust header of this cylinder (#4) and an inductive induced suction effect will be exerted in cylinder 4. The function of said inductive suction is to overcome to a large extent the inertia of the fresh gas charge, due to the frictional resistance, and to this fact also; piston #4 is now nearing the end of its downward (suction) stroke, and thus in that position whereby the suction effect in cylinder 4 is practically at its minimum.

This arrangement makes provision for, and provides a method whereby the full volumeteric cubical capacity of the cylinder is thus rendered available for the reception of the explosive mixture, when the same is inducted into the cylinder during the stroke designated as the suction stroke, instead of as heretofore having but a portion of its volumetric cubical capacity available for the reception of the fresh gas charge. This, as before specified, is due to the gas inertia, frictional resistance to the flow of gases and decreased suction effect toward the end of the stroke and high back pressure in the common (standard) exhaust header, reducing the emission of the exhausting burnt gas.

Upon the external circumferential surface of the lower section of the cylinder, in conjunction with a flange, a nozzle is superimposed, said nozzle being in direct communication with the internal bore of the cylinder by a series of ports passing through the walls of the cylinder, as noted. The port thus formed (the axis of the latter being at an angle of 45 degrees to the center line of the cylinder) is so situated that only at that portion of the piston's travel on the downward stroke, when the pistion is nearing the completion of said stroke, is communication established between the auxiliary exhaust port and the internal bore of said cylinder, by the piston which is traveling downward in said cylinder coming to that position whereby the auxiliary exhaust port is uncovered, thence to and through the auxiliary exhaust gas header to the exhaust gas ejector firment.

It will be noted that the auxiliary gas header has a series of contractions situated at its base adjacent to the point of connection with the gas header. The function of these contractions is to provide a series of nozzles whereby, due to the velocity flow of that volume of high pressure of exhaust gas released from the cylinder, piston of which is on the down or firing stroke, and which piston has descended to a point where the auxiliary exhaust port is uncovered and communication established between the firing cylinder and the auxiliary exhaust gas header, creating an ejector effect at the base of the auxiliary exhaust pipes other than that pipe which, at that specific time, is being used as the auxiliary exhaust pipe from that cylinder whose piston is on the down firing stroke of its cycle.

This ejector action at the base of the auxiliary exhaust pipes exerts an inductive effect upon the contents of that cylinder whose stroke is at that portion of its cycle known as the suction stroke, and which has thus established communication with the auxiliary exhaust gas header through its auxiliary exhaust port by its piston uncovering the said auxiliary port, as herebefore described.

The inductive effect thus created within the cylinder now at its suction stroke, occurs, and is applied at that time when the piston of said cylinder is approaching its lowest limit of travel and the suction pull of which is practically at its minimum effect.

This inductive effect, due to the suction pull, provides an additional means whereby a strong suction effect or pull is exerted and maintained in this cylinder at that point when heretofore the suction effect has been practically *nil*.

This additional suction effect thus applied at the lower end of a stroke furnishes and applies a means whereby, acting through induction, provisions are thus made and applied to overcome the inertia of the fresh gas charge, and by and due to the above specified actions, the full available volumetric cubical capacity of said cylinder is thus filled with the fresh gas charge, thereby providing a means for obtaining the maximum horse power output per cylinder.

Heretofore, due to the aforesaid conditions of gas inertia, and weak suction pull toward the end of the suction stroke, only a partial filling of the total available volumetric cubical capacity of the cylinder was accomplished, with the resultant cutting down of the available horse power output per cylinder.

This condition is more marked at the higher speeds of said internal combustion engine when the frictional resistance to the flow of gases, and the inertia factor, relative to the admission, is more pronounced. The volume of high pressure exhaust gas released through the auxiliary exhaust port after passing through the auxiliary exhaust gas header and creating the conditions before described, is finally discharged into said exhaust gas ejector fitment, where the discharge end of said auxiliary exhaust gas header terminates.

Said ejector fitment is so designed, it will be noted, that by and due to the discharge of the volume of high pressure exhaust through the nozzle, a powerful ejector action is created in the fitment. This ejector action creates a strong and partial vacuum or suction pull in the main exhaust gas header and in that portion of the main exhaust gas ejector fitment, in which said fitment that branch of the main exhaust pipe terminates.

The function of this suction pull is as follows: To provide a means whereby a complete scavengering of the contents of that cylinder whose piston is now nearing the completion of its upper exhaust stroke is accomplished. Owing to the fact that at this initial point of release of the exhaust gases being at a pressure of 40–50 lbs. per square inch, it will be readily observed that the initial discharge of the exhaust gases will take place through the auxiliary exhaust port, instead of being discharged wholly to the standard exhaust header, as heretofore from the cylinder, the piston of which is on its up travel of the exhaust stroke of its cycle, simultaneously with the exhaust from that cylinder, whose piston has just reached the limit of its down firing stroke. The effect of this high back pressure in the standard exhaust header is to retard the evacuation of the burning gases which are now being discharged from the cylinder whose piston is on the up travel of the exhaust stroke of its cycle.

What I claim to be new is:

1. The combination with an internal combustion engine embodying a plurality of cylinders, pistons, a main exhaust header and means to exhaust into the header at predetermined points successively in the cycle of operation, of an auxiliary header arranged as a blower in relation to the main header, and means to exhaust from one cylinder into the auxiliary header at a point in the cycle coinciding with the first mentioned exhaust from another cylinder.

2. The combination with an internal combustion engine embodying a plurality of cylinders, pistons, a main exhaust header and means to exhaust into the header at predetermined points successively in the cycle of operation, of a fitment introduced into the exhaust line from the main header, a nozzle introduced into the fitment, an auxiliary exhaust header communicating with the nozzle, and means to exhaust from one cylinder into the auxiliary header at a point in the cycle coinciding with the first mentioned exhaust from another cylinder.

3. The combination with an internal combustion engine embodying a plurality of cylinders, pistons, a main exhaust header and means to exhaust into the header at predetermined points successively in the cycle of operation, of a fitment introduced into the exhaust line, comprising an enlarged chamber having a concaved lower wall, a nozzle introduced into the fitment directed above the concave wall and approximately in line with the exhaust travel, an auxiliary header communicating with the nozzle, and means to exhaust from one cylinder into the auxiliary header at a point in the cycle coinciding with the first mentioned exhaust from another cylinder.

In testimony whereof I hereunto affix my signature.

HARRY JAMES GEAKE.