No. 774,867. PATENTED NOV. 15, 1904.

M. R. CONWAY.

MOTOR.

APPLICATION FILED AUG. 29, 1900.

NO MODEL. 4 SHEETS—SHEET 1.

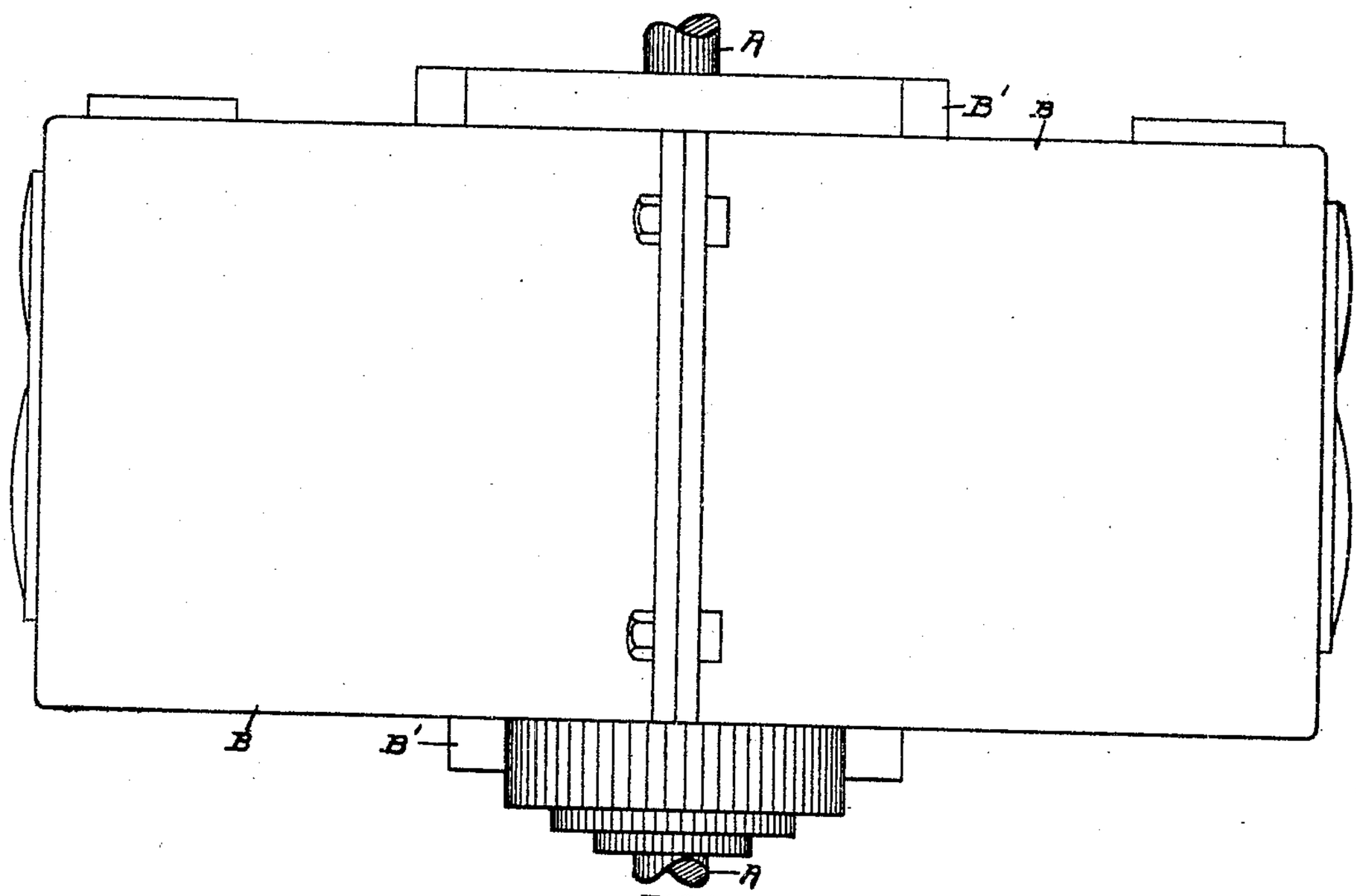

FIG. 1.

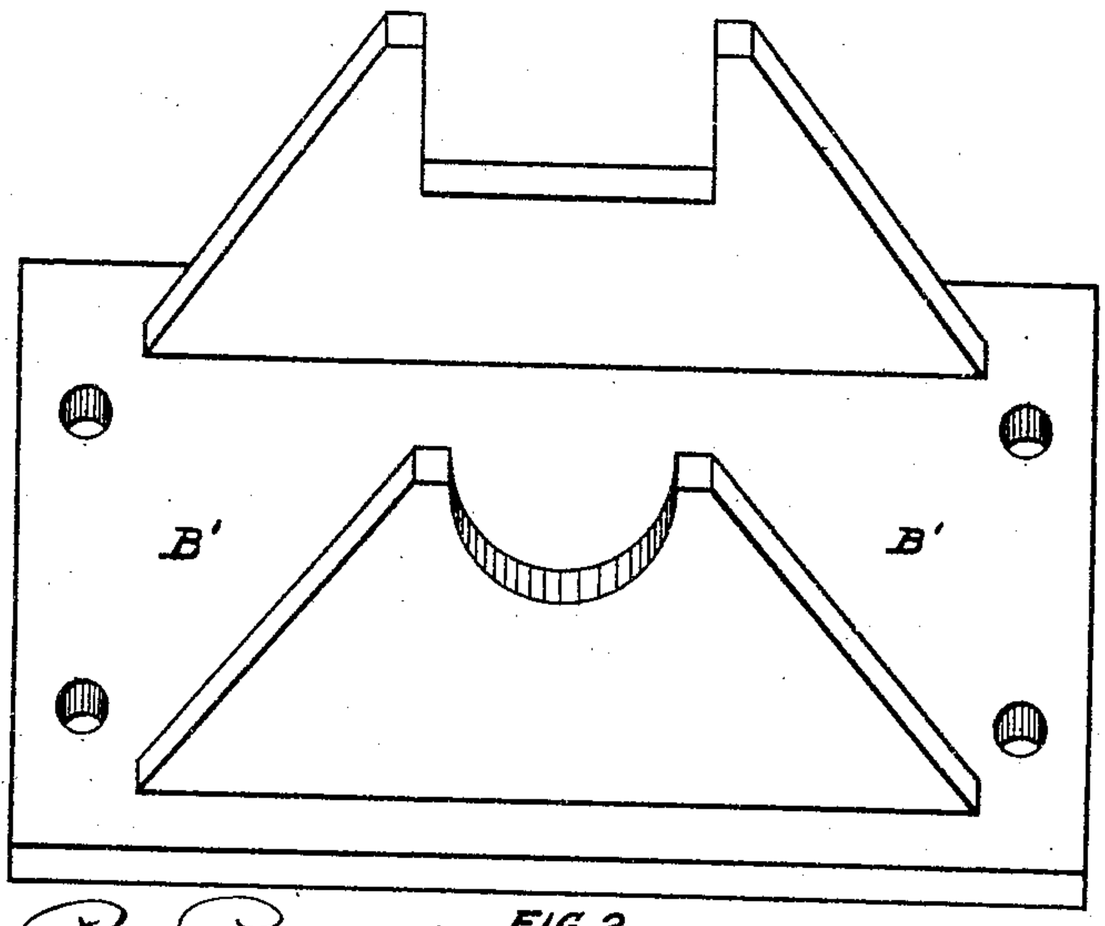

FIG. 2.

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NO MODEL. 4 SHEETS—SHEET 2.

FIG. 3

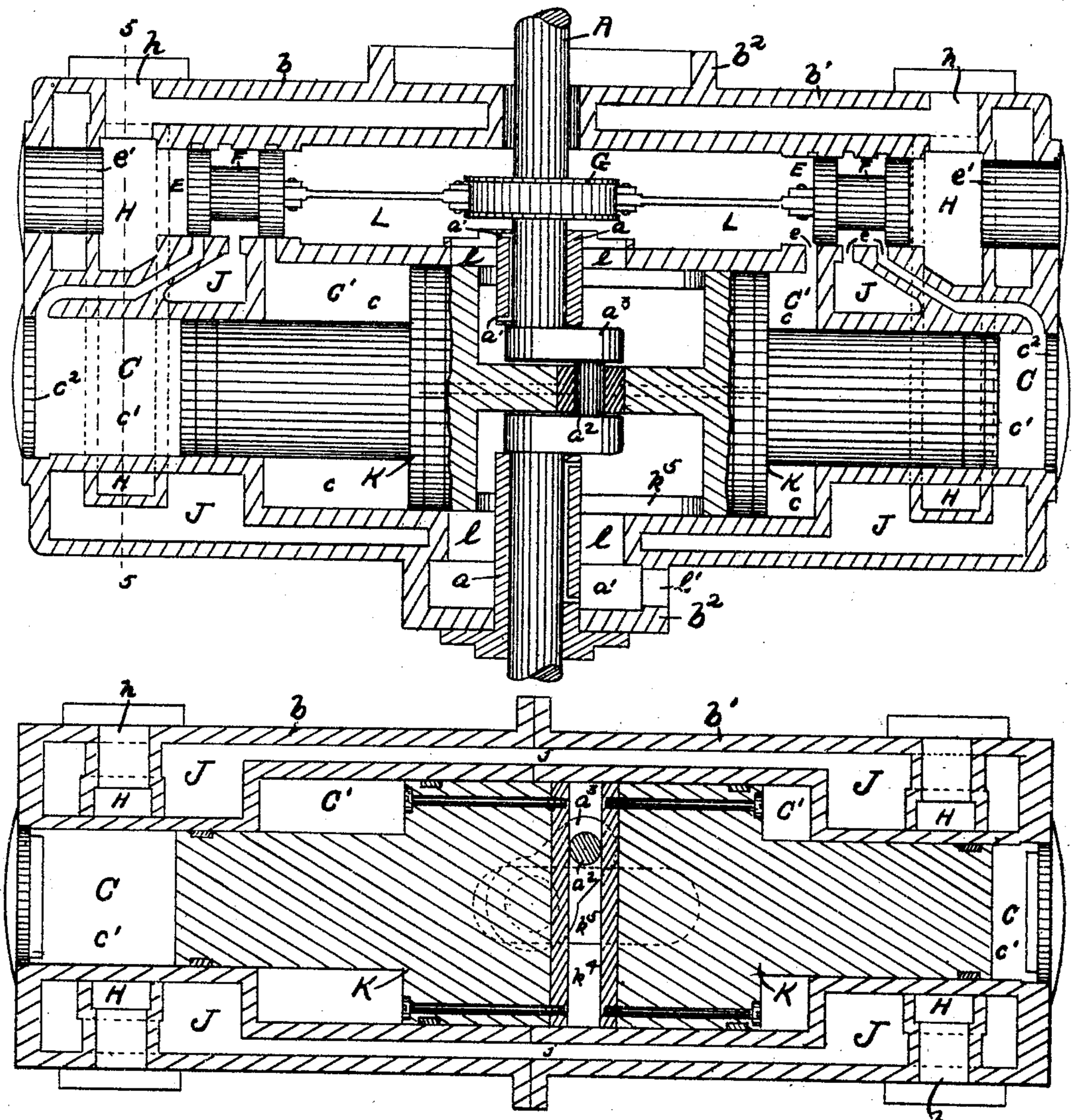

FIG. 4

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NO MODEL. 4 SHEETS—SHEET 3.

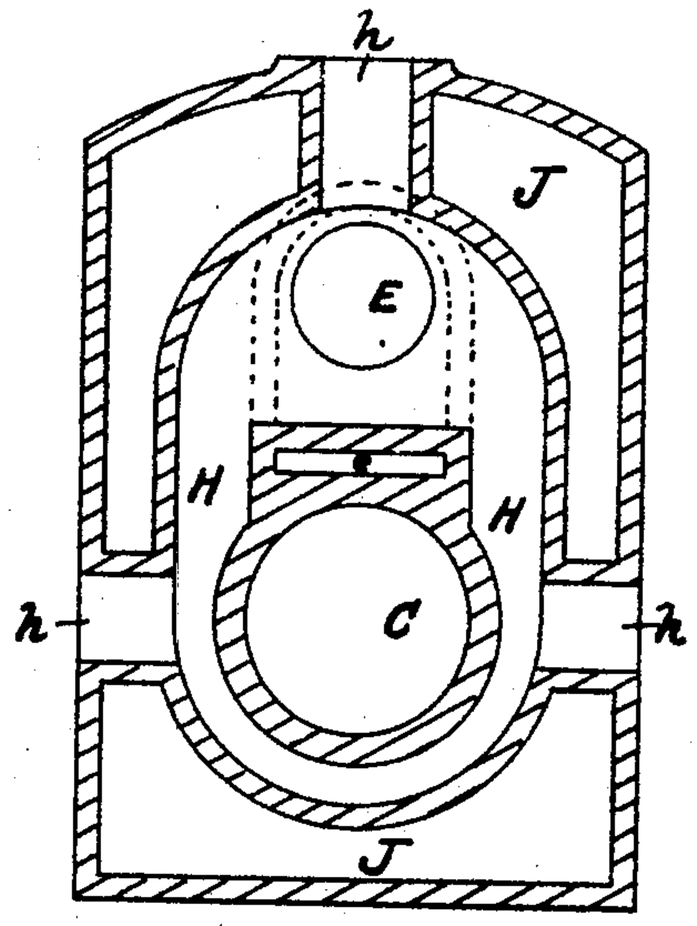

FIG. 5.

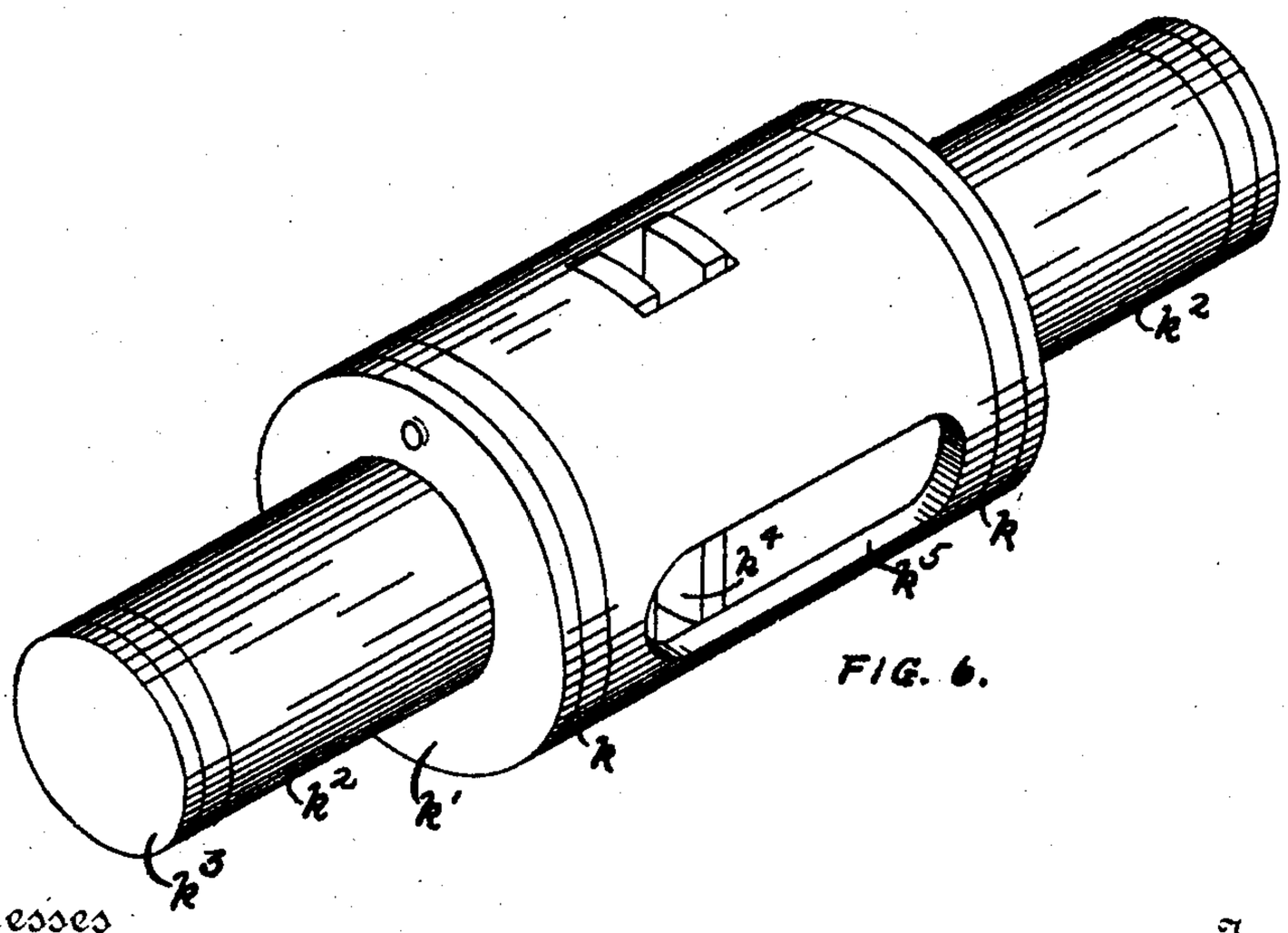

FIG. 6.

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No. 774,867. PATENTED NOV. 15, 1904.

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APPLICATION FILED AUG. 29, 1900.

NO MODEL. 4 SHEETS—SHEET 4.

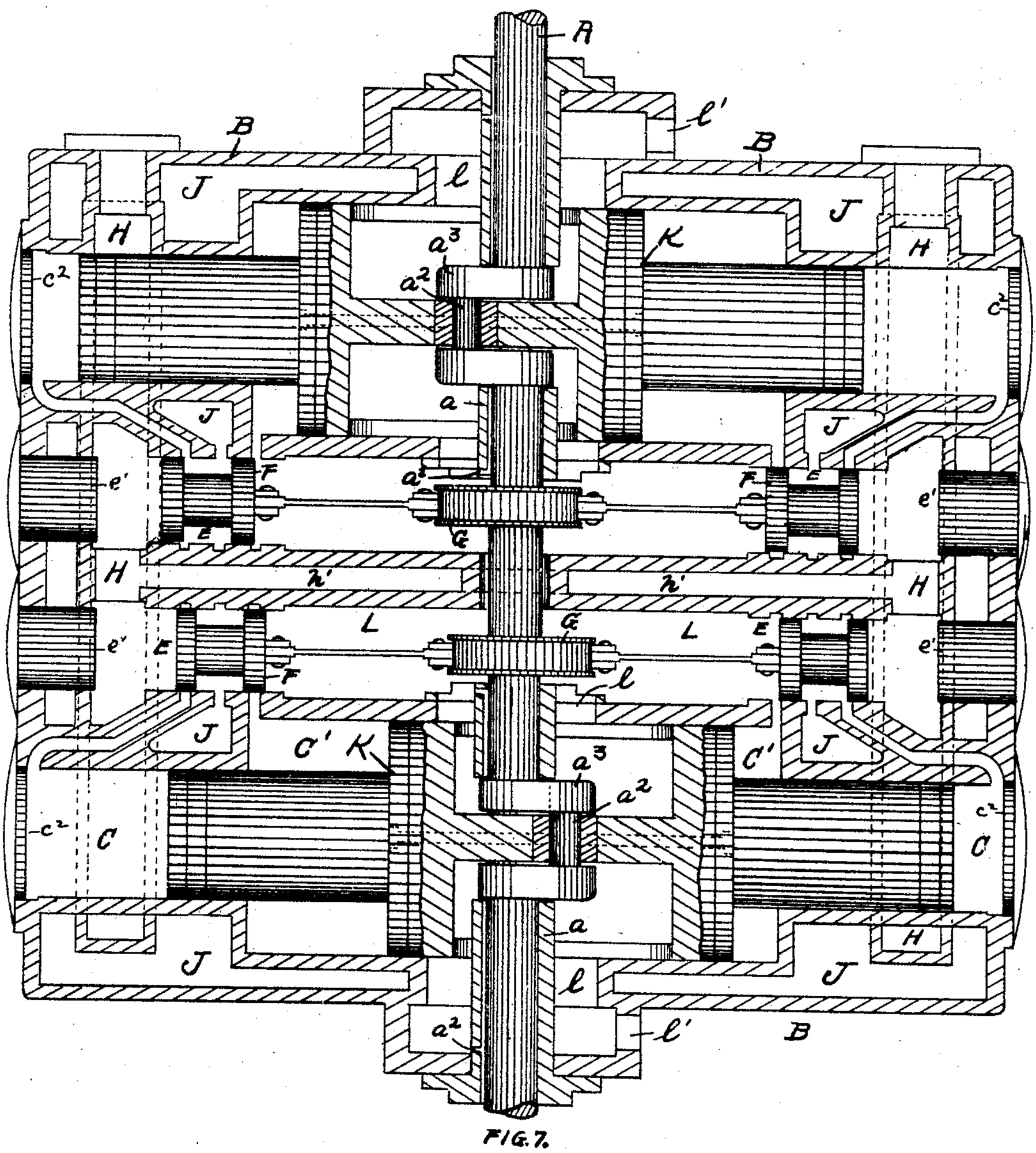

FIG. 7.

Witnesses
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No. 774,867. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

MICHAEL R. CONWAY, OF CINCINNATI, OHIO, ASSIGNOR TO THE KISINGER-ISON COMPANY, A CORPORATION OF OHIO.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 774,867, dated November 15, 1904.

Application filed August 29, 1900. Serial No. 28,409. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL R. CONWAY, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Motors, of which the following is a specification.

The object of my invention is to provide new and useful apparatus for utilizing the pressure and expansion of fluids under pressure; and the invention consists in the parts and combinations and arrangements of parts hereinafter set forth and claimed.

In the drawings, Figure 1 is a top plan view of a motor embodying my invention; Fig. 2, a perspective view of its bed plate or support; Fig. 3, a horizontal section of the motor; Fig. 4, a vertical section on line 4 4 of Fig. 3; Fig. 5, a section on line 5 5 of Fig. 3; Fig. 6, a perspective view of the piston, and Fig. 7 a horizontal section of a modified form of the invention.

The reference-letter A denotes a power-shaft; B, a casing; B′, a bed-plate adapted to support casing B; C C′, high and low pressure cylinders, respectively; E, valve-chambers; F, valves; G, a valve-actuating eccentric; H, a high-pressure chamber; J, a low-pressure chamber; K, a piston, and L an exhaust-chamber.

The power-shaft A may be of any suitable form and provided with suitable means for transmitting its motion. It is rotatably mounted in casing B on bearings *a*, which are provided with channels *a′*, permitting access of the surrounding medium to the surface of the shaft. The casing B is preferably of cast-iron cast in two parts *b* and *b′*, joining in the vertical plane through the axis of the shaft, and is provided at either end with projections b^2, adapted to take into corresponding notches in bed-plate B′ and support it. In each part of casing B is a recess *c*, constituting half of the low-pressure cylinder C′, and a smaller recess *c′*, coaxial with recess *c* and constituting the high-pressure cylinder C. Adjacent to cylinders C C′ is a valve-chamber E, having suitable ports *e*, and in which the valve F is reciprocated by eccentric G on shaft A. At its inner portion the chamber E is enlarged to form a portion of the exhaust-chamber L. For convenience in casting, the recess *c′* and chamber E may be extended through the sides of the casing and closed by plugs c^2 and *e′*, respectively. Encircling cylinder C is a high-pressure chamber H, which may be thrown into communication therewith by valve F. Openings *h* permit access for the supply of steam, and passage *h′* serves to throw the chambers in the opposite sides in communication. The low-pressure chamber J encompasses cylinders C and C′, valve-chamber E, and high-pressure chamber H on their exposed sides and communicates with the corresponding chamber in the other part of the casing through passages *j*.

The piston K consists of a central larger portion *k*, adapted to slide in cylinder C′ and having the annular low-pressure piston-surfaces *k′* and smaller portions k^2, adapted to slide in cylinder C and having high-pressure piston-surfaces k^3. At k^4 the piston is provided with a transverse slot-engaging crank-pin a^2, carried by crank-arm a^3 on shaft A at k^5, with a longitudinal slot permitting its reciprocation relatively to shaft A. The crank-pin a^2 is made of hardened steel, and slot k^4 is lined with hardened-steel plates secured in place and rendered adjustable by screws passing through the piston to surfaces *k′*. It will be noted that the engagement between slot k^4 and pin a^2 is a line engagement—*i. e.*, have only one line of contact—and that therefore the friction between them is the minimum. Furthermore, this engagement permits the use of the full length of slot k^4. The adjustable lining-plates for slot k^4 render it possible to take up play due to wear. It is found that this produces an admirable connection for high-speed engines, having little friction and knocking in its action. The slot k^5 slidably engages the bearing *a*, and thus prevents accidental rotation of the piston. In order to render the application of the pressure of piston K on crank-pin a^2 more direct and so decrease the tendency to bind, the crank-arms a^3 should be not longer than the radius of the portion *k*.

In operation high-pressure steam or other fluid is admitted to chamber H through one of the openings *h*, the other openings being plugged to form a tight chamber. By the operation of valves F the high-pressure steam is admitted to one of the cylinders C, whence after a partial expansion it is conducted into low-pressure chamber J, from which it is admitted into low-pressure cylinder C′ and after complete expansion exhausted into exhaust-chamber L, whence it passes through passages *l* to the exhaust-opening *l′*. It will be noted that the low-pressure chamber J completely surrounds the cylinder, valve-chambers, and high-pressure chamber on their exposed sides, thus forming a very effective and economical jacket, as most of the heat radiated from the high-pressure steam will be absorbed and utilized by the low-pressure steam and a uniform temperature maintained in both cylinders. The valve-gearing is such that steam is admitted from the respective chambers behind both piston-surfaces on one side of the shaft A and allowed exit from before both piston-surfaces on the other side, so as to cause reciprocation of the piston. Before entering chamber H the steam is supplied with a small quantity of oil, which lubricates all bearings and frictional surfaces.

In Fig. 7 I have illustrated a motor in which two pistons K are connected with the same power-shaft at an angle to each other, so as to avoid dead-centers.

It will be seen that the foregoing motor is entirely self-contained; that all its parts are sealed from the outside air; that all the dynamic strains are toward or away from the power-shaft irrespective of the position of the casing, so that the simplest form of mounting will suffice; that no cross-heads, stuffing-boxes, or pivotal connections are required; that the cylinders are maintained at the same uniform temperature; that most of the radiated heat is utilized as motive power; that all the frictional parts are completely automatically lubricated without requiring access from outside; that dust is excluded from working parts by the outward tendency of the exhaust-steam, and that the parts may be accurately and quickly constructed.

While I have described my invention as utilizing steam as the expansive fluid, it is obvious that it is applicable to use with other expansive fluids.

I claim as my invention—

1. The combination in a motor of a power-shaft; low-pressure cylinders, on opposite sides of and adjacent to the shaft, in alinement with each other; high-pressure cylinders of smaller diameter than the low-pressure cylinders and coaxial therewith; a rigid piston having a large central portion adapted to fit the low-pressure cylinders and smaller extensions adapted to fit the high-pressure cylinders; a crank-arm on the shaft; a crank-pin on the crank; and a slotted connection between the crank-pin and piston, substantially as and for the purpose set forth.

2. The combination in a motor of a power-shaft; low-pressure cylinders, on opposite sides of and adjacent to the shaft; in alinement with each other; high-pressure cylinders of smaller diameter than the low-pressure cylinders and coaxial therewith; a rigid piston having a large central portion adapted to fit the low-pressure cylinders and smaller extensions adapted to fit the high-pressure cylinders; a crank-arm on the shaft, not longer than the radius of the larger portion of the piston; a crank-pin on the crank; and a slotted connection between the crank-pin and piston, substantially as and for the purpose set forth.

3. The combination in a motor of a power-shaft; low-pressure cylinders, on opposite sides of and adjacent to the shaft, in alinement with each other; high-pressure cylinders of smaller diameter than the low-pressure cylinders and coaxial therewith; a high-pressure chamber; a low-pressure chamber containing the high-pressure chamber and cylinders; means of admission from the high-pressure chamber to the high-pressure cylinder; means of admission from the high-pressure cylinder into the low-pressure chamber; means of admission from the low-pressure chamber into the low-pressure cylinder; means for exhausting the low-pressure cylinder; a rigid piston having a large central portion adapted to fit the low-pressure cylinders and smaller extensions adapted to fit the high-pressure cylinders; a crank-arm on the shaft; a crank-pin on the crank; and a slotted connection between the crank-pin and piston, substantially as and for the purpose set forth.

4. The combination in a motor of a power-shaft; low-pressure cylinders, on opposite sides of and adjacent to the shaft, in alinement with each other; high-pressure cylinders of smaller diameter than the low-pressure cylinders and coaxial therewith; a high-pressure chamber; a low-pressure chamber containing the high-pressure chamber and cylinders; means of admission from the high-pressure chamber to the high-pressure cylinder; means for introducing oil into the high-pressure cylinder; means of admission from the high-pressure cylinder into the low-pressure chamber; means of admission from the low-pressure chamber into the low-pressure cylinders; means for exhausting the low-pressure cylinder; a rigid piston having a large central portion adapted to fit the low-pressure cylinders and smaller extensions adapted to fit the high-pressure cylinders; a crank-arm on the shaft; a crank-pin on the crank; a slotted connection between the crank-pin and piston; a chamber inclosing the crank-arm and its connections with the piston; and means for conducting the

exhaust from the lower-pressure cylinder into said chamber, substantially as and for the purpose set forth.

5. The combination of a rigid piston operating in cylinders C′ C′; shaft A; crank-arm a^3; crank-pin a^2; and slot k^4 lined with hardened-steel plates adjustably secured in position by means of screws passing through the body of the piston, substantially as specified.

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