No. 647,172. Patented Apr. 10, 1900.

E. J. WOOD.

ROTARY STEAM ENGINE.

(Application filed Aug. 19, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 3.

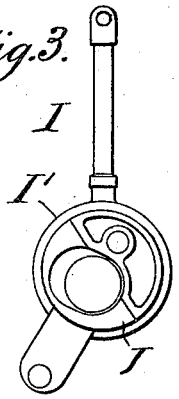


Fig. 1.

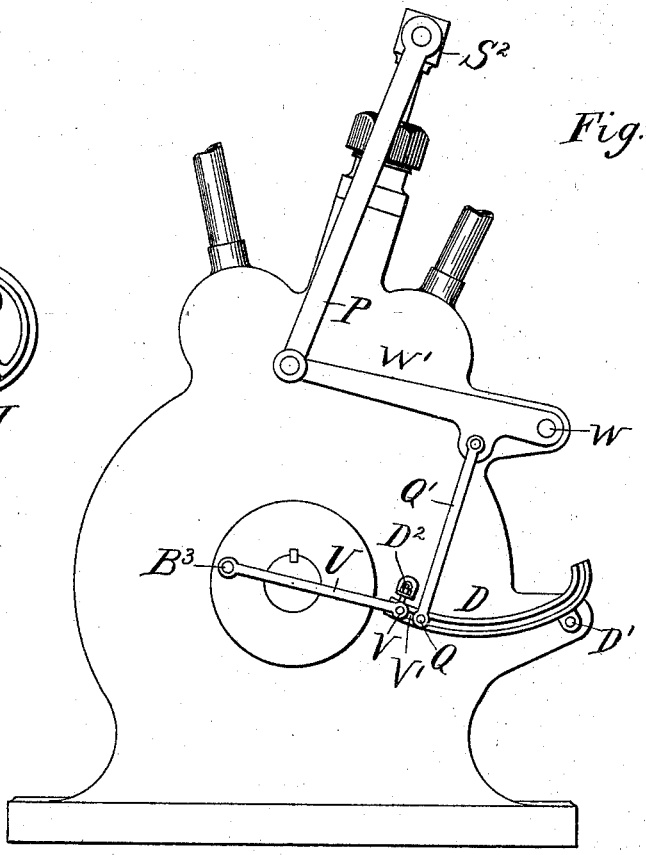
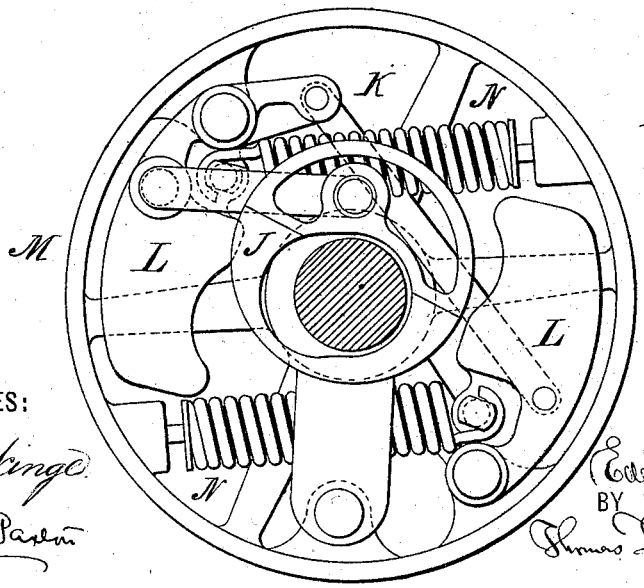


Fig. 2.



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3 Sheets—Sheet 2.

Fig. 4.

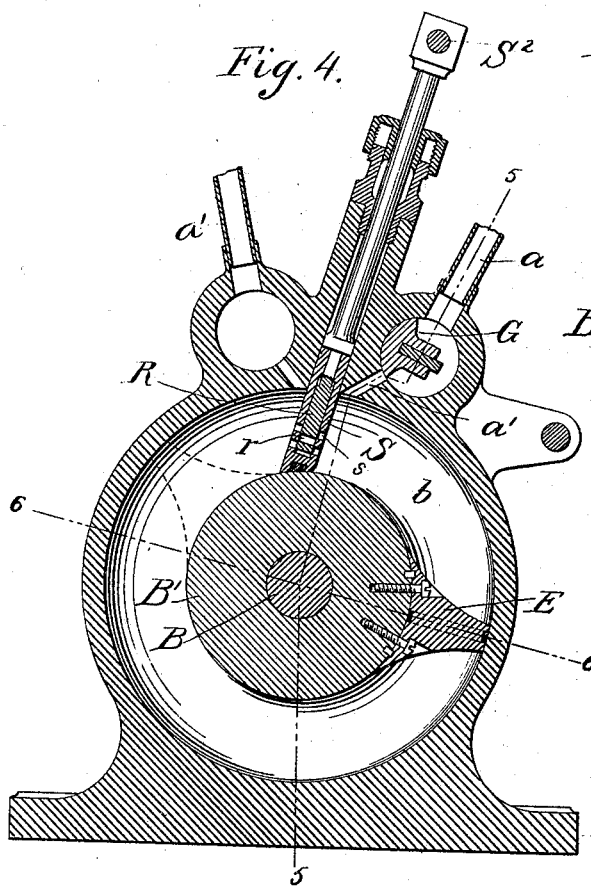


Fig. 5.

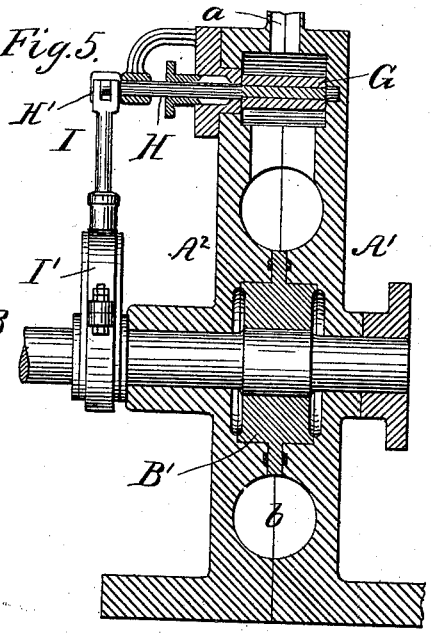


Fig. 6.

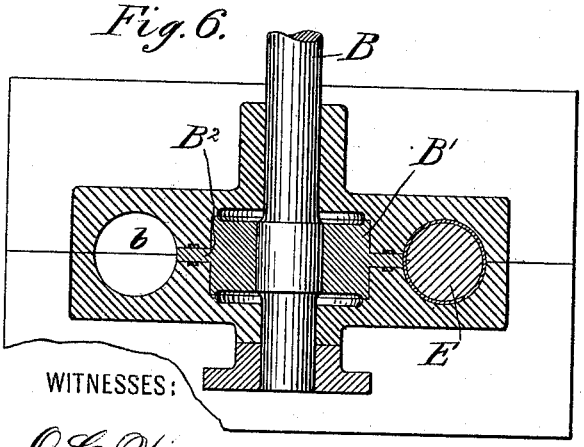
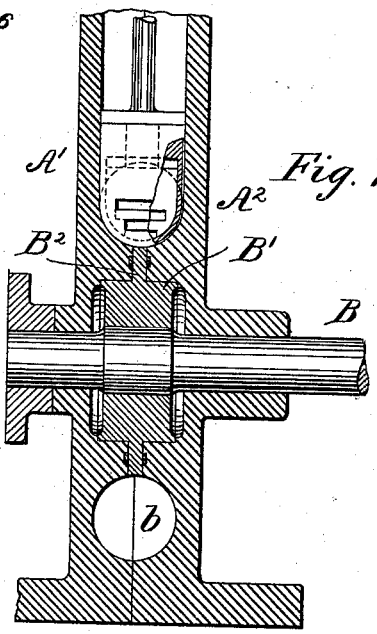


Fig. 7.



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(Application filed Aug. 19, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 8.

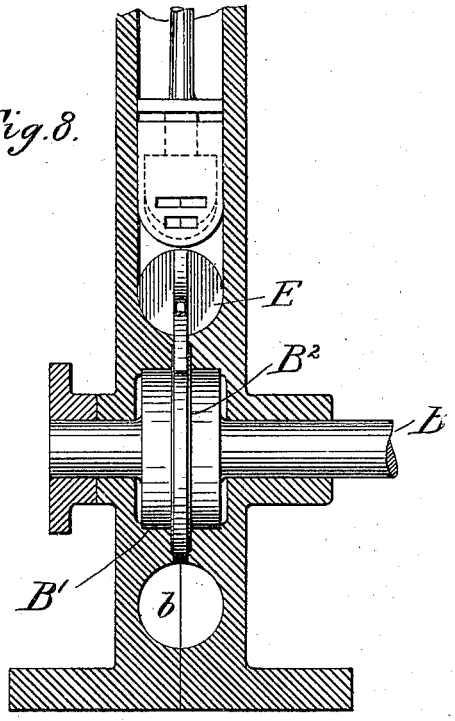


Fig. 10.

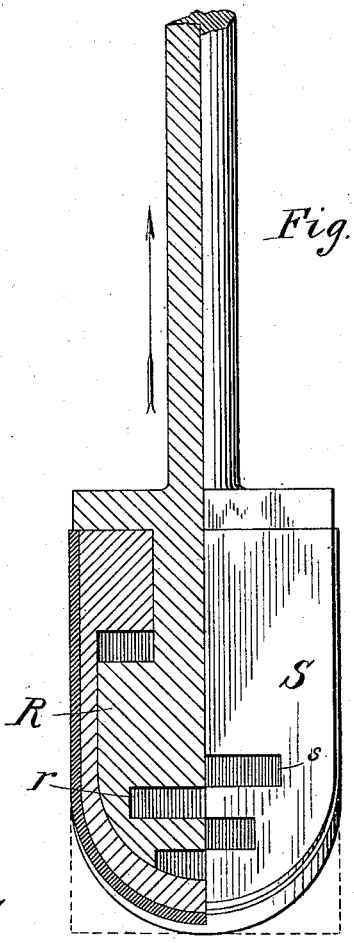
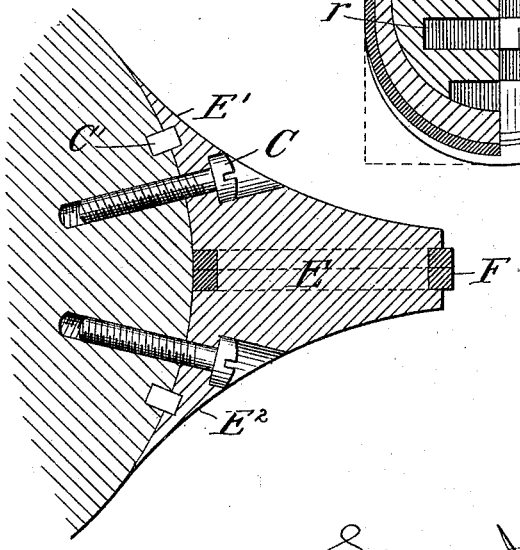


Fig. 9.



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UNITED STATES PATENT OFFICE.

EDGAR J. WOOD, OF NEW YORK, N. Y., ASSIGNOR TO MARGARET A. WOOD, OF SAME PLACE.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 647,172, dated April 10, 1900.

Application filed August 19, 1899. Serial No. 727,829. (No model.)

To all whom it may concern:

Be it known that I, EDGAR J. WOOD, a citizen of the United States, residing in New York, in the borough of Brooklyn and State of New York, have invented a certain new and useful Improvement in Rotary Steam-Engines, of which the following is a specification.

My engine may be made in various sizes; but the invention is intended more particularly for small-size engines adapted to drive fans and light manufacturing machinery. It is of the class in which a "piston" or wing is carried on the wheel and revolves in an annular passage in a stationary casing and an abutment is formed by a part moving inward from the outside to close the annular passage and is withdrawn for a brief period at each revolution to let the piston move past.

My improvements relate to the details of the mechanism. Among other advantages they allow the steam to exhaust through the abutment before commencing to withdraw the latter. I have devised a construction which enables this to be effectively attained with simple mechanism.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a side view showing the principal parts. Fig. 2 is an outline showing one form of governor that may be used in connection with my improved engine. Fig. 3 represents certain parts detached. Fig. 4 is a central section transverse to the axis, showing the parts in the position of full operation. Fig. 5 is a section on the line 5 5 in Fig. 4. Fig. 6 is a section on the line 6 6 in Fig. 4. Fig. 7 is a vertical section. In all the above figures the abutment is in position to close the annular passage and make the engine effective. Fig. 8 is a vertical section showing the piston in its highest position and with the abutment correspondingly elevated to allow the piston to pass. Fig. 9 is a section of a portion corresponding to Fig. 4 on a larger scale. Fig. 10 shows a portion of the abutment on a larger scale. It is a face view partly in section.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A' A^2 are stout stationary castings, which together constitute the main body or casing of the engine. B is a shaft supported in strong bearings and carrying a hub B', from which extends a thin smoothly-finished disk B^2. The latter carries on its periphery a separately-formed part E, which serves as the wing or piston, with efficient means for strongly and stiffly securing the same to the disk.

I make the annular channel or chamber *b* of circular cross-section, half in each of the parts A' A^2. The piston E is correspondingly circular. It is widened in its inner side by webs E' E^2 and is strongly and stiffly secured to the rim B^2 by the aid of bolts C and keys C'. I have shown two of the latter; but a greater number may be employed, matched one half in the disk B^2 and the other half in the wide base of the piston E E' E^2. The piston carries two mismatched packing-rings F, the recess for the packing in the piston being properly adapted, so that the packing is continuous.

The steam is admitted from a steam-pipe (not represented) through a passage *a*. Its admission to the engine is controlled by an oscillating valve G, which is turned by a shaft H, having an arm H', actuated by a link I, connecting to an eccentric-ring I', which is carried on a movably-mounted eccentric J, the position of which is controlled by a governor K, carried in the fly-wheel M. When the speed is too great, the weights L L are moved apart in opposition to the force of the springs N and by pulling the link I shift the eccentric in a line oblique to its eccentricity, so that, although it continues to open the valve at the same point in the revolution of the shaft B as at first, it will hold it open a less time, and consequently the admission of steam to the engine through the induction passage or port *a* will be cut off at an earlier point in each revolution. When the speed is too slow, the springs N assert themselves and draw the weights L together, thus thrusting on the rod I and shifting the eccentric in the opposite

direction and correspondingly prolonging the period of admission of the steam.

The specific construction of governor does not constitute a part of the present invention. It is set forth for the purpose of disclosing one means by which the oscillating valve G may be automatically controlled from the main driving-shaft.

The abutment is peculiar. What I will term its "main body," although the parts may be so proportioned that the other is a larger part, is a slide R, capable of moving longitudinally inward and outward. When it is in its extreme inward position, it extends across the annular chamber *b*. It is accurately finished and packed to move steam-tight, but is provided with a series of narrow horizontal apertures *r*, which perform an important function.

S is a slide mounted steam-tight on the steam-face of the main abutment R and having apertures *s*, corresponding to the apertures *r* in the abutments. When this slide S is in its extreme downward position, the apertures *r* and *s* are out of coincidence, and the abutment R with the slide S constitute together a steam-tight abutment. This is the condition which obtains during the principal portion of each revolution, the strong steam coming in through the port *a* and maintaining a high pressure in the annular chamber *b* behind the piston E. At some period in the revolution the valve G is closed by the action of the connected mechanism operated by the engine, and the admission of steam is cut off, allowing the steam which is already received to act expansively with diminishing force. This condition obtains, the force of the steam acting behind the piston to induce and maintain the motion until the piston has nearly completed its revolution. The dotted lines in Fig. 4 indicate, approximately, the position at which the exhaust, effected by the first portion of the rising motion of the slide S, should commence.

A cross-head S^2 on the upper end of the slide S receives links P, which connect with arms W', one on each end of a rocking shaft W. This shaft receives its rocking motion through a link Q', connected with a roller Q, which, with an associated roller V and a connecting-link V', is reciprocated in an approximately-horizontal path to the right and left by a link U, operated by a crank-pin B^3, carried on the main shaft B. In making these reciprocations the rollers travel in a peculiarly-formed way D, adapted to strongly support and guide them. The principal portion of the way is only slightly curved, so that the rollers in being traversed through such part of the way hold the cross-head S^2 stationary. This is the period while the abutment is down in gentle but steam-tight contact with the rim of the wheel-web B^2 and with adjacent surfaces of the casing A' A^2. Near the outer end of the path of the rollers Q V the way D is greatly curved, so that the roller Q in traversing into this portion of the way is rapidly raised, and during the return movement this roller is rapidly lowered again. These are the rapid movements required in the connected abutment R S to allow the traverse past it of the piston E at each revolution.

The way D is adjusted on a slightly-turning center D', controlled by a screw D^2, so that its inclination may be changed by very fine degrees, when required, by reason of wear or other cause in order to attain the correct position of the abutment when it is in action.

The first movement for the exhaust is the upward movement of the slide S, induced by the action of the links P and connections operated by the engine. The slide S moves upward the first part of its motion without carrying the slide R with it, the latter being retained by inertia and friction; but before the slide S has moved far the apertures *s* and *r* begin to coincide and the steam rushes through those apertures and escapes through the exhaust-passage *a'* at the upper part of the main body on the side of the abutment opposite to that at which the induction-port is located, the general character of the exhaust-port *a'* being somewhat similar. Next the further upward movement of the slide S causes it to strike the upper end of the chamber, and thence forward the further rising movement of the slide S carries with it the abutment-slide R. Both move together until the abutment is entirely out of the way, while the piston E moves past the abutment. During such motion the slide S commences to move downward and so soon as the abutment has passed its lower edge acts on the abutment R, carrying it downward. This movement of the parts R and S relatively to each other insures a closing of the abutment. So soon as the piston E has passed and the abutment has moved inward behind it the valve G opens and allows live steam to come in through the aperture *a* and commence to act with full force between the abutment R S and the piston E, causing the latter to strongly revolve the shaft B. The operations are repeated indefinitely, the valve G being closed at earlier or later periods in the stroke, as determined by the governor, to maintain an approximately-uniform speed.

Packings are liberally introduced, as partly indicated, to prevent the leakage of steam through the several joints.

I attach importance to the fact that the abutment is in two parts R and S, with apertures in each which can be made to coincide, because the opening movement will, by first bringing these apertures *r* and *s* into coincidence, allow the steam to exhaust through them, and thus reduce or entirely avoid the pressure on the abutment. I also attach importance to the fact that the motion of the

main abutment R is communicated through the slide S, because it simplifies the mechanism and insures the assuming of the proper condition to relieve the pressure before the abutment proper commences to move and also insures the closed condition of the abutment so soon as it has moved downward to its working position.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention.

It will be understood that there may be any ordinary provisions, as a spring, a piston operated by steam or air pressure, or positive connections through a cam (not shown) for moving the slide S and its attachments inward.

The inner end of the sliding abutment S, instead of having the semicircular form shown clearly in Fig. 10, may be square, as indicated by dotted lines in that figure; but in such case it will obviously be necessary to cut into the parts A' A^2 to allow the corners to be received.

It is obvious that the engine may be used in the same way with the same effect with any other gaseous fluid instead of steam.

I claim as my invention—

1. In a rotary engine of the type described, the combination with the main casing having the annular steam-space, and induction and valveless exhaust-passages, a piston revolving in the steam-space, a movable abutment coacting with said piston, and controlling the exhaust, means for positively operating said abutment, and the valve G in the induction-passage and means for operating it, substantially as set forth.

2. In a rotary steam-engine of the type described, the combination with the main casing having the annular steam-space, valved induction and valveless exhaust-passages, of a drive-shaft carrying a hub, a piston located within said steam-space, having opposite curved webs, and detachably bolted to the hub, and a movable abutment controlling the exhaust the lower end of said abutment being curved to coact with the curved webs of the piston and packed, and external means for positively operating said abutment, substantially as herein specified.

3. In a rotary steam-engine, the combination with the main casing having the annular steam-space and an exhaust leading therefrom, of a drive-shaft carrying the hub, a piston carried by the latter and movable along the steam-space, a movable abutment containing a transverse opening, and a valve within said abutment to control the communication through the abutment with the exhaust, and means for moving said abutment across the steam-space, substantially as herein specified.

4. In a rotary steam-engine, the combination with the main casing having the annular steam-space and an exhaust leading therefrom, of a drive-shaft carrying a hub, a piston carried by the latter and movable along the steam-space, a movable abutment containing a transverse opening and a valve S for controlling the communication through the abutment with the exhaust, and means for moving said abutment across the steam-space, substantially as herein specified.

5. In a rotary steam-engine, the combination with the main casing having the annular steam-space and an exhaust leading therefrom, of a drive-shaft carrying a hub, a piston carried by the latter and movable along the steam-space, a movable abutment containing a transverse opening, and an independently-movable slide for controlling the communication through the abutment with the exhaust, and means for successively operating such slide and withdrawing the abutment from the steam-space and for returning the same each by a positive motion and with a single throw, substantially as herein specified.

6. In a rotary steam-engine of the type described, the combination with the main casing having the exhaust and valve-controlled supply-ports and annular steam-space, of a main shaft carrying a smoothly-flanged hub, a piston movable within said steam-space and secured to such flange, a movable abutment between the exhaust and supply ports, and provided with a packed stem extending externally, a link connected therewith and attached to an arm W′ on a rocking shaft W, and connections thereto from rollers Q and V, playing in a curved way D and a connection U to such rollers from a crank-pin B^3 carried around with the shaft arranged to successively move the abutment in both directions and to hold it in a fixed position for the period required, all substantially as herein specified.

7. In a rotary engine of the type described, the combination with the main casing having an annular exhaust-supply and rotating piston, of an abutment reciprocative in the path of the piston, and devices and connections between said abutment and the driving-shaft, including the curved way D adjustable to vary the motion transmitted from the driving-shaft to the abutment, substantially as set forth.

8. In a rotary steam-engine of the type described, the combination with the main casing having the exhaust and valve-controlled supply-ports and annular space, of a main shaft carrying a smoothly-flanged hub, a piston movable within said steam-space and secured to such flange, a movable abutment between the exhaust and supply ports, and provided with a packed stem extending externally, two links connected therewith each attached to an arm W′ on a rocking shaft W, and connections thereto from rollers Q and V

playing in a curved way D and a connection U to such rollers from a crank-pin B^3, carried around with the shaft, and provisions as the pivot D′ and screw D^2 for changing the position of said way and thus changing the movement with capacity for fine adjustment, all substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

EDGAR J. WOOD.

Witnesses:
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M. F. BOYLE.