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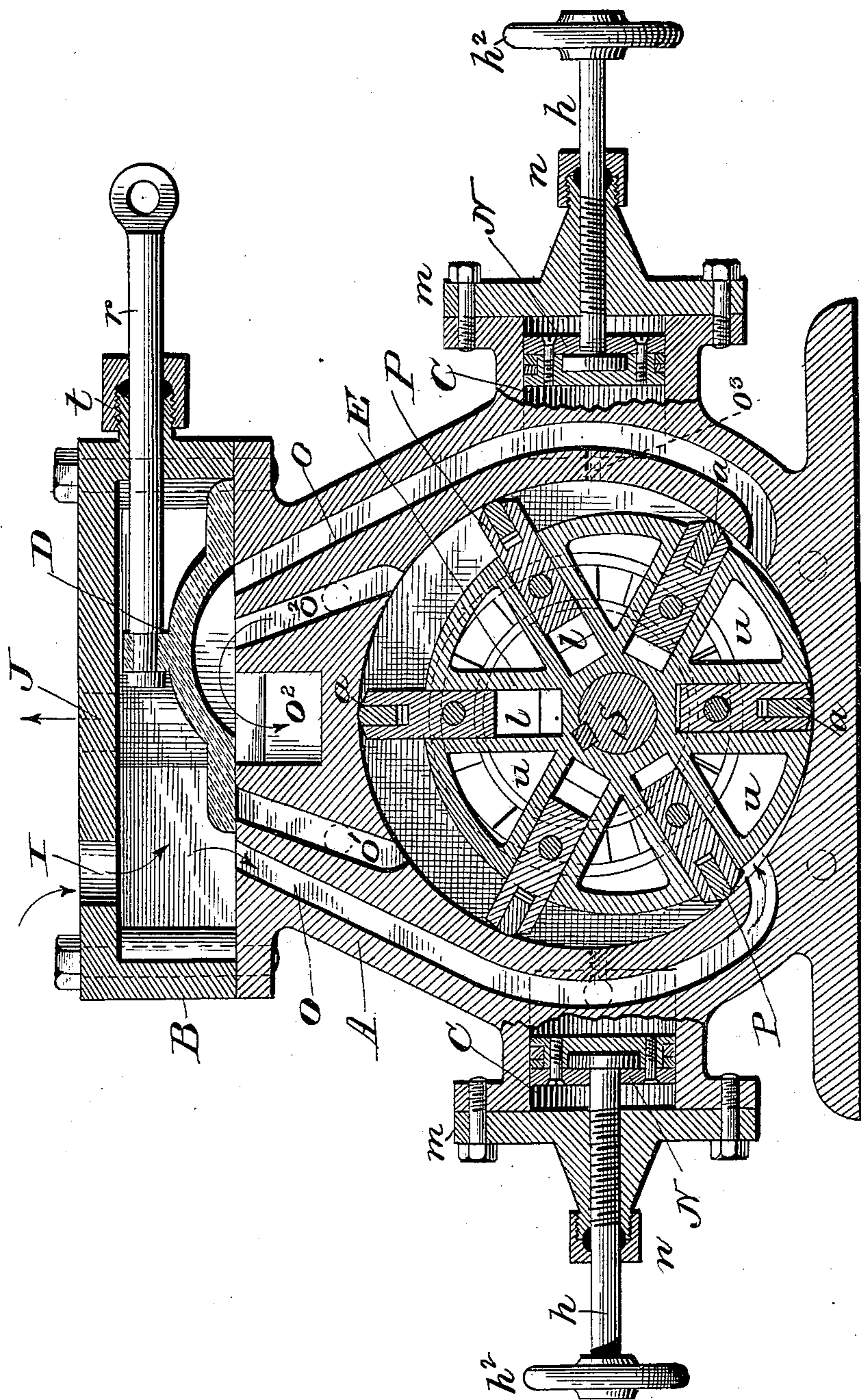
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W. N. WHIPPLE.
ROTARY STEAM ENGINE.

No. 465,907.

Patented Dec. 29, 1891.

Fig. 1.



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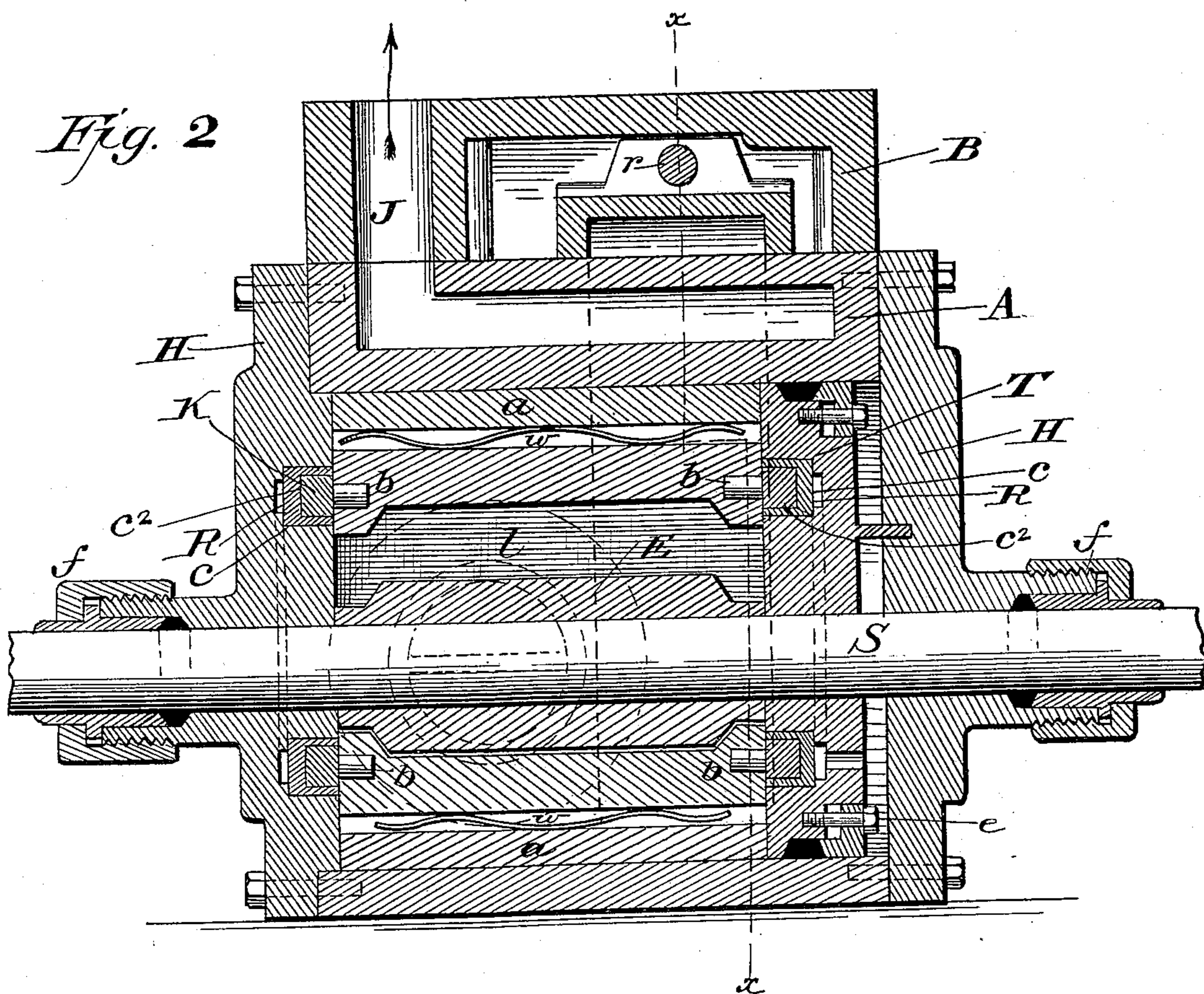


Fig. 3

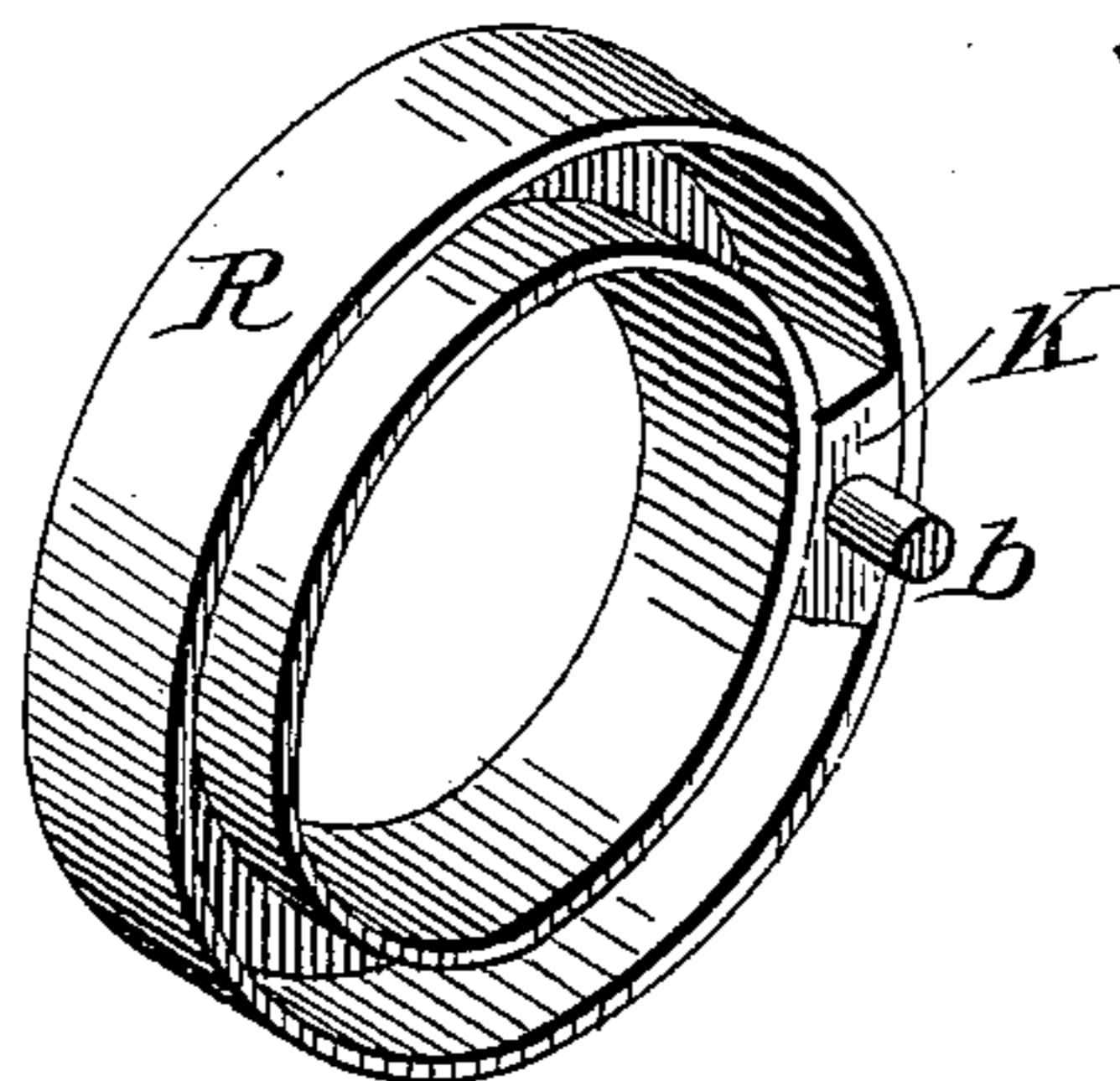
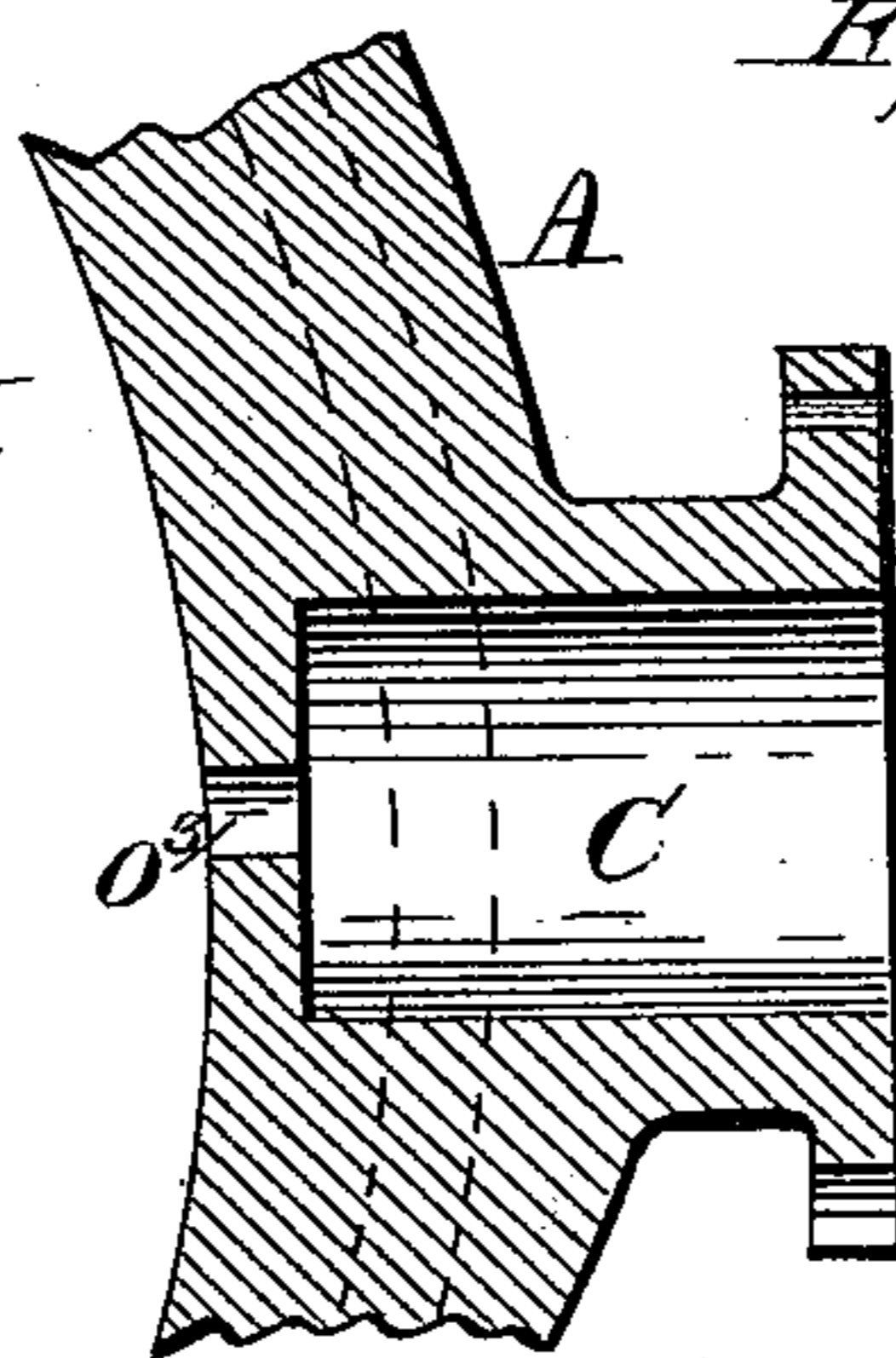


Fig. 7.



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Fig. 4.

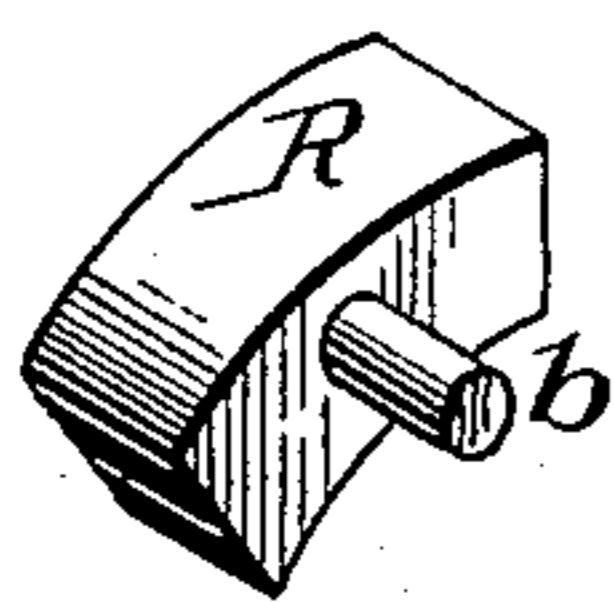
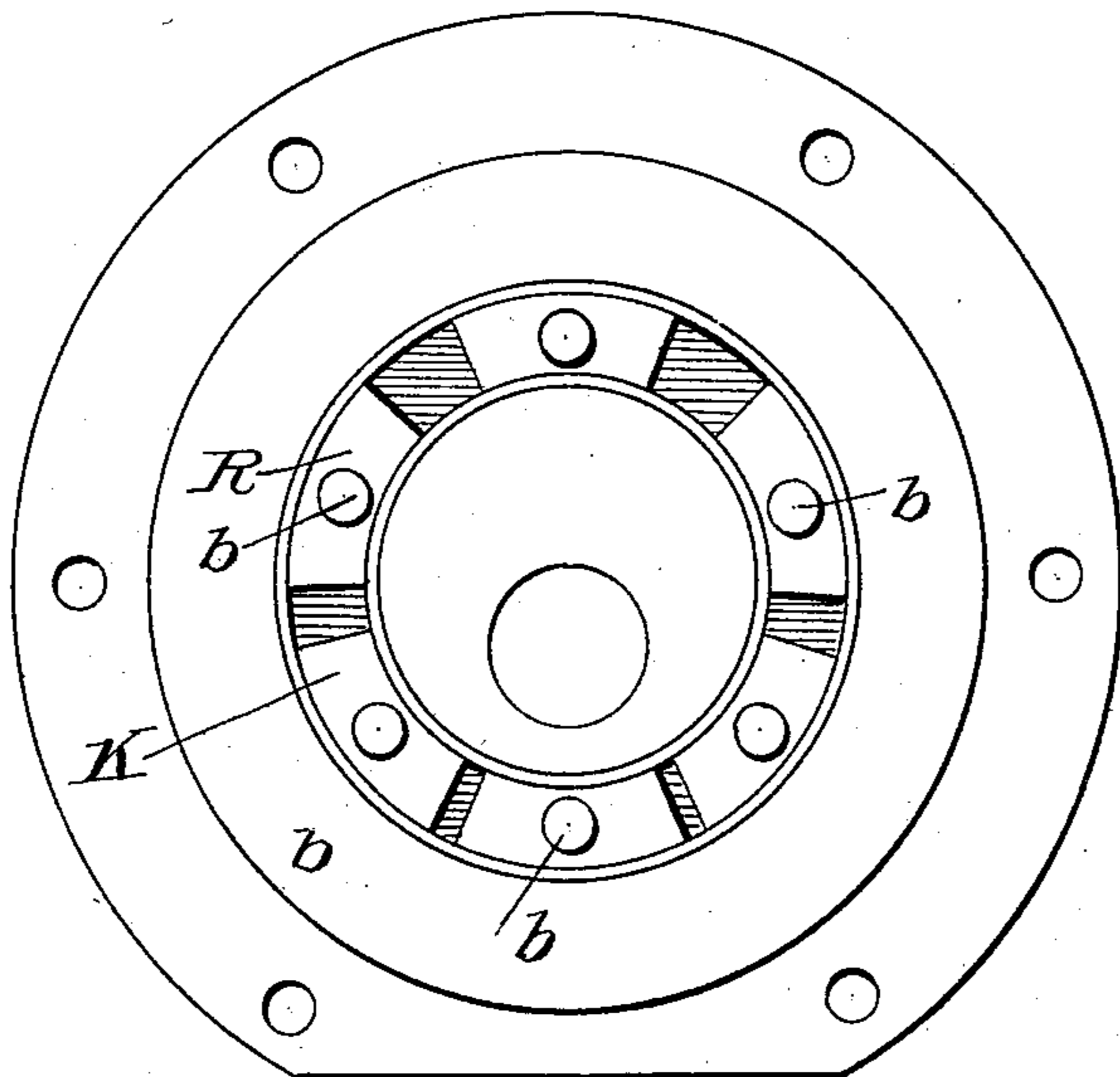


Fig. 6.

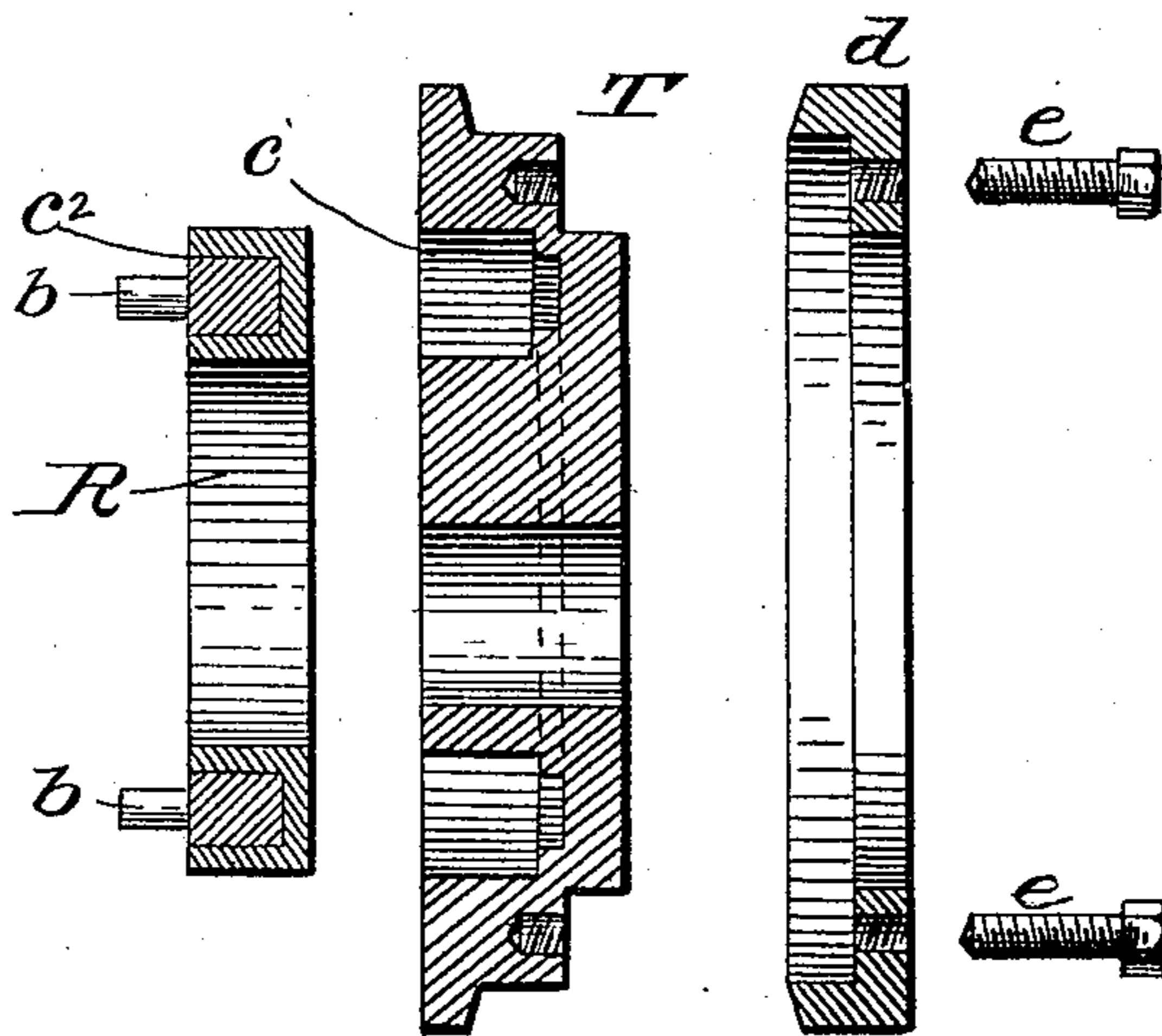


Fig. 5.

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UNITED STATES PATENT OFFICE.

WILLIAM N. WHIPPLE, OF DRESDEN, NEW YORK.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 465,907, dated December 29, 1891.

Application filed October 30, 1890. Serial No. 369,782. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM N. WHIPPLE, a citizen of the United States, residing at Dresden, in the county of Yates and State of New York, have invented certain new and useful Improvements in Rotary Steam-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 appertains to make and use the same.

My invention relates to improvements in rotary steam-engines of the class in which the driving-shaft is set eccentric to the bore of the cylinder.

The object of my invention is to produce a rotary engine in which a high efficiency is obtained from steam expansion in a simple and direct manner.

My invention consists in the combination, with the engine-cylinder, of one or more auxiliary steam-chambers, which are alternately supplied with steam at boiler-pressure, the said steam being as often cut off from and expanded therein against the pistons automatically by the pistons themselves. The said auxiliary steam-chambers are adapted to be diminished or increased in steam capacity proportioned to the work upon the engine or the power required by means of a movable piston therein.

My invention also consists in the means by which the pistons are made to revolve concentric with the bore of the cylinder and in the details of construction and the adaptation of steam-ports, as will be more fully hereinafter described and set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a transverse section of my improved engine, taken on the plane indicated by the dotted line $x x$ of Fig. 2, a portion being broken away, showing sections of the auxiliary chambers. Fig. 2 is a longitudinal section of my improved engine. Fig. 3 is a detached perspective view of one of the annular rings and one segmental block. Fig. 4 is a face view of one of the cylinder-heads, showing one of the annular rings and the segmental blocks. Fig. 5 represents detached sectional views of the steam packing-plate, packing-box ring, annular ring, and segmental blocks. Fig. 6 is a detached view of one of

the segmental blocks and pivot-pins. Fig. 7 is a detached sectional view of the auxiliary steam-chamber.

Referring to the drawings, A represents the engine-cylinder, and B the steam-chest, provided with the steam-inlet I and exhaust-outlet J, and also with a packing-box and gland t .

D represents a valve of the usual D-slide form adapted to be moved in the steam-chest by means of the valve-rod r for the purpose of admitting steam to start, and also to reverse the engine and to connect the ports o' with o^2 and exhaust-outlet J to form a continuous exhaust-passage.

S is the driving-shaft, to which is solidly attached the piston hub or block E. The said piston-hub is of the proper diameter to just clear contact with the inside or bore of the cylinder, and is provided with the required number of transverse radial slots or openings l , adapted for the insertion of the series of steam-pistons P, fitted therein. The said pistons have packing-strips a inserted in their outer ends, and which are adapted to be set up against the bore of the cylinder by means of the springs w .

C represents the auxiliary steam-chambers, which are cylindrical in form, and are provided with covers m and packing-boxes n , of the usual construction. The said chambers are cast integral with the cylinder A or solidly attached thereto.

N represents a piston, fitted into the bore of the auxiliary chamber, and which is adjustable or movable therein by means of the screw-threaded rod h and hand-wheels h^2 .

H H are the cylinder heads or covers, provided with shoulders upon their inner faces, which fit into the bore of the cylinder, and with the usual stuffing-boxes and glands $f f$ upon their outer faces, and are secured to the cylinder by screws in the usual manner. One of the said cylinder-heads has formed upon its inner face an annular channel or recess c , concentric with the bore of the engine-cylinder, into which one of the annular rings R is inserted and adapted to revolve therein. The said annular ring R is also formed with an annular recess or channel c^2 , which is adapted for the insertion of the segmental blocks K, which correspond in number for

each annular ring to the number of steam-pistons P, to which the said segmental blocks are pivoted by means of the pins *b*, attached to said blocks, and which enter perforations in the ends of the pistons. One of the said segmental blocks is solidly attached to each of the annular rings R, as shown in Fig. 3, the others being free to adjust themselves therein, as is required by the eccentricity between the shaft and bore of the cylinder.

T represents a packing-plate, which is perforated for the shaft S, and which is turned upon its edge to fit the bore of the cylinder, and made steam-tight therein by means of the stuffing-box ring *d* and screws *e*. Space is provided between the said packing-plate and the adjacent cylinder-head, to which steam-pressure is admitted for the purpose of making steam-tight joints between the ends of the piston-hub and pistons and the opposite cylinder-head and said packing-plate. Undue pressure against the packing-plate is obviated by admitting steam-pressure between the packing-plate and the opposite cylinder-head through the triangular openings or passages *u* in the piston-hub. The said packing-plate is provided with an annular channel or recess formed upon its face, into which segmental blocks are inserted, the construction being identical with that in the cylinder-head at the opposite end of the piston, before described.

o o are the steam-induction ports.

o' o' are the steam-exhaust ports.

o³ is a steam-port opening (shown in full lines in Fig. 7) between the auxiliary chamber and the inside or bore of the cylinder.

It will be observed that by the arrangement of steam and exhaust ports herein shown a vacuum will be formed or produced by the outgoing steam in the steam-port cut off from the boiler and nearest to the exhaust-port through which steam is being exhausted, and that the atmospheric pressure in front of the pistons upon the exhaust side of the engine will be largely removed and the efficiency of the engine increased thereby. It will also be observed that only one of the auxiliary steam-chambers herein shown are in use at one time, two only being required to run the engine in either direction.

From the foregoing description it will be seen that steam, being admitted through one of the steam-ports, as required by the direction in which the engine is to run, enters the steam-space of the cylinder between the two pistons nearest the entering steam-port and exerts a force to drive the engine, measured by the steam-pressure, upon the effective area of the piston, the effective area being the difference in the exposed area of any two pistons between which the steam is acting. It will also be seen that when the forward piston of any two pistons has passed by the steam-port connecting the auxiliary chamber with the inside of the cylinder (the length of cylinder-wall between the entering-steam

port and port of the auxiliary chamber being less than the distance between two pistons) the unexpanded steam from the boiler will then be admitted to and fill the auxiliary steam-chamber, and that the said steam from the boiler will be cut off from the said chamber when the rear piston of the two has passed by the steam-induction port, and that the steam in the said chamber, and which is now cut off from the boiler, will then be expanded against the forward piston having the greater area and in the direction to drive the engine, and that this operation will be repeated as often as any two pistons pass the said openings or ports, as described. The slide-valve D is operated by hand to start the engine in the direction it is to run and to reverse the engine. The steam is exhausted through the eduction-port farthest from the induction-port in which the steam is entering, the steam being still further expanded by entering and filling the first or nearest exhaust-port. The steam therein being cut off before exhaust takes place, no loss or waste of steam is caused thereby. It will also be seen that the steam contained in the auxiliary steam-chamber is not exhausted by the running of the engine, but is only reduced in pressure by expansion therein, and that no reduction in quantity or loss of steam takes place, except by expansion, to drive the engine and by prolonging a greater pressure against the driving-piston after the rear or following piston has cut off the steam from the boiler. It will now be seen that the ability to control the dimensions or holding capacity of the auxiliary chamber is an important feature of my invention, as a greater or less pressure against the pistons is maintained thereby, and that the greater the size of the auxiliary steam-chamber the nearer the normal or boiler pressure will be exerted against the pistons. It will also be seen that the arrangement of the steam and exhaust ports in their relation to the number of pistons employed is another important feature of my invention, the steam being automatically cut off by the pistons and continuously expanded to the farthest effective point, or so long as one of two pistons between which the steam is expanding has the greater steam-exposed area, the bore of the cylinder acting as an abutment to the fullest extent of the eccentricity between the inside surface of the cylinder and piston-hub. It will further be seen that a salient feature of my invention is in the means employed for retaining the revolving pistons concentric with the bore of the cylinder, the concentric channels, and segmental blocks free to adjust themselves in the said channels, the pistons pivotally attached thereto and held in both directions thereby, and the piston ends rounded to a radius from the center of said pivots, which forms an arrangement peculiarly adapted for the purpose.

I am aware that pistons in eccentric rotary engines have been held outward by means of

the inner ends riding upon a surface concentric with the bore of the cylinder, and which are held back against the sliding friction in the piston-hub, by means of contact against the bore of the cylinder, the arrangement being defective in that the contact-pressure of the piston against the cylinder is not equal at all points in the revolution, the cylinder being worn out of truth thereby, and which is obviated by the means herein described.

I am also aware that other devices have been invented for the purpose of preserving contact and concentricity of the pistons with the bore of the cylinder, such as struts or distance-pieces connecting opposite pistons, in combination with springs, and by means of springs alone, with none of which does my invention conflict.

It is apparent that my invention is susceptible of other modifications not shown herein in its general form and construction of details without departing from the spirit thereof. I do not therefore limit myself to the precise form or construction or proportion and number of parts as shown herein.

Having described my invention, I claim—

1. In a rotary engine of the kind described, the combination of the fixed annular channels or recesses $c\ c$, concentric with the bore of the steam-cylinder, the annular rings $R\ R$, adapted to be inserted in said annular channels $c\ c$ and to revolve therein, the annular channels or recesses $c^2\ c^2$, formed in said annular rings, the segmental blocks K , adapted to fit into said annular channels $c^2\ c^2$, one of said segmental blocks being solidly attached to one of each of said annular rings and the others free to adjust themselves in the said channels $c^2\ c^2$, formed in said annular rings, and the steam-pistons P , adapted to be pivotally attached to the said segmental blocks by means of the pivot-pins b , substantially as and for the purpose specified.

2. In a rotary engine of the kind described, the combination of the fixed annular channels or recesses $c\ c$, the annular rings $R\ R$, the annular channels or recesses $c^2\ c^2$ in said annular rings, the segmental blocks K and pivot-pins b , the pistons P , pivotally attached to said segmental blocks and provided with the packing-strips a and springs w , the piston hub or block E , having transverse radial slots l and steam openings or passages u , said radial slots adapted for the insertion of the said pistons, the driving-shaft S , and the packing-plate T , packing-box ring d , and screws e , substantially as and for the purpose specified.

3. In a rotary engine of the kind described, the combination, with the steam-cylinder A , of the auxiliary steam-chamber C , the piston N , adjustable or movable in said auxiliary chamber, the steam ports or openings o^3 between said steam-cylinder and auxiliary chamber, and the induction-ports $o\ o$, and exhaust ports $o'\ o^2$ in said steam-cylinder, arranged in relation to each other and to the

number of engine-pistons, substantially as and for the purpose specified.

4. In a rotary engine of the kind described, the described steam-cylinder A , auxiliary steam-chamber C , and piston N , in combination with the steam-chest B , provided with steam-inlet I and outlet J , the valve D , adapted to be moved in said steam-chest to cover and uncover the steam-ports in said steam-cylinder, and the cylinder heads or covers $H\ H$, adapted to fit the bore of said steam-cylinder and perforated or bored for the shaft S and provided with the packing-boxes $f\ f$, one of said cylinder-heads having an annular channel or recess c formed upon its inner face concentric with the bore of the steam-cylinder, adapted for the insertion of one of the annular rings R , substantially as and for the purpose specified.

5. In a rotary engine of the kind described, the described steam-cylinder A , auxiliary steam-chamber C , and piston N , the steam-chest B , valve D , and cylinder-heads $H\ H$, in combination with the driving-shaft S , the piston hub or block E , provided with transverse radial slots l and steam-passage openings u , the pistons P , adapted to fit into the said radial slots and provided with the packing-strips a and springs w , and the packing-plate T , perforated for the shaft S and provided with the annular channel or recess c upon its inner face concentric with the bore of the cylinder for the insertion of one of the annular rings R , the said packing-plate adapted to be made steam-tight in the bore of the steam-cylinder by means of the packing-box ring d and screws e , and to be set up against the piston-hub and ends of the pistons by steam-pressure between the said packing-plate and the adjacent cylinder-head, substantially as and for the purpose specified.

6. In a rotary engine of the kind described, the combination comprising the steam-cylinder A , steam-ports $o\ o$, o' , o^2 , and o^3 in said steam-cylinder, the auxiliary steam-chambers C , pistons N , piston-rods h , covers m , packing-boxes t , and hand-wheels h^2 , the steam-chest B , provided with steam-inlet I , exhaust-outlet J , and packing-box t , the valve D , and valve-rod r , the cylinder heads or covers $H\ H$, and packing-boxes $f\ f$, the driving-shaft S , the piston hub or block E , the pistons P , the piston-packing strips a , and springs w , the packing-plate T , packing-ring d , screws e , the annular rings $R\ R$, the annular channels or recesses $c\ c$ and $c^2\ c^2$, the segmental blocks K , and pivot-pins b , constructed and arranged in the manner and for the purpose substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM N. WHIPPLE.

Witnesses:

JNO. WHITAKER,
OSCAR CONKLIN.