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H. LEMP.

VALVE MECHANISM FOR ENGINES.

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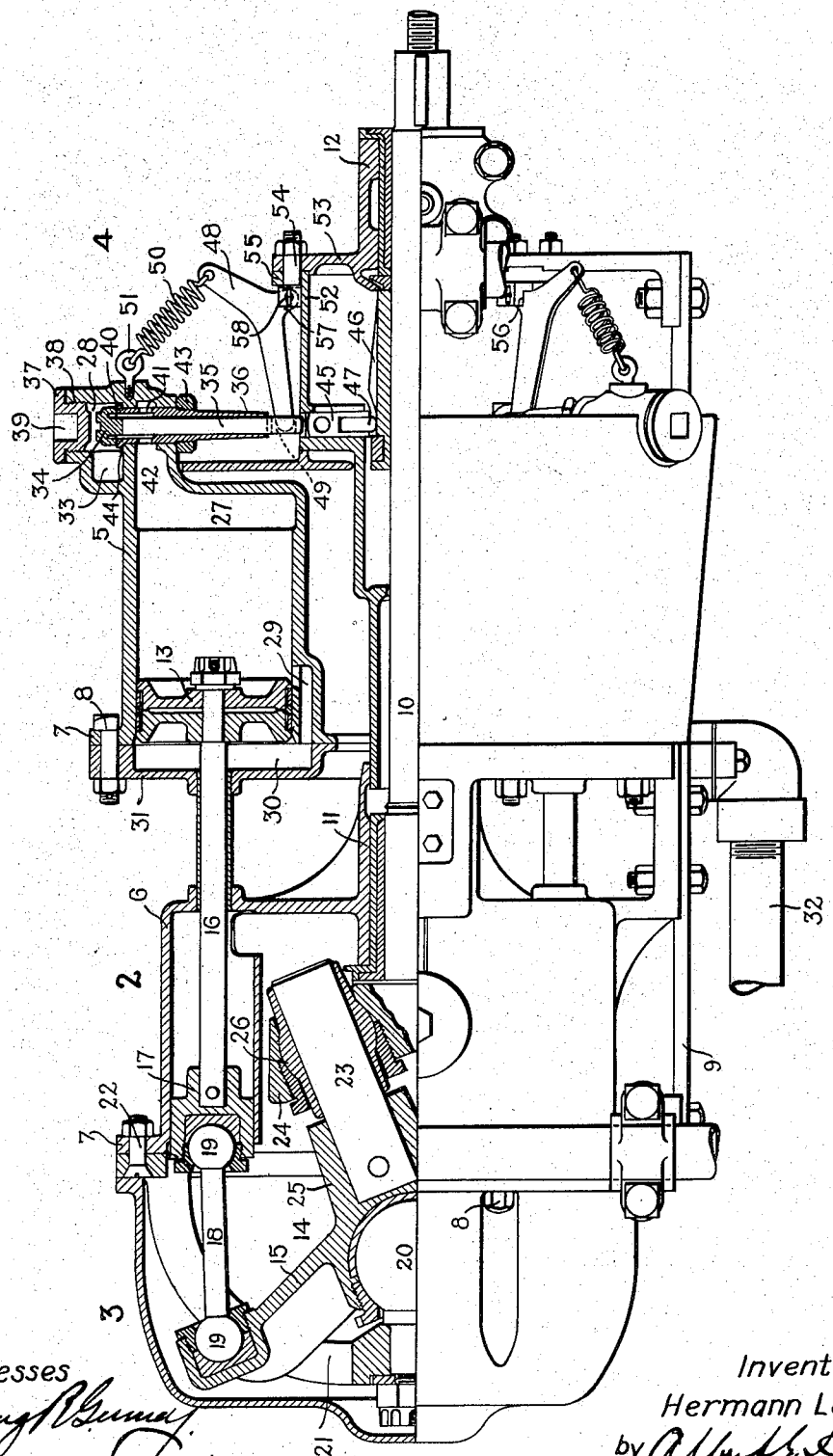

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VALVE MECHANISM FOR ENGINES.

No. 853,095. Specification of Letters Patent. Patented May 7, 1907.

Application filed November 4, 1904. Serial No. 231,381.

To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Valve Mechanisms for Engines, of which the following is a specification.

My invention relates to engines and more particularly to valve mechanisms for controlling the admission of motive fluid to the cylinder or cylinders. Its object is to improve the general construction of valve mechanisms so as to render the valve or valves more accessible for removal and repair, and to arrange the valve springs so that they are not affected by the heat from the cylinders or other parts.

For an understanding of the invention attention is directed to the following description taken in connection with the accompanying drawing, and its scope will be set forth in the appended claims.

In the accompanying drawing, which illustrates one embodiment of the invention, is shown an engine of the multi-cylinder type, with one half in plan and the other half in longitudinal section on the plane of the axis of one cylinder.

I have elected to illustrate my invention as applied to an engine of the type disclosed in the United States Patent No. 748,083 of Dec. 29, 1903, granted jointly to me and Otto F. Persson.

The engine is preferably constructed in sections, and referring to the drawing, 1 represents the cylinder section, 2 the cross-head section, 3 the crank or wabbler section, and 4 the section containing the cam or cams for operating the valves. The cylinder section comprises a plurality of parallel piston containing cylinders 5 arranged symmetrically around a common axis, and is preferably, although not necessarily, a single casting. The cross-head section 2 is also a single casting and comprises cylinders 6 which are arranged similarly to the piston containing cylinders and axially aline therewith. The several sections are bolted together and for this purpose they are provided with circumferential flanges 7 at their ends, which receive the securing bolts 8. The sections may be further secured by side bars 9 which are suitably bolted to the sections, commonly one at each side, as shown in the plan portion of view.

Extending centrally through the sections, 1, 2 and 4 and disposed parallel to the axes of the piston cylinders, is a crank shaft 10 which is mounted in bearings 11 and 12 provided in the cross-head section and the cam section respectively. The pistons 13 reciprocate in a direction parallel to the axis of the shaft 10 and their rectilinear motion is translated in rotary motion of the shaft by means of a wabbler 14 or other crank movement. The wabbler is provided with as many arms 15 as there are pistons, and the latter are each connected with an arm by means of a piston rod 16, a cross-head 17 and a connecting rod 18. Each arm receives an oscillatory movement from its respective piston, and in order to provide for constantly changing angularity between each arm and its respective connecting rod, the latter is connected with its cross-head and wabbler arm by ball-and-socket joints 19. Corresponding oscillations of the arms are successively produced in a direction clockwise or anti-clockwise, depending upon the direction of the order of the impulse of the pistons. In other words the pistons impart a universal movement to the wabbler. To provide for this movement the wabbler is mounted upon a central bearing which is preferably a ball 20. This is carried by a skeleton shaped frame 21 that is secured to the adjacent end of the cross-head section by bolts 22.

The movement of the wabbler is changed into continuous rotation of the crank shaft 10 by means of a crank pin 23 and a crank arm 24. The pin is secured at one end in the hub 25 of the wabbler and its axis is disposed at an angle to the axis of the crank shaft. This angle is the same for every position of the wabbler so that the outer end of the pin describes a circle concentric with the crank shaft. The crank arm 24 is connected with the outer end of the pin and is revolved thereby, hence causing the crank shaft to rotate. A suitable ball and socket joint 26 is provided between the arm and the pin so as to permit the latter to turn in the arm as they both revolve together.

Each cylinder is provided with a clearance space 27 which connects with a chamber 28 for the admission of steam or other motive fluid. The exhaust from the cylinder discharges through exhaust ports 29 into an annular exhaust chamber 30 which is cored out in the plate 31 cast integral with the cross-

head section. This chamber discharges through the exhaust pipe 32 into the atmosphere, or into a condenser or a muffler according to whether the engine is used as a steam or an explosive engine.

The parts containing the admission chambers 28 are preferably cast integral with the cylinder section, although this is not necessary, and they are arranged at the heads of the cylinder, projecting laterally therefrom or overhang the end of the cylinder section. This latter feature of the construction is important as it provides a space between the chambers and the shaft in which the valve mechanism may be arranged in a very compact manner. An annular steam supply conduit 33 extends around the circumference of the cylinder section and connects with the several admission chambers. This steam supply conduit is also preferably cast integral with the cylinder section in order to strengthen it and at the same time simplify and cheapen the construction.

Communication between the admission chamber and the clearance space 27 of each cylinder is controlled by an outwardly opening valve 34, which in its simplest form is of the puppet valve type. The stem 35 of the valve extends transversely to the axis of the cylinder and radially with respect to the crank shaft. The valve stem is guided in a sleeve 36 which is removably secured to the admission chamber and projects inwardly toward the crank shaft. Arranged in line with each valve is a removable plug or cap 37 which screws into a threaded opening 38 in the wall of the valve chamber. This plug is provided with a countersink 39 or its equivalent for receiving a key by which the removal or insertion of the plug may be accomplished. The opening 38 is of ample diameter to permit the puppet valve and the valve stem sleeve to pass freely through it when being removed or put into place. The end of the sleeve in the admission chamber is provided with an annular shoulder 40 which is carefully finished to form the seat for the valve. This end is also counterbored to a certain depth to provide a space around the valve stem that connects with ports 41 in the sleeve and the passage 42 communicating with the clearance space of the piston cylinder and through which the motive fluid passes to the latter. The sleeve is firmly secured in position by means of a nut 43 which engages an exteriorly screw threaded portion thereof and screws against the inner wall of the admission chamber, whereby the flange or shoulder 40 at the seat end of the sleeve is held firmly in place upon an interior flange 44 in the admission chamber.

At the ends of the valve stems adjacent to the crank shaft are valve tappets 45 which are preferably separate from the stem, the latter being merely held in contact therewith so as to receive motion from them. This arrangement enables the valves to be readily removable without disturbing the tappets. The tappets are arranged in the cam section 4 and are adapted to receive motion from a cam 46 that is adjustable on the crank shaft to which it is splined. Anti-friction rollers 47 are provided on the tappets to reduce wear as the tappets ride over the cam. To vary the lift of the valves and thereby the point of cut off, the cam may be adjusted axially by any desired mechanism, such for example, as the cam shipper shown in the patent hereinbefore referred to.

The cam is common to the valves and acts directly through the valve stems to open them. The seating of the valves is accomplished through individual spring actuated bell crank levers 48. These levers extend in the general direction of the crank shaft, away from the cylinders, and are mounted on a suitable part of the engine, preferably the cam section. Each lever is loosely connected with its respective valve stem in order to be readily detached therefrom when it is desired to remove the valve. The valve stem is provided with a slot 49 in which the end of one arm of the lever engages. To permit this to be withdrawn from the slot the lever is mounted on a removable pivot as explained hereinafter. The spring 50 for actuating the lever is connected with the free arm thereof so as to be removed as far as practicable from the hot walls of the cylinders and admission chambers, and also to be surrounded by an air space for preventing any considerable degree of heat being radiated or conducted thereto. The springs are of the extension type and each extends from the free end of its respective lever to the adjacent admission chamber where it is anchored, as by means of an eye bolt 51. The springs are under sufficient tension to maintain the valves seated during the period when the rotating cam is not acting on them except under conditions of abnormal back pressure. When the cam lifts the valves the springs are placed under additional tension by reason of the levers moving with the valves, so that as the cam moves from under the valve stems or tappets the valves are quickly and positively seated.

The cam section 4 is composed of a cylindrical portion 52 and a head 53 which carries the shaft bearing 12. The head is secured in place by bolts 54 which extend through openings in it and in the circumferential flange 55. These bolts afford a simple means for fulcruming the spring actuated levers for the valves. For this purpose the heads are each provided with a diametrical slot 56 into which extend lugs 57 formed on the levers. The heads and lugs are provided with registering openings for receiving cotter pins 58. By this arrangement each lever

is disconnected from its respective valve stem, by merely taking out the cotter pin or pivot, and the end of the lever can be withdrawn from the slot of the valve-stem. The valve can then be removed after the valve plug 37 is unscrewed. By unscrewing the nut 43 the valve stem sleeve may also be removed. Thus it will be seen that the construction of the valve mechanism is simple and can be easily taken apart when desired.

The diameter of the cam section is much smaller than that of the cylinder section. This permits the valve mechanism to be arranged around the cam section without increasing the overall dimensions of the engine, while still attaining the various objects aimed at by the invention.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In an engine, the combination of a cylinder, an admission chamber communicating therewith, a valve in said chamber for controlling the admission of motive fluid to the cylinder, a stem for the valve which extends transversely to the axis of the cylinder, means which engage the stem for opening the valve, a lever connected with the stem for closing the valve having a free end extending outwardly from the cylinder, and a spring attached at one end to the free extremity of the lever and supported by a fixed part of the engine structure and the lever.

2. In an engine, the combination of a cylinder, an admission chamber communicating therewith, a valve in said chamber for controlling the admission of motive fluid to the cylinder, a stem for the valve which extends transversely to the axis of the cylinder, a rotating cam which engages the said stem for opening the valve, an inclosure for the cam which is located at the head of the cylinder, a bell-crank lever fulcrumed on the inclosure and arranged with one arm extending substantially parallel to the axis of the cylinder and the other arm extending substantially transverse thereto, a connection between the first arm of the lever and the stem, and a spring attached to the outer end of the transversely extending arm of the lever and to the cylinder so that its body portion is isolated from the hot parts of the engine to minimize the conduction of heat to it.

3. In an engine, the combination of a cylinder, a valve chamber communicating therewith, a valve therein for controlling the admission of motive fluid to the cylinder, a stem for the valve which is provided with a slot, a lever fulcrumed on the engine and engaging at one end in the said slot, an extension spring attached at one end to the free extremity of the lever and at the other end to the cylinder and having its body isolated from the engine to minimize the conduction of heat thereto, and a means independent of the lever which opens the valve against the tension of said spring.

4. In an engine, the combination of a cylinder, a valve chamber communicating therewith, a valve therein for controlling the admission of motive fluid to the cylinder, a stem for the valve which is provided with a slot at one end and extends transversely to the axis of the cylinder, a removable plug in the wall of said chamber for permitting the valve to be removed, a lever removably engaging at one end in the slot of the valve stem, a spring acting upon said lever which is isolated from the cylinder and valve to minimize the conduction of heat thereto, and means for opening the valve against the tension of said spring.

5. In an engine, the combination of a shaft, a plurality of parallel cylinders, chambers for the cylinders, valves therein for controlling communication between the chambers and cylinders, stems for the valves which are disposed radially to the shaft, a common actuator which engages the stems for opening the valves, bell-crank levers attached to the valve stems, an inclosure for the actuator, pivots for the levers which are arranged around the shaft and in a plane transverse thereto so that the levers move in planes parallel to the shaft, and extension springs which are directly attached to the said levers for closing the valves and are located with an open space between them and the cylinders to minimize the conduction of heat to the latter.

6. In an engine, the combination of a cylinder, a chamber connected therewith, a valve for controlling communication between the chamber and cylinder, a stem attached to the valve which is provided with a slot, a sleeve for the stem which is removably secured in position, means engaging the stem for opening the valve, a spring actuated lever for closing the valve which is removably fulcrumed in such a position that one end projects into the slot of the stem, and a removable cap or plug in the said chamber for permitting the valve and the valve stem sleeve to be removed.

7. In an engine, the combination of a cylinder, a rotary shaft disposed parallel to the axis thereof, an overhanging admission chamber at the head of the cylinder, a valve therein, a stem for the valve which extends transversely to the axis of the cylinder, means on the shaft for controlling the lift of the valve, a bell-crank lever fulcrumed at a point between the shaft and the valve and

laterally of the cylinder head, a connection between one arm of the lever and the valve stem, and a spring attached to the other arm of the lever and to the cylinder which acts through the lever to seat the valve.

8. In an engine, the combination of a plurality of parallel cylinders, pistons operating therein, a central shaft extending parallel to the cylinders and receiving rotary motion from the pistons, admission chambers at the heads of the cylinders, a motive fluid supply conduit common to the admission chambers, puppet valves in said chambers radially disposed around the shaft, a cam mounted on the shaft for controlling the lift of the valves, an inclosure of the cam which surrounds the shaft and is arranged at the heads of the cylinders, and spring actuated levers connected with the valve stems for seating the valves which are fulcrumed upon said inclosures.

9. In an engine, the combination of a plurality of parallel cylinders formed of a single casting, admission chambers cast on the head of the cylinders, a supply conduit also cast integral with the cylinders which is common to the said chambers, a rotating shaft located centrally of the cylinders, pistons in the cylinders, means for imparting rotary motion to the shaft from the pistons, valves in the admission chambers, an adjustable cam rotating with the shaft for opening the valves, levers mounted around the shaft and each being pivoted to move in a plane parallel to the axes of the cylinders and shaft and springs attached to the outer ends of the levers and to the cylinder heads.

In witness whereof, I have hereunto set my hand this 2nd day of November, 1904.

HERMANN LEMP.

Witnesses:

JOHN A. MCMANUS, JR.,

DUGALD MCK. MCKILLOP.