No. 774,868. PATENTED NOV. 15, 1904.

M. R. CONWAY.

STEAM ENGINE.

APPLICATION FILED JULY 5, 1902.

NO MODEL. 5 SHEETS—SHEET 1.

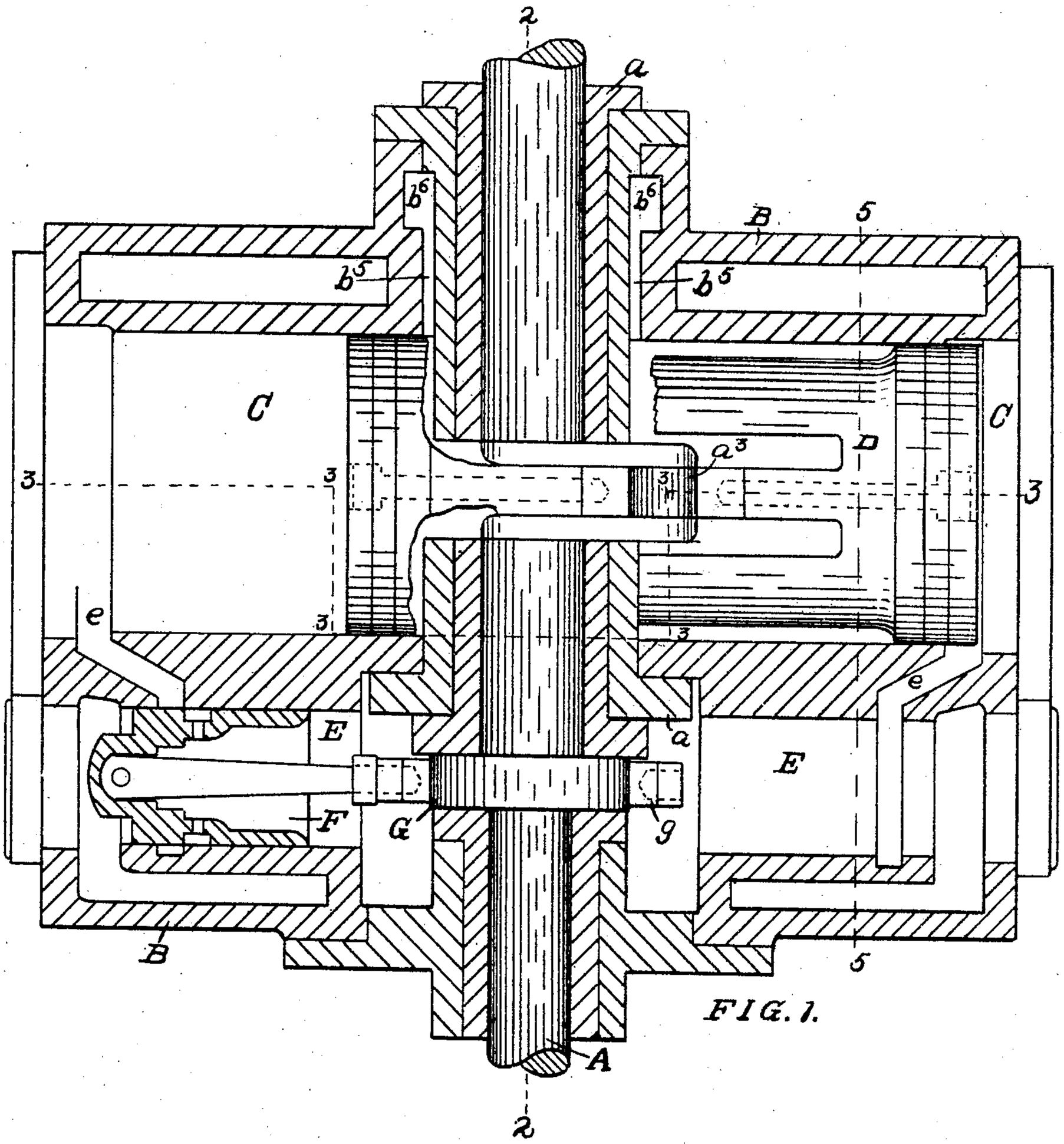

FIG. 1.

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NO MODEL. 5 SHEETS—SHEET 2.

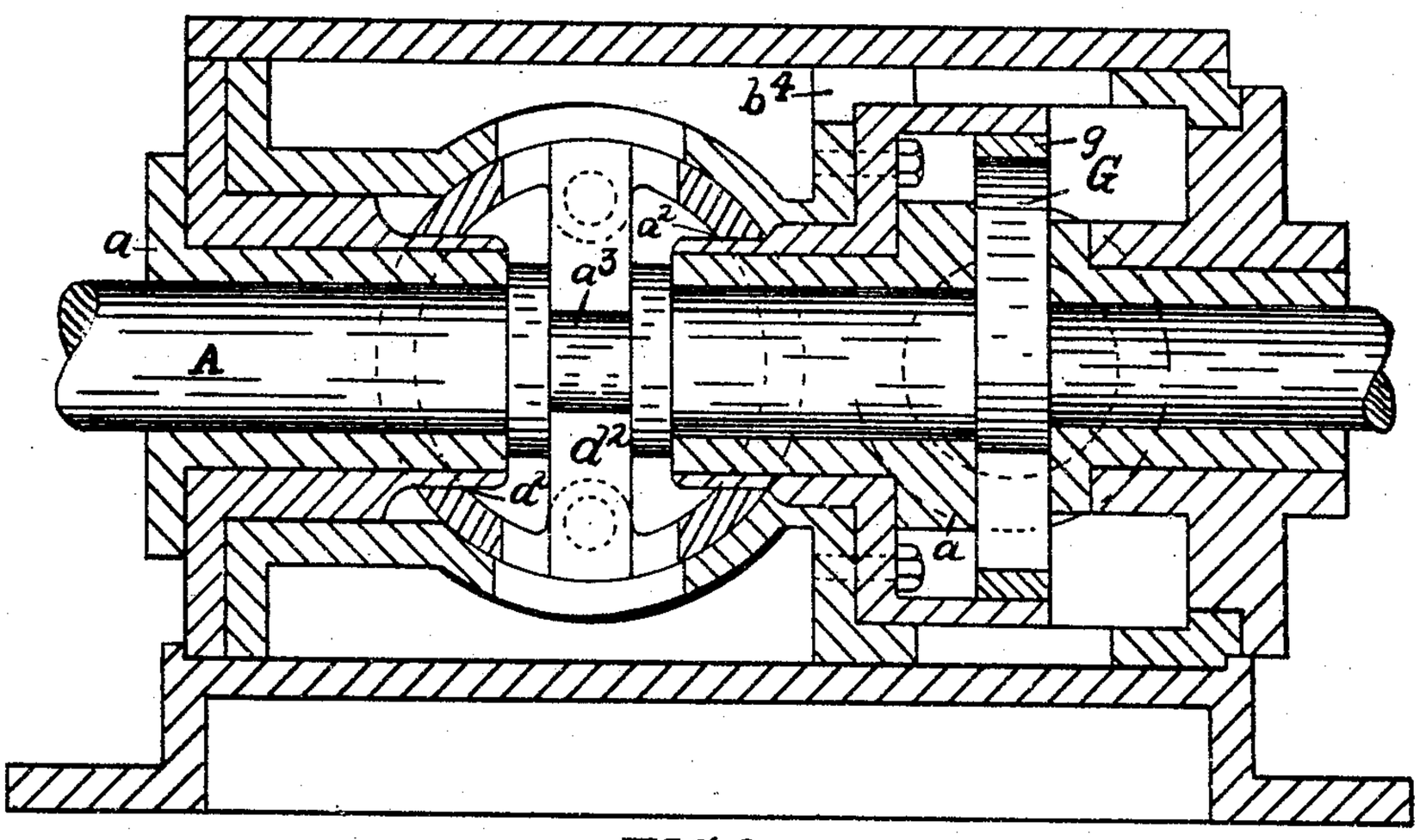

FIG. 2.

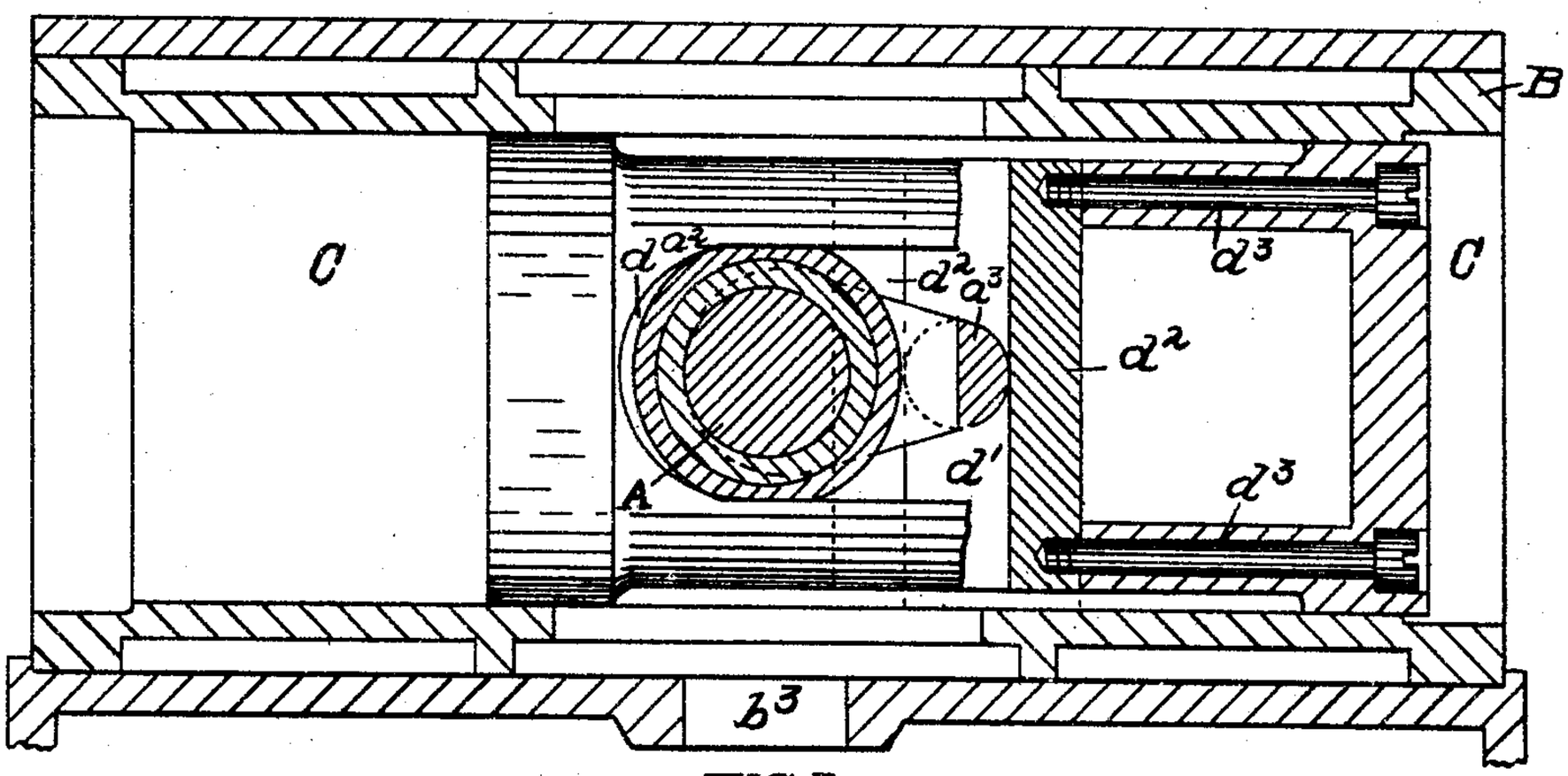

FIG. 3.

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NO MODEL. 5 SHEETS—SHEET 3.

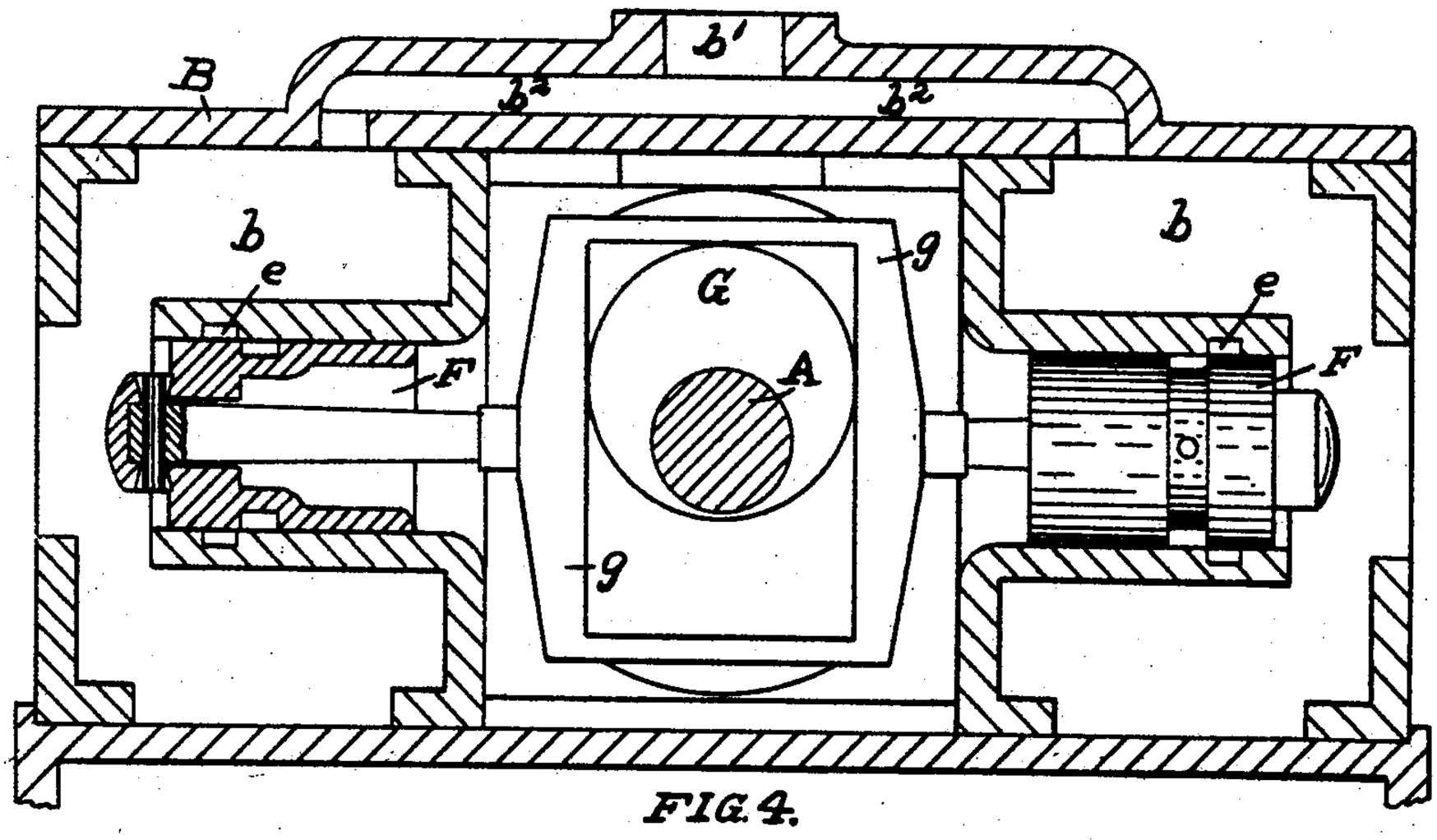

FIG. 4.

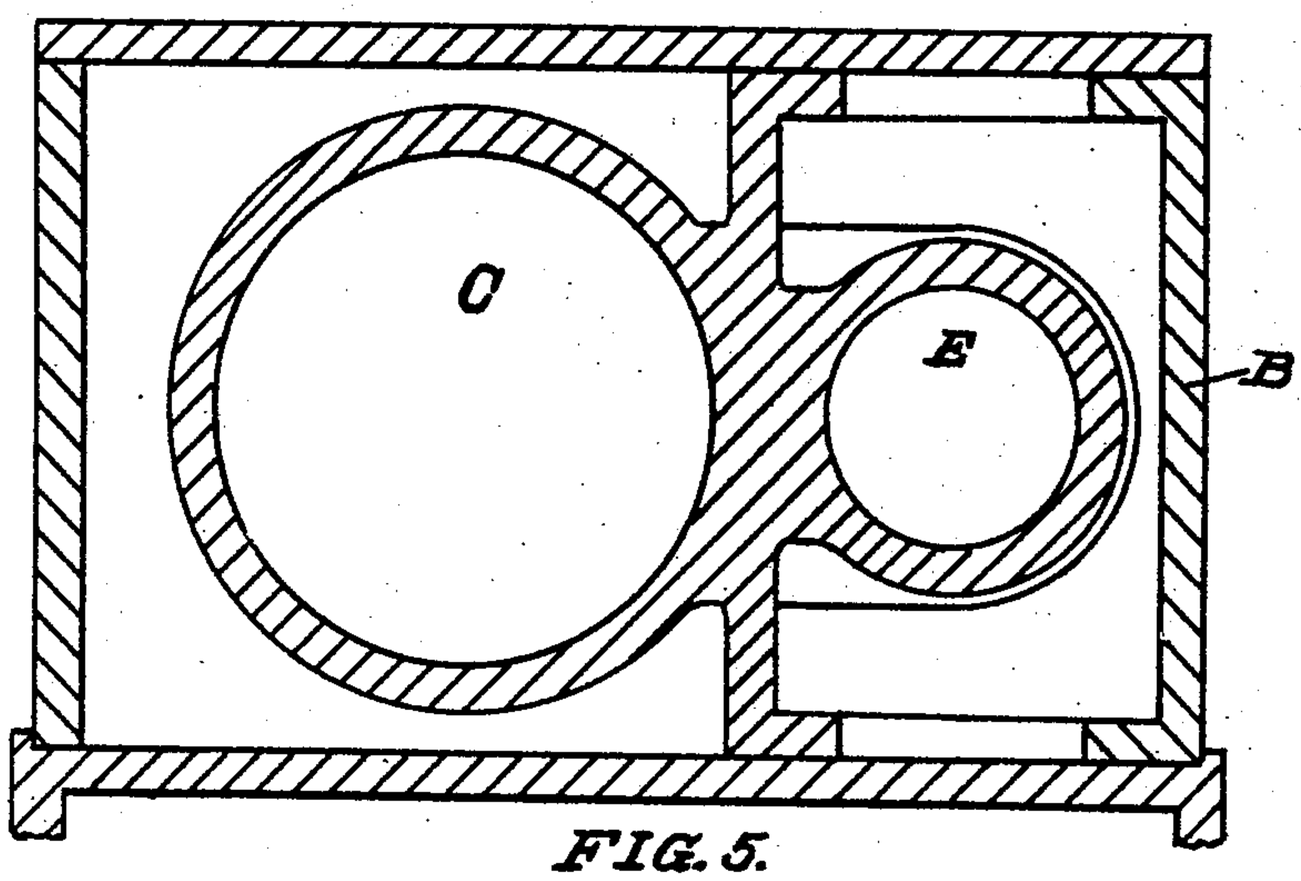

FIG. 5.

Witnesses

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NO MODEL. 5 SHEETS—SHEET 4.

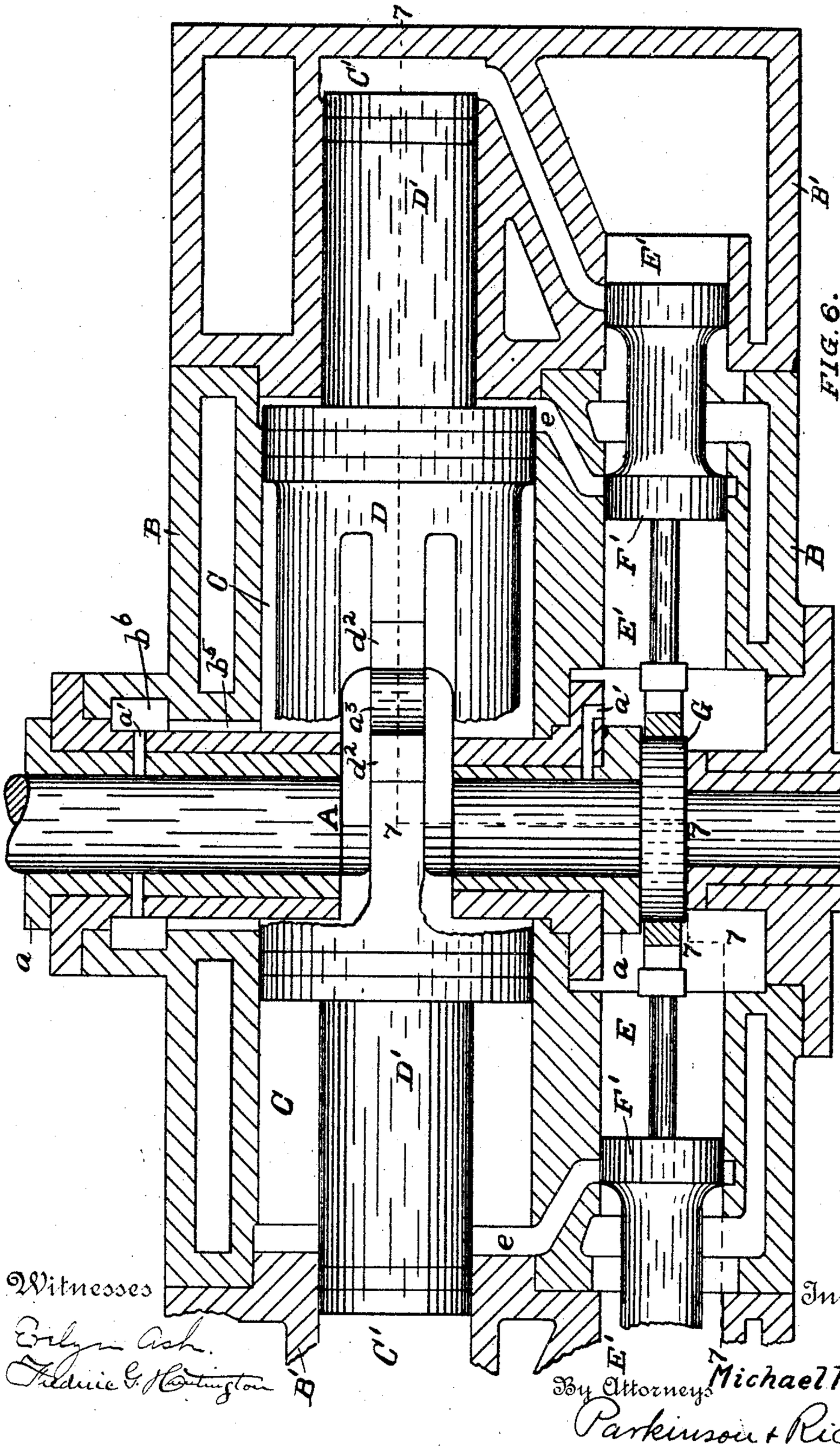

FIG. 6.

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APPLICATION FILED JULY 5, 1902.

NO MODEL. 5 SHEETS—SHEET 5.

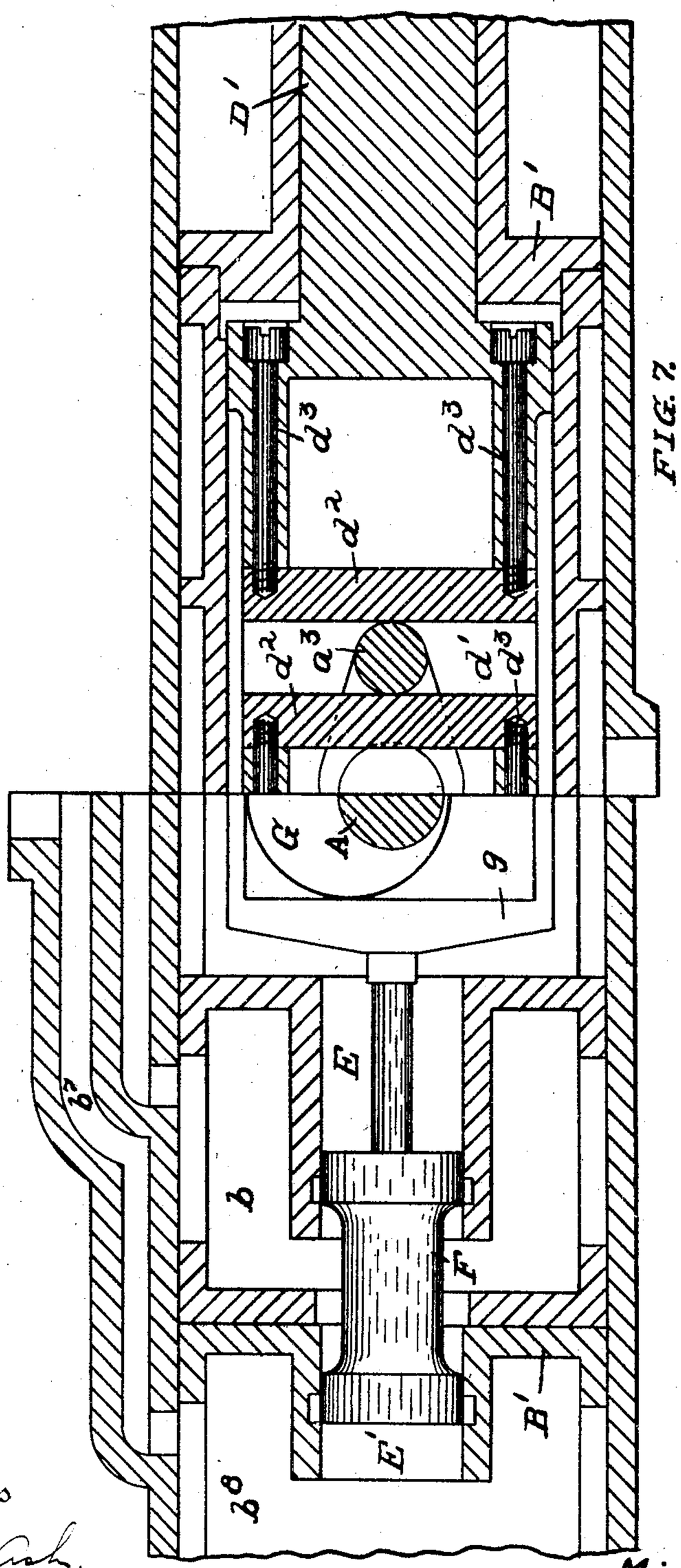

FIG. 7.

Witnesses

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No. 774,868. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

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

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 774,868, dated November 15, 1904.

Application filed July 5, 1902. Serial No. 114,407. (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 Steam-Engines, of which the following is a specification.

The object of my invention is to produce a high-speed engine with the fewest possible moving parts and a minimum of friction and inertia; to produce an engine having its steam-passages so arranged that the steam passes as a blast through or over all the bearings and frictional surfaces, keeping them at uniform temperatures, thereby preventing hot-boxes or overheated bearings, and moving the film of lubricant on the bearings and frictional surfaces gradually onward until ejected at the exhaust, thus keeping every bearing cleansed of grit due to wear; to produce an engine in which the lubricant is fed at the throttle, whence the steam carries it as a fine spray to all the bearings and frictional surfaces, insuring the positive and uniform lubrication of all the parts; to produce an engine having for its body or frame a hollow chest with all the bearings and frictional surfaces on the inside, with the steam-passages so disposed that every cavity within the chest is filled with steam, so that the outward pressure of the steam at every possible crevice maintains an outward ooze, positively excluding dust from all the bearings and frictional surfaces; to produce an engine of simple and durable construction which can be economically constructed and yet insure the highest degree of accuracy.

My invention consists of the parts and combinations and arrangements of parts hereinafter described and claimed.

In the drawings, Figure 1 is a horizontal section of an engine embodying my invention; Fig. 2, a section on line 2 2 of Fig. 1; Fig. 3, a section on line 3 3 of Fig. 1; Fig. 4, a section showing the valve-gear and valves; Fig. 5, a section on line 5 5 of Fig. 1; Fig. 6, a horizontal section of a modification of my invention as applied to a compound engine, and Fig. 7 a section on line 7 7 of Fig. 6.

Reference-letter A denotes a power-shaft; B, a casing containing the operative parts; C, cylinders; D, a piston; E, valve-chambers; F, valves; G, a valve-actuating eccentric; B′, additional casings for compound engine; C′, high-pressure cylinders; D′, high-pressure pistons; E′, high-pressure valve-chambers, and F′ valves for compound engine.

The shaft A may be of any suitable form provided with suitable means for transmitting its motion. It is rotatably mounted in bearings *a* in casing B and passages *a′* for permitting access of the lubricant to the bearing-surface of the shaft.

The casing B is preferably of cast-iron made in one piece, with a cylindrical opening passing through it in one direction for the passage and mounting of the crank-shaft A and with cylindrical openings passing through it in a direction at right angles to and having their axes intersecting and lying in the same plane as the axes of the former opening to form the cylinders C and valve-chambers E. The crank-shaft opening is made large enough to permit the passage of the crank at one side and the insertion of the valve-gear at the other. By this arrangement the mounting-surfaces for the shaft may be trued upon a lathe and the casing swung ninety degrees and the cylinders and valve-chambers trued up, thus insuring accuracy and economy in manufacture.

The piston D is preferably of cast-iron cast in one piece. Its ends are somewhat larger than the middle portion and nicely fit in cylinders C. The shaft A passes through the center of the piston at right angles thereto, for which purpose it is slotted at *d* to permit reciprocations. The bearings *a* project into slot *d* and have flattened bearing-surfaces a^2, which engage the sides of the slot and hold the piston against rotation. The crank-shaft A is provided with crank-arms and crank-pin a^3, which engages slot *d′* in piston D, whereby the reciprocations of the piston cause rotation of shaft A. The slot *d′* is formed by pieces d^2 of hardened steel, supported only at their ends and secured in position by means of screws d^3. This furnishes a resilient bear-

ing for the crank-pin at the moment of greatest strain and provides a means for taking up wear by inserting plates between the pieces d^2 and their supports. It will be noted that the engagement between pin a^3 and slot d' is a line engagement—*i. e.*, has but one line of contact—and therefore the friction between them is the minimum, and ample room for lubrication is allowed. Furthermore, this engagement permits the use of the full length of slot. It is found that this produces an admirable connection for high speed, having little friction or knocking in its action.

Steam mixed with oil is supplied to chambers b through opening b' and passages b^2. The valve-chambers E communicate with cylinders C by means of ports e, and valves F, actuated by eccentric G, serve to properly supply steam from chambers b to cylinders C. Instead of a strap for communicating the motion of eccentric G to valves F, I employ a yoke g, which has a line engagement with the eccentric, thus reducing the friction to a minimum and allowing access for lubrication. An exhaust-opening b^3 permits the escape of the exhausted steam, which coming from the valve-chambers strikes the eccentric G and its yoke g, thoroughly lubricating them, thence passing through passage b^4, provided for the purpose, the exhaust-steam blast strikes the crank-pin a^3 and slot d', lubricating them, and finally escapes through opening b^3. Passages b^5 permit the access of exhaust-steam to chamber b^6, surrounding one of the shaft-bearings, and since the other shaft is always surrounded by exhausted steam it will be seen that all the bearings and connections of my engine are constantly subjected to a blast of exhausted steam. This not only thoroughly lubricates the bearings and connections, but maintains them at a uniform temperature—*i. e.*, that of the exhausted steam—thus preventing unequal expansions and consequent wear. The constant passage of the exhausted-steam blast over the bearings and connections carries away any dirt or grit resulting from wear and also prevents entry of dust or grit. It will be noted that this construction produces a completely inclosed engine, with all its working parts subjected to the cleansing action of the exhausted steam, and that at the bearings there will be an outward tendency or action due to the pressure of the exhausted steam, so that there will be an outward ooze of the lubricant which prevents the working in of dust or grit, so that cleaning is unnecessary.

By using the slot-and-pin connection for transmitting the motions of piston D to shaft A, I am enabled to dispense with boxes, &c., and thus not only reduce the friction, but save the power necessary to overcome the inertia of the box. The accuracy of cylinder-bore resulting from my construction renders packing the piston unnecessary. Sometimes it will be found desirable to form minute annular grooves in the outer surface of the piston, which filling with lubricant form a capillary packing.

In Figs. 6 and 7 I have illustrated my invention as applied to a compound engine. To accomplish this, casings B′, containing a high-pressure cylinder C′ and valve-chambers E′, are secured to the ends of casing B so as to bring the cylinders and valve-chambers in alinement, as shown in Fig. 6. High-pressure pistons D′, which are coaxial extensions of piston D, are provided to operate in cylinders C′. Valves F′ are substituted for valves F, and a complete compound engine is obtained in which high-pressure steam laden with oil enters through passages b^7 into chamber b^8, whence it enters high-pressure cylinders C′ and is exhausted into chambers b. From chambers b the low-pressure steam enters cylinders C and is exhausted through valve-chambers E, as before.

My invention has been described as operated by steam; but it is obviously capable of operation with other expansible fluids.

While I have illustrated and described the preferred form of application of my invention, this is obviously capable of many variations without departing from the spirit of the invention. I therefore do not wish to be limited to the exact construction shown.

I claim as novel and desire to secure by Letters Patent—

1. The combination in an engine of a power-shaft; cylinders on opposite sides of said shaft in alinement with each other; a double rigid piston adapted to operate in both cylinders and intersecting the shaft; a slot in the piston formed of two resilient plates supported only at the ends; a crank-arm on the shaft and a pin on the crank-arm engaging the slot, substantially as specified.

2. The combination of shaft A; cylinder C; piston D; slot d' formed by resilient plates d^2 which are supported only at the ends and adjustably held in position by screws d^3 passing through the face of the piston; a crank-arm on shaft A; and crank-pin a^3 engaging slot d', substantially as specified.

3. The combination in an engine of a casing formed in one piece; a cylindrical opening piercing said casing in one direction; a shaft mounted in said opening; cylindrical openings piercing said casing in a direction at right angles to the former opening and constituting the low-pressure cylinder of a compound engine and the valve-chambers thereof, the axes of said cylinder and valve-chamber openings intersecting the axis of the shaft-opening and lying in the same plane; supplemental casings containing high-pressure cylinders secured to the former casing with the high-pressure cylinders in alinement with the low-pressure cylinders, and forming continuations of the same at either end; a rigid piston having a large central portion adapted to operate in the low-

pressure cylinder, and smaller coaxial extensions at either end adapted to operate in the high-pressure cylinders; and an operative connection between the piston and shaft, substantially as specified.

4. The combination in an engine of a casing formed in one piece; a cylindrical opening piercing said casing in one direction; a crank-shaft mounted in said opening; cylindrical openings piercing said casing in a direction at right angles to the former opening and constituting the low-pressure cylinder of a compound engine and the valve-chambers thereof, the axis of said cylinder and valve-chamber openings intersecting the axis of the shaft-opening and lying in the same plane; supplemental casings containing high-pressure cylinders secured to the former casing with the high-pressure cylinders in alinement with the low-pressure cylinders, and forming continuations of the same at either end; a rigid piston having a large central portion adapted to operate in the low-pressure cylinder, and smaller coaxial extensions at either end adapted to operate in the high-pressure cylinders; and a slot-and-pin connection between the piston and shaft, substantially as specified.

5. The combination in an engine of a casing formed in one piece; a cylindrical opening piercing said casing in one direction; a shaft mounted in said opening; cylindrical openings piercing said casing in a direction at right angles to the former opening and constituting the low-pressure cylinder of a compound engine and the valve-chambers thereof, the axes of said cylinder and valve-chamber openings intersecting the axis of the shaft-opening and lying in the same plane; supplemental casings containing high-pressure cylinders secured to the former casing with the high-pressure cylinders in alinement with the low-pressure cylinders, and forming continuations of the same at either end; a rigid piston having a large central portion adapted to operate in the low-pressure cylinders, and smaller coaxial extensions at either end adapted to operate in the high-pressure cylinders; an operative connection between the piston and shaft and passages for conducting the exhausted steam over the bearings and connections, substantially as specified.

6. The combination in an engine of casing B; casings B′ secured to either side of casing B; shaft A mounted in casing B; cylinders C and C′; pistons D and D′; slot d' in piston D, engaging crank-pin a^3 on shaft A; valve-chambers E and E′; valves F′; and eccentric G and yoke g for operating valves F′, substantially as specified.

7. The combination in an engine of casing B; casings B′ secured to either side of casing B; shaft A mounted in casing B; cylinders C and C′; pistons D and D′; slot d' in piston D, engaging crank-pin a^3 on shaft A; valve-chambers E and E′; valves F′; eccentric G and yoke g for operating valves F′; and passages for conducting the exhausted steam over the bearings and connections, substantially as specified.

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