Nov. 2, 1937. E. SCHMID 2,097,741

VALVE MECHANISM IN INTERNAL COMBUSTION ENGINES OF THE OPPOSED PISTON TYPE

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Fig. 1

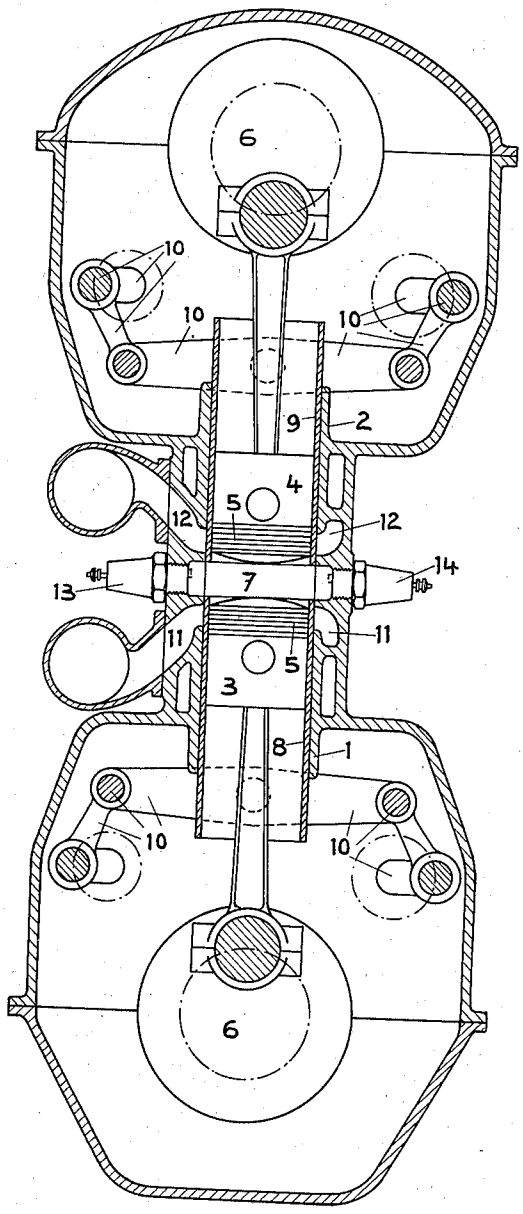


Fig. 2

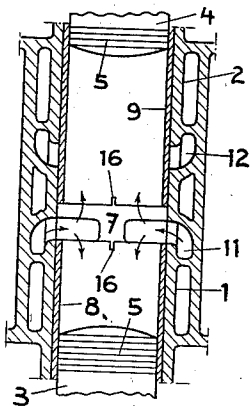


Fig. 3

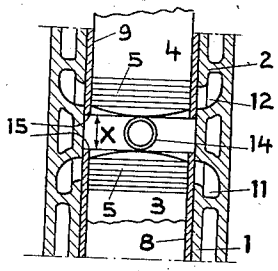
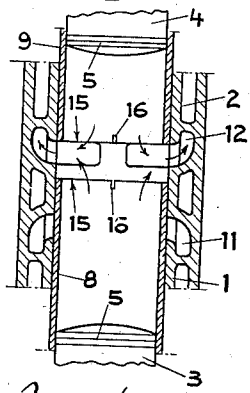


Fig. 4



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VALVE MECHANISM IN INTERNAL COMBUSTION ENGINES OF THE OPPOSED PISTON TYPE

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In Germany February 5, 1935

4 Claims. (Cl. 123—51)

My invention relates to improvements in the valve mechanism of high-speed internal combustion engines of the opposed piston type in which two individual sleeves operate in a pair of opposed cylinders possessing the same cross-section throughout their lengths; and the objects of my invention are, first, to provide means for positively steering the movement of said valves in a confined way and in a constrained manner; second, to afford facilities for the self-sealing of said valves to the cylinder wall; and, third, to eliminate the possibility of the piston rings getting stuck fast to the valve ports.

Valve mechanisms for internal combustion engines of the opposed piston type embodying pairs of sleeve valves between cylinder walls and pistons are known. Said sleeve valves possess ports or slits operating in conjunction with the intakes and exhausts of the cylinders, they are not self-sealing, are not positively steered along a confined and prescribed path nor in a constrained manner and also do not move in a common cylinder pipe of constant cross-sectional area. They are, on the contrary, moved by means of spring-actioned levers and steer with the aid of beveled edges in the manner of valves between two co-axial cylinders in a special place of explosion which latter is separated from the cylinders by means of annular slits and has a smaller cross-sectional area. Such a latter arrangement of the valve mechanism cannot be used practically in the case of high-speed internal combustion engines, e. g. aircraft motors, due to the lack of a positive and compulsory run and of the self-sealing feature and due to the danger of the piston rings getting stuck fast. It has been proposed to use the marginal edges of sleeve valves for the steering of internal combustion engines with pairs of cylinders lying parallel. These latter, however, also were provided with piston rings which were raking the intake and exhaust-slits, whereby said rings easily became stuck fast to the latter. This is the reason why such a valve mechanism allows but a relatively slow opening and closing action of intake and exhaust. Moreover, due to the cylinders lying parallel, such a latter design calls for an interconnection of the places of explosion necessitating the existence of faulty or injurious spaces. Thus this latter proposition also cannot be practically used for the steering of high-speed internal combustion engines. Again one has proposed, in the case of internal combustion engines with a single cylinder, to use a single, partly self-sealing and positively actuated sleeve valve. This latter was also however, steered by means of slits and thus the danger of the piston rings becoming entangled with said slits remained. Moreover, such a latter sleeve-valve alone had to steer the intake as well as the exhaust and it had to be provided with interior and exterior sealing rings. Other propositions along this line of thought and embodying a single sleeve for steering purposes lacked the self-sealing feature and the feature of the compulsory run.

The present invention now, in order to provide a valve mechanism for internal combustion engines of the opposed piston type embodying two axially movable sleeves and the self-sealing feature and thus suited for high-speed motors, has one of the two sleeves which are adapted as reciprocating valves steer the intake-openings and the other sleeve steer the exhaust-openings, both sleeves steering by way of their marginal edges in a through-going cylinder pipe of constant cross-section and whereby said steering is done in a positive and compulsory run.

I attain the above-mentioned objects by the mechanism illustrated in the accompanying drawing, in which—

Fig. 1 is a vertical section through the engine-block and through a pair of opposed cylinders;

Fig. 2 shows the action of the marginal edges of the two sleeves in steering the intake ports;

Fig. 3 shows the marginal edges of the two sleeves at the moment of explosion; and

Fig. 4 shows said edges steering the exhaust ports at the initial position of the pistons.

1 and 2 are two co-axial cylinders lying opposite each other and being rigidly interconnected and housing the pistons 3 and 4 which are provided with sealing rings and which are actuated by crankshafts 6. 7 is the place of explosion common to both cylinders. Thin-walled cylindrical sleeve-valves 8 and 9 are located between the cylinder walls and the pistons, said sleeves being operated by way of drives 10 which latter impart to the first, in an otherwise well-known manner, an unequally oscillating movement. 11 is the intake and 12 the exhaust, 13 and 14 are the spark plugs. Said sleeves 8 and 9 do not possess slits or openings in their skirts, but steer solely and exclusively by means of their marginal edges 15 lying toward the place of explosion. Sleeve 8 steers the intake port and sleeve 9 the exhaust port.

The distance x between the two sleeve valves 8 and 9 at the moment of explosion (Fig. 3) may be kept very small which circumstance is very advantageous in the case of Diesel motors which require a high ratio of compression.

In order to make the sleeve valves at their marginal steering edges self-sealing by means of the pressure of the explosion, they are provided with slit-like recesses 16 (Figs. 2 and 4).

It also was possible to have sleeve 9 steer the intake port and sleeve 8 the exhaust port. The steering operation of the valves becomes evident from Figs. 2 and 4.

The advantages of my invention are the following: Both sleeve valves 8 and 9 have no openings so that a sticking fast of piston rings 5 to any valve ports cannot take place; the piston rings 5 also do not pass over the marginal steerings edges 15, which latter need project but for a very small distance into the place 7 of the explosion (Fig. 3) so as to expose them as little as possible to the explosion—e. g. in the case of sleeve valves of 2 millimeter thickness it is sufficient to have the latter project approximately 5 millimeters into space 7 and the explosive pressure then is sufficient for expanding and thus sealing the edges of sleeves 8 and 9 which are provided with recesses 16. A sealing of those ends of sleeves 8 and 9 which project out of cylinders 1 and 2 by means of covers is not necessary; the absence of port openings in the sleeves allows the adoption of great cross-sections for the passages, particularly since each of the sleeves has to attend but one phase.

The engine illustrated also could possess opposed pistons operating in two cylinders the longitudinal axes of the latter intersecting at an oblique angle instead of at right angles as shown.

I claim:

1. In an internal combustion engine, the combination comprising two opposed pistons, a common cylinder having the same inner cross section throughout for said opposed pistons and having inlet and exhaust ports, a sleeve valve for each piston of relatively thin material interposed between the piston and the interior wall of said cylinder, one of said sleeve valves controlling the inlet port and the other controlling the exhaust port, said sleeve valves controlling said ports by their inner edges which slide across said ports and beyond the same in cooperation with said constant cross sectional inner wall of said cylinder.

2. In an internal combustion engine, the combination comprising two opposed pistons, a common cylinder for said opposed pistons having inlet and exhaust ports, a sleeve valve for each piston of relatively thin material interposed between the piston and the interior wall of said cylinder, one of said sleeve valves controlling the inlet port and the other controlling the exhaust port, said sleeve valves controlling said ports by their inner edges which slide across and beyond said ports in cooperation with the inner wall of said cylinder.

3. In an internal combustion engine, the combination comprising two opposed pistons, a common cylinder having the same inner cross section throughout for said opposed pistons and having inlet and exhaust ports in an intermediate zone of said cylinder of uniform cross section, a sleeve valve for each piston free from ports and of relatively thin material interposed between the piston and the interior wall of said cylinder and sliding on said interior wall up to and beyond the respective ports of the cylinder, one of said sleeve valves controlling the inlet port and the other controlling the exhaust port, said sleeve valves controlling said ports by their inner edges which slide across said ports and beyond the same in cooperation with said constant cross sectional inner wall of said cylinder.

4. In an internal combustion engine, the combination comprising two opposed pistons, a common cylinder for said opposed pistons having inlet and exhaust ports in an intermediate zone thereof, a sleeve valve for each piston free from ports and of relatively thin material interposed between the piston and the interior wall of said cylinder and sliding on said interior wall up to and beyond the respective ports of the cylinder, one of said sleeve valves controlling the inlet port and the other controlling the exhaust port, said sleeve valves controlling said ports by their inner edges which slide across and beyond said ports in cooperation with the inner wall of said cylinder.

ERNST SCHMID.