J. L. JOHNSON.

ENGINE.

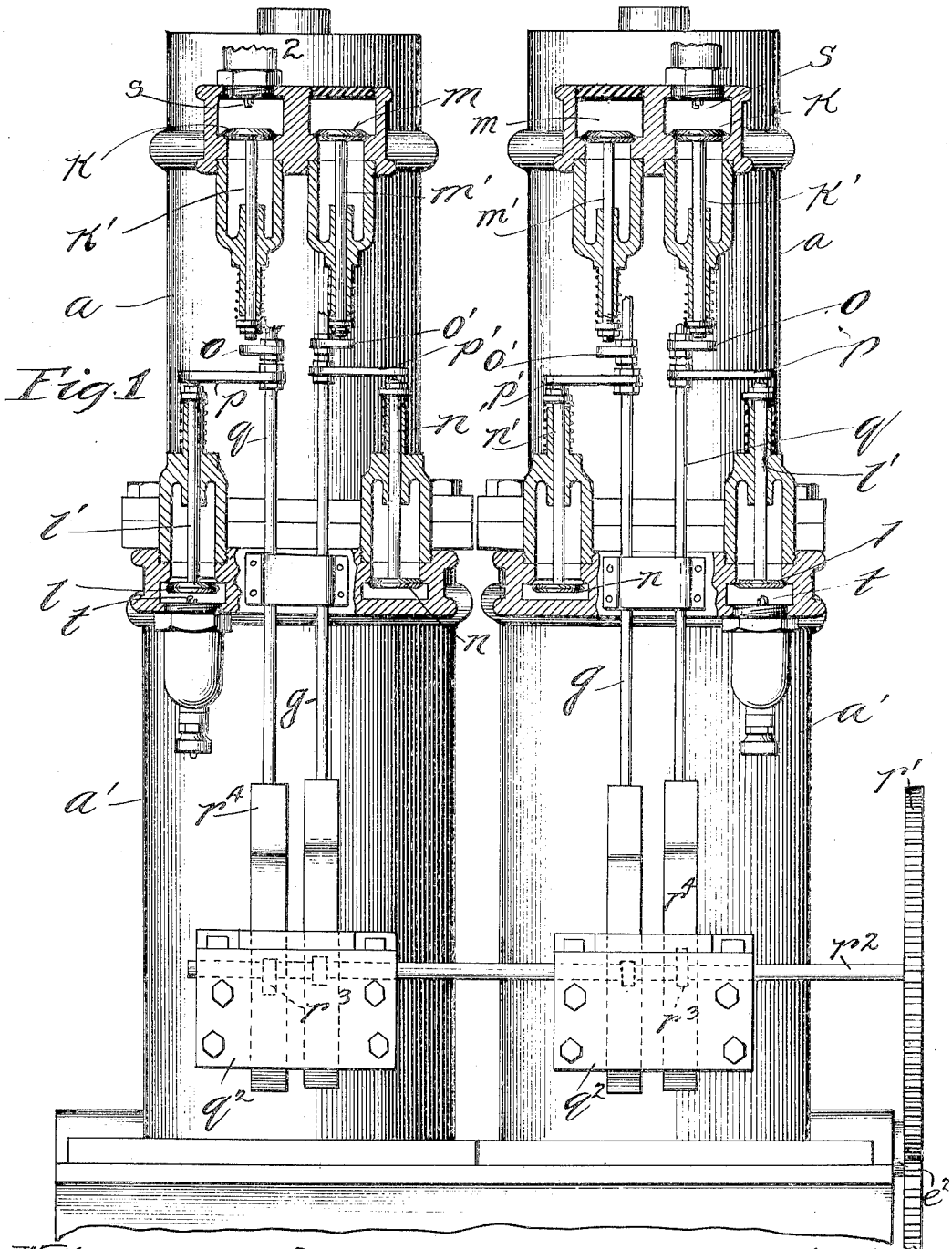
APPLICATION FILED AUG. 3, 1908.

1,009,669.

Patented Nov. 21, 1911.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses: 2

D. A. Faubenschmidt

L. J. Dumais.

Inventor:

John L. Johnson

By G. L. Cragg

Atty

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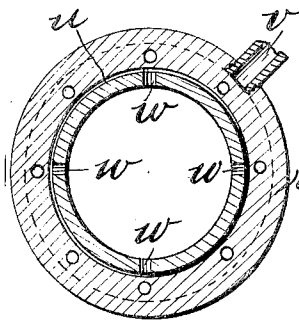
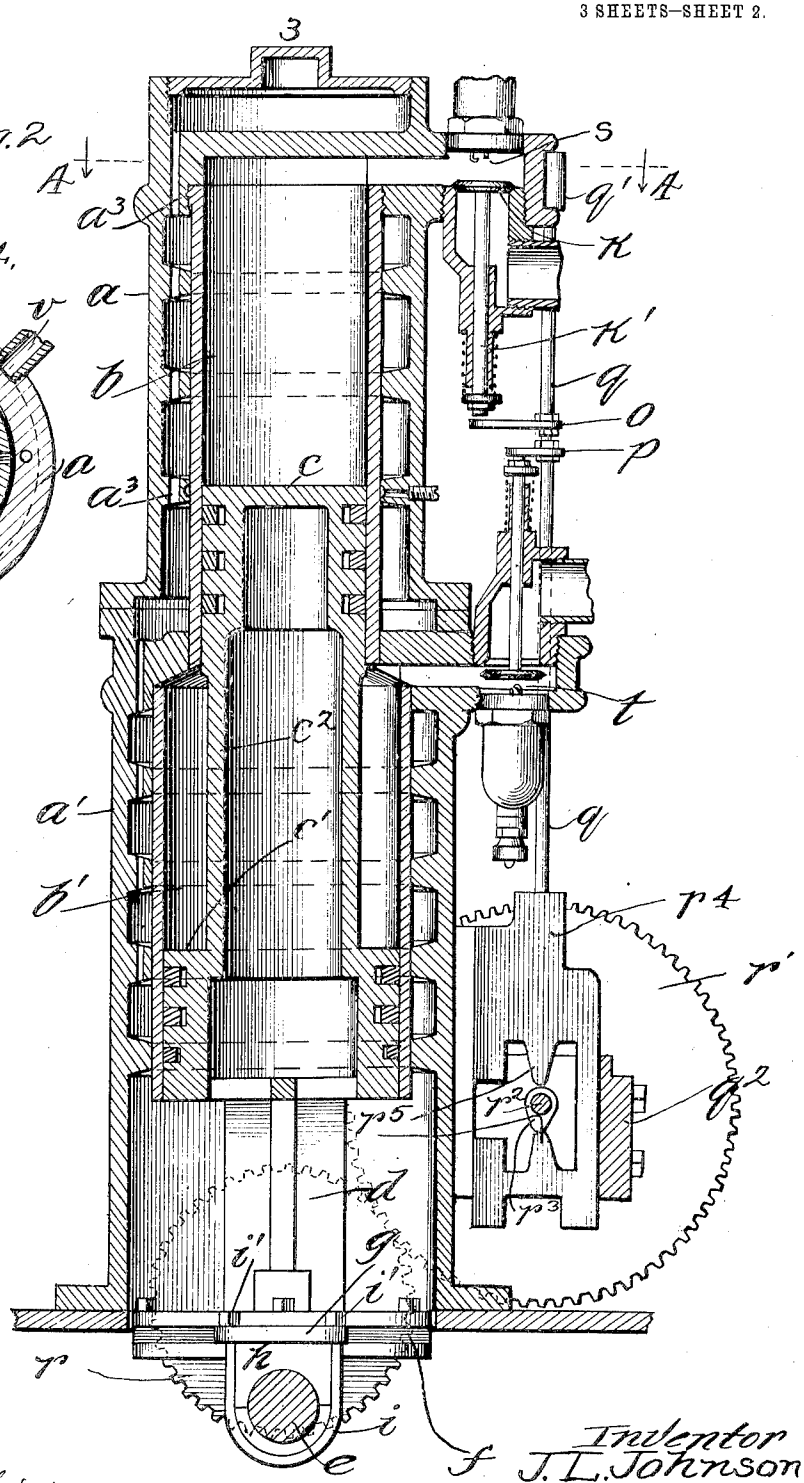
3 SHEETS—SHEET 2.

Fig. 2

Fig. 4.





Witnesses.

G. A. Rauberschmidt

L. J. Dumais.

Inventor

J. L. Johnson

By G. L. Gragg

Atty

J. L. JOHNSON.

ENGINE.

APPLICATION FILED AUG. 3, 1906.

1,009,669. Patented Nov. 21, 1911.

3 SHEETS—SHEET 3.

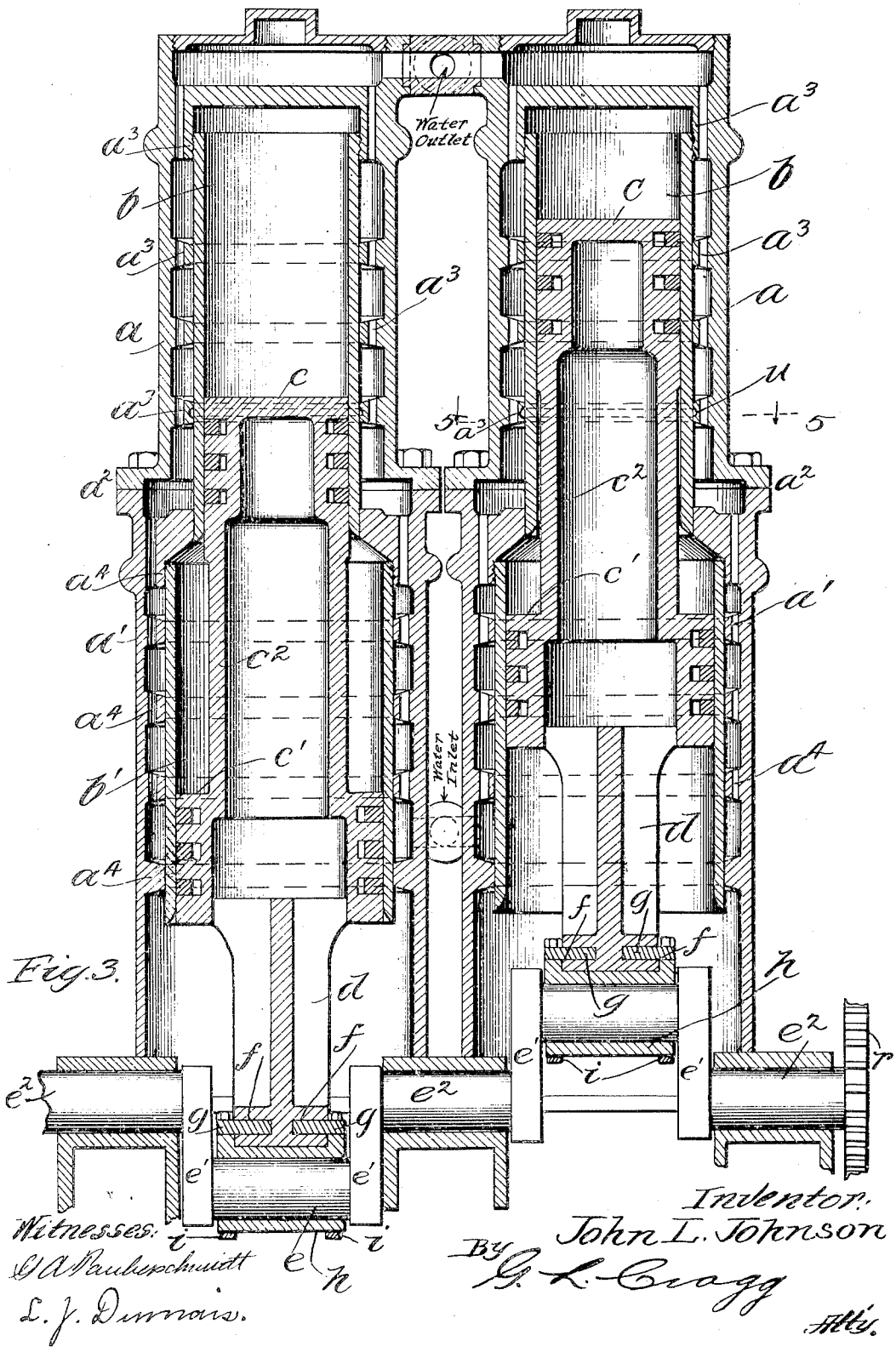


Fig. 3.

Witnesses:
G. A. Paulenschmidt
L. J. Dunnais.

Inventor:
John L. Johnson
By G. L. Cragg
Atty.

UNITED STATES PATENT OFFICE.

JOHN L. JOHNSON, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO GEORGE J. REELING, OF CHICAGO, ILLINOIS.

ENGINE.

1,009,669. Specification of Letters Patent. Patented Nov. 21, 1911.

Application filed August 3, 1908. Serial No. 446,606.

To all whom it may concern:

Be it known that I, JOHN L. JOHNSON, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Engines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to internal combustion engines and its various objects and advantages will readily appear from the following description of the preferred embodiment of the invention, shown in the accompanying drawings, in which—

Figure 1 is a view in elevation, partially in section, of an engine containing the invention. Fig. 2 is a vertical sectional view. Fig. 3 is a vertical sectional view taken at right-angles to the direction in which Fig. 2 is taken, a water outlet being illustrated in this figure which is not illustrated in Fig. 1, Fig. 3 illustrating a modification of the structure shown in Fig. 1 in this respect. Fig. 4 is a sectional view on line 5—5 of Fig. 3.

Like parts are indicated by similar characters of reference throughout the different figures.

My invention is realized in each of the two units illustrated, and I will, therefore, particularly describe the left-hand unit shown in Figs. 1, 2 and 3, parts of a similar nature and function appearing in the right-hand unit being given similar characters of reference.

In each unit of the invention that is to be particularly described, I have shown an outer jacket composed of two cylindrical sections a a^1 that are bolted together at a^2, the upper cylindrical jacket a having a series of insetting flanges a^3 that are in driving fit with a steel engine cylinder b. Similarly, the lower cylindrical jacket section a^1 is provided with insetting flanges a^4 that are in driving fit with a steel engine cylinder b^1. The lower end of the upper cylinder b projects into the upper end of the jacket provided for the lower cylinder b^1 and is in driving fit with a reduced extension of the flange a^4. The additional insetting flanges a^3 are provided with a series of vertically extending apertures therethrough, so as to establish communication between the insetting flanges substantially throughout the combined length of the portions of the united jackets that inclose the engine cylinders. These vertical openings through the flanges a^3, by establishing paths between the spaces intervening between the flanges, enable cooling water or other cooling fluid to be circulated. A compound piston is provided for reciprocation within the cylinders b b^1, the upper section c of such compound piston being of smaller diameter than the lower section c^1 of such compound piston inasmuch as the sections c c^1 are arranged in tandem to travel back and forth within the cylinders b b^1 that are arranged in tandem. The portions of the cylinders b b^1 above the piston sections c c^1 constitute combustion or explosion chambers, the gas within which, when ignited, exerts downward pressure upon the piston, fresh gas being admitted to the upper portion of each combustion chamber the inflow of the unused gas and the outflow of the spent gas being controlled by means of valve mechanism that will hereinafter be described. The operation of the valves is so timed that gas in one combustion chamber explodes at a time and the spent gas is exhausted from but one chamber at a time, all as will appear.

It will be seen from the drawings that the section c^1 of the compound piston is of annular shape, but the area thereof which is disposed to pressure of ignited gas, should preferably be equal to the area of the section c of the compound piston, so that equal torque is exerted upon the shaft by the exploding gas in each combustion chamber.

In the particular embodiment of my invention illustrated, the cylinders b b^1 not only form parts of combustion chambers, together with the sections c c^1 of the compound piston, but they also constitute guides for directing the sections c c^1 of the compound piston in the line of travel of the piston, whereby special guides, cross-heads and slides are eliminated.

In accordance with my present invention, I eliminate the swinging pitmen and substitute therefor a bar d which is rigid with respect to the compound piston at one end and in driving relation with the crank pin at the other end, this crank pin, in the embodiment of the invention illustrated, being

joined to a pair of cranks e^1 that are provided upon the crank shaft e^2. The interconnection between the crank pin e and the rigid extension d of the piston, is effected by the construction now to be described, which includes two guide-ways f formed in said extension d, and two insetting plates g led into said guide-ways, said plates being secured upon the top of the box h provided for the crank pin, by means of straps i and nuts i^1. As the piston rises and falls, the plates g reciprocate in the guide-ways f in a direction transverse to the line of travel of the piston. The structure f g h and i thus constitutes a cross-head that is guided in its travel by structural parts that move with the piston. The structure that has been thus far described is provided with four valves, the valves k and l constituting intake valves for the cylinders b and b^1, respectively, while the valves m and n constitute the exhaust valves for said cylinders, respectively. These valves k l m and n are, respectively, provided with stems k^1 l^1 m^1 and n^1 that are, when idle, spring-pressed to close the valves, as is common practice. In the embodiment of the invention shown, the stems k^1 l^1 of the intake valves extend toward each other and are included in the paths of movement respectively of the arms o and p, which project from a common actuating rod q that is provided with an upper guide q^1 and a lower guide q^2.

The crank shaft e^2 carries a pinion r which is in mesh with a gear wheel r^1, which latter is provided with a shaft r^2 that has a series of cams r^3, each of which is provided for the purpose of operating the valve-controlling rod associated with a set of valves, and inasmuch as there are four sets of valves it is to be understood that there are four such cams r^3 upon the shaft r^2, as indicated in dotted lines at the lower part of Fig. 1. Each cam r^3 engages a peculiarly shaped cam block r^4, illustrated most clearly in Fig. 2, and which constitutes a continuation of the rod q that is guided in the lower guide q^2 which is laterally extended for the purpose of receiving the cam block r^4. This cam block is provided with two insetting noses r^5 that ride upon the associate cam r^3 in a manner to effect the opening of the intake valve l at the beginning of one revolution, and the intake valve k at the beginning of the second revolution of the crank shaft. The shaft r^2 has association with a rod g similar to the association of said shaft with the rod q, the rod g carrying arms o^1 and p^1 which are coöperatively related to the stems m^1 n^1 of the exhaust valves m and n. The exhaust valve m is, by means of the rod g and the mechanism interrelating it with the shaft r^2, caused to open upon the beginning of the second half of the said first revolution, and the exhaust valve n is caused to open upon the beginning of the second half of the second revolution, whereby the spent gas is discharged.

I have shown sparking devices s t for the purpose of igniting the admitted gas, the operation of which is well understood and need not here be described.

The same shaft r^2 which operates the rods q g of the left-hand unit also operates the rods q g of the right-hand unit, but the cams r^3 upon the shaft r^2 that operate the rods q g of the right-hand unit do not have the same angular relation with said shaft r^2 as do the cams r^3 that operate the rods q g of the left-hand unit. All of the cams r^3 are so interrelated with the shaft r^2 that gas is admitted to the various cylinders that it may be compressed and exploded or ignited in said cylinders in a manner to effect two turning efforts upon the crank shaft per revolution, the left-hand unit of the engine exerting turning effort at the beginning of the first revolution, the right-hand unit exerting turning effort at the beginning of the second half of the first revolution, the left-hand unit of the engine exerting turning effort at the beginning of the second revolution, and the right-hand unit exerting turning effort at the beginning of the second half of the second revolution of the engine. The exhaust valve associated with each cylinder operates at the beginning of the second half of the second revolution of the crank shaft that occurs after the associate intake valve has started to open.

I have thus shown how two units of my invention may be coöperatively related to get advantages equal to and superior to those that are secured by a four cylinder engine. Having shown how my invention may be adapted to a four cylinder engine, it will be obvious to those skilled in the art how the device of my invention may be adapted to engines having six or more cylinders.

The engine of my invention includes a lubricating feature illustrated most clearly in Fig. 4 and at section line 5 5 of Fig. 3. In these views I have illustrated an annular channel u within an insetting flange a^3, an oil pipe v conducting oil fed by gravity to said annular channel u. The oil entering the channel u circulates about the cylinder encircled by said channel and enters the interior of said cylinder through openings w, whereby the oil is distributed about the cylinder so as to thoroughly lubricate the portion of the reciprocating piston engaging said cylinder.

The igniting devices of each unit of the engine are operated in sequence by mechanism that is so well understood as not to require illustration.

It will be seen that I have provided an internal combustion engine including two units located side by side, each unit having two

combustion cylinders arranged in tandem, a compound piston working within said cylinders, an intake valve for each cylinder, an exhaust valve for each cylinder, an igniting device for each cylinder, mechanism for operating the intake valves in sequence and the exhaust valves in sequence, a cross-head journaled upon a crank pin, and guiding means traveling with the piston for guiding the travel of the cross-head transversely to the direction of movement of the piston, the mechanism controlling the admission of gas to the engine serving to admit gas to the four cylinders in sequence.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the precise construction shown, as modifications may readily be made without departing from the spirit of my invention.

Having thus described my invention, I claim as new and desire to secure by Letters Patent the following:—

1. An engine structure including two engine cylinders of differing diameters arranged in tandem, a cast jacket for each engine cylinder, the cast jacket of the larger engine cylinder having an insetting flange at its end adjacent to the cast jacket of the smaller engine cylinder and surrounding the contiguous end of the smaller engine cylinder.

2. An engine structure including two engine cylinders of differing diameters arranged in tandem, a cast jacket for each engine cylinder, the cast jacket of the larger engine cylinder having an insetting flange at its end adjacent to the cast jacket of the smaller engine cylinder and surrounding the contiguous end of the smaller engine cylinder, and additional insetting flanges provided upon the cast jackets and serving to hold the engine cylinders in alinement.

In witness whereof, I hereunto subscribe my name this 22d day of July A. D., 1908.

JOHN L. JOHNSON.

Witnesses:
GEORGE J. REELING,
JOHN P. CHARBONNIER.