H. EASON.

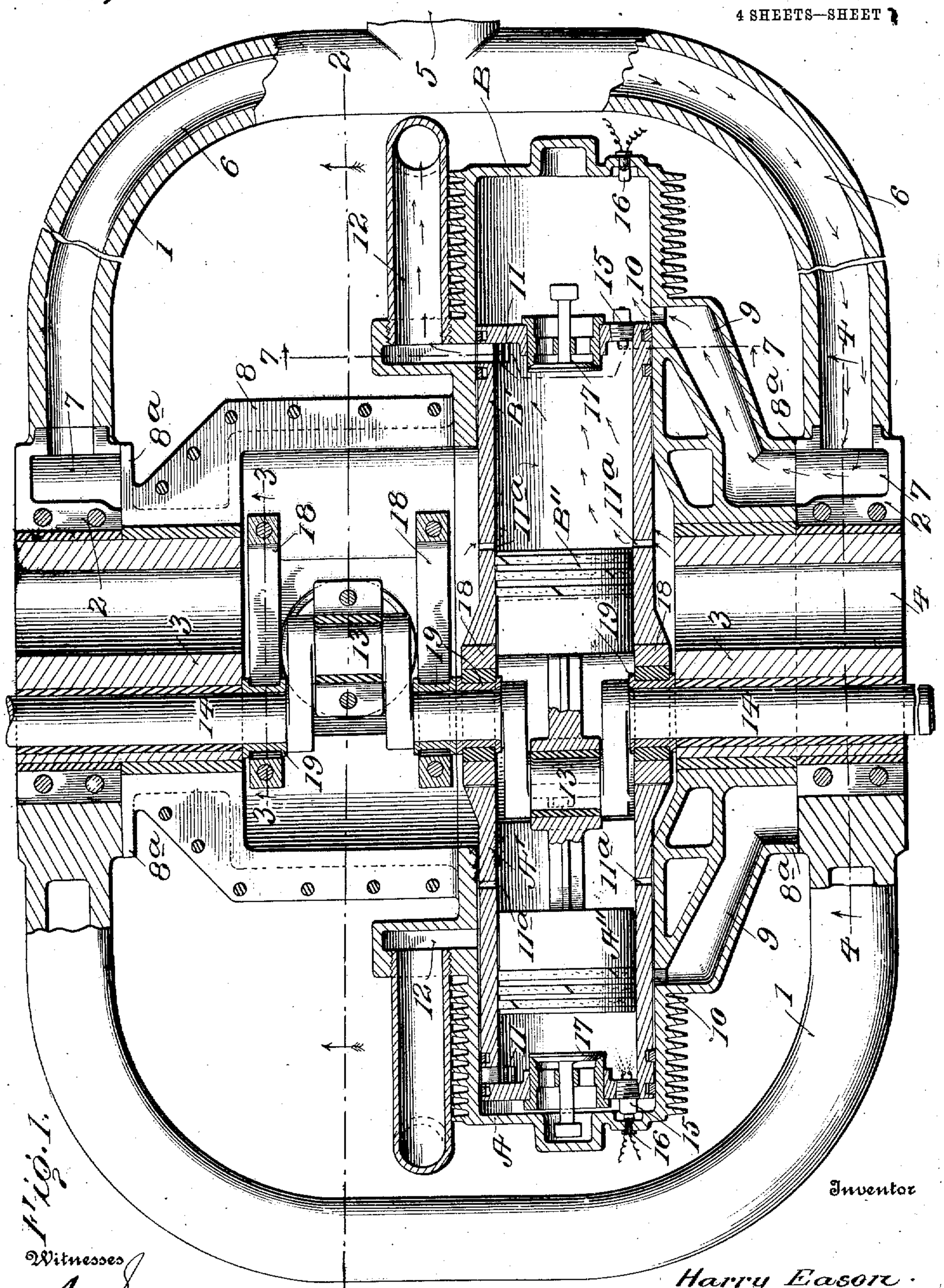
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 16, 1908.

963,880.

Patented July 12, 1910.

4 SHEETS—SHEET 1.



Witnesses

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4 SHEETS—SHEET 2.

Fig. 3.

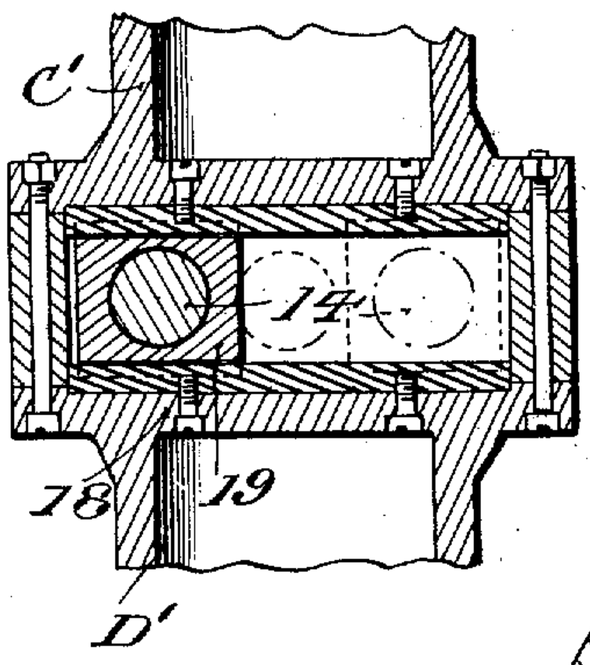

Fig. 2.

Witnesses

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4 SHEETS—SHEET 3.

Fig. 5.

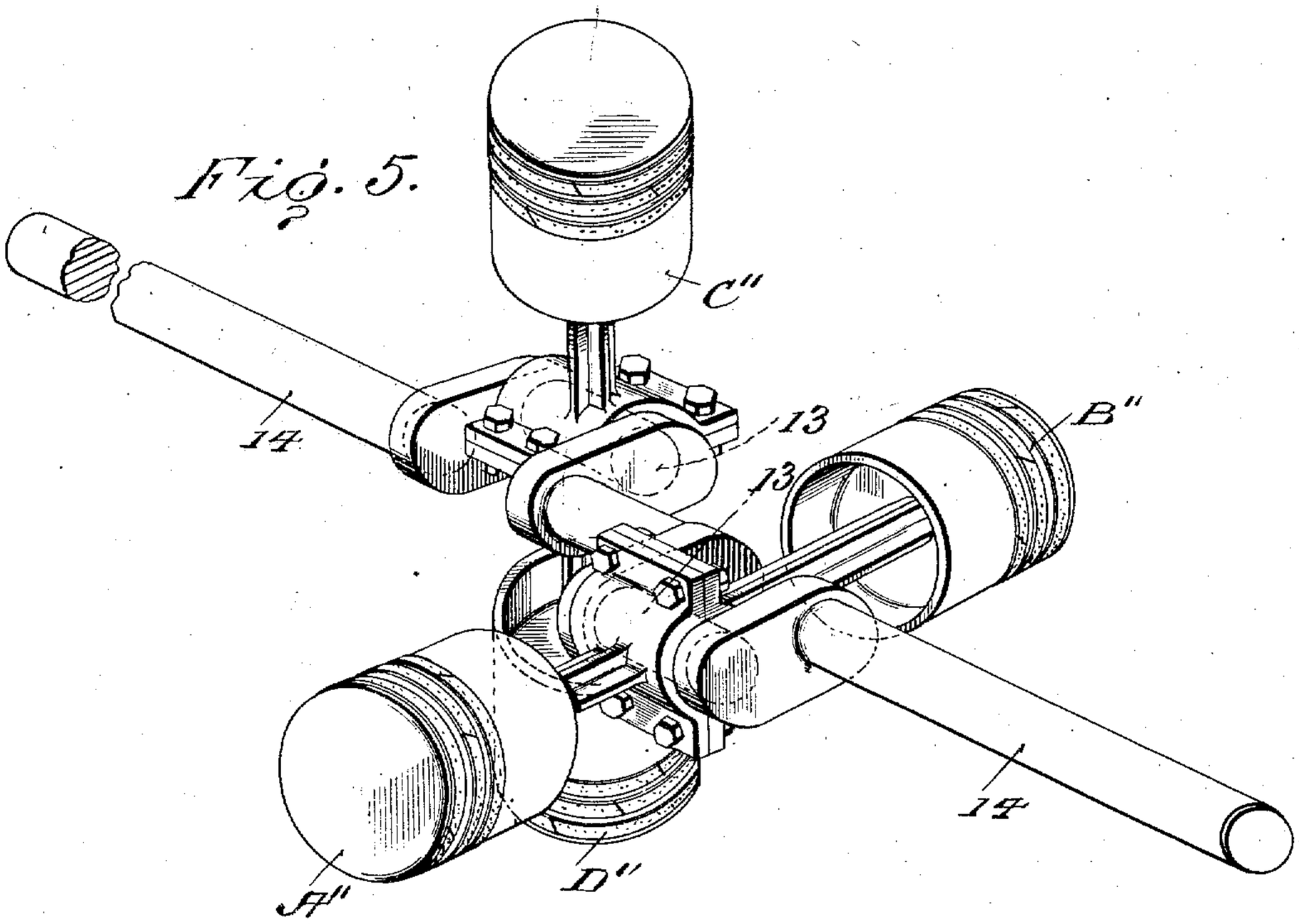
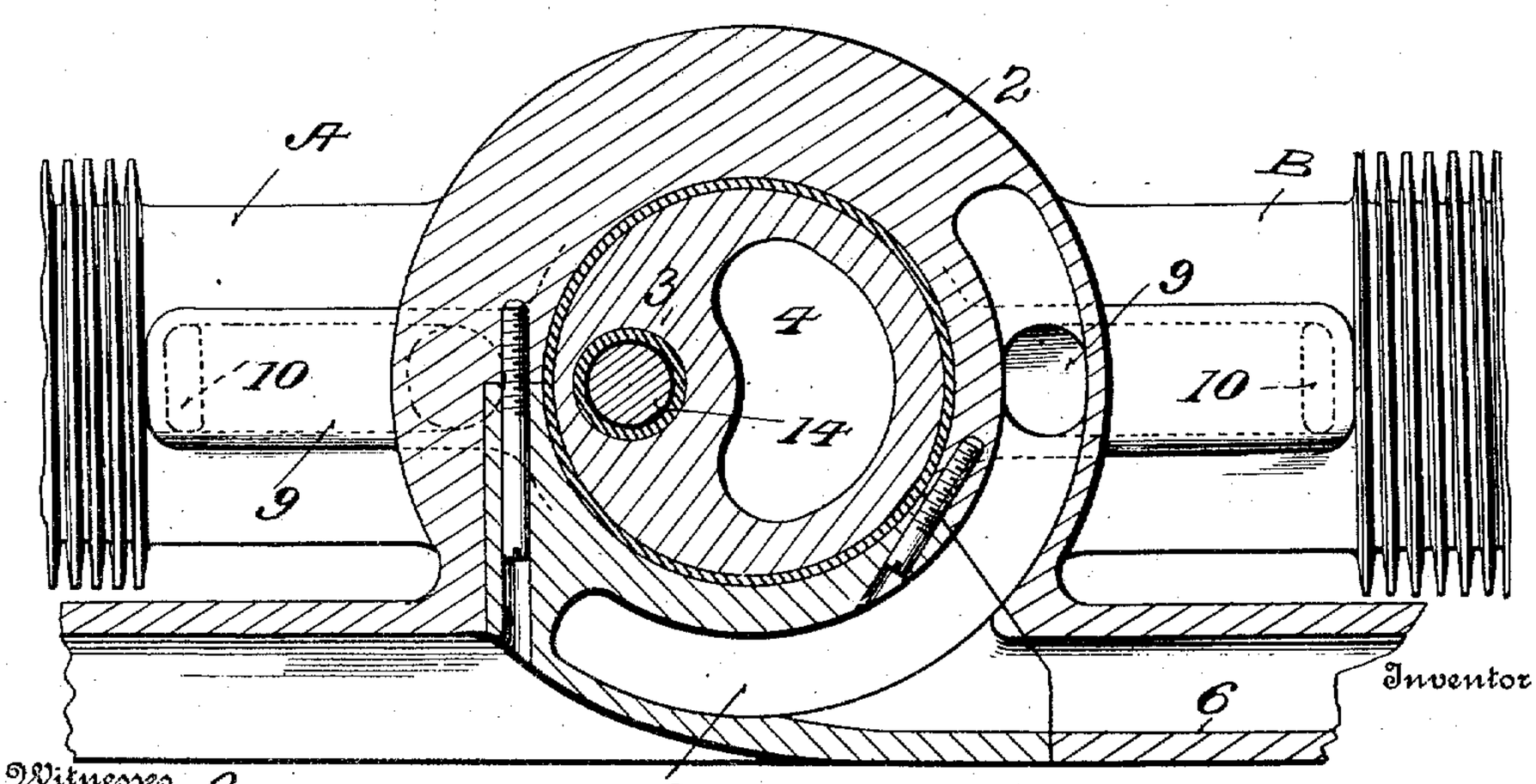


Fig. 4.



Witnesses

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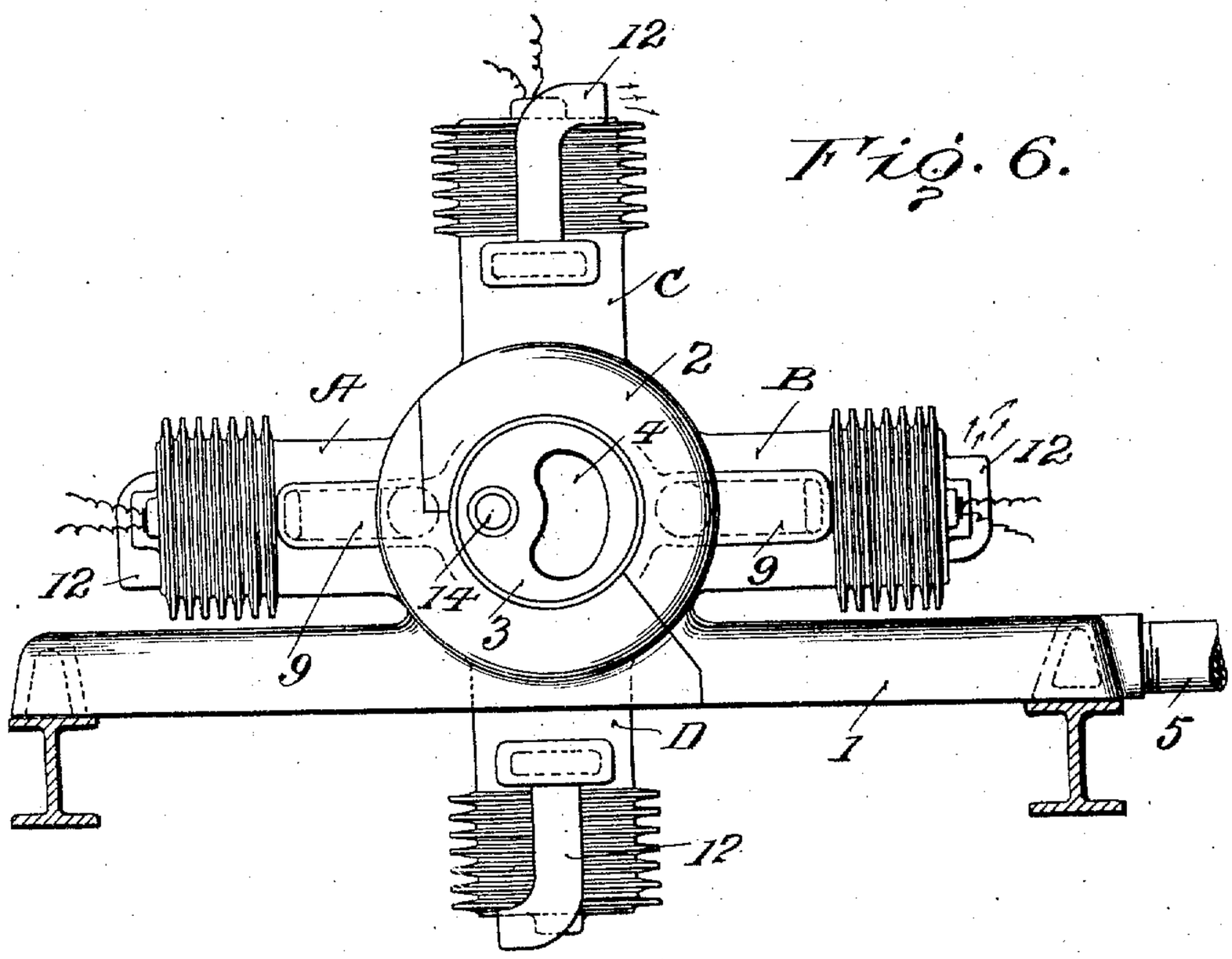

Fig. 6.

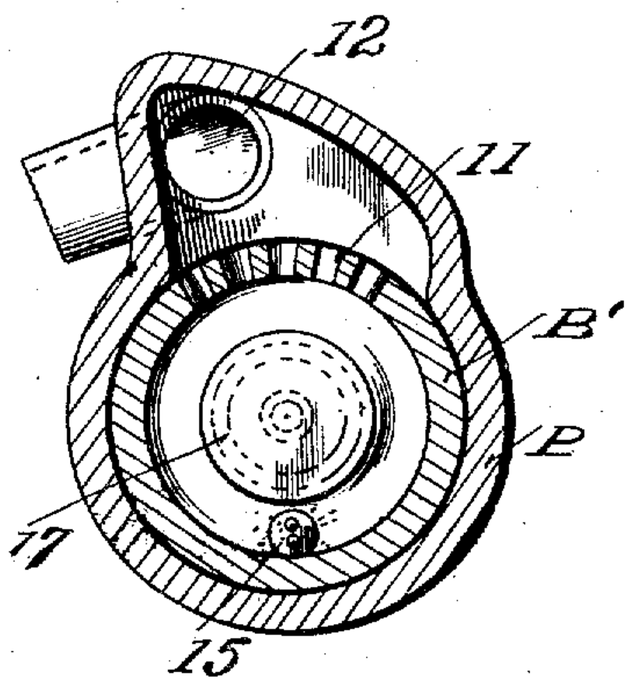

Fig. 7

Witnesses

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UNITED STATES PATENT OFFICE.

HARRY EASON, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO EASON ENGINE CO., A CORPORATION OF PENNSYLVANIA.

INTERNAL-COMBUSTION ENGINE.

963,880. Specification of Letters Patent. Patented July 12, 1910.

Application filed July 16, 1908. Serial No. 443,867

To all whom it may concern:

Be it known that I, HARRY EASON, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention comprehends certain new and useful improvements in internal combustion engines of the rotary type and my invention has for its primary object, a simple and efficient construction of engine of this character which will develop a maximum efficiency with a relatively short piston stroke, which will embody correlated parts that are at all times in balanced relation to each other and which will be so constructed that in operation the expansion chamber back of the working piston in the forward traverse thereof will be less than the displacement of the piston, the invention also providing means whereby the amount of explosive mixture taken into the cylinder or cylinders can be, if desired, considerably greater than the displacement of the piston or pistons.

With these main objects in view, and with other objects that will be hereinafter set forth, the invention consists in certain constructions, arrangements, constructions of the parts that I shall hereinafter fully describe and then point out the novel features thereof in the appended claims.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings in which:

Figure 1 is a horizontal sectional view of an internal combustion engine constructed in accordance with my invention; Fig. 2 is a vertical sectional view thereof on the line 2—2 of Fig. 1; Fig. 3 is a detail sectional view on the line 3—3 of Fig. 1. Fig. 4 is an enlarged sectional side elevation the section being taken on the line 4—4 of Fig. 1; Fig. 5 is a perspective view of four working pistons that are employed in the present embodiment of the invention; Fig. 6 is a side elevation of the engine on a reduced scale; and, Fig. 7 is a detail sectional view the section being taken on the line 7—7 of Fig. 1.

Referring to the drawings, the numeral 1 designates the bed of my improved rotary internal combustion engine, said bed being of any desired construction and design, except as hereinafter noted, and in the present instance being substantially oval, as best illustrated in Fig. 1; forming a supporting frame within which the operative parts of the engine rotate. The bed 1 is provided at opposite sides with enlarged portion 2 in which the bearings or cylinder supports 3 are mounted, said bearings being respectively provided with laterally extending air passages 4 for the free circulation of air through the crank case. At one end, the bed is formed for connection with a carbureter or other suitable source of supply of the gaseous fuel, as indicated at 5, and the bed is provided with passages 6 which diverge from the point 5 and which lead to segmental chambers 7 formed in the enlarged portions 2.

As contemplated by my invention, the engines constructed in accordance therewith will have a plurality of compression cylinders arranged so as to balance each other, and it is to be understood that the invention may embody either two, four or any greater number that is a multiple of two. In the present instance, I have illustrated four compression cylinders set at right angles to each other and arranged in longitudinally alined pairs, the cylinders being designated A, B, C, and D, respectively as best illustrated in Fig 6. These compression cylinders are all connected together for simultaneous rotation by any desired construction of two part castings, one part of which is illustrated in Fig. 1 designated 8 and such casting is formed at opposite sides with annular flanges 8^a designed to control the opening and closing of the chambers 7 as the cylinders rotate, the flanges working against the inner faces of the enlarged portions 2 of the bed 1 (see Fig. 1). The charge compression cylinders A, B, C, and D are each provided with a charge supply passage 9 leading from the flange 8^a outwardly to a port 10 which is preferably laterally elongated, as indicated in Fig. 4. Each compression cylinder is further formed with a series of exhaust ports 11 that are slightly out of alinement with the inlet ports 10, (see Fig. 1), and that communicate with exhaust passages 12 that are formed by pipes connected to the respective cylinders as shown and being preferably provided with rearwardly facing extremities designed to assist in suck-

ing out the spent gases from the cylinders as the same rotate.

Each compression cylinder contains a working cylinder, the same being designated A′, B′, C′, and D′ respectively. These are mounted for a rectilinear or back and forth movement in their respective compression cylinders, and the working cylinders in turn contain working pistons A″, B″, C″ and D″, said pistons having their respective rods directly connected to the wrist pins 13 of a crank shaft 14, the cranks of said shaft being set at 180 degrees apart and the shaft 14 being journaled eccentrically in the hollow bearings or supports 3. 15 designates the spark plugs or charge igniting devices of which there is one for each of the working cylinders, mounted in the outer end thereof, the plugs being designed to close the charge igniting circuits at the terminals 16, upon the completion of the outward traverse or stroke of the working cylinders. And 17 designates the automatically acting valves for the working cylinders, said valves being mounted in the outer ends thereof and controlling the communication between the interior of the working cylinders and the interior of the compression cylinders.

In order to effect the necessary movement of the working cylinders in their compression cylinders, I have connected together the complemental or longitudinally alined working cylinders of the same set or pair, by means of yokes 18 on opposite sides of the cylinders, said yokes constituting guideways for crossheads or blocks 19 mounted on the crank shaft 14, as best illustrated in Figs. 1, 2 and 3.

In describing the practical operation or working of my improved rotary internal combustion engine, reference is to be had particularly to Figs. 1 and 2 which together illustrate the correlated position of the parts of all four of the compression cylinders and their working cylinders. In the cylinder A, the charge has been compressed and is just about to be ignited. In the cylinder B, the charge has been ignited and a fresh charge is being admitted through the passage 9 into the compression cylinder B and back of the outer end of the working cylinder B′. In the cylinder C, the charge previously admitted is being compressed while in the cylinder D, the charge has been ignited and is working with its expansive force. As a charge is ignited in the working cylinder A′, it is obvious that the piston A″ will travel forwardly in the working cylinder while at the same time the cylinder itself is moving forwardly, the entire set of cylinders and pistons revolving all the while. When the piston A″ shall have reached, in its forward traverse, a point just past the air inlet ports 11*, the working cylinder A′ will have reached a position where its exhaust ports register with the exhaust chamber or passage 12 and thereupon the spent gases will be exhausted, while at the same time, it is obvious that in this forward traverse of the piston and working cylinders, a partial vacuum is being established in the compression cylinders. When the revolution of parts reaches the supply chamber or passage 7, the partial vacuum thus established will aspirate a fresh charge through the adjoining passage 6 and such charge will be admitted until the reverse movement of the working cylinder closes the port 10 of the corresponding compression cylinder in which it is contained. And thereafter, on the reverse stroke of the working cylinder and piston, the charge which has been thus admitted will automatically open the valve 17, and flow into the outward end of the working cylinder and will be compressed by and between the outer end of the compression cylinder and the correlated piston, while at the same time, the exhaust ports will have been cut off and the charge will then be ignited after it has been fully compressed.

From the foregoing descriptions in connection with the accompanying drawings, it will be seen that I have provided an efficient construction of internal combustion engine in which all parts revolve on their own centers and in which each part is balanced by a corresponding part; and that the pistons are double, or arranged in longitudinally alined working pairs with their rods connected directly to the wrist pin of the crank shaft, thereby eliminating the use of connecting rods.

It is also to be particularly noted that the pistons operate in working cylinders that are in turn mounted in charge-compression cylinders for relatively longitudinal movement therein coincident with, but at a slower rate of speed than, the said pistons, whereby the friction of the pistons is materially reduced; and, what is more important, such arrangement provides that the explosive charge will drive the pistons and (through them) the shaft with an expansion chamber less than the displacement of the piston, owing to the following-up movement of the working cylinders as the pistons travel forwardly. Conversely, the amount of the explosive mixture taken into the working cylinders can be, if desired, several times greater than the displacement of the pistons. Also, the force of the explosions at one-half stroke is exactly tangential to the throw of the crank, thereby obtaining maximum efficiency with a relatively short stroke, and, as above noted, with an expansion chamber less than the displacement of the piston. As each explosion drives the crank shaft one complete revolution except that portion of the stroke where the exhaust parts are un-

covered, it will be seen that with a double throw crank shaft and four cylinders, the shaft is driven continuously and uniformly by two explosions, and without any jar or undue vibration, no balance or fly-wheel being necessary.

Having thus described the invention, what is claimed as new is:

1. In an engine of the character described, the combination of a compression cylinder, a working cylinder mounted to move therein, a piston movable within the working cylinder, a crank shaft to which the piston is operatively connected, and a connection between said crank shaft and the working cylinder arranged to effect a forward movement of the working cylinder during the forward movement of the piston within the working cylinder.

2. In an engine of the character described, the combination of a compression cylinder, a working cylinder mounted to move therein, a piston movable within the working cylinder, a crank shaft to which the piston is operatively connected, and a connection between the crank shaft and working cylinder arranged to effect a forward movement of the working cylinder within the compression cylinder during the forward movement of the piston within the working cylinder, but at a slower rate of speed than the working cylinder.

3. In an engine of the character described, the combination of a compression cylinder, a working cylinder movable within the compression cylinder, a piston movable within the working cylinder, a crank shaft to which the piston is operatively connected, the connection between the shaft and working cylinder being arranged to move the working cylinder simultaneously with and in the same direction as the piston, means for admitting a charge into the compression cylinder back of the working cylinder in the forward simultaneous movement of the latter and the piston, means for excluding said charge from the working cylinder during said movement, and means for subsequently admitting the charge into the working cylinder during the reverse movement of both working cylinder and piston so as to compress the charge between the piston and the end of the compression cylinder.

4. In an engine of the character described, the combination of a pair of oppositely positioned and longitudinally alined compression cylinders, supports upon which said cylinders are mounted to rotate, a crank shaft journaled eccentrically in said supports, working cylinders mounted in the compression cylinders, pistons mounted in the respective working cylinders, a connection between said working cylinders and said crank shaft arranged to effect a forward movement of the working cylinders in the compression cylinders during the forward movement of their respective pistons within said working cylinders, and means for admitting charges into the compression cylinders.

5. In an engine of the character described, the combination of a pair of oppositely positioned and longitudinally alined compression cylinders, supports upon which said cylinders are mounted to rotate, a crank shaft journaled eccentrically in said supports, working cylinders mounted in the compression cylinders, pistons mounted in the respective working cylinders, a connection between said working cylinders and said crank shaft arranged to effect a forward movement of the working cylinders in the compression cylinders during the forward movement of their respective pistons within said working cylinders, means for admitting charges into the compression cylinders during the forward movements of the working cylinders and for excluding said charges from the working cylinders during such movement, and means for subsequently admitting the charges into the working cylinders during the reverse movements of said cylinders and pistons.

6. In a rotary internal combustion engine, the combination of a supporting frame or bed, cylinder supports mounted therein, a crank shaft journaled in the said supports, compression cylinders mounted to turn on said supports, working cylinders mounted to move in said compression cylinders, pistons mounted to move in the working cylinders and operatively connected to said crank shaft, means for admitting a charge into the compression cylinders and thence into the working cylinders, and a connection between the shaft and the working cylinder arranged to effect a longitudinal movement of the working cylinders relatively to their compression cylinders during the rotation of the shaft and the revolution of the compression cylinders.

7. In a rotary engine, of the internal combustion type, the combination of a supporting framework, cylinder supports mounted therein, longitudinally alined oppositely extending compression cylinders mounted to revolve on said supports, working cylinders mounted to move in the compression cylinders longitudinally with respect thereto, pistons mounted in the working cylinders, a crank shaft journaled in said supports, and operatively connected to said pistons, means for admitting the charge into the compression chamber, and thence to the working cylinders, and a connection between both of the working cylinders and the shaft arranged to move the working cylinders and the compression cylinders longitudinally relatively thereto during the revolution of the compression cylinders and the recti-

linear movement of the pistons and the consequent rotation of the shaft.

8. In a rotary internal combustion engine, the combination of a supporting framework, cylinder supports carried thereby, compression cylinders mounted to revolve on said supports, and formed with inlet and exhaust ports, working cylinders mounted to move in said compression cylinders and formed with exhaust ports adapted to register with the exhaust ports of the compression cylinders, pistons mounted to move in said working cylinders, a shaft to which said pistons are operatively connected, means for moving said working cylinders longitudinally relatively thereto during the revolution of the compression cylinders and rotation of the shaft, the working cylinders being movable past the inlet ports of the compression cylinder so as to admit a charge back of the working cylinders, the framework being provided with a supply chamber and a supply passage leading thereto, the compression cylinders being provided with inlet passages leading to their inlet ports and arranged to successively register with the supply chamber during the revolution of the cylinders.

9. In a rotary engine, the combination of oppositely extending compression cylinders, working cylinders mounted to move in said compression cylinders, means for admitting a charge into the compression cylinders and thence to the working cylinders, pistons mounted to move in said working cylinders, a shaft to which said pistons are operatively connected, a yoke connecting said working cylinders together and a crosshead movable in said yoke and mounted upon said shaft whereby to effect the longitudinal movement of the working cylinders relatively to the compression cylinders upon the rotation of the shaft.

10. In an internal combustion engine, the combination of a compression cylinder, a support therefor, a working cylinder mounted to move in the compression cylinder, a piston mounted to move in the working cylinder, a shaft to which said piston is operatively connected, means for admitting a charge into the compression cylinder and subsequently into the working cylinder, an igniting device carried by the working cylinder, and a switch carried by the compression cylinder and designed to be actuated to close the igniting circuit by and upon contact with the igniting device.

11. In an engine of the character described, the combination of a compression cylinder formed with an inlet port and with an extension having an exhaust port, a working cylinder movable within the compression cylinder and provided with an inlet port and an exhaust port, a piston mounted to move within the working cylinder, a shaft to which said piston is operatively connected, a connection between said shaft and working cylinder arranged to move the working cylinder forwardly as the piston moves forwardly, whereby to create a partial vacuum back of the working cylinder upon its forward stroke so as to suck in a charge at the time the outer end of the working cylinder passes the inlet port of the compression cylinder, and for inwardly opening the inlet valve mounted in the outer end of the working cylinder which is arranged to control communication between the compression cylinder and the working cylinder.

12. In an internal combustion engine, the combination of a compression cylinder formed with an inlet port and an extension formed with an exhaust port out of alinement with each other, a working cylinder mounted to move in the compression cylinder and formed at its end with a check valve controlled inlet establishing communication between the compression cylinder and working cylinder and arranged to open inwardly, said working cylinder being formed with exhaust ports arranged to register with the exhaust port of the compression cylinder and being also formed, nearer its inner end, with auxiliary exhaust ports a crank shaft to which said piston is connected, and a connection between the crank shaft and working cylinder arranged to move the working cylinder forwardly in the compression cylinder during the forward movement of the piston within the working cylinder, the parts being so arranged that the exhaust ports of the working cylinder will register with the exhaust port of the compression cylinder substantially simultaneously with the travel of the piston past the auxiliary exhaust ports of the working cylinder.

13. In an internal combustion engine, the combination of a compression cylinder, a working cylinder mounted to move in the compression cylinder, a piston mounted for a rectilinear movement in the working cylinder, a crank shaft connected to said piston, and a connection between said crank shaft and working cylinder arranged to move the working cylinder forwardly during the forward movement of the piston, but at a slower rate of speed than the piston, and also arranged to move the working cylinder rearwardly simultaneously with the reverse movement of the piston, whereby the amount of the explosive mixture taken into the working cylinder is greater than the displacement of the piston.

14. In a rotary internal combustion engine, the combination of a bed, a pair of longitudinally alined compression cylinders mounted to revolve on said bed, a crank shaft, supports in which said crank shaft is journaled eccentrically to the center of revo-

lution of the cylinders, working cylinders mounted to move in the compression cylinders, pistons mounted in the working cylinders, and a connection between the working cylinders and the crank shaft arranged to effect a movement of the working cylinders within the compression cylinders simultaneously with the movement of the piston within the working cylinders.

15. In a rotary engine, a compression cylinder provided with an inlet port and with an extension having an exhaust port and with a rearwardly opening passage leading from the exhaust port, supports on which the cylinder is mounted to revolve, a working cylinder mounted within the compression cylinder, a crank shaft journaled in the cylinder supports eccentrically to the center of revolution of the cylinder, a piston mounted in the working cylinder and operatively connected to said crank shaft, and a connection between the working cylinder and the crank shaft arranged to effect a movement of the working cylinder in the compression cylinder during a movement of the piston within the working cylinder.

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

HARRY EASON. [L. S.]

Witnesses:

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