(No Model.)

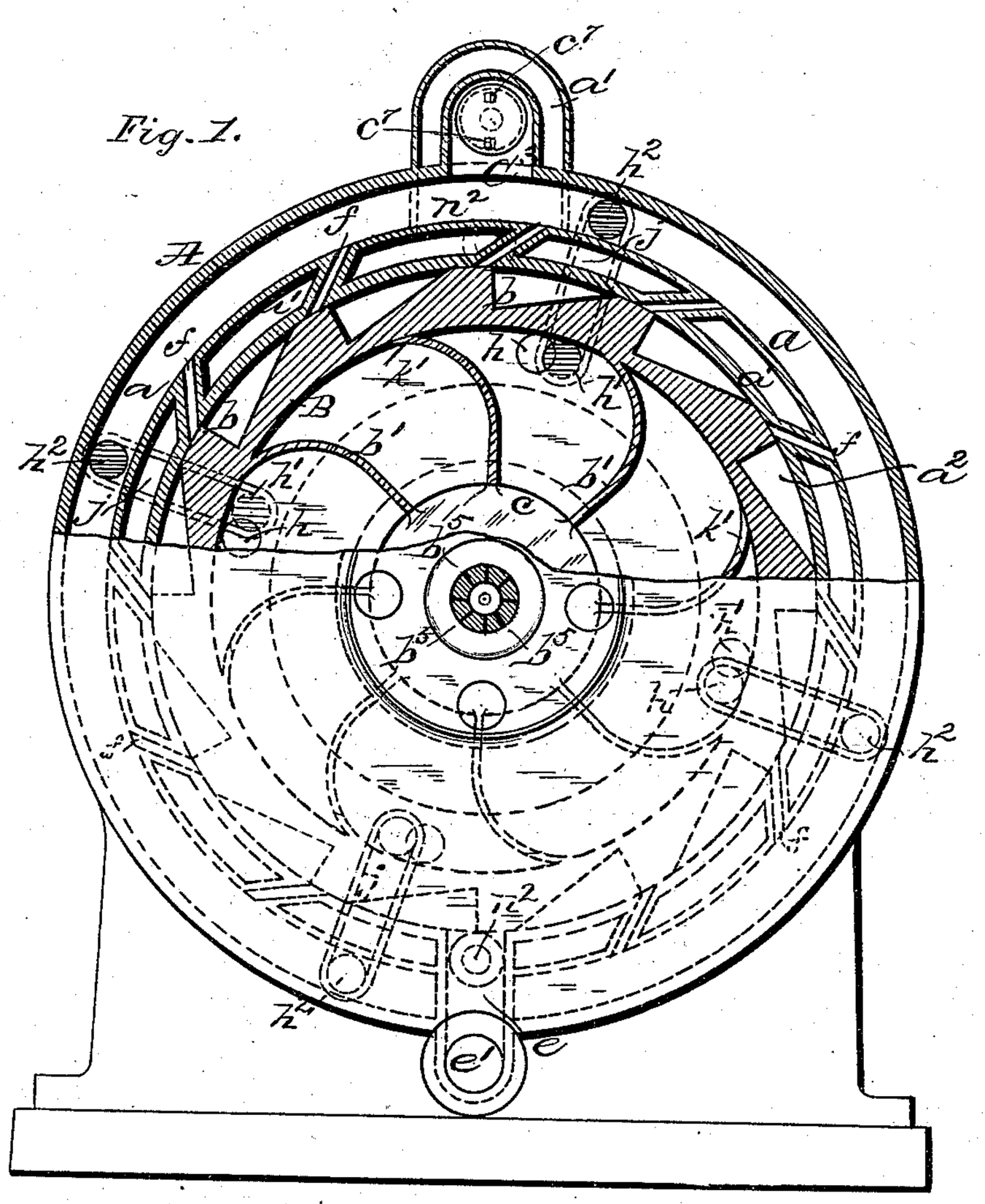
6 Sheets—Sheet 1.

J. J. BORDMAN.

GAS ENGINE.

No. 547,414. Patented Oct. 8, 1895.

Fig. 1.



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6 Sheets—Sheet 2.

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No. 547,414. Patented Oct. 8, 1895.

Fig. 2.

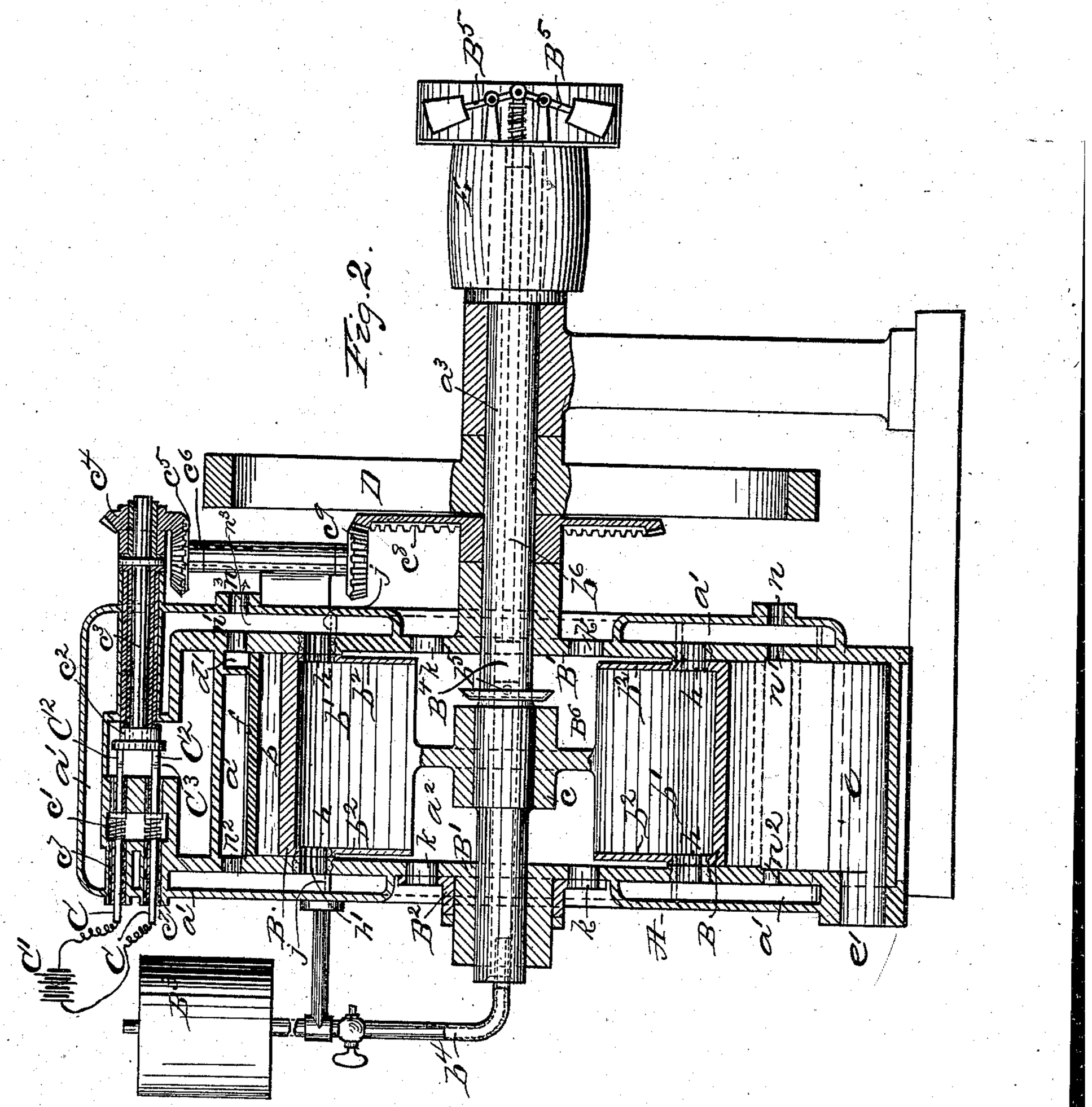

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Fig. 3.

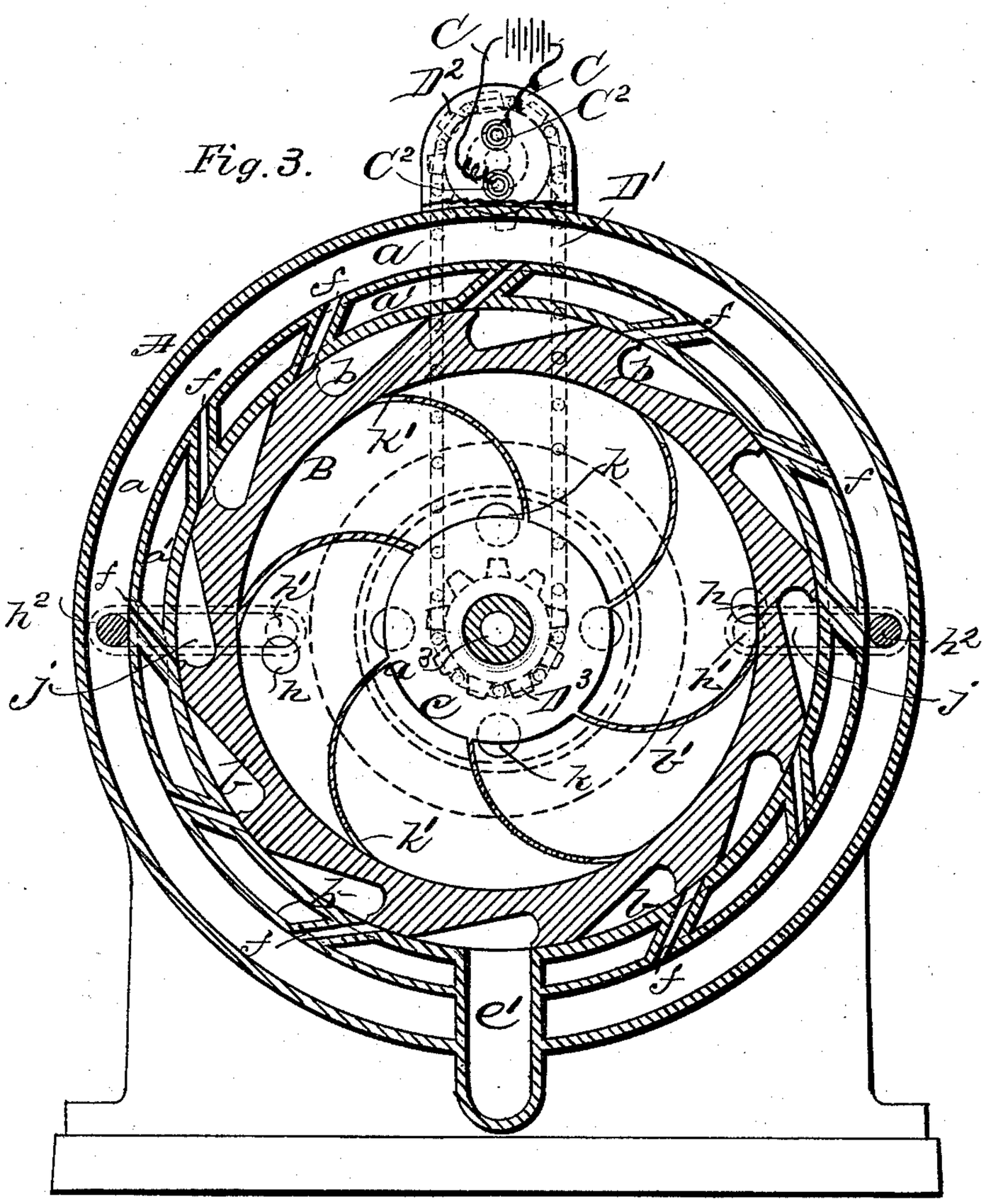

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Fig. 5.

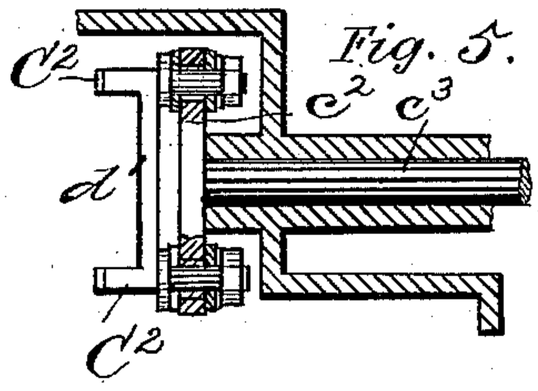

Fig. 4.

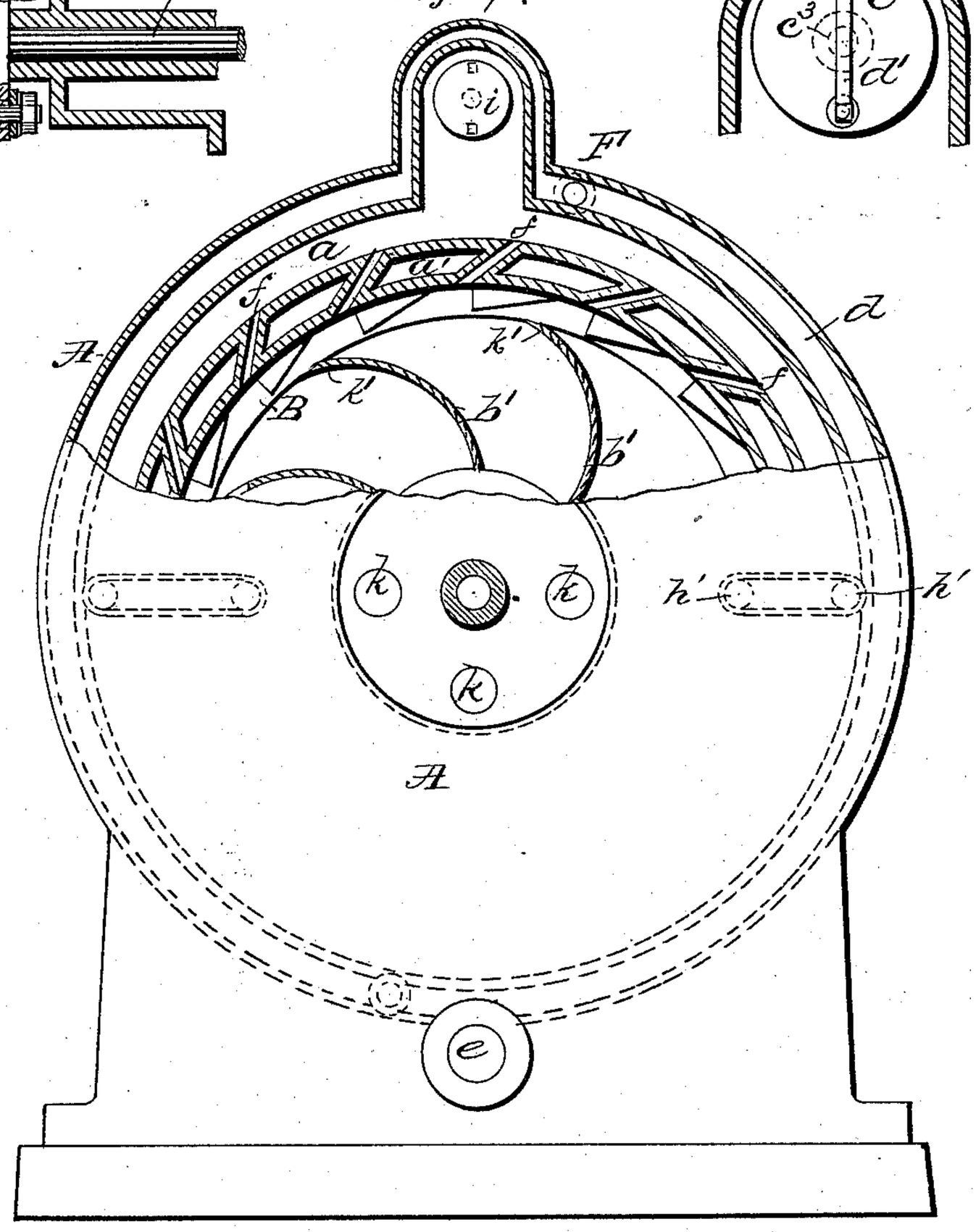

Fig. 6.

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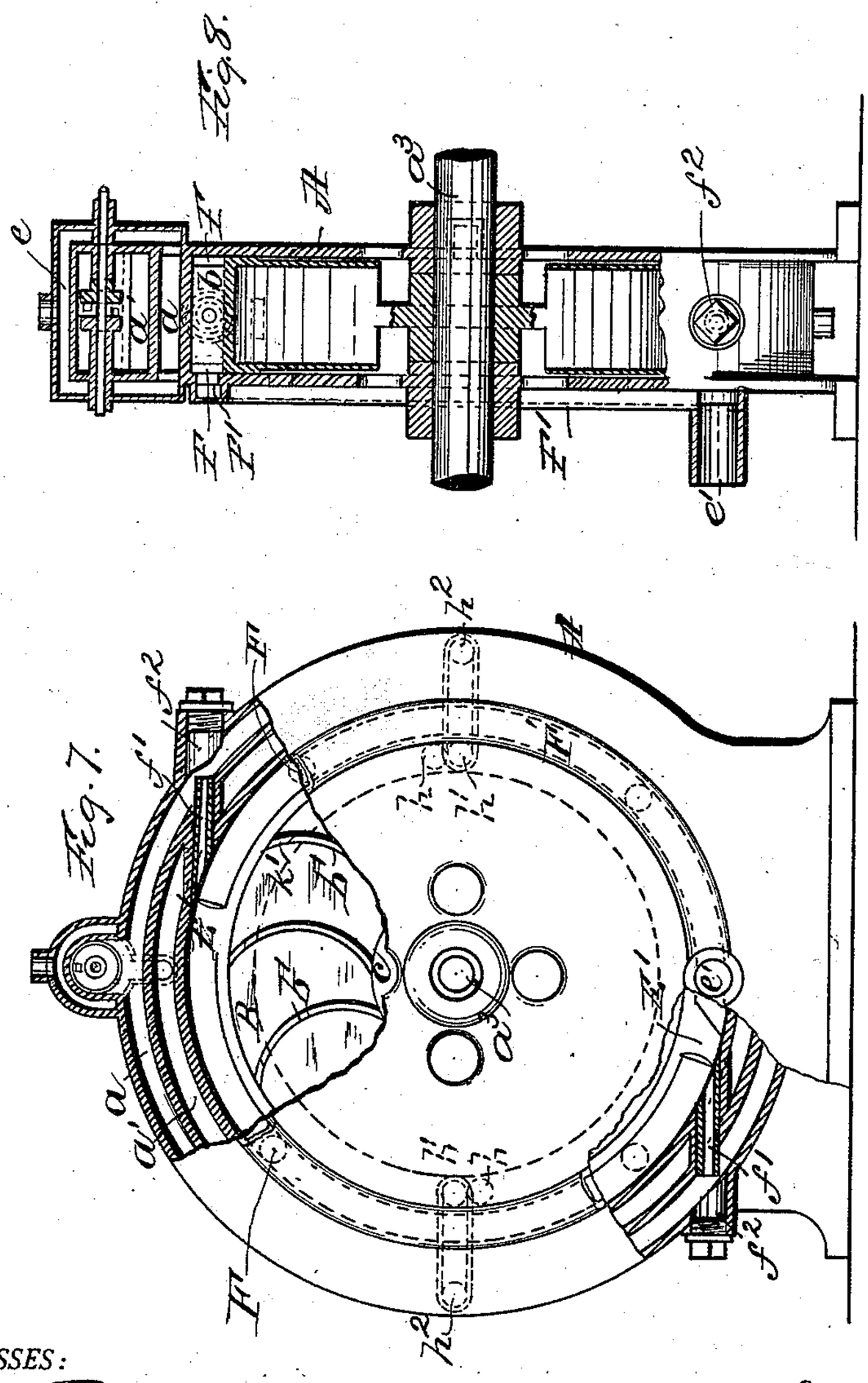

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No. 547,414. Patented Oct. 8, 1895.

Fig. 9.

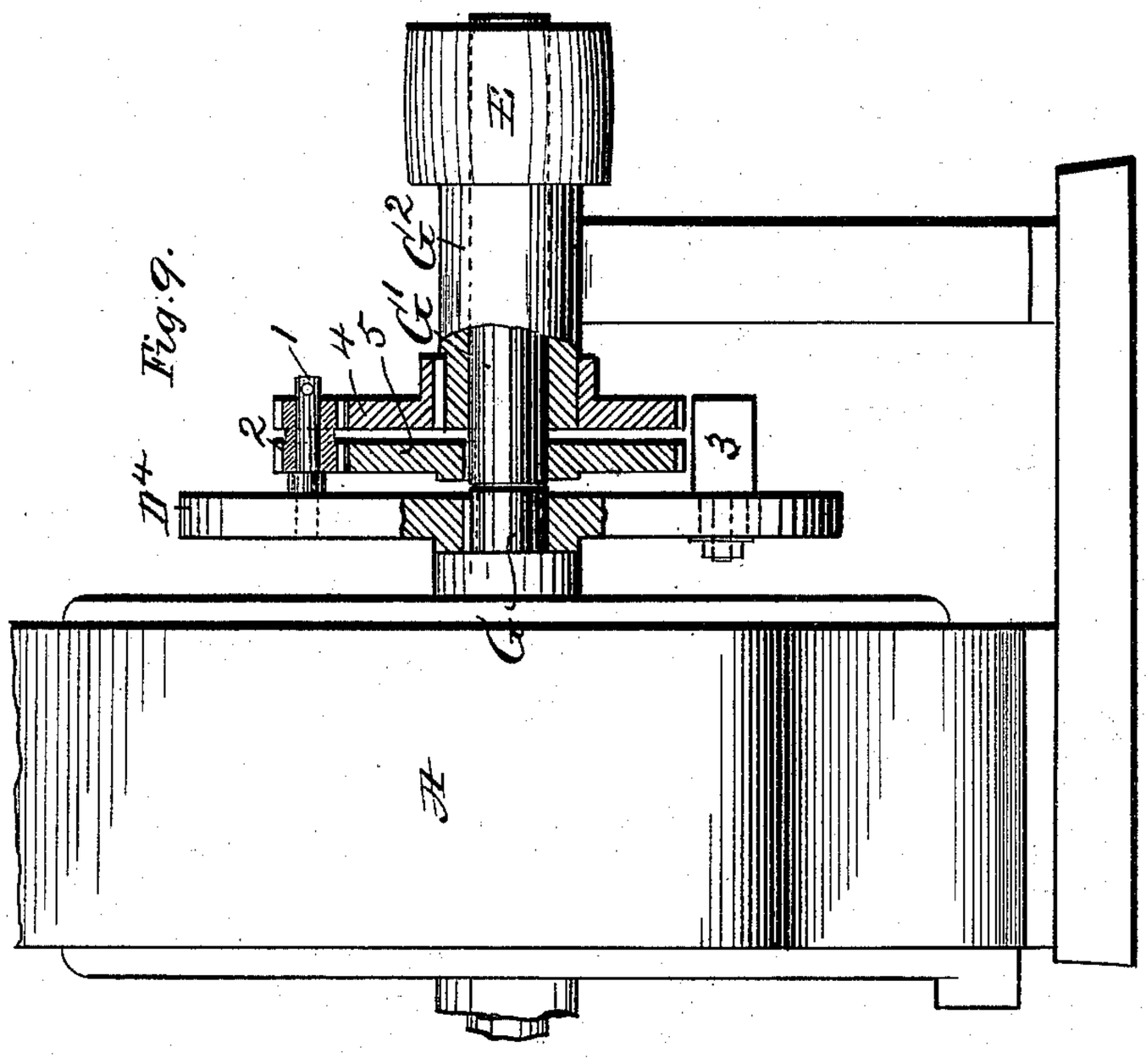
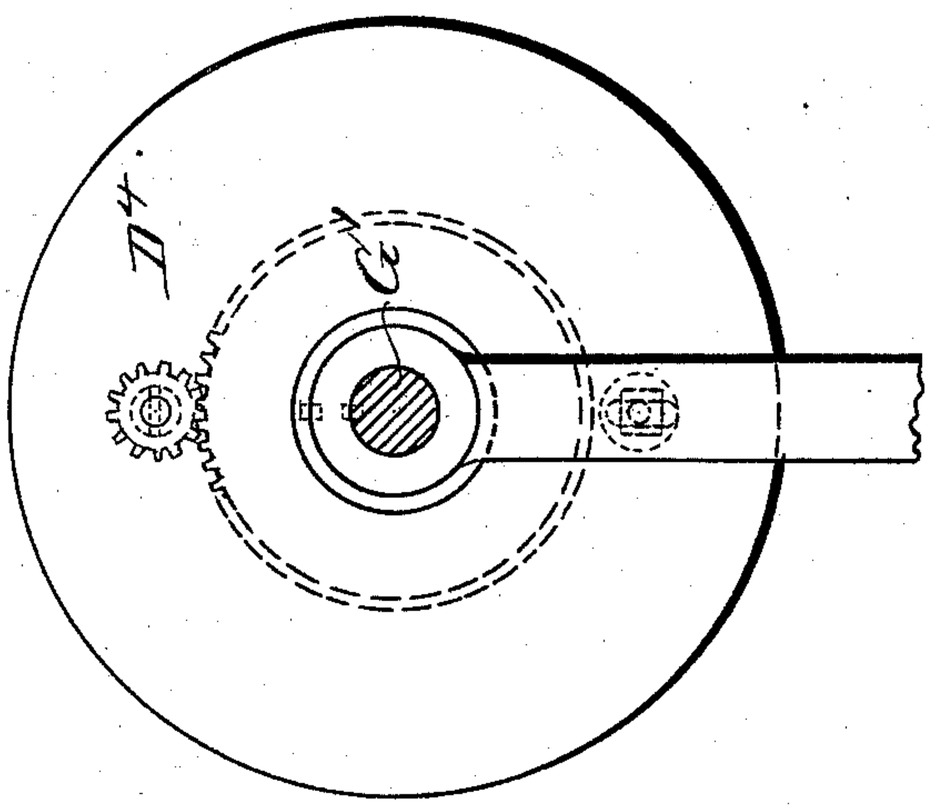


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOHN J. BORDMAN, OF BROOKLYN, NEW YORK.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 547,414, dated October 8, 1895.

Application filed February 3, 1894. Serial No. 498,943. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. BORDMAN, a citizen of the United States of America, and a resident of Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to that class of engines in which an explosive-gas is employed, and it comprises a turbine-wheel operating to open and close the gas and air ports and to receive the impulse of the explosive-mixture.

I will describe an engine embodying my invention, and then point out the novel features in appended claims.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of an engine embodying my invention. Fig. 2 is a longitudinal central section thereof. Fig. 3 is a transverse vertical section, showing a modified arrangement of ports. Fig. 4 is an elevation, partly in section, showing a modification. Fig. 5 is an end view of the igniting-chamber, showing a part of the igniting mechanism. Fig. 6 is a cross-section thereof. Fig. 7 is an elevation, partly in section, showing a modification. Fig. 8 is a transverse section thereof. Fig. 9 shows a mechanism for modifying the speed of the power-transmitting shaft, and Fig. 10 is a side elevation thereof.

Referring by reference-characters to the drawings, A designates a cylindrical casing, supported by a suitable base and comprising an annular explosion-chamber a, an annular water-jacket a', and the interior chamber a^2, within which the power-wheel B rotates. Water is supplied to the jacket through the passage n, circulates through n' n^2, and discharges through n^3. This power-wheel B is rigidly mounted on a power-shaft a^3, having bearings through the end walls B′ of the casing A, and provided with a fly-wheel D and a band-wheel or pulley E.

The power-wheel B is provided in its periphery with buckets b, the end walls of which extend substantially at right angles to the axis of the wheel and are designed to receive the shock or force of the exploding gas which passes from the explosion-chamber a into the buckets through ports f, extended through the water-jacket a'. The ports f are shown as arranged at a tangent, so that the force of the explosion will be more direct upon the walls of the buckets. The walls of the ports f do not extend entirely across the water-jacket, but spaces or openings are left at the ends for the free circulation of water, as shown at d' in Fig. 2. The water-jacket a' not only extends around the inner circumference of the explosion-chamber, but extends over the outer side thereof, as plainly shown in Fig. 2. This water-jacket obviously serves to prevent an over-heating of the parts coming in contact with the exploding gas.

The wheel B has blade-like spokes b', extending from the hub c to the rim or pocket portion, and these spokes, with the end walls b^2, form the gas and air mixing chambers. Atmospheric air passes into the spaces or chambers between the blades or spokes through holes k in the casing A, and if desired the flow of air may be regulated by means of a damper (shown in Fig. 2) in the form of an annulus B^2, mounted to rotate on a bearing of the shaft a^3, and provided with openings that may register more or less with the holes k. Some or all of the blades or spokes b' may be provided with openings k' for the more thorough circulation and mixture of the gas and air.

I will now describe means for supplying gas to the engine.

B^3 indicates a tank or receptacle for containing a supply of gasoline or other hydrocarbon, and this tank has a valve-controlled conduit b^4, communicating with a longitudinal hollow or chamber in the shaft a^3, which at its inner end has a series of outlets b^5 opening into the space containing the blades or spokes of the wheel. In order to govern the inflow of gas, and therefore govern or render uniform the speed of the engine, I provide a valve to open or close more or less the openings b^5. As shown in Fig. 2, this valve consists of a plug or piston B^4, adapted to slide longitudinally in the bore of the shaft a^3. It has connection with a rod b^6, extending through the shaft and having pivotal connection at the outer end with fulcrumed weighted arms B^5, which by centrifugal action serve to move the rod b^6, and consequently the valve B^4. The concave disk B^6 centrifugally diffuses a liquid, as gasoline, issuing from out-

lets b^5. The gasoline issues from the openings b^5 in the form of a spray or vapor by centrifugal action or by the suction of the wheel B and becomes thoroughly mixed with the air. This explosive mixture passes from the spaces or chambers between the blades or spokes to the explosion-chamber, through ports h in the end walls b^2, through ports h', communicating with radial channels j, formed in the end walls B′ of the casing A, and through ports h^2, which communicate with the explosion-chamber a. In other words, the blade-like spokes of the power-wheel serve the purpose of an exhaust-fan, drawing the air and gas into the wheel and by centrifugal force the mixed air and gas is driven through the ports communicating with the explosion-chamber. It will be seen that the end walls b^2 of the wheel B serve as a valve to cut off and open the flow of gas and air to the explosion-chamber and that the peripheral face of the wheel B adjacent the brackets b serve as a cut-off valve for the ports f. An exhaust-passage e leads from the pockets b to any outlet e' for the discharge of the products of combustion.

I will now describe means for igniting the gas in the explosion-chamber.

C designates pole-pieces having bearings of insulating material c^7 and having electrical connection with any desired source of electricity—such, for instance, as a battery C′. The pole-pieces have a yielding longitudinal movement, and for this purpose I employ springs c', abutting at one end against collars or shoulders on the pole-pieces and at the other end against a fixed portion of the casing, as shown in Fig. 2.

C^2 designates contact-pieces adapted to make and break connection with the pole-pieces. These contact-pieces are mounted on a carrier c^2, which has rotary motion imparted to it from the shaft a^3. As shown in Fig. 2, this carrier is mounted on the inner end of shaft c^3, having an insulated bearing in the casing and provided at its outer end with a bevel-gear c^4, meshing with a bevel-gear c^5 on a shaft c^6. The opposite of the shaft c^6 has a bevel-gear c^9, engaging with a gear-wheel c^8, rigidly mounted on the shaft a^3.

The contact-pieces C^2 and the pole-pieces C are arranged to make and break electrical connection within a chamber C^3, having communication with the explosion-chamber a, and the rotary movement of the contact-pieces is so timed that the arc or sparking will take place when the explosion-chamber is filled with explosive and the several ports h' are closed and the several ports or jet-passages f are uncovered at their inner ends.

In the example of my improvement shown in Fig. 3 there are but two gas-ports leading into the explosion-chamber, and it will be seen that the ports h are arranged in different circles and that the ports h' are also arranged in different circles, so that said chamber is charged with gas but once during an entire revolution of the power-wheel, and to properly time the igniting mechanism I have shown the carrier for the contact-pieces as rotated from the shaft a^3 by means of a sprocket-chain D′ and the sprocket-wheels D^2 D^3.

In the example shown in Fig. 4 I have shown a water-jacket d as surrounding the outer side of the explosion-chamber.

In the modification, Figs. 5 and 6, I have shown the contact-pieces made in the form of a yoke d', which has insulated connections with the carrier c^2.

In lieu of the several buckets heretofore described for the power-wheel I may employ two buckets for the gas explosion, as shown at E′ in Figs. 7 and 8, and the faces of these buckets may be concaved, as shown. In this example I use jet-tubes f', projected through bearings through the water-jacket, and the casing A may have plug-stopped openings f^2 opposite the jet-tubes f, so that said jet-tubes may be easily inserted or removed when desired. In this example the exhaust or spent gases pass through lateral ports F into an annular passage F′ formed in the casing and having an outlet e'.

In Figs. 9 and 10 I have shown means for reducing the speed of the driving-pulley E. In this device the driving-shaft is made in two sections G G′, the section G having bearings in the casing A and the section G′ having a bearing in a pillow-block G^2. On the section G of the shaft is affixed a crank D^4, which may be in the form of a fly-wheel or arm. A pin 1 extends from the crank D^4 and a double pinion 2 is rotarily mounted on this pin. The crank may have a weight 3 attached to it to counterbalance the double pinion 2. One section of the double pinion 2 meshes with a gear-wheel 4, mounted in a fixed position on the pillow-block G^2, and the other portion of the double pinion meshes with a gear-wheel 5 fixed on the section G′ of the driving-shaft. The pinion 2, in rolling around the fixed gear 4, is caused to rotate on its pin and impart rotary motion to the gear 5 and section G′ of the shaft, when gear 5 has a greater or less number of teeth than gear 4. For example, gear 4 may have one hundred teeth and gear 5 one hundred and one teeth The pinion having ten teeth, in rolling around gear 4, will revolve on its pin ten times, and in rolling around gear 5 impart a movement or speed relatively to gear 4, equal to one tooth, or the difference between the numbers of teeth of the two gear-wheels.

Having described my invention, what I claim is—

1. A gas engine having in combination a casing provided with a combustion chamber, extending around it a power wheel within the casing, means for igniting the gas and a water jacket, extending around the inner circumference of the combustion chamber substantially as specified.

2. In a gas engine the combination of a casing having an annular explosion chamber and

a water jacket, and having the ports leading from the explosion chamber to the exterior of the power wheel, substantially such as described and a power wheel serving to open and close said ports, substantially as specified.

3. In a gas engine the combination with a casing having an annular explosion chamber, the power wheel located within the circumference of the explosion chamber provided with peripheral buckets, means comprising a chambered driving shaft for supplying gas to the interior of the power wheel, the air openings leading through the casing to the interior of the power wheel and means for adjusting the entrance of air, substantially as specified.

4. In a gas engine, the combination with a casing having the explosion chamber, the water jacket, the power wheel located within the circumference of the explosion chamber and having the buckets or abutments, the recessed power shaft having communication with the interior of the power wheel, means for automatically regulating said communication, and a supply tank having communication with the recess in said shaft, substantially as specified.

5. In a gas engine, the combination with a casing having an explosion chamber, of means for supplying gas and air thereto, and the power wheel located within the circumference of the explosion chamber having peripheral buckets or abutments, the blades or spokes forming gas and air mixing chambers, substantially as specified.

6. In a gas engine, the combination with a casing having the annular explosion chamber, provided with a series of ports leading to the power wheel, means for igniting an explosive in said chamber, a supply tank for said explosive, a water jacket adjacent the explosion chamber and the power wheel arranged within the circumference of the explosion chamber having the concaved buckets or abutments, substantially as specified.

7. In a gas engine, the combination with a casing having an explosion chamber, a power shaft and a power wheel, of gas igniting mechanism comprising a source of electricity, pole pieces having a yielding longitudinal movement, the contact pieces, a rotary carrier for said contact pieces, and means for rotating said carrier from the power shaft, substantially as specified.

8. In a gas engine, the combination with a casing having the annular gas chamber, and the power wheel, arranged within the gas chamber of a gas supply tank, a recessed power shaft having communication therewith and having outlets into said wheel, and a valve for automatically governing said outlets substantially as specified.

9. In a gas engine, the combination with a casing having a gas chamber, and the power wheel, of the gas supply, the recessed power shaft having communication therewith and having outlets opening into said wheel, the automatic valve for said outlets, and the distribution disk adjacent said outlets into the wheel, for diffusing the entering gas, substantially as specified.

10. In a gas engine, the combination with the casing having the gas chamber and water jacket; the power wheel and the power shaft, of an igniting mechanism, comprising a source of electricity, the pole pieces, the rotary contact pieces, the carrier therefor and the gear wheel communications between said carrier and power shaft, substantially as specified.

11. In a gas engine, the combination with a casing having the gas chamber, and a water jacket extending around said gas chamber, and having portions extending around the inner side of said gas chamber; the power wheel within the gas chamber and having the buckets; the power shaft, the gas supply having communication with the interior of the wheel and igniting mechanism substantially as specified.

12. In a gas engine, the combination of the casing having an annular gas chamber and an annular water jacket; of the power wheel B located within the gas chamber; the recessed power shaft having outlets into said wheel; the plug valve or equivalent B^4, and the weighted arms B^5, for moving said valve substantially as specified.

13. A rotary gas engine comprising a combustion chamber and a power wheel, the said wheel, in its rotary movement serving to draw an explosive element to its interior and forcing it by centrifugal action, into the combustion chamber, substantially as specified.

14. An explosive engine, comprising a rotary wheel within a casing having an annular combustion chamber, means for supplying air and gas to the interior of said wheel and ports providing communication between the interior of the wheel and the combustion chamber, the said wheel in its rotary motion serving to draw air and gas into the wheel and expelling it into the combustion chamber, substantially as specified.

15. In a gas engine the combination with a casing, having an annular combustion chamber, of a power wheel within the circumference of said chamber and having blade like spokes forming chambers, and ports leading from the interior of the wheel to the combustion chamber, the openings of said ports within the wheel, being arranged in different circles, one relatively to the other, whereby the explosive element will be discharged into the combustion chamber, but once during the revolution of the wheel, substantially as specified.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 1st day of February, 1894.

JOHN J. BORDMAN.

Witnesses:
JAS. E. WARNER,
W. L. BENNEM.