

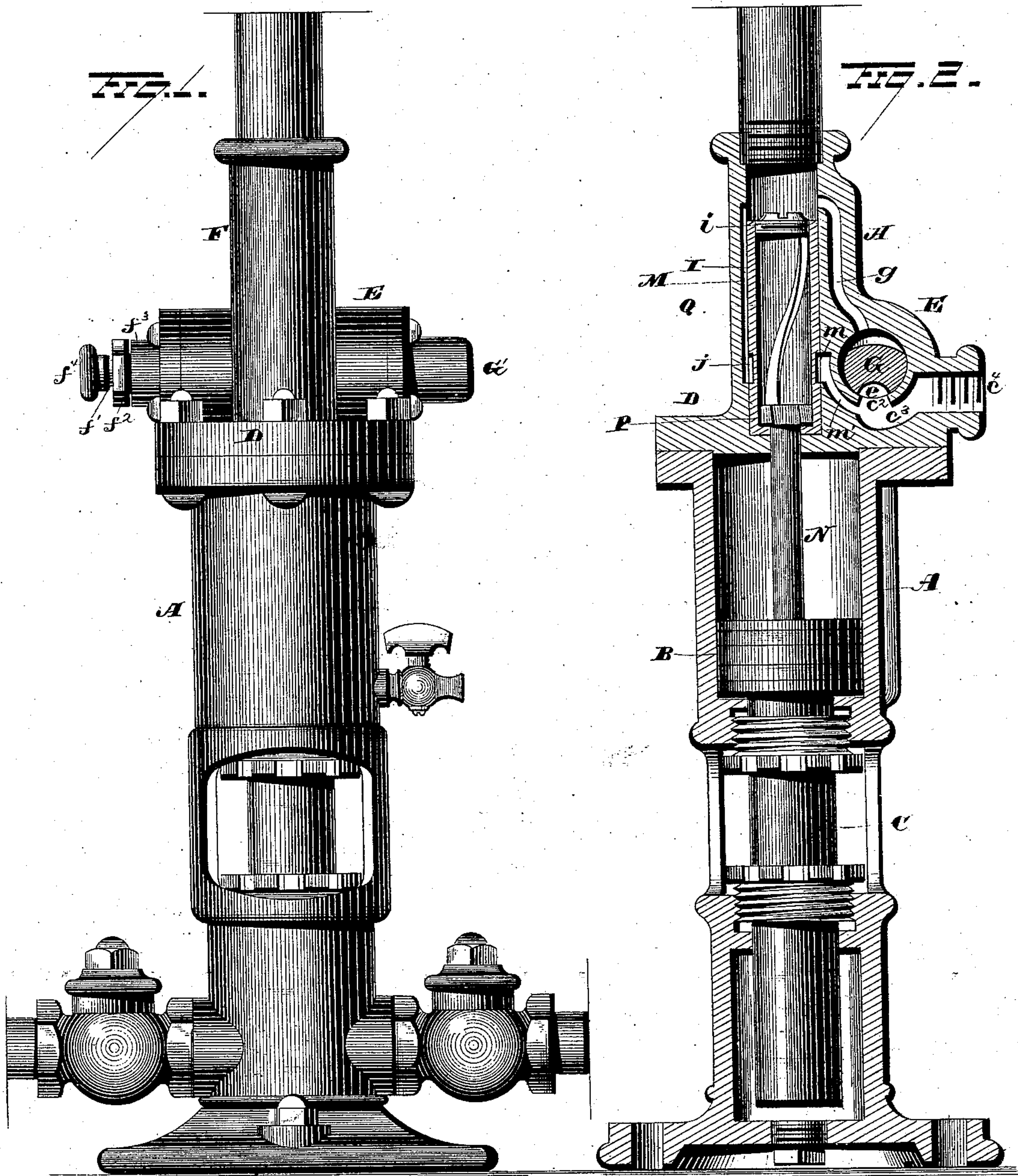
(No Model.)

5 Sheets—Sheet 1

W. K. MILLER.  
STEAM ACTUATED VALVE.

No. 287,845.

Patented Nov. 6, 1883.



WITNESSES

E. J. Nottingham  
Geo. F. Downing.

*INVENTOR*

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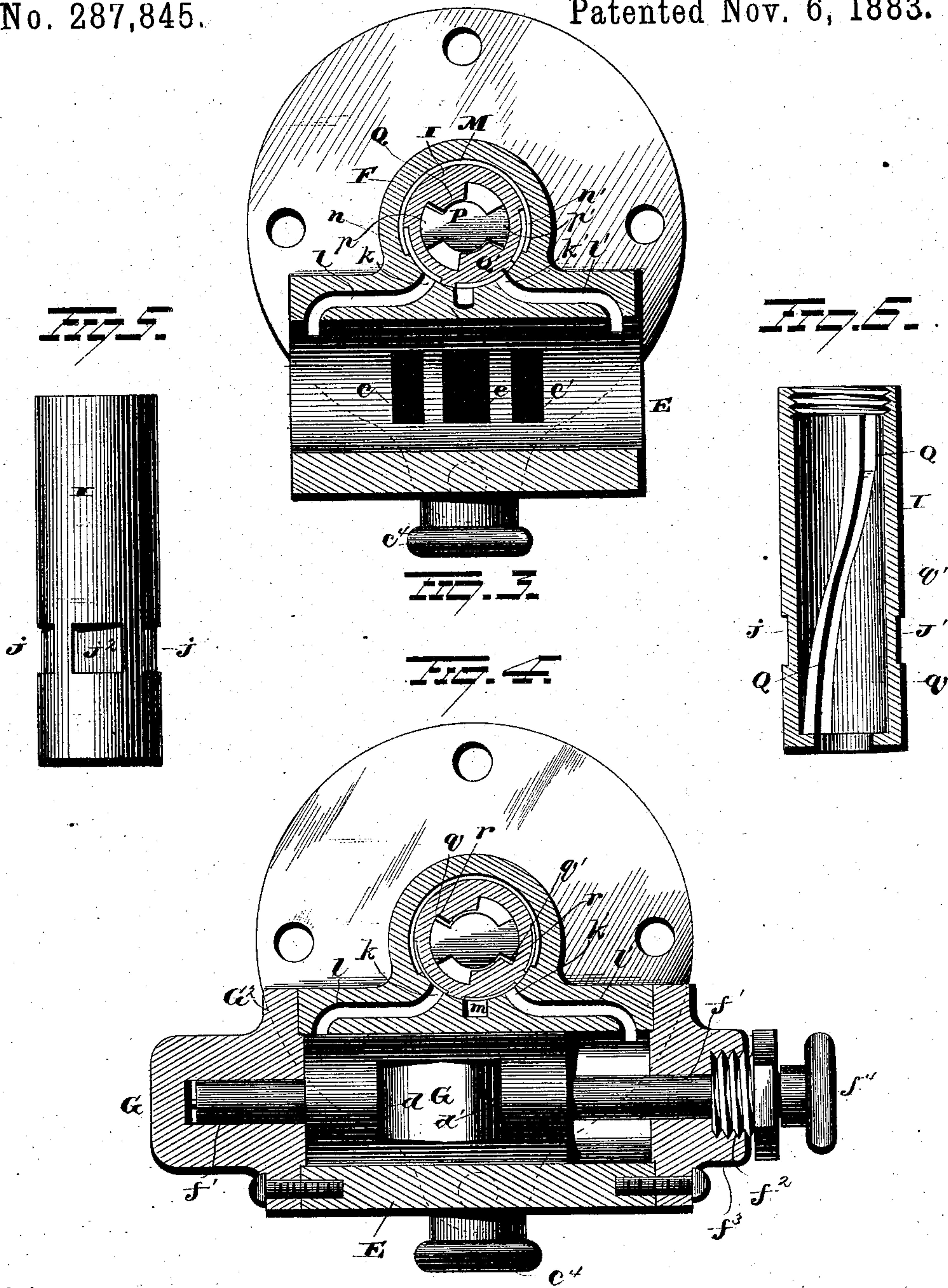
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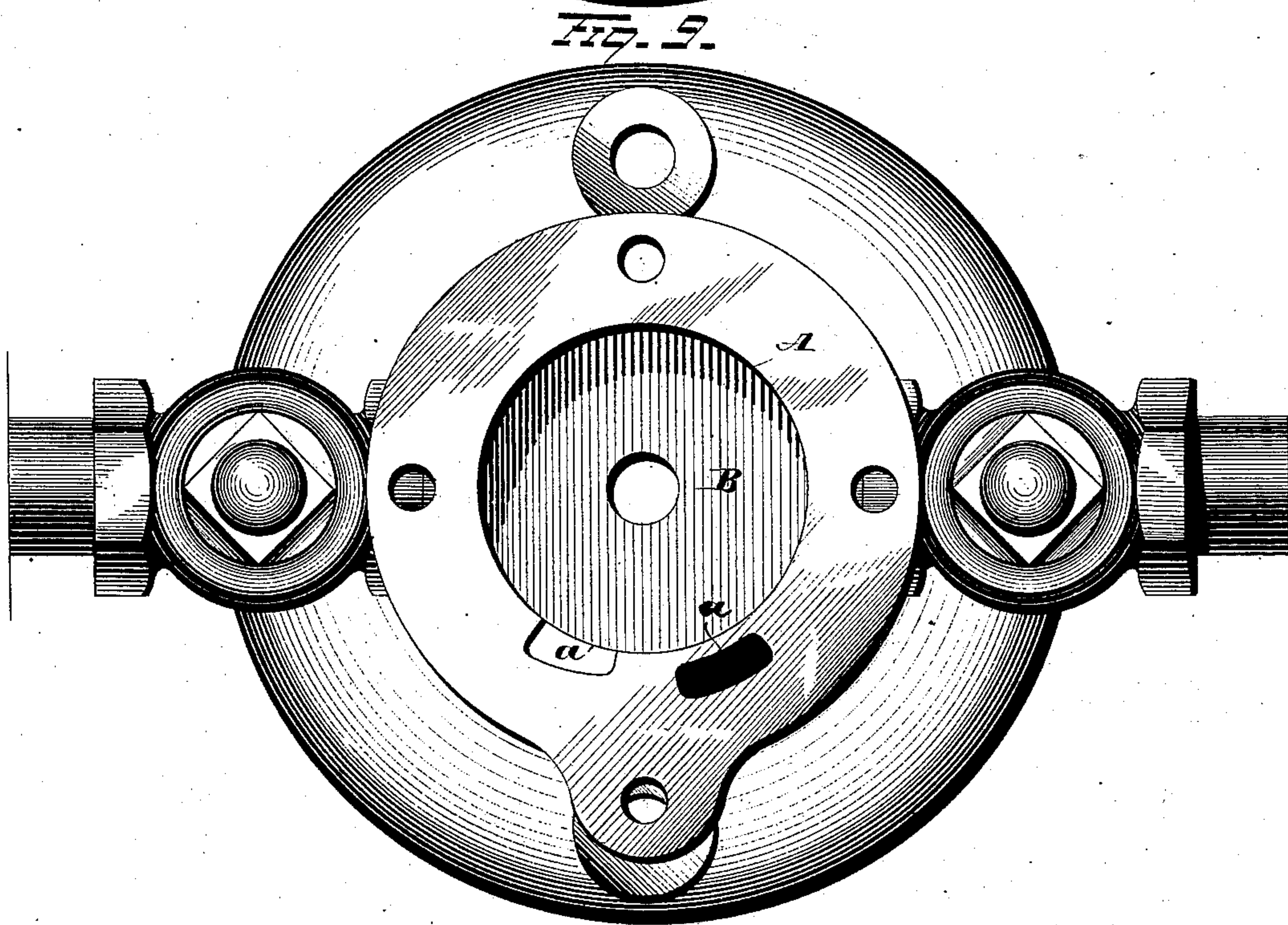
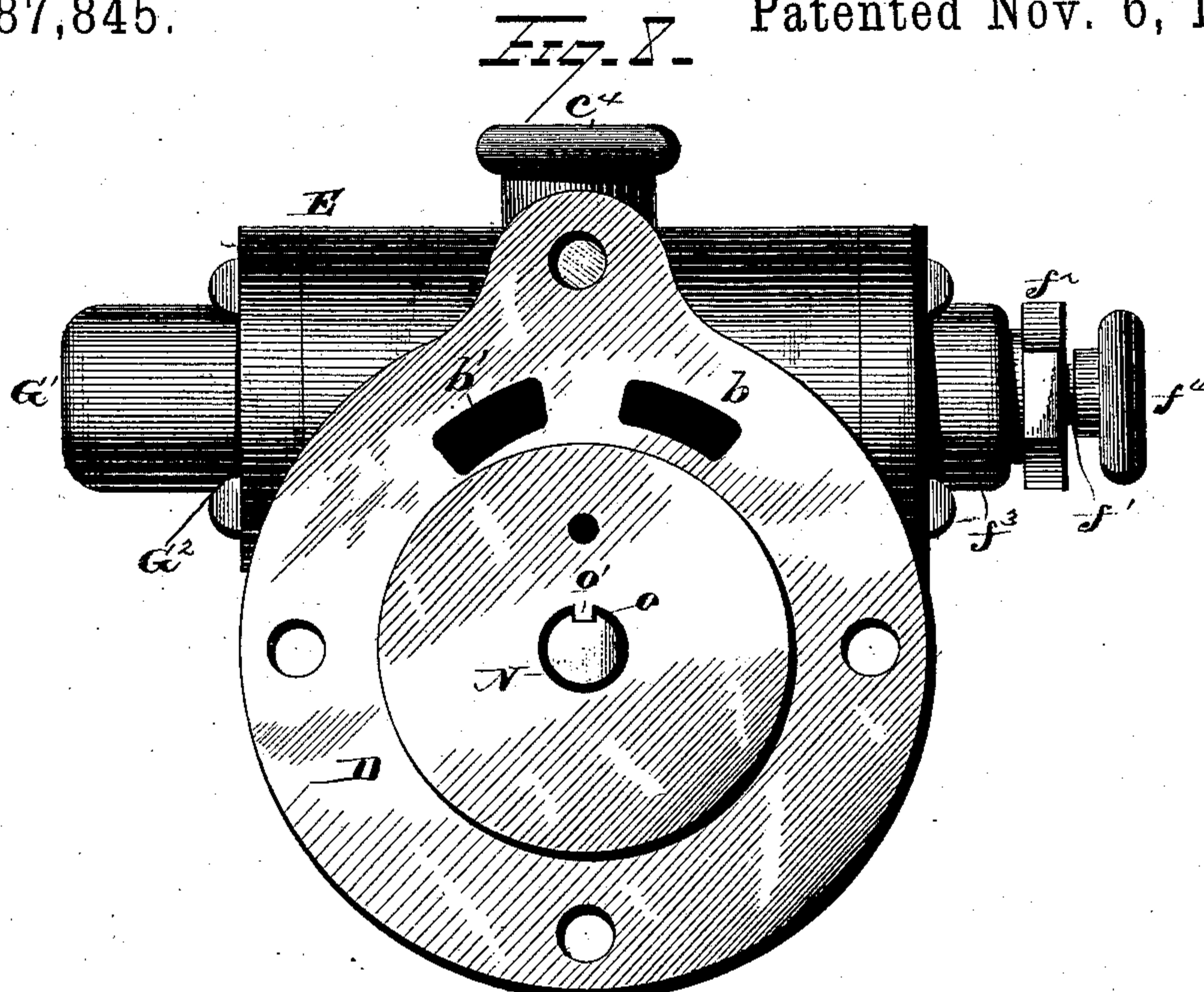
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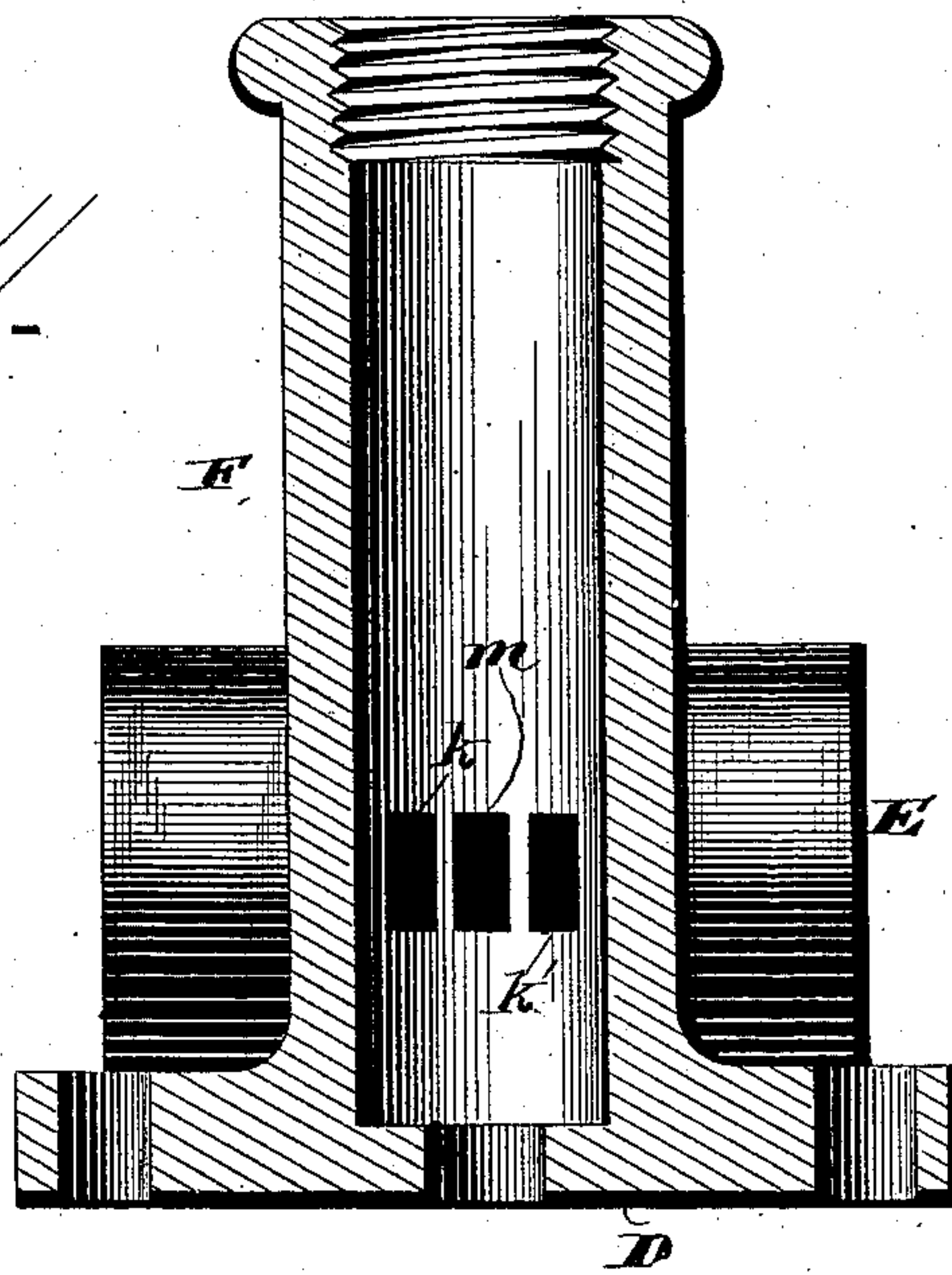
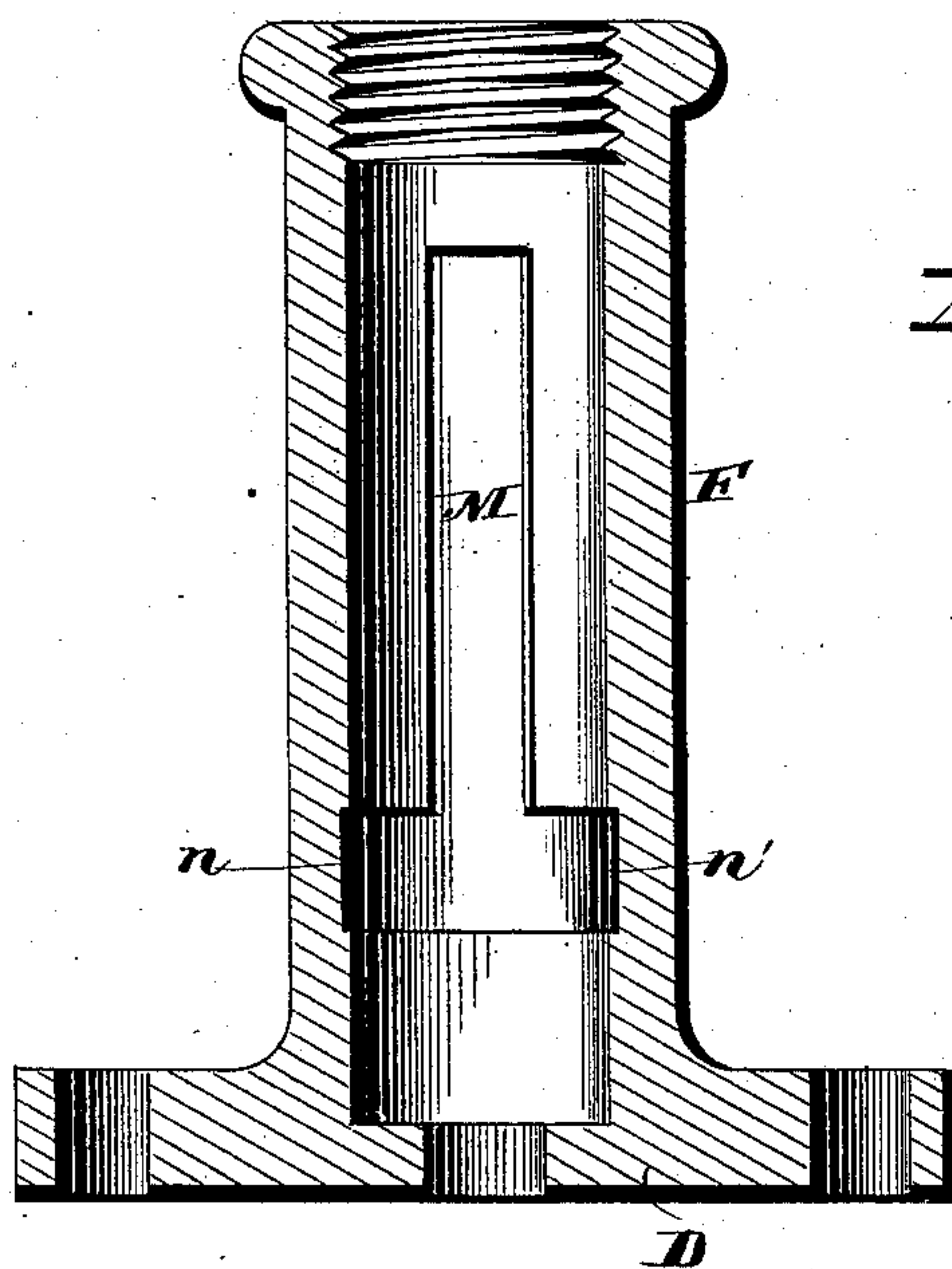
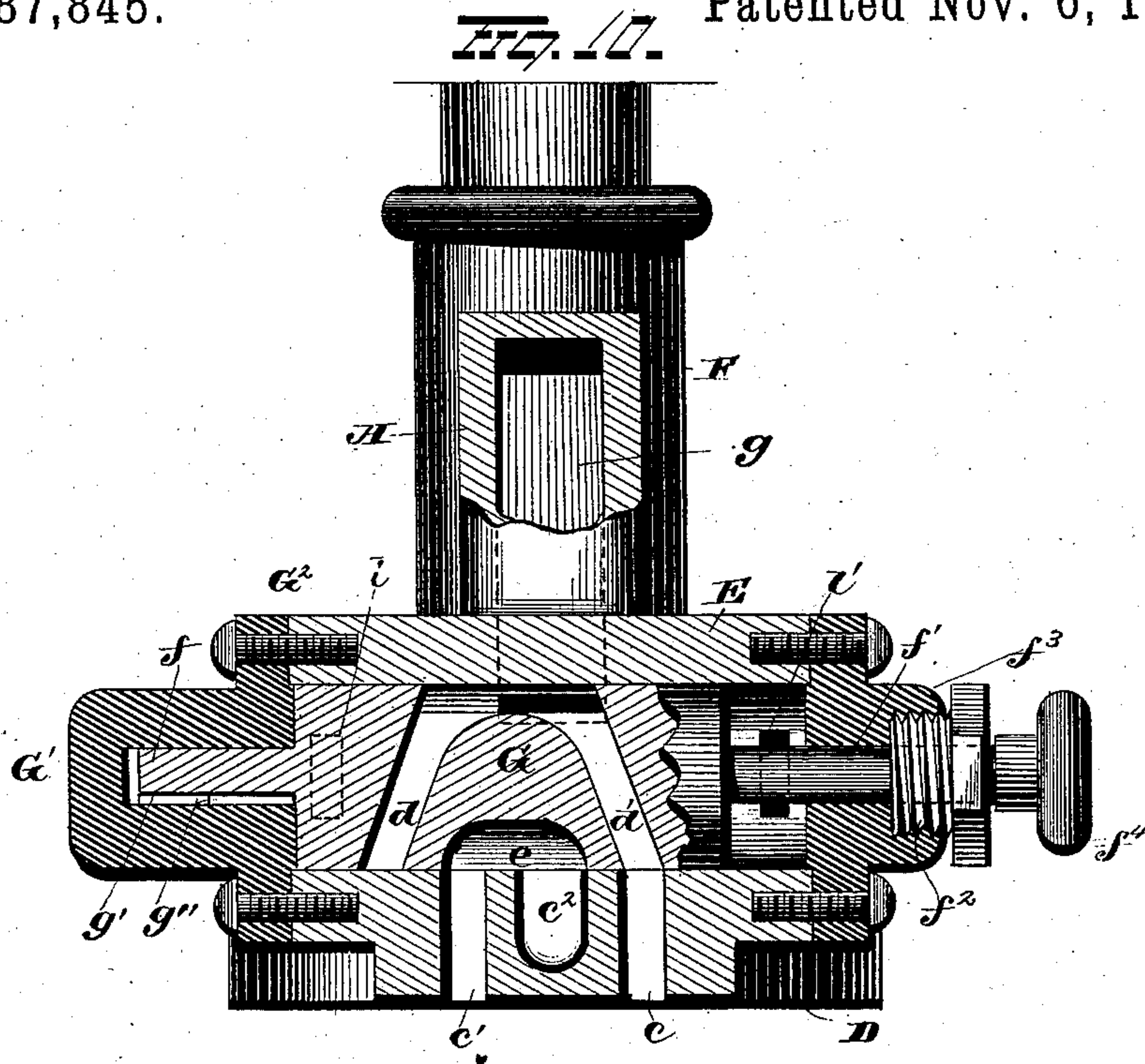
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(No Model.)

5 Sheets—Sheet 5.

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FIG. 12.

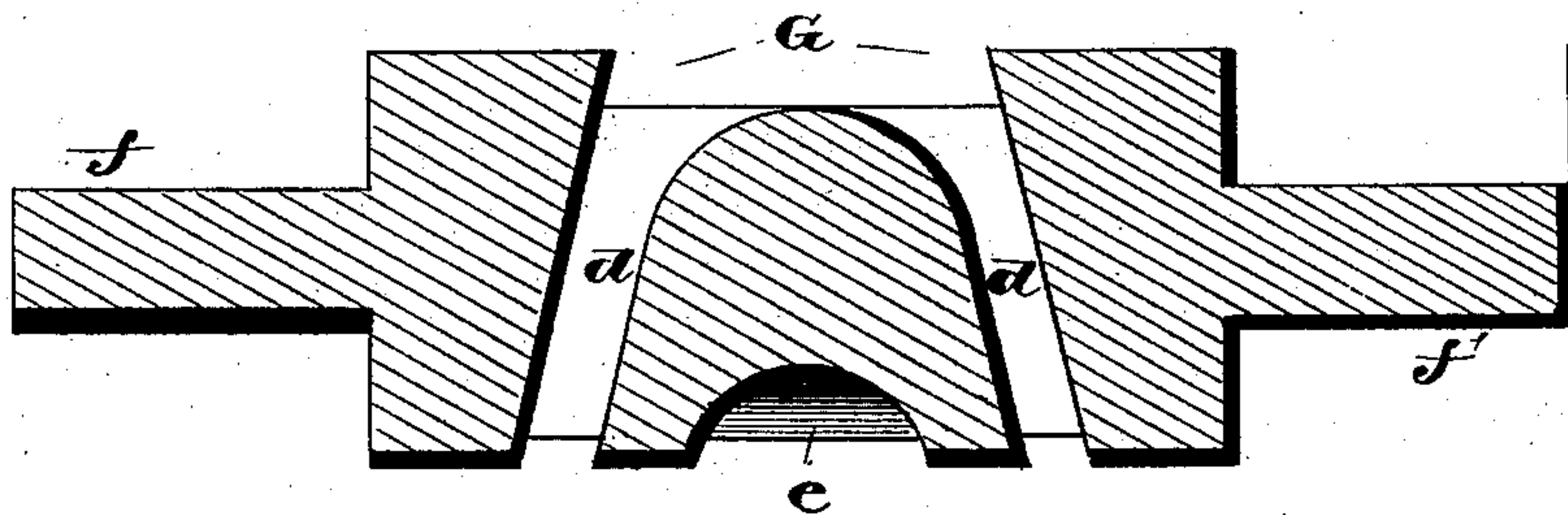
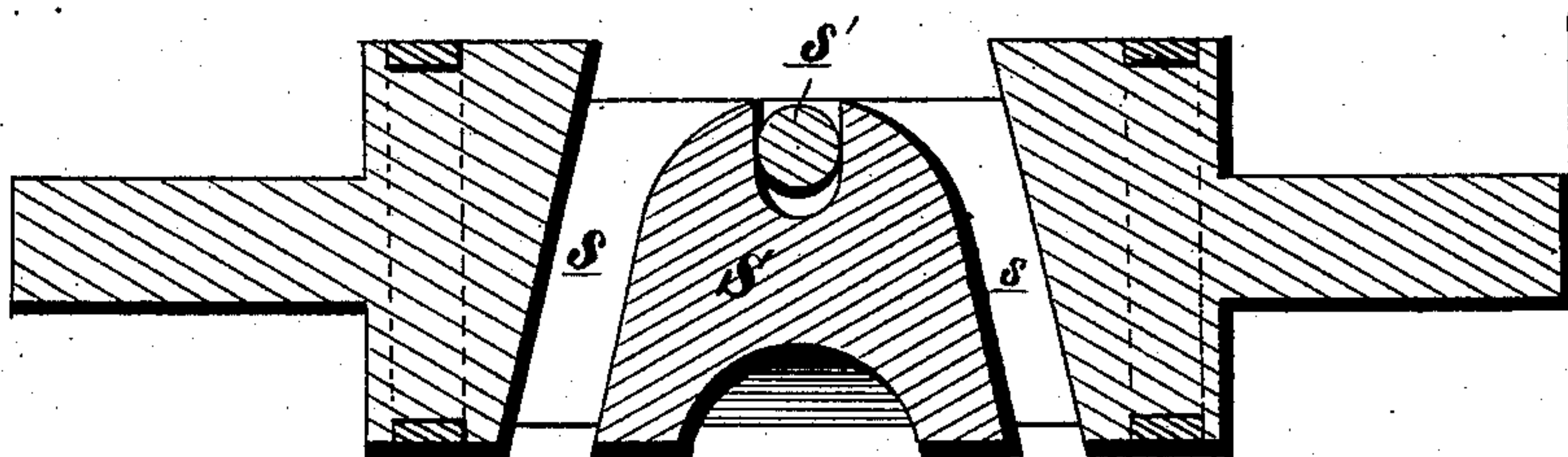


FIG. 13.



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# UNITED STATES PATENT OFFICE.

WILLIAM K. MILLER, OF CANTON, OHIO.

## STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 287,845, dated November 6, 1883.

Application filed September 11, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM K. MILLER, of Canton, in the county of Stark and State of Ohio, have invented certain new and useful  
5 Improvements in Steam-Actuated Valves for Pumping and other Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it ap-  
10 pertains to make and use the same.

My invention relates to an improvement in steam-actuated valves for steam pumping and other engines.

The object of my invention is to provide an  
15 engine of such construction and arrangement of valve mechanism that the main valve for supplying and regulating the admission of steam to the main cylinder shall be actuated and governed by an auxiliary valve connected  
20 with the main piston in such a manner as to be shifted at the extreme ends of the stroke of the main piston, and thereby avoid all centers or dead-points and permit of the operation of the engine at any desired rate of speed, fast or  
25 slow, without changing the position of the main valve until the piston has nearly completed its stroke.

A further object of my invention is to impart an axial movement to an auxiliary valve  
30 by means of devices connected with the main piston and extending into said valve, whereby the actuating mechanism is wholly protected from view and exposure, a stuffing-box dispensed with, and the actuating mechanism of  
35 the valve kept thoroughly lubricated.

With these ends in view my invention consists, first, in the combination, with a steam-actuated main valve, of a non-reciprocating auxiliary valve for governing and regulating  
40 the supply of steam to actuate the main valve, and devices connecting the main steam-piston and auxiliary valve and adapted to impart an axial movement to the latter at the ends of the stroke of the main piston.

My invention further consists in the combination, with the engine-piston and auxiliary valve, of a rod connected with the piston and extending into the valve, and devices for imparting an axial movement to said valve at the  
50 ends of the stroke of the piston.

My invention further consists in certain other

features of improvement, as will be hereinafter explained, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation of a steam pumping-  
55 engine having my invention embodied therein. Fig. 2 is a view partly in vertical section and partly in side elevation. Fig. 3 is a transverse section taken through the line *x x* of Fig. 2, the main valve being removed. Fig. 4 is a  
60 similar view of the auxiliary valve. Fig. 6 is a longitudinal section. Fig. 7 is a transverse section of the auxiliary valve and its cross-head. Fig. 8 is a plan view of the under side of the cylinder-head, in which the main and  
65 auxiliary valves are seated. Fig. 9 is a plan view of the upper end of the steam-cylinder, the head being removed. Fig. 10 is a sectional view, showing the port for supplying steam to the main valve. Fig. 11 shows the interior of  
70 the auxiliary valve-seat. Fig. 12 is a longitudinal section of the main valve, and Fig. 13 is a modification.

A represents the steam-cylinder of a pump-  
ing-engine. B is the steam-piston, and C is the  
75 plunger. These parts may be of any approved construction, the improvement not being confined to pumping-engines, but is susceptible of use with other forms or types of steam-  
80 engines.

Steam-ports *a a'* are located at one end of  
cylinder A, the port *a* supplying steam to the under side of piston B, while steam is supplied to the upper side through port or opening *a'*. To the upper end of the cylinder is secured  
85 the head D, which is provided with steam-passages *b b'*, registering, respectively, with the ports *a a'*. Cylinder-head D is constructed with two valve-chests, E and F, which are preferably cast in a single piece with the cylinder-head. E is the main valve-chest, and is  
90 provided near its central portion with the main steam-port *c c'*, through which steam is conveyed through the passages *b b'* and ports *a a'* to the opposite ends of the steam-cylinder. A  
95 central port, *c²*, connects by a passage, *c³*, with the main steam-exhaust *c⁴*, with which a pipe may be connected for conveying the exhaust-steam to any desired point. G is the main  
100 valve, and is of the type known as a "piston-valve." It is provided with two through openings or steam-passages, *d d'*, through-



which steam is conveyed to the steam-ports  $c$   $c'$ , and with a central steam pocket or recess,  $e$ , of sufficient length to overlap the exhaust-port  $c^2$ , and either one of the ports  $c$  or  $c'$ , to permit of the exhaust from the opposite ends of the steam-cylinder. Steam is supplied through the pipe  $H$ , connected with the top of the auxiliary valve-chest, and flows through the steam-passage  $g$ , leading from the upper end of the auxiliary valve-chest, to the central portion of the main valve-chest, and from thence flows through either one of the steam-passages  $d$   $d'$  in the valve, according to the position of the latter end, and from thence, by the ports and passages described, to the steam-cylinder, and actuates the piston. Main valve  $G$  is provided at one end with the valve-stem  $f$ , which is provided with a longitudinal groove,  $g'$ , in which engages a feather or spline,  $g''$ , on the head  $G'$  of the cap  $G^2$ , the latter extending outwardly a sufficient distance from the one end of the valve-chest to afford room for the movement of the stem. The groove and spline prevent axial movement of the valve, and thereby insure the proper relation between its steam-passages and the ports in the valve-chest. The opposite end of the main valve is provided with a stem,  $f'$ , which extends through the stuffing-box  $f^2$  in the cap  $f^3$ , and is provided at its outer end with a knob,  $f^4$ , to enable the valve to be readily shifted by hand to reverse the engine, if desired, at any portion of its stroke. I will now proceed to describe the devices employed for automatically supplying steam to the opposite ends of the main valve, for shifting it at at each end of the stroke of the main piston of the engine.

I is an auxiliary valve of the construction known as a "cup-valve," and is seated in the auxiliary valve-chest  $F$ . This valve is hollow, and is provided at its upper end with a plug,  $i$ , which prevents the entrance of steam at its upper end. The periphery of valve  $I$  is provided, preferably near its lower end, with the side recesses,  $j$   $j'$ , and central recess,  $j^2$ . The valve-chest  $F$  is provided with two steam-ports,  $k$   $k'$ , which communicate by steam-passages  $l$   $l'$  with the opposite ends of the main valve-chest  $E$ , and with a central exhaust-port,  $m$ , which communicates by a steam-passage,  $m'$ , with the main exhaust  $c^4$ . Valve-chest  $F$  is also provided with a steam-passage,  $M$ , which extends from the top of the valve to a point opposite the ports  $k$   $k'$   $m$ , where it is provided with lateral steam-passages  $n$   $n'$ . A portion of the steam entering the upper end of the valve-chest  $F$  flows into the steam passage or groove  $M$ , and serves to force the auxiliary valve snugly against its seat. By imparting an axial movement to the auxiliary valve, steam will flow from the passage or groove  $M$  through the side recess  $j$  in the periphery of the valve, and from thence into the port  $k$  and through the steam-passage  $l$  into the space at one end of the main valve, while steam exhausts through the steam-passage  $l'$ , port  $k'$ , exhaust-recess  $j^2$  in the valve, exhaust-port  $m$

in the auxiliary valve-chest, steam-passage  $m'$ , and out through the main exhaust  $c^4$ . Thus, by imparting a partial rotary movement to the auxiliary valve, steam is supplied to one end of the main valve and exhausted from its opposite end, which operation causes the main valve to be quickly and positively shifted by the pressure of steam. To the main piston is connected a rod,  $N$ , which is provided with a longitudinal groove,  $o$ , in which engages a feather or spline,  $o'$ , on the cylinder-head, whereby the rod is free to reciprocate with the main piston, but is retained against rotary movement. The upper end of the rod  $N$  is provided with a cross-head,  $P$ , the wings  $p$   $p'$  of which are provided with oppositely-inclined faces  $q$   $q'$ , which engage the inclined faces  $r$   $r'$  of the cams  $Q$   $Q'$  at opposite ends on the interior of the auxiliary valve. Cam-surfaces  $Q$   $Q'$  are connected by the ribs  $q'$ , to prevent the valve from rotary displacement. By reason of the fact that the cams  $Q$   $Q'$  are located within the opposite ends of the valve, the latter is not shifted until the main piston has reached nearly the end of its stroke, when the cross-head will engage the cam and quickly and positively shift the valve by imparting to it partial rotary movement, which operates to instantly shift the main valve by opening an exhaust for the escape of steam from one of its ends and supplying live steam to its opposite end, to move the valve lengthwise, and thus exhaust steam from one side of the main piston and supply live steam to the opposite side thereof and force it through its return-stroke.

The wearing-surfaces of the cross-head and cams for actuating the auxiliary valve are kept constantly lubricated by means of the leakage of steam from the engine-cylinder through the groove  $o$  of the rod  $N$  and into the interior of the valve. The periphery of the auxiliary valve is also kept lubricated by the passage of steam through the longitudinal groove in its valve-seat. This valve is retained on its seat by reason of the differential areas of its ends, the area of the upper end being sufficiently greater than the lower to preserve a preponderance of pressure downward on the valve, whereby the lower end of the latter serves as a valve to prevent the escape of live steam past the valve and into the engine-cylinder; hence the auxiliary valve serves the twofold purpose of regulating the supply of steam to the main valve and also to close the opening to the engine-cylinder, and thereby obviate the employment of a stuffing-box around the rod  $N$ .

From the foregoing description it will be observed that the entire valve mechanism is located within the cylinder and cylinder-head, and is arranged in a very compact form; further, that the main valve is automatically and instantly shifted at the ends of the stroke of the engine-piston, and thus dead-points are obviated and any desired rate of speed obtained without affecting the operation of the valve mechanism, which is kept constantly



lubricated by oil conveyed thereto by the steam, and the friction of the parts reduced, owing to the dispensing with a stuffing-box around the valve-operating rod.

5 It is evident that many slight changes in the construction and relative arrangement of the different parts of my improvement might be resorted to without departing from the spirit of my invention. Instead of cam projections on  
10 the inner periphery of the auxiliary valve, I might employ cam-grooves and arrange the cross-head to engage therewith. Again, instead of having the lengthwise groove or passage M formed in the auxiliary valve-chest,  
15 it might be formed in the periphery of the valve and connect with lateral grooves or passages in the lower portion of the valve-chest. Again, the main valve may consist of two pistons attached to a common rod, the pistons  
20 provided with suitable packing, and an independent valve located between the pistons and connected with the rod by a yoke or other suitable devices, so as to have independent vertical adjustment and be retained against  
25 its seat by steam-pressure; or it may be constructed in the manner illustrated in Fig. 13, the pistons being formed at the opposite ends of a single cylinder having a center recess, s, with a transverse driving-bar, s', cast integral  
30 therewith. The valve S is made separate from the cylinder, and provided on its back with a transverse groove, into which is received the driving-bar, whereby the independent valve is firmly connected with the cylinder, and is  
35 reciprocated therewith, and yet has a free and independent vertical movement. Again, instead of providing the auxiliary valve with cam-surfaces at its opposite ends and a single cross-head to engage therewith to rotate the  
40 valve, the latter may have oppositely-inclined cam-surfaces at its central portion, and the rod provided with two cross-heads located on opposite sides of the cam-surfaces, so that at the termination of the stroke of the piston in  
45 one direction one of the cross-heads will engage the cam-surface and rotate the valve in one direction, while at the termination of the stroke of the piston in the opposite direction the other cross-head will engage the other cam-  
50 surface and rotate the valve in the opposite direction; hence I would have it understood that I do not restrict myself to the exact construction and arrangement of parts shown and described; but,

55 Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a steam-actuated main valve and a non-reciprocating auxiliary  
60 valve, of devices connecting the engine-piston and auxiliary valve and adapted to impart an axial movement to the latter at the ends of the stroke of the main piston, substantially as set forth.

65 2. The combination, with a steam-actuated main valve and an auxiliary valve, of a rod

connected with the engine-piston and extended into the auxiliary valve, and devices for imparting an axial movement to said valve, substantially as set forth.

3. The combination, with an auxiliary valve  
70 constructed with cam-surfaces on its interior, of a rod connected with the engine-piston, and provided with a cross-head arranged to engage with said cam-surfaces and impart an  
75 axial movement to the auxiliary valve, substantially as set forth.

4. The combination, with an auxiliary valve closed at one end, a rod connected with the engine-piston and fitted in the opposite and  
80 cupped end of the valve, and devices within the valve for imparting an axial movement thereto, substantially as set forth.

5. The combination, with the engine-cylinder and piston, of an auxiliary valve adapted  
85 to close the opening between the valve-chest and engine-cylinder, substantially as set forth.

6. An auxiliary valve constructed and arranged, substantially as described, to operate  
90 by differential pressure on its ends to preserve a steam-tight joint between the valve-chamber and engine-cylinder, substantially as set forth.

7. The combination, with an auxiliary valve and valve-chamber having inlet and exhaust  
95 ports located at one side thereof for regulating the supply of steam to and its exhaust from a steam-actuated main valve, of a steam-supply passage located at the opposite side of the  
100 auxiliary valve and valve-chamber, and provided with branch passages, the parts being constructed and arranged to cause the auxiliary valve to be forced snugly against its seat by steam-pressure, substantially as set forth.

8. The combination, with an auxiliary valve  
105 provided with interior cam-surfaces at its opposite ends, of a grooved rod connected with the engine-piston at one end, and provided at its opposite end with a cross-head that engages the cam-surfaces on the interior of the auxil-  
110 iary valve, and a feather or spline for preventing the rotation of the rod, substantially as set forth.

9. The combination, with the main valve provided with a grooved stem, of an extended  
115 closed cap provided with a feather or spline for receiving the stem and retaining the valve against rotary movement, substantially as set forth.

10. The combination, with a steam-actuated  
120 main valve and an auxiliary valve, of a main steam-supply port leading from one end of the auxiliary valve chest or chamber to the central portion of the main valve chest or chamber, substantially as set forth.

125 In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM K. MILLER.

Witnesses:

GEORGE F. DOWNING,  
S. G. NOTTINGHAM.