No. 616,643. Patented Dec. 27, 1898.

E. B. TREE.
ROTARY ENGINE.

(Application filed June 28, 1897.)

(No Model.) 3 Sheets—Sheet 1.

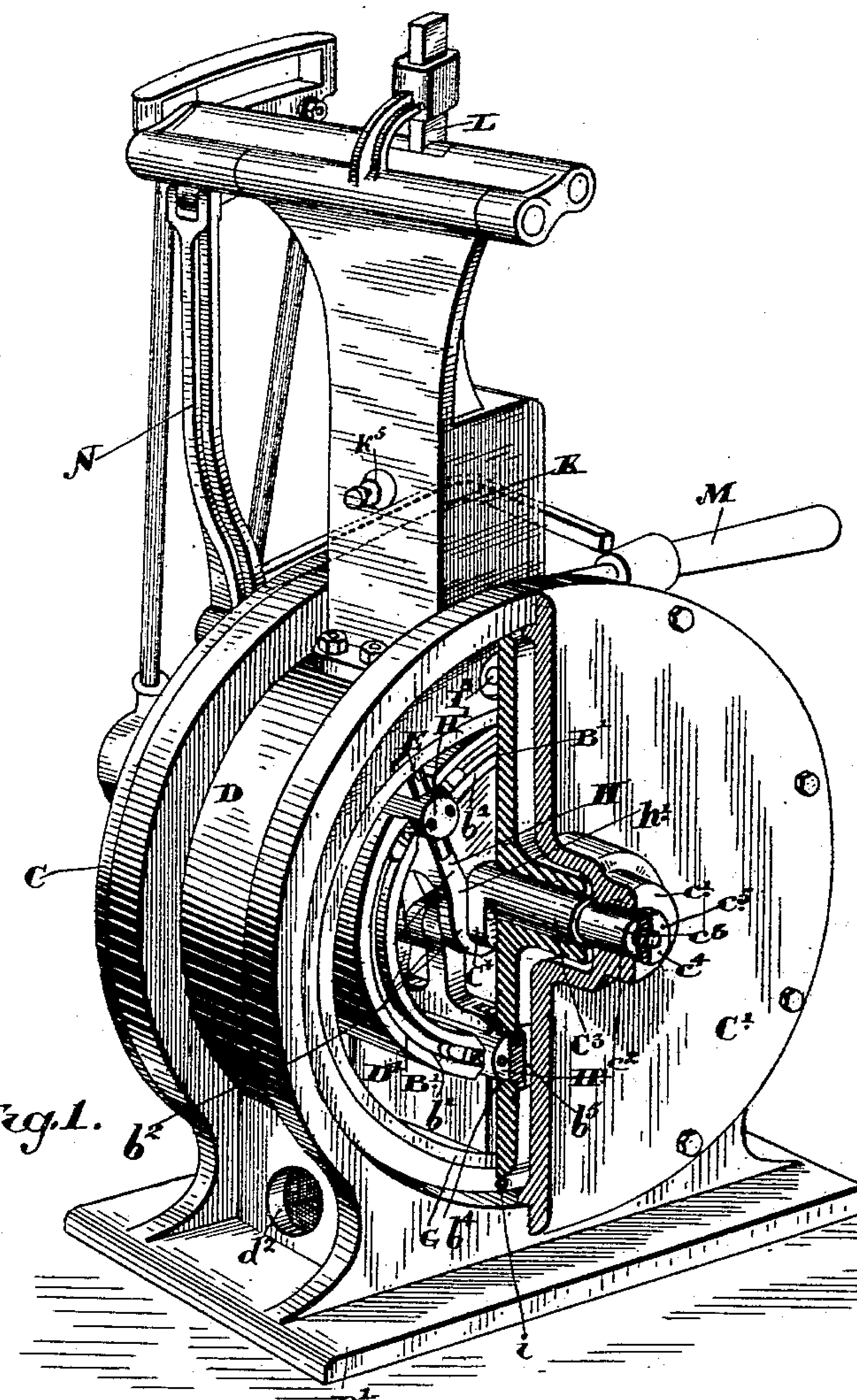

Fig. 1.

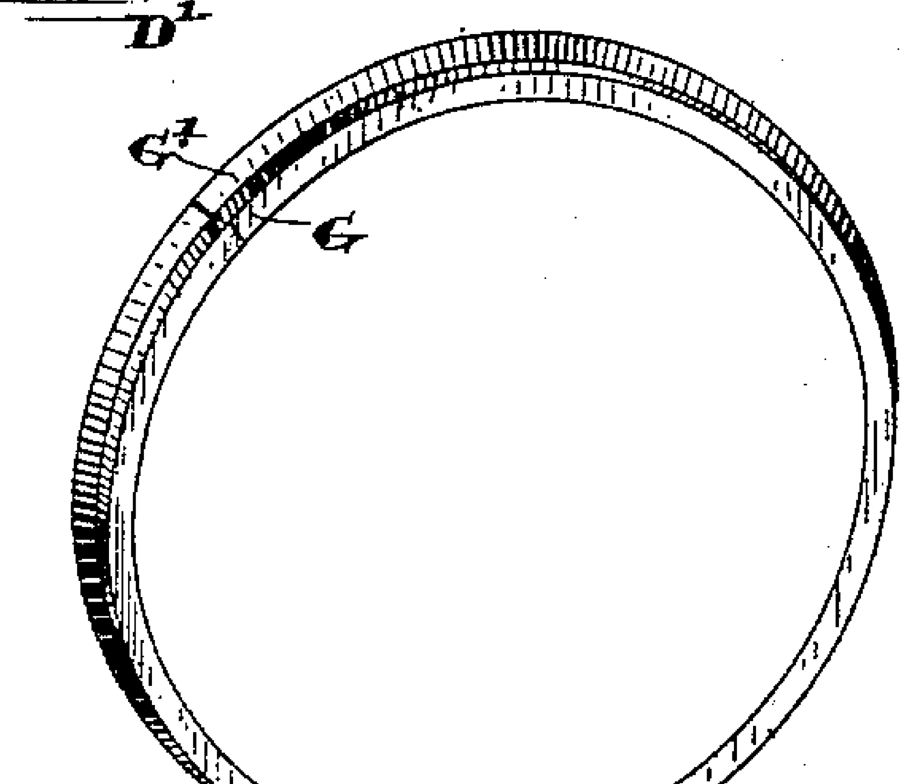

Fig. 5.

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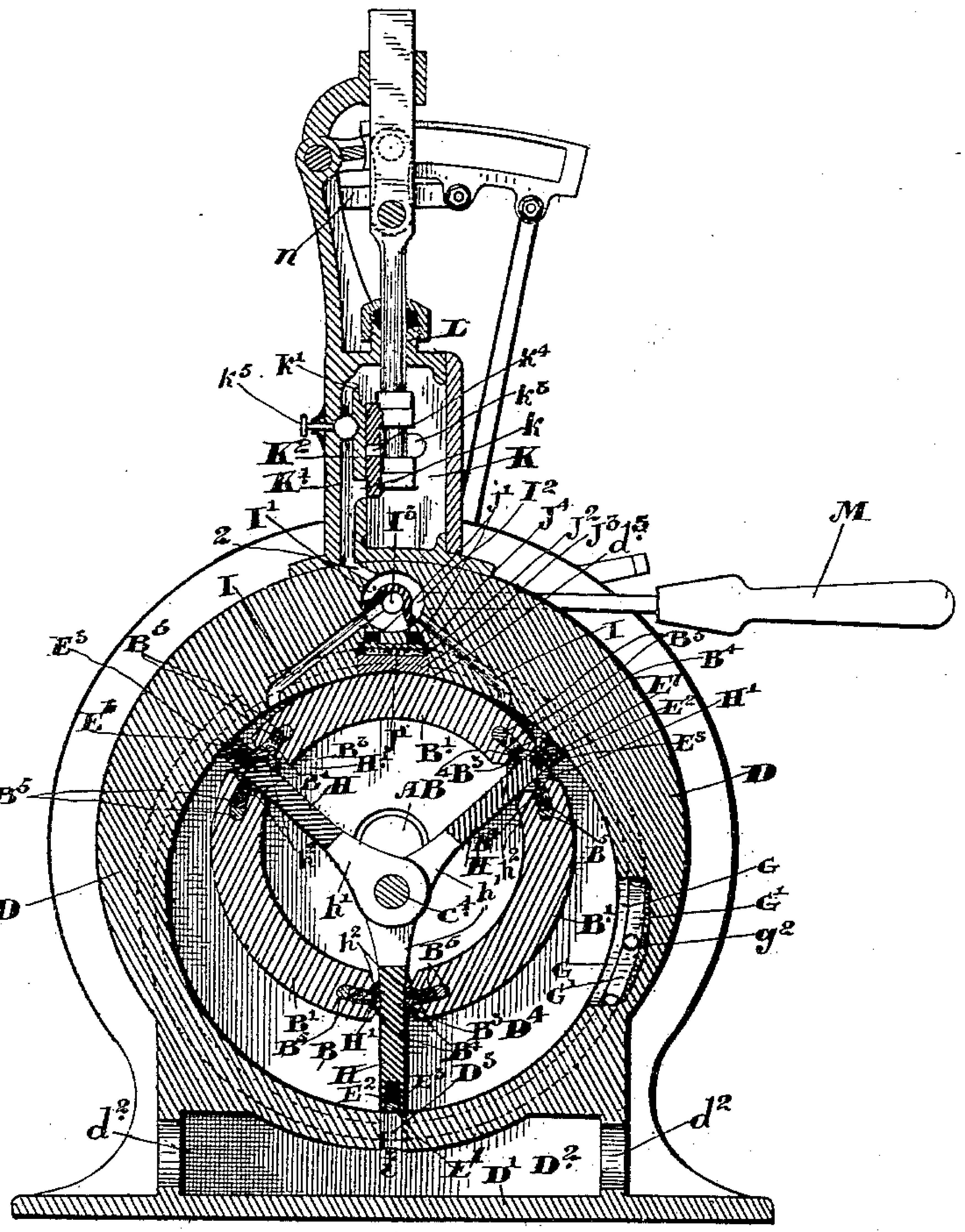

Fig 2.

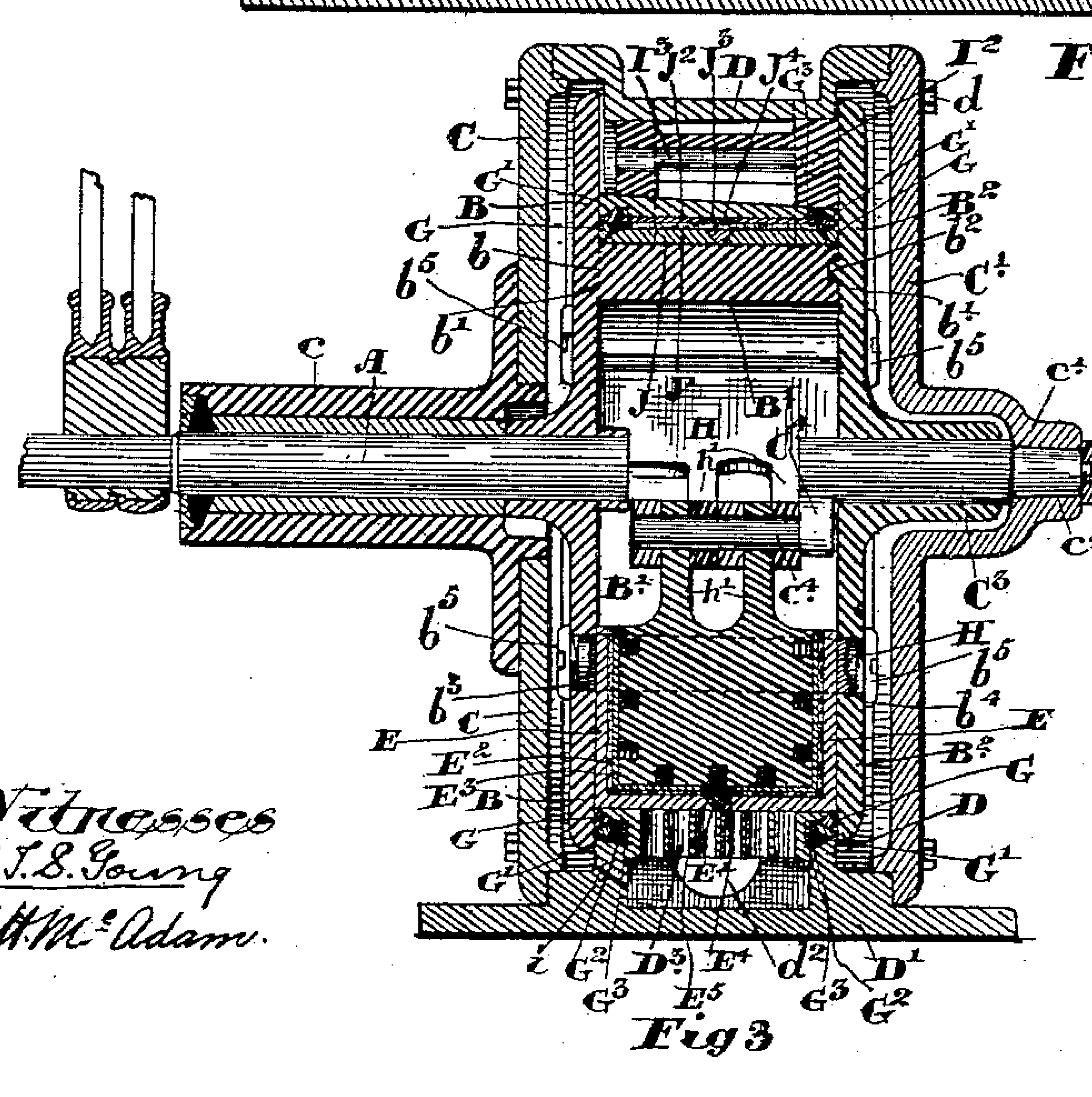

Fig 3

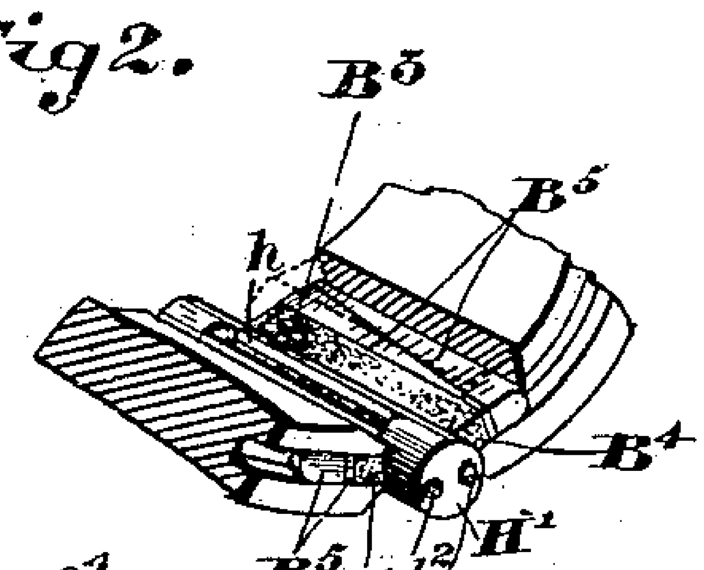

Fig.4.

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E. B. TREE.

ROTARY ENGINE.

(Application filed June 28, 1897.)

(No Model.) 3 Sheets—Sheet 3.

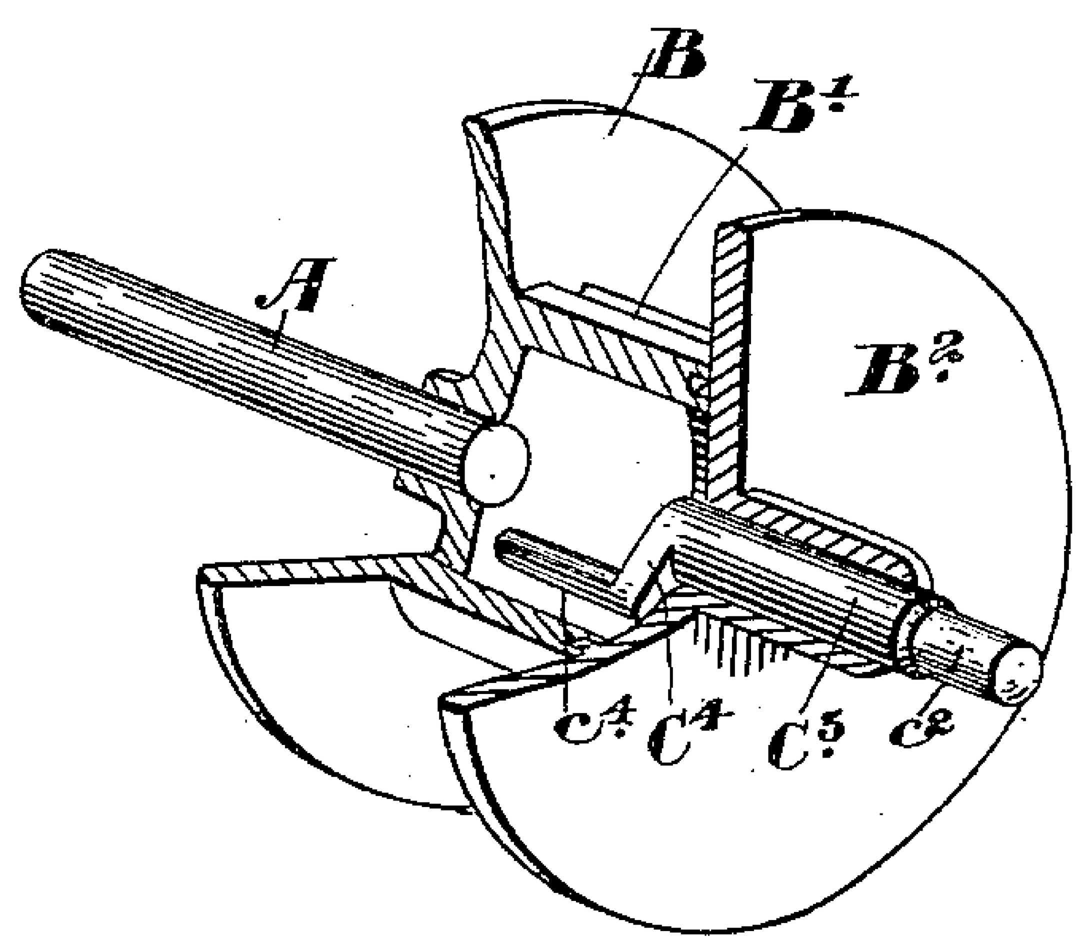

Fig. 6.

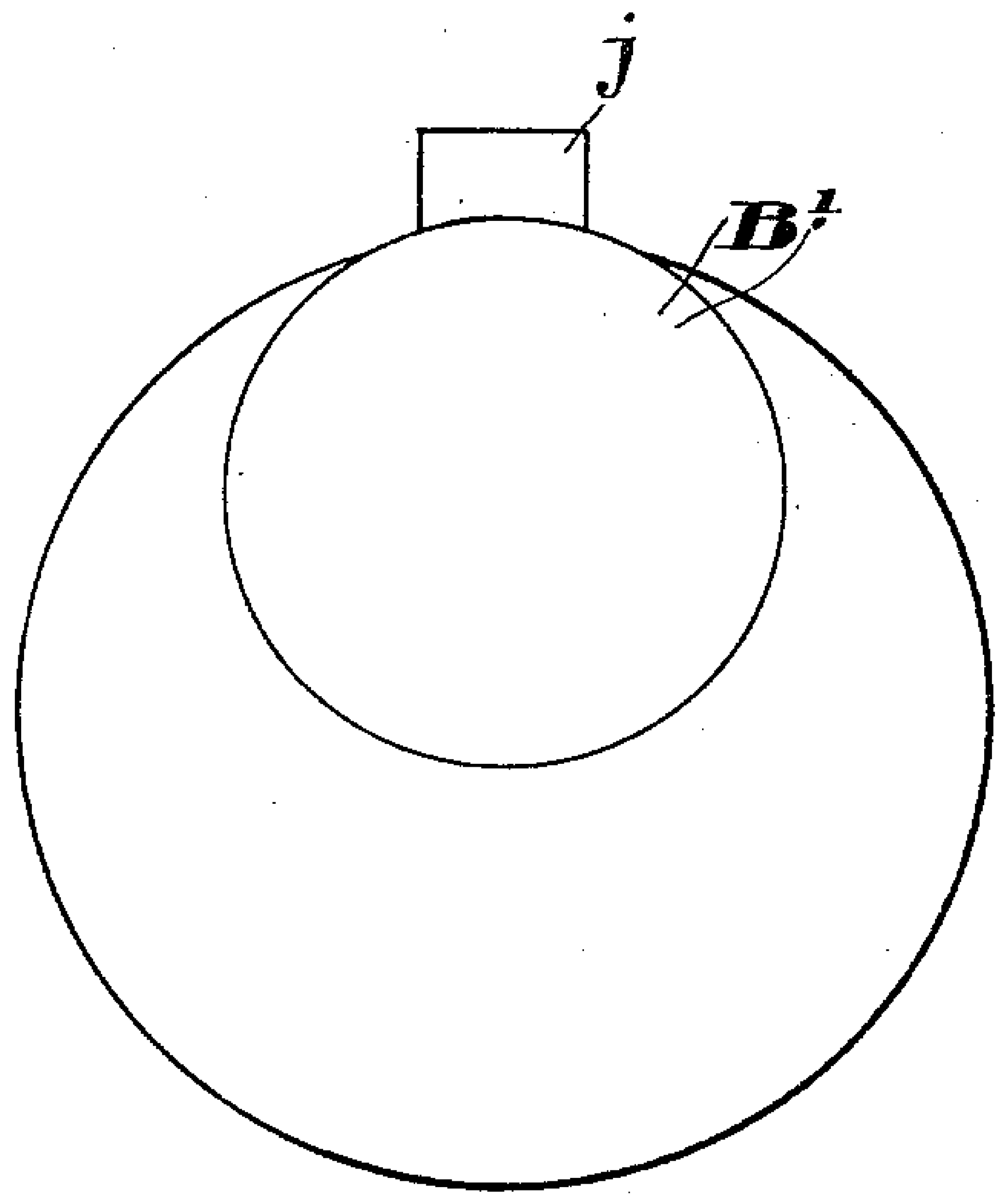

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Fig. 7.

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UNITED STATES PATENT OFFICE.

EBER BLAKE TREE, OF WOODSTOCK, CANADA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO WILLIAM OLIVER TAYLOR, OF PRINCETON, CANADA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 616,643, dated December 27, 1898.

Application filed June 28, 1897. Serial No. 642,590. (No model.)

To all whom it may concern:

Be it known that I, EBER BLAKE TREE, insurance agent, of the town of Woodstock, in the county of Oxford, in the Province of Ontario, Canada, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to improvements in rotary engines; and the object of the invention is to design a simple, easily-controlled, noiseless, and economic form of rotary engine in which there will be no back pressure, which may be run at a very high rate of speed with little wear or tear, and in which the expansion of the steam may be used as advantageously, if not more so, than in the ordinary reciprocating engine; and it consists, essentially, in the novel construction and arrangement of the parts hereinafter described, and more particularly set forth in the claims.

Figure 1 is a perspective view of my rotary engine, with one side of the casing partially in section to exhibit the interior construction. Fig. 2 is a vertical cross-section. Fig. 3 is a longitudinal vertical section. Fig. 4 is a detail showing the means of packing the slots through which the wing-pistons extend. Fig. 5 is a perspective detail of the concentric packing-rings. Fig. 6 is a detail of the piston-ring and end disks. Fig. 7 is a diagrammatic view of the piston-ring and inner periphery of the casing.

In the drawings like letters and numerals of reference indicate corresponding parts in each figure.

A is the main shaft, which has secured to its inner end the disk B. C is the outer disk-plate of the casing, and c is the bushing, secured to the casing, through which the shaft extends. C′ is the plate at the opposite side, which is provided with a central hollow projecting portion c', having a central tapered aperture c^2, through which extends the tapered end c^3 of the stud C^3, which has a crank-shaped end C^4, the pin of which I designate c^4. The pin of course is eccentric to the shaft. The stud C^2 is secured in position by a nut c^5, which is screwed onto the threaded reduced end.

B′ is the ring-piston, which preferably forms part of the disk B, and B^2 is the disk on the opposite side thereof to the disk B. The hub of the disk B is keyed to the shaft A, and the hub of the disk B^2 revolves upon the stud C^3.

b is an annular projection on the disk B^2, which fits into a corresponding recess in the end of the ring-piston B′, and thereby forms a steam-tight joint between the disk and piston. The disk B^2 is bolted to the ring-piston, so that the piston rotates with it. The lower portion of the ring-piston in Fig. 3 is shown in dotted lines as one of the wings hereinafter described is centrally located.

D is the central portion of the casing, which is secured to the disk-plates by bolts d. It will be noticed that the inner sides of disks B and B^2 are separated slightly from the central portion D and that the outer sides of the disks B and B^2 are separated from the disks C and C′.

D′ is the bed-plate, which forms part of the central portion D of the casing, and D^2 is a chamber formed beneath the central portion of the casing and provided with ports d^2 at each end.

D^3 is the exhaust-port, which is formed of a series of tubular holes arranged in alinement. By making the exhaust-ports in this form I am enabled to preserve the concentric interior of the chamber D^4. The chamber D^4 is concentric to the pin c^4, with the exception at the top, where it has a slight depression d^3, into which the ring-piston fits.

G are split packing-rings, triangular in cross-section, which fit into corresponding recesses in the central portion D at the edge of the concentric chamber D^4.

G′ are correspondingly-formed split packing-rings located peripherally circumferentially outside of the packing-rings G and in corresponding recesses.

G^2 are manila packing-rings located to the inside of the packing-rings G′.

G^3 are compression-rings (see Figs. 2 and 3) located to the inside of the manila packing-rings G^2 and compressibly held against the manila packing-rings G^2 by the springs g^2.

It will thus be seen that a perfectly steam-tight joint is provided around the edges of the chamber D^4 between the central portion D and the rotatable disks B and B^2.

H are wings provided with inwardly-extending arms h', which are journaled on the pin c^4, as indicated. The wings extend through cross-slots h in the rollers H′, such rollers extending through apertures B^3 in the ring-piston B′ into recesses b^3 and b^4 in the disks B and B^2, respectively.

h^2 are two holes which extend through the rollers H′, being open on the edge of the slot h, such holes being filled with manila, so as to render the slot through which the wings pass steam-tight. The concentric faces of the apertures B^3, through which the rollers H′ extend, are provided at each side with manila packings B^4, which are held against the rollers H′ by the wedge-blocks B^5. (See Fig. 4.) The outer ends of the recesses b^3 and b^4, into which the rollers H′ extend, are closed and made steam-tight by the screw-caps b^5. The outer and side edges of the wings H are packed by the L-shaped packing-blocks, which extend along each side and to the center of the outer edge of each wing H, where they are beveled, as shown. A wedge-block E′ fits between the center ends. To the inside of the L-shaped packing-blocks is situated manila packing E^2, which is compressibly held against the outer L-shaped packing-blocks by the inner spring-held L-shaped compression-strips E^3. The wedge-block E′ is held so as to force the L-shaped blocks E outwardly by the cross-strip E^4, compressed by one of the springs E^5. It will thus be seen that the edges of the wings H contacting with the disks B^2 and inner periphery of the chamber D^4 are rendered steam-tight.

J is a packing-block extending across the center of the recess d^3, and J′ is a manila packing-block situated above the packing-block J, and J^2 is a compression-strip located above the manila packing. The packing-block J is made in two parts, separated by the wedge-shaped block J^3. The strip J^2 is made in two parts, separated by the plate J^4, which is pressed by the springs j', so as to provide a wedging action to take up the wear of the two parts of the block J′, which, it will be noticed on reference to Fig. 3, abut at the outside the packing-rings G and G′.

I are ports which lead from the central aperture I′, preferably tapered from end to end and located in the upper portion of the casing above the packing J, to points in the concentric chamber D^4 on each side of the upper portion of the ring-piston B′. The aperture I′ is provided with a valve-plug I^2, having a cut-off partition substantially U-shaped in cross-section and a central longitudinal opening I^3, leading to the open end of the aperture I′, which communicates around the edge of the disk B and by the passage-way i at the bottom with the exhaust.

K is a steam-chest secured at the top to the center portion D of the casing.

K′ is the steam-port, which is separated from the chest by the partition K^2.

k is the valve-port in the partition K^2, and k' is the inlet-port leading from the top of the valve-chest into the steam-port.

k^3 is the steam-pipe leading into the steam-chest.

L is the valve-rod, which derives its upward-and-downward movement through the ordinary link-motion and eccentrics, which it is not necessary to describe. It is sufficient to say that the valve-rod extends through the upper end of the steam-chest and is provided with a plate at the lower end having a port k^4. The steam-port is ordinarily closed by the cock k^5.

M is a handle which is connected to the end of the valve-plug I′, extends through a slot in the casing, and is designed to reverse the valve by swinging such handle upwardly, and thus reverse the direction of rotation of the engine, as will be understood from what is described hereinafter. At the same time the handle M would come in contact with the lower end of the bell-crank N, which is connected by the bar n to the link, and such link will be thrown over into the position shown in dotted lines, thus providing for the proper working of the valve for reversing.

As hereinbefore described, I preferably provide three wings H. In starting the engine I turn on the cock k^5, so as to permit of the steam to pass from the chest through the steam-inlet port k', port K′, passage-way 2, into the valve-chamber I′, whence it passes through the passage-way I against the right wing H in the position shown in the drawings. The eccentric will now be so arranged on the shaft that the valve-rod L would pass upwardly, opening the valve-port k and permitting the steam to pass from the steam-chest through the port K′ and passage-way 2, valve-aperture I′, and port I against the next succeeding wing. The cock k^5 may be at any time closed after once the engine is started. The eccentric is so timed that the steam is admitted through the port K′ during a small part of the distance traversed by the wing from the position shown in the drawings to the position of the wing shown above the exhaust-port, and the expansion of the steam thus admitted would take place to drive such wing the remaining portion of the distance to above the exhaust-port, thus utilizing to the greatest possible extent the expansive force of the steam. When the valve-rod is caused to move downwardly still farther the port k^4 will come opposite to the port k and cause the admission of the steam for the next succeeding wing, when the expansion will take place as before. Upon the valve-rod now being caused to rise by the eccentric the lower end of the valve-plate will again uncover the port k and cause the admission of the steam against the third succeeding wing, thus providing for the admission of the steam three times during the revolution, or once for each wing, and utilizing to the greatest extent possible the expansive force of such steam. It will also be noticed on reference to Fig. 2 that the surplus exhaust, if any, will be carried off through the passage-way i opposite to that in which the steam enters and the central aperture of the tapered plug I^2 and around the edges of the disk B′ and through the passage-way i.

It will be noticed in the construction of the engine that the wings always rotate circumferentially within the periphery of and with the steam-tight disks B and B^2.

It will also be seen that practically the same leverage is exerted upon the wings during the time expansive pressure is used as the area of the wing gradually increases to the point of exhaust. During the period of the exhaust as the area presented by the wing is at its maximum it will be seen that the expansive force of the steam as it exhausts instead of exerting back pressure upon the wings will give a decided onward pressure.

In Fig. 6, A is the main shaft of the engine, supporting the disk B. B′ is the piston-ring formed on the disk B. B^2 is the opposite disk, in which is journaled the stud C^3, having crank end C^4 with a pin c^4.

In Fig. 7 is shown the relation of the piston-ring B and casing D with packing J.

What I claim as my invention is—

1. In a rotary engine, in combination the main driving-shaft, the casing, the end disk and ring-piston secured to the main shaft and concentric to it, and the opposite end disk secured to the ring-piston comprising the revolving casing, the stationary stud opposite the shaft forming a journal for one rotating disk of the revolving casing, the concentric crank-pin connected to the stud, a chamber between that part of the rotating disk that extends beyond the periphery of the ring-piston, the ring-piston, and the central portion of the casing, such chamber being crescent-shaped in form and having the inner side concentric to the shaft and the outer side concentric to the crank-pin, three equidistant wings journaled on the pin and extending through slots on the ring-piston into the concentric chamber completely located within the periphery of the rotary disks and designed to rotate with them, suitable ring-packing between the inner rotating disks and the central portion of the casing and suitable inlet and exhaust ports as described.

2. In a rotary engine, in combination the main driving-shaft, the casing, the end disk secured to the main shaft and the ring-piston forming part thereof, the stationary stud held on the opposite side of the casing, the crank-pin formed on the end of the stationary stud, a chamber between that part of the rotating disk that extends beyond the periphery of the ring-piston, the ring-piston, and the central portion of the casing, such chamber being crescent-shaped in form and having the inner side concentric to the shaft and the outer side concentric to the crank-pin, suitable packing-rings and springs for exerting a constant tension upon the same, the wings, the L-shaped packing-blocks at the side edges of the wings, the rollers provided with central slots located in the apertures in the ring-piston through which the wings pass, and journaled at the ends in recesses in the disk, the caps for closing such recesses steam-tight, the manila packing on each side of the roller in the ring-piston and wedge-blocks for holding such packing in position and suitable inlet and exhaust ports as described.

3. In a rotary engine, in combination the main driving-shaft, the casing, the end disks secured to the main shaft and the ring-piston forming part thereof, a stationary stud held in the opposite side of the casing, the crank-pin formed on the end of the stationary stud, a chamber between that part of the rotating disk that extends beyond the periphery of the ring-piston, the ring-piston and the central portion of the casing, such chamber being crescent-shaped in form and having the inner side concentric to the shaft and the outer side concentric to the crank-pin, suitable packing-rings and springs for exerting a constant tension upon such rings, the wings, the L-shaped packing-blocks on the outer and side edges of the wings, the rollers provided with central slots located in the apertures in the ring-piston through which the wings pass and journaled at the ends in recesses in the disks, the caps for closing such recesses steam-tight, the manila packing on each side of the roller in the ring-piston, wedge-blocks for holding such packing in position, suitable inlet and exhaust ports, a depression formed at the top of the concentric outer side of the crescent-shaped chamber and designed to receive and form a steam-check for the meeting sides of the crescent-shaped chamber and the divided packing-block centrally located in the depression as described.

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