(No Model.)

4 Sheets—Sheet 1.

J. H. DOW.

ROTARY ENGINE.

No. 360,766. Patented Apr. 5, 1887.

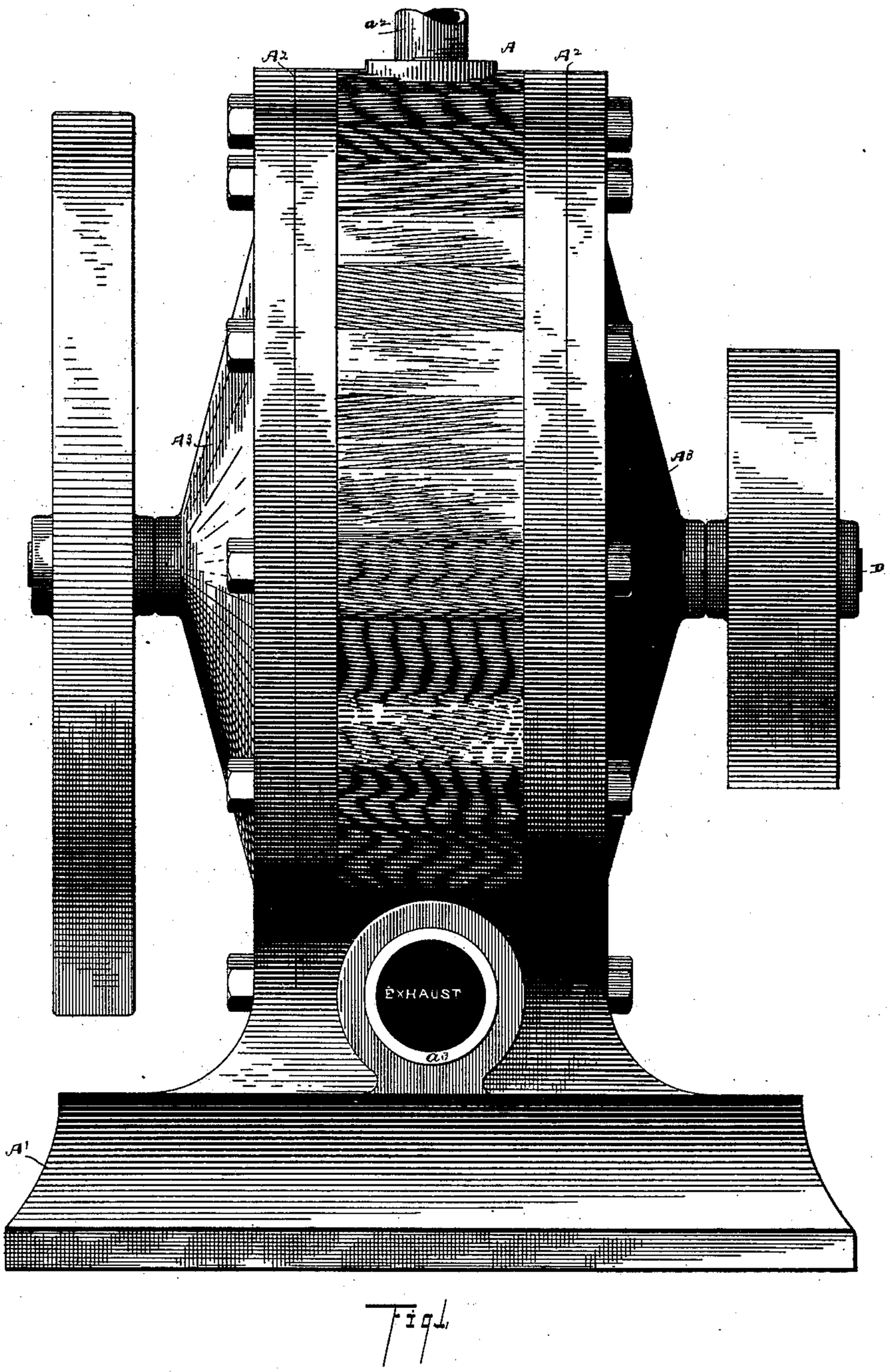

Fig. 1.

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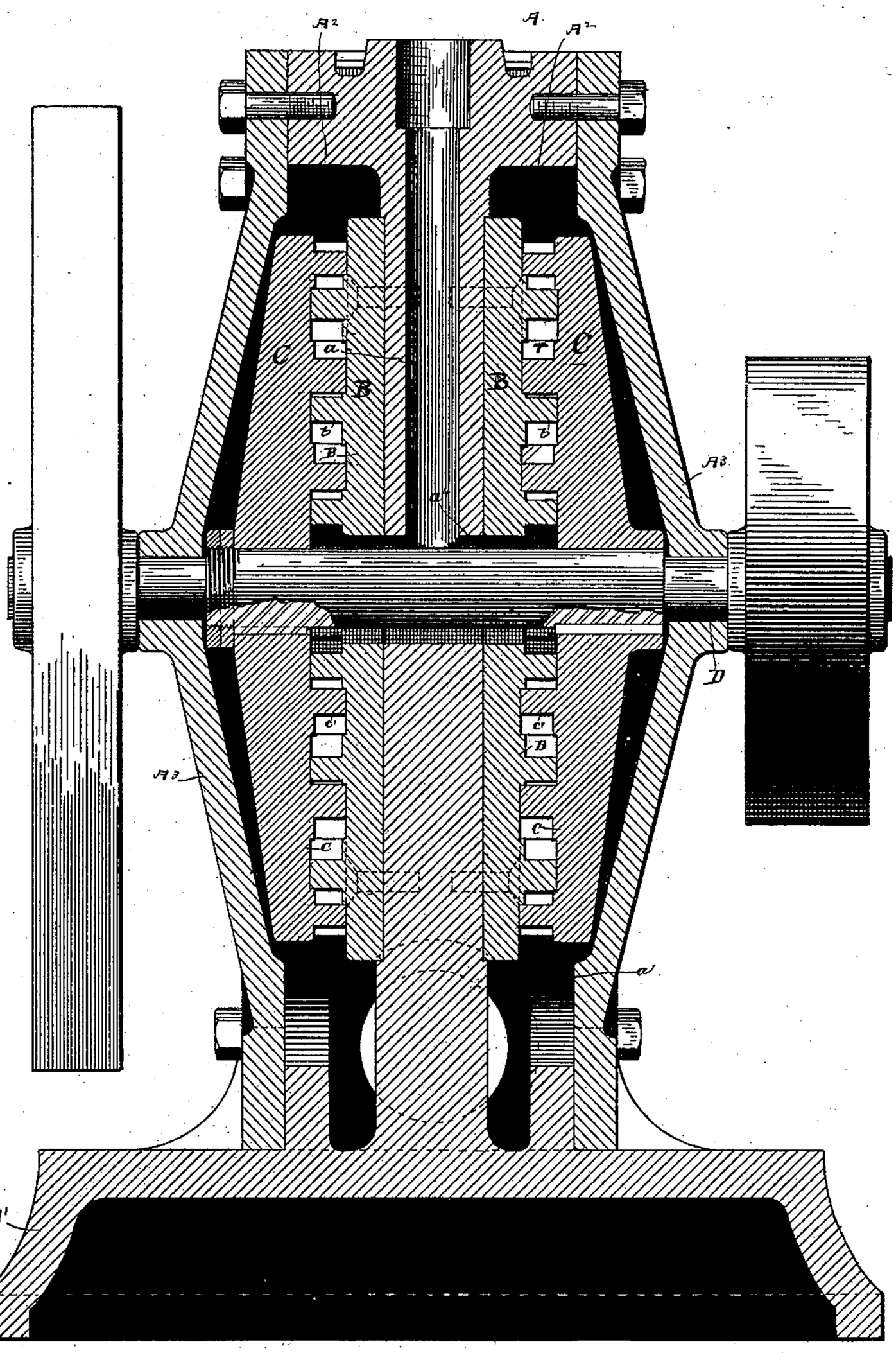

Fig. 2

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ROTARY ENGINE.

No. 360,766. Patented Apr. 5, 1887.

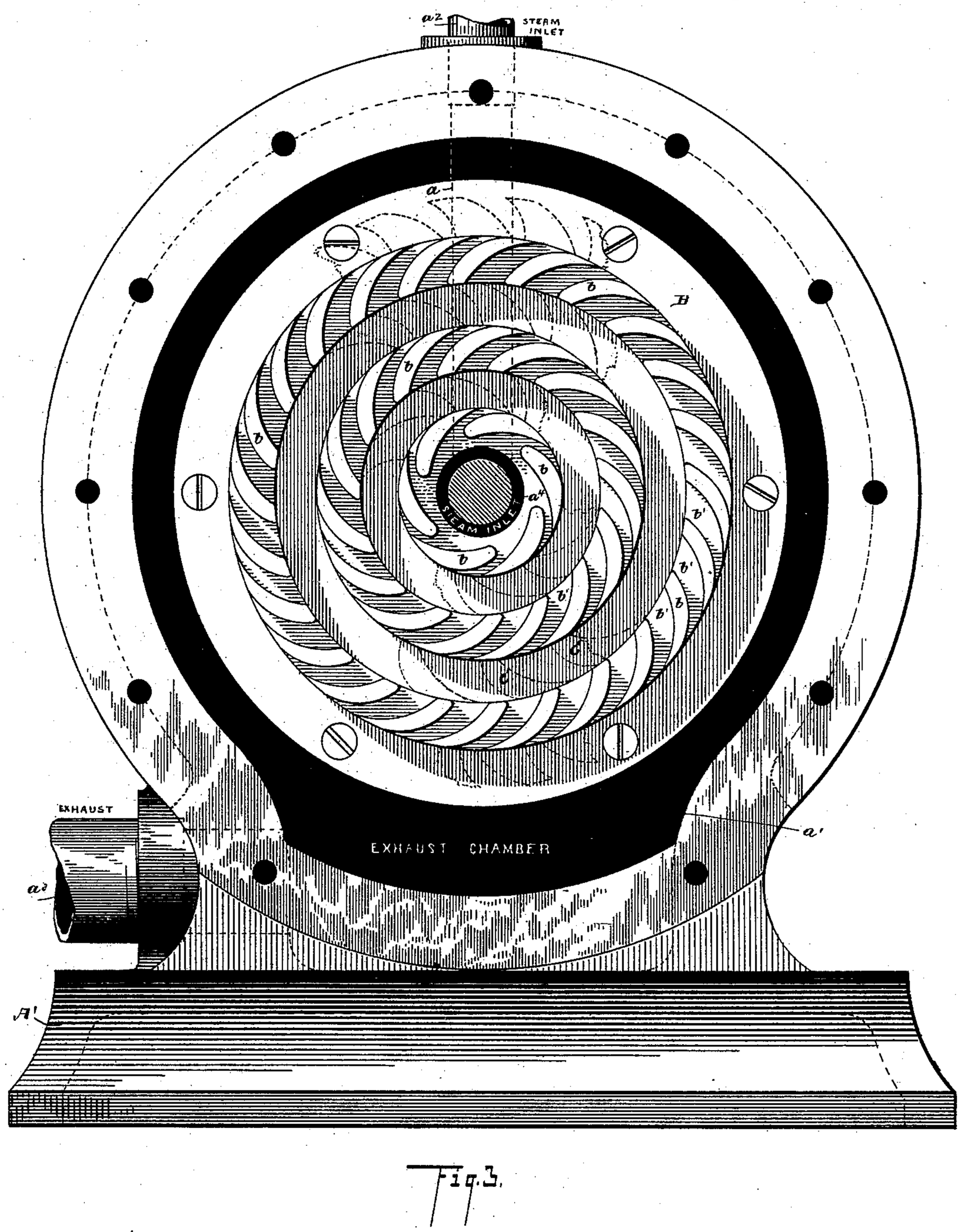

Fig. 3.

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ROTARY ENGINE.

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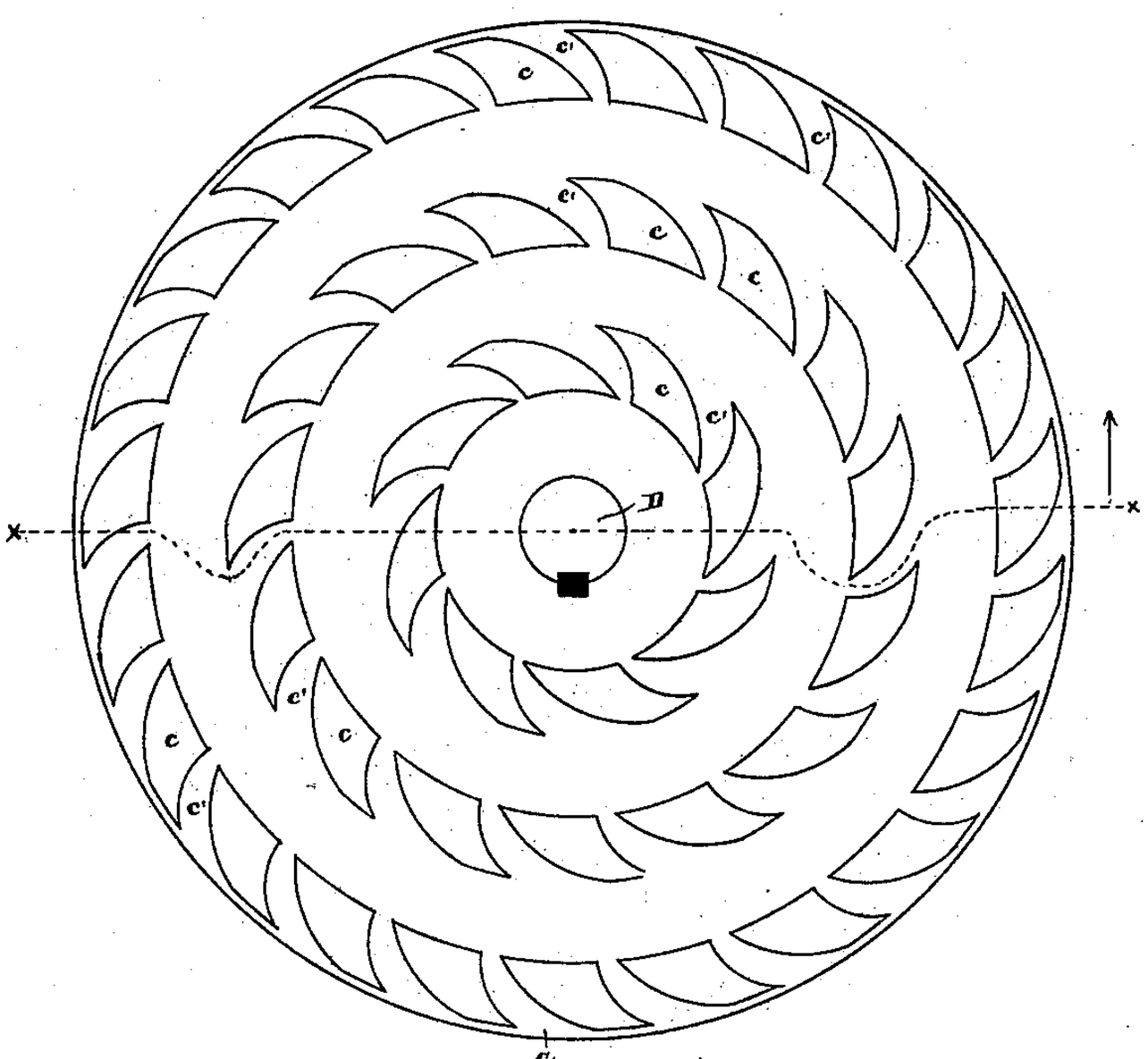

Fig. 4.

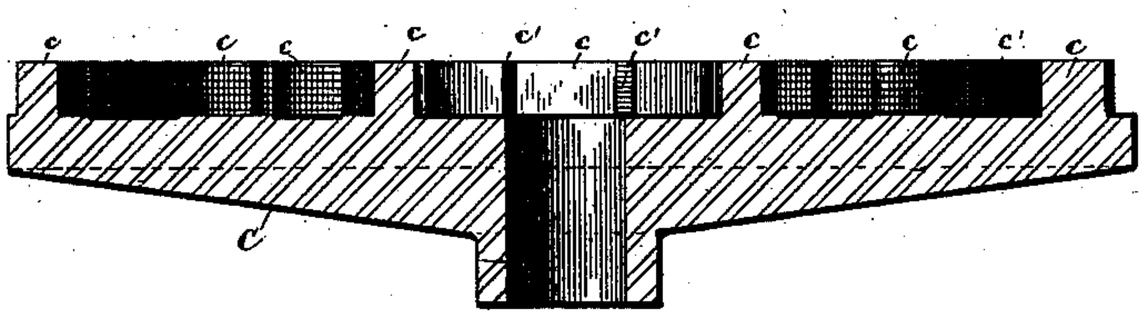

Fig. 5.

WITNESSES

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UNITED STATES PATENT OFFICE.

JOSEPH H. DOW, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO WILLIAM CHISHOLM, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 360,766, dated April 5, 1887.

Application filed December 23, 1886. Serial No. 222,392. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. DOW, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Rotary 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 pertains to make and use the same.

My invention relates to improvements in rotary steam-engines in which the engine is of the double variety, with an arrangement of parts made to balance the pressure of steam endwise of the shaft. The engine has two stationary disks facing outward and two rotating disks facing inward, the latter being mounted on a shaft in common, with means for adjusting one or both of the rotating disks endwise on the shaft, to the end that the parts are packed and the wear taken up by such adjustment. The stationary disks each have two or more series of curved chutes arranged on the face thereof, the chutes of each series being arranged in order concentric with the shaft. The rotating disks have, respectively, series of curved buckets arranged on the face thereof in order concentric with the shaft, such series corresponding in number with the series of the chutes, the different series of buckets being made to travel in annular paths between the respective series of chutes. The chutes are slightly separated the one from the other, leaving small curved passage-ways or vents between them, and the same arrangement is had with the buckets, the curves of these passage-ways respectively of the chutes and buckets being in reverse order. The chutes form cut-offs for the passage-ways of the buckets, and vice versa, by means of which the steam intermittently or in pulsations impinges upon the buckets at a suitable angle to propel the latter, and by means of the different series of chutes and buckets the direction of the steam is reversed from chute to bucket and from bucket to chute, and by reason of the greater area in the aggregate of the passage-ways of the successive larger series of buckets and chutes the steam is used expansively, to the end that a high speed of the engine is attained and great power is developed as compared with the amount of steam used, and that the friction and wear of the engine are merely nominal, and that the engine can be made at a greatly-reduced initial cost.

In the accompanying drawings, Figure 1 is a side elevation of my improved engine. Fig. 2 is an elevation in transverse section taken through the center of Fig. 1. Fig. 3 is an end elevation with the cylinder-head and revolving disk removed, but showing in dotted lines different relative positions of the buckets of the rotating disk. Fig. 4 is a diagrammatic view showing the arrangement of buckets of a rotating disk. Fig. 5 is an elevation in section, the section-line corresponding to the irregular line *x x*, Fig. 3.

A represents the body of the engine, the same terminating below in a supporting-base, A′, and having cylinders set in line with each other and presenting outward in opposite directions, together with covers A^3 for the respective cylinders. A steam-chamber, *a*, is cored in the casting, as is shown, and an exhaust-chamber, *a′*, the former having suitable steam-pipes, a^2, attached, and the latter being provided with suitable exhaust-pipes, a^3. The exhaust-chamber is in open relation with both cylinders, as shown.

B are disks that are set at the inner ends of the respective cylinders. In practice these disks will probably be cast integral with the body of the engine. The disks B have, respectively, two or more series of guide-wings, *b*, arranged on the face thereof in order concentric with the shaft D. These guide-wings of a series are slightly separated the one from the other, leaving small curved passage-ways, vents, or ports *b′* between the next adjacent guide-wings.

C are rotating disks, mounted on the shaft D in position facing inward and in close relation with the opposing disks B. The disks C have buckets *c*, arranged in concentric series, as shown, a series of buckets being made to fit in between the next adjacent series of guide-wings, the different buckets being separated to form curved passage-ways *c′*. When the parts are in position, the passage-ways *b′* and *c′* curve in reverse direction, as shown more clearly in Fig. 3. One of the disks C may

be secured rigidly to the shaft; but as no packing is used the other disk is adjusted accurately lengthwise of the shaft to bring the disks C in the desired close relation with the disks B. The ordinary groove and spline is employed to hold the adjustable disk from turning on the shaft, and by means of nuts *d* and *d'* the disk is brought to the desired adjustment and rigidly secured. The cylinder-head stands away from the disk C, leaving ample room for the steam that is discharged at the periphery of the disk to find its way to the exhaust-chamber *a'*. The openings at *a*⁴ around the shaft D, where the latter passes through the walls of the steam-chamber and through the disks B, are sufficient to admit the steam between the faces of the respective pairs of disks.

The passage-ways *b'* are flaring, the smaller part being the outer or discharging end, by reason of which the steam is not wire-drawn, but is delivered with full force to the buckets. The passage-ways, *c'*, between the buckets are flaring, but have the larger end presenting outward, by reason of which the steam, after delivering its blow upon the bucket, may expand, and by reason of such expansion gather momentum for impact with the next series of buckets. By reason of the rapid rotary movement of the engine and of the large mouths of the passage-ways *c'* and of the larger number of passage-ways between the guide-wings and buckets of the successive outer series, the steam discharged from a given passage-way *c'* of the inner series will be distributed to two or more passage-ways of the next series of chutes, thus giving the steam ample room for expansion between the different series of buckets. Now, if a continuous opening were had at any one time and at any place through the passage-ways of all the series of chutes and buckets, the steam would of course blow through and much of its force be wasted. In the upper portion of Fig. 3, with the position of buckets shown in dotted lines, the inner and outer series of buckets are cut off while the intermediate series is taking steam. In the lower portion of this figure the position is reversed, the inner and outer series of buckets being shown in position taking steam and with the intermediate series of buckets cut off. Now, while it is admitted that comparatively light blows are given by the impact of steam upon the buckets, these blows are very numerous and the velocity of the steam is great, and, by reason of the steam striking the bucket at an angle to the line of motion to the latter, a still greater velocity is given to the bucket, so that the high speed attained compensates for the small force of the steam acting at any given point.

The faces and sides of the buckets and guide-wings are turned off accurately, as is also the face of each disk between the series of buckets and guide-wings, so that the parts, when in position, fit as close as may be and allow the engine to turn freely. The engine, therefore, is approximately frictionless, and the wear is consequently reduced to a minimum.

As far as I am able to judge from careful experiments made thus far with an engine of the variety herein described that develops about six horse-power, substantially the same power is had from a given amount of steam at a given pressure as with an engine of the ordinary reciprocating variety, while my improved engine is much cheaper in initial cost, is more durable, and much less in size and weight than an ordinary engine of equal capacity.

The parts A², shown and described as cylinders, being considerable larger in diameter than the inclosed disk, might, if preferred, be made other than cylindrical in form—for instance, square, polygonal, or of other forms—and, so long as they inclose a disk-chamber of suitable size, would answer the purpose, and would evidently be within the purpose and spirit of my invention. I therefore do not wish to be understood as limiting myself to a cylindrical form of these parts, although I see no good reason for departing from such cylindrical form.

What I claim is—

1. In a rotary engine, the combination, with two disk-chambers set in line and presenting outward in opposite directions, and series of vents arranged at the inner end of each disk-chamber, of a shaft having its axis coincident with the common axis of the two stationary vent-plates, disks mounted on the shaft to operate in the respective disk-chambers, and series of buckets made on the inner faces of the disks and made to travel between or radially outside the series of vents, substantially as set forth.

2. In a rotary engine, the combination, with disk-chambers, shaft, vents, disks, and buckets, arranged substantially as indicated, of a steam-chamber located between the disk-chambers, and openings made around the shaft, such openings leading from the steam-chamber and discharging into the inner series of vents, thence discharging outward through all the alternate series of vents and buckets to the aforesaid disk-chambers, substantially as set forth.

3. In a rotary engine, the combination, with two disk-chambers, shaft, vents, disks, and buckets, and steam-chamber located between the disk-chambers, substantially as indicated, of an exhaust-chamber made in open relation with disk-chambers, substantially as set forth.

4. In a rotary engine, the combination, with disk-chambers, shaft, and steam-chambers, substantially as indicated, of a series of stationary vents located, respectively, at the inner end of each disk-chamber in concentric order with the shaft, and disks mounted on the shaft to operate in the respective disk-chambers, each disk having series of buckets made on the inner face thereof, to travel respectively between or radially outside the series of vents,

said vents and the bucket passage-ways being set in reverse curves, substantially as set forth.

5. In a rotary engine, the combination, with disk-chambers, shaft, and disk mounted on the shaft, substantially as indicated, of two or more series of stationary curved vents located, respectively, at the inner ends of the disk-chambers, and buckets arranged in series on the inner faces of the disks, to travel between or radially outside the different series of vents, said buckets being made to overlap the exit end of vents of the next inner series to form cut-offs for the latter, substantially as set forth.

6. In a rotary engine, the combination, with disk-chambers, shaft, disks, and buckets, substantially as indicated, of flaring vents having their smaller ends presenting outward, and flaring passage-ways made between the buckets, said passage-ways having their larger ends presenting outward, substantially as set forth.

7. In a rotary engine, the combination, with disk-chambers, vents, shaft, disks, and buckets, substantially as indicated, of suitable mechanism, preferably as shown, for adjusting one or both of the disks lengthwise of the shaft, substantially as set forth.

8. In a rotary engine, the combination, with disk-chambers and shaft and a steam-chamber located between the disk-chambers, of two or more series of buckets which run between or radially outward from corresponding series of stationary vents, substantially as described.

In testimony whereof I sign this specification, in the presence of two witnesses, this 29th day of November, 1886.

JOSEPH H. DOW.

Witnesses:
CHAS. H. DORER,
ALBERT E. LYNCH.