No. 889,583. PATENTED JUNE 2, 1908.

F. A. CLEVELAND.

ROTARY ENGINE.

APPLICATION FILED APR. 9, 1908.

2 SHEETS—SHEET 1.

FIG. 1.

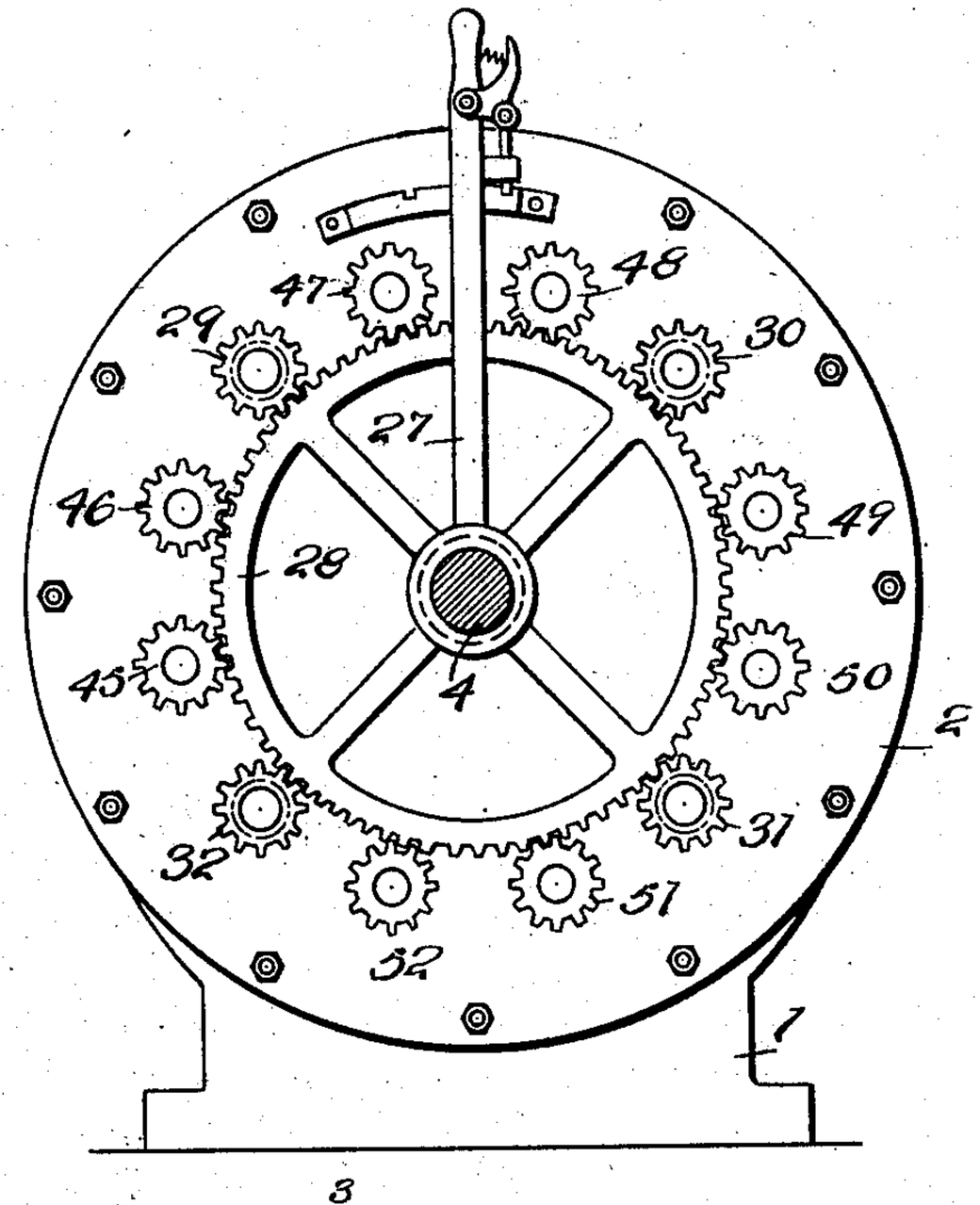
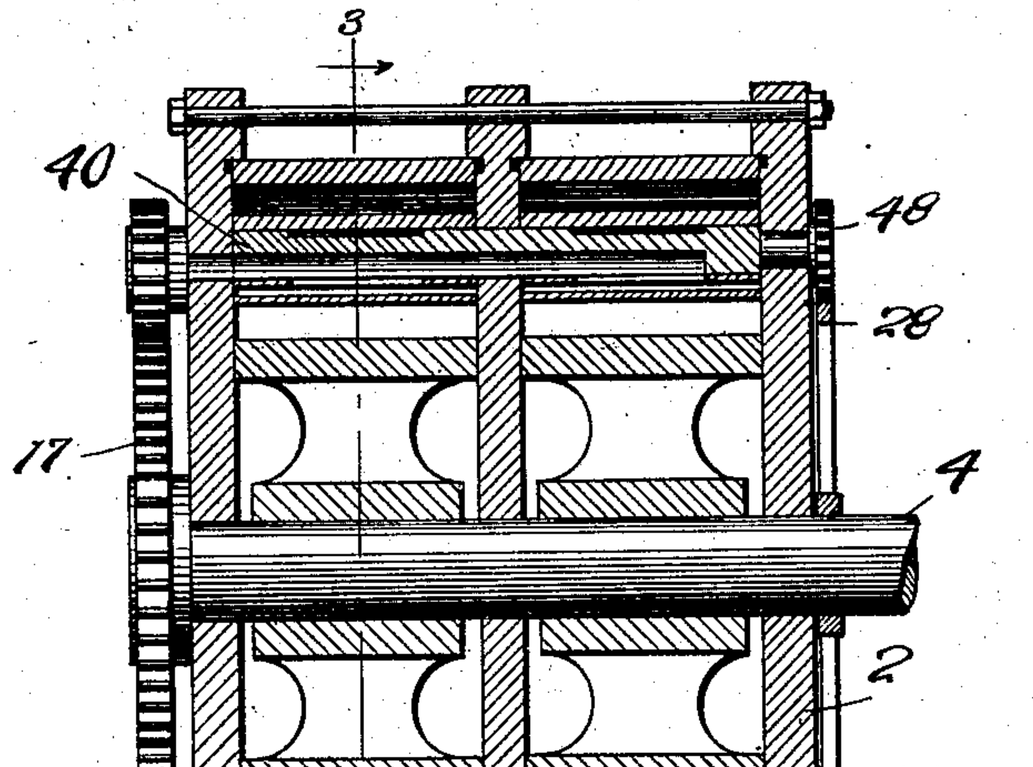


FIG. 2.



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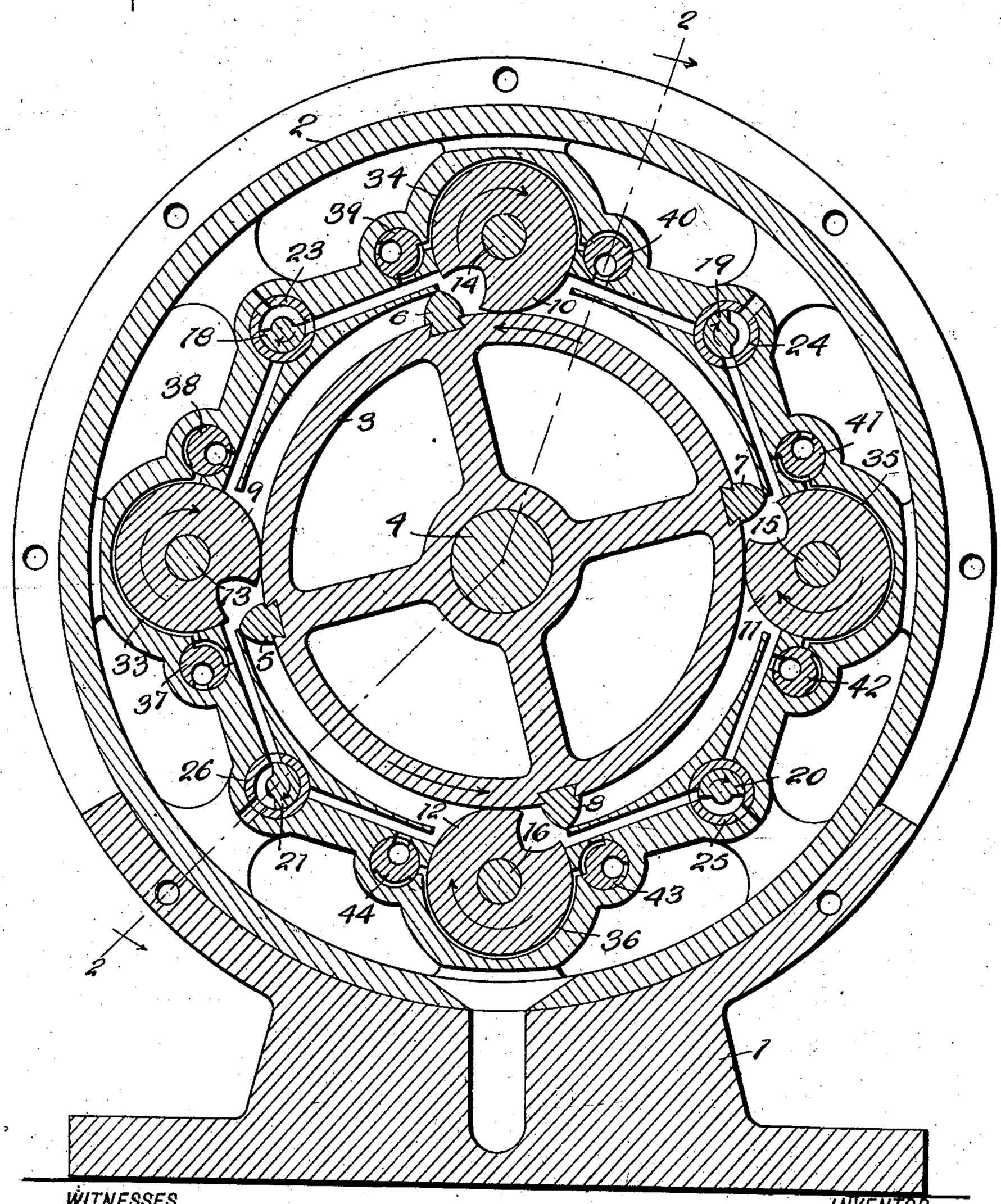
2 SHEETS—SHEET 2.

Fig. 3.



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ROTARY ENGINE.

No. 889,583. Specification of Letters Patent. Patented June 2, 1908.

Application filed April 9, 1908. Serial No. 425,990.

To all whom it may concern:

Be it known that I, FREDERICK A. CLEVELAND, a citizen of the United States, and resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, the object being to provide an engine of this type in which the steam may operate upon the rotary cylinder at several different points to produce a rotary movement thereof.

This invention relates more particularly to the valve construction and also to the arrangement of the valves by means of which the steam is utilized in the most economical manner.

In the form of engine which I have adopted to illustrate my invention in this application, I have provided a pair of rotary cylinder cores each positioned in a cylindrical chamber. These cylinder cores are each provided with a number of projections or wings against which the steam operates to impart a rotary movement to a cylinder core. A number of abutting cores are positioned so as to rotate in contact with the cylinder cores and separate the spaces between adjacent projections or wings so as to form inclosures into which the steam may be admitted to operate upon the projections and cause a rotary movement of the cylinder cores. The admission of the steam to these several inclosures is controlled by valves of peculiar construction which will be more fully described hereinafter. The abutting cores above described are provided with recesses so formed as to allow the projections or wings to pass therethrough as the abutting cores are rotated with the cylinder cores, thus permitting a continuous rotation of the latter.

The several cores may be operatively connected together by suitable mechanism and caused to rotate together relatively so that the projections from the cylinder core and the recesses in the abutting cores will come together at the proper points to permit the projections to pass successively through the several recesses as stated and in continuous contact therewith. At other points in the cycle of rotation the outer ends of the projections or wings are in contact with the inner surface of the cylindrical chamber in which the aforesaid cylinder core is positioned, thus forming an inclosure on either side of each of the projections or wings. Means are provided for admitting steam to the inclosure on either side of each of the projections or wings in order to produce a rotation of the cylinder core in either direction as may be desired.

Exhaust valves of peculiar construction, as will be more fully described hereinafter, are provided.

By placing the projections or wings of the cylinder cores at such intervals of space that they will pass through the abutments and recesses at consecutive intervals of time instead of passing through the several abutments or recesses simultaneously, or by placing two or more of these sets of cores end to end on common shafts and arranging the valves so that the steam may be admitted at different points in the cycle of rotation of the several cylinders, it will be evident that one or more of the projections or wings upon the cylinder cores will always be in a position to be acted upon by the steam and, consequently, dead centers are avoided and the engine may be started at any point. This latter arrangement is shown in the drawings.

By the arrangement as shown of the projections or wings in such manner that all of the projections or wings upon the same cylinder core will pass through the several abutting cores synchronously it will be seen that the steam will operate upon all sides of the cylinder core at the same time and with the same pressure, and, consequently, the cylinder core will be balanced and side thrust will be avoided, thus producing an even and smooth rotation resulting in a great saving in losses due to friction and also in wear upon the bearings.

In an engine in which the projections or wings pass through the recesses at successive intervals of time this balancing effect may be obtained by so arranging two or more sets of cylinders upon a common shaft that the pressure may be equalized.

Provision is also made for balancing the steam pressure against the abutting cores and for utilizing the steam pressure to hold

the abutting cores and the cylinder core in contact without loss in expansive force of the steam so utilized, as will be more fully described hereinafter.

Other objects will be in part obvious and will in part appear hereinafter in connection with the drawings accompanying this specification.

Like parts have been given similar reference numbers in the several views.

Figure 1 is an end view of an engine such as described which illustrates my invention. Fig. 2 is a sectional side elevation of the engine taken on the line 2—2 of Fig. 3. Fig. 3 is an enlarged sectional end view taken through the center of one of the cylinders.

A suitable support is shown at 1 upon which is mounted a casing or housing 2. In this casing or housing I have provided a cylinder core 3 mounted upon a suitable shaft 4 which may be journaled in the ends of the casing 2. The cylinder core is provided with a number of projections or wings, such as 5, 6, 7, and 8, which may be secured thereto by any suitable means. Abutting cores, such as 9, 10, 11 and 12, corresponding in number to the number of projections or wings, are mounted upon suitable shafts, such as 13, 14, 15 and 16, respectively, so that the periphery thereto is in contact with the periphery of the cylinder core 3. These abutting cores are each provided with a suitable recess therein so positioned and preferably of such form and shape as to permit the projections or wings to pass therethrough in contact with the walls thereof. This permits a complete and continuous rotation of the cylinder core 3, as the abutting cores are rotated simultaneously with the cylinder core by means of gears which are connected to the ends of each of said shafts 13, 14, 15 and 16, respectively, and are rotated by means of the gear 17 which is mounted on the shaft 4, which is shown in Fig. 2. The aforementioned gears meshing therewith and which rotate the said shafts 13, 14, 15 and 16 do not show in this view. The recesses in the abutting cores are so positioned that as said cores are rotated as described the projections or wings on the cylinder core pass simultaneously therethrough, as shown in Fig. 3.

Rotary valves, as shown at 18, 19, 20 and 21 are positioned intermediary of the abutting cores above described. These valves are rotated simultaneously by means of gears meshing with the gear 17 mounted on the shaft 4, one of said gears being shown at 22 in Fig. 2. These gears are of such a size that the valves rotate with relation to the cylinder core in the ratio of four to one. Cylindrical valve casings, shown at 23, 24, 25 and 26 positioned on each of the aforesaid rotary valves 18, 19, 20 and 21 respectively, are adapted to be oscillated by means of the reversing lever 27 shown in Fig. 1, which is attached to a large gear 28 meshing with smaller gears 29, 30, 31 and 32 which are attached to each of the aforesaid cylindrical valve casings 23, 24, 25 and 26 respectively. By this means the steam may be directed to either side of the projections or wings of the cylinder core to cause a rotation thereof in either direction, as will be readily understood by reference to Fig. 3. The amount of steam to be admitted is also controlled by providing several positions for the lever 27, as shown in Fig. 1.

In order to insure a more perfect contact between the cylinder core 3 and the abutting cores 9, 10, 11 and 12, and also to remove the side thrust upon the shaft bearings of the abutting cores, a chamber is provided on the side each of the abutting cores opposite to the cylinder core 3, as indicated at 33, 34, 35 and 36, respectfully in Fig. 3. Provision is made for admitting steam to these chambers by means of oscillating valves, such as 37 and 38 for the chamber 33; 39 and 40 for the chamber 34; 41 and 42 for the chamber 35; and 43 and 44 for the chamber 36. The steam so admitted to these chambers being at the same pressure as that in the cylindrical chamber will operate against the abutting cores and hold the same in contact with the cylinder core 3, thus automatically preserving a steam tight joint between the several cores while the steam in the cylindrical chamber in which the cylinder core 3 is positioned is operating thereupon to produce a rotary movement thereof as described. The valves 37 and 38 are oscillated by means of gears such as 45 and 46, respectively, which mesh with the gear 28 which is in turn oscillated by the reversing lever 27, as already explained and shown in Fig. 1. The valves 39 and 40 are oscillated in a like manner by means of the gears 47 and 48 the valves 41 and 42 by means of the gears 49 and 50 and the valves 43 and 44 by means of the gears 51 and 52, respectively. Exhaust openings are provided as shown in Fig. 3 in the valves 37, 38, 39, 40, 41, 42, 43 and 44. These openings are so arranged as to register with openings in the casing communicating with the respective steam chambers ahead of the projections 5, 6, 7 and 8.

It will be seen from the drawings, Fig. 3, that these valves 37 to 44 are arranged to operate in pairs, one of each pair operating as an admission valve to control the admission of live steam to the chambers 33, 34, 35 and 36 while the other valve of the pair operates as an exhaust valve.

When the engine is reversed by throwing the lever 27 these valves are rotated and then operate in a similar manner but on opposite sides of the abutting cores; that is, the admission valve then operates as an exhaust valve and the exhaust valve as an admission valve. This same movement of the reversing lever 27 also throws the cylindrical valves

23, 24, 25 and 26 so as to admit the live steam to the opposite side of the projections 5, 6, 7 and 8, respectively, as already explained.

The two sets of cylinders and abutting cores shown in Fig. 2 may be so arranged that the corresponding projections 5, 6, 7 and 8 of the cylinder cores stand intermediary of one another and, consequently, one set is always in position to be operated upon by the entering steam and start the engine and also provides when operating for a continuous steam pressure rotating the cylinder cores.

From the position shown in Fig. 3 the steam is beginning to be admitted through the rotating valves 18, 19, 20 and 21 to one side of the projections 5, 6, 7 and 8 and at the same time is admitted through the valves 37, 39, 41 and 43 to the chambers 33, 34, 35 and 36 at the rear of the abutting cores 9, 10, 11 and 12, respectively, thus holding these abutting cores in contact with the cylinder 3 and also balancing the steam pressure from the opposite side of these abutting cores.

The operation of the steam against the projections 5, 6, 7 and 8 simultaneously causes a rotation of the cylinder core 3. The chamber in advance of these projections is open through the exhaust openings in the valves 38, 40, 42 and 44, respectively, preventing any compression or retardation of the rotation of the cylinder core 3.

It will thus be seen that I have provided a very efficient and simple construction which may be adapted with slight changes in design to engines in which compressed air and various other sources of power is used with equally good results.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention designed without departing from the scope thereof, I intend that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative merely of an operative embodiment of my invention and not in a limiting sense.

What I claim is:

1. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylindrical chamber outside of said cylinder core into a plurality of steam chambers, a plurality of valves each adapted conversely to admit the steam to either end of one of said steam chambers to cause a rotation of said cylinder core in either direction, and a plurality of exhaust valves positioned and arranged to operate conversely in pairs in conjunction with said last named valves to permit the exhaust of the steam from the opposite end of said steam chambers.

2. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylindrical chamber outside of said cylinder core into a plurality of steam chambers, a plurality of rotary admission valves positioned intermediary of said abutting cores adapted to be rotated at a predetermined relative speed simultaneously with said cylinder core, a plurality of valve casings each arranged to operate in conjunction with one of said admission valves and adapted conversely to cause the steam to be admitted to either end of said steam chambers to cause a rotation of said cylinder core in either direction, and a plurality of exhaust valves positioned and arranged to operate conversely in pairs in conjunction with said last named valves to permit the exhaust of the steam from the opposite end of said steam chamber.

3. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylindrical chamber outside of said cylinder core into a plurality of steam chambers, each of said abutting cores being provided with a chamber on one side thereof into which steam may be admitted to hold said core in contact with said cylinder core, a plurality of valves each adapted to control the admission of steam to one of said last named chambers, and a plurality of valves adapted to control the admission of steam to said steam chambers to cause a rotation of said cylinder core.

4. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylindrical chamber outside of said cylinder core into a plurality of steam chambers, each of said abutting cores being provided with a chamber on one side thereof into which steam may be admitted to hold said core in contact with said cylinder core, a plurality of valves each adapted to control the admission of steam to one of said last named chambers, and conversely to control the exhaust from said steam chambers, and a plurality of valves adapted to control the admission of

steam to said steam chambers to cause a rotation of said cylinder cores.

5. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylindrical chamber outside of said cylinder core into a plurality of steam chambers, each of said abutting cores being provided with a chamber on one side thereof into which steam may be admitted to hold said core in contact with said cylinder core, a plurality of valves arranged and adapted to operate conversely in pairs, one to control the admission of steam to said last named chamber and the other to control the exhaust from said steam chamber, and a plurality of valves adapted to control the admission of steam to said steam chambers to cause a rotation of said cylinder core.

6. In a rotary engine, in combination, a casing provided with a cylindrical chamber, a cylinder core positioned in said chamber and provided with a plurality of projections from the periphery thereof, a plurality of abutting cores arranged and adapted to rotate in conjunction with said cylinder core and to separate that portion of the cylinder chamber outside of said cylinder core into a plurality of steam chambers, each of said abutting cores being provided with a chamber on one side thereof into which steam may be admitted to hold said core in contact with said cylinder core, a plurality of valves arranged in pairs on either side of said abutting cores and adapted to operate conversely to control the admission of steam to said last named chamber and to control the exhaust from said steam chamber, and a plurality of valves adapted to control the admission of steam to said steam chambers to cause a rotation of said cylinder cores.

7. In a rotary engine, in combination, a cylinder core, adapted to be operated upon by steam to produce a rotary movement thereof, an abutting core adapted to rotate in contact therewith, a chamber positioned on one side of said abutting core into which steam may be admitted to hold said abutting core in contact with said cylinder core, means for admitting steam to said cylinder core, and a pair of valves adapted to operate conversely, one to control the exhaust of the steam from said cylinder core and the other to control the admission of steam to said chamber.

8. In a rotary engine, in combination, a cylinder core positioned in a cylindrical chamber and adapted to be operated upon by the steam entering said chamber to produce a rotary movement thereof, an abutting core adapted to rotate in contact with said cylinder core, a chamber positioned on one side of said abutting core and communicating with said cylindrical chamber by either one of a pair of valves, a pair of valves adapted to be operated conversely, one to control the exhaust of the steam from said cylindrical chamber and the other to control the admission of steam to said abutting core chamber, means for controlling the admission of steam to said cylindrical chamber, and means for operating said valves.

9. In a rotary engine, in combination, a cylinder core positioned in a cylindrical chamber and adapted to be operated upon by the steam entering said chamber to produce a rotary movement of said core, an abutting core adapted to rotate in contact with said cylinder core, a chamber positioned on one side of said abutting core and communicating with said cylindrical chamber on either side of said abutting core by means of a pair of valves operative alternately according to the direction of rotation of said core to admit steam to said chamber to hold said abutting core in contact with said cylinder core or to control the exhaust of the steam from said cylindrical chamber, means for admitting steam to said cylindrical chamber to produce a rotation of said cylinder core in either direction, and means for operating said valves.

10. In a rotary engine, in combination, a cylinder core adapted to be operated upon by steam to produce a rotary movement thereof, an abutting core adapted to rotate in contact therewith, a chamber positioned on one side of said abutting core into which steam may be admitted to hold said abutting core in contact with said cylinder core, and a pair of valves operative to control the admission of steam to said chamber.

11. In a rotary engine, in combination, a cylinder core adapted to be operated upon by steam entering a cylindrical chamber in which said cylinder core is positioned to produce a rotary movement thereof, an abutting core adapted to rotate in contact with said cylinder core, a chamber positioned on one side of said abutting core and communicating with said cylindrical chamber by means of a valve through which steam may be admitted to hold said abutting core in contact with said cylindrical core, means for admitting steam to said cylindrical chamber, and means for operating said valve.

12. In a rotary engine, in combination, a cylinder core positioned in a cylindrical chamber and adapted to be operated upon by steam entering said chamber to produce a rotary movement of said core, an abutting core adapted to rotate in contact with said cylinder core, a chamber positioned on one side of said abutting core and communicating with said cylindrical chamber on either side of said abutting core by means of a pair of

valves operative alternately according to the direction of rotation of said core to admit steam to said chamber to hold said abutting core in contact with said cylinder core, means for admitting steam to said cylindrical chamber to produce a rotation of said cylinder core in either direction, and means for operating said valves.

Signed at New York city in the county of New York and State of New York this 30th day of March A. D. 1908.

FREDERICK A. CLEVELAND.

Witnesses:
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