(No Model.) 2 Sheets—Sheet 1.

J. BEYSTRUM.

ROTARY STEAM ENGINE.

No. 302,316. Patented July 22, 1884.

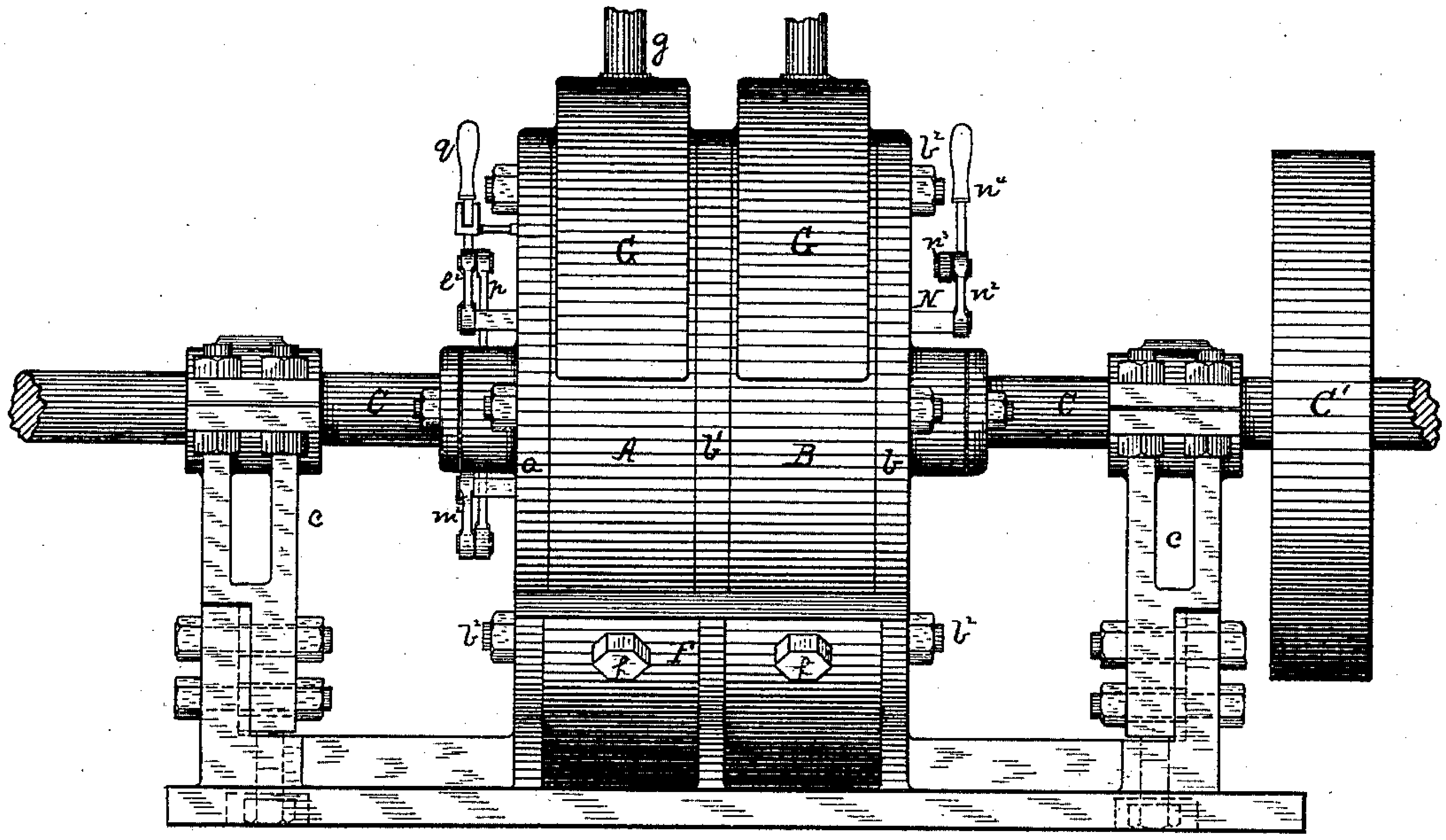

Fig 1.

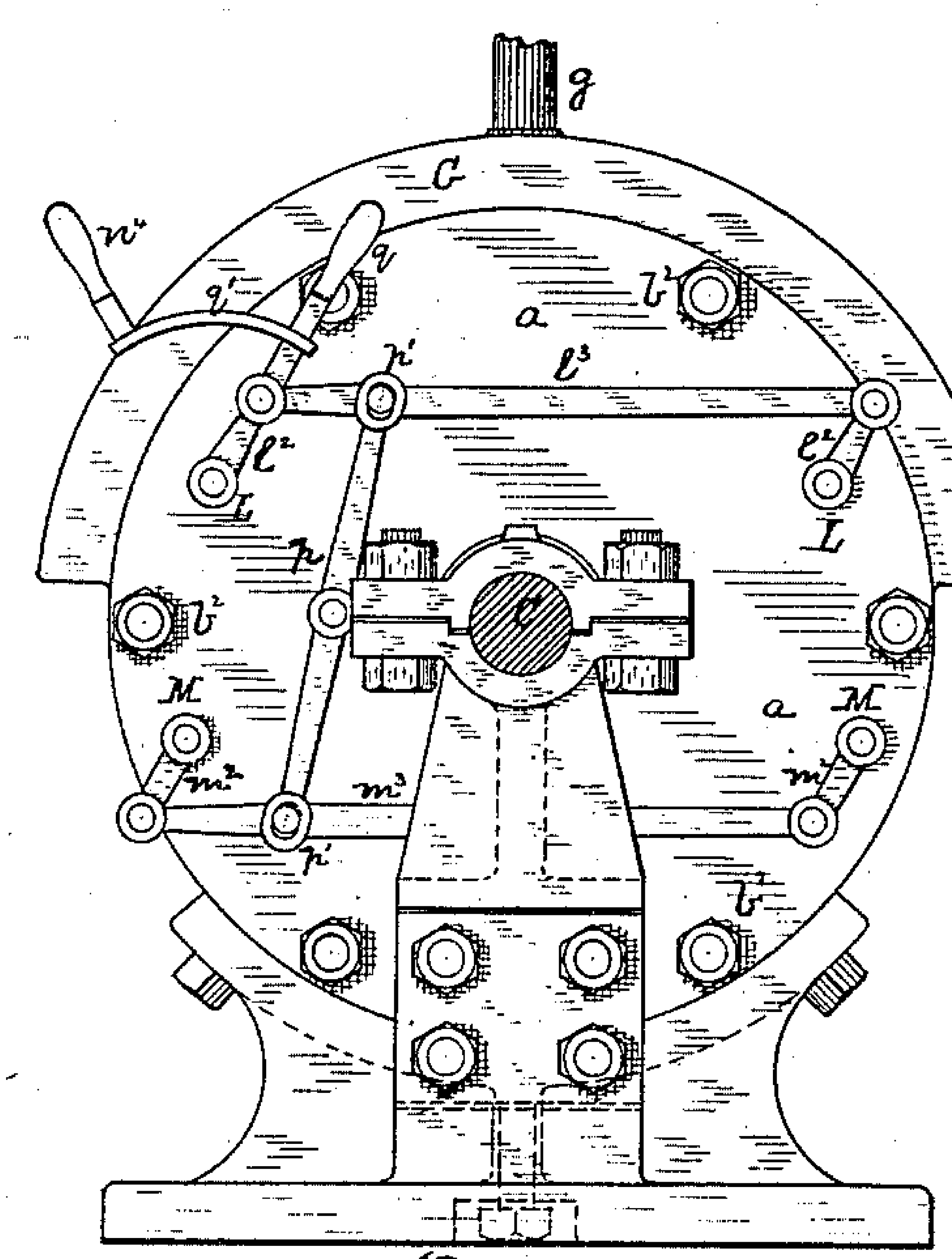

Fig 2.

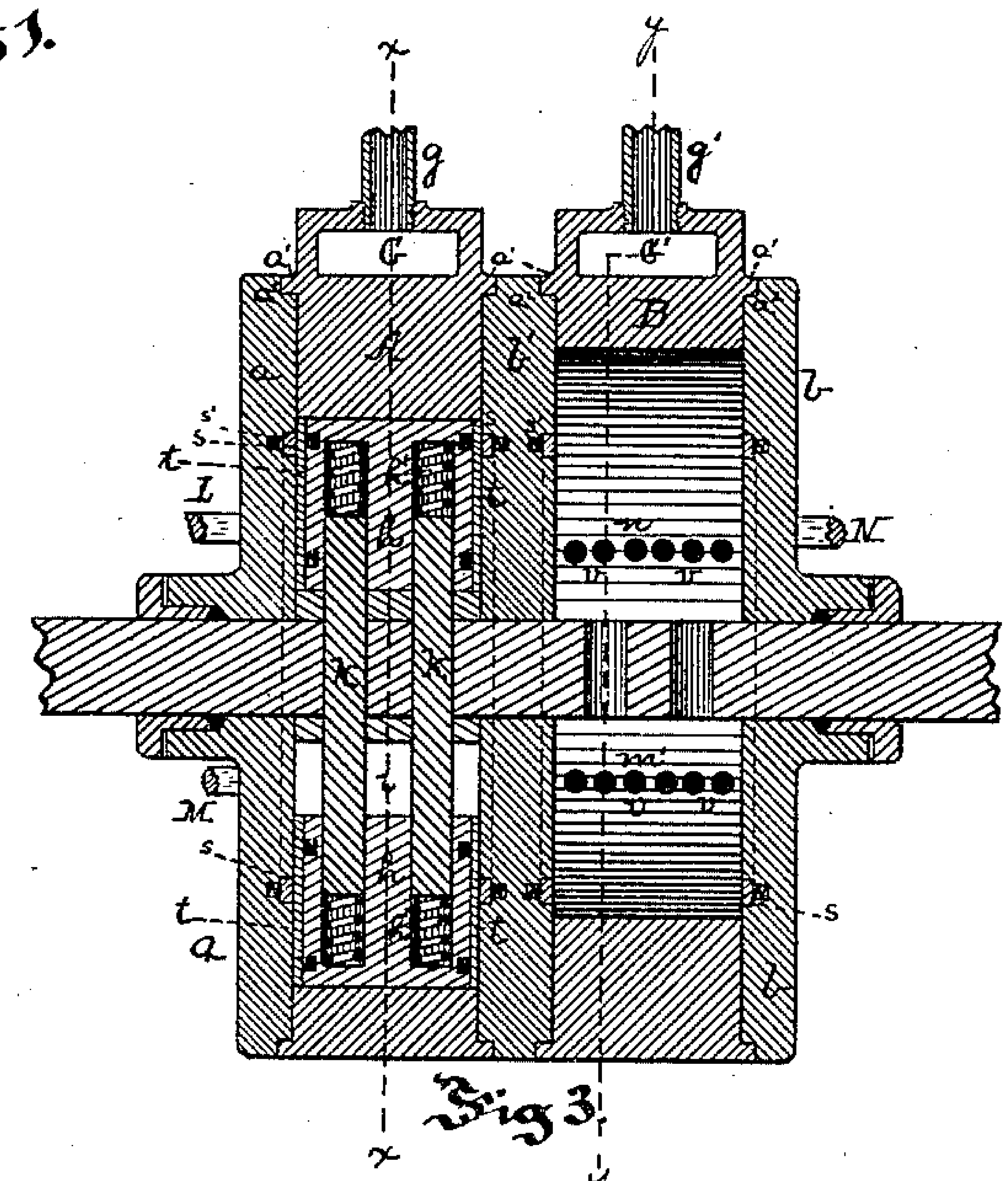

Fig 3.

Witnesses.
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(No Model.)

2 Sheets—Sheet 2.

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Fig 4.

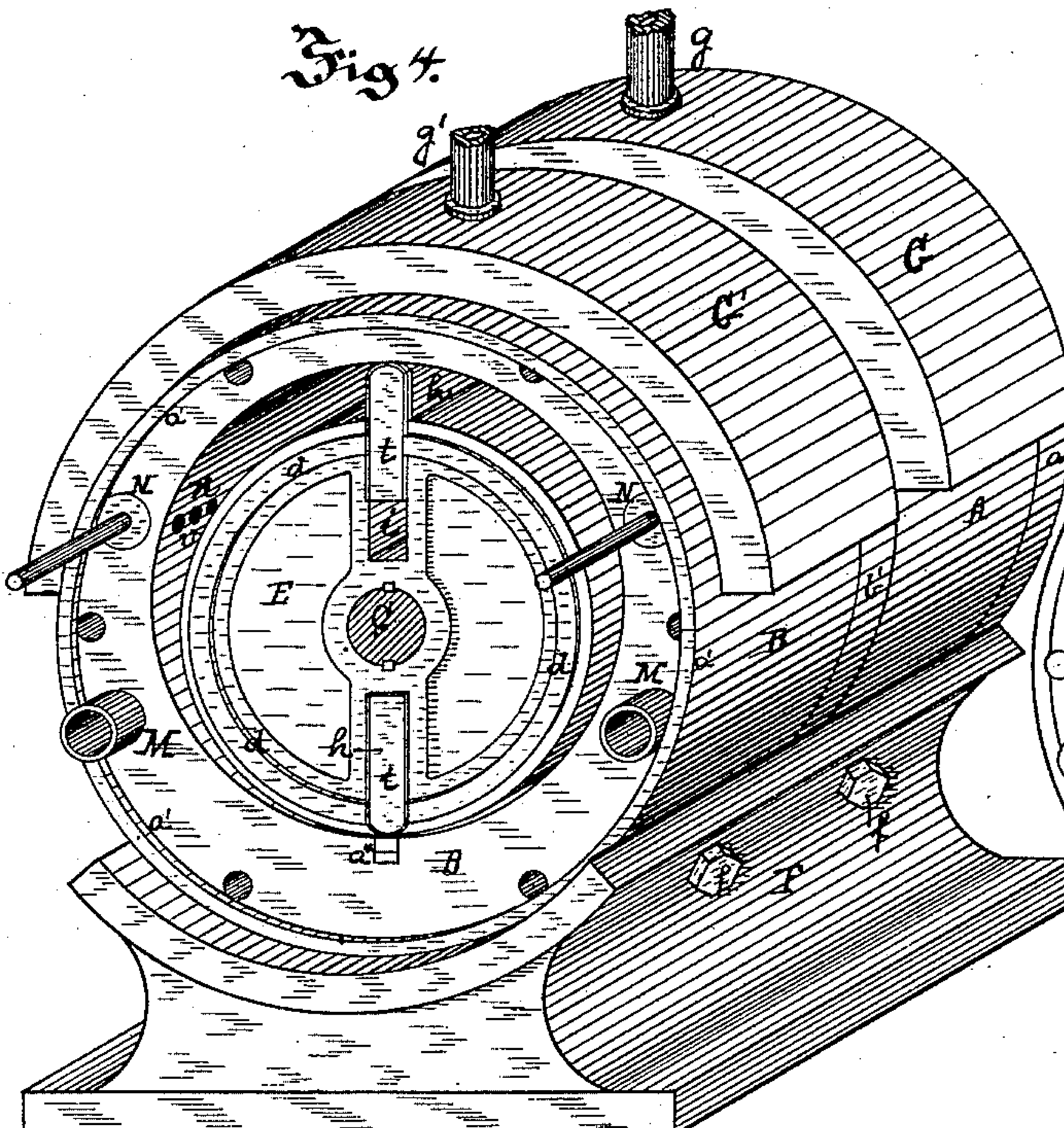


Fig 5.

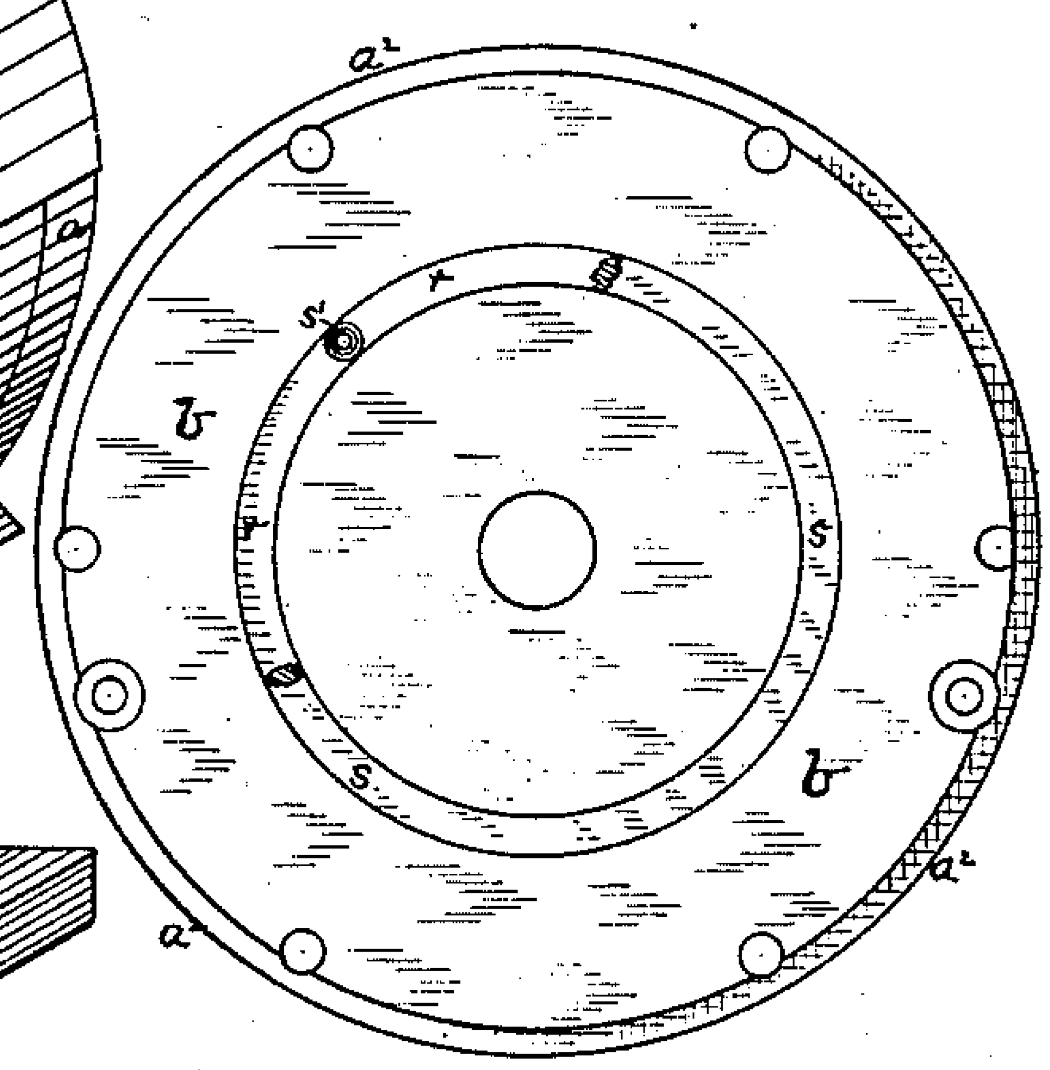
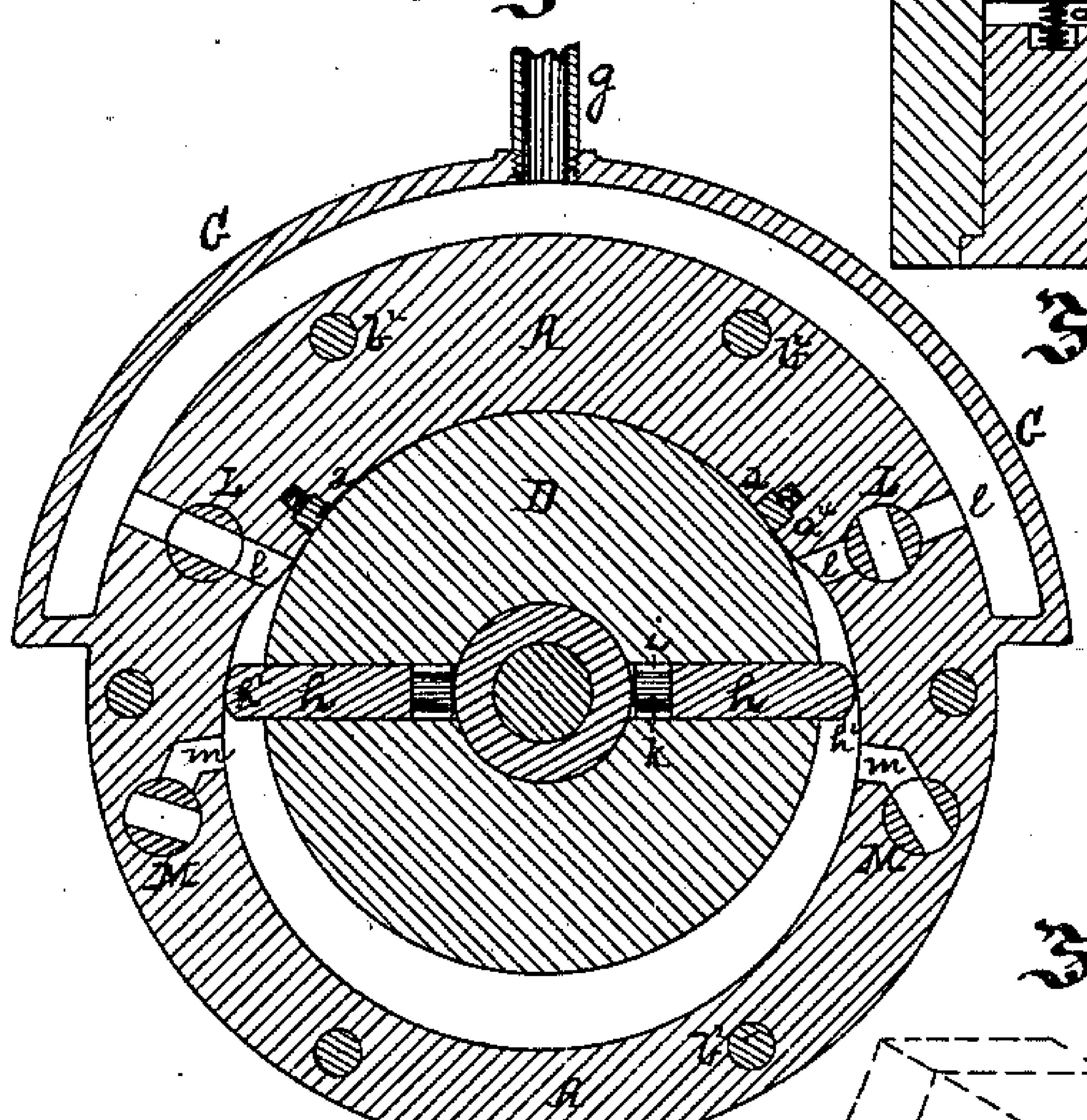


Fig 6.



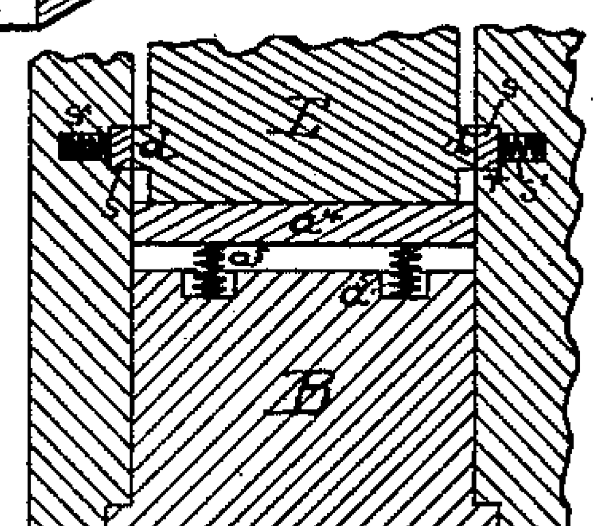


Fig 8.

Fig 7.

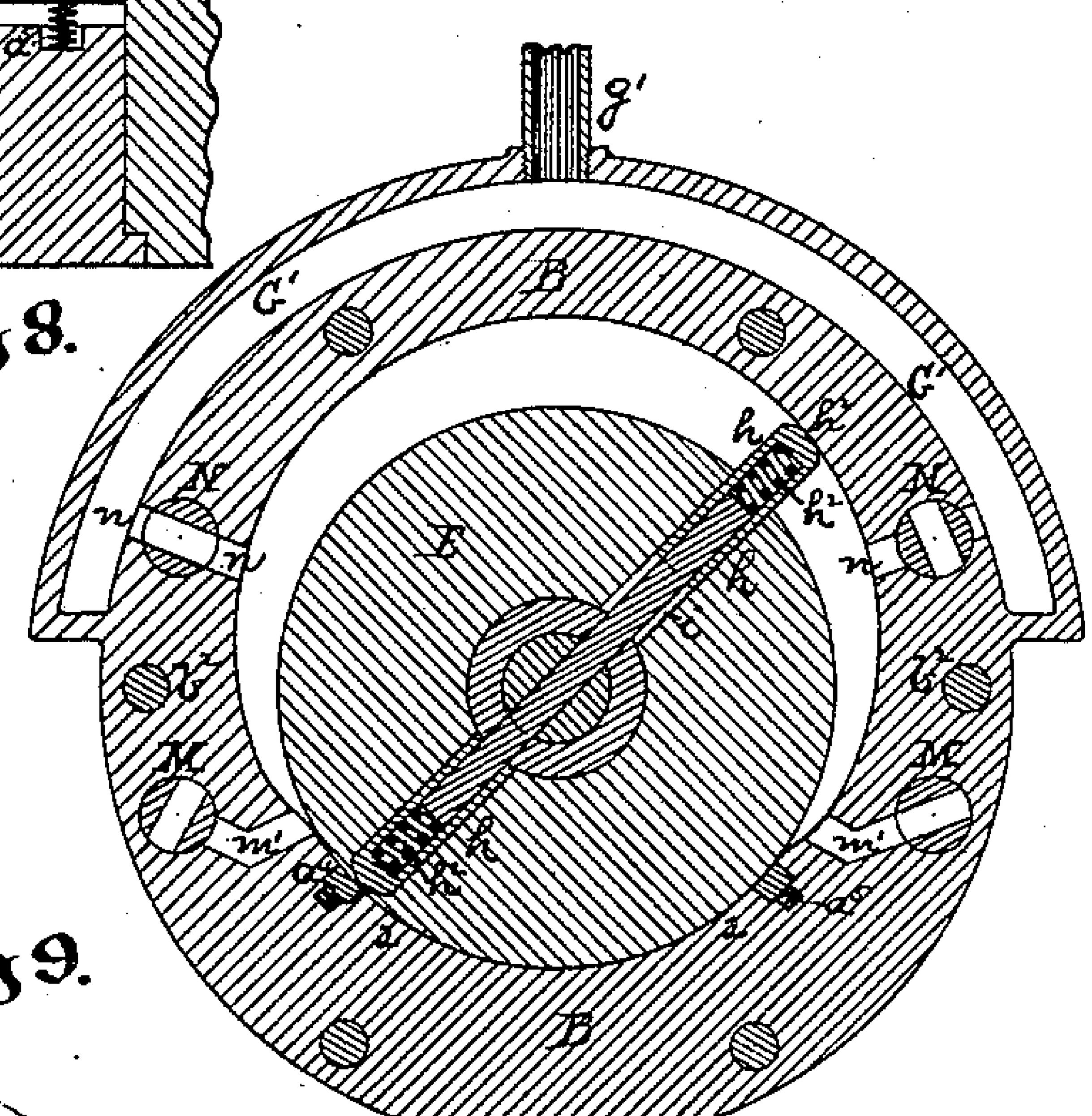
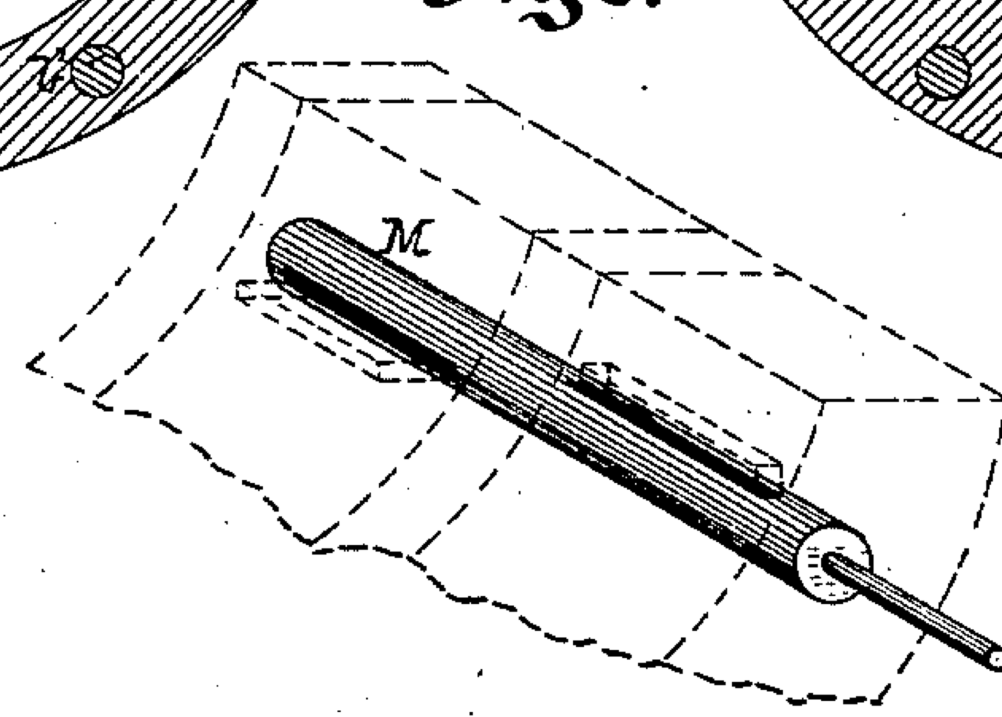


Fig 9.



Witnesses.

F. G. Kay

J. W. Cooke

Inventor.

John Beystrum

by James I. Kay

Attorney

UNITED STATES PATENT OFFICE.

JOHN BEYSTRUM, OF ALLEGHENY CITY, PENNSYLVANIA.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 302,316, dated July 22, 1884.

Application filed February 15, 1884. (No model.)

To all whom it may concern:

Be it known that I, JOHN BEYSTRUM, of Allegheny City, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Rotary Steam-Engines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to rotary steam-engines, its objects being to simplify this class of engines, to do away with all valve movements during the operation of the engine, and to provide simple and efficient means for packing the parts.

It consists in certain improvements in the construction of the engine and the means of packing the same, as hereinafter described and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view of my improved engine. Fig. 2 is an end view thereof. Fig. 3 is a vertical central section thereof, one hub being removed. Fig. 4 is a perspective view, the cylinder-head of the exhaust-cylinder being removed. Fig. 5 is a face view of said cylinder-head. Fig. 6 is a vertical section of the supply-cylinder on the line *x x*, Fig. 3; and Fig. 7 is a like view of the exhaust-cylinder on the line *y y*, Fig. 3, this section being taken on a line cutting the sliding rods carrying the pistons to show their construction. Fig. 8 is a detached sectional view illustrating the packing of the drum against the cylinder-heads, and Fig. 9 is a view of the valves employed to connect the two cylinders of the engine.

Like letters of reference indicate like parts in each.

In the drawings, A represents the supply-cylinder of the engine, and B the exhaust-cylinder thereof; *a*, the supply-cylinder head; *b*, the exhaust-cylinder head, and *b'* the cylinder-head or plate between said cylinders A and B.

C is the shaft carrying the drum D of the supply-cylinder and the drum E of the exhaust-cylinder, this shaft extending centrally through the engine and being packed therein by suitable stuffing-boxes. This shaft C is mounted in suitable bearings, *c*, on either side of the engine, and carries the fly-wheel C'. The parts of the cylinder are cast to shape, and each cylinder is formed of a ring having an annular shoulder, *a'*, around the outer edges thereof, fitting into the corresponding groove, a^2, in the cylinder-heads *a b b'*, and the cylinders and heads are secured together by the bolts b^2 passing through the two cylinders and the three cylinder-heads. The engine is supported on a suitable base, F, being bolted thereto by the bolts *f*, on which base the bearings *c* of the shaft C are also secured. The inner walls of each cylinder are formed substantially eccentric to the shaft C, and the hubs D E are circular, being secured centrally on the shaft, and their outer faces or peripheries being concentric with the shaft and fitting for a portion of their surface against the inner walls of the cylinders. The inner walls of the cylinders may be made circular in shape, and the faces of the hubs fit against them for but a small portion thereof, as shown in Fig. 4; but I prefer to form the inner walls of the cylinder or drum irregular in shape, so that the hub will fit for a greater portion of its face against the inner walls of the cylinder, and only that portion of the cylinder-walls be eccentric that is required for the steam-space where the steam presses against the pistons carried by the hubs. Where so constructed the portions of the cylinder-walls between the numbers 2 2, between the two supply-valves employed in each cylinder, are made concentric with the shaft, and the cylinder is given the shape shown in Figs. 6 and 7, the portion of the cylinder-walls concentric with the shaft not being employed in the operation of the engine, and acting to form a packing between the hub and the cylinder. To further insure a tight packing between the hub and the cylinder, I have provided the packing-bars a^4, fitting in seats in the cylinder and having the springs a^5 behind them, to force them out against the face of the hub, and thus insure a tight packing between them and prevent the passage of steam between these portions of the cylinder and hub. These packing-bars are not necessary, however, as where the faces of the cylinder and hub fit against each other in all ordinary circumstances this is sufficient. The eccentric portion of the cylinder forms the steam-space between the hub and the cylinder, through which the steam employed passes in rotating the hub within the cylinder, and this eccentric portion is preferably formed in the lower part of the cylinder A and in the upper part of the cylinder B, being formed in opposite parts of the engine in order that the steam may pass directly from one cylinder into the other, as hereinafter described.

On the upper part of the cylinder A is the steam-supply box G, having the steam-supply pipe g, and extending part way around the body of the cylinder, in order to reach the point at which steam is supplied to the engine according to the direction in which the shafts rotate, and a similar box, G′, is formed on the exhaust-cylinder B, this box having the exhaust-pipe g'. The hubs D E are provided with the pistons h, these pistons sliding in seats i, and being mounted on bars k, passing through the shafts C, and fitting into holes in the pistons. At the base of these holes are the springs h', which press against the bars k and against the pistons, so forcing the pistons out against the walls of the cylinder, so that as the shaft and the hub secured thereon are rotated the faces of the pistons press against the inner walls of the cylinder, the springs causing the faces of the pistons to conform to the irregular shape of the inner walls of the cylinder. The pistons are the same width as the cylinder, so that when the steam passes into the steam-space thereof it will press against these pistons, and thus carry them around within the cylinder and cause the rotation of the hub and the power-shaft C. The construction of these parts in the exhaust-cylinder is substantially the same, except that a larger steam-space is employed in the exhaust-cylinder, as hereinafter referred to.

L L are the supply-valves communicating between the steam-supply box G and the steam-space of the cylinder A. M are the valves leading from the steam-space of the supply-cylinder to that of the exhaust-cylinder, these valves M acting as exhaust-valves from the cylinder A and supply-valves to the cylinder B, and M N are the exhaust-valves of the cylinder B, communicating with the exhaust-box G′. All these valves are made in duplicate, one on each side of the cylinder, in order to allow the reversing of the engine. These valves are preferably made rotary valves, and the valves L L M M are operated through the cylinder-head a, the valves L L being connected with the rods l^2, and the valves M M connected to the valve-rods m^2, the valve-rods l^2 being coupled by the rod l^3, and the valve-rods m^2 being coupled by the rod m^3, so that they are operated together. Pivoted on the cylinder-head a is the lever p, which is connected to the coupling-rods l^3 m^3 by links p', passing over lugs on said rods, so that these valves may all be operated by means of the lever q, formed of an extension of one of the valve-rods l^2, and fitting within the guides q'. By this construction the four valves may be rotated by the movement of this lever q, and steam admitted to the engine and the valves reversed by means of this lever. When the lever q is drawn to one end of the guide-yoke q', as illustrated in the drawings, it opens the left supply-valve L and closes the right supply-valve L, and through the lever p opens the right valve M and closes the left valve M, and by drawing said lever to the opposite end of the guide-yoke it reverses the position of these valves, closing the left valve L and right valve M and opening the right valve L and left valve M, thus admitting steam to the opposite side of the engine and reversing the same, as can be readily seen in Figs. 6 and 7. The exhaust-valves N, communicating with the box G′, extend through the cylinder-head b, and are connected by means of the valve-rods n^2 and a coupling-rod, n^3, with each other, so that they may be operated by the lever n^4, formed of the extension of one of said valve-rods n^2. These rotary valves L M N extend through, or part way through, the cylinder, and communicate with ports leading into the cylinders, the valves L communicating with the ports l, the valves M communicating with the ports m in the main cylinder A, and with the ports m' in the exhaust-cylinder B, and the valves N communicating with the ports n between the exhaust-cylinders and the exhaust-box G′. The valves M thus form a communication between the two cylinders, so that after the steam passes from the steam-supply box G through the valve L into the steam-space of the first cylinder expanding therein, and pressing against the piston h carries said piston around until it passes the port m on the other side of the cylinder. The steam then passes through said port into the valve M, and from said valve through the port m' into the steam-space of the cylinder B, when it presses against the piston h of said cylinder and carries it around past the port n on the opposite side of the cylinder, and passes through the valve N into the exhaust-box G′. The openings of the ports l, m, m', and n into the cylinders are preferably the same width as the cylinders, to give free ingress and egress, and to give wearing surface for the pistons the mouths of the ports are formed of a series of openings, v. Where the engine is constructed to operate only in one direction, as it is not reversed, these valves and their operating-levers may be dispensed with, the steam passing directly through the port l into the main cylinder, and from it through the port m, thence through a port to the port m', and thence through the exhaust-cylinder and port n to the exhaust-pipe.

The hubs D E are packed against the cylinder-heads on either side of them in the following manner: The hubs have the annular rings d formed on the faces thereof near their peripheries, the rings extending slightly beyond the faces of the hubs, and the cylinder-heads have the annular recesses r opposite said rings d, in which are fitted the packing-rings s, these rings s being forced out against the rings d by springs s', four of these springs being generally employed, and the springs fitting in seats back of said annular recesses. The rings thus prevent the escape of steam from the steam-spaces of the cylinders between the faces of the cylinders, heads, and hubs. In order to pack the sides of the pistons h against the piston-heads, I employ the packing-plates t, fitting in grooves along the side edges of the pistons, and having springs fitting in seats formed in the pistons, as fully shown in Fig. 3, and these packing-plates bearing against the cylinder-heads prevent the escape of steam around the sides of the pistons, while the faces of the pistons bear against the inner walls of the cylinder, and said faces being curved, as at h^2, to give a broader bearing on the walls of the cylinder. As preferably constructed, the steam-space of the exhaust-cylinder B is made larger than that of the supply-cylinder, in order to receive all the steam from the supply-cylinder, as after its entrance in said cylinder it will expand, and if the steam-space in each cylinder were of the same size the back-pressure of the exhaust-steam from the second cylinder would materially retard the effect of the live steam. This may be accomplished either by forming the hub E smaller or enlarging the cylinder B in the direction of its diameter or width, or both.

The operation of my improved rotary engine is as follows: When it is desired to rotate the engine from right to left, the supply-valve L, the right valve M, and the left exhaust-valve N are opened by the levers q and n^4. Steam is admitted to the box G, and, passing through the port l and valve L, expands and presses against the side or face of the piston, extending out into the steam-space of the cylinder A, and the pressure of the steam against this piston carries it around until it passes the port m, the pressure of the piston on the opposite side of the hub and the springs h' causing the piston h to hold against the walls of the cylinder, and the packing-plates t preventing the steam from passing around the piston, so that all the force of the live steam bears against this piston, extending beyond the periphery of the hub, the force thus being exerted at the outer end of the hub. When this piston passes the port m, the piston h on the opposite side of the hub has passed beyond the ports l, and the steam pressing against this piston operates in the same manner, carrying this piston around until it passes the port m, and at the same time forcing the exhaust-steam through the port m and valve M into the steam-space of the cylinder B, and drawing the first piston h past the port l, the live steam thus pressing against one or the other piston on the hub and the operation being continuous and causing the rotation of the hub and shaft. Meanwhile the exhaust-steam passing through the port m and valve M enters the exhaust-cylinder B through the port m' and operates in the same manner in said cylinder, pressing against one of the pistons h in the hub E and carrying it around past the exhaust-port n, and so drawing the other piston past the ports m', and the exhaust-steam from the cylinder passing through the port n and valve N into the exhaust-box G', the exhaust-steam being thus utilized in this cylinder and aiding greatly in the rotation of the driving-shaft, the power obtained from this exhaust-cylinder increasing the power of the engine about one-third. Where the inner walls of the cylinders are made concentric with the shaft for the portion not employed for steam-space, it is evident that this portion forms a tight packing between the hub and cylinder, and, as it prevents any back-pressure against the piston until it passes the supply-port, it is evident that this adds materially to the force obtained from the engine. As the hub is rotated in the cylinder the pistons are pressed back into their seats by the walls of the cylinder, thus forcing the opposite ends out into the steam-space and compressing the springs in the pistons by means of the bars k, passing through the shaft, so that the springs press out these pistons and cause the pistons to hold against the inner walls of the cylinder and prevent the steam from passing between them and said inner walls. The only movable parts of the engine are the shaft and hubs, rotated as above described, and the pistons sliding back and forth within the hubs, the rods or bars k sliding within the shaft and hubs as they are rotated, so that it is evident there are but few parts to get out of order, and the engine is therefore durable and but little subject to wear in the parts. The packing of the parts is accomplished simply by the packing-ring s and plates t, which can be easily and rapidly replaced at slight cost. The engine has been successfully operated, a speed of fourteen hundred revolutions per minute being obtained with a pressure of eighteen pounds steam to the square inch.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In rotary engines, the combination of the shaft C, disk secured thereto, sliding pistons h, cylinder having eccentric inner walls, supply-valves L, and exhaust-valves M, substantially as and for the purposes set forth.

2. In rotary engines, the combination, with the cylinder, shaft, disk, and pistons, of the rotary valves L M, valve-rods l^2 m^2, coupling-rods l^3 m^3, and lever p, substantially as and for the purposes set forth.

3. In rotary engines, the combination of the hub having the rings d extending slightly beyond the faces thereof, and cylinder-heads having the corresponding packing-rings, s, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN BEYSTRUM, have hereunto set my hand.

JOHN BEYSTRUM.

Witnesses:
C. Y. O. DERGGRER,
JAMES I. KAY.