

(No Model.)

3 Sheets—Sheet 1.

L. SIVERTSON.
ROTARY ENGINE.

No. 562,159.

Patented June 16, 1896.

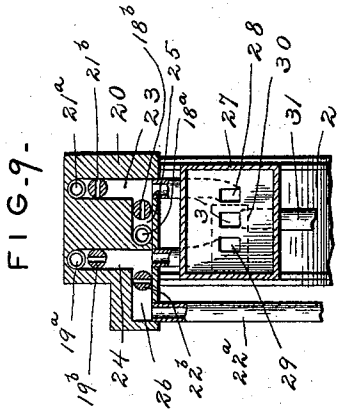


FIG. 9-

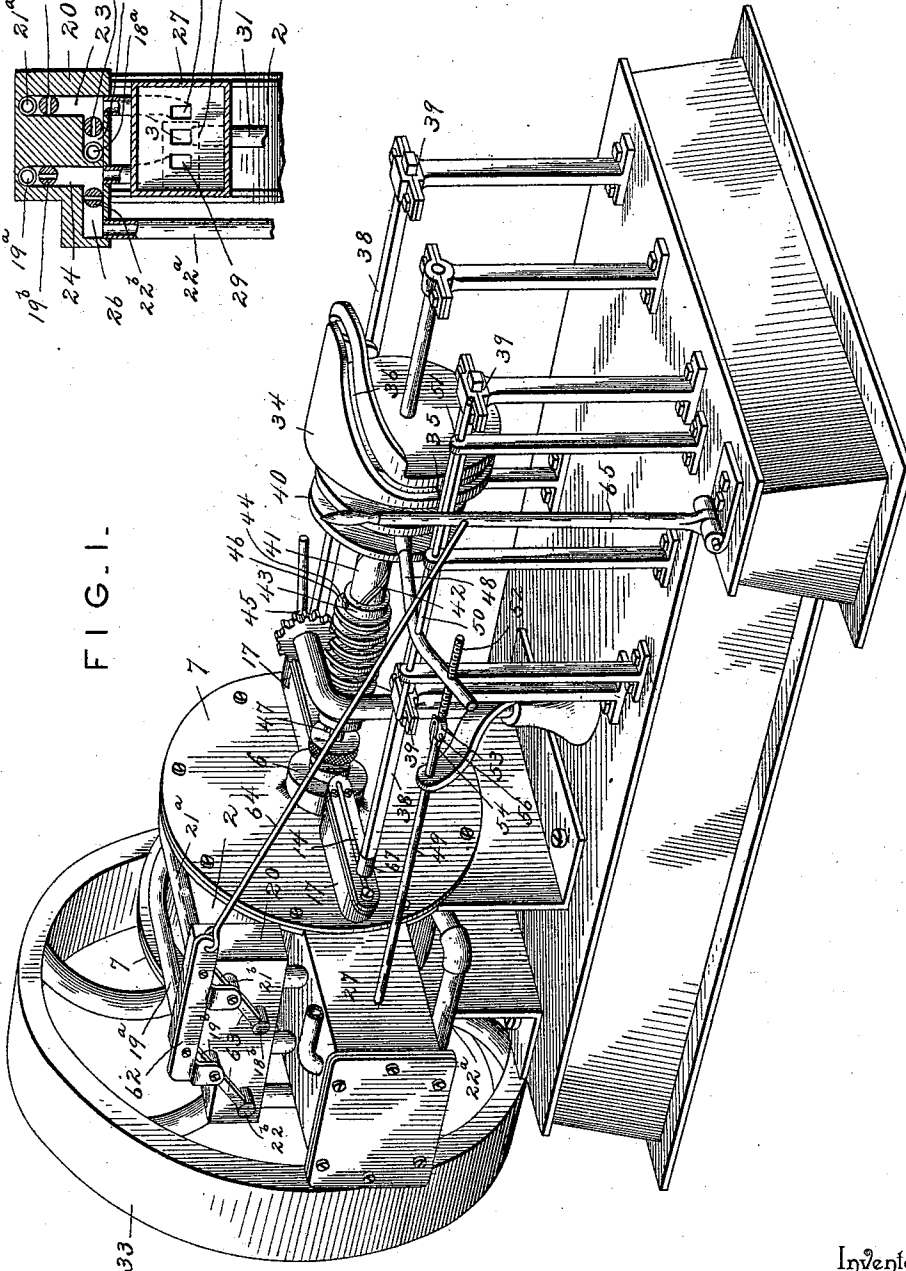


FIG. 1.

Inventor

Lucas Sivertson.

Witnesses

Harry L. Amer.
[Signature]

By *his* Attorneys,

Chas. H. Snow & Co.

(No Model.)

3 Sheets—Sheet 2.

L. SIVERTSON.
ROTARY ENGINE.

No. 562,159.

Patented June 16, 1896.

FIG. 2.

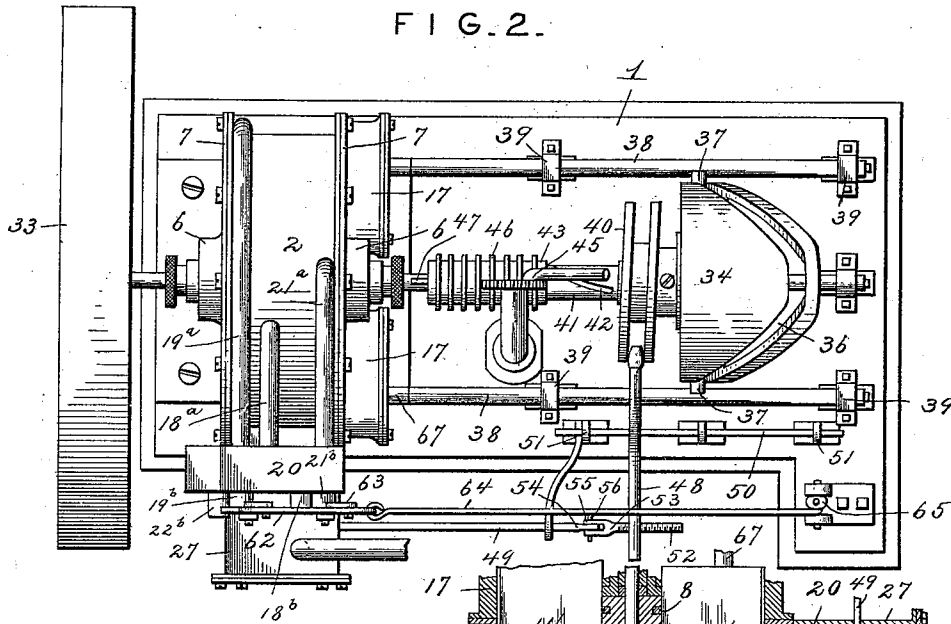


FIG. 3.

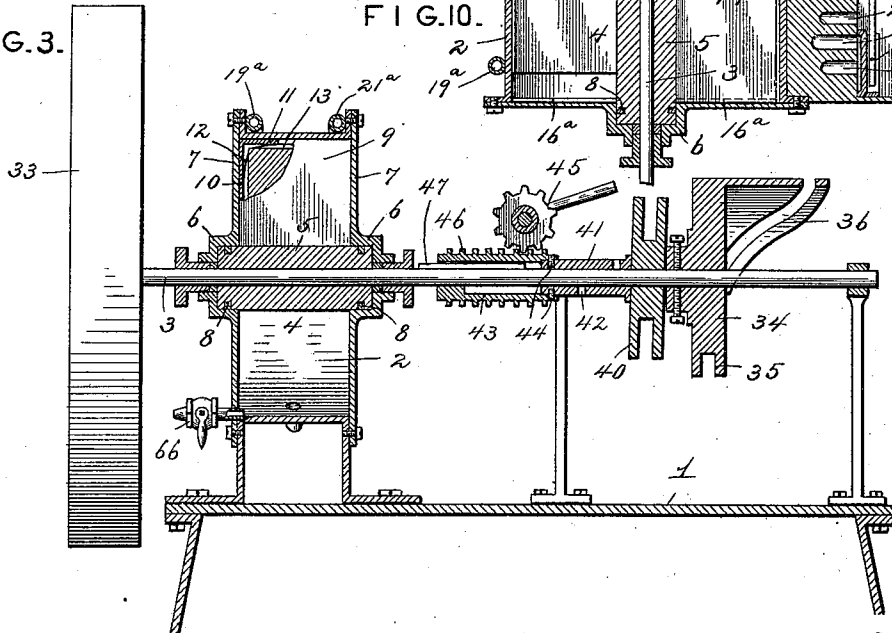
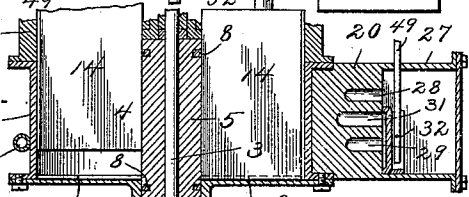


FIG. 10.



Inventor

Witnesses

Harry L. Amer.

By his Attorneys,

Lucas Sivertson.

L. SIVERTSON. ROTARY ENGINE.

No. 562,159.

Patented June 16, 1896.

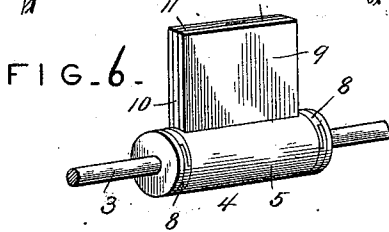
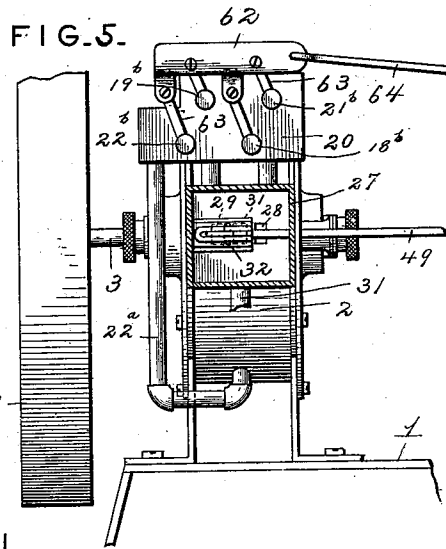
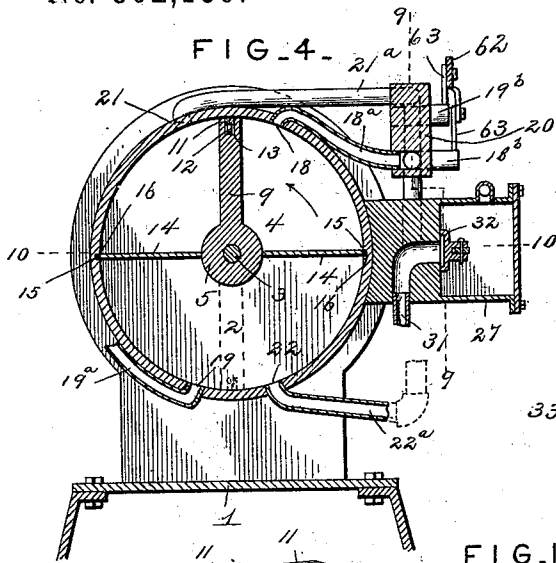


FIG. II.

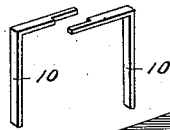


FIG. 7.

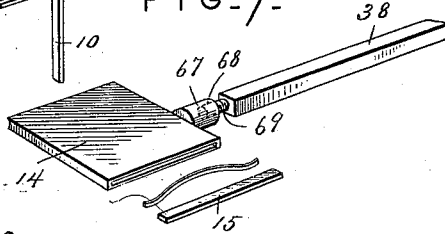
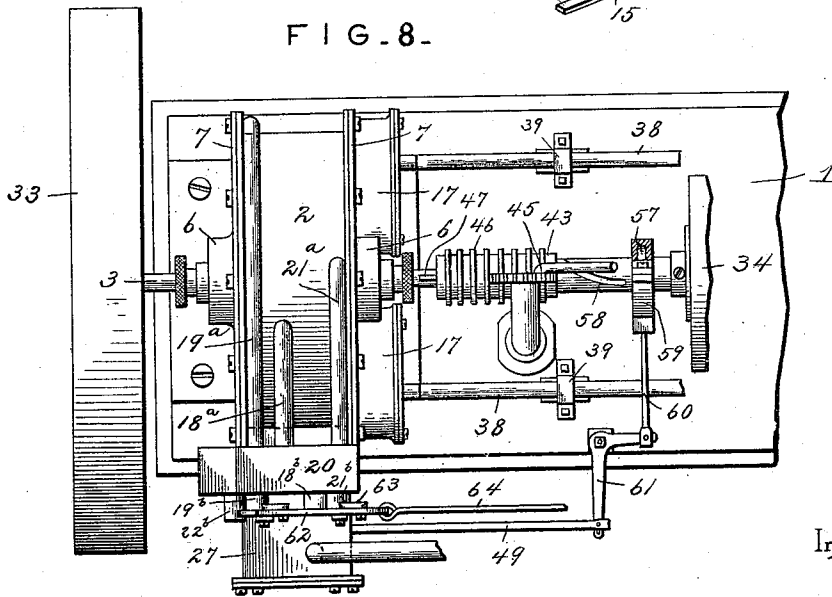
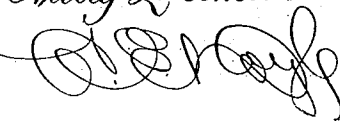


FIG. 8.



Inventor

Witnesses

Harry L. Ames.


By his Attorneys,

Lucas Sivertson.



UNITED STATES PATENT OFFICE.

LUCAS SIVERTSON, OF ROTHSAY, MINNESOTA, ASSIGNOR OF ONE-HALF TO
JENS G. WALLA AND JOHN A. WALLA, OF HORACE, NORTH DAKOTA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 562,159, dated June 16, 1896.

Application filed October 18, 1895. Serial No. 566,131. (No model.)

To all whom it may concern:

Be it known that I, LUCAS SIVERTSON, a citizen of the United States, residing at Rothsay, in the county of Wilkin and State of Minnesota, have invented a new and useful Rotary Engine, of which the following is a specification.

My invention relates to rotary concentric-cylinder engines, and has for its object to provide a simplification of and improvement upon the construction shown and described in my former patent, No. 528,493, granted October 30, 1894, such improvement relating particularly to the construction of the piston and the valve mechanism.

Further objects and advantages of this invention will appear in the following description, and the novel features thereof will be particularly pointed out in the appended claims.

In the drawings, Figure 1 is a perspective view of an engine constructed in accordance with my invention. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal section of the same in the plane of the axis of the driving-shaft. Fig. 4 is a transverse section of the cylinder, valve-casing, and steam-chamber. Fig. 5 is a front view, partly in section, of the steam-chest and valve-casing. Fig. 6 is a detail view of a piston detached. Fig. 7 is a similar view of one of the sliding abutments. Fig. 8 is a partial plan view showing the eccentric-adjusting mechanism applied to an eccentric of a different form from that illustrated in Figs. 1, 2, and 3. Fig. 9 is a vertical section of the reversing and slide valve casings to show the relative arrangement of the valves, channels, and passages whereby pressure is communicated from the slide-valve casing to the passages leading to the cylinder. Fig. 10 is a horizontal section of the cylinder on the line 10 10 of Fig. 4. Fig. 11 is a detail view of the piston-packing strips.

Similar numerals of reference indicate corresponding parts in all the figures of the drawings.

1 designates a suitable base, upon which is arranged the cylinder 2, and extending axially through the cylinder is the driving-shaft 3, which carries the piston 4. The piston comprises a core 5, which fits at its extremities in axial extensions or boxes 6, formed in

the heads 7 of the cylinder, and packing-rings 8 are arranged upon the extremities of the core and bear against the walls of said extensions or boxes to prevent lateral vibration of the piston, and a wing 9, carried by said core in a radial position and forming the movable abutment for the pressure of the motive agent. Said wing is provided with a packing-strip of sectional construction, the same including the parallel side legs 10, provided at their outer ends with inwardly-extending arms 11, which are rabbeted or halved and overlap to form a sliding extension-joint. Expansion-springs 12 are arranged between the inner sides of the packing-strip sections and the floors of the grooves 13, in which said sections are mounted, to insure the uniform contact of the outer surfaces of the sections with the surfaces of the side and heads of the cylinder.

Arranged to operate in the cylinder parallel with the axis of the driving-shaft are the sliding abutments 14, consisting of flat blades arranged in a common plane and at diametrically opposite sides of the core of the piston with spring-actuated packing-strips 15 upon their outer or remote edges to fit in guide-grooves or seats 16 in the inner surface of the side wall of the cylinder, the inner or contiguous edges of said blades being concaved to fit the convex or cylindrical surface of the core of the piston. This manner of mounting the fixed or casing abutments causes uniform pressure thereof upon the surface of the core to prevent the communication of pressure from a compartment of the cylinder upon one side of an abutment to the compartment upon the other side. The front edges of these abutments fit in seats consisting of grooves 16^a, formed in alinement with the guides 16 in the head of the cylinder, and the abutments extend through stuffing-boxes 17, formed in the opposite head of the cylinder.

Formed in the wall of the cylinder and communicating with the interior thereof, respectively, upon opposite sides of the plane of the abutments are the ports 18 and 19, and communicating, respectively, with these ports are the passages 18^a and 19^a, which extend to the valve-casing 20. Also communicating

with the cylinder, respectively, upon opposite sides of the plane of the abutments are the ports 21 and 22 from which extend the passages 21^a and 22^a, also in communication with said valve-casing. The valve-casing is provided with main channels 23 and 24 and lateral or auxiliary channels 25 and 26, communicating with the main channels. The main channels communicate with the steam-chest 27 through the inlet-ports 28 and 29, formed in a slide-valve seat 30 upon opposite sides of the exhaust-port 31, and communicating directly with said main channels are the passages 19^a and 21^a, while the passages 18^a and 22^a communicate, respectively, with the auxiliary or lateral channels 25 and 26. These channels are respectively provided with controlling or reversing valves for respectively opening and closing communication between the steam-chest and the cylinder to regulate the direction of rotation of the piston. The main channels 23 and 24 are fitted, respectively, with valves 21^b and 19^b, which respectively control the passages 21^a and 19^a, and the lateral channels 25 and 26 are respectively fitted with valves 18^b and 22^b for controlling the passages 18^a and 22^a, respectively. Hence, inasmuch as the passages 18^a and 19^a communicate with the cylinder upon opposite sides of the plane of the diametrically opposite fixed abutments the opening of the valves 18^b and 19^b, as shown in Fig. 9, will cause the rotation of the piston in the direction indicated by the arrow in Fig. 4, each passage serving alternately to convey live steam from the steam-chest or slide-valve casing 27 to the cylinder and convey exhaust-steam from the cylinder in advance of the piston to the exhaust-port 31.

The inlet and exhaust ports in the seat of the slide-valve casing 27 are controlled by the slide-valve 32 of the ordinary construction. Therefore, when the valves are in the positions indicated in Figs. 4, 5 and 9, in which the inlet-port 28 is exposed and the inlet-port 29 is in communication with the exhaust-port 31, the live steam, or equivalent motive agent, passes through the port 28 into the main channel 23 and thence by way of the open valve 18^b to the passage 18^a, and enters the cylinder through the port 18 in rear of the piston-wing to cause rotation in the direction indicated in Fig. 4, said wing, at the time of admitting steam through the port 18, being in an approximately vertical position above the core, as shown. When the piston-wing is in this position, the fixed abutments are both extended to cut off that part of the cylinder in which the wing or movable abutment is located from that part with which communicates the port 19. Approximately at the same time that steam is admitted through the port 18 in rear of the piston-wing the abutment in front of said wing begins to recede as shown in Fig. 10, and thereby opens communication between the space or compartment in advance of the

piston-wing and the portion of the cylinder with which communicates the port 19, whereby the portion of the cylinder in advance of the piston-wing exhausts through said port 19 and passage 19^a into the channel 24 and thence through the port 29 to the exhaust-port 31. By the time the piston-wing reaches the plane of the abutment in advance thereof, said abutment has receded out of the path of the piston-wing, and after the piston has passed said valve the latter again advances until, when the piston-wing reaches the vertically pendent position indicated in dotted lines in said Fig. 4, the abutment just passed and now in rear thereof has again advanced to its closed position. At this point the movement of the slide-valve 32 has opened communication between the slide-valve casing or steam-chest 27 and the port 29, and has connected the port 28 with the exhaust-port 31, whereby live steam passes through said port 29, channel 24, passage 19^a, and port 19 to the compartment of the cylinder between the rear side of the piston-wing and said abutment which has just reached its closed position, and at the same time the other abutment which has now become the abutment in advance of the piston begins to recede and thereby allows the cylinder to exhaust in advance of the piston through the port 18.

It will be obvious, from the foregoing description, that the forward movement of a fixed abutment occurs during the interval in which the piston-wing is advancing from a position in the plane of said abutment to a position perpendicular to that of the abutment, and that said abutment does not reach its closed position until the piston-wing has made, approximately, a quarter-revolution after passing the valve, or has moved far enough to pass the port through which steam is about to be admitted, but inasmuch as the port which has been supplying the live steam is not arranged in communication with the exhaust-port 31 until after that part of the cylinder with which said steam-port communicates has been cut off by the complete advance movement of the abutment, the pressure between the plane of said abutment which has just been passed by the piston and the rear side of the piston-wing is at its maximum, whereby there is no loss of pressure due to a necessity for filling the quadrant-chamber in rear of the piston-wing or between said wing and the abutment which has now reached its operative position. Thus, the pressure upon the rear side of the piston-wing is continuous and uniform throughout the operation of the mechanism.

Fixed to the driving-shaft, preferably contiguous to the plane of the cylinder, is a fly-wheel 33, and also secured to said shaft is a cam 34, of which one portion, 35, of the cam groove or surface is arranged in a true transverse plane, while the other portion, 36, is curved or looped from the cylinder. Operating in said cam-groove are pins 37, carried

by slide-bars 38, which are secured, respectively, to the fixed abutments and operate in guides 39, supported by the base. Said pins are preferably provided with antifriction-rolls. This cam imparts the desired reciprocatory movement alternately to the abutments, as hereinbefore described.

Arranged contiguous to the cam and mounted loosely upon the driving-shaft is an eccentric 40, having a sleeve 41, provided with a spiral groove 42, and keyed upon the shaft contiguous to said sleeve of the eccentric is a tubular slide or collar 43, which is provided with a pin 44 to operate in the spiral groove of the sleeve.

Any suitable means for adjusting the slide or collar longitudinally upon the shaft may be employed, that shown in the drawings consisting of a gear-lever 45, the teeth of which mesh with peripheral webs or teeth 46 on said slide or collar.

The slide or collar is held from rotary movement independently of the shaft by means of a key 47, operating in a suitable keyway in the slide or collar, and hence the peripheral webs or teeth on said slide or collar provide for the permanent engagement of the teeth of the gear-lever therewith, and at the same time provide for the adjustment of the slide or collar without checking the movement of the machine.

In Fig. 1, 2 and 3 I have shown an eccentric constructed of parallel disks arranged in parallel planes at an inclination to the axis of the driving-shaft, whereby different points in the periphery of the eccentric are located at different distances from the cylinder, and operating between said disks is one extremity of an arm 48, which is connected to the slide-valve stem 49, said arm being guided to slide accurately in a direction parallel with the driving-shaft by means of a guide-pin 50, operating in aligned guides 51. Said arm is preferably provided with an antifriction-roll for contact with the contiguous surfaces of the disks on the eccentric, and the connection between the slide-valve stem and said arm, in order to provide for relative adjustment of said parts to cause the slide-valve to operate properly upon its seat to admit and cut off steam, consists of a threaded section 52, engaging a threaded aperture in the arm, and coupled, as at 53, to the main portion of the stem. In the construction illustrated, said coupling consists of a tongue 54 on the extremity of the main portion of the stem fitting between parallel ears 55 on the threaded section and held in place by a transverse pin 56.

It will be seen that the throw of the slide-valve is due to the inclination of the eccentric with relation to the axis of the shaft, and that the points at which the slide-valve opens and closes the inlet-ports 28 and 29 are regulated by the relation of this plane of inclination with the wing of the piston. In other words, steam may be admitted to the cylin-

der in advance of or subsequent to the arrival of the piston-wing at a given point by varying the plane of inclination of the eccentric, and this variation of the plane of inclination may be accomplished by turning the eccentric around the axis of the shaft as a center. This adjustment of the eccentric, which is designed to govern the lap and lead of the slide-valve, is accomplished by the axial movement of the slide or collar upon the shaft through the manipulation of the gear-lever or adjusting-lever hereinbefore described. The construction of this lever is such as to maintain it at the desired adjustment, and hence without checking the operation of the engine the lap and lead of the slide-valve may be adjusted manually to produce the desired speed of rotation and vary the expenditure of motive agent to suit the load. This adjustment of the lap and lead of the slide-valve to suit the load and the speed of the engine provides for the economization of motive agent, and hence of fuel, by securing the maximum expansion of said agent, or by utilizing that expansion to continue the operation of the parts after the supply of the agent has been cut off temporarily.

In Fig. 8 I have shown the same means for adjusting the mechanism for controlling the lap and lead of the slide-valve applied to an eccentric of the ordinary construction embodying a core 57, carrying a spirally-grooved sleeve 58, of the construction above described, and a strap or stirrup 59, which is connected to the eccentric-rod 60. When this form of eccentric is employed, a longitudinally-reciprocatory movement of the eccentric-rod is produced instead of the transverse vibratory movement of the arm 48 described in connection with the construction shown in Figs. 1, 2 and 3, and hence in order to communicate motion in the proper direction to the slide-valve stem it is necessary to interpose means such as a bell-crank lever 61. In this construction the lap and lead of the slide-valve are varied by changing the plane of the major axis of the eccentric with relation to the plane of the wing of the piston, and thus, as above described in connection with the preferred form of the invention, by changing of the plane of eccentricity with relation to said piston.

The means shown in the drawings for adjusting the controlling or reversing valves to vary the direction of rotation of the piston includes a reversing-bar 62, pivotally connected to the crank-arms 63 of said valves and in turn connected by a link 64 with the reversing-lever 65, which is fulcrumed upon the base or other suitable support. The cylinder is provided with the usual blow-off cock 66.

In order to provide for replacing the blades of the abutments when worn without replacing the slide-bars by which motion is communicated to said blades from the cam, the

shanks 67 of said blades are provided with threaded sockets 68 for engagement by threaded stems 69 on said slide-bars.

Various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of this invention.

Having described my invention, what I claim is—

1. In a rotary engine, the combination with a cylinder, a concentric piston, sliding abutments mounted in the cylinder and connections between the piston and the abutments, said cylinder being provided with duplicate inlet and outlet ports, of a slide-valve chamber having a seat provided with inlet and exhaust ports, main channels 23 and 24 in communication, respectively, with the inlet-ports, lateral or auxiliary channels 25 and 26 in communication with said main channels, each main and auxiliary channel being in communication by an independent passage with one of the ports in the cylinder, controlling or reversing valves arranged respectively in said main and auxiliary channels, means for simultaneously operating said controlling or reversing valves to respectively open and close the same in pairs, a slide-valve operating in said chamber, and valve mechanism for communicating motion to the slide-valve, substantially as specified.

2. In a rotary engine, the combination with a cylinder, a piston, sliding abutments operatively connected with the piston, and a slide-valve controlling inlet and exhaust ports in communication with the cylinder, of an eccentric loosely mounted upon the shaft of the piston, an arm arranged in operative relation with the eccentric connections between the stem of the slide-valve and said arm, including an adjustable part capable of movement parallel with the path of the slide-valve, and means for imparting rotary movement to the eccentric independently of the piston and securing said eccentric at the desired adjustment, whereby the inclination of the eccen-

tric with relation to the piston may be varied to regulate the lap and lead of the valve, substantially as specified.

3. In a rotary engine, the combination with a cylinder, a rotary piston, sliding abutments operatively connected with the piston, and a slide-valve controlling inlet and exhaust ports in communication with the cylinder, of an eccentric mounted for rotary adjustment upon the shaft of the piston and provided with a spirally-grooved sleeve, a slide or collar keyed upon said shaft for axial movement and provided with a pin engaging the spiral groove in the sleeve of the eccentric, means for moving said slide or collar upon the shaft and securing it at the desired adjustment, and connections between the eccentric and the slide-valve stem, including an arm 48, and a threaded part 52, engaging an aperture in the arm and detachably secured to the stem, substantially as specified.

4. In a rotary engine, the combination with a cylinder, a piston, cut-off valves operatively connected with the piston, and a slide-valve controlling inlet and exhaust ports in communication with the cylinder, of an eccentric loosely mounted upon the shaft of the piston and having a spirally-grooved sleeve, connections between the eccentric and said slide-valve, a slide or collar keyed upon the shaft for longitudinal movement and having a pin engaging said spiral groove in the sleeve of the eccentric, said slide or collar being tubular and provided with exterior peripheral webs or teeth extending continuously around the slide or collar, and an adjusting-lever provided with a gear in permanent engagement with the webs or teeth of said slide or collar, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

LUCAS SIVERTSON.

Witnesses:

ED. E. JUVRUD,
O. E. JUVRUD.