Nov. 3, 1925. 1,559,595

A. A. WEST

ENGINE AND PISTON

Filed Aug. 21, 1923 2 Sheets-Sheet 1

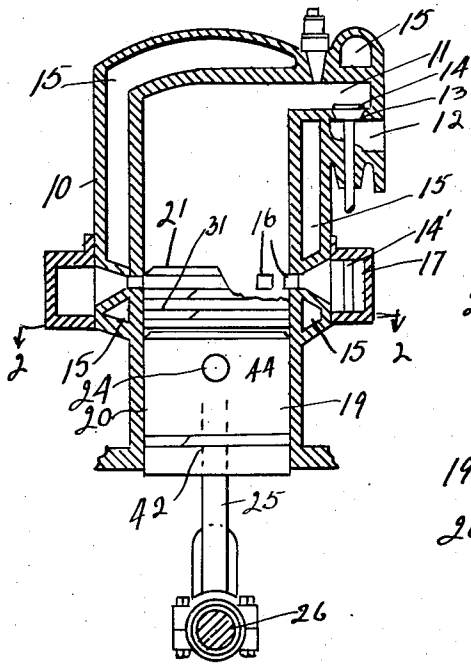


Fig. 1.

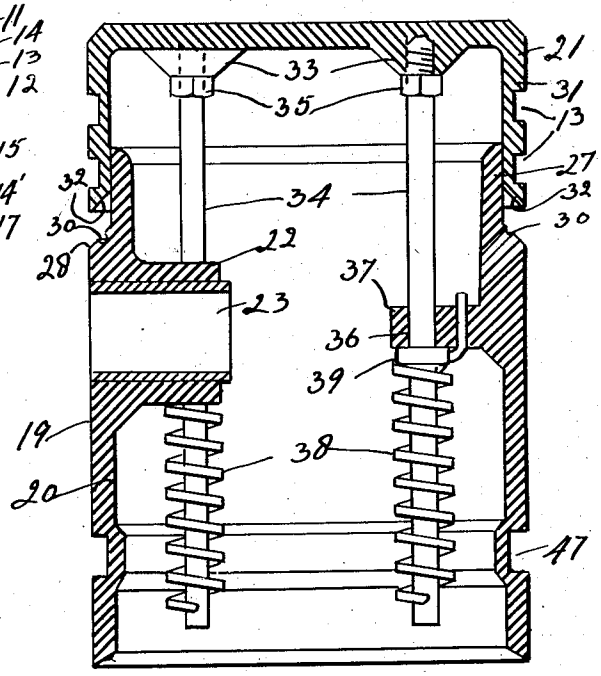


Fig. 3

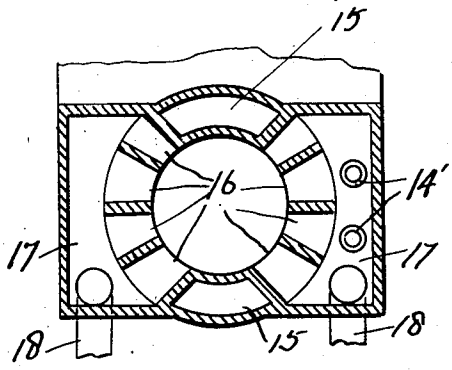


Fig. 2

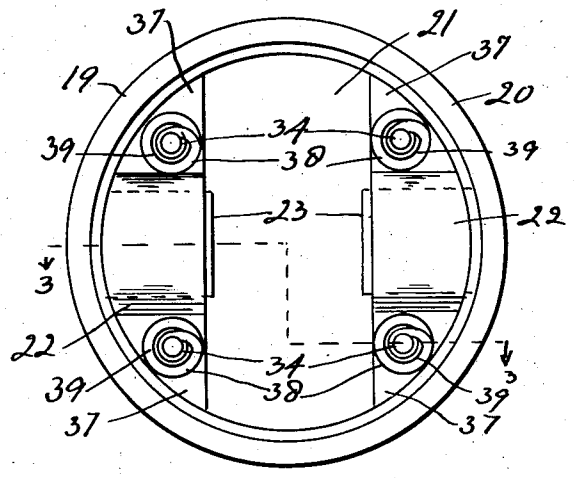


Fig. 4

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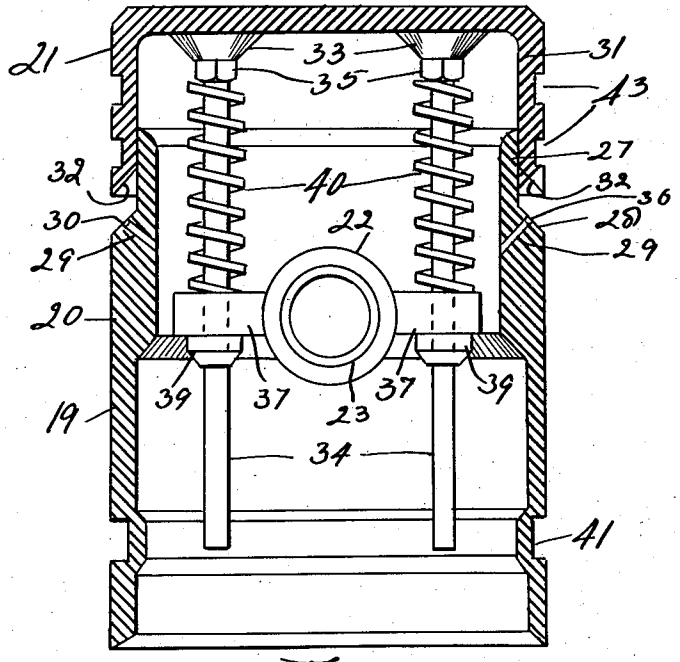


Fig. 5

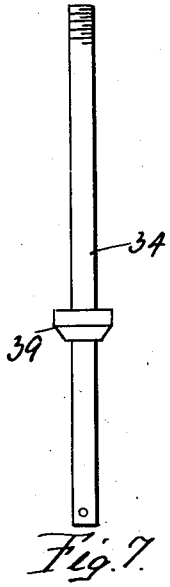


Fig. 7.

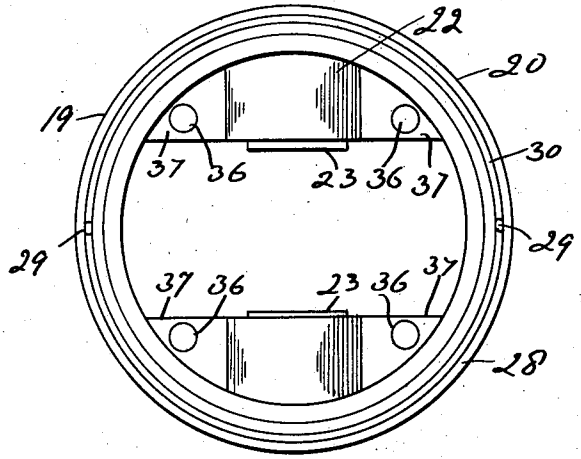


Fig. 6.

INVENTOR

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Patented Nov. 3, 1925. 1,559,595

UNITED STATES PATENT OFFICE.

AUGUSTUS ALBERT WEST, OF PHILADELPHIA, PENNSYLVANIA.

ENGINE AND PISTON.

Application filed August 21, 1923. Serial No. 658,527.

To all whom it may concern:

Be it known that I, AUGUSTUS ALBERT WEST, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented new and useful Improvements in an Engine and Piston, of which the following is a specification.

My invention relates to new and useful improvements in an engine and piston therefor, and has for its primary object the provision of an exhaust normally closed by the piston which will be opened at the end of only the "working" stroke of the piston. The present invention is an improvement on the invention shown and described in my application bearing Serial Number 636,472, filed May 3rd, 1923.

Another object of my invention is to provide a supplementary exhaust for engines which is particularly adapted for use in internal combustion engines although not limited thereto. In the conventional four-cycle internal combustion engine, the supplementary exhaust is located in the region of the position of a piston when at the bottom of its stroke and is made use of in connection with the usual exhaust located in the region of the position of the piston when at the top of its stroke.

A further object of this invention is to so construct the piston that the head thereof will have two different distances of travel in order that the exhaust, located in the region of the position of the piston when at the end of its "working" stroke, will be closed at all times except during the exhaust period coincident to the ending of said "working" stroke.

A still further object of my invention is to construct a piston of two parts, one telescoping over the other, and provided with means to normally hold them in extended condition.

The advantages of my invention include a more complete scavenge of the cylinder which tends to reduce the heat in the engine, it produces a less noisy exhaust, which may eliminate the muffler on explosive engines, thus relieving the back pressure attendant to the use of the muffler, hence improving the power factor from the usual amount of fuel resulting in a saving thereof. The lessened exhaust noise is most desirable in the operation of internal combustion engines and particularly when used in aeroplanes and motor boats.

I accomplish the above mentioned objects by providing an exhaust, preferably comprising a plurality of ports, in the engine cylinder below the normal lowest point of travel of the piston head so that on the intake stroke the piston covers this exhaust, but the pressure on the piston, due to the explosion, causes the head to telescope on the piston skirt and therefore travel a greater distance than when descending on the intake stroke. Thus, on the explosion stroke, the piston head travels below the exhaust allowing the dissipated motive fluid, such as burned gases, or a portion thereof, to escape from the cylinder through the uncovered exhaust. When used in connection with the usual exhaust at the top of the cylinder the latter is opened at substantially the same time.

My invention effects an abundant exhaust as the supplementary exhaust ports are opened at approximateely thirty degrees before dead center and closed approximately thirty degrees beyond dead center. During the same time the usual upper exhaust is open and so remains for a period of about two hundred and thirty degrees to which my supplementary exhaust adds the equivalent of a sixty degrees period in scavenged effect, approximating a total of two hundred and ninety two degrees of exhaust period of a possible three hundred and sixty degrees. Thus my invention gives an additional exhaust benefit of approximately twenty-five per cent over the usual or ordinary exhaust.

A further advantage is the cushioned effect, due to the spring tension, at the top of the piston travel which softens the blow of the explosion. This beneficial cushion effect is analogous to the action in reciprocating steam engines where a small amount of steam is purposely retained in the cylinder at the end of the steam exhaust stroke. In my device this cushion effect tends to lessen jar and "pounding" on the moving parts which should lengthen the life of the engine.

An important feature of the two piece

piston is the communication between the interior and exterior thereof which permits any excess lubricant climbing the cylinder walls to pass into the piston thus preventing it reaching the firing chamber where it might foul the spark plug or get under the poppet valves and prevent their proper operation. Some carbon, the absolute prevention of which seems impossible, will also pass through the communication between the interior and exterior of the piston so that the tendency will be to lessen the carbon deposit in the cylinder and thus add to the efficiency of the engine.

A further feature of the preferred construction contemplates the location of the springs some distance from the piston head so that the heat will have little, if any, effect on the temper or tension thereof and said springs will be cooled by the lubricant in the engine crank case which is splashed into the piston.

With these ends in view, this invention consists in the details of construction and combination of elements hereinafter set forth and then specifically designated by the claims.

In order that those skilled in the art to which this invention appertains, may understand how to make and use the same, I will describe its construction in detail, referring by numerals to the accompanying drawings forming a part of this application, in which:—

Fig. 1, is a fragmentary transverse sectional elevation of an engine embodying my invention.

Fig. 2, is a section at the line 2—2 of Fig. 1 with the piston removed.

Fig. 3, is an enlarged vertical section of the piston per se at approximately the line 3—3 of Fig. 4.

Fig. 4, is a bottom plan view of said piston.

Fig. 5, is a vertical section of the piston at right angles to the showing in Fig. 3, illustrating the springs differently located.

Fig. 6, is an end or top plan view of the piston skirt.

Fig. 7, is a side elevation of one of the rods.

In carrying out my invention as here embodied, 10 represents a cylinder of the conventional four-cycle type having a passageway 11 communicating with the firing chamber and with the exhaust chamber 12 through the exhaust port 13 controlled by the usual valve 14. The compartments designated by the numeral 15 are portions of the usual passageways for the cooling fluid such as water.

In the lower part of the cylinder, and more particularly in the region of the lowermost position assumed by the piston, is formed an exhaust which for convenience of differentiating from the usual upper exhaust will be termed the supplementary exhaust and this is herein illustrated as comprising a plurality of exhaust ports 16 suitably spaced about the cylinder and preferably arranged in two diametrically opposite sets, said ports forming communications between the lower part of the interior of the cylinder and supplementary exhaust chambers 17 from which lead exhaust pipes 18. Although the description of the construction and operation of my device will include the two exhausts I wish it understood that I do not bind myself to the use of the usual upper exhaust.

In one of the supplementary exhaust chambers 17 are mounted the tubes 14′ for the passage of the valve stems.

In the cylinder is reciprocatingly mounted my improved piston 19 comprising principally two sections 20 and 21 telescopingly mounted one on the other whereby one may slide relative to the other. The section 20 is the skirt and the section 21 the head.

The skirt 20 is of tubular formation open at both ends and is provided with the usual wrist pin bearings 22 holding the bushings 23 in which set the ends of the wrist pin 24 having one end of a connecting rod 25 attached thereto with the other and of said connecting rod joined to the crank shaft 26.

At the upper end of the skirt is formed the reduced waist 27 providing an exterior shoulder 28 which is preferably inclined as shown and from this shoulder lead any number of inclined ducts 29 constituting communications between the interior and exterior of the piston and the upper outer ends of all these ducts 29 preferably enter an annular channel 30 produced in the shoulder 28.

On the reduced waist 27 of the piston skirt is telescopically mounted the petticoat 31 of the piston head 21 so that the latter may slide relative to the piston skirt and the lower edge of the petticoat is preferably beveled as at 32 to correspond with the inclined shoulder 28 with which it coacts to limit the inward or collapsing movement of the head.

Into bosses 33 on the inner face of the end wall of the piston head or into the end wall itself when of sufficient thickness, are threaded the rods 34 which may be held in place by lock nuts 35. Although I do not wish to be limited to any specific number of rods I deem it best to use four and these pass through holes 36 in the webs 37 formed as an integral part of the piston skirt and preferably also integral with the wrist pin bearings. By forming the webs as above stated they strengthen or brace the wrist pin bearings and add rigidity to the piston skirt which will assist in holding it to its true circular contour. The rods while primarily acting as guides both for the piston head

and springs the latter to be directly described, also assist in radiating the heat from the piston head.

To the lower free end of each rod is attached one end of a spring 38 which is coiled about the rod and has its other end attached to a web 37, Fig. 3, so as to normally extend the piston or force the head away from the skirt but this extending movement is limited by the stops 39 carried by the rods, the same being formed integral with the rods or as separate pieces and attached to the rods in any well known manner. The movement of the head relative to the skirt may be varied by screwing the rods more or less into the bosses as will be obvious.

The above arrangement and location of the springs separates them from the piston head a sufficient distance to be little effected by the heat and permits them to be cooled by the splash system of lubrication but if found desirable or advisable springs 40, Fig. 5, may be coiled about the upper ends of the rods so as to rest on the webs and press against the piston head. Also a combination of these two arrangements might be made if greater tension should be desired.

The skirt is provided with a groove 41 for a piston ring 42 and the piston head likewise is provided with grooves 43 for piston rings 44.

In practice as the piston descends during the suction stroke the exhaust ports 16 are covered by petticoat forming a part of the head so that none of the motive fluid is lost, but on the firing or "working" stroke the head will be telescoped or collapsed on the skirt, against the action of the springs, due to the pressure generated by the motive fluid, sufficiently to open the supplementary exhaust ports 16 and permit the escape of the bulk of the dissipated motive fluid while the balance will be forced out of the usual upper exhaust thus more completely scavenging the cylinder.

As the lubricant travels up the sides of the cylinder walls it will reach the space between the shoulder 28 on the skirt and coacting edge 32 of the head and any excess will be forced, by the action of the two parts of the piston, around the channel 30 and through the ducts 29 into the interior of the piston carrying with it any loose particles of carbon thereby tending to reduce deposits thereof.

Of course, I do not wish to be limited to the exact details of construction as herein shown as these may be varied within the limits of the appended claims without departing from the spirit of my invention.

Having thus fully described my invention, what I claim as new and useful is:—

1. In an engine, a cylinder provided with the usual and a supplemental exhaust, a piston having a head movable relative to the skirt, said head having a greater travel distance on the working stroke due to pressure of the motive fluid to uncover the supplemental exhaust at the end of said working stroke.

2. A piston consisting of a head for coaction with the walls of an engine cylinder, a skirt for coaction with the walls of an engine cylinder and springs to normally force one from the other.

3. An engine piston including a skirt, a head telescopically mounted thereon and means to normally hold the head in extended relation.

4. An engine piston including a skirt, a head telescopically mounted thereon, rods carried by the head, webs in the skirt through which the rods pass, and springs coacting with the rods and webs to hold the head extended relative to the skirt.

5. An engine piston including a skirt, a head telescopically mounted thereon, rods carried by the head, webs in the skirt through which the rods pass, and springs coacting with the webs and piston head to normally hold the latter in extended position.

6. As an article of manufacture, a piston including a skirt having a reduced waist and provided with a shoulder at the lower end of the waist, a head telescopically mounted on said waist and having its movement in one direction limited by said shoulder, and means to normally force the head away from said shoulder.

7. As an article of manufacture, a piston including a skirt having a reduced waist and provided with a shoulder at the lower end of the waist, a head telescopically mounted on said waist and having its movement in one direction limited by said shoulder, rods adjustably connected with the head, webs formed integral with the skirt inside thereof and through which said rods pass, and springs coiled about the lower ends of said rods and attached to the webs and rods to normally force the head away from the shoulder.

8. As an article of manufacture, an engine piston including a skirt having a reduced waist and provided with an inclined shoulder at the lower end of said waist, a head telescopically mounted on the waist and provided with a beveled lower edge coinciding with the inclined shoulder, the movement of said head in one direction being limited by contact of the beveled edge with the inclined shoulder and springs to normally force the head away from the shoulder.

9. As an article of manufacture, an engine piston including a skirt having a reduced waist and provided with an inclined shoulder at the lower end of said waist, said skirt having ducts therethrough leading

from the inclined faces of the shoulder to the interior of the skirt, a head telescopically mounted on the waist and provided with a petticoat, the lower edge of which coacts with the shoulder to limit the movement of the head in one direction and means to force the head away from the shoulder.

10. As an article of manufacture, an engine pston including a skirt having a reduced waist and provided with an inclined shoulder at the lower end of said waist, said skirt having ducts therethrough leading from the inclined faces of the shoulder to the interior of the skirt, and said shoulder having a channel therein communicating with the ducts, a head provided with a petticoat telescopically mounted on the waist, the lower edge of the petticoat being beveled to coincide with the inclined shoulder with which it coacts to limit the movement of the head in one direction, rods carried by the head and projecting into the skirt, webs formed integral with the skirt and having holes through which said rods pass, means on said rods to limit the movement of the head in the other direction and springs attached to the rods and webs to normally force the head outward.

11. An engine piston including a skirt having a reduced upper end and provided with communications between the interior and exterior thereof in the region of the point of connection of the skirt proper with its reduced portion, a head slidably mounted on the reduced end of the skirt and means to normally force said head outward.

12. An engine piston including a skirt having a reduced waist at the upper end providing an exterior shoulder, wrist pin bearings formed inside of the skirt, webs formed integral with bearings and skirt, said webs having holes therethrough, a head provided with a petticoat slidably mounted on the waist, the lower edge of said petticoat coacting with the shoulder to limit the inward movement of the head, rods having threaded connection with the head and passing through the holes in the webs, means to hold the rods in any adjusted position, means on said rods to limit the outward movement of the head and spring attached to the webs and rods for normally forcing the head outward.

13. The combination with an engine including a cylinder provided with the usual exhaust and a supplementary exhaust, of a piston consisting of a skirt having a reduced waist, an exterior shoulder, bearings and webs formed integral with said bearings and the skirt, said webs having holes therethrough, a head provided with a petticoat slidably mounted on the skirt, the edges of said petticoat coacting with the shoulder to limit the inward movement of the head, rods connected to the head and passing through the holes in the webs and means connected to the rods and webs for normally forcing the head outward, said piston normally covering the supplementary exhaust but the head being forced inward relative to the skirt to uncover the supplementary exhaust on the firing stroke.

14. The combination with an engine including a cylinder provided with the usual exhaust and a supplementary exhaust, of a piston consisting of a skirt having a reduced waist, an exterior inclined, shoulder with a channel formed therein from which lead ducts passing through the skirt to provide communications between the interior and exterior of the skirt, integral bearings within the skirt and integral apertured webs formed with the bearings and skirt, a head consisting of an end wall and skirt slidably mounted on the waist of the skirt, the edge of said skirt beveled to coincide with the inclined shoulder, said edge of the petticoat coacting with the shoulder to limit the inward movement of the head and acting to force excess lubricant through the ducts, rods having threaded connection with the end wall of the head and passing through the apertures in the webs, means on said rods for coaction with the webs to limit the outward movement of the head, and springs coiled about the rods below the webs and attached to said webs and the free ends of the rods to force the head outward, said piston normally covering the supplementary exhaust and the head being forced inward relative to the skirt on the firing stroke to uncover said supplementary exhaust.

15. An engine piston comprising a head for coaction with the walls of an engine cylinder, a skirt also for coaction with the engine cylinder walls, and means to normally force the head away from the skirt.

16. The combination with an engine including a cylinder, a crank shaft and a connecting rod, of a piston skirt coacting with the walls of the cylinder and connected with the connecting rod in fixed relation, a piston head associated with the skirt and also coacting with the cylinder walls, and means to normally force the head away from the skirt without affecting the relation of said skirt to the connecting rod.

In testimony whereof, I have hereunto affixed my signature.

AUGUSTUS ALBERT WEST.