O. J. COLE.

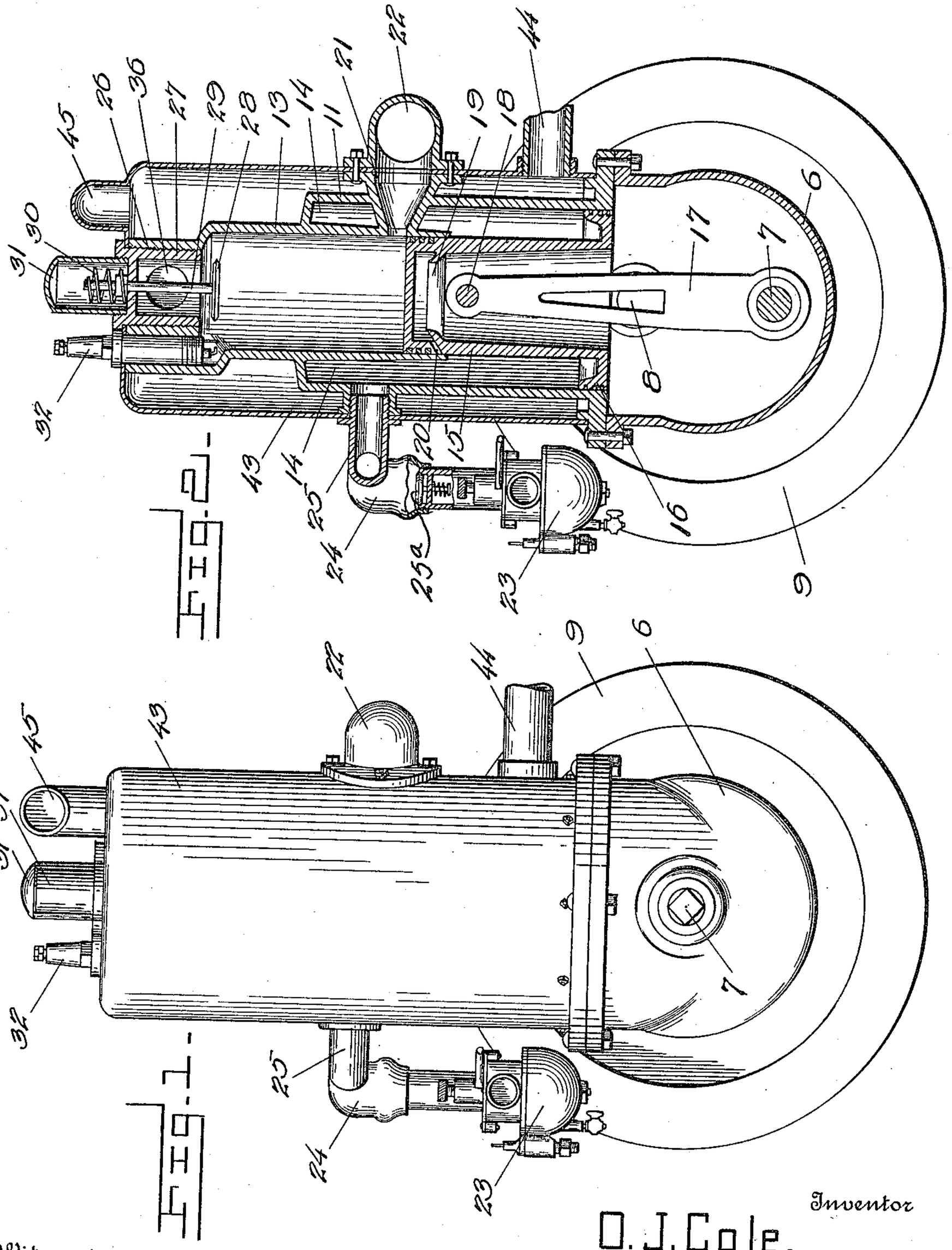
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED AUG. 27, 1912.

1,154,844.

Patented Sept. 28, 1915.

3 SHEETS—SHEET 1.



Witnesses

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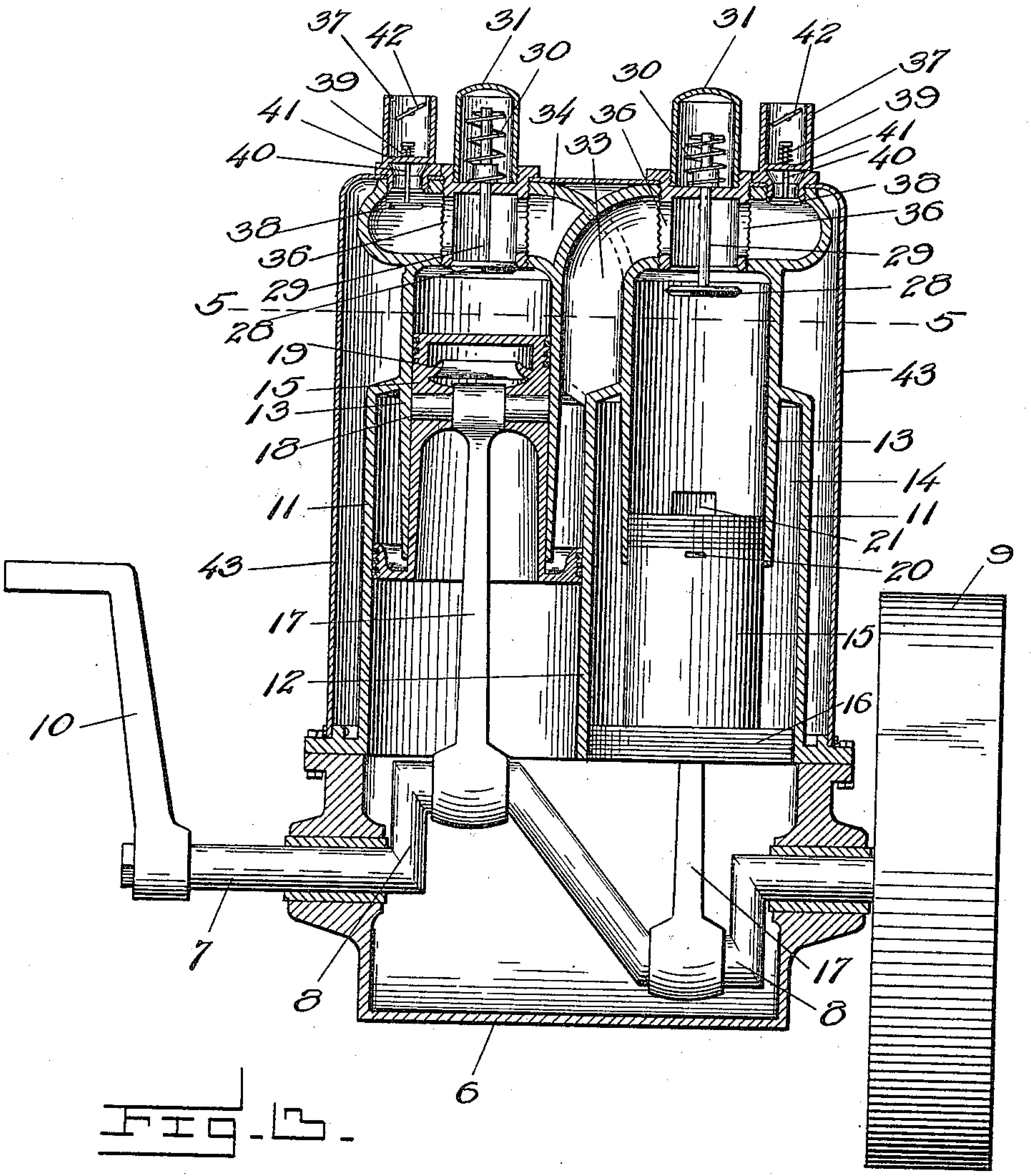

Fig. 2.

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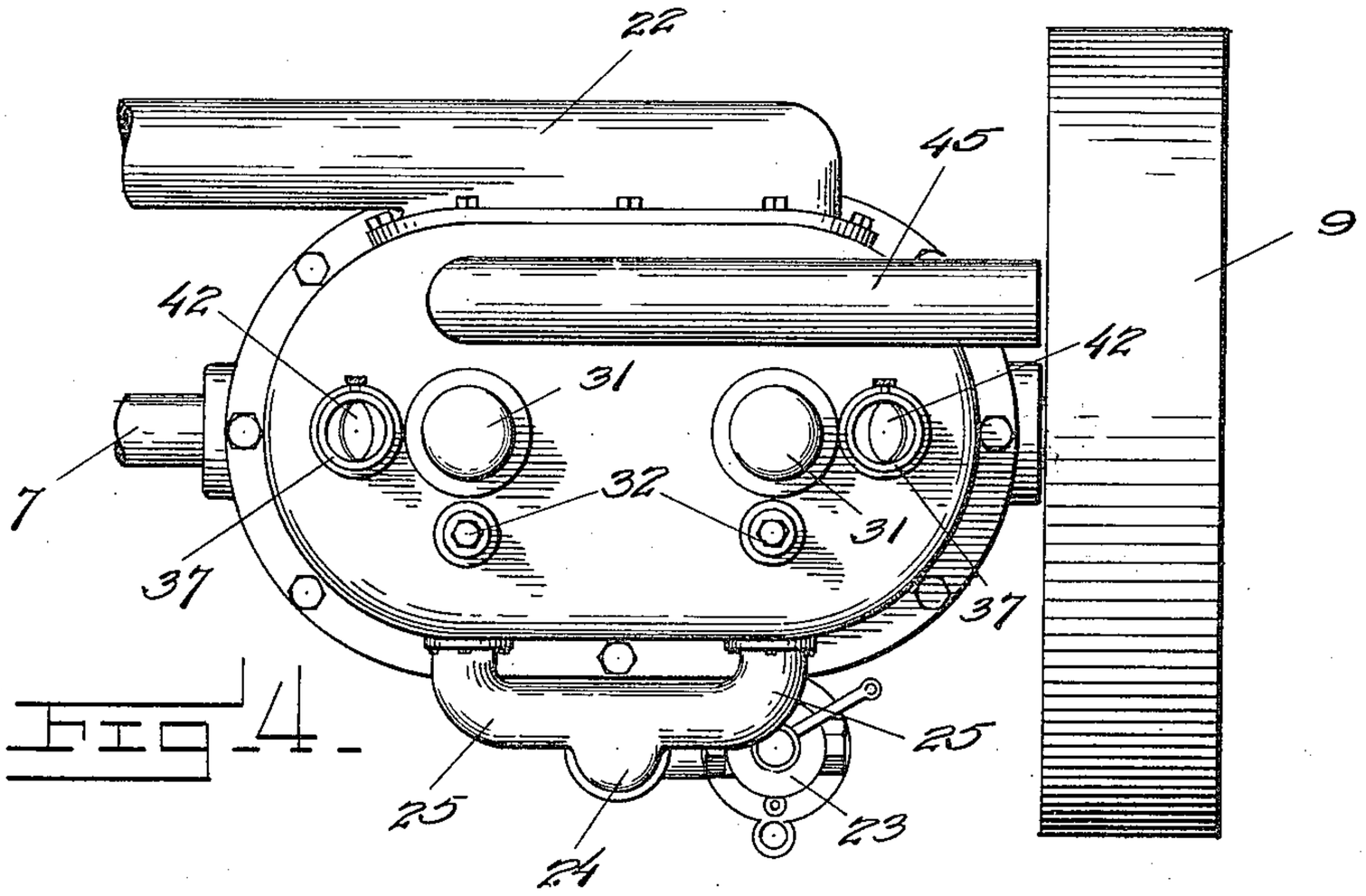

Fig. 4.

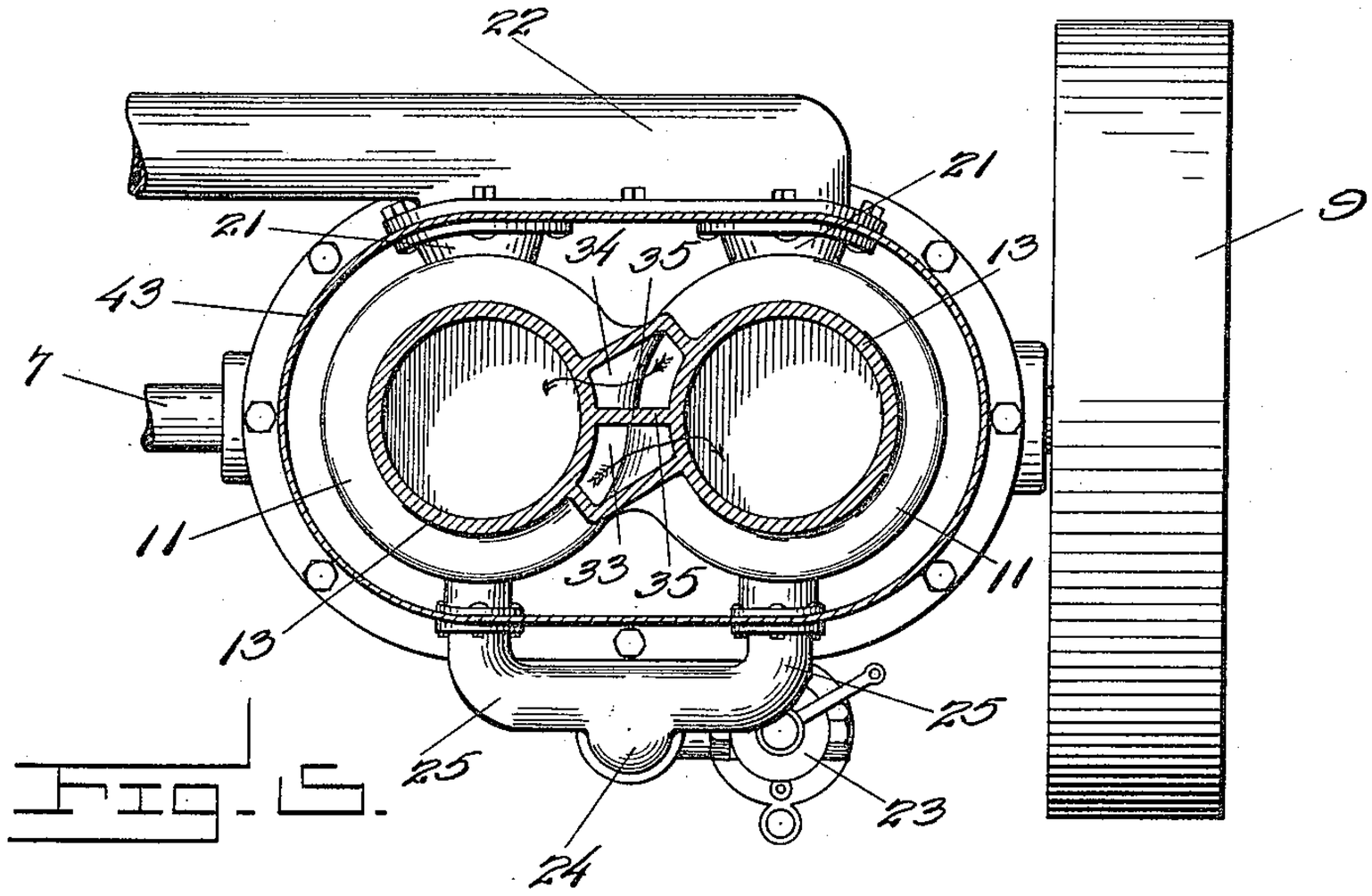

Fig. 5.

Witnesses

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UNITED STATES PATENT OFFICE.

ORLANDO JAMES COLE, OF COXS CREEK, KENTUCKY.

INTERNAL-COMBUSTION ENGINE.

1,154,844. Specification of Letters Patent. Patented Sept. 28, 1915.

Application filed August 27, 1912. Serial No. 717,282.

To all whom it may concern:

Be it known that I, ORLANDO J. COLE, a citizen of the United States, residing at Coxs Creek, in the county of Nelson and State of Kentucky, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

The present invention relates to internal combustion engines of the type wherein two or more working pistons are provided with pumping pistons, the pumping piston of one working piston serving to force the explosive charge into the cylinder containing the other working piston.

An important object of the invention is to provide an engine of the above mentioned character, which is so constructed that a proper amount of fresh air is introduced into the explosive cylinders to expel the products of combustion therefrom, subsequently to which the explosive charge is introduced into said cylinders, the same having been first properly heated before such introduction.

A further object of the invention is to provide an engine of the above mentioned character, which is compact in the arrangement of its parts, strong, durable, and not liable to derangements.

A further object of the invention is to provide an engine of the above mentioned character, which will make very little noise during its operation.

A further object of the invention is to provide novel means for holding the valves in place, whereby the valves may be easily and quickly removed to be cleaned or ground.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same, Figure 1 is an end view of the engine, Fig. 2 is a central transverse sectional view through one of the cylinders and associated elements, Fig. 3 is a central vertical longitudinal sectional view through the engine, Fig. 4 is a plan view of the same, and, Fig. 5 is a horizontal sectional view taken on line 5—5 of Fig. 3.

In the drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention, the numeral 6 designates a closed crank case, within which is mounted a crank shaft 7, having cranks 8. Rigidly mounted upon one end of the crank shaft 7 is a fly-wheel 9, as shown. Connected with the opposite end of the crank shaft 7 is a starting crank 10. Rigidly mounted upon the crank case 6 are upstanding pumping cylinders 11, having a common inner wall 12, as shown. Formed upon the upper ends of the pumping cylinders 11 and preferably cast integral therewith, are explosion cylinders 13, the lower end portions of which extend downwardly for considerable distances within the pumping cylinders 11, providing annular spaces 14, which overlap the lower portions of the explosion cylinders 13. Disposed within the explosion cylinders 13 are hollow working pistons 15, having their upper ends closed and their lower ends open, as shown. Formed upon the lower open end of each of the working pistons 15 is a pumping piston 16, which is of greater diameter than the working piston, as shown. The pumping piston 16 overlaps upwardly the lower end of the working piston. By having the pumping piston thus overlapping upwardly the lower end of the working piston and the explosion cylinder 13 extending downwardly into the upper end of the pumping cylinder 11, quite a compact construction is obtained, whereby the engine may be built quite short. Extending into the hollow working pistons 15 are pitmans 17, which are pivotally connected therewith by pins 18. These pitmans extend downwardly and engage the cranks 8, as shown.

Each of the working pistons 15 is provided near and spaced from its upper closed end, with an annular oil catching and holding trough 19, having communication with a suitable number of openings 20, adapted to conduct the oil to the inner surface of the cylinder 13. As is customary, the crank case 6 is partially filled with oil and some of this oil is splashed by the pitman 17 and crank 8 into the trough 19, during the operation of the engine. Heretofore it has been particularly difficult to supply oil to the inner surface of the explosion cylinder where the piston that operates therein is provided with a pumping piston of greater diameter. It is thus seen that I have provided novel and simple automatic means for supplying oil to the inner surface of the explosion cylinder. Each of the explosion cyl-

inders 13 is provided with an exhaust port or opening 21, which is uncovered when the working piston 15 moves to its lowermost position. This exhaust port leads into a common exhaust pipe or manifold 22.

The numeral 23 designates a carbureter of any well known or preferred type, connected with a manifold 24, which supplies the explosive charge into the upper ends or spaces 14 of the pumping cylinders 11, through pipes 25, as shown. 25[a] is a check valve.

As shown in Fig. 2, the upper end of each of the explosion cylinders 13 is provided with a reduced internally screw-threaded sleeve or extension 26, for receiving an externally screw-threaded valve casing or shell 27, as shown. This valve casing 27 has its upper end closed and its lower end open and adapted to have communication with the interior of the explosion cylinder. The lower end of the valve casing 27 serves as a seat for a downwardly opening check valve 28, connected with a stem 29, extending upwardly through the closed upper end of the casing 27. Surrounding the upper end of the valve stem 29 is a coil spring 30, which serves to normally hold the valve 28 in its closed position.

The numeral 31 designates a cap or cup which surrounds the upper end of the valve stem 29 and has screw-threaded engagement with the valve casing 27, as shown. This cap keeps out the dust and the like from the valve stem and also muffles the noise made by the valve when the same is operating. Each of the explosion cylinders 13 is provided with a spark plug 32, disposed near one side of the valve casing 27, as shown.

Disposed between the explosion cylinders 13 are gas conduits 33 and 34, which are cast integral with the explosion cylinders, as shown. These gas conduits have a common dividing wall 35 and their side walls are formed by the walls of the explosion cylinders, as shown in Fig. 5. The gas conduit 33 has its lower end in open communication with the space 14 of the pumping cylinder 11 to the left and extending upwardly to the right to extend transversely over the explosion cylinder 13 to the right, as shown. The gas conduit 34 has its lower end in free communication with the space 14 of the pumping cylinder 11 to the right and extending upwardly to the left to traverse the upper end of the explosion cylinder 13 to the left, as shown. Each of the gas conduits 33 and 34 has free communication with the valve casing 27 through oppositely arranged openings 36, formed in such valve casing. The particular arrangement and formation of these gas conduits is an important feature of the invention, as it enables the gas or explosive charge to receive the maximum amount of heat from the explosion cylinder before being fed into the same. It is thus seen that by having the side walls of the gas conduits formed of the walls of the explosion cylinders, the heat from the explosion cylinders may readily radiate into said gas conduits. This construction is also cheap and compact. Having screw-threaded engagement with the upper ends of the gas conduits 33 and 34 are air supply casings or pipes 37, having their lower ends leading into said gas conduits.

The numeral 38 designates inwardly opening check valves, normally held seated by springs 39, surrounding valve stems 40, which operate through stationary spiders 41. Swingingly mounted within the air supply casings 37 are valves 42, to regulate the amount of air passing therethrough. Surrounding the explosion cylinders 13 and pumping cylinders 11, is a sheet-metal water jacket 43, suitably spaced from the same and extending downwardly to the crank case 6, as shown. The water is fed into the jacket 43 through a lower pipe 44 and discharges from the same through an upper pipe 45, as shown. Instead of passing water through the jacket 43, I may pass air through the same or any other suitable cooling medium.

The operation of the engine is as follows: Assuming that the engine is operating and the working pistons 15 occupy the positions shown in Fig. 3, the pumping cylinder 11 to the right has been filled with the gas or explosive charge due to the downward movement of the pumping piston 16. The working piston 15 to the right has moved downwardly to pass the exhaust port 21, whereby the products of combustion may pass therethrough. Upon the previous down stroke of the pumping piston 16 to the left, air was introduced into the upper end of the gas conduit 33 through casing 37 and gas into the upper portion of the left cylinder 11. When the pumping piston 16 to the left, moves upwardly to assume the position shown in Fig. 3, the exhaust port 21 being uncovered, as above stated, the check valve 28 will be unseated and the air supplied into the cylinder 13 to the right before the explosive charge is supplied therein. This air serves to expel any of the products of combustion that may remain in the cylinder and forms a blanket or partition between such products of combustion and the fresh charge. Upon the upward movement of the piston 15 to the right, the exhaust port 21 is of course closed and the valve 28 seated, subsequently to which the fresh charge is compressed and fired when the piston is in its upper position. When the pumping piston 16 to the right has moved to the lowermost position, as shown in Fig. 3, fresh air is drawn into the outer end of the gas conduit 34, which is in turn introduced into the explosion cylinder 13 to the left when the piston 15 moves downwardly to uncover the ex-

haust port. The upward movement of the piston 16 to the right forces this air and the gas into the cylinder 13, to the left through the gas conduit 34, it being understood that the air first enters the cylinder 13 to the left to drive out all the products of combustion and form a blanket between such products of combustion and the fresh charge. Upon the upward movement of the piston 15 to the left, the fresh charge is entrapped, compressed and fired, as is customary. It is thus seen that the pumping piston of one working piston supplies air and gas to the explosion cylinder of the other working piston. The pitmans 17 and cranks 8 operating within the crank case 6 splash the oil contained therein into the hollow pistons 15, which oil is caught within the annular troughs 19 and fed through the openings 20 to lubricate the exterior surface of the working pistons and the inner surface of the explosion cylinders.

Attention is called to the fact that the inner wall of the annular space 14 or the upper end of the pumping cylinder 11 is formed of the lower portion of the working cylinder 13. By this construction a large heating area is provided for utilizing the heat generated in the cylinder 13, to heat the fresh charge being compressed within the space 14. The water or the like circulating within the jacket 43 serves to heat the outer wall of the pumping cylinder 11, thus aiding in heating the fresh charge of gas drawn therein upon the down stroke of the piston. It is thus seen that there are three means which serve to properly heat the fresh charge, to wit, the lower portion of the working cylinder, serving as the inner wall of the annular space 14 or upper end of the pumping cylinder, the water circulating in the jacket 43, and the conduits 33 and 34 having their side walls formed of the walls of the working cylinders.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that certain changes in the shape, size, and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claim.

Having thus described my invention, I claim:—

In an engine of the character described, the combination with a pair of explosion cylinders provided near their lower ends with pumping cylinders, pistons mounted to operate in the explosion cylinders and having flanges operating within the pumping cylinders, gas supply conduits communicating with the interior of the pumping cylinders and having horizontal portions extending across the upper ends of the explosion cylinders and beyond the same for a substantial distance, a jacket surrounding the top of the explosion cylinders and the upper portions of the gas conduits and extending downwardly about the explosion cylinders, valve casings passing through the top of the jacket, the horizontal portions of the gas supply conduits and having screw-threaded engagement with the top of the explosion cylinders, inwardly opening check valves carried by the valve casings, air supply conduits passing through the top of the jacket and leading into the outer ends of the horizontal portions of the gas supply conduits, inwardly opening check valves controlling the passage of air through the air supply conduits, adjustable cut off valves arranged within the air supply conduits, and means for connecting the pumping cylinders with a carbureter for supplying fuel thereto.

In testimony whereof I affix my signature in presence of two witnesses.

ORLANDO JAMES COLE.

Witnesses:

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JOHN S. KEELEY, Jr.