

R. H. BOHLER.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED DEC. 29, 1916.

1,248,250.

Patented Nov. 27, 1917.

2 SHEETS—SHEET 1.

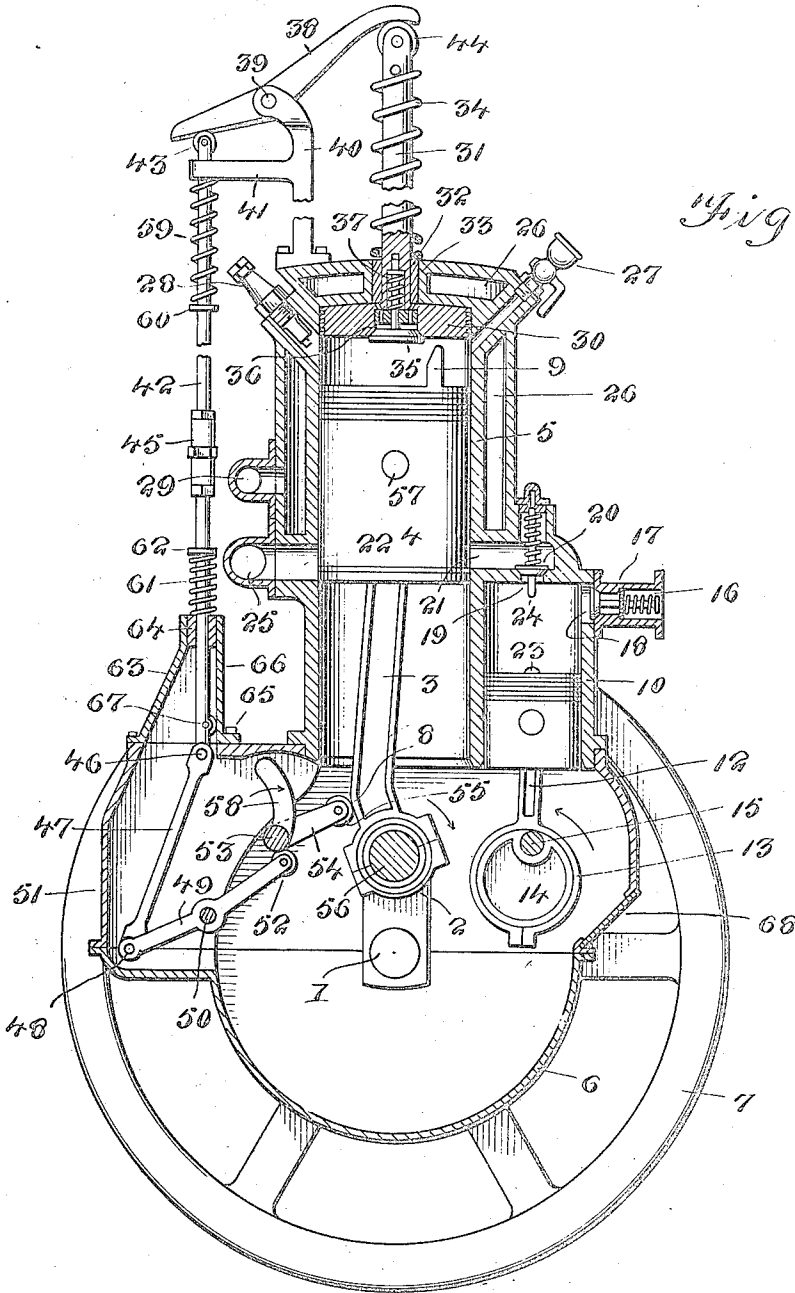


Fig. 1.

WITNESSES

E. R. Ruppert.
R. M. Smith.

INVENTOR

Robert H. Bohler

BY

Victor J. Evans

ATTORNEY

R. H. BOHLER.
 INTERNAL COMBUSTION ENGINE.
 APPLICATION FILED DEC. 29, 1916.

1,248,250.

Patented Nov. 27, 1917.

2 SHEETS—SHEET 2.

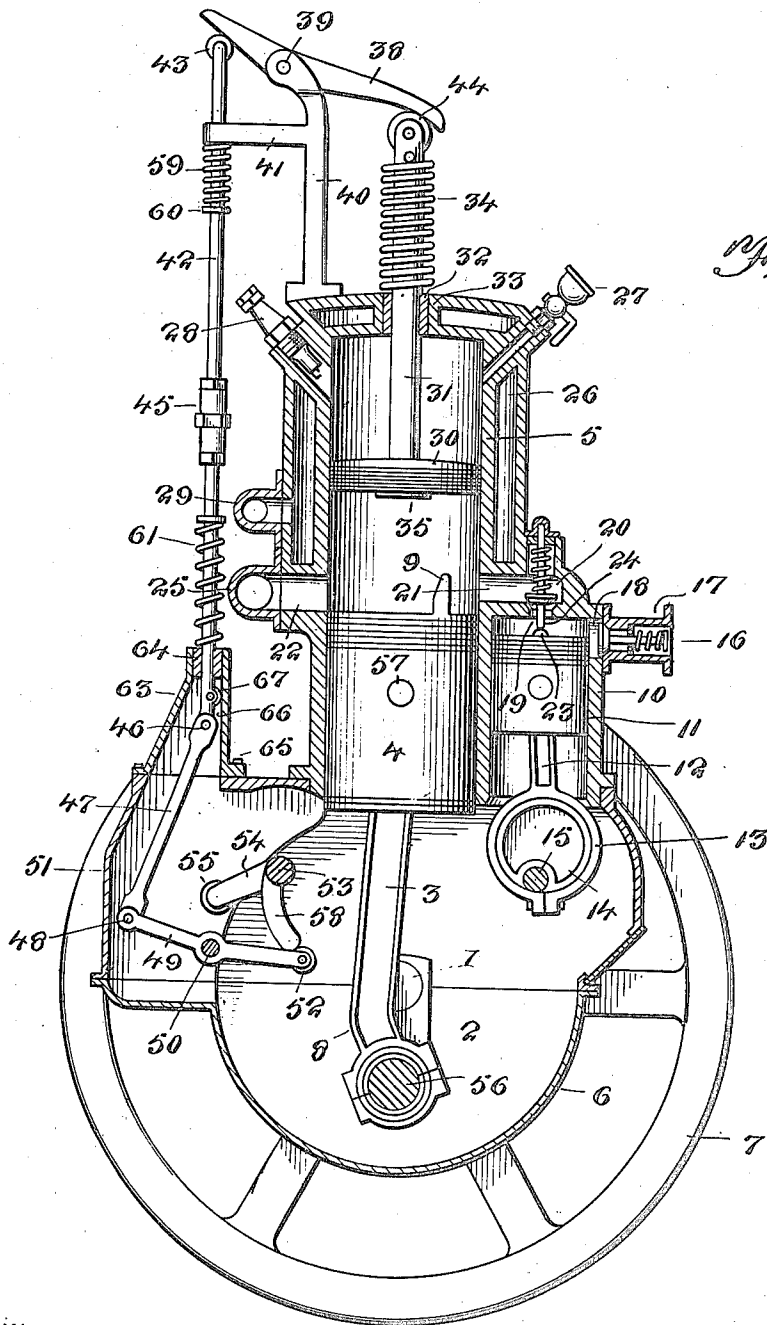


Fig. 2.

WITNESSES
E. R. Ruppert.
R. M. Smith.

INVENTOR
Robert H. Bohler
 BY *Victor J. Evans*
 ATTORNEY

UNITED STATES PATENT OFFICE.

ROBERT H. BOHLER, OF WAYCROSS, GEORGIA.

INTERNAL-COMBUSTION ENGINE.

1,248,250.

Specification of Letters Patent.

Patented Nov. 27, 1917.

Application filed December 29, 1916. Serial No. 139,631.

To all whom it may concern:

Be it known that I, ROBERT H. BOHLER, a citizen of the United States, residing at Waycross, in the county of Ware and State of Georgia, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

One of the principal objects of the present invention is to provide novel means for counteracting the tendency of the explosive force against the piston head to cramp or tilt the piston and cause a frictional drag of the same at one side of the cylinder or along the inner surface of that side wall of the cylinder which is opposite the line of thrust between the wrist pin of the piston and the connecting rod bearing of the crank shaft.

With the above and other objects in view, the invention consists in the novel construction, combination and arrangement of parts, herein described, illustrated and claimed.

In the accompanying drawings:—

Figure 1 is a longitudinal section through an internal combustion engine embodying the present invention, showing the power piston at the limit of its return movement and the beginning of its working stroke.

Fig. 2 is a similar view showing the power piston at the limit of its working stroke and the scavenging piston approaching the limit of its working stroke.

Referring to the drawings 1 designates the crank shaft of the engine, 2 the connecting rod bearing, 3 the connecting rod, 4 the piston, 5 the cylinder, 6 the crank case in which the crank shaft 1 is journaled and 7 the fly-wheel fast on the crank shaft. The parts above referred to are generally arranged in the ordinary relation to each other but in carrying out the present invention, the connecting rod 3 is provided with an offset rounded shoulder or bearing surface 8 the purpose of which will presently appear. The piston 4 is shown as provided with the usual deflecting or baffle lip 9.

Arranged at one side of the cylinder 5 and preferably formed as an integral part thereof is a compressing cylinder 10 in which reciprocates a piston 11 coupled by means of a connecting rod 12 to an eccentric strap 13 which encircles an eccentric 14 on a compressor shaft 15 parallel to the crank shaft 1 and arranged at one side thereof and in a higher plane. The shaft 15 is geared to and driven by the shaft 1, any suitable form of

gearing (not shown) being employed for that purpose, the gearing being such that the shafts 1 and 15 rotate at the same speed.

Associated with the compression cylinder 10 is a charge intake valve 16 which works in a casing 17 fastened to the cylinder 1 and communicating therewith through an inlet port 18 shown as formed in one side of the cylinder 10. The valve 16 is of the ordinary automatic spring seated check type, serving to allow the mixture to be drawn into the cylinder 10 by the suction of the piston 11 and closing to prevent the mixture from being forced back to the carbureter not shown which communicates directly with the valve casing 17.

The cylinder 10 is formed in the head thereof with an outlet port 19 which is controlled by an automatic check valve 20 of the spring seated type, the valve 20 operating in a valve chamber 21 which communicates with the cylinder 5 through the side wall thereof and at such a point that it is only uncovered by the piston 4 as the latter approaches the limit of its working stroke. Opposite the inlet port 21 is an exhaust port 22 which is of greater width than the inlet port 21 and located slightly closer to the inner end of the cylinder than said inlet port so that the inlet port will begin to open slightly before the exhaust port as better indicated in Fig. 2 in which the piston 4 is shown at the full limit of its working stroke. In the return stroke of the piston 4, the exhaust port 22 is covered before the intake port is fully covered or closed and the charge entering through the inlet port 21 is compressed in the return movement of the piston. The valve 20 is positively operated just before the compressing piston reaches the extreme limit of its compressing stroke by means of a projection or stud 23 on the head of the piston 11, which strikes against the stem 24 of the valve 20, thus forcing the valve 20 away from its seat and permitting the compressed charge in the cylinder 10 to enter the main power cylinder 5. This occurs when the parts assume the relation shown in Fig. 2 or in other words when the inlet port 21 is uncovered by the piston 4. The compressed charge on entering the cylinder 5 is then deflected upwardly by the lip 9 on the head of the piston 4, the charge then striking the scavenging piston hereinafter referred to and being deflected downwardly thereby so as to force the burned gases

through the exhaust port 22 with which an exhaust pipe 25 is connected. The cylinder is shown as provided with the usual water jacket 26, priming cup 27 and igniter or spark plug 28. 29 designates one of the water connections for the jacket 26.

Mounted to reciprocate in the combustion chamber of the power cylinder 5 is a scavenging piston 30 which is comparatively thin and which is carried by a piston rod 31 reciprocating through a bushing 32 inserted in an opening 33 in the cylinder head. The rod 31 is encircled by a coiled expansion spring 34 the tension of which is exerted to yieldingly hold the scavenging piston 30 against the cylinder head and quickly return said scavenging piston to the position shown in Fig. 1 when it has completed its working or scavenging stroke. The quick return of the scavenging piston 30 is effected by a pressure relief valve 35 which controls a central port 36 extending through the piston 30, said valve 35 being yieldingly held against and returned to its seat by means of a spring 37. The valve 35 automatically opens in the return movement of the scavenging piston 30 so as to permit the air between the piston 30 and the cylinder head from forming a cushion which would resist the return movement of the scavenging piston, the air trapped between the scavenging piston and the cylinder head passing by the valve 35 into the combustion chamber.

The means for operating the scavenging piston 30 comprises a rocker arm 38 which is mounted on a pivot 39 between the ends thereof, said pivot being carried by a supporting bracket 40 shown as fastened to the cylinder head. The bracket 40 embodies a guide 41 shown in the form of a laterally projecting arm and slidable through the guide 41 is a push rod 42 having a roller 43 at its extremity which coöperates with one end of the rocker arm 38. The other end of the rocker arm coöperates with a roller 44 journaled in the outer extremity of the piston rod 31.

The push rod 42 is of sectional construction and rendered longitudinally extensible by means of a turn buckle 45. The lower end of the rod 43 is connected by a piston 46 to a link rod 47 in turn connected by a pivot 48 to one arm of a lever 49 journaled between its ends on a shaft 50 supported in the side walls of an extension 51 of the crank case or housing 6. At its inner end the lever 49 carries a roller 52 which, when the scavenging piston 30 is at the limit of its return movement, bears against a shaft 53 journaled in the opposite side walls of the crank case. The shaft 53 is geared in any suitable manner so as to operate at the same speed therewith and preferably rotate in the same direction. It is preferred to gear the shaft 15 to the crank shaft 1 so as to rotate

in the opposite direction. The shaft 53 has an arm 54 carrying at its free end a roller 55 which in each complete revolution of the shaft 53 bears against and coöperates with the rounded face or offset 8 of the connecting rod 3 for the purpose of crowding the connecting rod toward the right in Fig. 1 when the center of the crank pin 56 is directly over the center of the crank shaft 1 and in line with the centers of the crank shaft 1 and the wrist pin 57 of the piston. The shaft 53 also has another arm 58 which is curvilinear in shape and which wipes against the roller 52 of the lever 49 for the purpose of rocking said lever 49 and through the connections described, actuating the scavenging piston 30 on the working stroke thereof. The lever 49 is held in the position illustrated in Fig. 1 by means of a spring 59 coiled around the push rod 42 between the guide 41 and a collar or shoulder 60 on said rod. 61 designates a lighter check spring which is interposed between a shoulder or collar 62 on the push rod 42 and a push rod guide 63 containing a bushing 64 for the rod 42. The guide 63 is preferably formed separately from the engine frame and is connected thereto by suitable fastening means 65. Said guide embodies a bearing surface 66 which lies in a plane parallel to the path of movement of the push rod 42 and the latter has journaled thereon an anti-friction roller 67 which runs against the bearing surface 66 to overcome any tendency of the link rod 47 to bend or cramp the lower end of the push rod 42. By removing the push rod guide 63, access may be had to those members of the actuating mechanism of the scavenging piston which lie within the crank case and extension 51 thereof. The crank case is also provided at the side opposite the extension 51 with a detachable plate or cover 68 for giving access to the shaft 15 and the parts associated therewith.

From the foregoing description taken in connection with the accompanying drawings, the operation of the engine will now be understood to be as follows. Each stroke of the piston 4 toward the crank shaft forms a working or power stroke. As the power piston approaches the inner limit of its movement, it first starts to uncover the inlet port 21 and then the exhaust port 22. When the inlet port 21 is uncovered, the compressing piston 11 completes its working stroke, unseats the valve 20 and liberates the compressed charge into the combustion chamber between the power piston 4 and the scavenging piston 30. Before the power piston completes its full working stroke, the scavenging piston 30 starts in the same direction and moves with greater speed but only about five-eighths of the length of the working stroke of the power piston. This is brought about by the coöperation of the arm 58 of

the shaft 53 with the lever 49. As soon as the arm 58 passes out of engagement with the lever 49, a quick return movement of the scavenging piston 30 is effected by the spring 34, the valve 35 acting to dissipate in air cushion which might otherwise form behind said scavenging piston. In the return movement of the piston 4, the charge is compressed, and when said piston reaches the limit of its return movement, the charge is fired, in the same manner as the ordinary two-cycle engine. One of the most important features of the invention resides in the coöperation which takes place in the arm 54 of the shaft 53 and the connecting rod 2. Ordinarily, in the initial stage of an explosion, the connecting rod bearing 2 being just past the center, the connecting rod 3 occupies a slightly angular position in relation to the path of movement of the power piston and therefore there is a tendency to crowd the piston 4 against the left hand wall of the cylinder in Fig. 1. Just at this time, the arm 54 acts against the surface 8 of the piston rod 3 and tends to push said piston rod bodily together with the piston 4 over against the right hand side of the cylinder in Fig. 1. Therefore one operation counteracts the other, eliminating excessive wear at one side of the piston and thereby greatly prolonging the life and durability of the engine as a whole.

I do not desire to be restricted to the exact construction hereinabove described as it will be apparent that the invention is susceptible to changes in the form, proportion and minor details of construction which may accordingly be resorted to without departing from the principle or sacrificing any of the advantages of the invention.

I claim:-

1. In an internal combustion engine, a cylinder, a reciprocatory piston working therein, a crank shaft, a connecting rod between said piston and crank shaft, a countershaft coöperating with said connecting rod to press the latter in the direction in which the crank pin is moving at a time when said crank pin is between the crank shaft center and the piston pin center.

2. In an internal combustion engine, a cylinder, a reciprocatory piston working therein, a crank shaft, a connecting rod between said piston and crank shaft, a countershaft coöperating with said connecting rod to press the latter in the direction in which the crank pin is moving at a time when said crank pin is between the crank shaft center and the piston pin center, the last named means comprising an arm on said countershaft, and a roller at the free end of said arm which bears against the connecting rod once in each rotation of the crank shaft.

3. In an internal combustion engine, a cylinder a reciprocatory piston working therein, a crank shaft, a connecting rod between said piston and crank shaft, a countershaft coöperating with said connecting rod to press the latter in the direction in which the crank pin is moving at a time when said crank pin is between the crank shaft center and the piston pin center, the last named means comprising an arm on said countershaft, and a roller at the free end of said arm which bears against the connecting rod once in each rotation of the crank shaft, said connecting rod embodying an offset bearing surface with which said roller coöperates.

In testimony whereof I affix my signature.
ROBERT H. BOHLER.