Nov. 27, 1928. 1,693,506

T. V. HEMMINGSEN

TWO-STROKE INTERNAL COMBUSTION MOTOR WITH SCAVENGING AND EXPULSION THROUGH PORTS IN THE CYLINDER

Filed Feb. 21, 1927

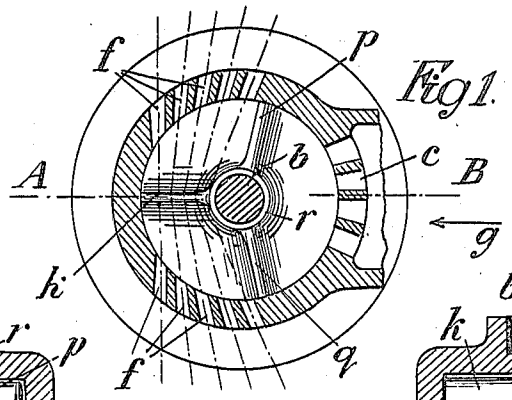


Fig 1.

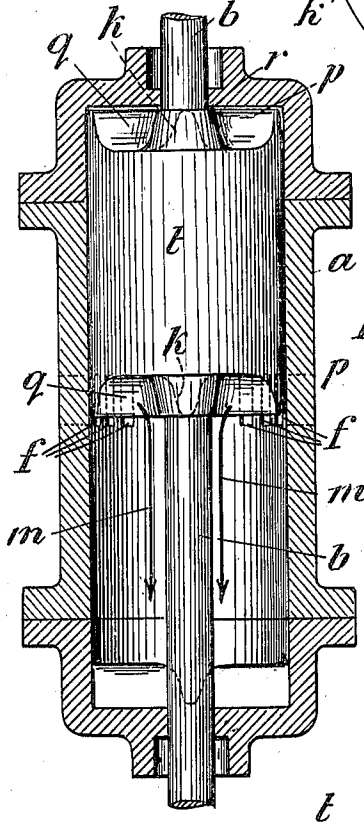


Fig 2.

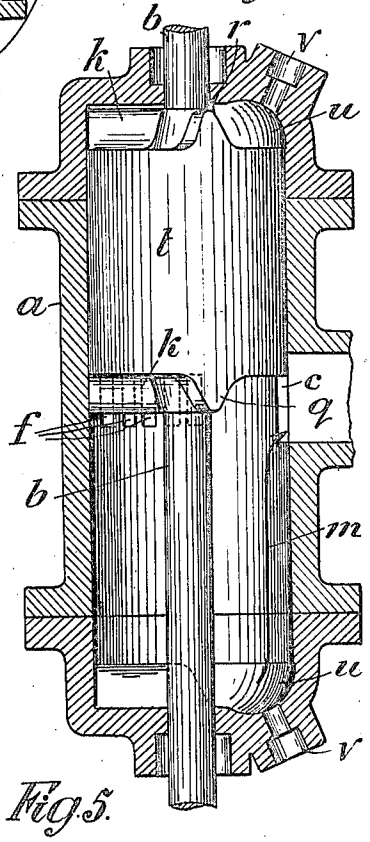


Fig 3.

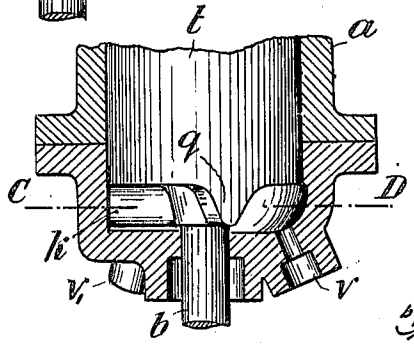


Fig 4.

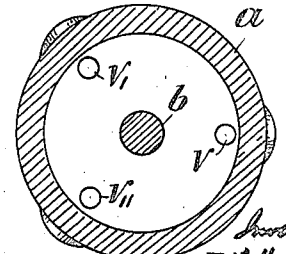


Fig 5.

Inventor:
T. V. Hemmingsen
by Langner, Parry, Card & Langner
Attys

Patented Nov. 27, 1928. 1,693,506

UNITED STATES PATENT OFFICE.

TORKILD VALDEMAR HEMMINGSEN, OF COPENHAGEN, DENMARK.

TWO-STROKE INTERNAL-COMBUSTION MOTOR WITH SCAVENGING AND EXPULSION THROUGH PORTS IN THE CYLINDER.

Application filed February 21, 1927, Serial No. 169,945, and in Denmark May 12, 1926.

This invention relates to an improvement in two stroke internal combustion engines with scavenging and expulsion through ports in the cylinder, of the kind in which the expulsion ports are arranged in one group, while the scavenging ports are arranged in two groups symmetrically situated in relation to a plane passing through the cylinder axis and the centre of the exhaust ports, the said two groups of scavenging ports consisting in a number of channels.

The invention consists in a special arrangement of the said channels, by which an effective scavenging of the whole cylinder volume is obtained, and in connection with this arrangement, a shaping of the piston and the cylinder cover into a suitable form so as to correspond with the said arrangement.

The invention is illustrated in the drawing in which

Fig. 1 shows in cross section a cylinder comprising an example of a performance of the arrangement according to the invention,

Fig. 2 shows the same cylinder in longitudinal section at right angles on line A—B in Fig. 1 and looking in the direction indicated by the arrow *g*,

Fig. 3 shows the same cylinder in longitudinal section on line A—B in Fig. 1,

Fig. 4 shows part of a corresponding section through a modified construction, and

Fig. 5 shows the same in cross section on line C—D in Fig. 4.

In the drawings *a* indicates the cylinder, *b* the piston rod and *c* the exhaust ports. It will be seen from Fig. 1 that the scavenging ports *f* are arranged in two groups symmetrically situated in relation to the plane indicated by the line A—B which passes through the cylinder axis and the centre of the exhaust ports *c*.

The scavenging ports *f* consist in a number of channels separated by ribs and of such a direction that their central lines, which two and two intersect each other in the plane of symmetry A—B, will meet in this plane of symmetry at points that are opposite to the exhaust ports *c* in relation to the piston rod *b*. The central lines of the channels situated nearer the exhaust ports *c* will intersect each other directly behind the piston rod *b* while the more distant channels, as seen from the exhaust ports *c*, have such a direction that their central lines will intersect each other very near the cylinder wall. The central lines of the remainder of the channels will intersect each other in points that are evenly distributed over the intermediate distance, as will appear from Fig. 1.

In connection with the above described arrangement the piston *t* is shaped in a special manner.

In Fig. 2 the piston is seen from outside in its upper or inner dead centre position, while the cylinder is shown in section. It is assumed that a double acting engine is concerned, and the piston rod *b* is provided with tail rod. The piston head is curved towards a horizontal deflector *k* in both ends, the said deflector extending from a boss *r* on the piston and from the side of this boss that is opposite to the side nearest the exhaust ports *c*, so that it is situated centrally between the two groups of scavenging ports *f*. In the position of the piston as shown in Fig. 2 the scavenging air flows out through the scavenging ports *f*, and this scavenging air stream will then by means of the deflector *k* be made to flow longitudinally in the cylinder as indicated by the arrows *m* and will flow downwards through one half of the cylinder and upwards through the other half (see also Fig. 3) and will then pass out through the exhaust ports *c* so that an effective scavenging of the whole cylinder volume is obtained.

To further ensure the correct guiding of the scavenging air two deflectors *p* and *q* on the piston head and similar to the deflector *k* are provided, which deflectors *p* and *q* are arranged symmetrically in relation to the line A—B and forming a suitable angle to this plane, more preferentially so that they meet the edge of the scavenging ports nearest to the exhaust ports *c*, see Fig. 1.

Projections may advantageously be formed in the cylinder cover, of such a nature that they correspond with the pockets formed in the piston *t* between the deflector *k* and the deflectors *p* and *q* and exactly fit the shape of the piston, and so that, when the piston is in its bottom position, only so much play is left which suffices to meet the wear on the bearings. No projection is provided, however, to enter the third pocket between the deflectors *p* and *q*. The cylinder cover is here, on the contrary, provided preferentially with suitable grooves or hollow spaces *u* (see Fig. 3), so that a compression space of suitable proportions is formed here. The whole of the quantity of air introduced into the cylinder will then be

compressed in this space, and the fuel valve v is also located here.

The inner surface of the cylinder cover may also be shaped so (or in such a manner made into a plane surface) that three spaces are produced when the piston is in its bottom position, namely, between the cylinder cover and the bottoms of the three pockets between the deflectors k, p and q in the piston t, and in this case the total volume of the three spaces must be made to be suitable for the compression.

This construction is shown in Figs. 4 and 5. Fuel valves v, v_{I} and v_{II} are arranged in the cylinder cover opposite every one of the three compression spaces.

An arrangement according to the invention is of special advantage with double acting engines with a continuous piston rod (provided with tail rod). A similar result may, however, also be obtained where no piston rod is found in the cylinder, as is the case with single acting engines, or in the top end of vertical, double acting engines where the piston rod is provided with no tail rod.

I claim:

1. A two-cycle internal combustion engine comprising a cylinder having a head, a piston working therein, said cylinder being provided with piston controlled inlet ports for scavenging air and piston controlled exhaust ports, said exhaust ports being symmetrically arranged in a group in that part of the cylinder remote from said head, extending through only a portion of the cylinder circumference, the axis of symmetry of said exhaust ports and the cylinder axis defining a plane of symmetry, said inlet ports being arranged in two groups disposed in the remaining part of the cylinder circumference, symmetrically with respect to the said plane of symmetry, the directional axes of said inlet ports intersecting said plane of symmetry in points located in the space between the cylinder axis and that part of the cylinder wall opposite said exhaust ports, and the sequence of said intersecting points being in the same order as the sequence of the said inlet ports, said points of intersection with said plane being substantially evenly spaced apart, the incoming streams of scavenging air thereby meeting in said plane of symmetry, uniformly from the middle of the cylinder to said part of the cylinder wall.

2. A two-cycle internal combustion engine as claimed in claim 1, the head of the piston being provided with deflectors comprising three radially arranged ridges dividing the piston head into three distinct areas, one deflector being situated in said plane of symmetry in the loci of the points of intersection of the center lines of said inlet ports, the other two deflectors being situated symmetrically with reference to said plane of symmetry, and constituting with said first-mentioned deflector and with the piston, two symmetrically disposed angular pockets, each one of said pockets extending over one group of inlet ports.

3. A two-cycle internal combustion engine comprising a cylinder having a head, a piston working therein, said cylinder being provided with piston controlled inlet ports, for scavenging air and piston controlled exhaust ports, said exhaust ports being symmetrically arranged in a group in that part of the cylinder remote from said head, extending through only a portion of the cylinder circumference, the axis of symmetry of said exhaust ports and the cylinder axis defining a plane of symmetry, said inlet ports being arranged in two groups disposed in the remaining part of the cylinder circumference, symmetrically with respect to the said plane of symmetry, the directional axes of said inlet ports intersecting said plane of symmetry in points located in the space between the cylinder axis and that part of the cylinder wall opposite said exhaust ports, and the sequence of said intersecting points being in the same order as the sequence of the said inlet ports, said points of intersection with said plane being substantially evenly spaced apart, the head of the piston being provided with deflectors comprising three radially arranged ridges dividing the piston head into three distinct areas, one deflector being situated in said plane of symmetry in the loci of the points of intersection of the center lines of said inlet ports, the other two deflectors being situated symmetrically with reference to said plane of symmetry, and constituting with said first-mentioned deflector and with the piston, two symmetrically disposed angular pockets, each one of said pockets extending over one group of inlet ports, said cylinder head being provided with two symmetrically disposed triangular shaped projections matching with the said symmetrically disposed pockets, said projections displacing the volumes of said pockets when the piston is in its upper dead center position, leaving a third pocket, disposed between the two second mentioned deflectors and that part of the cylinder wall on the same side as the exhaust air ports to constitute a combustion chamber, and a fuel valve located in the cylinder head communicating with said third pocket.

4. A two-cycle internal combustion engine as claimed in claim 3, the cylinder head being povided with cup-shaped wells.

5. A two-cycle internal combustion engine comprising a cylinder having a head, a piston working therein, said cylinder being provided with piston controlled inlet ports for scavenging air and piston controlled exhaust ports, said exhaust ports being symmetrically arranged in a group in that part of the cylinder remote from said head, extending through only a portion of the cylinder circumference,

the axis of symmetry of said exhaust ports and the cylinder axis defining a plane of symmetry, said inlet ports being arranged in two groups disposed in the remaining part of the cylinder circumference, symmetrically with respect to the said plane of symmetry, the directional axes of said inlet ports intersecting said plane of symmetry in points located in the space between the cylinder axis and that part of the cylinder wall opposite said exhaust ports, and the sequence of said intersecting points being in the same order as the sequence of the said inlet ports, said points of intersection with said plane being substantially evenly spaced apart, the incoming streams of scavenging air thereby meeting in said plane of symmetry, uniformly from the middle of the cylinder to said part of the cylinder wall, the head of the piston being provided with deflectors comprising three radially arranged ridges dividing the piston head into three distinct areas, one deflector being situated in said plane of symmetry in the loci of the points of intersection of the center lines of said inlet ports, the other two deflectors being situated symmetrically with reference to said plane of symmetry, and constituting with said first-mentioned deflector and with the piston, two symmetrically disposed angular pockets, each one of said pockets extending over one group of inlet ports, the cylinder head being flat and forming with the deflectors on the piston three combustion chambers between the piston head, cylinder walls and cylinder head when the piston is in its upper dead center position, a fuel valve in the cylinder head for each of said combustion chambers.

6. A two-cycle internal combustion engine comprising a cylinder having a head, a piston working therein, said cylinder being provided with piston controlled inlet ports for scavenging air and piston controlled exhaust ports, said exhaust ports being symmetrically arranged in a group in that part of the cylinder remote from said head, extending through only a portion of the cylinder circumference, the axis of symmetry of said exhaust ports and the cylinder axis defining a plane of symmetry, said inlet ports being arranged in two groups disposed in the remaining part of the cylinder circumference, symmetrically with respect to the said plane of symmetry, the directional axes of said inlet ports intersecting said plane of symmetry in points located in the space between the cylinder axis and that part of the cylinder wall opposite said exhaust ports, and the sequence of said intersecting points being in the same order as the sequence of the said inlet ports, said points of intersection with said plane being substantially evenly spaced apart, the incoming streams of scavenging air thereby meeting in said plane of symmetry, uniformly from the middle of the cylinder to said part of the cylinder wall, the head of the piston being provided with deflectors comprising three radially arranged ridges dividing the piston head into three distinct areas, one deflector being situated in said plane of symmetry in the loci of the points of intersection of the center lines of said inlet ports, the other two deflectors being situated symmetrically with reference to said plane of symmetry, and constituting with said first-mentioned deflector and with the piston, two symmetrically disposed angular pockets, each one of said pockets extending over one group of inlet ports, the cylinder head being provided with ridges matching with the deflectors on the piston, three combustion chambers being thereby constituted between the piston head, cylinder wall and cylinder head when the piston is in its upper dead center position, said cylinder head being provided with fuel valves, one for each of said combustion chambers.

In testimony whereof I affix my signature.

TORKILD VALDEMAR HEMMINGSEN.