Sept. 24, 1940. O. LESER ET AL 2,216,083

INTERNAL COMBUSTION ENGINE

Filed Oct. 22, 1938

Fig. 1

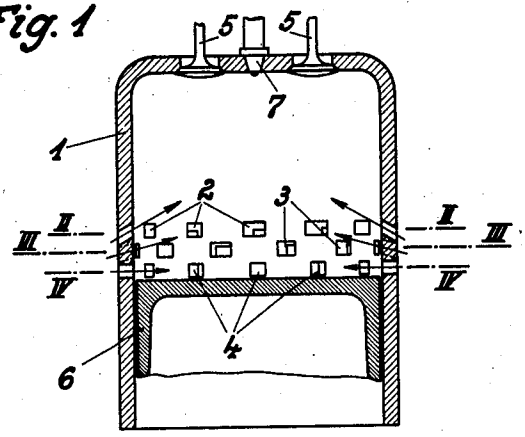


Fig. 2

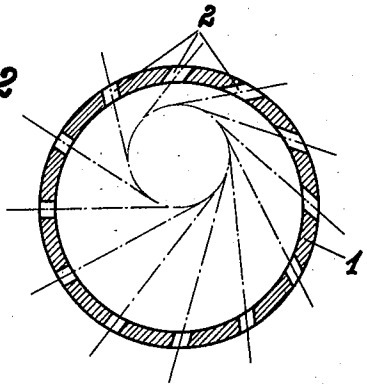


Fig. 3

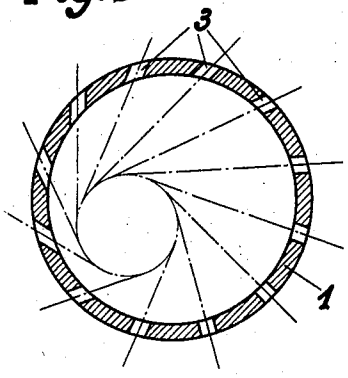
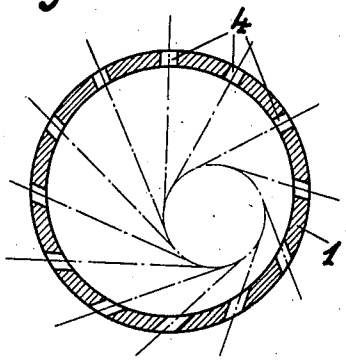


Fig. 4



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INTERNAL COMBUSTION ENGINE

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7 Claims. (Cl. 123—65)

This invention relates to two-stroke cycle combustion engines having provision for scavenging the combustion gases from the engine cylinder.

One object of the invention is the provision of a two-stroke cycle combustion engine in which the cylinder wall is provided with slots through which scavenging air is supplied when the slots are uncovered by the piston, the slots being so arranged as to cause the cylinder to be supplied with air streams that are successively tangent to a circle located eccentrically of the cylinder axis and so arranged as to effectively scavenge the exhaust gases from the cylinder.

Another object of the invention is the provision of an engine of the character mentioned in which there are a plurality of rows of annularly spaced scavenging air slots, the streams of air from one row of such slots being directed successively tangential to a circle located eccentrically of the cylinder axis while the streams of air from another row of slots are successively tangential to another circle eccentric of the cylinder axis and displaced around the cylinder axis from the first circle mentioned.

Another object of the invention is the provision of an engine of the character mentioned having a plurality of rows of scavenging air slots arranged for the supply of scavenging air streams tangential to different circles eccentric of the cylinder axis, the slots of the different rows having different inclinations with respect to a plane transverse of the cylinder axis so that the circles to which the slots of the different rows are tangentially arranged will be displaced axially of the cylinder further than the axial displacement of the rows of slots themselves.

Another object of the invention is the provision of a two-stroke cycle engine having a plurality of rows of annularly spaced scavenging air slots provided in the cylinder wall and adapted to be uncovered by the piston when near the end of its working stroke, the various slots being so arranged as to direct scavenging air streams from opposite sides of the cylinder axis cooperating to produce a number of whirling actions effective in preventing the retention of a core or cores of the exhaust gases.

Other objects and advantages of the invention will be apparent from the following description, the appended claims, and the accompanying drawing, in which:

Fig. 1 is a vertical central sectional view through the working cylinder of an engine, embodying the present invention;

Fig. 2 is a transverse section taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse section on the line 3—3 of Fig. 1; and

Fig. 4 is a transverse section on the line 4—4 of Fig. 1.

Referring more particularly to the drawing by reference numerals, 1 designates the cylinder of an internal combustion engine of the two-stroke cycle type in which the fuel is supplied through a suitable fuel inlet means such as a fuel injector nozzle 7 which may be of any suitable construction. Within the cylinder is a piston 6 which is adapted to successively uncover rows of scavenging air ports or slots 2, 3 and 4 when near the end of its working stroke. Air is supplied under pressure through these scavenging air ports and exhaust gas is exhausted through a suitable exhaust opening which, as shown, is provided in the cylinder head. Two exhaust openings are shown controlled by exhaust valves 5 which may be of the poppet or any other suitable type, automatically controlled at the proper time in the sequence of operations in the customary manner.

As will be seen from Fig. 2, the scavenging air slots 2 are arranged on all sides of the cylinder axis, being spaced annularly and so arranged that the mid lines of the slots will be tangent to a circle that is eccentric of the cylinder axis, the mid lines of the successive slots touching the eccentric circle successively so that the whirling action they create will be a cumulative one.

The row of slots 3 is axially displaced with respect to the slots 2, slots 3 being also so arranged as to supply scavenging air streams that are tangential to an eccentric circle, but this circle is displaced around the axis of the cylinder with respect to the tangent circle illustrated in Fig. 2.

The row of slots 4 which are last uncovered by the piston are so arranged that the mid lines of the slots are tangential to a circle lying eccentrically of the cylinder axis as will be seen from Fig. 4, and from Figs. 2, 3 and 4 it will be noted that the whirling action produced by the different rows of slots will be centered at different points that are regularly spaced around the cylinder. Where there are three rows of slots, as in accordance with the construction shown, the displacement of the circles to which the scavenging air streams are eccentric will be 120°. Thus any core of exhaust gas that tends to remain in the cylinder within any circulating and upwardly spiraling air stream will be effectively scavenged, as a number of spirally ascending scavenging cir-

culating streams are produced, corresponding to the number of rows of slots, all the streams circulating in the same general direction of rotation but being focused about different points.

The slots 4 which are last uncovered by the piston, as will be seen from Fig. 1, provide scavenging air streams that are directed substantially parallel with the top of the piston and have a cooling effect on the piston. The streams coming from the slots 3 are directed angularly towards the cylinder head so that the circle to which the streams coming from these slots is tangent will be axially disposed from the tangent circle illustrated in Fig. 4 at a considerably greater distance than the spacing between the rows of slots 3 and 4. The slots 2 have their mid lines inclined upwardly towards the cylinder head at still a greater angle so that the circle to which the slots 2 direct their streams will be considerably displaced in a direction axially of the cylinder.

As will now be apparent, the several whirling actions focused at several different points will effectively remove all of the burned gases and will not permit a core of exhaust gas to remain as might be the case if a single row of slots were provided to give a circulating effect around the cylinder axis. The scavenging action produced in accordance with the present invention is obtained without having the several whirling actions produce objectionable disturbance contrary to the general circulating movement, as the whirling action produced by one row of slots does not interfere substantially with the whirling action produced by the next series of slots, the result being that as the burned gases are carried upwardly towards the head of the cylinder and any small cores of exhaust gases that might tend to remain in the midst of any ascending air stream will be carried along by the circulating action of the other streams.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening adjacent one end of the cylinder and having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke and remote from the exhaust opening adjacent the other end of the cylinder, the slots of each row having their middle lines so arranged as to cause air streams to be directed from all sides of the cylinder axis and into the cylinder substantially tangential to a circle of substantial diameter located eccentrically of the cylinder axis the circles corresponding to the different rows of slots being displaced annularly from one another around the cylinder axis with each circle arranged entirely at a side of the cylinder axis.

2. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening and having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke, the slots of one row having their middle lines so arranged as to be successively tangential to a circle located eccentrically of the cylinder axis to create a whirl in one direction and the slots of another row having their middle lines so arranged as to be successively tangential to another circle located eccentrically of the cylinder axis and displaced from the first circle around the cylinder axis to create a whirl in the same direction as the whirl created by the slots of the first row.

3. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening in the cylinder head and having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke, the rows of slots being displaced axially of the cylinder, the middle lines of the slots of each row being arranged successively tangent to a circle located eccentrically of the cylinder axis and the eccentrically located circles for successive rows of slots being successively disposed about the axis of the cylinder, the slots of the different rows creating whirls having the same direction of rotation.

4. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening in the cylinder head, means operable to close said opening, said cylinder having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke, the rows of slots being displaced axially of the cylinder, the middle lines of the slots of each row having a substantially even spacing apart and being arranged successively tangent to a circle located eccentrically of the cylinder axis, with the slots of successive rows creating whirls in the same direction of rotation and the eccentrically located circles for successive rows of slots being successively disposed at regular intervals about the axis of the cylinder and in axially spaced planes.

5. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening and having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke, the rows of slots being displaced axially of the cylinder, the middle lines of the slots of each row being arranged successively tangent to a circle located eccentrically of the cylinder axis and the eccentrically located circles for successive rows of slots being successively disposed about the axis of the cylinder, the middle lines of the slots of the successive rows being inclined at different angles to a transverse plane through the cylinder so that the distance between the eccentrically located circles measured axially of the cylinder is greater than the distance between the successive rows of slots.

6. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust opening and having a plurality of rows of annularly spaced scavenging air slots in the cylinder wall adapted to be uncovered by the piston when near the end of its working stroke, the rows of slots being displaced axially of the cylinder, the middle lines of the slots of each row being arranged successively tangent to a circle located eccentrically of the cylinder axis and the eccentrically located circles for successive rows of slots being successively disposed about the axis of the cylinder, the middle lines of the slots of the successive rows being inclined at different angles to a transverse plane through the cyl-

inder so that the distance between the eccentrically located circles measured axially of the cylinder is greater than the distance between the successive rows of slots, the slots of the row last uncovered by the piston being arranged to direct their air streams substantially parallel to the top of the piston.

7. A two-stroke cycle engine of the character described comprising a cylinder having an exhaust valve adjacent one end of the cylinder and having a row of annularly spaced scavenging air slots in the cylinder wall at the other end of the cylinder adapted to be uncovered by the piston when near the end of its working stroke, the successive slots of the row having their middle lines successively tangent to a circle which is located eccentrically of the cylinder axis, such circle being located at one side of the cylinder axis and having a diameter slightly smaller than the radius of the cylinder.

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