913,070.

J. C. & W. C. STRICKLER.
INTERNAL COMBUSTION ENGINE.
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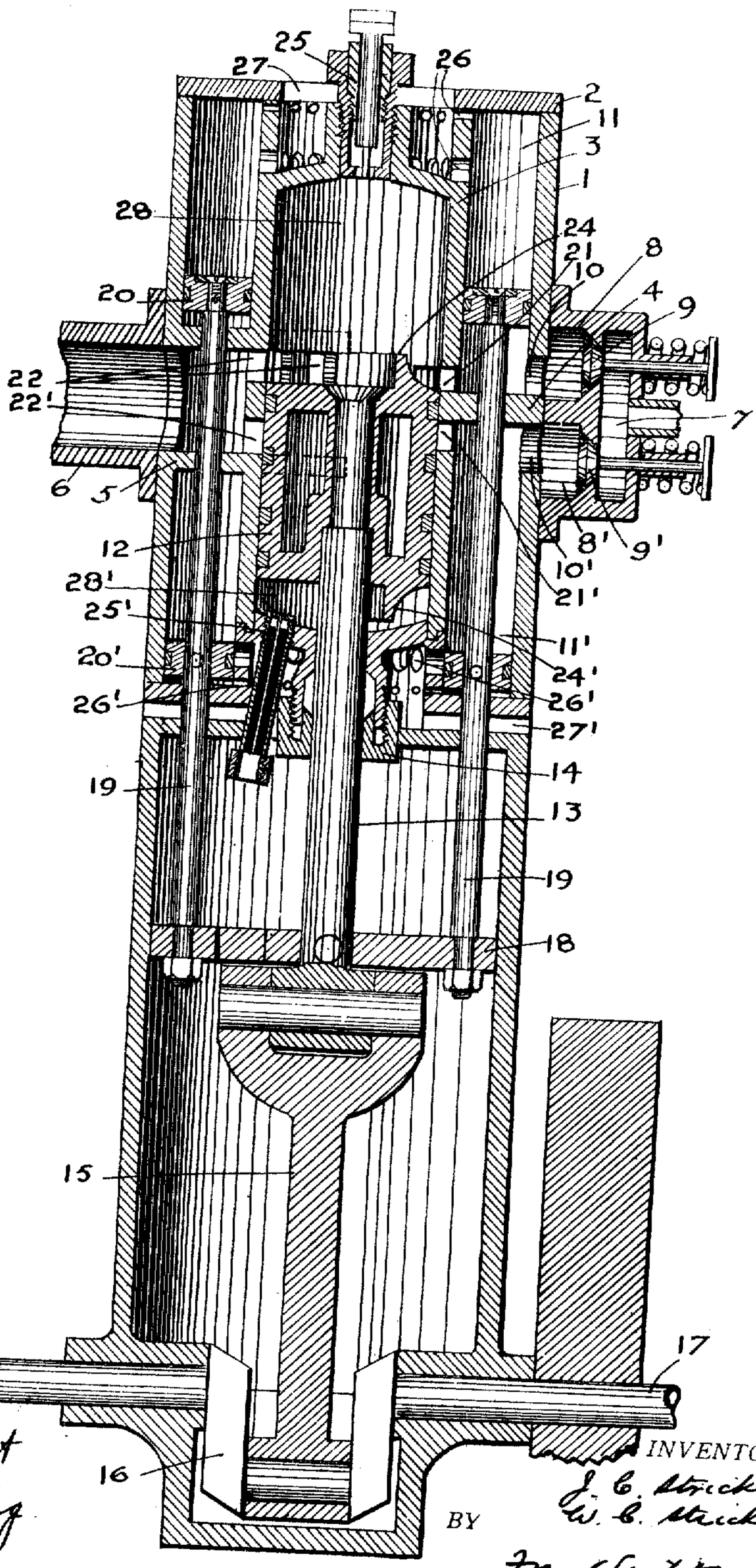

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UNITED STATES PATENT OFFICE.

JOHN C. STRICKLER AND WILLIAM C. STRICKLER, OF SAN FRANCISCO, CALIFORNIA.

INTERNAL-COMBUSTION ENGINE.

No. 913,070. Specification of Letters Patent. Patented Feb. 23, 1909.

Application filed February 12, 1908. Serial No. 415,465.

To all whom it may concern:

Be it known that we, JOHN C. STRICKLER and WILLIAM C. STRICKLER, citizens of Switzerland, residing at San Francisco, in the county of San Francisco and State of California, have invented new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The object of the present invention is to provide an internal combustion engine, which can be used with a lower grade of oil than those at present in use, and with greater efficiency and economy.

In the accompanying drawing, the figure is a vertical or longitudinal section of the engine.

Referring to the drawing, 1 indicates the casing of the engine, which is cylindrical in form, and is closed at the top by a cover 2, and 3 indicates the working cylinder, which is located centrally with reference to the cylindrical casing 1, and is supported therefrom by means of a partition plate 4, and by the extended conduit 5 for the escaping products of combustion, which conduit leads to, and registers with, the exhaust pipe 6.

7 indicates a feed chamber, connected in the usual manner with a carbureter, and, leading from said feed chamber, are upper and lower ports 8, 8′, on opposite sides of the partition 4, controlled respectively by check valves 9, 9′. These ports connect with openings 10, 10′, through the wall of the casing, leading to the annular compartments 11, 11′, on opposite sides of the partition plate 4. Within the working cylinder reciprocates the piston 12, having a piston rod 13, passing through a stuffing box 14, and connected with a pitman 15 which is connected with a crank 16 on the driven shaft 17, the last mentioned parts being of the usual construction. With said piston rod is also connected a plate 18 to which are connected the lower ends of connecting slide rods 19. Two only of these rods are shown, but they may be of any suitable number as four or six, symmetrically arranged around the working cylinder. To these rods are connected, on opposite sides of the partition plate 4, upper and lower plunger rings 20, 20′, which reciprocate in the annular compartments 11, 11′, between the working cylinder and the casing.

21, 21′, indicate the inlet ports into the working cylinder for the combustible gases, these ports extending only on the side of the cylinder next to the openings 10, 10′, and 22, 22′, indicate the upper and lower outlet ports from the working cylinder, these being located in the side of said cylinder remote from the said openings, and opening into the extended exhaust conduit 5. The partition 4 is arranged opposite to the middle working cylinder, extending partly around the working cylinder 3 and within the casing 1 and connecting said working cylinder to said casing, and the conduit 5 is also arranged opposite to the middle of said working cylinder 3, but on the opposite side to the partition 4, and extends between said working cylinder and the casing 1 for the remainder of the circumferential distance around said working cylinder. The supply ports 21, 21′, are provided through the working cylinder on opposite sides of said partition for supplying a combustible gas, and the exhaust ports 22, 22′, are provided in the wall of the working cylinder on the opposite side to the supply ports and leading to the conduit 5.

The piston is formed with semi-annular deflecting flanges 24, 24′, such as are commonly used in this class of engines, the function of which is to deflect the entering combustible gases in such direction as to expel the products of combustion of the previous charge. 25, 25′, indicate upper and lower spark plugs for igniting said gases. 26, 26′, are upper and lower inlet ports for admitting air into the annular compartments between the working cylinder and the casing, and 27, 27′, are passages leading to said latter ports from the external atmosphere.

The following is the mode of operation of the engine. Supposing the parts to be in the position indicated in the drawing, in which a charge has been compressed in the lower combustion chamber 28′, and that ignition takes place in said chamber by means of the spark plug 25′, this combustion forces the piston 12 upwards, closing the upper inlet ports 21 and the upper exhaust ports 22, and compressing in the upper combustion chamber 28 the charge which has just been admitted through said inlet ports 21. Both plunger rings travel upwards with the piston, the function of the lower ring being to draw air in through the passage 27′ and ports 26′ into the lower annular space 11′ below the plunger ring 20′ and at the same

time to compress the charge in said annular space 11′ above said plunger ring. As soon as the piston passes the upper exhaust ports 22, it begins to compress the charge in the upper combustion chamber 28, and at the same time the upper plunger ring performs two functions, namely, the expulsion of the air from the upper annular chamber 11 above the plunger ring 20, and the drawing in of the charge through the upper check valve 9 into the annular chamber 11 below said plunger ring 20. As the piston approaches the end of its upward movement, the lower edge of said piston passes the exhaust ports 22′, when the products of combustion immediately escape into the exhaust pipe 6, and immediately thereafter the charge which had been compressed in the annular compression chamber 11′ passes through the inlet ports 21′ into the lower combustion chamber, from which, on account of the form of the deflecting flange 24′, it expels the products of the previous combustion. The operation is then repeated, but in the reverse direction.

The following are the advantages of the above-described construction. By reason of the fact that the combustion chamber is almost completely surrounded by annular chambers, each of which, at one part of the cycle of the engine, is a compression chamber for compressing the charge, and that this compression takes place in each annular chamber surrounding the corresponding combustion chamber immediately after combustion, and while the piston is being driven by the force of the combustion, it results that much of the heat of combustion transmitted to the walls of the working cylinder is taken up by the compressed charge in the annular compressor chamber. On account of the great heat thus transmitted, oil can be used of a much lower grade, than is at present used for this class of engines. At the same time the annular chamber below the plunger ring is formed into a cooling chamber, by drawing a charge of cold air into said chamber around the working cylinder. The parts therefore are well constructed and arranged, first, to abstract the heat of combustion to pre-heat the charge before explosion, and then to cool the working cylinder.

Various other modes of assembling and arranging the parts may be adopted without departing from the spirit of our invention, but we prefer that herein disclosed.

We claim:—

1. In an internal combustion engine, the combination of a cylindrical casing, a working cylinder within the casing, closed at both ends, and forming with the casing an annular chamber, a piston in said cylinder, a piston rod connected with said piston and passing through one of the ends of the working cylinder, upper and lower plunger rings in said annular chamber, and operatively connected with said piston rod, whereby the piston and plunger rings reciprocate in unison, means for partitioning the annular chamber into compartments, in which said plunger rings respectively reciprocate, an inlet port from each of the annular compartments leading into the end of the working cylinder adjacent to said compartment at a point adjacent to the middle of the cylinder, and adapted to be closed by the piston as it moves from its terminal position in the other end of the cylinder, a sparking device in each of said closed ends of the working cylinder, and a port leading to each compartment and adapted to supply combustible fluid thereto, substantially as described.

2. In an internal combustion engine, the combination of a cylindrical casing, a working cylinder within the casing, closed at both ends, and forming with the casing an annular chamber, a piston in said cylinder, a piston rod connected with said piston and passing through one of the ends of the working cylinder, upper and lower plunger rings in said annular chamber, and operatively connected with said piston rod, whereby the piston and plunger rings reciprocate in unison, means for partitioning the annular chamber into compartments, in which said plunger rings respectively reciprocate, the wall of the working cylinder at each end outside the corresponding plunger ring being freely exposed to the atmosphere independently of the movement of said ring, an inlet port from each of the annular compartments leading into the end of the working cylinder adjacent to said compartment at a point adjacent to the middle of the cylinder, and adapted to be closed by the piston as it moves from its terminal position in the other end of the cylinder, a sparking device in each of said closed ends of the working cylinder, and a port leading to each compartment and adapted to supply combustible fluid thereto, substantially as described.

3. In an internal combustion engine, the combination of a cylindrical casing, a working cylinder within the casing, closed at both ends, and forming with the casing an annular chamber, a piston in said cylinder, a piston rod connected with said piston and passing through one of the ends of the working cylinder, upper and lower plunger rings in said annular chamber and operatively connected with said piston rod, whereby the piston and plunger rings reciprocate in unison, means for partitioning the annular chamber into compartments, in which said plunger rings respectively reciprocate, means whereby, upon the movement of either plunger ring from the corresponding end of the working cylinder, atmospheric air is drawn by the plunger ring into the corresponding compartment and into contact with

the corresponding end of the working cylinder, an inlet port from each of the annular compartments leading into the end of the working cylinder adjacent to said compartment at a point adjacent to the middle of the cylinder, and adapted to be closed by the piston as it moves from its terminal position in the other end of the cylinder, a sparking device in each of said closed ends of the working cylinder, and a port leading to said compartment and adapted to supply combustible fluid thereto, substantially as described.

4. In an internal combustion engine, the combination of a cylindrical casing, a working cylinder within the casing, closed at both ends, and forming with the casing an annular chamber, a piston in said cylinder, a piston rod connected with said piston and passing through one of the ends of the working cylinder, upper and lower plunger rings in said annular chamber and operatively connected with said piston rod, whereby the piston and plunger rings reciprocate in unison, means for partitioning the annular chamber into compartments, in which said plunger rings respectively reciprocate, the casing being provided with conduits leading to the outer surface of each plunger ring, and also to the outer surface of the corresponding end of the working cylinder, whereby, by the movement of the plunger ring, air is sucked in from the atmosphere to cool the end of the working cylinder, an inlet port from each of the annular compartments leading into the end of the working cylinder adjacent to said compartment at a point adjacent to the middle of the cylinder, and adapted to be closed by the piston as it moves from its terminal position in the other end of the cylinder, a sparking device in each of said closed ends of the working cylinder, and a port leading to said compartment and adapted to supply combustible fluid thereto, substantially as described.

5. In an internal combustion engine, the combination of a casing, a working cylinder therein, closed at both ends, a piston in said cylinder, a piston rod passing through one end of the working cylinder, a partition arranged opposite to the middle of the working cylinder, and extending partly around the working cylinder and within the casing and connecting said working cylinder to said casing, a conduit also arranged opposite to the middle of said working cylinder, but on the opposite side to the partition, and extending between said working cylinder and casing the remainder of the circumferential distance around said working cylinder, ports on opposite sides of said partition for supplying a combustible gas, ports in the wall of the working cylinder opposite to the supply ports and leading to the conduit, plunger rings in the annular space between the casing and the working cylinder on opposite sides of the partition and conduit, and an operative connection between said rings and piston whereby they work in unison, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

JOHN C. STRICKLER.
WILLIAM C. STRICKLER.

Witnesses:
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