(No Model.) 5 Sheets—Sheet 1.

F. O. DESCHAMPS.

ROTARY STEAM ENGINE.

No. 568,337. Patented Sept. 29, 1896.

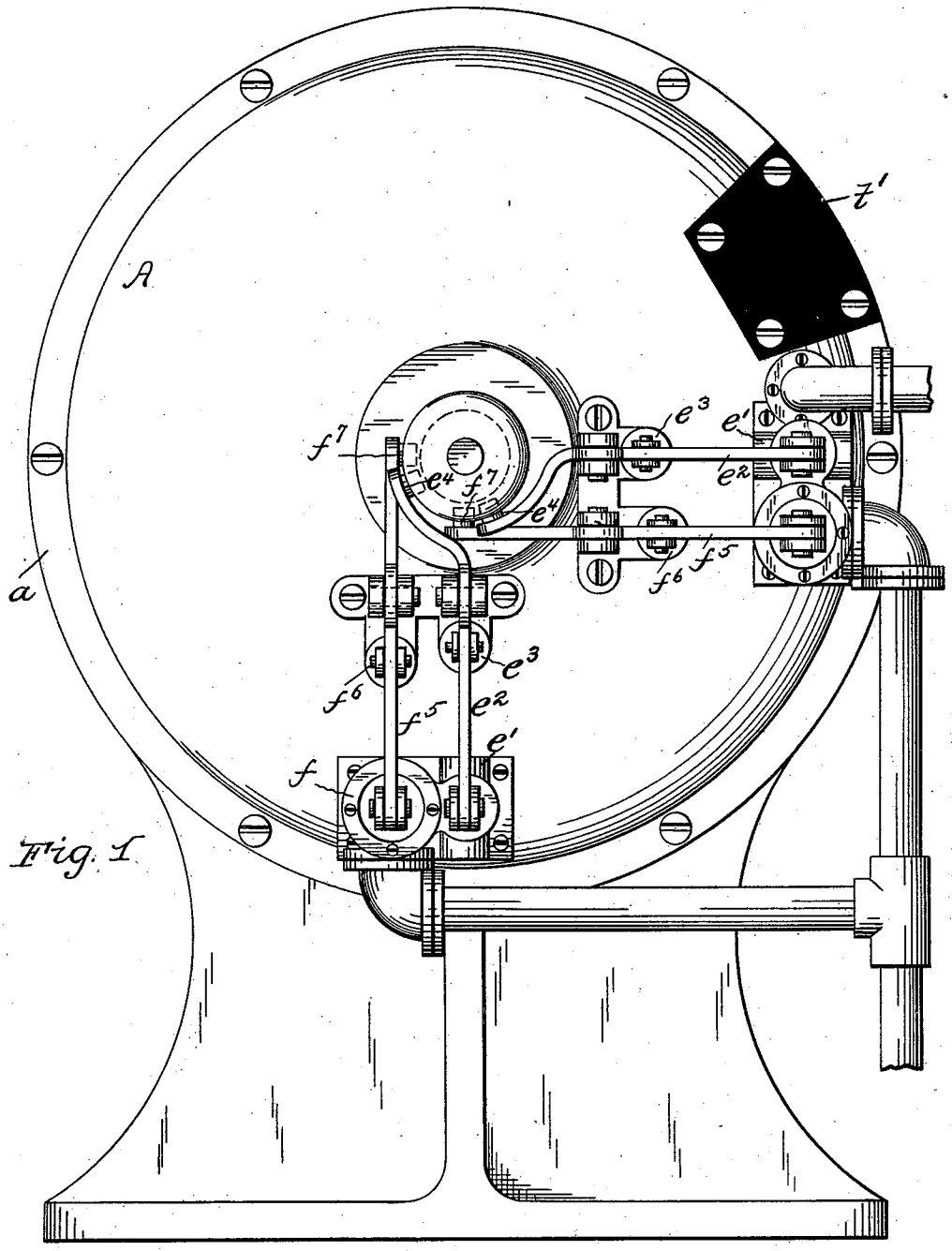

Fig. 1.

WITNESSES:

Chas. F. Pike

G. M. Copenhaver

INVENTOR

Francis O. Deschamps

BY

O. J. VanStavoren

ATTORNEY.

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F. O. DESCHAMPS.

ROTARY STEAM ENGINE.

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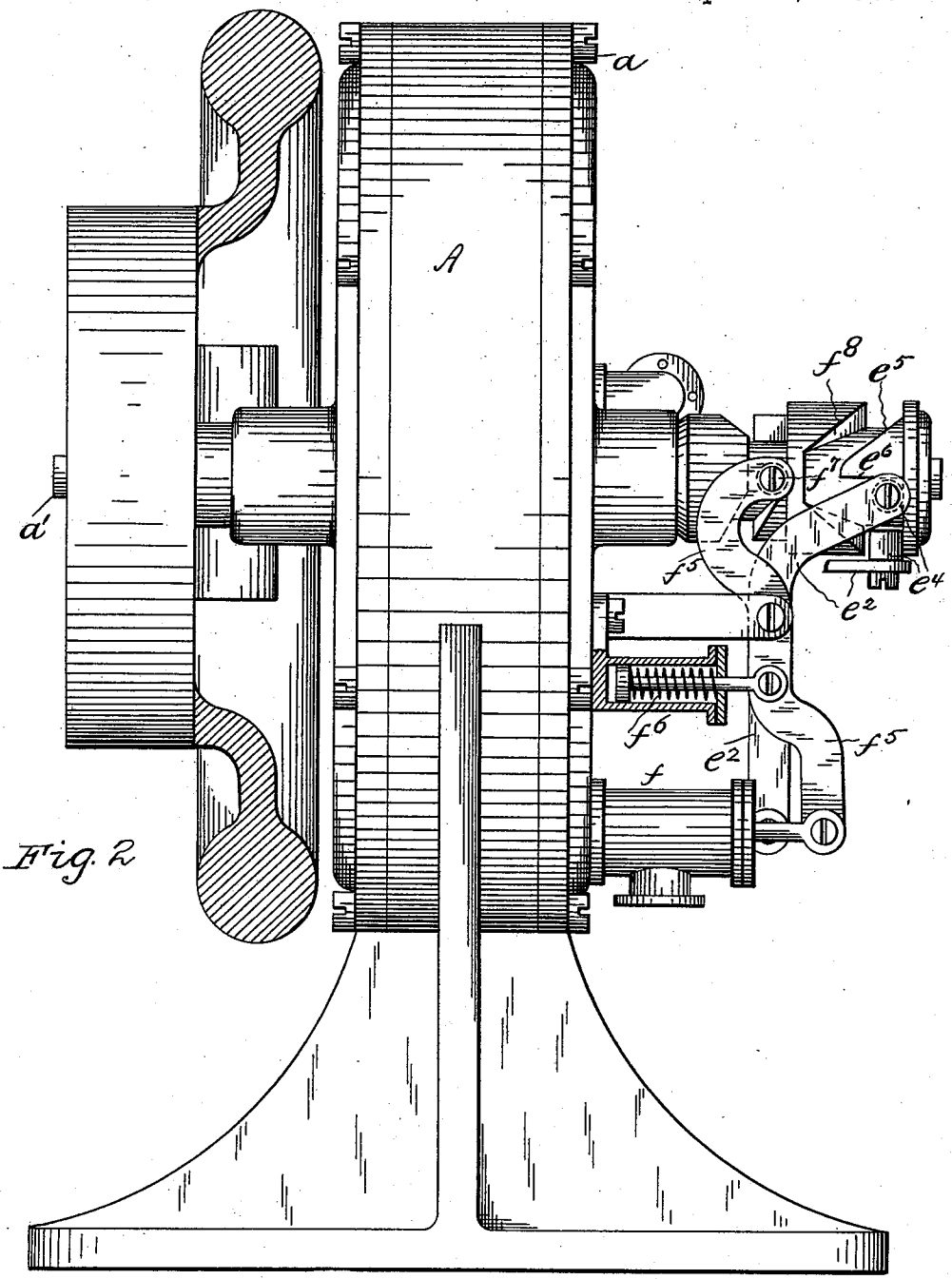

Fig. 2.

WITNESSES:

Chas. F. Peck,

G. M. Copenhaver

INVENTOR

Francis O. Deschamps

BY

D. J. Vanstavoren

ATTORNEY.

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F. O. DESCHAMPS.

ROTARY STEAM ENGINE.

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Fig. 3

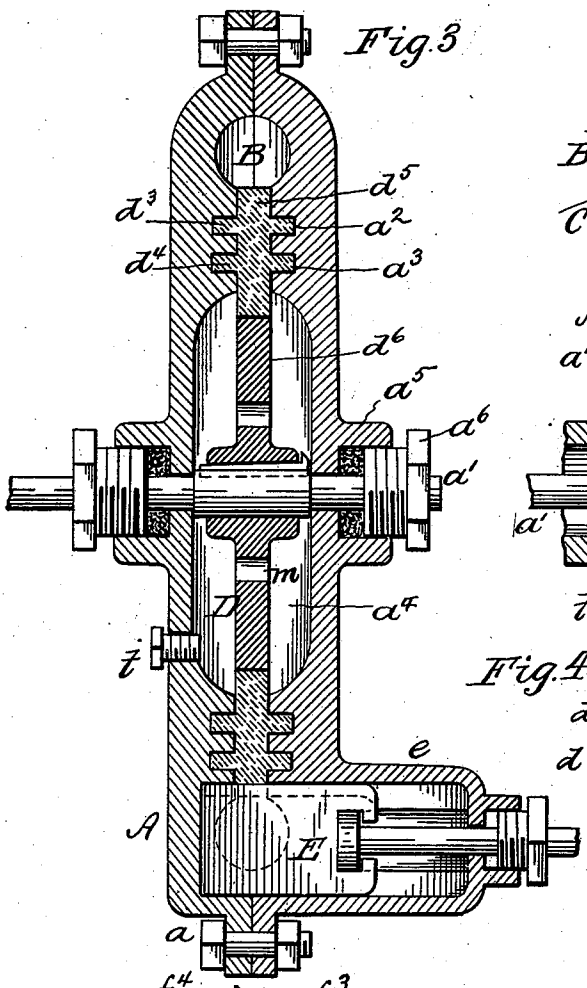


Fig. 4

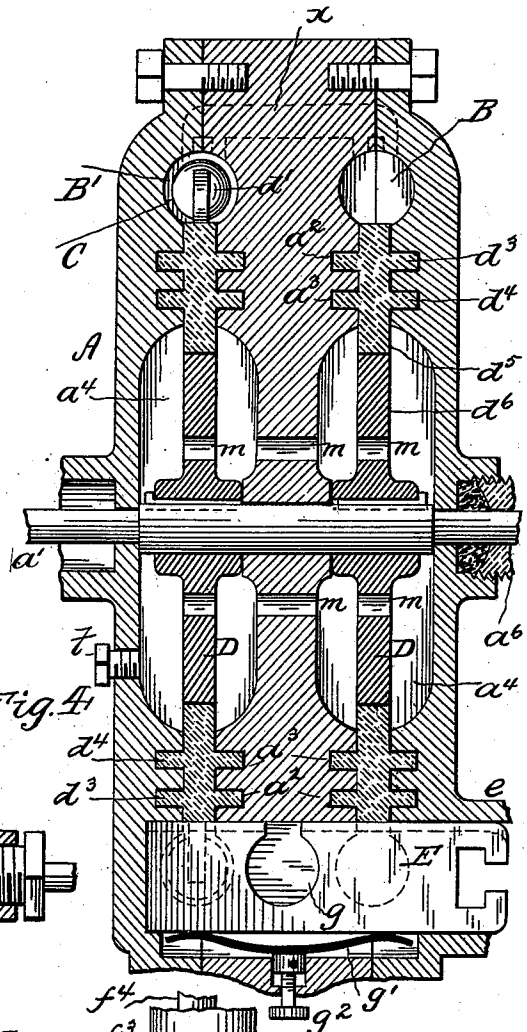


Fig. 5

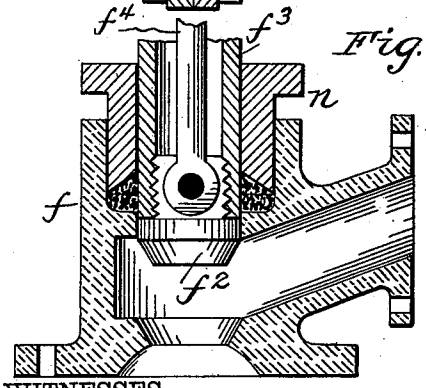
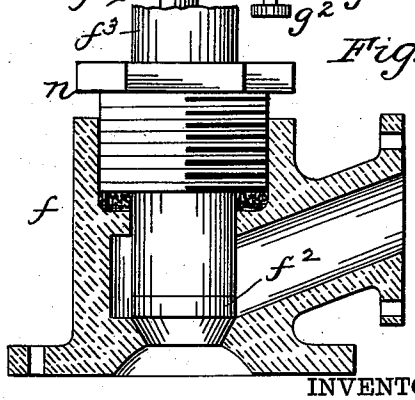


Fig. 6



WITNESSES:

Chas. L. Parker

J. M. Copenhaver.

INVENTOR

Francis O. Deschamps

By S. J. Vanstavoorn

Attorney

(No Model.)

5 Sheets—Sheet 4.

F. O. DESCHAMPS.

ROTARY STEAM ENGINE.

No. 568,337. Patented Sept. 29, 1896.

Fig. 7

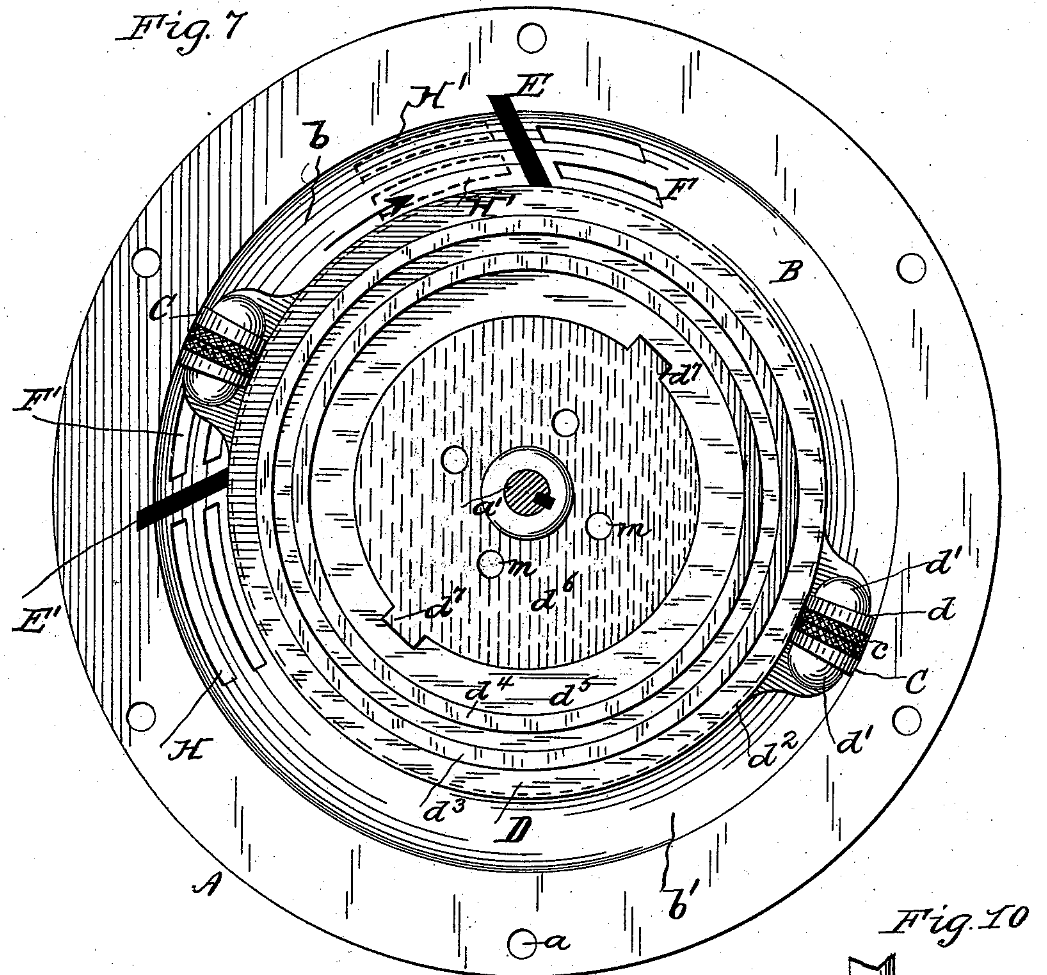


Fig. 9

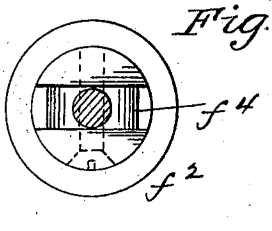


Fig. 8

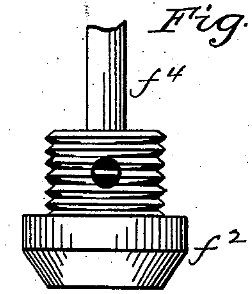
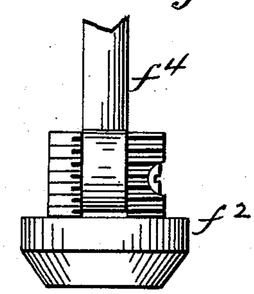


Fig. 10



WITNESSES:

Chas. F. Pike

G. M. Copenhaver.

INVENTOR

Francis O. Deschamps

By S. J. Van Stavoren

Attorney.

(No Model.) 5 Sheets—Sheet 5.

F. O. DESCHAMPS.

ROTARY STEAM ENGINE.

No. 568,337. Patented Sept. 29, 1896.

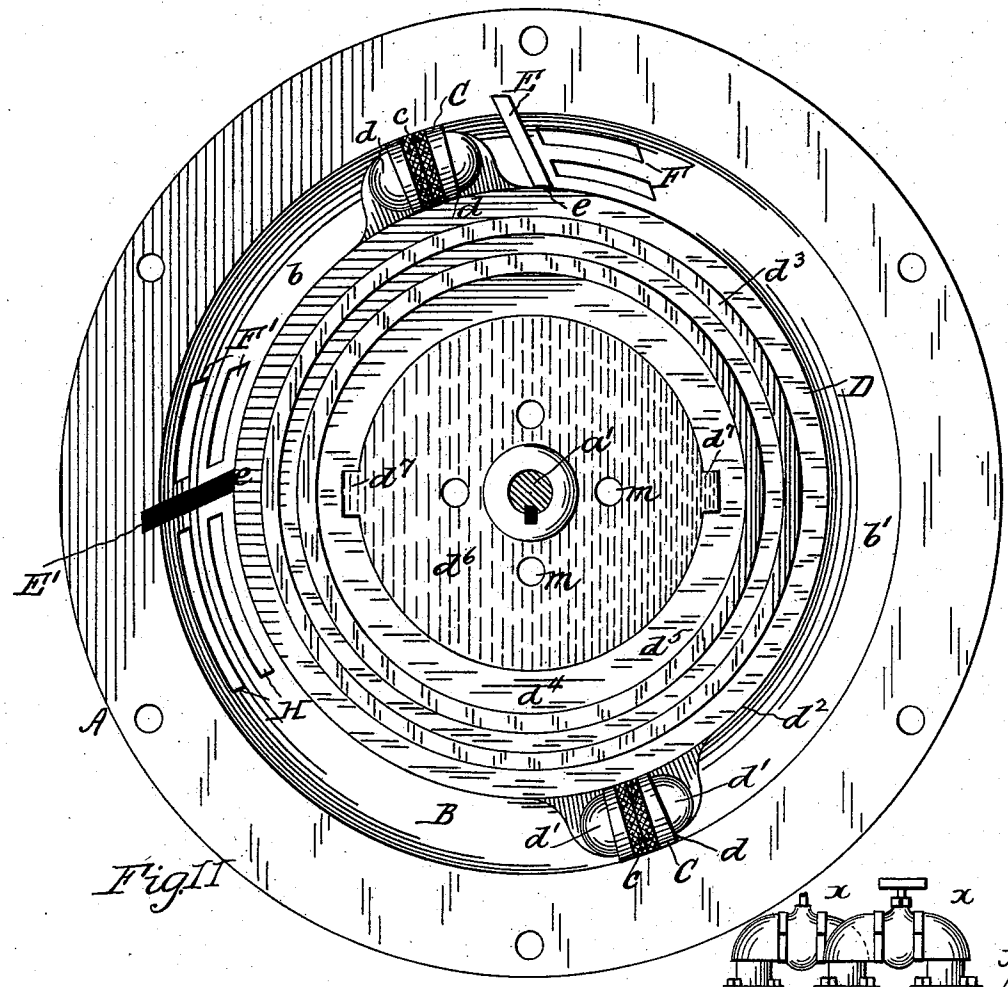


Fig. 11.

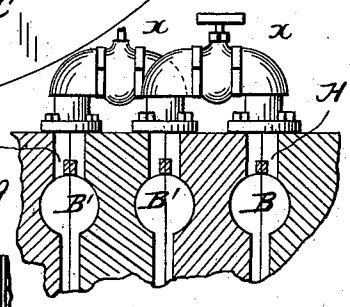
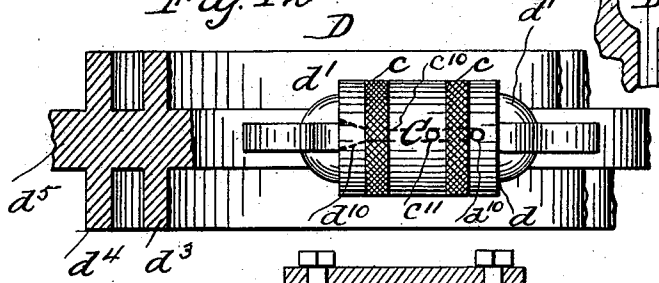


Fig. 14.

Fig. 12.



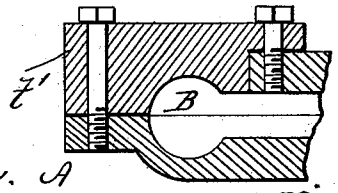


Fig. 13.

WITNESSES:

Chas. L. Cook

J. M. Copenhaver.

INVENTOR

Francis O. Deschamps

By C. J. Vanstavoren

Attorney

UNITED STATES PATENT OFFICE.

FRANCIS O. DESCHAMPS, OF PHILADELPHIA, PENNSYLVANIA.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 568,337, dated September 29, 1896.

Application filed April 26, 1894. Serial No. 509,046. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS O. DESCHAMPS, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Steam-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 appertains to make and use the same.

My invention has relation generally to fluid or vapor rotary engines, and particularly to rotary steam-engines; and it has for its object to so construct and operate the same that all mechanical and other advantages incident to a rotary steam-engine are maintained, or, in other words, regular even speed is secured, and in addition to which the steam is used expansively, all waste of steam usually occurring in this type of engines is avoided, and they may be in the form of high and low pressure or compound rotary steam-engines for securing a maximum effect with use of a minimum power. To this end I divide the annular steam chamber or cylinder through which the piston or pistons rotate into separate segmental chambers and alternately supply to and cut off the steam therefrom, one of said chambers having an exhaust-port which is normally open. The annular steam chamber or cylinder is divided into separate segmental cylinders by movable cylinder-heads, and each segmental cylinder is provided with a steam-supply and cut-off valve, both of which movable cylinder-heads and supply and cut-off valves are under the control of mechanism interposed between them and the driving-shaft of the engine, which mechanism may be arranged to provide for admitting steam into the segmental annular cylinders successively as the pistons enter the initial end of the same, and either for the full movement of a piston through said cylinders or for any desired part of such movement to admit of using it expansively, the effect whereof is that steam is admitted into two separate segmental cylinders of different lengths simultaneously to act upon a separate piston in each of said cylinders, which pistons are mounted upon a disk on the driving-shaft for rotating the latter. As the pistons rotate through the segmental cylinders and approach the cylinder-heads they then move out of the way of the pistons to permit them to pass by said heads, after which the latter close to maintain the separation and closure of the segmental cylinders for admission of steam to them and for cutting it off therefrom successively.

My invention has for its further object to provide a simple, inexpensive, and effective water or steam packing between the rotating disk and the segmental cylinders and between the disk and the casing therefor.

My invention has for its still further object to so construct the disk carrying the pistons and mounting the pistons on the disk that the pistons have free lateral movement independent of the disk to conform to any inequalities of bore or wear of the cylinders, and the periphery of the disk has free lateral movement independent of its hub or central part to admit of such periphery or rim of the disk conforming to any inequalities of surface contact between it and its casing or the packing interposed between said parts, the result whereof is that there is no lateral stress upon either the pistons, the disk rim or outer part, nor upon its central or hub part.

Again, my invention has for its object to provide a number of annular cylinders divided into segmental cylinders, as described, and arranged side by side or follow one another and conducting the exhaust-steam of a leading annular cylinder into a following corresponding cylinder for making a high and low pressure or compound rotary steam-engine.

My invention accordingly consists of the combinations, constructions, and arrangements of parts, as hereinafter more fully described in the specification and pointed out in the claims.

Reference is had to the accompanying drawings, wherein—

Figure 1 is an end elevation of a rotary engine embodying my improvements and showing more plainly a form of arrangement and construction of movable cylinder-heads, steam-supply and cut-off valves, and actuating mechanism interposed between said heads and valves and the driving-shaft of the engine. Fig. 2 is a side elevation, partly sec-

tional, of the same and partly broken away. Fig. 3 is a longitudinal vertical section, partly broken away, showing a single annular cylinder form of engine or one not compounded. Fig. 4 is a like view of a multiple annular cylinder form of engine or a high and low pressure or compound rotary engine. Fig. 5 is a section, drawn to an enlarged scale, of a form of steam-supply and cut-off valve in its open position. Fig. 6 is a like view of the same in its closed position. Fig. 7 is a diagrammatic transverse vertical section of the engine, showing movable cylinder-heads and rotating pistons in one position relatively to said heads and the steam-ports for the division-cylinders of said annular cylinder. Fig. 8 is an elevation of the steam-supply and cut-off valve shown in Figs. 5 and 6 detached from its tubular supporting-stem. Fig. 9 is a plan of the same. Fig. 10 is an elevation from a point of view different from that shown in Fig. 8. Fig. 11 is a view similar to Fig. 7, showing the cylinder-heads and pistons in another position relatively to said heads and steam-ports. Fig. 12 is an edge view, partly sectional and partly broken away, of the pistons and their supporting-disk. Fig. 13 is a sectional view of part of the engine-casing, showing a removable section on the line of the annular cylinder for obtaining access to the pistons in said cylinder; and Fig. 14 is a sectional view of multiple cylinder form of engine, showing more plainly the exhaust of one cylinder into another for effecting a compound rotary engine.

A represents a suitable casing, which may be made in two or more transversely-parted sections flanged, bolted, or otherwise secured together, as desired or as shown at a, the joints between which may be suitably finished or packed, as desired, to make them steam or air tight, and in which is suitably formed an annular steam cylinder or cylinders B B'. The latter may be round in cross-section, as shown, or they may be of any other desired configuration and are of a diameter as the requirements of service demand.

Within the cylinders B B' are rotating piston-heads C C, which, as shown, are cylindrical in shape and are loosely mounted in pockets or recesses d, formed between suitably-formed projecting jaws or lugs d' on the periphery d^2 of disks D. The piston-heads C may be provided with any suitable construction of packing-rings c.

The disks may be constructed and mounted upon shaft a', as desired. In the drawings they are shown provided on each side within or below their peripheral edge with a series of of separated concentric projecting flanges d^3 d^4, of any suitable form in cross-section, which fit loosely in corresponding grooves a^2 a^3, respectively, in the sections of casing A, which casing-sections also loosely embrace the outer portion of the disk web d^5, as shown more plainly in Figs. 3 and 4. This described form of disk and adjacent casing-section surfaces are provided for securing a tortuous or sinuous path between the same from cylinders B to the central inner chamber a^4 to avoid the use of mechanical packing between said surfaces and admit of the disks freely rotating with a minimum amount of friction between said parts. The small escape of steam or other vapor or fluid power media passing through said sinuous path forms a vapor or fluid packing for the same, which also lubricates said parts.

The condensations or drippings in chamber a^4 also provide a fluid or vapor packing therein for the boxes a^5 of shaft a', which, if desired, may be further protected against leakage by the stuffing-boxes a^6.

To admit of free movement of the pistons C laterally to conform to any inequalities of bore in cylinders B B', said pistons are loosely mounted between the jaws or lugs d' on the disks D, and to correspondingly admit of the rim d^5 of the disks having a free lateral movement independently of its center or hub part d^6 said parts d^5 d^6 are separately made and are loosely joined together by keys d^7, so as to rotate together. This avoids all lateral stress or strain on the disks D, their central sections d^6 being suitably keyed or secured to shaft a', as shown or as desired.

The annular cylinders B are divided into two segmental cylinders b and b', the former approximately being equal to a quarter-circle, by two movable cylinder-heads E E', of any suitable form, which project transversely into cylinder B and have one edge e impinging upon the periphery of disk D. They are preferably arranged in an annular form, as shown, and have suitable casings or supports e'. Said cylinder-heads have suitable connections with pivoted levers e^2, having suitable reacting-springs e^3 and a roller end e^4 and engagement with suitably-constructed cams e^5 on shaft a'. The cams e^5 may be made to move the levers e^2 in both directions of their movement, so as to positively raise and lower the movable cylinder-heads E; but by using the reaction-springs e^3 such cams may be formed, as shown, with a straight side e^6, so that the cylinder-heads E will have a quick return or closing movement independent of the cams e^5, which actuate to only open or raise said heads E in cylinder B B'.

Adjacent to the heads E are located the steam-inlet ports F F', which communicate with the steam-chests $f f$, respectively, inclosing a suitable form of steam-supply and cut-off valves f^2, (see more plainly Figs. 5, 6, 8, 9, and 10,) which, as shown, are screwed to tubular stems or guides f^3, having suitable stuffing-boxes n, and to the valves are hinged links f^4, having connection with pivoted levers f^5, provided with reaction-springs f^6 and roller ends f^7 for engagement with cams f^8 on driving-shaft a' for effecting a quick return of said valves after being opened by the cams f^8, or the latter may be arranged to both close and open valves.

By suitably constructing the cams f^8 the valves may be opened for the full length of the stroke of the pistons in segmental cylinders $b\,b'$, or otherwise, as desired. Said valves, constructed as shown, it will be noted are not subject to the steam-pressure in the chests $f\,f$, and hence they open and close easily and quickly.

When a compound form of engine is used, as shown in Fig. 4, the movable cylinder-heads E E′ are elongated to serve for all the cylinders B B′, in which case they are provided with apertures g for opening and closing the segmental cylinders $b\,b'$ in all the cylinders B B′ simultaneously. When the heads E E′ are of this elongated form, suitably constructed and located springs g' may be employed to maintain the proper impingement of their edge e with the periphery of disks D, which springs may have suitable tension devices g^2.

At the end of segmental cylinder b' is located the exhaust-port H, which leads to the air or other fixture when a single cylinder B is used. If additional cylinders B′ are employed, said exhaust leads to the successive cylinders, either as illustrated at x, Fig. 4, or as shown in Fig. 14.

The operation is as follows: The parts being in position, as shown in Fig. 7, both cylinder-heads E E′ are closed, as indicated by the heavy black ends for the same, and steam is being admitted to cylinder b through port F′, which is the initial end of said cylinder b, for pressure against the piston C in said cylinder to rotate disk D, steam having previously been admitted through port F, and cut off for corresponding action on piston C in cylinder b', so that while the piston C in cylinder b is under the direct influence of the pressure from the boiler the piston C in cylinder b' is then under the influence of the expansive force of the steam previously admitted to cylinder b' before the cylinder b was opened to admit a piston thereto. Hence the disk is rotated under the influence of both direct and expansive force of the steam supply. As soon as the piston C in cylinder B approaches the cylinder-head E it is raised to admit of such piston passing out of the cylinder b into cylinder b', said head immediately closing before steam is admitted through port F to cylinder b'. Meanwhile the piston C in cylinder b' has approached cylinder-head E′, the steam-head of said piston exhausting through port H and said head E′ opens to admit of said piston passing into cylinder b. As said head opens any steam in cylinder b also exhausts through port H before a piston C passes into said cylinder. It will be seen, therefore, that the steam in the form of engine shown is simultaneously used both direct and expansively in the different segmental cylinders of an annular cylinder, and that such steam is used expansively in any succeeding annular cylinders employed for corresponding purposes for obtaining the maximum effects with minimum power.

If desired, exhaust-ports H′ may be provided for chamber b, as indicated by the dotted lines at the exit end of said chamber, in which case said chamber will exhaust directly into a succeeding chamber B instead of indirectly through ports H, as heretofore described. If desired, only one piston-head C may be used on the disk or wheel D on the succeeding chambers B. So, too, if desired, the piston-head C may have a central aperture C^{10}, leading to one or more peripheral openings C^{11} in the heads C and communicating with openings d^{10} in the brackets d' (see more plainly dotted lines in Fig. 12) for admitting steam to both side heads to balance the same in the manner usually employed for steam-balanced valves.

If desired, the steam may be used expansively in both segmental cylinders of an annular cylinder.

Any suitable form of drip-cock t may be used for the chamber a^4, and suitable openings m are located in the disk D and in the division-sections of the casings for equalizing the condensations or drip in the different compartments of chamber a^4.

From the foregoing it will be noted that the variation in length of steam-chambers for the piston-heads, that is to say, one of them a quarter of a circle and the other the remainder of the circle, is such that one or the other of the piston-heads C is always under pressure of the boiler when the piston-heads are actuated. The effect of this is that the rotation of the piston-heads or the wheel upon which they are located rotates at an even speed at all times, or, in other words, a regular even speed is obtained which does not vary when the cylinder-heads are actuated.

I do not confine my invention to any particular construction and arrangement of the novel parts of my invention, nor to the type of actuating mechanism interposed between the movable cylinder-heads, the steam-supply and cut-off valves, and the engine-shaft, nor to any form of the said heads and valves, as it is obvious that the same may be variously constructed and arranged for operation without departing from the spirit of the invention.

Any suitable or desired vapor or fluid power media may be used.

What I claim is—

1. In a rotary steam-engine the combination of an annular cylinder divided into sections of different lengths, a rotating disk composed of sections loosely keyed together and having side flanges and a peripheral flange carrying piston-heads, steam and exhaust ports, movable cylinder-heads and supply and cut-off valves, substantially as set forth.

2. In a rotary steam-engine, having an annular cylinder divided into sections of different lengths, a rotating disk having piston-

heads, and valves adapted to simultaneously subject one of said piston-heads to a direct pressure of steam and the other to the expansive force of the steam, substantially as set forth.

3. In a rotary engine, the combination with its solidly-formed casing, having an annular cylinder divided into sections of different lengths, of a piston-carrying disk, composed of laterally-movable annular sections, and the sinuous steam-packing joint formed between the flanges of the former and the grooves of the latter, substantially as described.

4. In a rotary engine, a piston-carrying disk having side annular flanges fitting into corresponding grooves in the casing, in combination with a solidly-formed casing, having an annular cylinder divided into sections of different lengths, and an annular central drip-chamber surrounding the driving-shaft, which is provided with a drip cock or plug, as and for the purpose herein set forth and described.

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

FRANCIS O. DESCHAMPS.

Witnesses:

JOHN RODGERS,

S. J. VAN STAVOREN.