No. 760,062. PATENTED MAY 17, 1904.

W. D. EDWARDS.

ENGINE.

APPLICATION FILED MAY 21, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

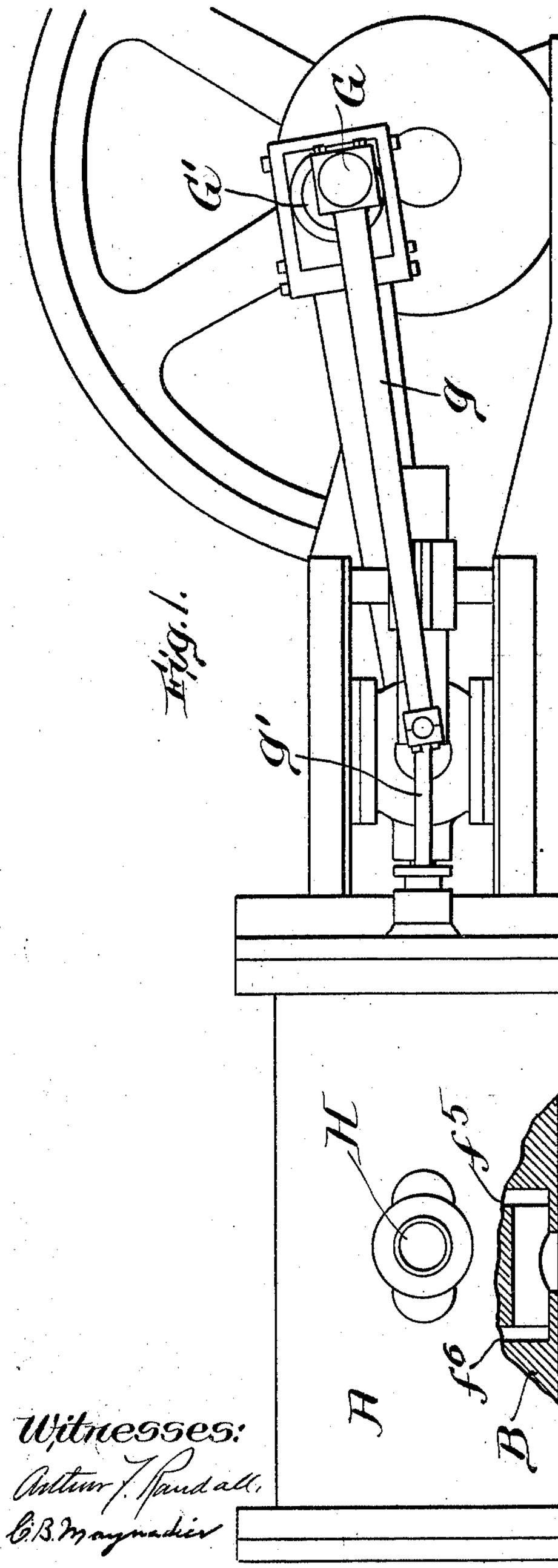

Fig. 1.

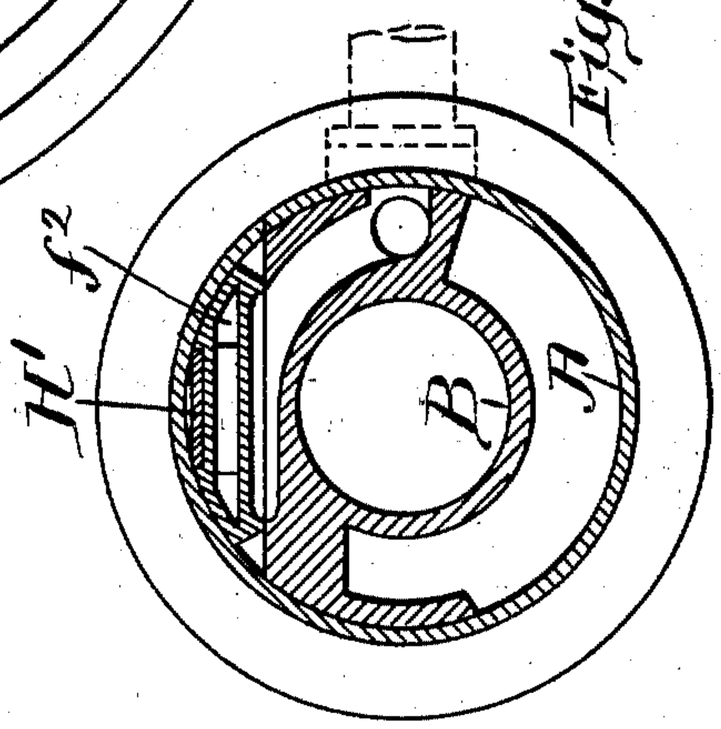

Fig. 4.

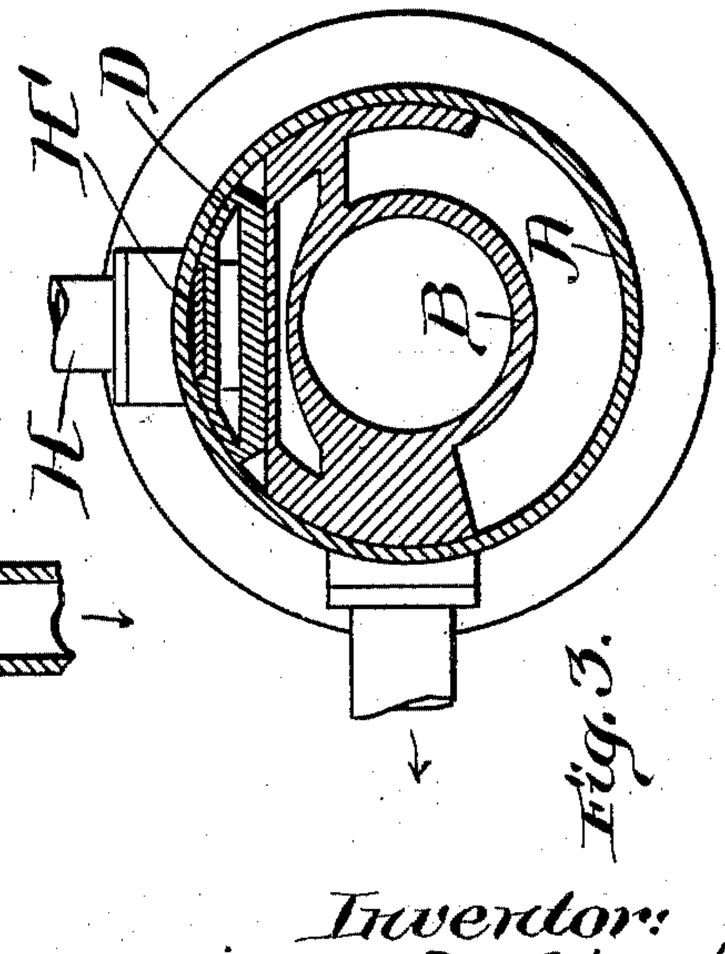

Fig. 3.

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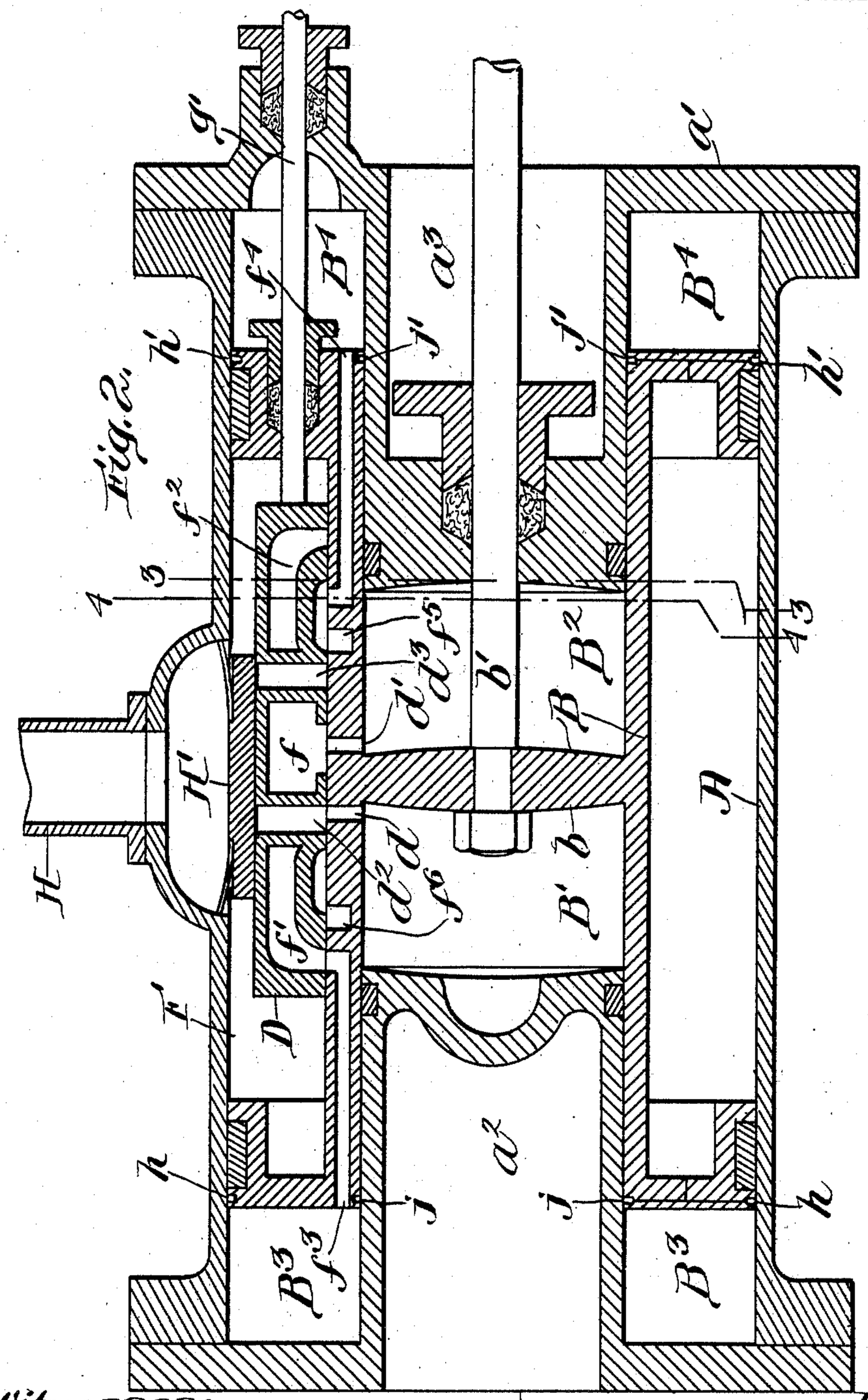
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 3.

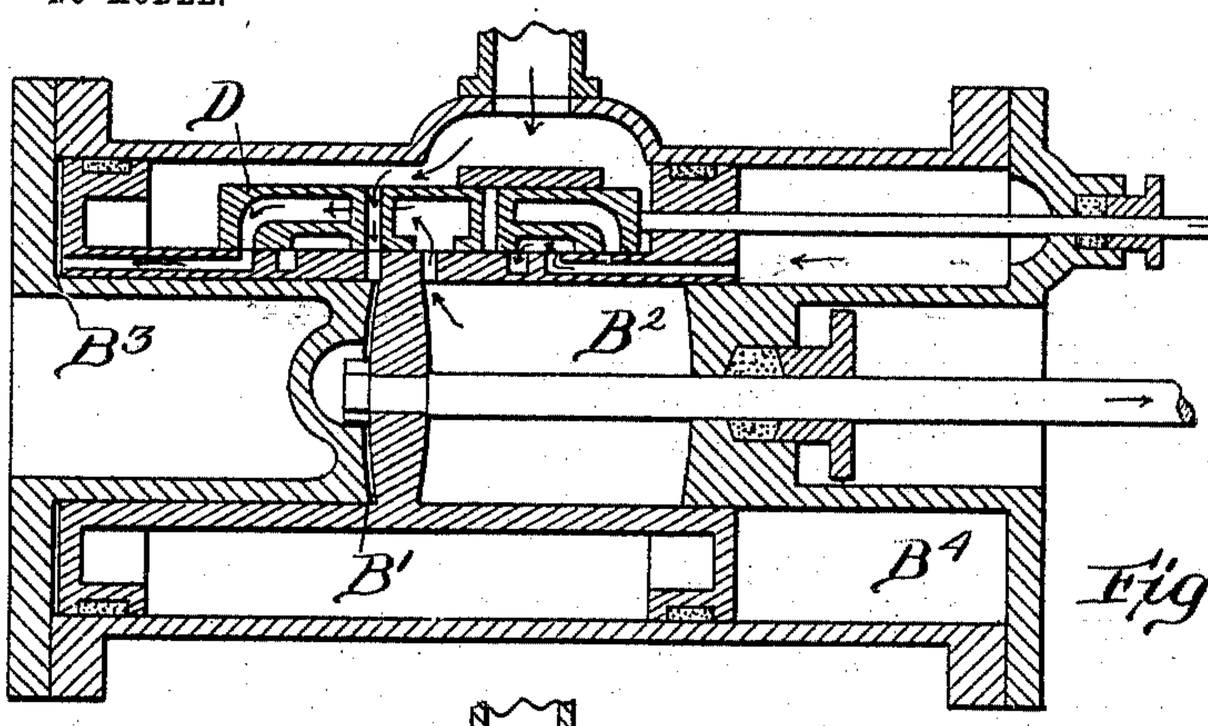

Fig. 5.

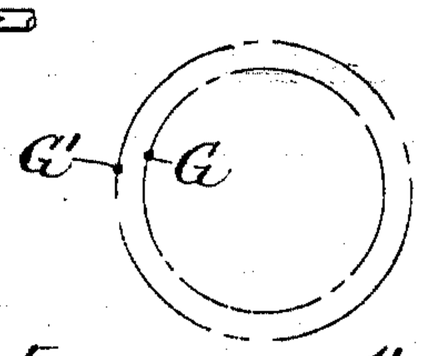

Fig. 5a.

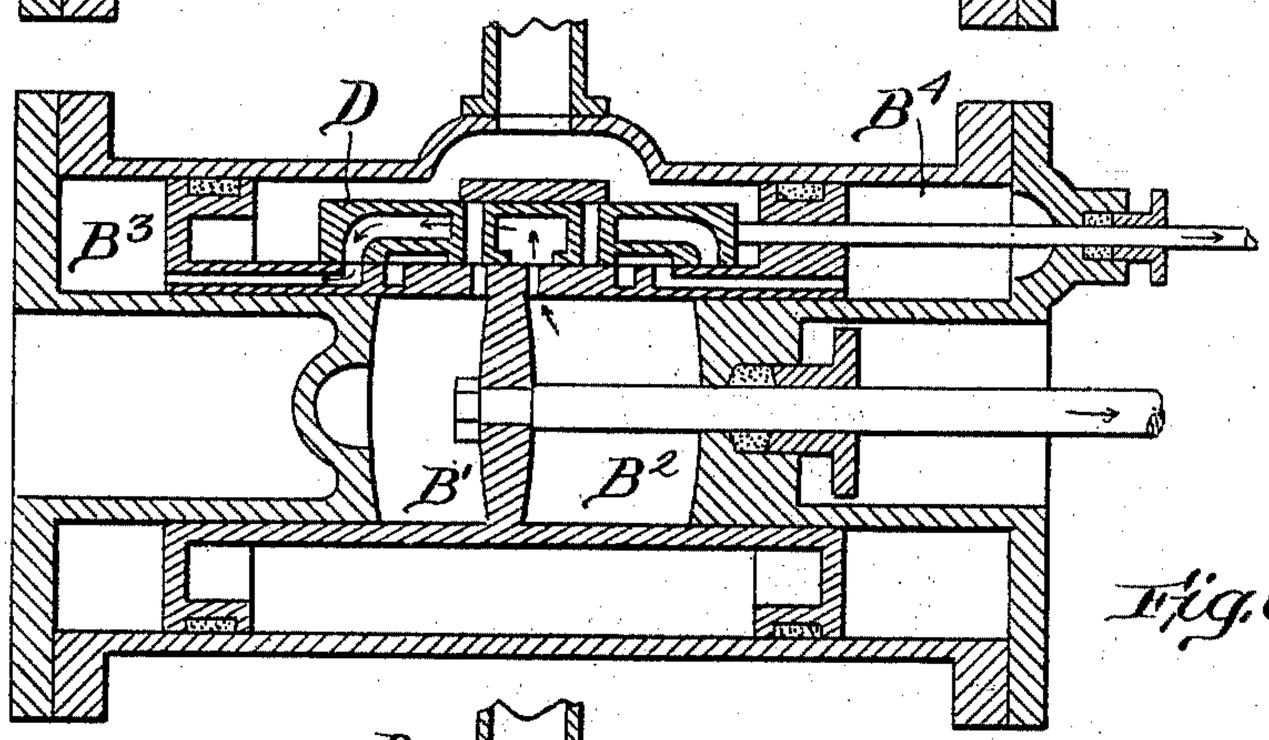

Fig. 6.

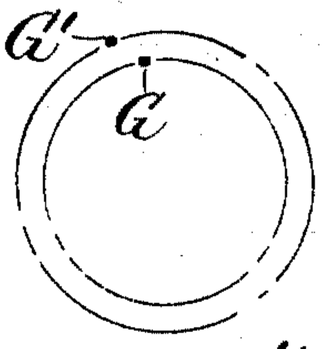

Fig. 6a.

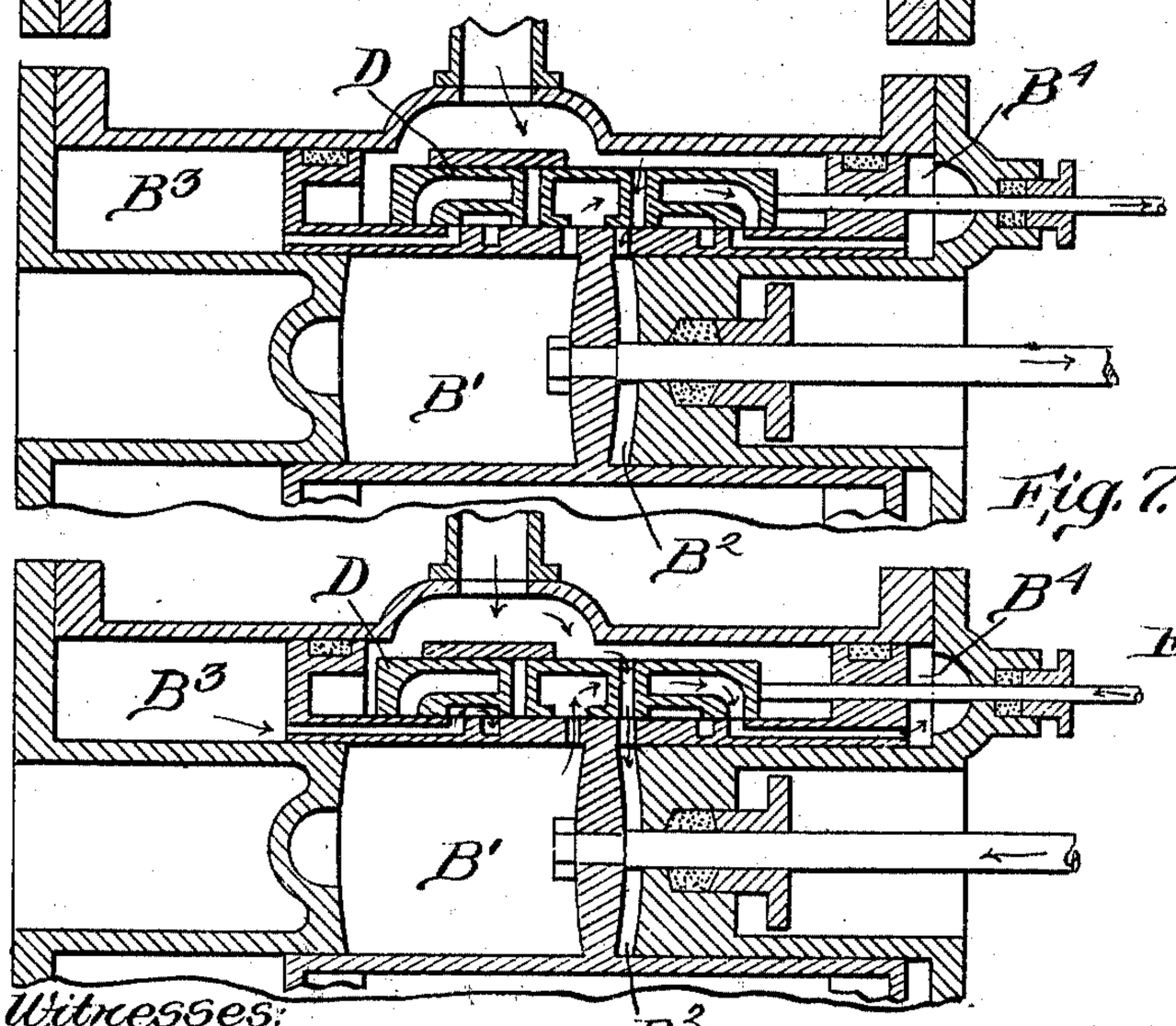

Fig. 7.

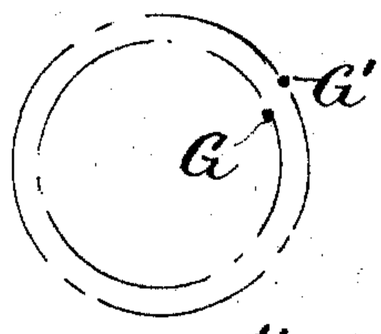

Fig. 7a.

Fig. 8.

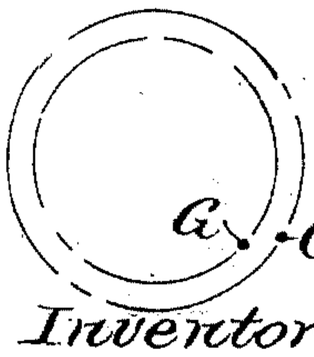

Fig. 8a.

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No. 760,062. Patented May 17, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM D. EDWARDS, OF BOSTON, MASSACHUSETTS.

ENGINE.

SPECIFICATION forming part of Letters Patent No. 760,062, dated May 17, 1904.

Application filed May 21, 1903. Serial No. 158,085. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. EDWARDS, of Boston, in the State of Massachusetts, have invented a new and useful Engine, of which the following is a specification, reference being had to the accompanying drawings, making a part hereof.

My invention is an engine with only one piston-rod and piston, but with two steam-spaces, the high-pressure steam admitted into one of the two steam-spaces on one side of the piston acting on the piston and then expanding into the other steam-space and again acting on the piston before the spent steam escapes through the exhaust, as will now be more fully described by reference to the drawings, in which–

Figure 1 is an elevation, partly in section, of my new engine. Fig. 2 is a horizontal central section of the cylinder of the engine shown in Fig. 1. Figs. 3 and 4 are sections on lines 3 3 and 4 4 of Fig. 2, on a reduced scale. Figs. 5 and 5^a to 8 and 8^a, inclusive, are sectional diagrams, showing the different positions of the piston and of the distribution-valve during the operation.

Cylinder A has its heads a a' formed with internal projections a^2 a^3, which, in connection with piston B, make high-pressure steam-spaces B′ B^2 and low-pressure steam-spaces B^3 B^4, so that the steam for running the engine flows first into space B′, thereby forcing piston B in one direction, after which that supply of high-pressure steam expands out of space B′ and into space B^4, the pressure of the low-pressure steam in space B^4 forcing cylinder B in the opposite direction; but as will be clear the pressure of the low-pressure steam in space B^4 coöperates with the pressure of a new supply of high-pressure steam admitted to space B^2 to move piston B during one stroke, and the pressure of the high-pressure steam in space B′ coöperates with the pressure of the low-pressure steam in space B^3 to move piston B during the opposite stroke—that is, steam from the boiler is admitted to space B′ and steam from space B^2 is admitted to space B^3 simultaneously to drive the engine one stroke, and from the boiler to space B^2 and from space B′ to space B^4 simultaneously to drive the engine at the opposite stroke.

The ends of piston B fit the inner surface of cylinder A and also fit over the projections a^2 a^3 on the heads a a', as clearly shown in the drawings, and the partition b divides the piston B into two parts and serves as a means of connecting piston B with piston-rod b'.

The body of piston B is provided with ports d and d', one for steam-space B′, the other for space B^2, and these ports d and d' are controlled by valve D, whose through-ports d^2 and d^3 serve to connect ports d and d' alternately with the steam-supply from valve-chest F. These ports d and d' serve alternately as inlet and outlet ports from spaces B′ and B^2; but while either is serving as an outlet-port it opens only into port f of valve D. This port f has two branches, f' f^2, one, f', opening through port f^3 into space B^3, the other, f^2, through port f^4 into space B^4.

In the position of valve D (shown in Fig. 2) the exhaust-port f^5 is shown open to port f^4, while exhaust-port f^6 is closed by valve D; but on shifting valve D exhaust-port f^6 will be open and f^5 closed.

Valve D is shifted by pin G eccentric on crank-pin G′ and connecting-rod g, connected to valve-rod g', the pin G giving the necessary motion to valve D in addition to that which it has with piston B, for in this example of my invention valve D reciprocates with piston B and owing to the action of pin G is moved back and forth on piston B.

The supply-pipe H is provided with cut-off plate H′, which fits over valve D and covers through-ports d^2 d^3 except during the time desired for admission of steam from the steam-supply, the amount of cut-off being easily determined by the width of plate H′, as will be obvious from Fig. 2, while if plate H′ were omitted that function would be performed wholly by pin G—that is, through-ports d^2 d^3 are closed by plate H′, as the width of plate H′ determines—and the relation of ports d^2 and d and d^3 d' depend wholly on the relation of pin G with crank-pin G′—that is, the travel of piston B is determined by crank-pin G′—and plate H′ is stationary, except when moved for regulation, while

valve D is reciprocated by pin G and piston B by crank-pin G′, and therefore valve D, moved by pin G, will be moving in the same direction as piston B, which is moved by crank-pin G′, but at a slower rate, and this will move ports d and d^2 out of register, thereby preventing further flow of steam into space B′ at one stroke and move ports d' and d^3 out of register, thus cutting off steam from space B^2; but it will be seen that near the end of a stroke the motion of piston B will be opposed to the motion of valve D, and the result will be the sudden opening of port d of space B′ at the beginning of one stroke and of port d' at the beginning of the opposite stroke.

The operation will be plain from the preceding description, especially when taken in connection with Figs. 5, 5^a to 8 and 8^a, inclusive, which show the positions of the piston and its valve corresponding to the positions of the crank-pin G′ and the pin G eccentric thereon, these being represented as to their relative positions at G and G′ in the diagrams. Thus when the pins G and G′ have just passed their inner dead-center, corresponding to the positions shown in Fig. 5^a, steam is flowing into space B′ from the boiler and steam from space B^2 is flowing into space B^3, while spent steam from space B^4 is escaping through the exhaust. When pins G G′ have reached the points indicated in Fig. 6^a, steam from the boiler is cut off, but space B^2 is still connected with space B^3 and B^4 with the exhaust. In Figs. 7 and 7^a the pins G and G′ are about to pass their outer dead-center, and the steam in space B^2 acts as a cushion while steam is about to escape through the exhaust from space B^3. In Figs. 8 and 8^a the pins G and G′ have passed their outer dead-center and steam from the boiler is flowing freely into space B^2 and steam from space B′ into space B^4, while space B^3 is open to the exhaust. It will be obvious that instead of steam other elastic fluids may be used and also that when external pressure is applied to reciprocate the piston the engine will be a compressor, air, for example, being first drawn through exhaust into spaces B^3 and B^2, and there compressed to one degree and then further compressed in spaces B′ B^2, and thence discharged into a reservoir through H. The steam-channels h h' and j j' about the outer and inner circumference of the ends of piston B are supplied with steam from valve-chest F through small ports, as clearly shown in the drawings, and serve to permit a thin film of steam to travel in contact with the cylinder-walls, raising the temperature of those walls. While this is a desirable feature of my engine, I make no claim to it in this application, as it will form the subject of another application.

What I claim as my invention is—

1. The engine above described characterized by a piston with annular projections at each end and a cylinder with internal projections at each end fitting within the annular ends of the piston and the annular ends of the piston fitting within the cylinder and over the internal projections of the cylinder; combined together and with valves and ports to provide high-pressure steam-spaces formed by the internal projections of the cylinder and the inner walls of the piston, and low-pressure steam-spaces formed by the inner walls of the cylinder with its internal projections and the annular ends of the piston, all arranged and operating substantially as described.

2. In combination a piston with annular projections at each end and provided with ports d d'; a cylinder with internal projections at each end, the internal projections of the cylinder fitting within the annular ends of the piston, and the annular ends of the piston fitting within the cylinder and over its internal projections; and valves with through-ports d^2 d^3 controlling the ports d d' through the piston, all arranged and operating substantially as described.

3. In combination a piston with ports d d' through it; valves with through-ports d^2 d^3 controlling ports d d' through the piston, and a cut-off plate H′ controlling the through-ports d^2 d^3, all arranged and operating substantially as described.

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