No. 679,937. Patented Aug. 6, 1901.

H. A. BENSON.

ROTARY ENGINE.

(Application filed Apr. 17, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

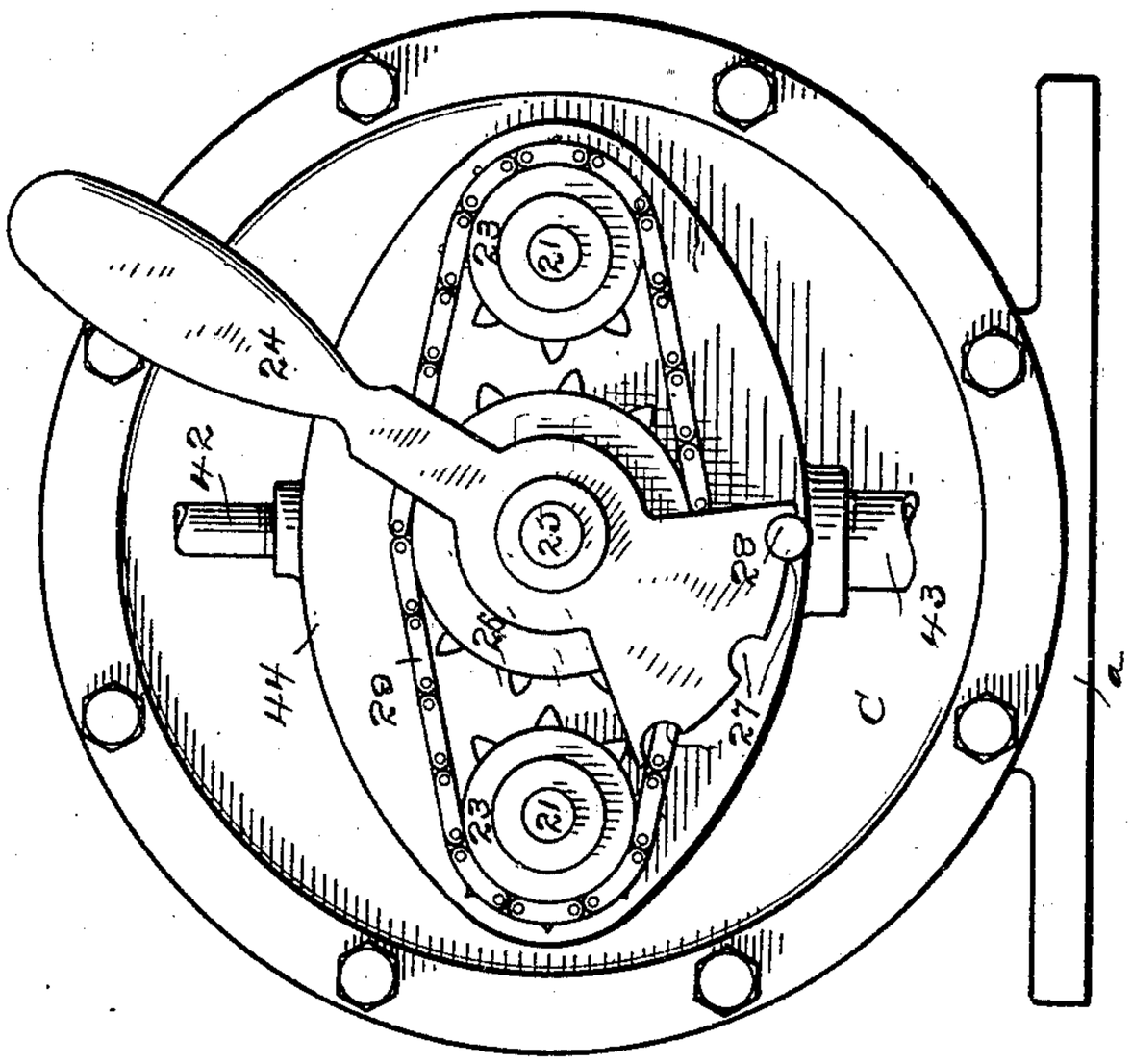
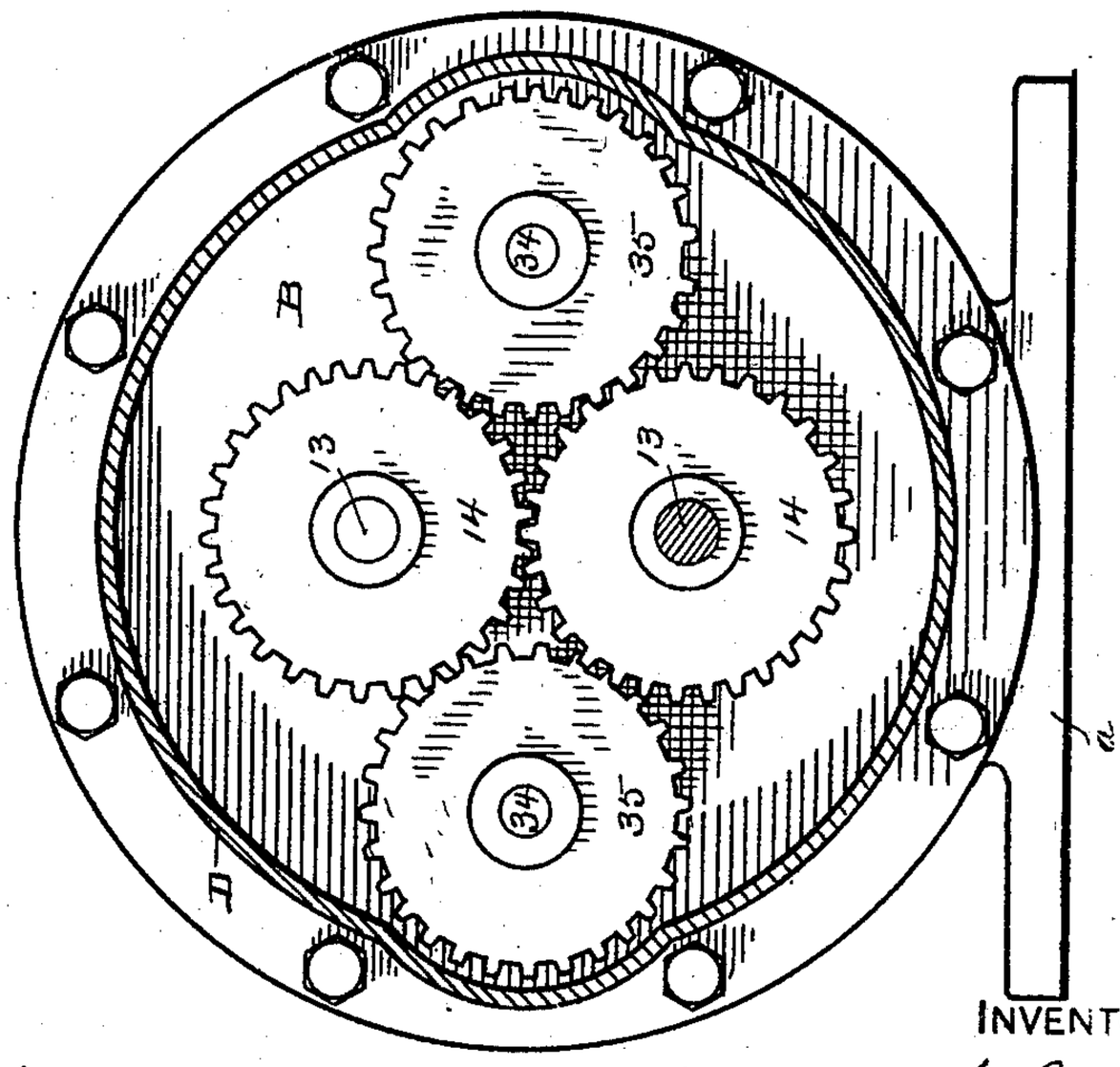


Fig. 2.



WITNESSES.

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Fig. 3.

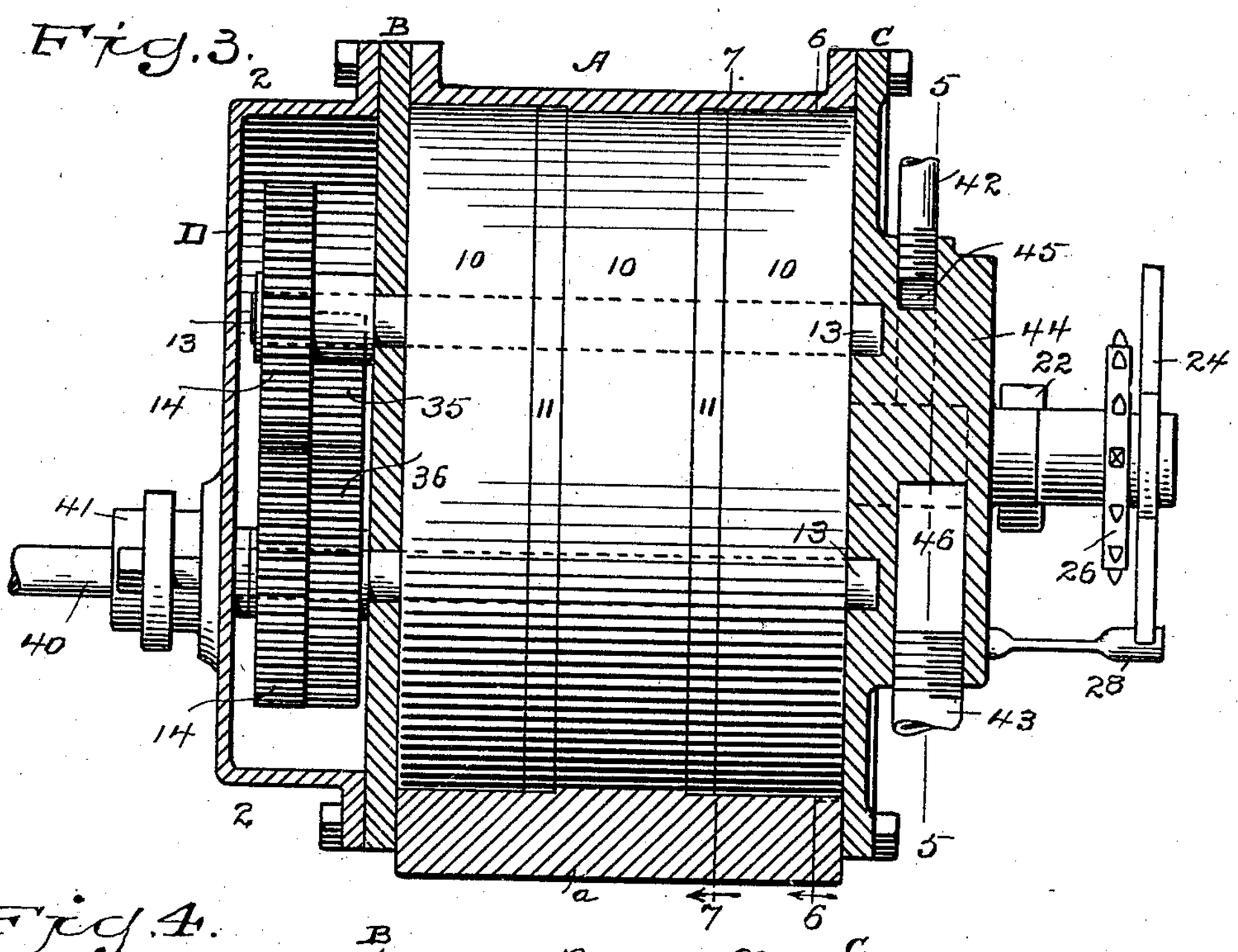

Fig. 4.

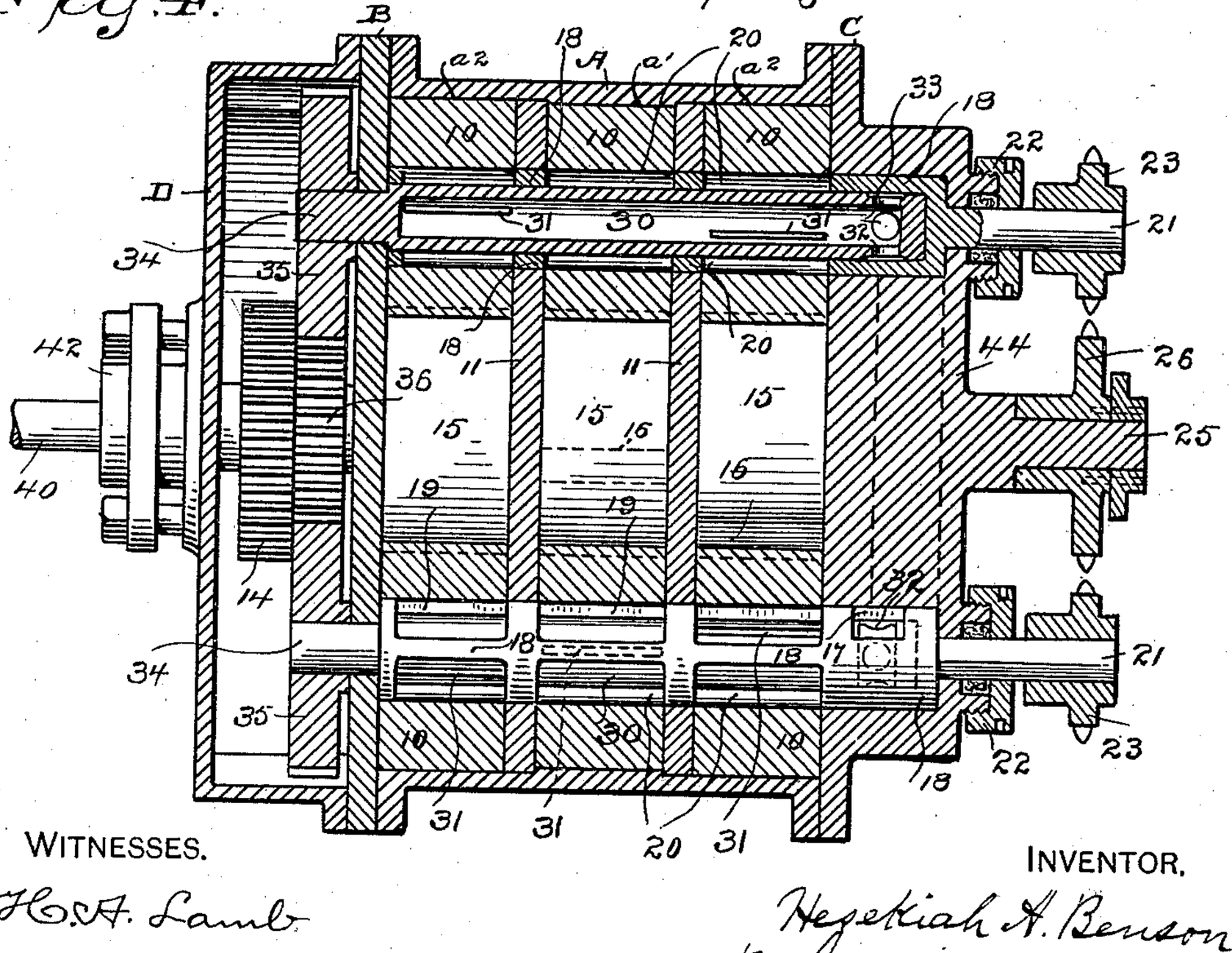

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Fig. 4.

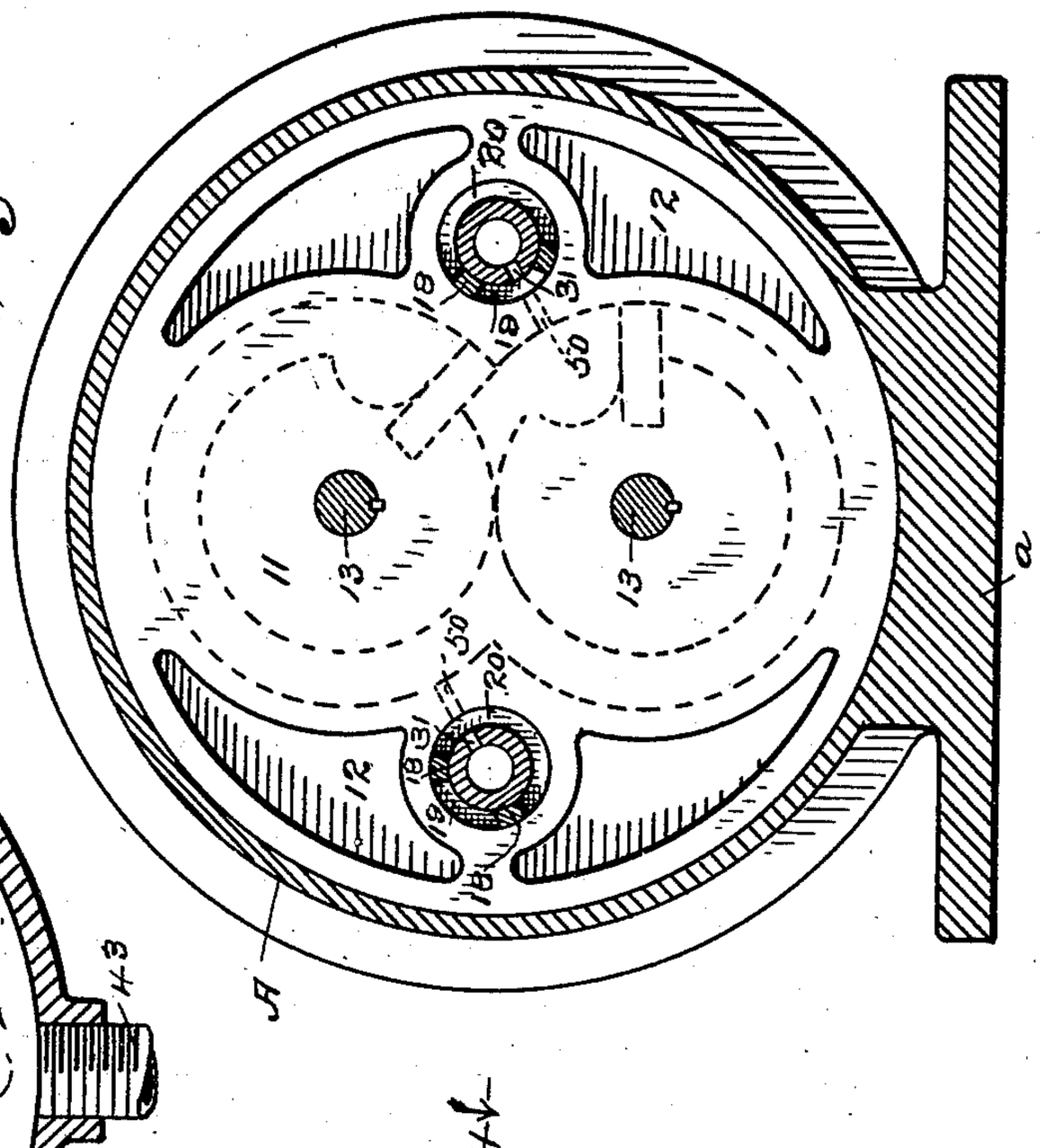


Fig. 5.

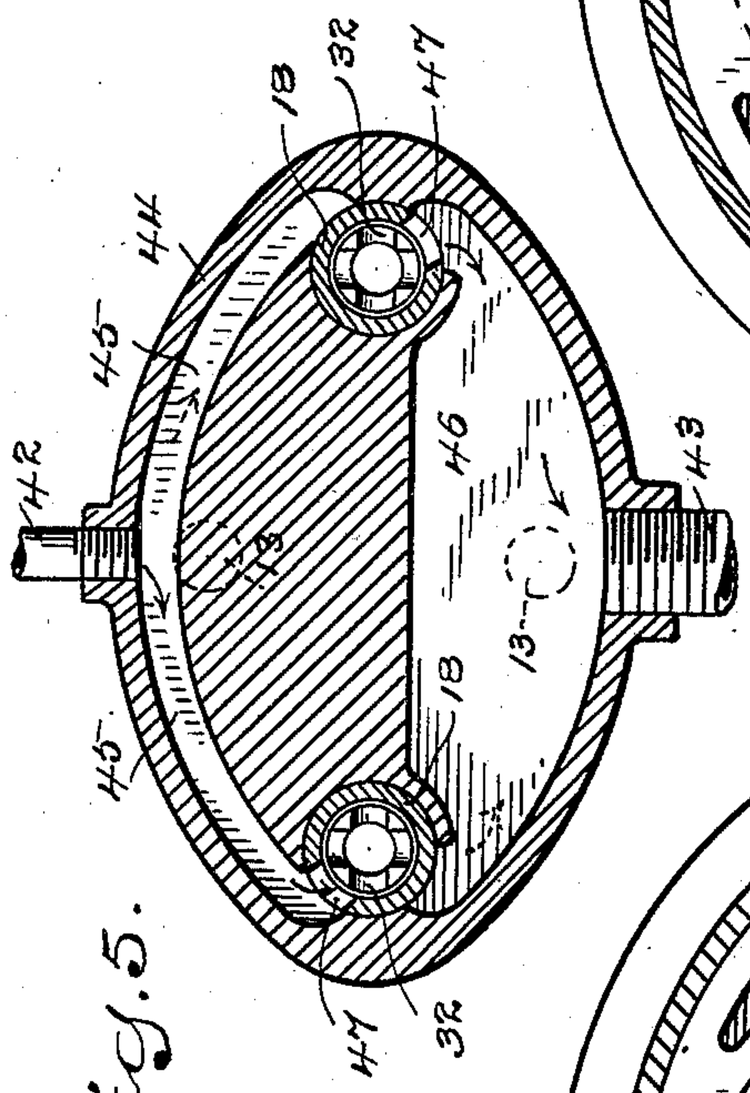
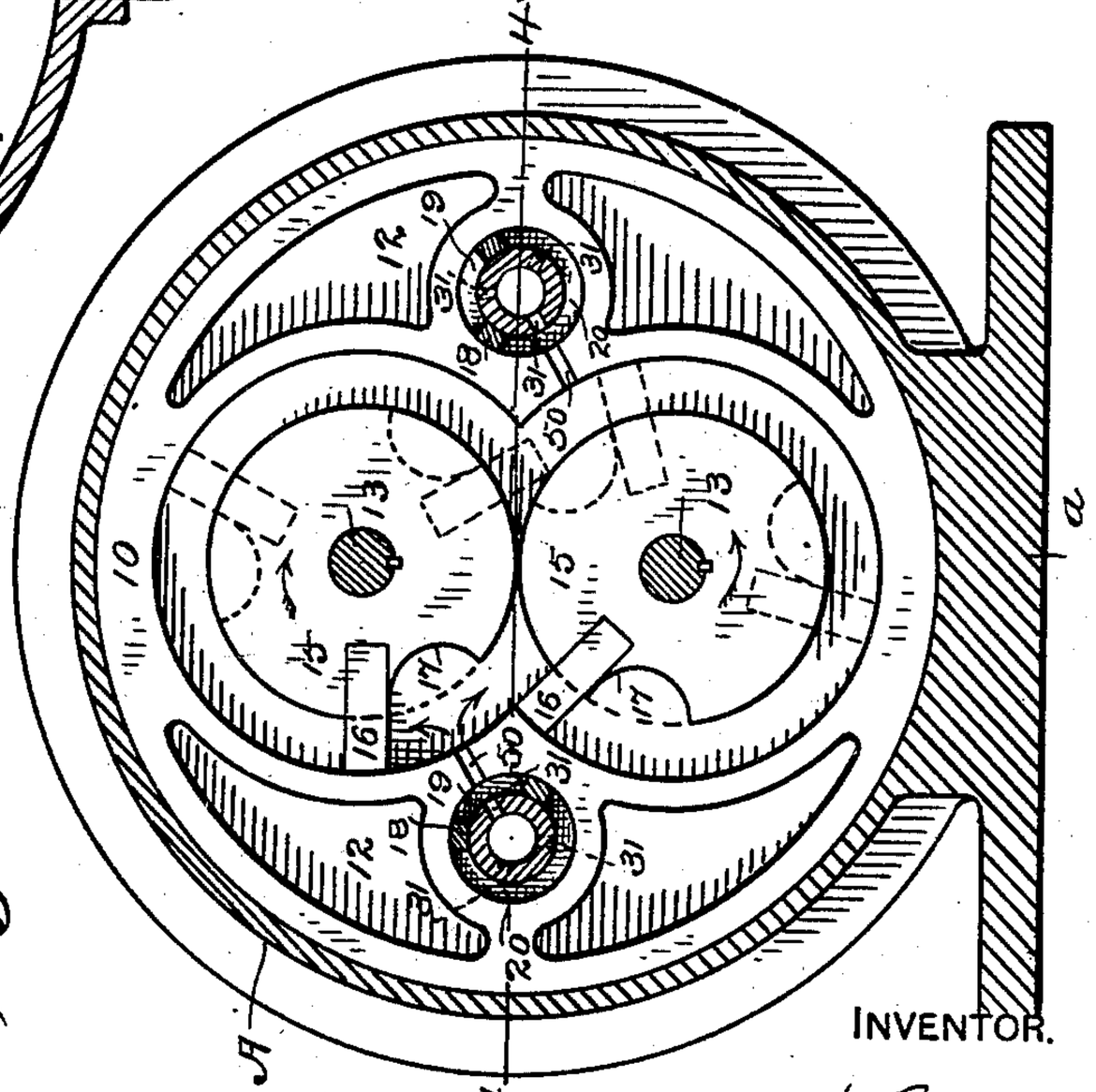


Fig. 6.



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UNITED STATES PATENT OFFICE.

HEZEKIAH A. BENSON, OF BRIDGEPORT, CONNECTICUT.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 679,937, dated August 6, 1901.

Application filed April 17, 1901. Serial No. 56,230. (No model.)

To all whom it may concern:

Be it known that I, HEZEKIAH A. BENSON, a citizen of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines of the type in which two rotary pistons are employed, each having a float adapted to enter a recess in the other, the two rotating with their peripheries in contact excepting when the floats are in the recesses.

While the invention may be applied to engines adapted to convert into motion the power from any fluid, I have designed it with particular reference to the use of steam as the working fluid, and I will hereinafter so refer to it.

The invention is of the type shown in my application filed October 5, 1900, Serial No. 32,138, and is in some respects quite similar thereto.

The invention consists in the construction and combinations of parts, substantially as hereinafter described and claimed.

In the accompanying drawings, Figure 1 represents an end view of the engine. Fig. 2 represents a section on the line 2 2 of Fig. 3. Fig. 3 represents a vertical central section through the casing in Fig. 1, but showing the principal parts inside of said casing as in elevation. Fig. 4 represents a horizontal section of the engine on the line 4 4 of Fig. 6, one of the valves being shown in plan. Fig. 5 represents a detail section on the line 5 5 of Fig. 3. Fig. 6 represents a section on the line 6 6 of Fig. 3. Fig. 7 represents a section on the line 7 7 of Fig. 3, the valves being shown in the reversed position from Fig. 6.

Similar reference characters indicate the same or similar parts throughout the several views.

The casing is composed of a central casting A, having a base *a* and provided with flanges to which the end castings B and C are bolted. Outside of the end casting B is a supplemental casting D, bolted thereto, the purpose of which will be hereinafter described. The interior of the space within the castings A, B, and C is occupied by three chambered castings 10, which are identical with each other and are separated from each other by partition-plates 11, said plates 11 dividing the space into three cylinder-chambers, in each of which are located a pair of coacting pistons, which will be presently described. The three chambers are provided in order that three pairs of pistons may be located therein, with their floats projecting in different radial directions in order to equalize or steady the action of the steam against them, the floats of the second or intermediate pair of the pistons being set one-third of the distance around from those of the first pair and the pistons of the third pair being set one-third of the distance around from those of the second pair, these relative spacings being indicated by the dotted lines in Fig. 6. As indicated in Figs. 6 and 7, the castings 10 and the partitions 11 may have spaces 12 formed therein for the sake of lightness.

Mounted in bearings in the end castings B and C are shafts 13, which pass through the cylinders and the partition-plates, said shafts being geared together by pinions 14 outside the end casting B. Keyed on the shafts 13 in each of the cylinders formed in the castings 10 are two pistons 15 in rolling contact with each other and each having a float 16 and a recess 17, the recesses being formed, as usual in this type of engine, to permit the floats to pass the opposing pistons. The three castings 10 and the two partition-plates 11 are held against each other within the casting A by the end castings B C without requiring other means for securing them in place. They are held with their chambers in alinement by the shafts 13 and the pistons carried thereby and by the valves and their sleeves, presently described. The central portion of the casting A is of slightly less diameter internally, as at a', than the portions a^2 each side thereof, and the central casting 10 is fitted within the portion a', while the two partition-plates 11 bear against the shoulders at the edges of said portion a'.

Two oscillating sleeves 18 are located in chambers formed therefor through the castings 10 and plates 11, one at each side of the center of the piston-chambers. Each of these sleeves is formed with ports, of which those indicated at 19 are the smaller and those indicated at 20 are the larger. Each sleeve is formed with a stem 21 at one end, which pro-

jects through a stuffing-box 22, carried by the casing, and has a sprocket 23 secured on its outer end. Pivoted on a stud 25, projecting from the casing between the stems 21, is a reversing-lever 24, and attached to said lever or formed integrally therewith is a toothed hub 26. The lower end of the lever 24 is formed with three notches 27, either one of which is adapted to receive a spring-catch 28 in order to hold said lever in its intermediate or either extreme position. A chain 29 is passed around the two sprockets 23 and is engaged by the teeth of the hub 26, whereby the two oscillating sleeves may be partially rotated simultaneously and in the same direction by means of the lever 24. Mounted within each sleeve 18 is a tubular valve 30, having each end closed and formed with elongated ports 31, one for each of the three cylinders, and the three ports being located equally distant from each other circumferentially. At one end the valve is provided with several holes or openings 32, which communicate with the ports of the steam-chest, hereinafter described. In order that neither of the holes 32 will ever become entirely obstructed or shut off, a groove 33 is formed in the outer surface of the valve and connects said holes. The other end of the valve is formed with a stem 34, projecting through the end casting B and having a pinion 35 secured to its outer end, said pinions and the valves being continuously rotated in the same direction by a pinion 36 on the lower shaft 13.

The power-shaft 40 is in alinement with the lower shaft 13 and may be formed integral therewith or may be coupled thereto. It passes through a stuffing-box 41, carried by the supplemental casting or casing D, which casing contains the intermeshing pinions 14, 35, and 36. No stuffing-boxes are employed in the end wall B, and hence a small amount of steam may escape into the casing D and serve to lubricate the pinions. A suitable opening may be provided to enable water of condensation to be drawn off from this casing.

The pipe for the supply of live steam is indicated at 42, and the exhaust-pipe at 43. These are connected with the steam-chest 44, preferably formed integrally with the casting C. The chest is formed with live-steam ports 45, leading from the pipe 42 to the chambers which receive the ends of the sleeves 18. Underneath these chambers communicate with the exhaust-space 46. The end of each sleeve opposite the ports 45 is formed with a port 47. The walls of the castings 10 are formed with ports 50, which connect the piston-chambers with the valve-chambers.

When steam is supplied through the pipe 42 and the lever 24 is swung to its extreme right or left position, said steam passes through the port 47, which is open (see Fig. 5) into the tubular valve at that side of the engine and through the ports 31 thereof, passing through these last-mentioned ports in the successive order in which they pass across the ports 19 of the sleeve surrounding the valve. It is to be borne in mind here that the sleeves 18 do not oscillate excepting for the purpose of reversing the engine or stopping it, as hereinafter described. The steam, passing through the ports 31 and 19, as just described, passes through the port 50 and acts upon the pistons and their floats to move them in the directions indicated by the arrows in Fig. 6. The steam in the cylinder-chambers behind the floats, which had given the preceding impulse to said floats, exhausts through the opposite port 50 and through the large port 20 of the sleeve 18 and through the port 31 into the other valve 30 and from the latter outward through the holes 32 and the port 47 of the sleeve 18, as indicated by the arrow in Fig. 5. Of course in operation the other two sets of pistons and floats are driven in the same manner, the steam acting on each pair of floats successively as the ports 31 of the valve which is acting to supply live steam follow each other in their time of passing across the ports 19 of the sleeve for that valve. In Fig. 6 I indicate by dotted lines the positions of the two ports 31 in those portions of the valve beyond the line of section on which the figure is drawn. When the lever 24 is moved to its other extreme position, the chain 29 oscillates the sleeves 18, so that the port 47 of the left-hand sleeve in Fig. 5 communicates with the exhaust-space 46 and the port 47 of the right-hand sleeve communicates with the live-steam port 45, and then the steam follows the course indicated by the dotted arrows in Fig. 5. This partial rotation of the sleeves causes the large port 20 of the left-hand sleeve in Fig. 6 to communicate with the port 50 adjacent thereto, and causes the small port 19 of the right-hand sleeve to connect with the port 50 on that side, as shown in Fig. 7. This, as will be obvious, will cause the pistons and floats to act in the direction the reverse of that indicated in Fig. 6. Throwing the lever 24 to the intermediate position moves the sleeves, so that the ports 47 of both of them are closed by the sides of the valve-chest, (indicated at 48.)

Having described the operation of the several parts of the engine, in connection with the description of the construction of such parts, further description of the operation will be unnecessary.

As will be seen, I have provided an extremely simple and operative rotary engine which is compact and yet powerful, light in weight, inexpensive to build, easy to assemble, readily reversible, and productive of no dead-point.

Having thus described my invention, I claim—

1. A rotary engine comprising in its construction a casing, a plurality of independent castings therein each having piston and valve chambers, intermediate partition-plates be-

tween said castings, and pistons and supply and exhaust valves located in their respective chambers in the said castings.

2. A rotary engine comprising in its construction a casing, a plurality of independent castings therein each having piston and valve chambers, intermediate partition-plates between said castings, and pistons and supply and exhaust valves located in their respective chambers in the said castings, the pistons being separated from each other by the partitions, and the shafts of the pistons and valves extending through said partitions.

3. A rotary engine comprising in its construction a cylindrical casing having its central portion of less diameter than its end portions, a chambered casting fitting said central portion, similar but larger chambered castings fitting the end portions of the casing, partition-plates separating the three castings, pistons in the chambers of the castings, and supply and exhaust valves.

4. A rotary engine comprising in its construction a casing provided with end walls and containing the pistons, and rotary valves, the shafts of the pistons and valves extending through one of said end walls and geared together outside of said wall, a casing inclosing said gearing, and a power-shaft extending through said casing and provided with a stuffing-box.

5. A rotary engine comprising in its construction rotary pistons, rotary valves, oscillatory sleeves for said valves, said sleeves being provided with sprockets 23, a chain connecting said sprockets and means for moving said chain, said sleeves being provided with ports for reversing the direction of the motive fluid.

6. A rotary engine comprising in its construction pistons, rotary valves, oscillatory sleeves inclosing said valves, and provided with ports for reversing the direction of the motive fluid, said sleeves having sprockets 23, a lever having a toothed hub mounted between said sprockets, a chain connecting the sprockets and engaging the teeth of said hub, and means for holding the lever in adjusted position.

7. A rotary engine comprising in its construction a casing, one end wall of which is formed with a steam-chest, pistons and valves in the casing, oscillatory sleeves inclosing said valves and having reversing-ports, the said valves and sleeves extending into said steam-chest.

8. A rotary engine comprising in its construction a casing having two end walls one of which is formed with a steam-chest, rotary pistons and valves in the casing and having stems or shafts projecting through one end wall and geared together, oscillatory sleeves inclosing the valves and having reversing-ports, the said valves and sleeves extending into said steam-chest.

9. A rotary engine comprising in its construction a casing having two end walls one of which is formed with a steam-chest, rotary pistons and valves in the casing and having stems or shafts projecting through one end wall and geared together, oscillatory sleeves inclosing the valves and having reversing-ports, the said valves and sleeves extending into said steam-chest, the said sleeves being provided with stems extending through and outside of the steam-chest and carrying means whereby they may be simultaneously oscillated.

10. A rotary engine comprising in its construction a casing having two end walls one of which is formed with a steam-chest, rotary pistons and valves in the casing and having stems or shafts projecting through one end wall and geared together, oscillatory sleeves inclosing the valves and having reversing-ports, the said valves and sleeves extending into said steam-chest, the said sleeves being provided with stems extending through and outside of the steam-chest, sprockets mounted on said stems, a lever having a toothed hub between said sprockets, and a chain connecting the sprockets and engaged by said toothed hub.

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

HEZEKIAH A. BENSON.

Witnesses:
A. M. WOOSTER,
S. W. ATHERTON.