2 Sheets—Sheet 1.

L. J. WING.

ROTARY ENGINE.

No. 259,967. Patented June 20, 1882.

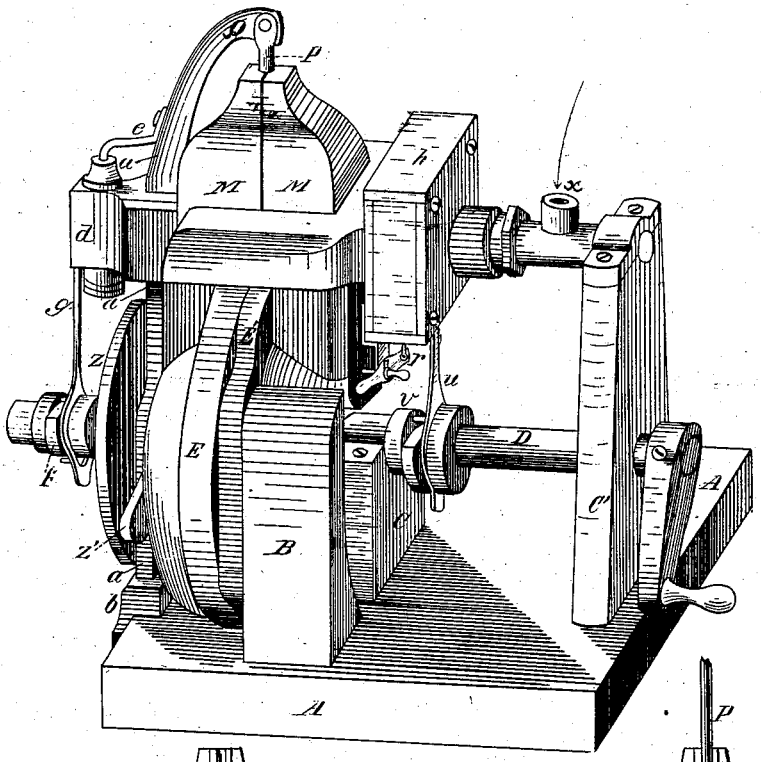

Fig. 1.

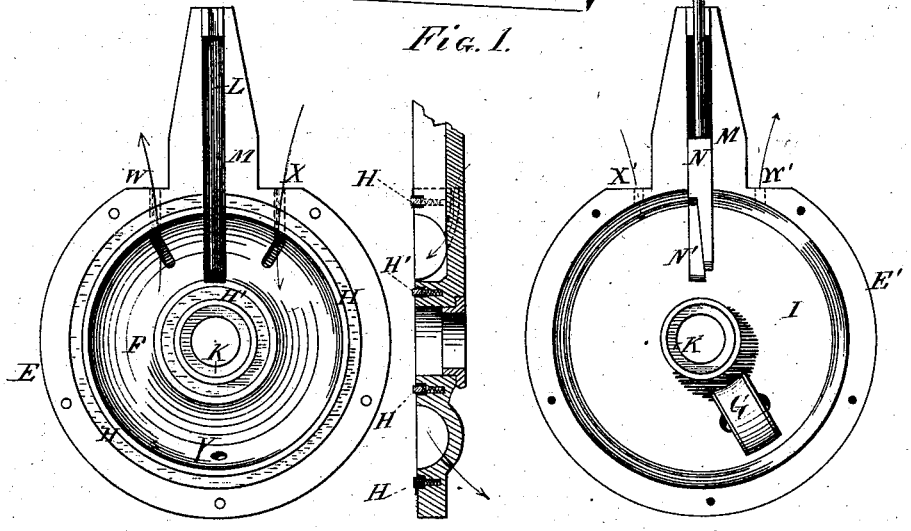

Fig. 2. Fig. 3. Fig. 4.

Witnesses:
Thomas Lally
Boyd Allen

Inventor:
L. J. Wing
by J. H. Adams
Atty.

2 Sheets—Sheet 2.

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ROTARY ENGINE.

No. 259,967. Patented June 20, 1882

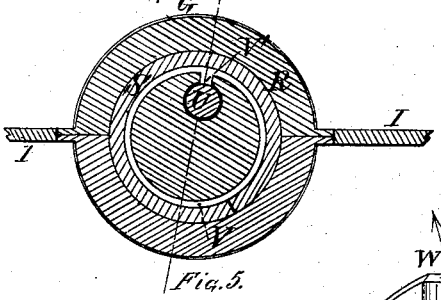

Fig. 5.

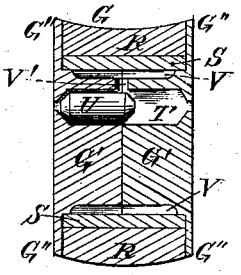

Fig. 6.

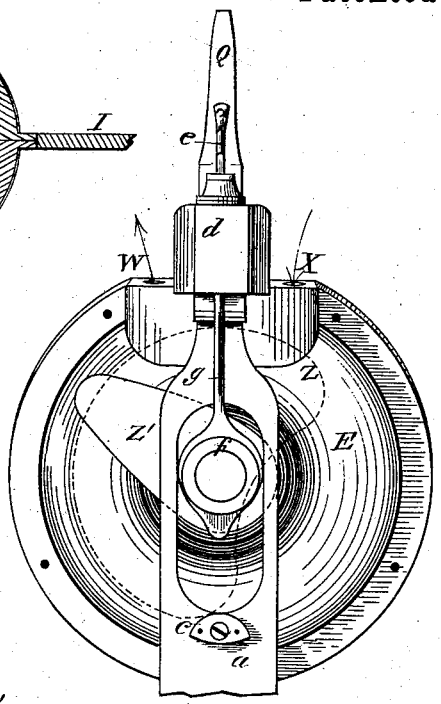

Fig. 7.

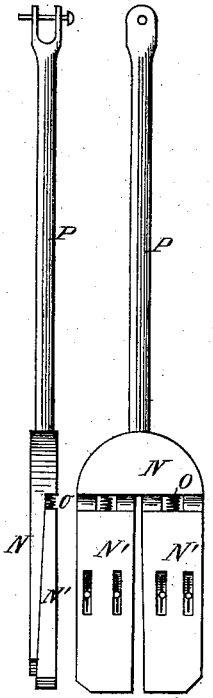

Fig. 8.

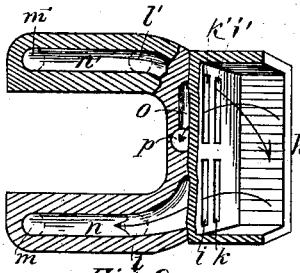

Fig. 9.

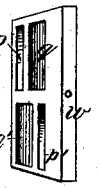

Fig. 11.

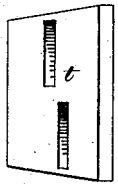

Fig. 12.

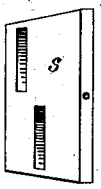

Fig. 13.

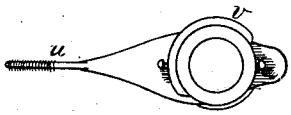

Fig. 14.

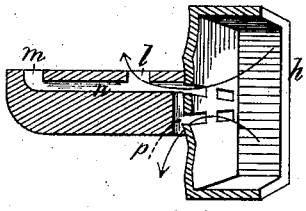

Fig. 10.

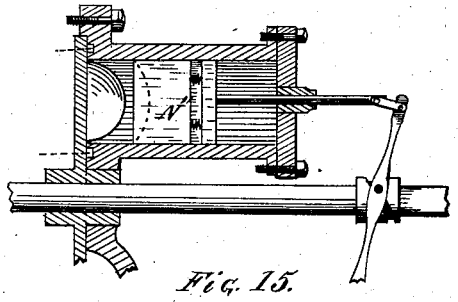

Fig. 15.

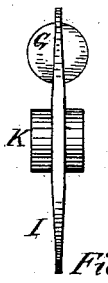

Fig. 16.

Witnesses:

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UNITED STATES PATENT OFFICE.

LEANDER J. WING, OF BOSTON, MASSACHUSETTS.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 259,967, dated June 20, 1882.

Application filed May 27, 1878.

To all whom it may concern:

Be it known that I, LEANDER J. WING, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Rotary Engines, of which the following is a specification.

In rotary steam-engines as ordinarily constructed the steam bears directly upon the shaft, which increases the friction and consequently requires the expenditure of considerable power to perform a given amount of work. In my machine I have reduced the friction to the minimum by so constructing the annular steam-chamber and the connecting parts as to cause the pressure of the steam to be applied directly to the rotation of the piston without bearing upon the edge of the disk, and thus relieving the pressure upon the shaft; and my invention consists in several improvements in the construction of rotary steam-engines, hereinafter fully set forth.

Figure 1 is a perspective view of an engine embodying my invention. Fig. 2 is a view of one half of the annular steam-chamber, showing the ports, the slot for the abutment, and the packing-rings. Fig. 3 is a section of the same. Fig. 4 is a view of the other half of the annular steam chamber, showing the rotating disk, the piston, and the sliding abutment. Figs. 5 and 6 represent sections of the piston enlarged. Fig. 7 is an end view, showing the devices for operating the abutment. Fig. 8 represents a front and side view of the abutment. Figs. 9 and 10 are sections of the steam chamber for containing the valves, and showing the connecting-passages between the chamber *h* and the annular steam-chamber and the exhaust. Figs. 11, 12, and 13 represent the reversing-valve, the sliding valve, and the stationary intermediate valve-plate. Fig. 14 is the cam that operates the sliding valve. Fig. 15 is a modification of the mode of constructing and connecting with the annular steam-chamber F the slot—or in this case chamber—in which the abutment slides. Fig. 16 represents the rotating disk carrying the piston.

A represents the bed-plate supporting the engine.

B is the standard, there being one on each side, to which the annular steam-chamber is bolted.

C and C′ are standards supporting the main shaft D.

E and E′ represent the two half-sections of the annular steam-chamber, each being formed with a groove extending entirely around, so that when the two parts are joined together they will form an annular chamber, in which is fitted the disk I, that carries the piston G. Near the outer edge of each half of the annular chamber is a recess or groove, in which is fitted so as to be steam-tight a metal packing-ring, H, having springs underneath to keep the ring pressed against the disk I. A similar metal packing-ring, H′, also provided with springs, is fitted between the inner edges of the annular steam-chamber and the chamber surrounding the hub of the disk I.

Between the two sections of the annular steam-chamber is fitted a disk, I, which is securely attached to the shaft D, so as to rotate with it. The outer and inner edges of each section of the annular steam-chamber are cut away to admit of the disk I being snugly fitted between and yet to rotate freely. The portion of the disk I covering the annular chamber is tapered or beveled from the center outward, for a purpose hereinafter explained. In that portion of the disk I which covers the annular chamber is fixed a piston, G, each portion of which that projects through the disk I fitting in each section of the annular steam-chamber F, so as to rotate freely in the same. At the center of the disk I is a hub, K, by which it is secured to the shaft D. At the center of the upper portion of the annular steam-chamber is a slot, L, extending downward to a point near the inner packing-ring, H′, and upward through a projection, M, as shown. In these slots, one-half on each side, is fitted a sliding abutment, N. This abutment consists of a metal plate having a central beveled slot extending from its lower edge to near its upper portion, as shown in Fig. 8, the slot passing over the disk I, and beveled so as to conform to the bevel of the disk I.

The abutment is provided with sliding sections N′, corresponding to the portions of the abutment on each side of the slot. The inner contiguous surfaces of the parts N and N′ are beveled in opposite directions, as shown in Fig. 8. The sliding portions N′ are attached to the

main portions N by headed pins passing through slots in the same, so as to allow of their free movement. The lower edges of the sections N′ are caused to project below the edges of the main sections N by means of springs O, arranged between the two sections N and N′, as shown in Fig. 8. The object of the sliding sections N′ projecting below the main section N is that when the ends of sections N are forced down to the lowest point in the slot L the section N′ will remain at its lowest point, and owing to the bevel between these two sections the abutment will be increased in thickness to fill the slot L in order to render it steam-tight at the proper time, and also, when drawn up, being reduced in thickness, is allowed to work freely and without friction in the slot L. The slot in the abutment may be provided with a metal packing, kept in place by springs or steam. This beveled slot is also designed to assist in rendering the fit of the abutment N on each side of the beveled disk I steam-tight, and is so constructed as to relieve the disk I from any friction caused by the operation of the abutment immediately after the abutment starts upward.

To the top of the abutment is attached a rod, P, the upper end of which is pivoted to an arm, Q, by which it is operated, the rod passing through a stuffing-box properly fitted in the projection M.

The piston G is shown in detail in Figs. 5 and 6 in section. It is composed of two sections, G′ and G′, secured together and provided with flanges G″ and G″, so as to form a recess around the piston. Within this recess is placed a metal packing-ring, S, of sufficient width to fill the space between the flanges G″ and G″, the edges of which ring are ground to fit steam-tight within the flanges G″ and G″. Underneath this metal ring is a recess, V, to admit steam through the connecting-passage V′, after it has passed through a chamber, T, in which is arranged a sliding plug, U. The plug U is fitted snugly but so as to slide freely in the chamber T. It is formed with beveled ends, which close the openings at each end of the chamber T. It is of such a length that when forced to one end of the chamber T by the action of the steam upon it while closing this end the steam admitted in the opposite open end of chamber T will pass through the passage V′ into the recess or chamber V and expand the cut-metal packing-ring S, so as to cause it to press against the soft-metal packing R, which is closely fitted to the inner surface of the annular steam-chamber F, the said packing R being convex to fit the outer bearing-surface and concave to fit the inner bearing-surface against the annular steam-chamber F. The packing R is of such width as to allow its either edge to extend slightly over the edges of the slot L in order to allow it to pass smoothly across the slot L while rotating in the annular steam-chamber F.

The sliding plug U is operated by the steam entering at either end of the chamber T, so that immediately upon the entrance of steam into the annular steam-chamber P the piston is packed steam-tight.

It is intended that the space between the ports W and W′, Figs. 2 and 4, and the slot L, and also that between the ports X and X′ and slot L, shall be sufficiently wide to admit of the piston passing the ports before reaching the abutment N, for the purpose of allowing the steam to exhaust from either port as the piston is advancing toward the abutment N, and thus relieve the latter from the steam-pressure while it is being drawn up to allow the piston to pass, it being understood that the piston may be made to move in either direction around the annular steam-chamber, the motion being reversed by means of devices hereinafter explained.

At the lower portion of the annular steam-chamber is an opening or passage, Y, provided with a pet-cock for the purpose of allowing the escape of any water of condensation in the annular steam-chamber.

A suitable oiling device may be arranged near the top of the projection M for the purpose of lubricating the abutment and also the disk.

The method of operating the abutment is as follows: The rod P, to which the abutment is attached, is pivoted at the upper end to an arm, Q, which forms a part of a slide, *a*. (See Figs. 1 and 7.) This slide extends downward to the bed-plate and moves through a guide, *b*. In the slide *a* is an oblong slot, as shown in Fig. 7, which is fitted to slide upon a hub, to each end of which latter are secured the sections Z and Z′ of a double cam, each section being arranged on opposite sides of the slide *a*. The cam Z (shown in dotted lines in Fig. 7) is made to bear at its periphery upon a projection or shoulder, *c*, fixed on one side of the slide *a*, and serves to draw the slide down after having been drawn up by the cam Z′. The cam Z′ is of such construction and so arranged on the main shaft D that it comes in contact with a shoulder on the inner side of the slide *a*, and when rotated throws up the said slide, and at the same time the abutment N, while the piston G is moving over the space between the ports W and W′ and the slot L, or the space between the ports X and X′ and slot L, according to the direction in which the piston is moving.

It will be seen that the cam Z′ throws up the slide *a*, and with it the abutment N, while passing in either direction, and as soon as it has performed this duty the cam Z instantly commences to draw down the slide *a* and abutment N, holding it in position until cam Z′ is ready to raise it up again.

I am aware that double cams of somewhat similar construction have been before used, as in the case of Van Pelt, who uses a yoke in the place of my slotted slide *a*; but I disclaim all right or interest in that or similar cams which lack the slotted slide, since I consider the slide as a necessary device to keep the

movement of the abutment-rod in line while it is being raised or lowered by the action of the cams Z and Z'.

In addition to this cam arrangement, for operating the abutment I have arranged a small steam-cylinder, *d*, provided with a piston the rod *e* of which is attached to the arm Q of the slide *a*. Steam is to be admitted to a steam-chamber connected with the cylinder *d* at the rear, and is passed from the steam-chamber to the cylinder *d* through a valve in the chamber operated by a cam, *f*, on the main shaft D, and attached to a connecting-rod, *g*. The object of this method of operating the slide and abutment by steam is to dispense with the operation of the cams in part or entirely during the time that the steam is applied.

The cams are designed to aid in regulating the movement of the slide *a* and abutment when operated by steam.

The steam-chamber *h* (shown in section in Figs. 9 and 10) consists of a box in which are arranged a reversing-valve, *w*, a sliding valve, *s*, and also an intermediate stationary plate, *t*.

In the valve-seat or rear of the steam-chamber are four slots or openings, as shown in Figs. 9 and 10, composing the ports and the exhausts. The ports *i* and *i'* connect through the passages *n* and *n'* and ports *m* and *l*, Fig. 10, with the ports W and W', Figs. 2 and 4, and ports X and X' through passage *n'* and ports *m'* and *l'*, Fig. 9, and allow the passage of steam to the annular steam-chamber F. By this means steam is admitted on each side simultaneously of the rotating disk I, thus exerting an equal pressure on each side of the disk I, and relieving the same from all friction occasioned by the pressure of the steam.

k and *k'* are the openings through which steam passes through the passage *o* to the exhaust *p*, Fig. 9. These exhaust-openings are diagonally opposite each other, and the ports are arranged in the same manner, thus bringing one exhaust and one port on either side of the steam-chamber *h*. The steam passes from the steam-chamber *h* through the port *i* into the passage *n*, through the ports *l* and *m*, Fig. 10, into the ports X and X', Figs. 2 and 4, and around the annular steam-chamber F, and it exhausts out of the ports W and W', Figs. 2 and 4, thence through the ports *l'* and *m'*, Fig. 9, and the passage *n'* into the steam-chamber *h* through the port *i'*.

Fig. 11 shows a reversing-valve. On the face corresponding with the valve-seat are two concave recesses, *q* and *q'*, diagonally opposite each other, and two ports, *p* and *p'*, also diagonally opposite each other, as shown. The concave recess *q* is of such a width as to cover the openings, (being the port *i* and the exhaust *k'*,) thus constituting a continuous passage for the exhaust-steam from the annular steam-chamber F, through the passage *o* to the exhaust *p*. While the concave recess *q* is in such position as to cover the openings *i'* and *k'* the port *p'*, Fig. 11, will be exactly over port *i*, Fig. 9, and thus allow the steam to pass directly to the annular steam-chamber F.

When it is desired to reverse the motion of the engine the position of the reversing-valve *w* shown in Fig. 11 is changed by means of a lever, *r*, and a connecting-rod, so as to bring the concave recess *q'* over the openings *i* and *k*, while the port *p* is brought at the same time over the port *i'*, thus reversing the whole action of the live and exhaust steam.

Fig. 13 is a double sliding valve having its ports corresponding with the ports *i* and *i'* on the valve-seat in steam-chamber *h*.

t, Fig. 12, is a stationary plate interposed between the valves *w* and *s*. The openings in plate *t* are made to correspond with the ports *i* and *i'* on the valve-seat, and the ports of the valve *s*, Fig. 13. The object of the stationary plate *t* is to counteract the effect of the wear of metal which would occur in the event of running the engine in one direction for a long time, so that in reversing the engine, if there were no intermediate plate, the faces of the valves would be worn away in such a manner as to cause them to leak steam in consequence of being required to slide on different surfaces.

The valve *s* is for the purpose of letting on and cutting off the steam at each half-revolution of the piston G, and is operated by means of a cam, *v*, Fig. 14, on the main shaft D. The cam *v* is connected to the lower part of the valve-plate *s* by means of a connecting-rod, *u*.

Fig. 1 shows an engine complete by itself, and in such case a fly-wheel would be necessary to avoid dead-centers; but I propose to connect with this an exact duplicate from a line drawn perpendicularly through the center of the steam-pipe *x*, so that the steam will be caused to enter alternately each half of the engine by the action of the cam *v* on the valve *s* in each portion, and thus is secured a constant flow of steam from the boiler, either all on one piston or partly on each in the separate portions, and thus I am enabled to avoid all dead-points, and the engine can be started into full operation without regard to the position of the valves or the piston. As soon as the piston has passed the ports X and X', Figs. 2 and 4, on its way from the abutment, and steam is admitted to the annular steam-chamber F, the piston is carried by the steam, through the action of the cam *v* operating the sliding valve *s* through one-half the circle of the annular steam-chamber F, when the steam is shut off, and from this point the expansion of the steam already in the annular steam-chamber F and occupying the space between the closed abutment and the piston G forces the piston beyond the ports W and W', acting as exhausts. When using two cylinders the expansion of steam is operating the piston in one annular chamber, and the full force of steam from the boiler is applied to operate the piston in the opposite annular steam-chamber, by which it is evident that a continual stream of steam is applied to the pistons during a whole revolu-

tion, besides having the benefit of the expansion during nearly two-thirds of the revolution, being about one-third for each piston.

Fig. 15 represents a modification of the method of constructing and connecting with the annular steam-chamber F the slot or chamber in which the abutment slides. It is designed to be attached to or form a part of the sides of the annular steam-chamber F, and is intended to operate horizontally instead of vertically, as shown in Figs. 1, 2, and 3. In this case the abutment N″ moves in a chamber in which it is fitted and operated by a cam on the main shaft D through a connecting-rod. By this modification the abutment is required to move only about one-half the distance of that shown in the drawings, Figs. 2 and 4, which facilitates the running the engine at great speed. In this case two abutments are required, one for each half-annular steam-chamber.

I claim—

1. In a rotary steam-engine, the annular steam-chamber F, which is bisected by the beveled disk I, and in which disk the piston G, constructed as shown, is rigidly fixed, substantially as shown and described, and for the purposes herein set forth.

2. The sliding abutment N, provided with the sliding beveled sections N′ and N′ and springs O, constructed and arranged substantially as shown and described, and for the purposes herein set forth.

3. The sliding abutment N, provided with the sliding beveled sections N′ and N′, the springs O, and the beveled slot in said abutment, in combination with the rotating beveled disk I, substantially as shown and described, and for the purposes herein set forth.

4. The annular steam-chamber F, bisected by the beveled disk I, provided with the piston G, in combination with the sliding abutment N, substantially as shown and described, and for the purposes herein set forth.

5. The cams Z and Z′ and the slotted slide *a*, interposed between the cams, in combination with the arm Q, the connecting-rod *p*, and the abutment N, substantially as shown and described, and for the purposes herein set forth.

6. The steam-cylinder *d*, the cam *f*, and the connecting-rods *g* and *e*, in combination with the arm Q and abutment, substantially as shown and described, and for the purposes herein set forth.

7. The cams Z and Z′ and slotted slide *a*, interposed between the cams, in combination with the cylinder *d*, connecting-rods *g* and *e*, arm Q, connecting-rod *p*, and abutment N, substantially as shown and described, and for the purposes herein set forth.

8. The steam-chamber *h*, containing the reversing-valve *w*, which is provided with the diagonally-arranged concave recesses *q* and *q′* and with the diagonally-arranged ports *p* and *p′*, in combination with the sliding valve *s*, substantially as shown and described, and for the purposes herein set forth.

9. In a rotary engine, the diagonally-slotted and vertically-movable valve-plate *t*, interposed between the reversing-valve *w* and the sliding valve *s*, substantially as shown and described, and for the purposes herein set forth.

10. The steam-chamber *h*, containing the reversing-valve *w*, which is provided with the diagonally-arranged concave recesses *q* and *q′* and with the diagonally-arranged ports *p* and *p′*, in combination with the sliding valve *s* and the interposed valve-plate *t*, substantially as shown and described, and for the purposes herein set forth.

11. The reversing-valve *w*, provided with the concave recesses *q* and *q′* and the ports *p* and *p′*, in combination with the ports *i* and *i′* and the exhausts *k* and *k′*, diagonally opposite of the valve-seat, said concave recesses *q* and *q′* adapted, as shown, to form alternately a continuous passage from the annular steam-chamber F through the ports W or X and the passage *n′* or *n* to the exhaust *p*, substantially as shown and described, and for the purposes herein set forth.

12. The combination of the steam-chamber *h*, provided with the valves *s* and *w*, the interposed plate *t*, and the valve-seat provided with the ports *i* and *i′*, arranged diagonally opposite, and the exhausts *k* and *k′*, in combination with the passages *n* or *n′*, the ports X X′ and W W′, and the annular steam-chamber F, as shown and described, and for the purposes herein set forth.

13. The reversing-valve *w*, provided with the concave recesses *q* and *q′* and the ports *p* and *p′*, diagonally-opposite, in combination with the valve-seat of steam-chamber *h*, as shown and described, and for the purposes herein set forth.

14. The steam-chamber *h*, provided with the valves *w* and *s*, cam *v*, and connecting-rod *u*, in combination with the abutment N, the beveled disk I, and the annular steam-chamber F, substantially as shown and described, and for the purposes herein set forth.

15. The steam-chamber *h*, provided with the valves *w* and *s*, cam *v*, and connecting-rod *u*, in combination with the abutment N, the beveled disk I, the annular steam-chamber F, the cylinder *d*, the connecting-rod *g*, and the cam *f*, substantially as shown and described, and for the purposes herein set forth.

16. The coms Z and Z′ and the slotted slide *a*, interposed between the cams, the abutment N, the beveled disk I, and the annular steam-chamber F, in combination with the steam-chamber *h* and the cylinder *d*, substantially as shown and described, and for the purposes herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEANDER J. WING.

Witnesses:
J. H. ADAMS,
THOMAS LALLY.