(No Model.) 4 Sheets—Sheet 1.

S. C. SHEPARD.

ROTARY STEAM ENGINE.

No. 525,121. Patented Aug. 28, 1894.

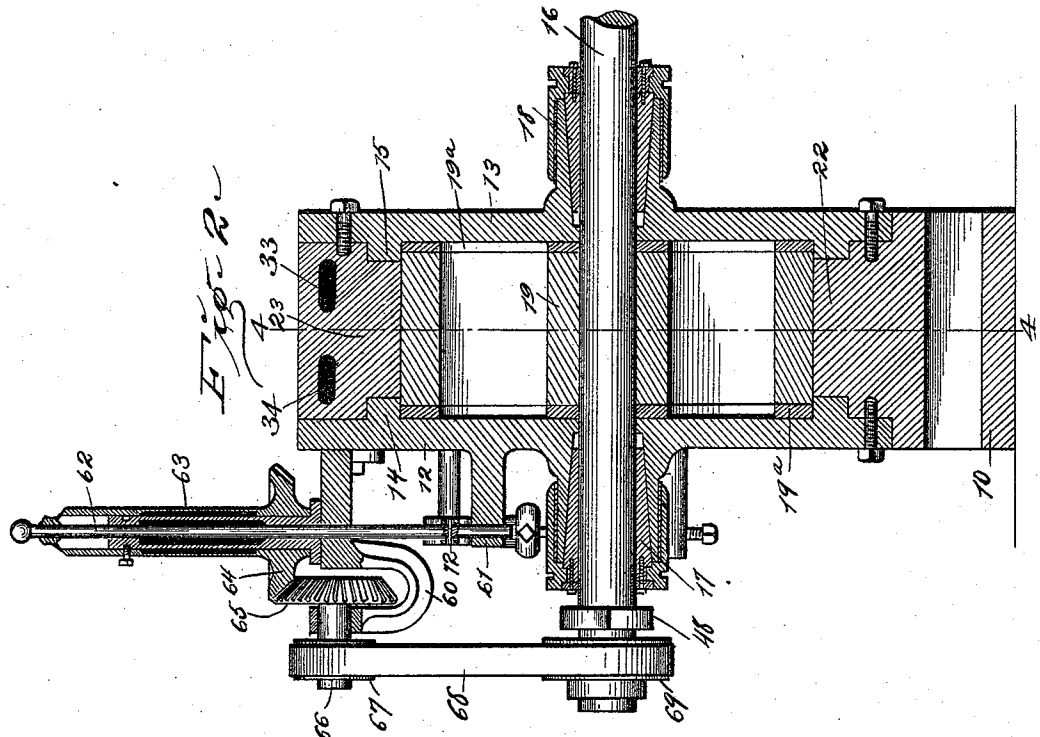

Fig. 2.

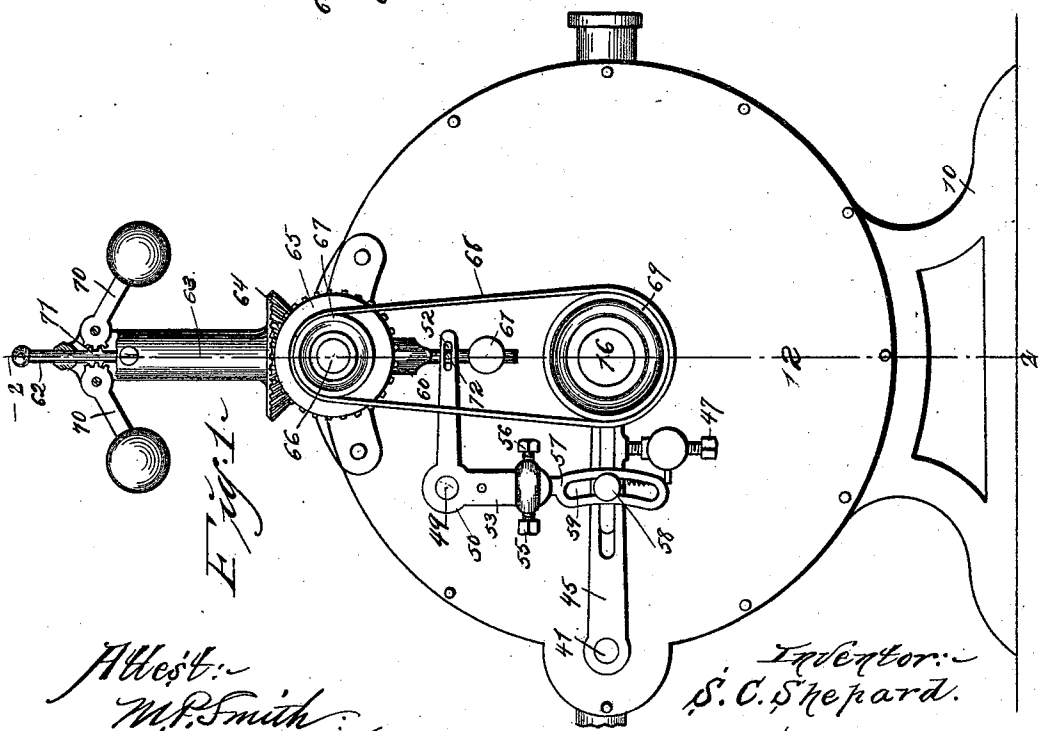

Fig. 1.

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ROTARY STEAM ENGINE.

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Fig. 4.

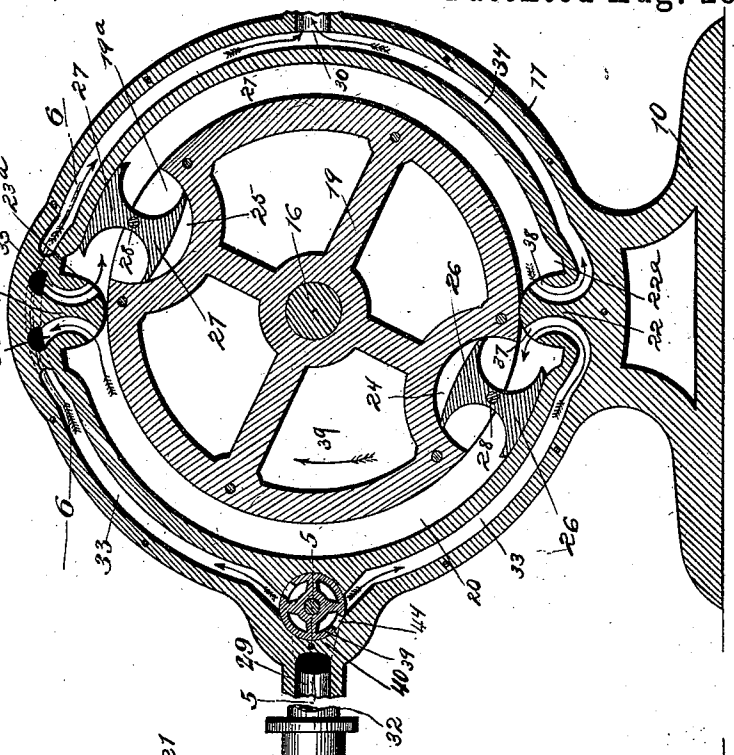
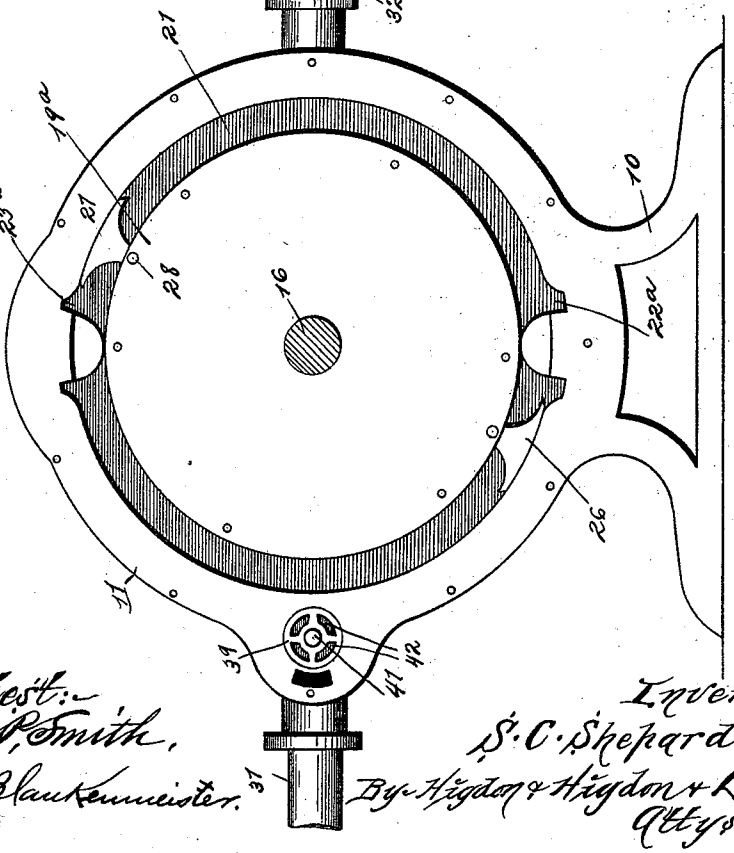


Fig. 3.



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4 Sheets—Sheet 3.

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Fig. 7.

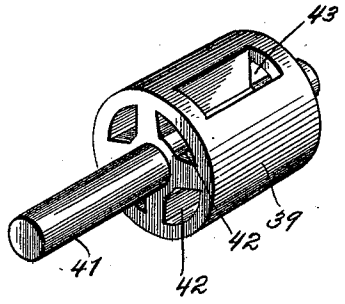


Fig. 5.

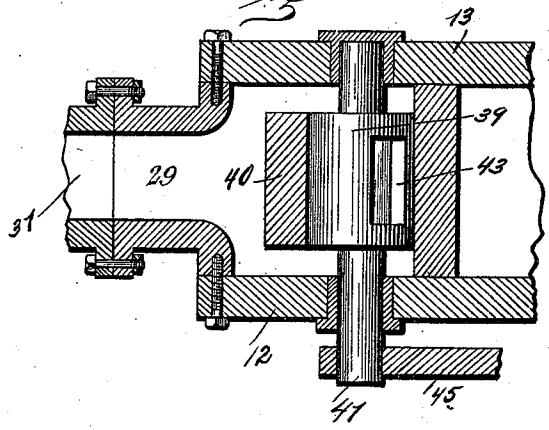


Fig. 6.

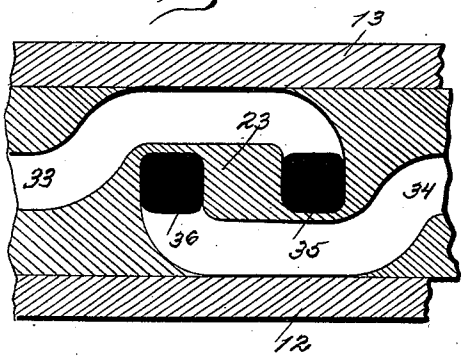


Fig. 8.

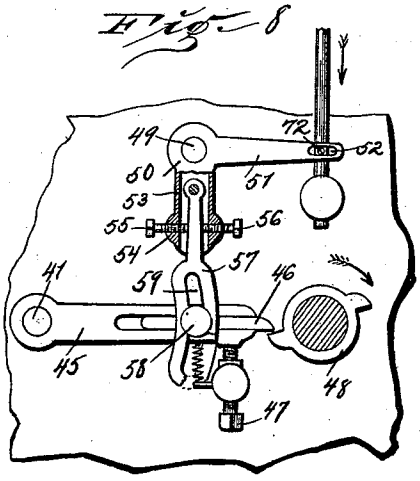


Fig. 9.

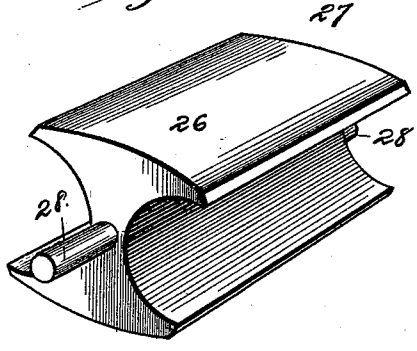
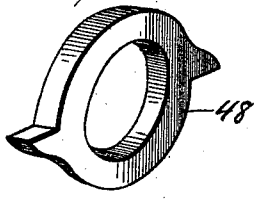


Fig. 10.



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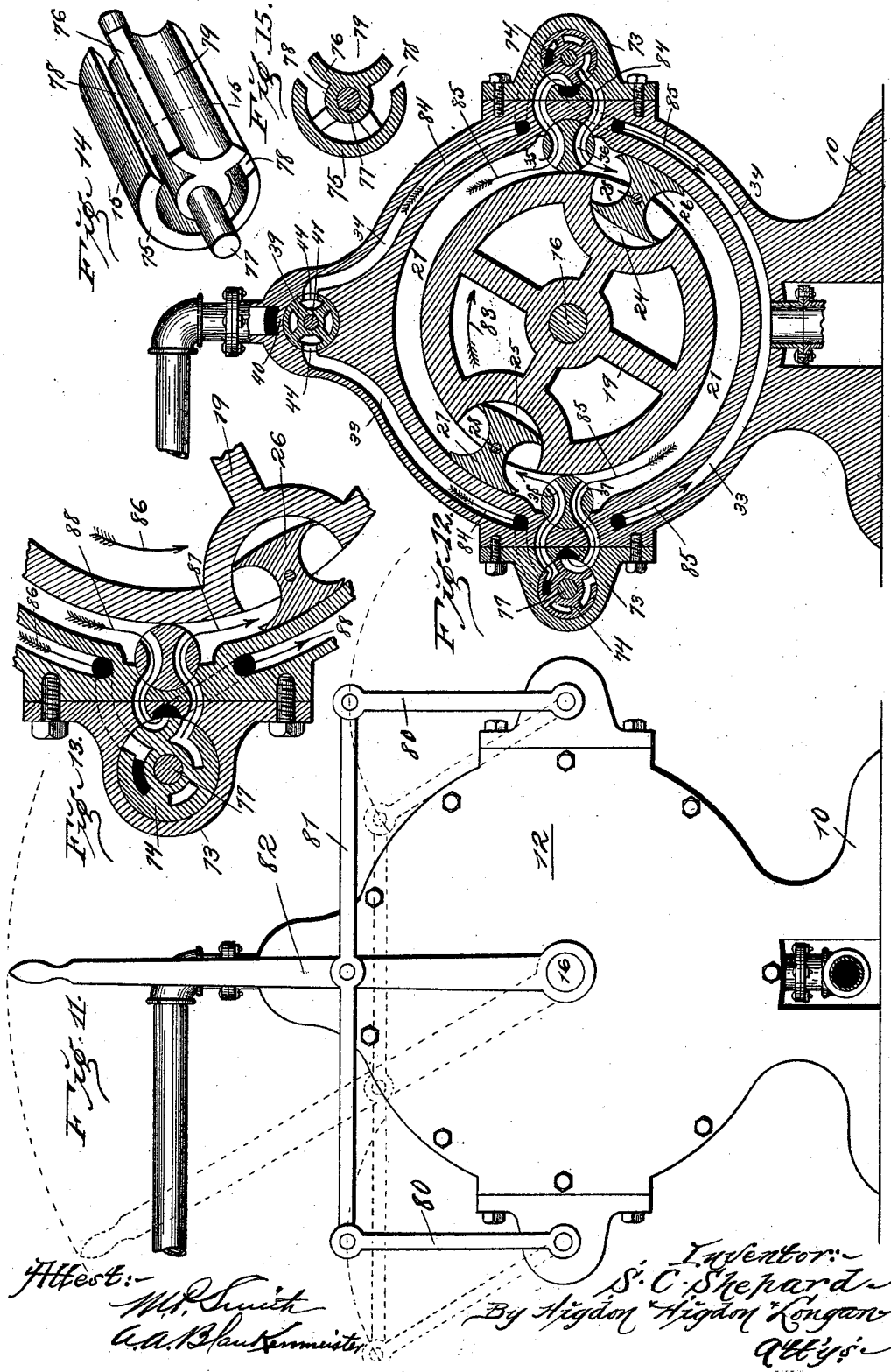

UNITED STATES PATENT OFFICE.

SYLVANDER C. SHEPARD, OF HANNIBAL, MISSOURI, ASSIGNOR OF ONE-HALF TO CORNELIUS A. TREAT, OF SAME PLACE.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 525,121, dated August 28, 1894.

Application filed May 14, 1894. Serial No. 511,266. (No model.)

To all whom it may concern:

Be it known that I, SYLVANDER C. SHEPARD, of the city of Hannibal, State of Missouri, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

The object of this invention is to provide improved means for rotating mechanism.

A further object of this invention is to improve the construction, operation and effectiveness of rotary steam engines.

To this end, my invention consists in the construction, combination and arrangement of parts, hereinafter set forth, pointed out in my claims and illustrated by the accompanying drawings, in which—

Figure 1 is a side elevation of the complete machine. Fig. 2 is a sectional elevation on the line 2—2 of Fig. 1. Fig. 3 is a side elevation of the machine, the front plate being removed. Fig. 4 is a sectional elevation of the machine on the line 4—4 of Fig. 2. Fig. 5 is a sectional plan on the line 5—5 of Fig. 4. Fig. 6 is a sectional plan on the line 6—6 of Fig. 4. Fig. 7 is a perspective view of the valve. Fig. 8 is a detail view of a portion of the governor mechanism. Fig. 9 is a perspective view of one of the piston heads. Fig. 10 is a detail perspective view of a portion of the governor mechanism. Fig. 11 is a side elevation of my invention provided with reversing mechanism. Fig. 12 is a central longitudinal cross-sectional view of the form of my engine, to which the reversing mechanism is applied. Fig. 13 is an enlarged detail sectional view of the valve in a reversed position from that shown in Fig. 12. Fig. 14 is a perspective view of the form of reversing valve I use, Fig. 15 being a cross-sectional view on the line 15—15 of Fig. 14.

This invention relates to my application for United States Letters-Patent for improvements in rotary pumps, bearing even date herewith, and is an adaptation of the principles of said pump to a rotary engine.

In the construction of the device as shown, the numeral 10 designates a base, and 11 an approximately annular shell formed on, or fixed to, said base and supported thereby. Fixed to the shell 11, in parallel planes and inclosing the sides of said shell, is a front plate 12 and a back plate 13, on which plates are formed annular flanges 14, 15 adapted to fit in annular recesses in the said shell.

Centrally located in bearings formed in the plates 12, 13, and extending transversely of the shell 11, is a driven shaft 16 provided with, and adapted to revolve in, stuffing-boxes 17, 18.

Located within the cylinder formed by the shell 11 and plates 12, 13, and rigidly mounted upon the shaft 16, is a head 19 comprising a body portion and plates 19^a mounted on said body portion and adapted for engagement with the inner faces of the said plates 12, 13, the periphery of which head is concentric with the interior face of said shell, and at such a distance therefrom as to form steam passages 20, 21.

Formed on, and extending inwardly from, the shell 11 are abutments 22, 23, which said abutments are provided with semi-circular faces and are located diametrically opposite each other, the apices of the semi-circular faces being adapted for engagement and sliding contact with the periphery of the head 19. Depressions 22^a and 23^a are formed in the interior face of the shell 11 on opposite sides of the abutments 22, 23, respectively.

Semi-cylindrical concavities, or depressions, 24, 25 are formed in the periphery of the head 19 between the plates 19^a, and mounted within said concavities and rotatably connected to the plates of said head are piston heads 26, 27 having two semi-circular concaved opposite sides and two convex opposite sides, the convex opposite sides being adapted for alternate engagement with the inner face of the shell 11, the concaved opposite sides being adapted for alternate engagement with the semi-circular faces of the abutments 22, 23. The connections between said piston heads and the plates 19^a comprise trunnions 28 mounted for rotation in bearings formed in said plates, the construction of the piston heads 26, 27 being clearly shown in Fig. 9.

An induction port 29 is provided in one side of the shell 11, and an eduction port 30

is provided in the side of the shell 11 diametrically opposite to the induction port. A steam induction pipe 31 communicates with the port 29, and a steam eduction, or exhaust, pipe 32 communicates with the port 30, the pipe 31 leading from a source of steam supply, the pipe 32 leading to a point of discharge of the exhaust steam, or further use thereof. An induction passage 33 is formed in the shell 11 adjacent to the port 29, said port 29 communicating with the said passage at approximately the central portion thereof. The passage 33 leads both ways from the port 29 to points of discharge within the passages 20, 21 at the lower and upper ends thereof, respectively. An exhaust passage 34 is formed in the shell 11 opposite to the passage 33, and communicates with the port 30. The passage 34 leads both ways from the port 30 to points of communication with the passages 21, 20 at the lower and upper ends thereof, respectively.

The upper end portions of the passages 33, 34 overlap, or cross, each other, and respectively communicate with ports 35, 36 in the abutment 23, the said ports affording communication between the said passages and the passages 20, 21 at the upper ends of said latter passages and on opposite sides of the said abutment. The lower end portions of the passages 33, 34 communicate with the lower ends of the passages 20, 21, by means of ports 37, 38, respectively formed in the abutment 22 and opening from opposite sides thereof.

The shaft 16 is adapted to be geared to any mechanism to be driven thereby.

Mounted in the path of the port 29 is a valve 39 (Fig. 7), which valve is separated from the axial path of the port 29 by a partition 40, and is mounted for oscillation by means of a spindle 41, journaled in the plates 12, 13. The valve 39 is provided with a plurality of longitudinal apertures, or bores, 42, 42 arranged in series concentrically to the center thereof and extending from end to end, and serving as steam ports therein. The port 29 branches and extends along the ends of the partition 40, and into communication with the ports formed by the bores 42, 42 in the valve 39 at either end of said valve. Longitudinal slots 43, 44 are provided in the periphery of the valve 39, which slots in connection with passages 33 afford communication between the ports formed by the bores 42, 42 and the induction passage 20.

The spindle 41 extends through the front plate 12 and has rigidly mounted, by one end, on its outer end portion, a lever 45, which lever is bifurcated at its forward end, and has mounted in the bifurcation a trigger 46. The trigger 46 is adjustable longitudinally within the bifurcation in the lever 45, and is maintained temporarily stationary by an adjusting screw 47 seated in said lever and impinging against said trigger.

A tripper 48 is mounted on the outer portion of the shaft 16 adjacent to the plate 12, and the trigger is so positioned relative to said tripper that the arms of the latter are adapted to intermittently and successively engage the said trigger and actuate the same.

A pivot 49 is mounted within, and projects horizontally outward from the outer face of, the plate 12, on which pivot is fulcrumed a bell-crank-lever 50 having the horizontal arm 51 provided with a slot 52 in its outer end portion, and the hollow arm 53 having the bossed portion 54, within which are seated diametrically opposite adjusting screws 55, 56. Pivotally mounted, by its upper end, in the upper portion of the arm 53 is a bridle 57, the adjusting screws 55, 56 impinging against opposite sides of the said bridle at points below the pivot thereof. The bridle 57 embraces a retaining screw 58 seated in, and projecting laterally from, the trigger 46, which retaining screw has a sliding bearing with the said bridle.

The slot 59 in the bridle is curved, in order that the retaining screw 58 may travel therein without disturbing the position of the said bridle.

Brackets 60, 61 are fixed to, and extend laterally from, the plate 12 in the vertical plane of the shaft 16, and a governor-rod 62 is mounted for reciprocation in a vertical plane in the said brackets. Mounted about the governor-rod 62, and adapted for rotation relative thereto, is a sleeve 63 having on its lower end portion a bevel-gear 64 meshing with a bevel-gear 65 on a countershaft 66, mounted in the bracket 60. Rigidly mounted on the outer end portion of the counter-shaft 66 is a belt-wheel 67 connected by means of a belt 68 to a belt-wheel 69 on the outer end portion of the shaft 16.

Pivotally connected to the sleeve 63, on diametrically opposite sides thereof, are centrifugal arms 70, which arms have segmental gears on their inner ends meshing with annular flanges 71 formed on the governor-rod 62. The lower end portion of the governor-rod 62 has seated therein a pin 72, which pin passes through the slot 52 in the horizontal arm 51 of the bell-crank-lever and connects said governor-rod to said lever.

Referring now to the reversible engine shown in Figs. 11 and 12, said engine is constructed similarly to the one just described, with the exception that the valve 39 is located on the top of the engine and the exhaust port in the bottom thereof.

On both sides of the engine are bolted casings 73 having located therein reversing valves 74, these being more clearly shown in Figs. 14 and 15. These valves consist of two semi-circular portions 75, 76, which are mounted upon the central shaft 77, leaving spaces 78 for the induction, or eduction, of steam. The depression in the portion 76 is designated by the numeral 79, which depression 79 is immediately over the end of the port 33 on one side, and over the port 34 on the other side. These ports 33, 34 communicate with

the ports 35, 36 and 37, 38, which are, in turn, both induction and eduction ports. Secured to those portions of the central shaft 77 extended outside of the casing 73, are vertical arms 80 connected by the horizontal bar 81.

A manually operated handle, or lever, 82 is pivoted to the central shaft 16, extends vertically upward, and is pivoted near its central point to the cross-bar 81. By throwing this lever to either the right, or left, as shown by dotted lines in Fig. 11, the valves 74 may be so positioned as to cause the live steam to enter either set of ports desired, and thus cause the engine to rotate in the desired direction.

Referring to Fig. 12, which shows the engine running in the direction indicated by the arrow 83, the live steam is entering through the ports, as indicated by the arrow 84 and exhausting through the ports, as indicated by the arrow 85.

The reverse rotation of the engine is shown in Fig. 13, where said engine is rotating in the direction indicated by the arrow 86. Here the live steam is entering through the ports as indicated by the arrow 87, and exhausting as indicated by the arrow 88.

The practical operation of the engine, the parts being in the position shown in Figs. 1, 2, 3, and 4, upon the admission of steam to the port 29, said steam will diverge and pass across either end of the partition 40, and into the ends of the ports 42, 42; from thence the steam will be led, by a slight oscillation of the valve 39, to the slots 43, 44 into the passage 33; the steam passes along the passage 33 in both directions from the ports 43, 44, and through the ports 35, 37 in the abutments 23, 22, respectively, into the passages 21, 20 at the upper and lower ends, respectively, of said passages. Within the passages 20, 21 the steam exerts an influence upon the abutments 22, 23 and the piston heads 26, 27, and the said piston heads being, by reason of their positioning upon a rotatable body, movable along the passages 20, 21, are, by the force of the said steam, caused to travel in said passages in a given direction, thus rotating the head 19, and, consequently, the shaft 16 and mechanism geared thereto. In the advancement of the piston heads 26, 27 along the passages 20, 21, one corner of each head will engage in the depression 23^a first reached thereby, and, contacting with the adjacent side of the abutment 23, be rotated upon its axis, bringing one of its semi-circular, or concaved, faces into contact with the semi-circular face of such abutment, thereby permitting the passage thereof beyond such abutment, each of the said piston heads being rotated a one-half revolution upon each contact thereof with an abutment. The continued rotation of the head 19 necessitates a successive and intermittent contact of the piston heads 26, 27 with the abutments, and, consequently, a successive and intermittent rotation of such piston heads, thus insuring an equal and uniform wear upon all sides of the piston heads and the said abutments.

It will be observed that in the rotation of the piston heads 26, 27, the corners thereof engage with the faces of the concavities 24, 25 and travel in an orbit co-incident with the arc of such concavities.

It will be observed, by reference to Figs. 4 and 6, that the passages 33, 34, in order to overlap, must diverge from a true vertical plane and be carried parallel to each other for a distance. The continued induction of steam necessitates a continuous eduction, or exhaust, thereof, which is provided by the release of the steam in advance of the piston heads 26, 27 through the ports 36, 38, into the passage 34, and from said passage through the port 30 and pipe 32 to points of exhaust, or further use. In the continued rotation of the shaft 16 the belt-wheel 69 is rotated, and, by reason of its connection through the belt 68, revolves the wheel 67, shaft 66 and bevel gear 65; the bevel gear 65 meshing with the bevel gear 64, rotates the sleeve 63 on the governor-rod 62. It follows, therefore, that the continuous rotation of the sleeve 63 will tend to elevate the outer end portions of the centrifugal arms 70, 70, and said arms having the segmental gears acting upon the flanges on the governor-rod, will, in the elevation thereof, depress said governor-rod, which movement of depression acting through the pin 72 on the horizontal arm 51 of the bell-crank-lever, will oscillate said bell-crank-lever and cause the bridle secured thereto to move horizontally, thus carrying the trigger 46 to, or from, the tripper 48 as the case may be.

In the continuous rotation of the shaft 16, the tripper 48 is rotated in the direction of the arrow adjacent thereto in Fig. 8, thereby acting upon the trigger 46 and oscillating the lever 45, which lever being rigidly connected to the outer end of the valve-spindle 41, oscillates said valve and controls the alignment of the ports 43, 44 with the passage 33. When the lever 45 is in its lowest plane, the ports 43, 44 are, as shown in Fig. 4, out of alignment, or communication, with the passage, but when the said lever is lifted by the actuation of the tripper, the valve will be oscillated a sufficient degree to align the said ports with the said passage. It, therefore, will be observed that the amount of communication, or the width of the port of communication between the valve and the passage 33, is controlled by the degree of elevation, or oscillation, of the lever 45, which is automatically regulated by the longitudinal movement of the trigger 46 through the medium of the bridle, bell-crank-lever and governor-rod, thus providing an automatic cut-off, whereby the induction of steam may be regulated and controlled.

The degree of oscillation of the valve may be manually regulated by the adjustment of the screws 55, 56, and consequent positioning of the bridle relative to the bell-crank-lever,

thus determining the range of longitudinal movement of the trigger 46 relative to the axis of the tripper.

What I claim is—

1. A rotary engine, comprising a cylinder, a head mounted for rotation in said cylinder, a shaft connected to said head, two diametrically-opposite piston heads connected with said head, a circular-passage about said head within said cylinder, two diametrically-opposite abutments on said cylinder obstructing said passage and separating it into two opposite semi-circular divisions, ports of communication between the divisions of said passage, induction and exhaust ports communicating with openings in both of said abutments, and a single valve constructed to admit steam alternately to the openings in said two abutments, substantially as herein specified.

2. In a rotary steam engine, the combination of a revolubly mounted head, a cylinder inclosing said head, a shaft driven by said head, induction and exhaust passages for said cylinder, a valve mounted in the induction passage and having a spindle extending outside said cylinder, a lever rigidly connected to said spindle, a trigger mounted for reciprocation in said lever, a tripper mounted upon said shaft and adapted for intermittent successive engagement with said trigger, a bell-crank-lever mounted upon said cylinder, a bridle adjustably connected to said bell-crank-lever and connected to said trigger, a governor-rod connected with said bell-crank-lever, a sleeve mounted upon said rod, centrifugal arms mounted on said sleeve, and gear connections between said sleeve and the said shaft, whereby the flow of steam from the induction passage is automatically controlled.

3. In a rotary steam engine, the combination of a cylinder, a head mounted for rotation within said cylinder, piston heads revolubly mounted upon said head, abutments on said cylinder adapted for engagement with said head and said piston heads, passages within said cylinder, within which said piston heads are adapted to travel, induction and exhaust passages communicating with the first said passages and with the induction and exhaust pipes, a valve located within said induction passage, whereby steam is controlled, and a reversing mechanism comprising valves located on the sides of the cylinder, passages within said valves to alternately register with the induction and eduction ports within the abutting heads, and vertical arms attached to the shafts of said valves connected to, and operated by, a hand lever, substantially as specified.

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

SYLVANDER C. SHEPARD.

Witnesses:
S. C. SWEET,
JNO. C. HIGDON.