W. BALL.

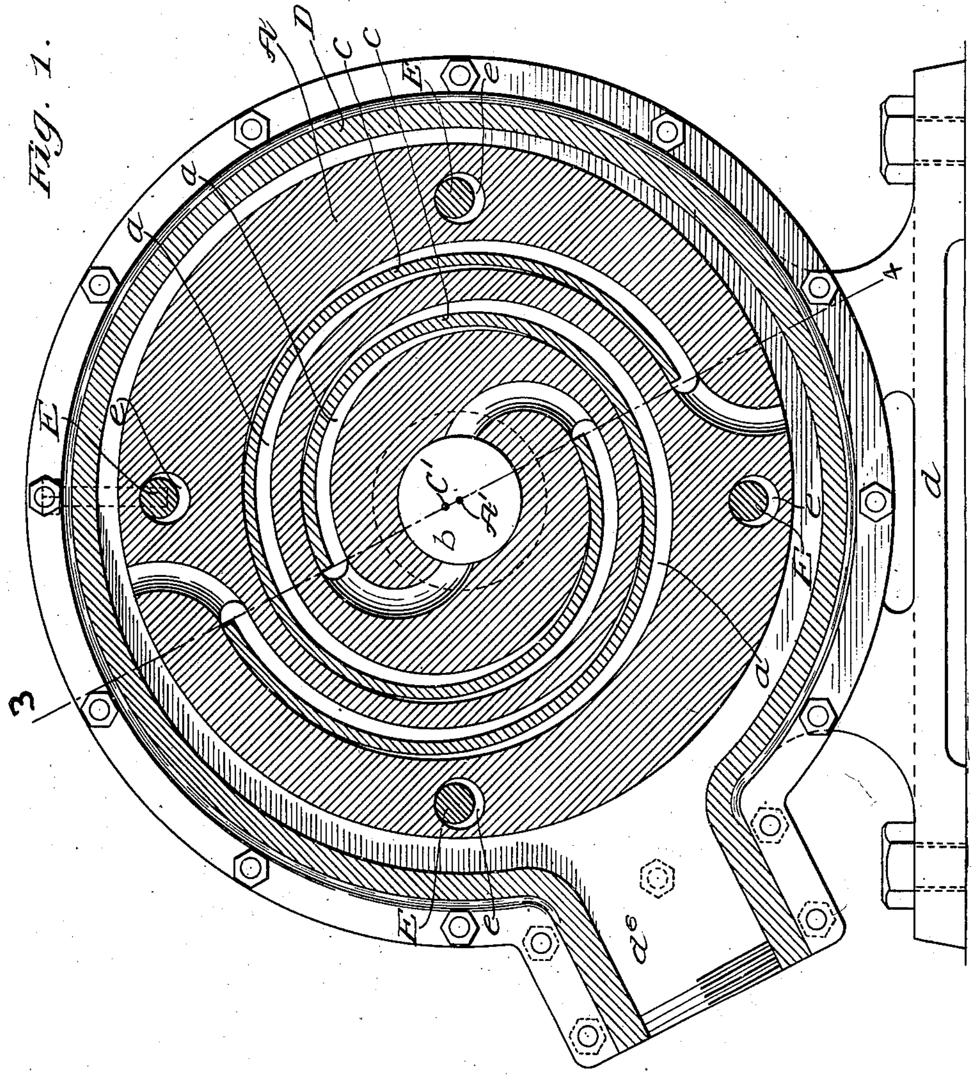
ROTARY ENGINE.

APPLICATION FILED MAR. 27, 1906.

1,041,721.

Patented Oct. 22, 1912.

3 SHEETS—SHEET 1.



Witnesses:
Charles D. Woodberry
Josephine H. Ryan

Inventor:
Walter Ball,
by Roberts, Roberts & Cushman,
Attys.

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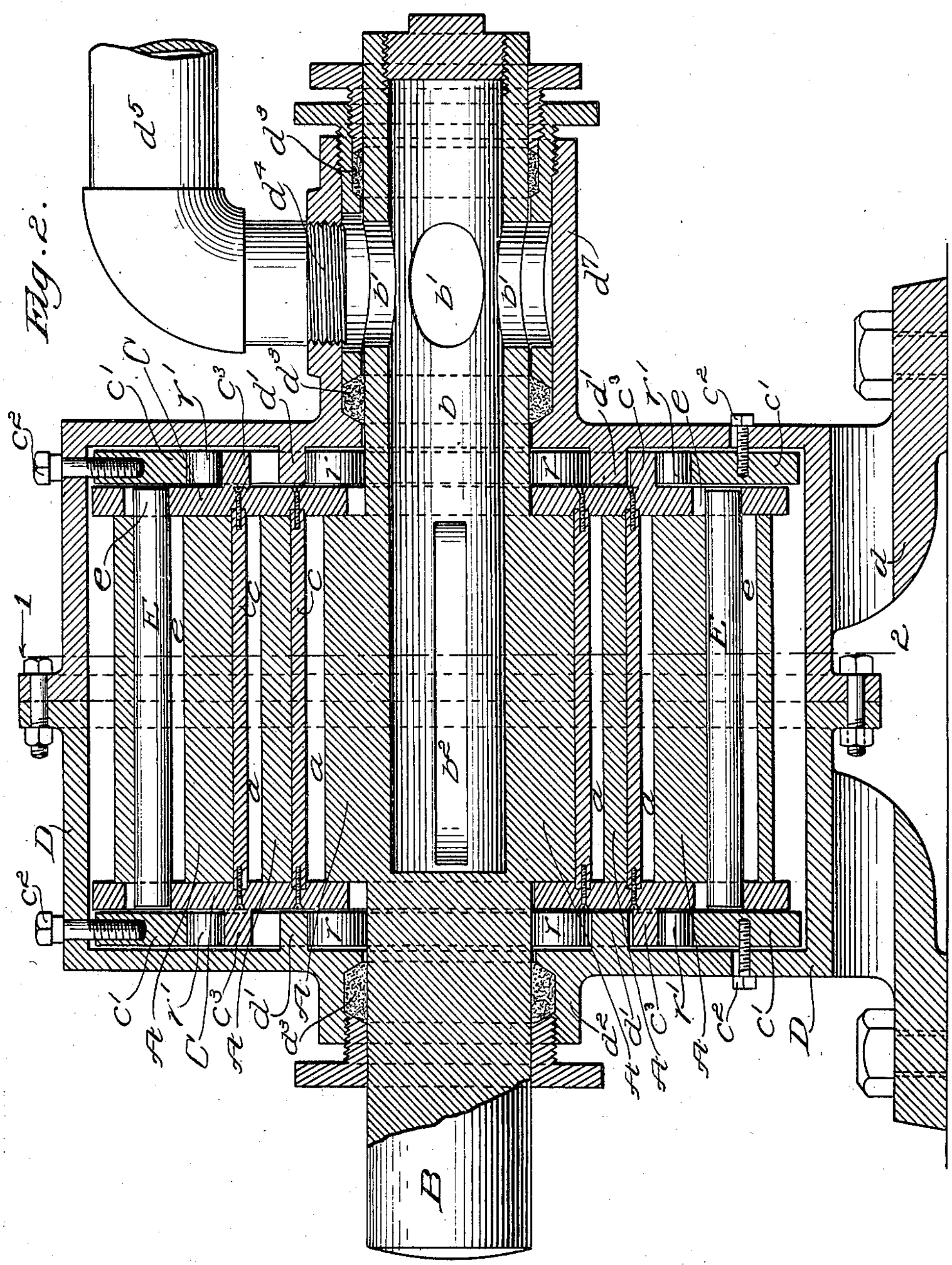
3 SHEETS—SHEET 2.

Fig. 2.



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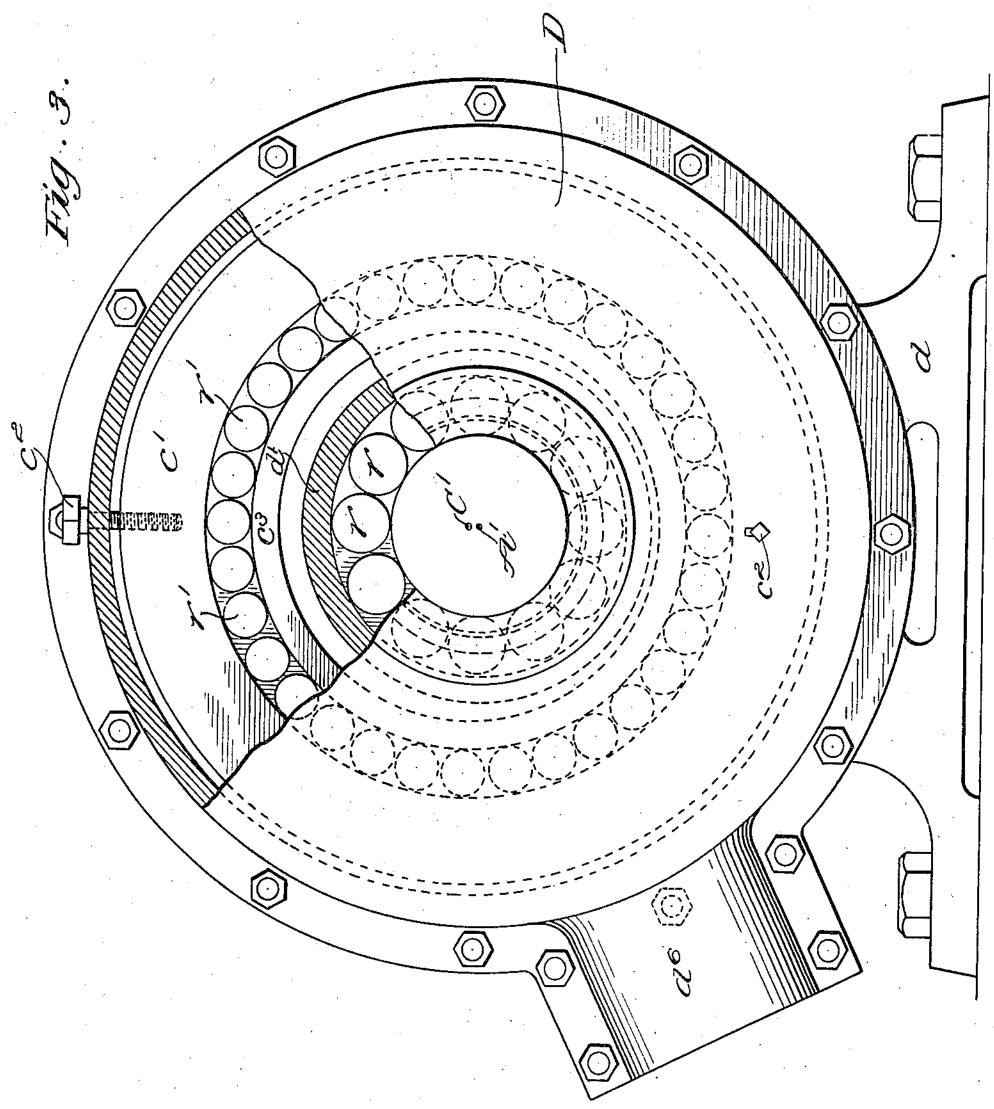
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

WALTER BALL, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO JOHN F. COOLEY, OF NEW YORK, N. Y.

ROTARY ENGINE.

1,041,721. Specification of Letters Patent. **Patented Oct. 22, 1912.**

Application filed March 27, 1908. Serial No. 423,705.

To all whom it may concern:

Be it known that I, WALTER BALL, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, the word engines being used in its broad sense including pumps, motors, and meters, and consists in the novel features hereinafter described and pointed out in the claims.

Referring to the accompanying drawings which illustrate one embodiment of my invention,—

Figure 1 represents a vertical cross section on line 1—2 of Fig. 2, of an engine embodying my invention, especially designed to be used as a liquid pump, Fig. 2 represents a longitudinal central section of the engine shown in Fig. 1 taken on line 3—4 of Fig. 1; and Fig. 3 is an end view, partly broken away, illustrating the roller bearings for the two rotary elements.

Referring to the drawings, A represents one of the two principal rotary elements, provided with a curved channel *a* which preferably describes a spiral path about the center of the element A. More than one curved channel may be provided and I have illustrated in the drawings two curved channels precisely similar to each other. The path of the curve of such channels may also be varied, but I have shown a spiral path as well adapted to the use of the engine as a pump. The rotary element A is mounted on a shaft B. The other principal rotary element is made up of the discoid members C, one at each side of the element A, having webs *c* extending between them and describing curves similar to the curve of the channels *a*, and contained within the channels *a*. The axis of the latter principal element is offset from the axis of the element A. Said axes are relatively fixed and are parallel with each other. The center of rotation, or the axis, of element A is shown at the point A′; and the center of rotation, or the axis, of the other element is shown at the point C′. The web *c* is of a width less than the width of the channel *a* by an amount equal to twice the offset between the axes of the elements and is at all positions of the elements tangent to the walls of the channel.

A casing D mounted on a suitable base *d* incloses and supports both rotary elements. The casing D is provided with annular inwardly extending projections d', forming bearing surfaces for roller bearings r held between said annular projections and the shaft B. The casing D is also provided with the exterior projection d^2 to accommodate the gland d^3, and the exterior projection d^7, accommodating similar glands d^3 and having an orifice d^4 with which a liquid supply pipe d^5 communicates.

The shaft B is made hollow as shown at b and is provided with a series of ports b' which successively register with the orifice d^4 as the shaft rotates. Ports b^2 connect the passage b with the inner ends of the spiral channels a. The outer ends of the spiral channels a communicate with the space between the rotary member A and the casing D. The casing D has an outlet port d^6.

The disk members C are provided on their outer sides with annular projections c^3 forming bearing surfaces for roller bearings r'. Bearing rings c' supported within casing D by means of adjusting screws c^2, form the opposite bearing surfaces for rollers r'.

To cause the two eccentric rotary elements to rotate together at equal angular velocities, they are coupled together by a plurality of cylindrical rollers E engaging circular bearing surfaces e in constant rolling contact therewith, the bearing surfaces e being distributed in each element in like angular and radial positions. The rollers E are less in diameter than the diameters of their respective bearing apertures e by an amount equal to the offset between the axes of the element. The elements will thus be caused to rotate together at equal angular velocities.

The operation of the device, when used as a pump, is as follows: Rotary motion is imparted in any manner from an external source of power to the rotary element A through shaft B. The other principal element is thereby also caused to rotate on its own fixed axis in the manner hereinbefore described, at the same angular velocity as the element A. The spiral webs c will roll upon the walls of the spiral channels a, as the webs and the walls of the channel are at all times tangent to each other the difference in radial distance between the elements at their points of contact being equal to the offset between the axes of the elements. There will also occur a slipping between the webs and the channels at the point of contact which in a full revolution will be equal to an amount corresponding to a circumference of a circle whose radius is equal to said offset. The point of tangency between the web and channel wall will progress relatively to the elements as the elements rotate, but will remain relatively fixed in relation to the plane of the relatively fixed offset centers of the elements. The broken line 5—6 represents the permanent plane in which said points of tangency will remain. As the point of tangency progresses with the rotation of the elements, the space between the web and the walls of the channel will progress correspondingly with relation to the elements and will draw in liquid through inlet pipe d^5, which is connected with a source of supply, whence the liquid will pass through chamber b in the shaft B, passage b^2, channels a, and be discharged from the outer ends of channels a into the space between the element A and the casing D and thence through outlet port d^6. During the operation above described the elements are assumed to have been rotating counter clockwise.

Obviously the engine may be rotated in reverse direction in which event the outlet port would become the inlet port and vice versa, and the course of the liquid would be the reverse of that just described; also while I have described its operation as a pump, obviously it could be used also as a motor or meter, and the word "engine" as used in the specification and claims is used in its broad sense, comprising pumps, motors and meters.

I claim:

1. In a rotary engine, two rotary elements mounted on parallel, relatively fixed axes offset from each other, a straight shaft, one of said elements being fast on said shaft, said element and shaft turning together as a single or integral part, said shaft supported in suitable bearings, and the other of said elements being supported by relatively fixed bearings whose axis is eccentric to the axis of said shaft, connection between said elements to cause them to rotate in the same direction at equal angular velocities, each of said elements being provided with spaced, curved walls, said walls forming a channel describing a curved path, the curved walls of each element projecting within the curved channel of the other element, said walls adapted as the elements rotate to remain tangent to each other, the point of tangency being progressive and remaining in the same plane with relation to a plane passing through the offset axes of the elements.

2. In a rotary engine, two rotary elements mounted on parallel, relatively fixed axes offset from each other, a straight shaft, one of said elements being fast on said shaft, said element and shaft turning together as a single or integral part, said shaft supported in suitable bearings, and the other of said elements being mounted in relatively fixed annular bearings surrounding said shaft but eccentric thereto, connection between said elements to cause them to rotate in the same direction at equal angular velocities, each of said elements having spaced, curved walls, said walls forming a channel describing a curved path, the curved walls of each element projecting within the curved channel of the other element, said walls adapted as the elements rotate to remain tangent to each other, the point of tangency being progressive and remaining in the same plane with relation to a plane passing through the offset axes of the elements.

3. In a rotary engine, two rotary elements mounted on parallel, relatively fixed axes offset from each other, a straight shaft, one of said elements being fast on said shaft, said element and shaft turning together as a single or integral part, said shaft supported in suitable bearings, and the other of said elements being mounted in relatively fixed annular bearings surrounding said shaft but eccentric thereto, connection between said elements to cause them to rotate in the same direction at equal angular velocities, each of said elements having spaced, curved walls, said walls forming a channel describing a curved path, the curved walls of each element projecting within the curved channel of the other element, said walls adapted as the elements rotate to remain tangent to each other, the point of tangency being progressive and remaining in the same plane with relation to a plane passing through the offset axes of the elements, and a casing inclosing both rotary elements and carrying said eccentric bearings one within the other, said casing providing a closed chamber communicating with said channels.

4. In a rotary engine, two rotary elements mounted on parallel, relatively fixed axes offset from each other, a straight shaft, one of said elements being fast on said shaft, said element and shaft turning together as a single or integral part, said shaft supported in suitable bearings, and the other of said elements being supported by relatively fixed bearings whose axis is eccentric to the axis of said shaft, connection between said elements to cause them to rotate in the same direction at equal angular velocities, each of said elements being provided with spaced, curved walls, said walls forming a channel

describing a curved path, the curved walls of each element projecting within the curved channel of the other element, said walls adapted as the elements rotate to remain tangent to each other, the point of tangency being progressive and remaining in the same plane with relation to a plane passing through the offset axes of the elements, and means to adjust the extent of offset between said axes.

5. In a rotary engine, two rotary elements mounted on parallel, relatively fixed axes offset from each other, a straight shaft, one of said elements being fast on said shaft, said shaft and element turning together as a single or integral part, said shaft supported in suitable bearings, and the other of said elements being supported by relatively fixed annular bearings surrounding said shaft but eccentric thereto, the element mounted on the shaft being provided with a channel describing a spiral path, said shaft being made hollow and the inner end of the spiral channel communicating with said hollow shaft, the outer end of said spiral channel opening through the periphery of said element, and the other of said elements having a wall describing a spiral path corresponding with the spiral path of the channel and projecting therein, said wall adapted as said elements rotate to remain tangent to the walls of the channel, the latter element being supported by annular bearings surrounding said shaft but eccentric thereto, and a casing inclosing both of said elements and carrying said shaft bearings and said eccentric annular bearings, said casing constituting a chamber spaced from the periphery of said element with which chamber the outer end of said spiral channel communicates, said chamber provided with a port.

Signed by me at Boston, Massachusetts, this 18th day of March, 1908.

WALTER BALL.

Witnesses:
ROBERT CUSHMAN,
CHARLES D. WOODBERRY.