

Improvement in Valve Gear for Steam Engines.

No. 122,269.

Patented Dec. 26, 1871.

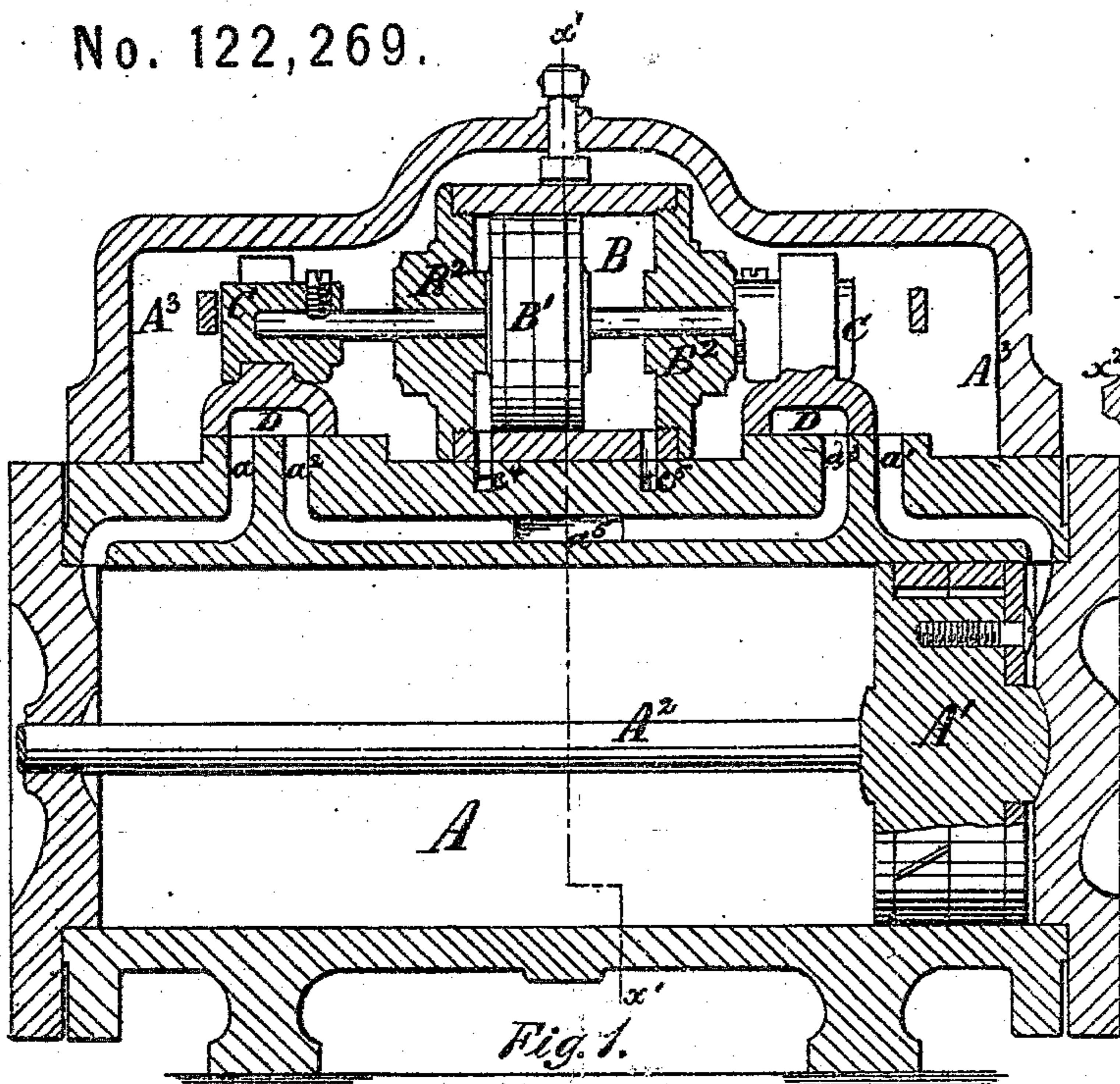


Fig. 1.

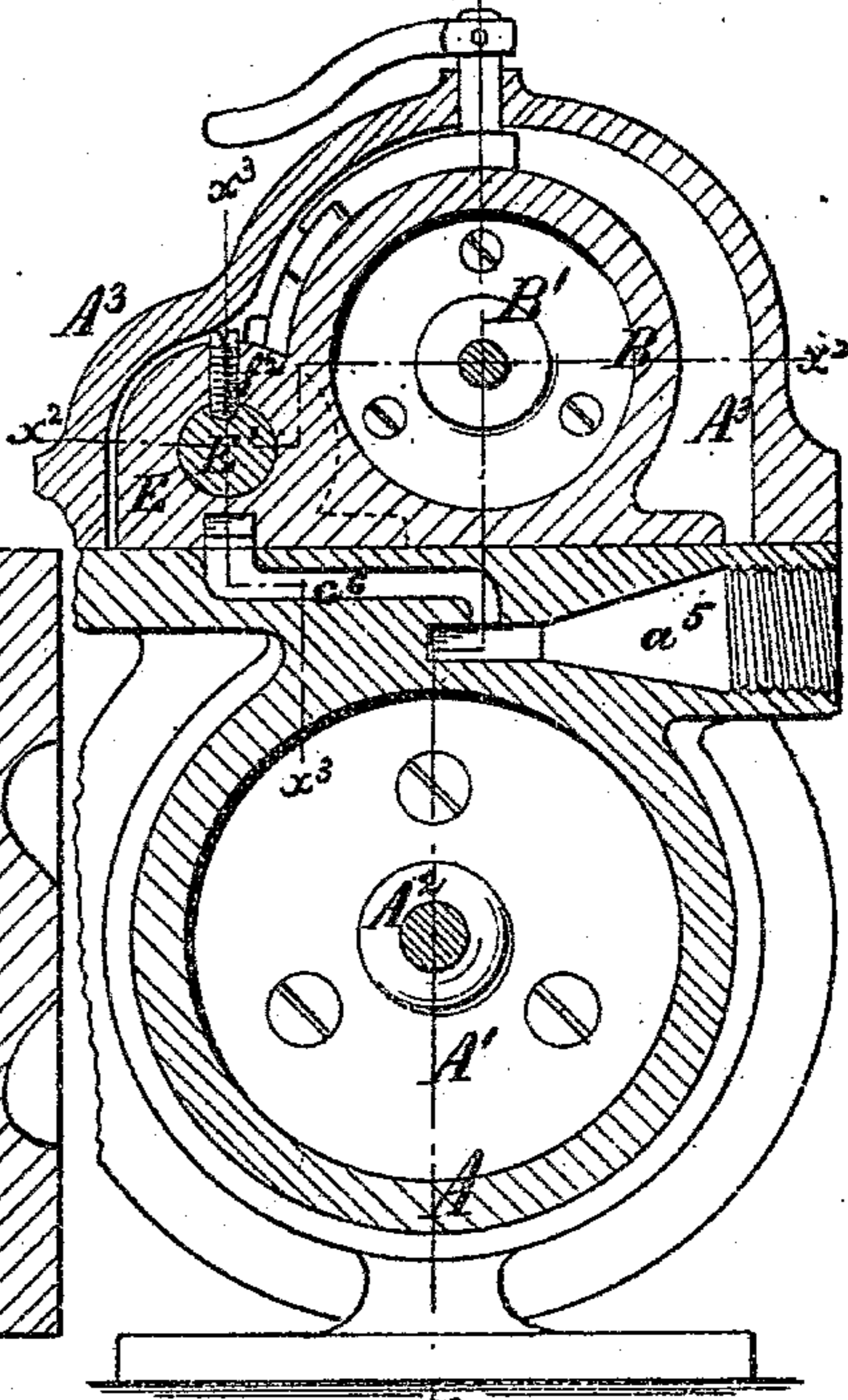


Fig. 2.

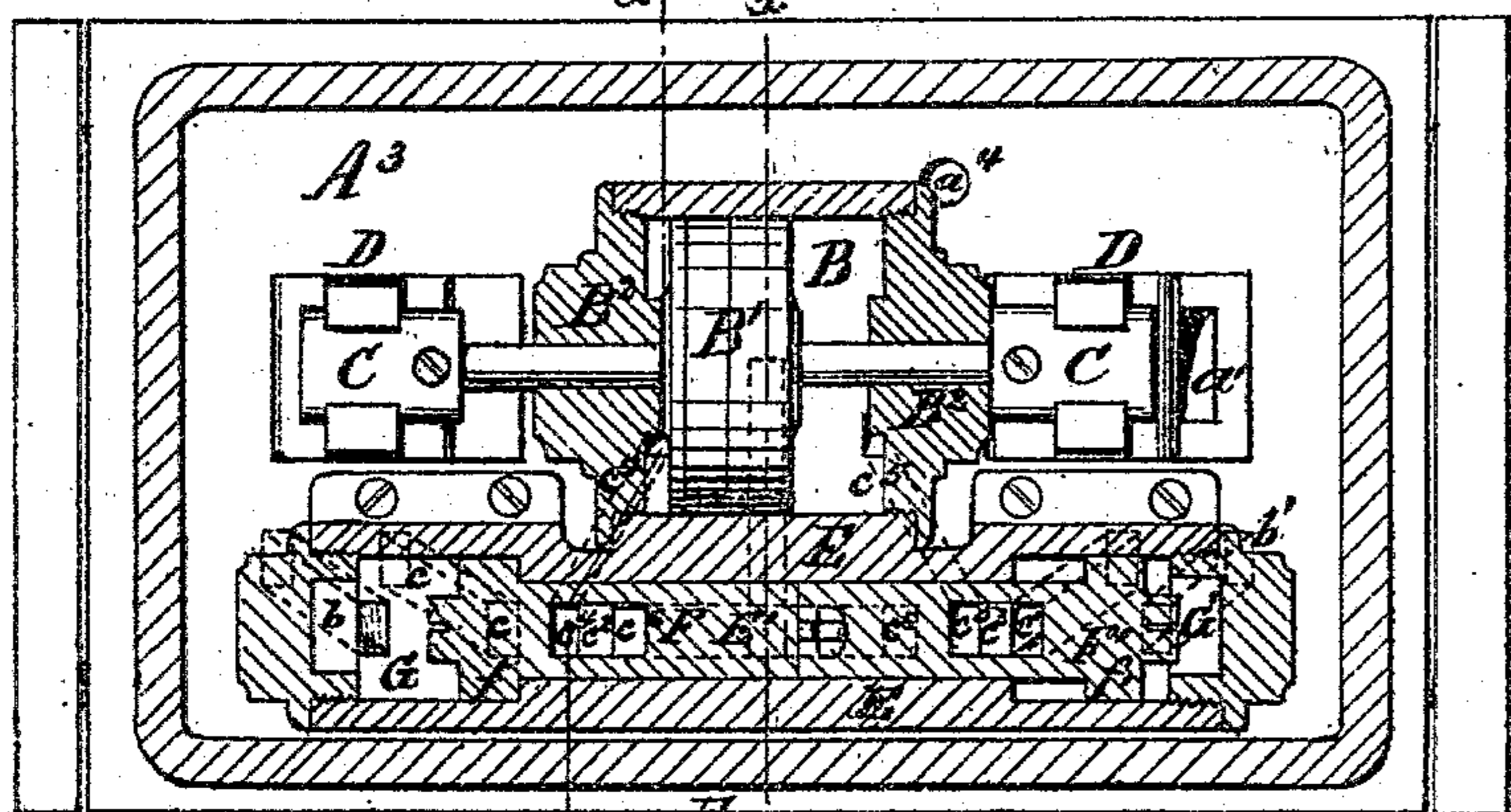


Fig. 3.

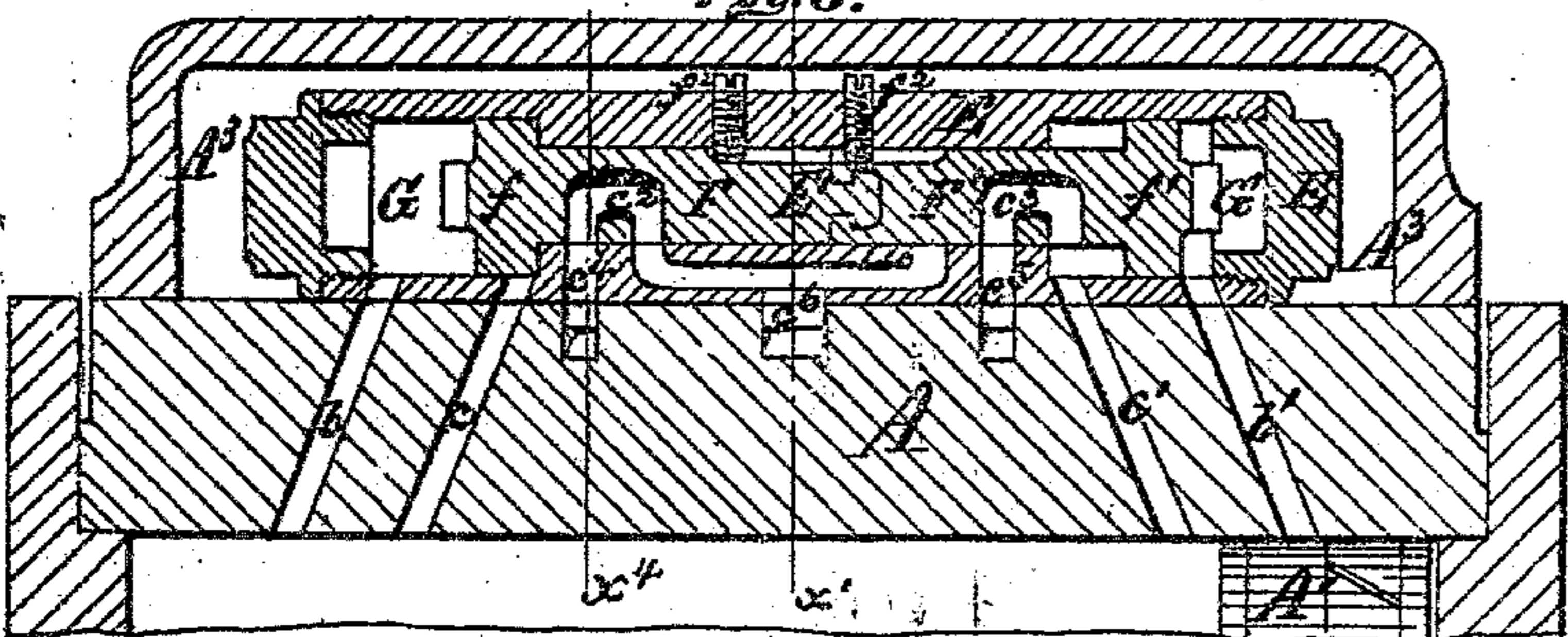


Fig. 4.

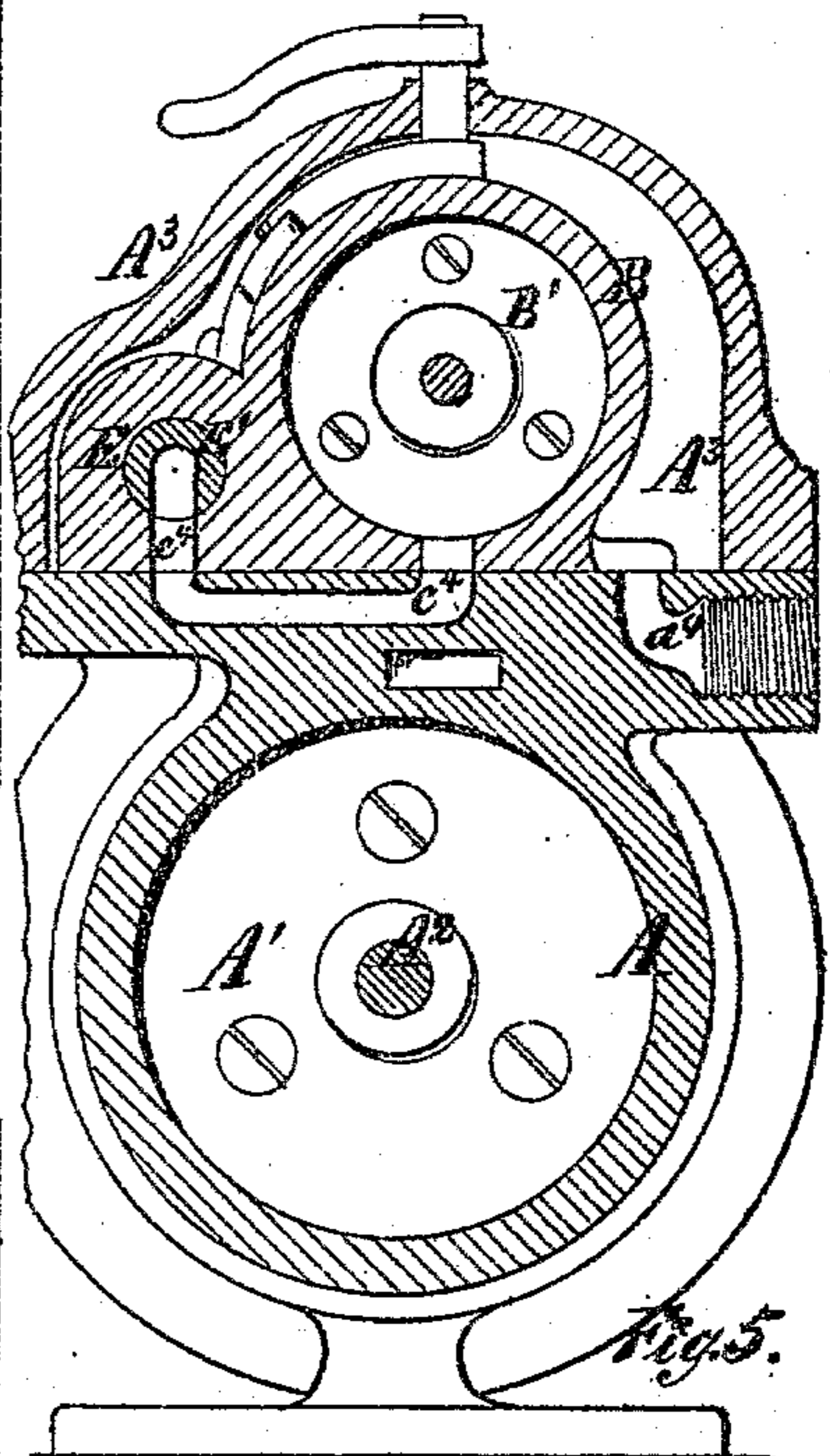


Fig. 5.

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IMPROVEMENT IN VALVE-GEARS FOR STEAM-ENGINES.

Specification forming part of Letters Patent No. 122,269, dated December 26, 1871.

To all whom it may concern:

Be it known that I, JOHN C. MACDONALD, of St. Louis, in the county of St. Louis and State of Missouri, have made certain new and useful Improvements in Valve-Gear for Steam-Cylinders; and I do hereby declare that the following is a full and true description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon.

The object of the improvements here presented is to dispense with valve-rods and connecting attachments ordinarily used to operate piston-rods and pistons of steam-cylinders, and to gain the required reciprocating motion for the piston by the direct action of steam pressure or power.

To achieve said object the nature of this invention relates: First, to the peculiar arrangement and construction of auxiliary cylinders and their reverse acting stops and slide-valves, in combination with the main cylinder of steam-engines. Secondly, to the arrangement of inductive and exhaust steam-passages and ports, by which the steam-power shall operate the valves in the auxiliary cylinders at regular periods to impart the required reciprocating motion to cylinder-pistons. Lastly, this invention relates to certain detail construction of parts, all of which will now more fully appear.

To enable those herein skilled to make and use my said improvements, I will now more fully describe the same, referring to the accompanying drawing, of which—

Figure 1 is a longitudinal vertical section at line $x x$. Fig. 2 is a transverse section at line $x^1 x^1$. Fig. 3 is a horizontal section plan at line $x^2 x^2$. Fig. 4 is a part vertical section at line $x^3 x^3$. Fig. 5 is a transverse section at line $x^4 x^4$.

A is the main cylinder. A¹ is the piston-cylinder. A² the piston-rod as ordinary. The main cylinder A is provided with main steam-ports $a a^1 a^2 a^3$, the said ports $a a^1$ communicating from cylinder steam-space with the steam-chest A³, the said ports $a^2 a^3$, however, being arranged horizontally and leading to the exhaust-pipe. The steam is fed into steam-chest A³ through side port a^4 , (see Fig. 5,) the exhaust escaping out of main exhaust a^5 , Figs. 1 and 2. Within the steam-chest on top cylinder A are the auxiliary cylinders, constructed, arranged, and provided with the valve-gear as follows: The slide-valve cylinder B is provided with proper piston B¹. In or-

der to form the required steam-tight joints for said piston the heads B² of cylinder B are cored with projecting cylindrical faces within and without said cylinder. (See Figs. 1 and 2.) The joint thus formed obviates steam-jacketing, also is more durable and reliable. At the ends of the piston-rod of piston B¹ are valve-heads C C, these being adjustably attached to said rod ends by proper set-screws. Further, the valve-heads C C are properly mortised to receive the bifurcated extensions of the reverse acting slide-valves D D. The body of said valves is formed D-shaped, being cored hollow to carry the exhaust steam from either end of cylinder alternately to main exhaust. The arrangement, therefore, of the auxiliary cylinder B and its reverse slide-valves D D is such that said valves shall open and close the main inductive and exhaust ports $a a^1 a^2 a^3$, as illustrated in Figs. 1 and 2. Also, forming part of the cylinder B is the further auxiliary cylinder E, cored with proper inner shoulders to limit the stroke of its stop-valve E', which is constructed and arranged as follows: The said stop-valve E' consists of cylindrical section F F' formed with the respective valve or piston-heads $f f^1$. (See Figs. 3 and 4.) In order to unite said sectional valve E' within the cylinder E, the sectional part F has at its inner end a stationary turn-bolt, this being fitted to lock in a proper slot in the contiguous arranged sectional part F', as indicated in Figs. 3 and 4. The cylindrical stop-valve E', when arranged to abut against the shoulders within the auxiliary cylinder E, forms steam-spaces or chambers G G', (see Figs. 3 and 4,) in which steam is admitted from the main cylinder, as will hereinafter appear. In order to guide in its slide motion the stop-valve E' the same is provided on top with a groove in which set-screws f^2 are fitted to engage; all lateral or irregular motion on part of said stop-valve is thus prevented. The duplicate arrangement of steam passages and ports to admit steam from the main cylinder to operate the valve-gear, before described, is as follows: The cylindrical stop-valve E' is operated by steam from cylinder A, passing through ports $b b'$; these ports are positioned at the outer ends of said cylinder to communicate by diagonal passages with the steam-chambers G G' of the auxiliary cylinder E, as clearly shown in Figs. 3 and 4. Further, there are similarly arranged the ports $c c^1$ to communi-

cate from the main cylinder with **D**-shaped ports $c\ c^3$ formed in the cylindrical stop-valve E' , (see Figs. 3 and 4;) from thence said ports $c\ c^3$ communicate with ports $c^4\ c^5$ (of main cylinder) with the steam-space of the slide-valve cylinder B , as shown in Figs. 3, 4, and 5. The steam, therefore, from main cylinder passing through ports $c\ c^1\ c^2\ c^3\ c^4\ c^5$ into slide-valve cylinder B in an alternate manner, operates its piston B^1 to make the reverse stroke required. Also, it will be noticed that by the arrangements of all said parts the cylindrical stop-valve E' is operated alternately by steam-power from main cylinder to admit, exhaust, and cut-off at proper periods the steam from the reverse acting slide-valves $D\ D$. The exhaust from the top cylinder B is passed through the ports $c^4\ c^5$ into **D**-shaped ports $c^2\ c^3$ of the valve E' , from thence out of central exhaust-port c^6 , shown in Figs. 2, 3, and 4, which leads to main exhaust or escape-pipe. The exhaust from the steam-chambers $G\ G'$ of the cylinder E returns and escapes with exhaust of main cylinder A . The direct action of steam passing through the passages arranged as described and shown is as follows: Supposing the main port a opened to live steam, the ports $a^3\ a^1$ are opened to exhaust. The piston A^1 having nearly finished its return stroke, steam-port c^1 is uncovered, admitting steam through said port into **D**-shaped port c^3 , from thence through port or passage c^5 into the slide-valve cylinder B , operating its piston B^1 to the left, which reverses the slide-valves $D\ D$ to open the main port a^1 to live steam and the main ports $a\ a^2$ to exhaust, (Figs. 1 and 3;) at the same time the exhaust of cylinder B is escaping through port c^4 into **D**-shaped port c^2 , from thence through central exhaust-port c^6 out of the exhaust-pipe. The piston A^1 , now ready to commence its forward stroke, uncovers port b' admitting steam into the steam-chamber G' , (of cylinder E), reversing its stop-valve E' to close port c^1 to live steam, open ports $c^5\ c^6$ to exhaust, also opening port c to receive live steam as soon as the piston has passed said port c in its forward stroke. Immediately, therefore, as the reverse stroke of the piston occurs, simultaneously occurs the reverse stroke of the reverse-acting valves, which open exhaust-ports, allowing escape of the exhaust from one

side of the piston-face, while the live steam with full power propels the piston to make its full travel. It will be noticed that, as the action of the steam is direct in its pressure from within and without the cylinders, the same degree of steam-heat is achieved, insuring an equalizing propelling power of steam, and also preventing condensation of steam and consequent loss of power.

My said improved valve arrangements are readily repaired, also are not liable to disorder, breakage, or leakage of any of its parts, utilizing the full power of steam, their operation being with less friction and greater power as well as with regularity, precision, and certainty.

Having thus fully described my said improvements, what I claim is—

1. The cylindrical stop-valve E' formed in sections $F\ F'$ having heads $f\ f'$, **D**-shaped ports $c^2\ c^3$, when arranged to operate as and for the purpose set forth.

2. The arrangement of auxiliary cylinders B and E , piston B^1 , double valve-heads $C\ C$, reverse slide-valves $D\ D$, cylindrical stop-valve E' , constructed to operate in combination with main cylinder A , substantially as and for the purpose set forth.

3. The arrangement of steam-passages or ports $b\ b'$, steam-chambers $G\ G'$, in combination with auxiliary cylinder E and cylinder A , substantially as and for the purpose set forth.

4. The arrangement of inductive and exhaust ports $c\ c^1$, **D**-ports $c^2\ c^3$, ports and passages $c^4\ c^5\ c^6$, in combination with cylinders $B\ E$, cylindrical stop-valves E' , and main cylinder A , substantially as and for the purpose set forth.

5. The auxiliary cylinders $B\ E$, valves $E\ D\ D$, steam-ports $c\ c^1\ b\ b'\ c^2\ c^3\ c^4\ c^5\ c^6$, arranged in combination with steam-chest A^3 , cylinder A having main ports $a\ a^1\ a^2\ a^3$, piston A^1 , when all said parts are constructed and arranged to operate as and for the purpose set forth.

In testimony of said invention I have hereunto set my hand.

JOHN C. MACDONALD.

In presence of—

WILLIAM W. HERTHEL,
ROBERT BURNS.

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