L. R. CARPENTER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 28, 1918.

1,345,530.

Patented July 6, 1920.

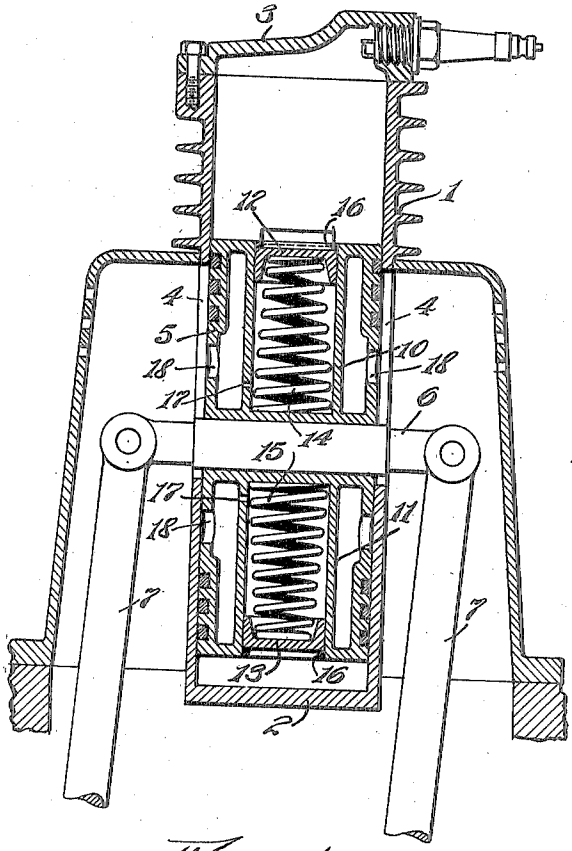
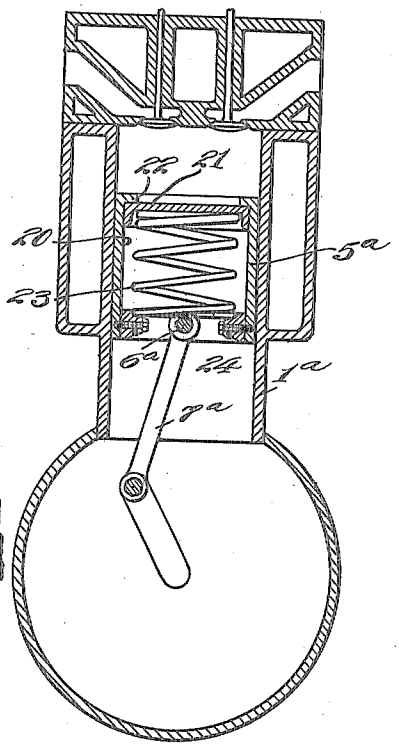


FIG. 1.

FIG. 2.



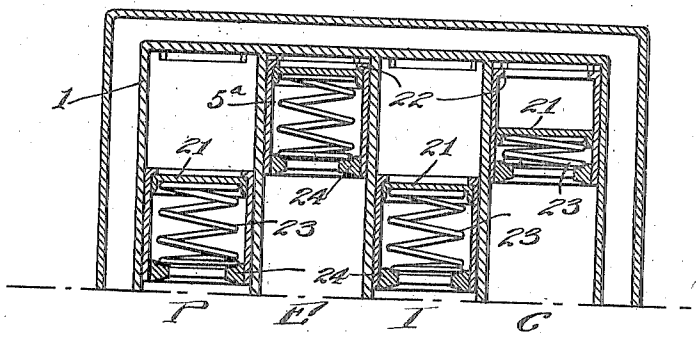


FIG. 3.

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UNITED STATES PATENT OFFICE.

LEE ROYAL CARPENTER, OF CLEVELAND, OHIO.

INTERNAL-COMBUSTION ENGINE.

1,345,530. Specification of Letters Patent. Patented July 6, 1920.

Application filed October 28, 1918. Serial No. 259,968.

To all whom it may concern:

Be it known that I, LEE ROYAL CARPENTER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to internal combustion engines, and particularly to the pistons employed therein, whether of the two-cycle or four-cycle type. The objects of the invention are the provision of an engine in which the working pressure shall be more uniform than heretofore, thereby giving a more even torque with less strain upon the parts; the provision of an engine in which the scavenging of the burned gases shall be very complete; while further objects and advantages of the invention will become apparent as the description proceeds. In some respects this application constitutes a division of my former application filed June 19, 1918, Serial No. 240,730; in other respects it contains and claims certain features described but not claimed in my co-pending application filed November 2, 1918, Serial No. 260,783.

In the drawings accompanying and forming a part of this application I have shown in a somewhat diagrammatic manner certain illustrative embodiments of my said invention, in which drawings: Figure 1 is a longitudinal sectional view through a preferred form of engine-cylinder construction provided with my improvements; Fig. 2 is a diagrammatic view of a modified form of my invention applied to a different type of engine; and Fig. 3 is a diagrammatic view illustrating still another modification of my improvements.

First describing the embodiment illustrated in Fig. 1, the cylinder 1 is of the type described and illustrated in my two co-pending applications, the same having end closures 2 and 3 respectively, and having its sides formed with longitudinal slots 4—4. The piston 5 consists of a cylindrical barrel traversed by the piston pin 6 whose ends project through the slots and are attached to connecting rods 7, 7, the latter being articulated to the crank in any suitable manner. The piston pin 6 is located substantially midway between the ends of this piston, and upon each side thereof there are located the axial cylindrical wells 10, 11, in which are snugly fitted the slidable plungers 12, 13, respectively, yieldingly held in outward position by means of suitable springs 14, 15, respectively, and secured against complete ejection by suitable stops 16, 16.

Within the purview of the present invention, the method of effecting the inflow and outflow of gases from the two ends of the cylinder is immaterial. The engine may be of either the two-cycle or four-cycle type, and if of the two-cycle type the lower end of the cylinder may constitute a charging chamber for the upper end as described and claimed in my application filed simultaneously herewith, or it may constitute a working chamber identical with the upper end of the cylinder, being charged with explosive mixture from the outside as described and claimed in my earlier application Serial No. 240,730. In either case the upper end constitutes a working cylinder and in the present embodiment the stiffness of the spring 14 is so gaged that the plunger 12 will be little if any displaced by the compression-pressure but will be displaced by the explosion pressure. In case the lower end of the cylinder be a working chamber the spring will preferably be adjusted in the same manner, but if it be a charging chamber the spring will be arranged to be displaced by the compression pressure, thereby maintaining upon the gas a more uniform pressure than would be the case with a solid piston.

In any case the side of each well is formed with a breather opening 17 in order to prevent the pistons from becoming fixed in one place by reason of pressure conditions, and the wall of the piston 5 is formed with apertures 18, 18 in line with the slots 4, 4. These apertures not only permit the ingress and egress of the air displaced by the pistons 12 and 13, but the movement of that air has a very decided cooling effect upon the entire piston.

In Fig. 2 I have illustrated a four-cycle engine of the simplest type, 1^a indicating the cylinder, 5^a the piston therein, and 7^a the connecting rod. The interior of this pis-

ton is formed with an axial cylinder bore 20 in which is slidably mounted the auxiliary plunger or piston 21 yieldingly held against the flange 22 by means of the spring 23. In the present embodiment I have shown this spring as seated upon a ring 24 removably secured inside the lower end of the piston 5^a and itself carrying the wrist pin 6^a. In this embodiment the stiffness of the spring 23 is so chosen as to allow little or no displacement of the auxiliary piston 21 by the compression pressure but a decided deflection during the initial part of the explosion pressure, thus taking up the sudden shock which would otherwise come upon the connecting rod, wrist pin, crank pin, crank and bearings, and yielding up its power in a more uniform manner throughout the extent of the working stroke.

In Fig. 3 I have shown my improvement as applied to a four-cycle, four-cylinder engine, the pistons being shown respectively at the completion of their power stroke, exhaust stroke, intake stroke and compression stroke, represented by the letters P, E, I and C. For convenience I have illustrated the cylinders as arranged to be fired in consecutive order. In this embodiment the cylinder and piston construction is the same as that shown in Fig. 2 excepting that each piston upon its outstroke approaches very closely to the end of the cylinder and the springs 23 are so adjusted in point of stiffness as to yield both to the compression pressure and to the explosion pressure. Thus upon the completion of the compression stroke, the compression space will be produced in great part by the displacement of the auxiliary piston 21, as shown in the fourth cylinder, which displacement will be only slightly increased upon the ignition. The power stored in the spring will be yielded up during the latter part of the power stroke so that the piston 21 will be completely restored at the end of the power stroke, (see the first cylinder); and upon the exhaust stroke will produce complete scavenging, (see the second cylinder); while upon the intake stroke will inspirate a complete charge undiluted by waste gases, (see the third cylinder).

It will, therefore, be seen that my invention is capable of expression in various mechanical forms and arrangements, not only those here shown but many others which will occur to those skilled in the art, all of which I desire to claim and protect in and by these Letters Patent.

Having thus described my invention, what I claim is:—

1. In an internal combustion engine, a piston having a cylindrical well opening through its working end, a secondary piston in said well, and yielding means coöperating with said secondary piston and opposing its inward movement, said well being formed beneath its piston with a breather aperture communicating with the outer air.

2. In an internal combustion engine a cylinder having an aperture in its wall, a piston in said cylinder and having an aperture adapted to register with said first aperture, and pumping means in said piston actuated by the operation of the engine and adapted to produce a movement of air through said apertures whereby the piston interior is cooled.

3. In an internal combustion engine, a piston, and a longitudinally mounted reciprocating air pump mounted in said piston and adapted to be actuated by the reciprocation of said piston to produce a movement of air inside said piston whereby the same is cooled.

4. In an internal combustion engine, a cylinder having an aperture in its wall, a piston in said cylinder and having a cylindrical well opening through its working end, the wall of said well being spaced from the piston wall; a secondary piston in said well, and means yieldingly opposing the inward movement of said secondary piston, said well having a breather opening in its wall and said first piston having an aperture adapted to register with the cylinder aperture.

5. In an internal combustion engine, a cylinder having an aperture in its wall, a piston in said cylinder and having a cylindrical well opening through its working end, a secondary piston in said well, on a spring in said well beneath said last piston, the wall of said well having an opening which communicates with said cylinder aperture.

6. In an internal combustion engine, a piston having a longitudinal cylindrical well opening through its working end, the mouth of said well having an overhanging flange, a secondary piston in said well beneath said flange, and a spring in said well tending to hold said secondary piston against said flange.

In testimony whereof I hereunto affix my signature.

LEE ROYAL CARPENTER.