July 14, 1925. 1,545,930

J. G. VINCENT

INTERNAL COMBUSTION ENGINE

Filed March 26, 1925

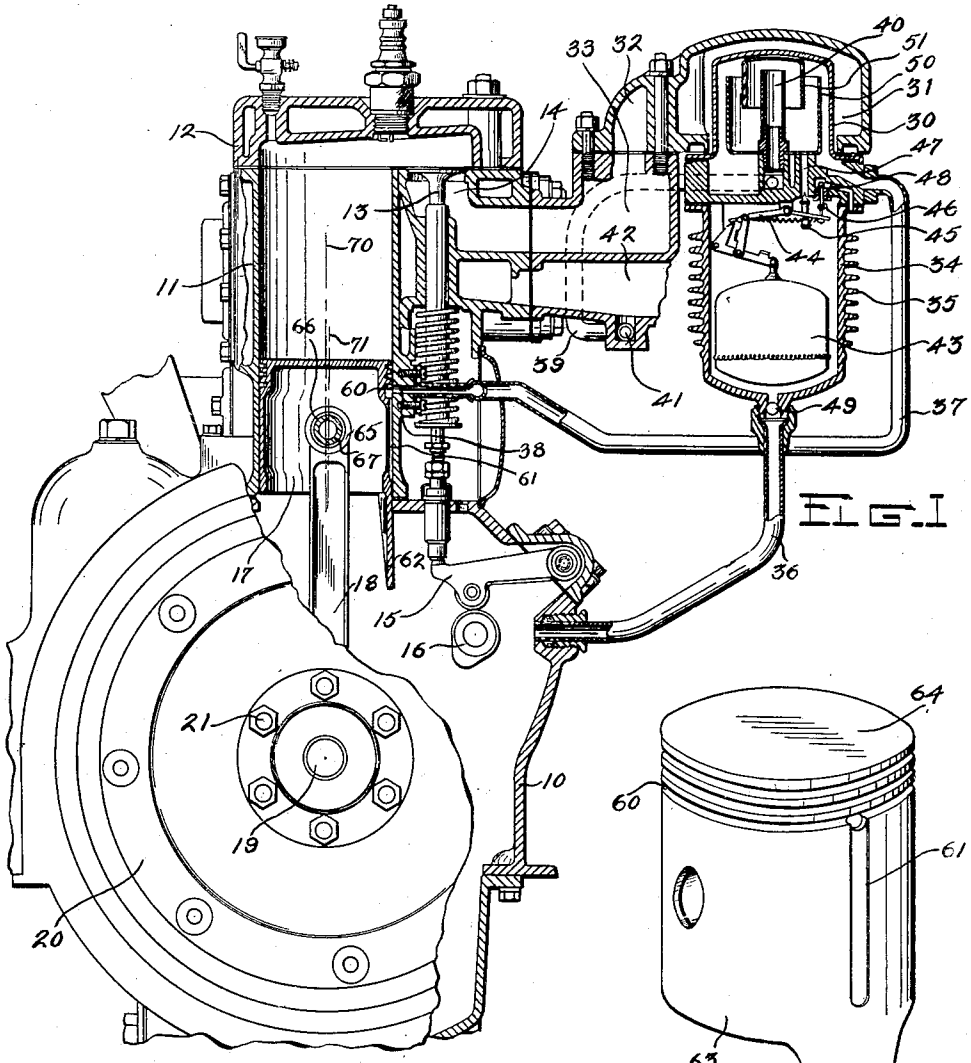

FIG. 1

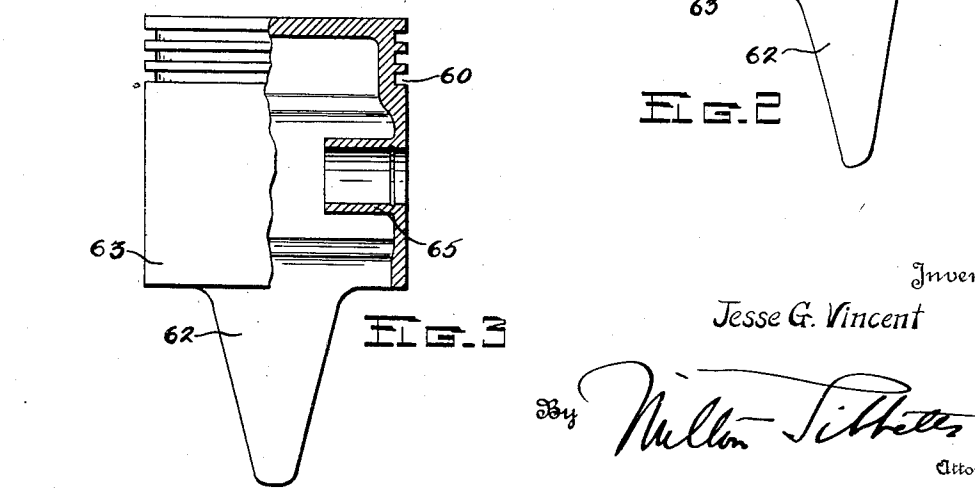

FIG. 2

FIG. 3

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INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, JESSE G. VINCENT, a citizen of the United States, and resident of Detroit, Wayne County, State of Michigan, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines and particularly to the piston and related parts.

In the manufacture of internal combustion engines, particularly those used for automobiles, motor boats, etc., the clearance between the piston and the cylinder has to be kept rather close in order to make the engine operate quietly, and a greater degree of quietness is one of the things towards which designers of these engines are always working. Pistons that are too tight in the cylinders are likely to stick when the engine becomes hot and particularly if the engine is operated at high speed when it is new and before the piston and cylinder surfaces have been well worked in. Pistons that are too loose are noisy and usually this noise takes the form of what is technically known as "piston slap." This slap is a sudden movement of the piston from one side of the cylinder to the other and usually occurs at the top of the stroke but sometimes also at the bottom of th stroke. It is a disagreeable clicking noise and engineers have spent much money and time in trying to find a positive cure without at the same time holding the factory to impracticable limits of manufacture.

It has been proposed as shown in patent to E. F. Roberts, No. 1,138,892, dated May 11, 1915, that piston slap may be obviated by slightly offsetting the piston pin in the piston. This produced an unbalanced effect so far as the piston head area was concerned and it seemed to in most cases entirely eliminate piston slap where the looseness of the piston was not too great. It did not and was not expected to eliminate piston slap in the case of very loose pistons.

In the use of offset piston pins of the character described in said Patent No. 1,138,892, it has been found that in some cases piston slap or something similar to it still existed where it was thought the offset should have cured it, and it was not until experiments with pistons more nearly balanced as to weight were used with offset pins that important new discoveries as to the value of the offset pin were made. Further experiment disclosed that with pistons such as shown in said Patent No. 1,138,892, while the offset pin arrangement would correct piston slap at the beginning of the firing stroke, there would in some cases remain another piston slap occurring at the beginning of the intake stroke or at the bottom of either stroke. This latter slap, it was discovered, was doubtless due to the unbalance of the weight of the piston due to the offset, and apparently it occurred when unbalance of head pressure was of less consequence. Of course these slaps were more prevalent at the higher speeds where the inertia was considerable.

One of the objects of the present invention, therefore, is to provide a piston and cylinder construction in which the parts will be so related that there will be freedom of movement between the piston and cylinder but without slap or rattle between them.

Another object of the invention is to provide a piston with its pin so arranged that the piston is substantially balanced as to weight on opposite sides of its pin bearing but is at the same time unbalanced as to head area on opposite sides of the pin bearing.

Other objects and advantages of the invention will appear from the following description taken in connection with the drawings, which form a part of this specification, and in which:

Fig. 1 is a vertical transverse section through an engine embodying the invention;

Fig. 2 is an enlarged perspective view of the piston shown in Fig. 1, and

Fig. 3 is an enlarged side elevation and part section through the piston.

Referring to the drawings, 10 represents the crankcase of an internal combustion engine, 11 is the cylinder block which may comprise one or more cylinders, 12 is the detachable cylinder head, 13 is one of the valves, the one shown being the exhaust valve and controlling the exhaust passage 14 in the cylinder block, 15 is the valve operating mechanism, 16 is the camshaft for operating the mechanism, 17 is the piston operating in the cylinder 11, and 18 is the connecting rod which connects the piston with the crankshaft 19 mounted in bearings

in the crankcase 10. Only the end of the crankshaft 19 is shown and on this end is mounted a flywheel 20 as by the nuts and bolts 21.

The engine here shown is provided with means for withdrawing some of the oil from the cylinder wall and rectifying it or separating it from the more volatile constituents with which it may have become contaminated. This means consists of an upper compartment 30 which is heated by a jacket 31 connected by a passage 32 with the exhaust manifold 33 of the engine, and a lower compartment 34 which is preferably air cooled as by fins 35 and is connected by an outlet pipe 36 leading to the crankcase 10. A pipe 37 leads from a port 38 in the side of the cylinder 11 to the compartment 30 and a pipe 39 leads from a stand pipe 40 in the upper compartment 30 to a port 41 in the intake manifold 42. There is a float 43 in the lower compartment or chamber 34, which float operates a trip mechanism 44 connected to alternately open and close valves 45 and 46 which control ports 47 and 48 respectively, the port 47 extending from the upper compartment 30 to the lower compartment 34 and the port 48 being a relief port. There is also a ball valve 49 at the outlet from the lower compartment 34. Telescoping baffles 50 and 51 are provided in the upper compartment 30.

The operation of this mechanism is as follows: Immediately as the engine is started suction is produced in the intake manifold 42 which causes a partial vacuum in both the upper and lower compartments 30 and 34. This causes the ball valve 49 to move up against its seat in the bottom of the lower compartment so that a partial vacuum is maintained in both compartments. It is assumed that the float 43 is in the low position in which it is shown in Fig. 1 and in this position the relief valve 46 is closed and the valve 45 is open. In some cases there are two ports 47 and similar valves for them so that oil may pass through one port and air may pass out through the other. However, one port is sufficient if it is made large enough. The oil and unburned fuel is thus drawn through the port 38 and pipe 37 into the space between baffle 50 and the wall of the compartment 30. As the oil fills the compartment the heat generated by the exhaust of the engine heats the oil, and the volatile constituents thereof are driven off. These, in gaseous form, are drawn through the stand pipe 39 and the pipe 41 into the intake manifold 42. The oil gradually flows over the top of the baffle 50 and after thus being separated from its more volatile constituents is precipitated to the bottom of that baffle and passes through the connecting port 47 to the lower compartment 34, causing the float to be raised gradually in that compartment. When the float has reached a certain height it causes the trip mechanism 44 to close the valve or valves 45 and open the relief valve 46. This breaks the vacuum in the lower compartment and the ball valve 49 drops from its seat and the accumulated oil passes through the pipe 36 into the crankcase 10. This of course causes the float 43 to drop and again the trip mechanism 44 is operated and the valves 45 and 46 assume their former position. This completes the cycle and the same thing is gone through with again.

The port 38 in the cylinder 11 is arranged so that it is traversed by the piston throughout its stroke. When the piston is at its lowest point the port 38 is preferably opposite one of the piston ring grooves. This ring groove is indicated at 60. The piston is also preferably formed with a longitudinal groove 61 which communicates with the groove 60 and the port 38 so that the suction at the port 38 will draw oil from the piston ring groove through about one-half of each stroke of the piston. During the remainder of the stroke of the piston, or when the main part of the piston is above the port 38, the port 38 is covered and thereby closed by an extension 62 extending downwardly from one side of the skirt 63 of the piston. The head of the piston is indicated at 64 and is preferably formed normal to the sides of the piston. Interiorly the piston is formed with bosses 65 in which are bearings 66 for a piston pin 67 mounted on the upper end of the connecting rod 18 above referred to. With this construction of piston it is evident that that part which is on the side of the piston on which the extension 62 is formed is of greater weight than is that part of the piston on the other side of a median plane through the longitudinal axis of the piston. The median plane referred to is indicated by the broken line 70 in Fig. 1 and another broken line 71 indicates the parallel and offset plane in which the axis of the piston pin 67 is arranged. The pin bearing 66 for the piston pin 67 is offset on that side of the piston to which the extension 62 is connected, or in other words, the offset is towards the heavier side of the piston. The offset is just sufficient and the additional weight of the extension 63 is such that the piston is substantially balanced as to weight on opposite sides of a plane such as the plane 71 passing through the center of the piston pin bearing. Thus the rapid reciprocation of the piston in the cylinder will not find an unbalanced condition of weight on the piston pin. At the same time, the offset arrangement of the piston pin will produce an unbalanced condition as to the head area and at the beginning of the firing

stroke this unbalanced condition will tend to eliminate the piston slap that might exist in the case of a centrally located pin.

While I have herein described in some detail a specific embodiment of my invention, which I deem to be new and advantageous and may specifically claim, I do not desire it to be understood that my invention is limited to the exact details of the construction, as it will be apparent that changes may be made therein without departing from the spirit or scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A piston comprising a head, a skirt, and a pin bearing, said parts being so formed and relatively arranged that the piston is substantially balanced as to weight, and is unbalanced as to head area, on opposite sides of its pin bearing.

2. A piston comprising a head, a skirt, and a boss having a pin bearing therein, said piston being substantially balanced as to weight on opposite sides of said pin bearing and unbalanced as to head area on opposite sides of said pin bearing.

3. A piston comprising a head, a skirt and a pin boss, said piston being formed heavier on one side of a longitudinal median plane parallel to said boss than on the other side, and the pin bearing in said boss being offset from said plane to substantially balance the weight of the piston on said bearing.

4. A piston having its head end formed substantially normal to its sides, having greater weight in its skirt on one side of a longitudinal median plane than on the other, and having its pin bearing parallel to and offset from said median plane.

5. In an internal combustion engine, the combination with the cylinder, of a piston therein having its skirt formed heavier on one side of a longitudinal median plane than on the other, and a connecting rod pivoted to said piston, said pivot being only slightly offset at one side of said median plane.

6. In an internal combustion engine, the combination of a cylinder having a side port therein, a piston having a skirt formed with a groove to register with said port during part of the travel of the piston and said skirt having an extension at one side only for covering said port when the rest of the piston has passed above the port, said extension making the piston slightly heavier on that side, and a connecting rod pivoted to said piston on an axis only slightly offset from the piston axis and towards that side of the piston having said extension.

In testimony whereof I affix my signature.

JESSE G. VINCENT.