(No Model.)

4 Sheets—Sheet 1.

R. S. CASE.

ROTARY ENGINE.

No. 576,090. Patented Feb. 2, 1897.

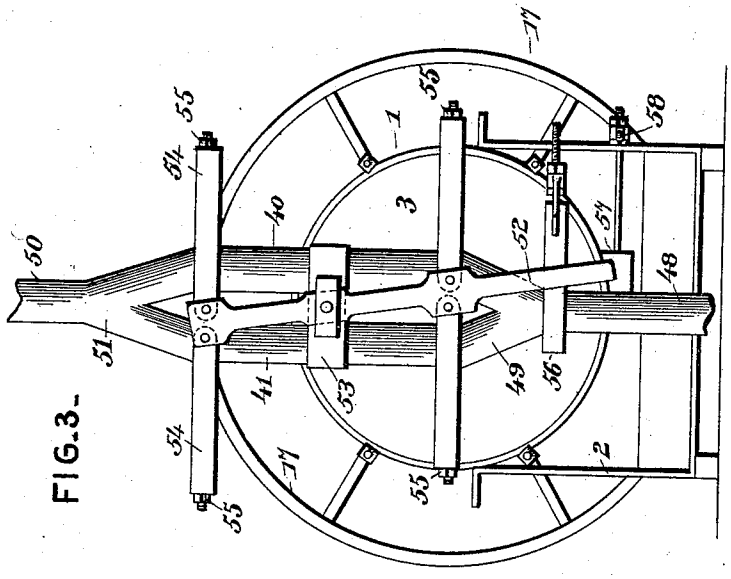

FIG. 3.

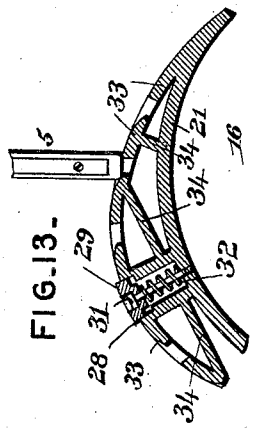

FIG. 13.

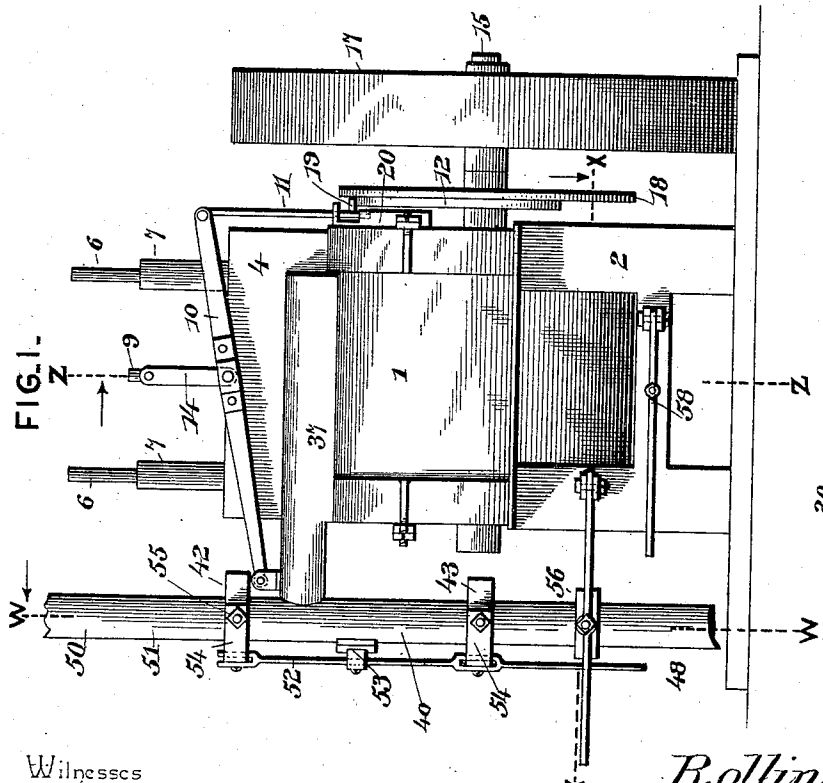

FIG. 1.

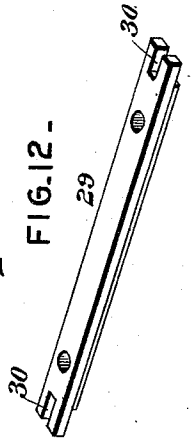

FIG. 12.

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(No Model.)

4 Sheets—Sheet 2.

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FIG. 5.

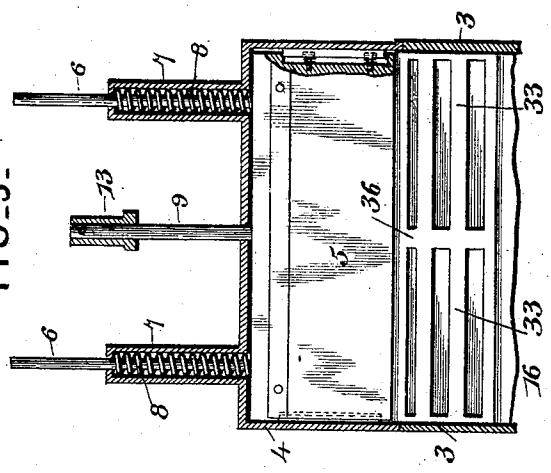


FIG. 16.

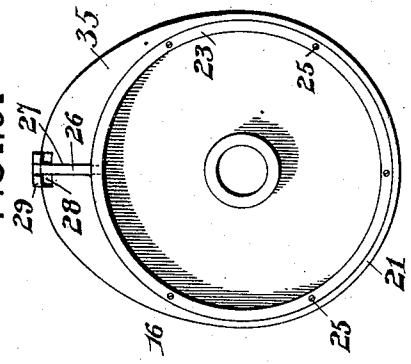


FIG. 2.

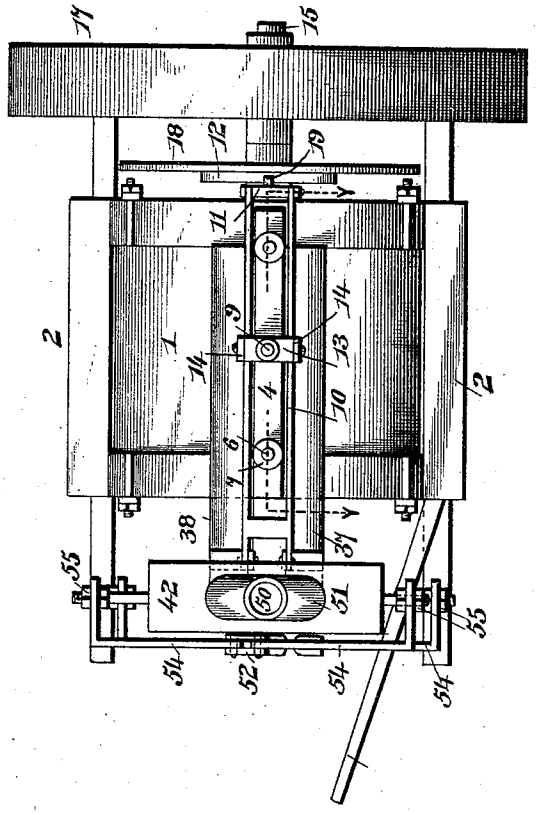
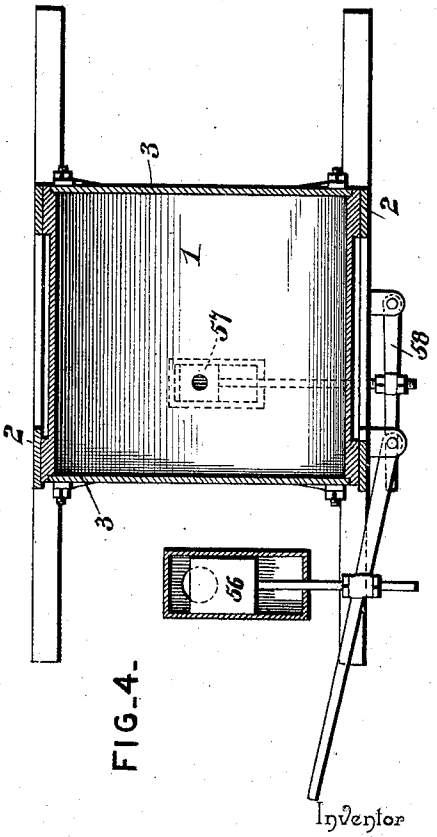


FIG. 4.



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(No Model.) 4 Sheets—Sheet 3.

R. S. CASE.

ROTARY ENGINE.

No. 576,090. Patented Feb. 2, 1897.

FIG. 11.

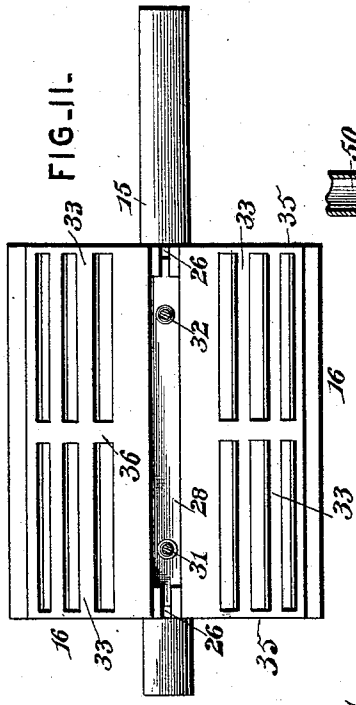


FIG. 7.

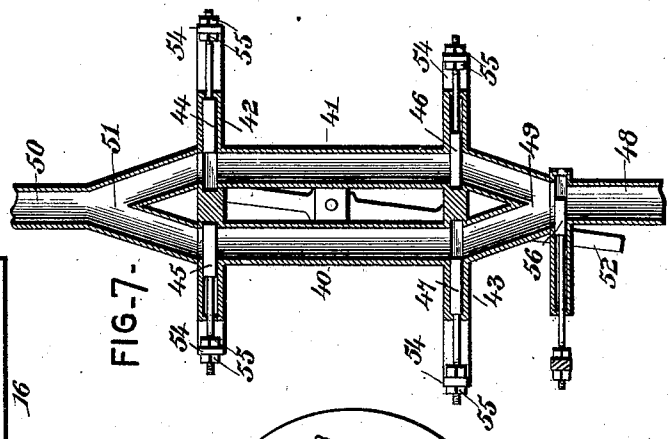


FIG. 8.

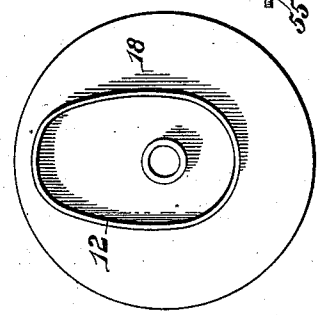


FIG. 10.

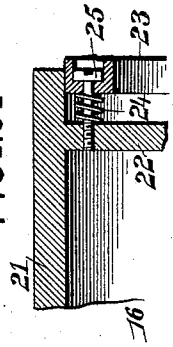


FIG. 6.

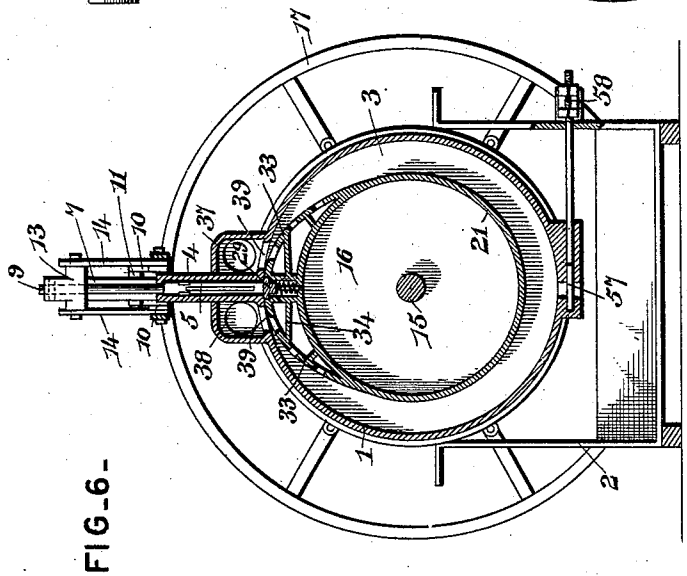
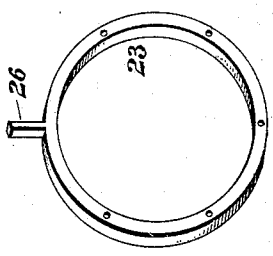


FIG. 9.



Witnesses
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(No Model.) 4 Sheets—Sheet 4.

R. S. CASE.

ROTARY ENGINE.

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FIG. 15.

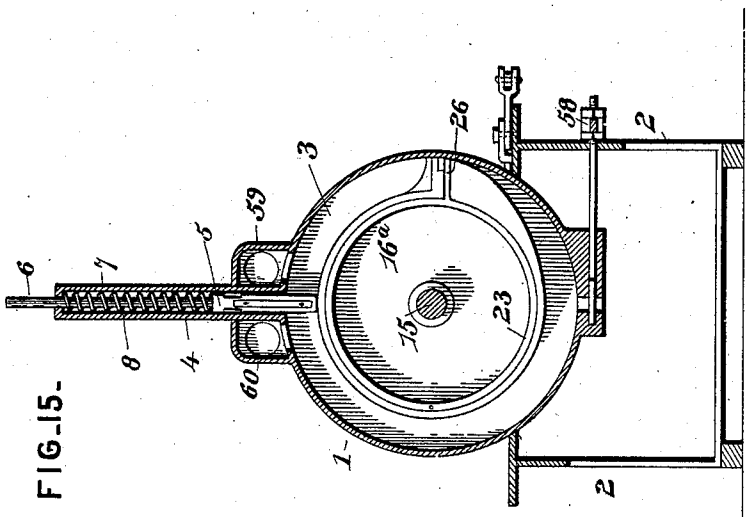
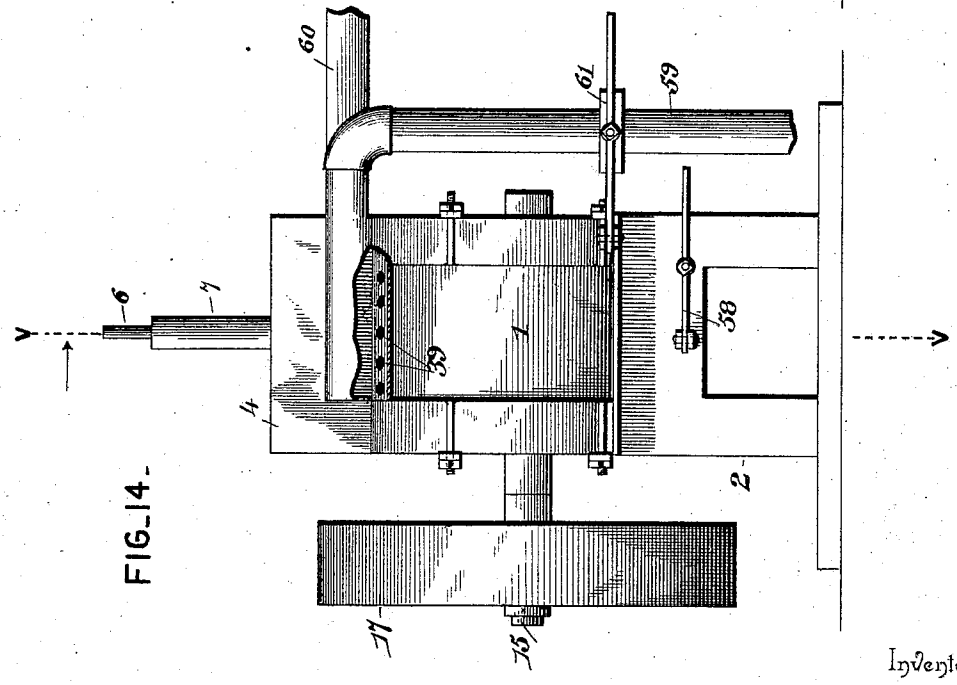


FIG. 14.



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UNITED STATES PATENT OFFICE.

ROLLIN S. CASE, OF PASADENA, CALIFORNIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 576,090, dated February 2, 1897.

Application filed April 23, 1896. Serial No. 588,769. (No model.)

To all whom it may concern:

Be it known that I, ROLLIN S. CASE, a citizen of the United States, residing at Pasadena, in the county of Los Angeles and State of California, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention has relation to rotary engines of the type known as "concentric piston," and the purpose of the improvement is to secure a steam-tight joint between the piston, the cylinder, the cylinder-heads, and the sliding abutment, and to provide an engine which will be light running and convert a maximum amount of steam into efficient energy for operating the machine to be driven.

A further object of the improvement is to devise an engine of the character aforesaid which will be responsive to the actuating medium, obviate dead-points, prevent an appreciable loss of power by inertia, and which will be compact in the arrangement of its parts and perform the required work in an effective and satisfactory manner.

For a full understanding of the merits and advantages of the invention reference is to be had to the accompanying drawings and the following description.

The improvement is susceptible of various changes in the form, proportion, and the minor details of construction without departing from the principle or sacrificing any of the advantages thereof, and to a full disclosure of the invention an adaptation thereof is shown in the accompanying drawings, in which—

Figure 1 is a side elevation of a rotary engine constructed in accordance with the principles of this invention for attaining the objects thereof. Fig. 2 is a top plan view thereof. Fig. 3 is an end view having the steam-pipes on the obverse side. Fig. 4 is a plan section on the line X X of Fig. 1. Fig. 5 is a detail section on the line Y Y of Fig. 2, showing the abutment and the pocket in which it is slidably mounted. Fig. 6 is a transverse section on the line Z Z of Fig. 1, looking to the right, as indicated by the arrow. Fig. 7 is a vertical section on the line W W of Fig. 1, looking to the left. Fig. 8 is a detail view of the plate having the cam for positively actuating the abutment and moving it within its pocket, so as to clear the piston. Fig. 9 is a detail view of a packing-ring to secure a steam-tight joint between the piston and the adjacent head of the cylinder. Fig. 10 is a detail section showing the manner of connecting the packing-ring to the piston. Fig. 11 is a top plan view of the piston. Fig. 12 is a detail view of the packing for securing a steam-tight joint between the piston and the cylinder. Fig. 13 is a detail view in section of a portion of the piston and cylinder, showing the relative disposition of the abutment when closing the space formed between two adjacent elements or ribs of the piston. Fig. 14 is a side elevation, parts broken away, of a non-reversible engine embodying the novel features of the present invention. Fig. 15 is a transverse section thereof on the line V V. Fig. 16 is an end view of the piston used in the reversible engine.

Corresponding and like parts are referred to in the following description and indicated in all the views of the accompanying drawings by the same reference-characters.

The cylinder 1 is mounted upon a suitable base or bed 2, and its ends are closed by heads 3, which are bolted or otherwise secured thereto in a substantial manner, which will admit of the heads being removed when it is required to gain access to the cylinder for any desired purpose. A pocket 4 is provided on one side of the cylinder to receive the abutment or valve 5, which is slidably mounted therein and suitably packed to prevent the escape of steam thereby from one side of the cylinder to the other. The inner or active edge of the abutment is concaved or hollow between its sides to conform to the curvature of the piston, so as to secure an extended bearing upon the latter to insure a close joint. Guide-rods 6 project from the outer or top edge of the abutment and operate in tubes 7, so as to prevent any appreciable lateral or longitudinal vibration of the abutment in its sliding movements. Coil-springs 8 are mounted upon the guide-rods 6 and are confined within the tubes 7 between the abutment 5 and annular stops of the tubes, and serve to project the abutment within the cylinder and against the piston. A stem 9 has connection with the abutment about intermediate of its ends and operates through

the outer or top side of the pocket and is operatively connected with a lever 10, which is fulcrumed at one end and extends lengthwise of the cylinder and to the free end of which is pivotally connected a lifter-bar 11, constructed to travel upon a cam 12, whereby the abutment is slid within the pocket 4 independently of the action of the piston thereon. A cross-head 13 is secured to the projecting end of the stem 9, and links 14 connect the ends of the cross-head with the parallel members of the lever 10, located upon opposite sides of the pocket 4, the said links having pivotal connection with the members of the lever and with the terminal portions of the cross-head. By this arrangement of the parts the lifting strain is equally distributed upon both sides of the stem and there is no tendency to cause any binding between the stem and the abutment when moving the latter outward by the action of the cam 12 on the lifter-bar 11, so that the piston may pass by the abutment in either direction, according to the rotation of the piston.

The shaft 15, upon which is mounted the piston 16, is journaled in the cylinder-heads 3 and has a band-pulley 17 upon its projecting end from which the power is taken in the usual way for driving the machine to be operated. A plate 18, secured upon the projecting end of the shaft 15, has the cam 12 on one face and is disposed so that the cam 12 will engage with the lower end of the lifter-bar 11 or an extension 19, projecting laterally therefrom. A guide 20 is provided for the lifter-bar 11 to operate in, and is secured to the adjacent cylinder-head, and is open on the side facing the plate 18, so that upon removing the band-pulley and the plate 18 the lifter-bar can be thrown up out of the way to admit of the removal of the cylinder-head and the piston.

The piston comprises a hub or shell 21 and a longitudinal enlargement 16, forming the piston proper. The shell 21 has its end pieces 22 set back a short distance from the extremities of the shell, forming recesses, in which are fitted packing-rings 23, of metal, which are moved outward against the cylinder-heads by springs 24, the latter being mounted upon pins or screws 25, let into the end pieces 22 and having their heads countersunk in the packing-rings, so as not to come in contact with the cylinder-heads. The springs 24 are of the coil type, and are mounted upon the pins or screws 25, and are confined between the packing-rings and the end pieces 22, and exert an outward pressure against the inner sides of the packing-rings, so as to press the latter closely against the cylinder-heads, so as to secure a steam-tight joint. An arm 26 projects radially from each packing-ring and operates in a slot 27 in each end of the piston 16 and forms a packing to prevent the leaking of steam at the ends of the piston proper. The sides of the piston 16 are similarly formed, and a longitudinal groove or seat 28 is located at an intermediate point and receives a packing 29 in the shape of a bar having notches 30 in its ends to receive the arms 26 of the packing-rings. This packing-bar 29 is retained in its seat by screws or fastenings 31, having their heads countersunk in the bar, and coil-springs 32, mounted upon the screws or fastenings 31, move the packing-bar 29 outward, thereby securing a steam-tight joint between the piston and the sides of the cylinder. The piston is composed of a series of strips 33, spaced a short distance apart and disposed with their greatest width in the path or direction of travel of the piston, and these strips are strengthened intermediate of their edges by plates 34, which are interposed between the shell 21 and the inner side of the strips 33. This construction admits of the steam acting at right angles against the sides of the plates 34. Hence the power is applied to the best advantage. The space between the strips 33 and the shell is closed at its ends by plates 35, and the strips 33 are connected intermediate of their ends by means of a bar 36, and the profile of the bar 36 and the plates 35 corresponds to the contour of the piston 16 in end elevation, thereby admitting of the abutment passing or riding freely over the piston when the latter is passing by the same. The space between the strips 33 is slightly less than the width of the engaging portion of the abutment or valve, so that the latter will touch one strip before leaving the other, as shown most clearly in Fig. 13, thereby preventing the escape or leakage of steam.

Steam-pipes 37 and 38 are placed one upon each side of the pocket 4 and communicate with the cylinder through a series of perforations or openings 39, forming ports for the ingress and egress of steam. Pipes 40 and 41 communicate with the pipes 37 and 38 and with steam-chests 42 and 43, in which operate valves 44, 45, 46, and 47 for controlling the flow of the steam so as to drive the engine in the required direction. The supply-pipe 48 communicates by means of a Y 49 with the steam-chest 43, and the exhaust-pipe 50 communicates with the steam-chest 42 by means of a Y 51, the branches of the Y's 49 and 51 coming about opposite the respective pipes 40 and 41. A lever 52, fulcrumed to a yoke 53, having connection with the pipes 40 and 41, is connected by means of L-shaped links 54 with the stems of the respective valves 44, &c., so as to operate the said valves simultaneously, whereby the live steam may be caused to enter either of the pipes 37 or 38 and exhausted from the other, according to the direction of rotation of the engine. Upon moving the lever 52 in one direction communication is established between the pipe 40 and the supply-pipe 48 and between the pipe 41 and the exhaust-pipe 50, and upon moving it in an opposite direction the supply-pipe 48 and the pipe 41 are brought into communication and the pipe 40 and the exhaust-pipe

50 have communication established between them, so that the engine will be driven in a reverse direction, as will be readily understood.

The outer ends of the several valve-stems are threaded and a pair of nuts 55 are mounted upon each, and the bent ends of the L-shaped links 54 have adjustable connection with the valve-stems by means of the nuts 55, which can be adjusted to properly position the valves relative to the throw of the lever 52. A valve 56 is located in the supply-pipe 48 to shut off or regulate the amount of steam to be admitted to the engine, according to the amount of work to be performed and the speed at which the engine is to be driven.

To relieve the engine of water of condensation, a valve 57 is located at the bottom side of the cylinder 1 and is operated by means of a lever 58, and upon opening the valve 57 any water which may have accumulated in the cylinder will be blown off if the engine is working, or escape by gravity if the engine is not in operation and is not under pressure. The lower portion of the cylinder is thickened sufficiently to receive the valve 57, which slides therein to close the opening through which the water of condensation escapes.

The form of engine shown in Fig. 1 and the detail views thereof is capable of having its motion reversed. Hence it is that the piston 16 has its sides similarly and oppositely formed and the lifting mechanism is resorted to for moving the abutment or valve, so as to clear the piston, thereby reducing the friction to a minimum and attaining the best possible results.

Figs. 14 and 15 show an engine which is not adapted to have its motion reversed and in general construction is similar to the reversible engine, and the corresponding parts are indicated by like reference-numerals. The piston 16^a has an abrupt shoulder or face against which the steam exerts its force, so as to drive the piston in the required direction, and the abutment is slid within its pocket by direct engagement therewith of the curved side of the piston. The live steam enters through the pipe 59 and the spent steam escapes through the exhaust-pipe 60, a valve 61 being located in the length of the live-steam pipe 59 to control the admission of steam to the engine when it is required to drive the latter.

Having thus described the invention, what is claimed as new is—

1. In a rotary engine, the combination of a cylinder having a pocket and a tube projecting from the pocket, an abutment or valve slidably mounted in the pocket and having a guide-rod operating in the said tube, a spring mounted upon the guide-rod and located within the aforesaid tube, steam-pipes placed upon each side of the pocket and communicating with the cylinder upon opposite sides of the abutment, other pipes in communication with the steam-pipes, steam-chests having connection with the last-mentioned pipes, supply and exhaust pipes connecting with the steam-chests, independent valves operating in the steam-chests, and a single lever for operating the valves, substantially as and for the purpose set forth.

2. In a rotary steam-engine, the combination with the cylinder and piston, of steam-pipes communicating with the cylinder for supplying and exhausting the steam, a second set of pipes connecting with the steam-pipes, steam-chests having connection with the second set of pipes, steam supply and exhaust pipes having communication by Y connections with the respective steam-chests, a series of four independent valves operating in the steam-chests for controlling the entering and the exhausting of the steam from the engine, and a lever for simultaneously actuating the several controlling-valves, substantially as and for the purpose set forth.

3. In a rotary engine, the combination with the cylinder and piston, of a pair of pipes communicating with the cylinder, steam-chests having connection with the said pipes, steam supply and exhaust pipes communicating by Y connections with the respective steam-chests, independent valves operating in the steam-chests for controlling the entering and the exhausting of the steam from the engine, approximately L-shaped links having connection with the valve-stems, and a lever having the L-links attached thereto, substantially in the manner set forth for the purpose described.

4. In a rotary engine, the combination of a cylinder having a pocket projecting from a side thereof, an abutment slidably mounted within the pocket and having a projecting stem, a lever comprising similar members located upon opposite sides of the pocket in parallel relation and having each member operatively connected with the stem of the abutment, a lifter-bar having connection with the lever, and a plate mounted upon the shaft of the piston and having a cam to engage with the lifter-bar to actuate it and move the abutment within its pocket, substantially in the manner set forth for the purpose described.

5. In a rotary engine, the combination of a cylinder having a pocket, an abutment slidably mounted within the pocket and having a stem operating therethrough, a cross-head secured to the projecting end of the stem, a lever comprising similar members placed upon opposite sides of the pocket in parallel relation, links connecting the individual members of the lever with the terminal portions of the cross-head, a lifter-bar, and a cam rotating with the piston-shaft and adapted to actuate the lifter-bar, substantially as and for the purpose specified.

6. In a rotary engine, a hub having a longitudinal enlargement at one side which is hollow and forms a piston, the latter comprising portions separated by longitudinal spaces, end

plates connecting the ends of the piston with the ends of the hub, a bar portion connecting the separated parts of the piston intermediate of its ends, and plates placed between the hub and the longitudinally-separated portions of the piston, substantially as and for the purpose set forth.

7. In a rotary engine, the combination of a cylinder, a hub located within the cylinder and having a longitudinal enlargement at one side which is hollow and forms a piston, the latter having portions separated by longitudinal spaces, plates connecting the separated portions of the piston with the hub, and a sliding abutment having its inner or engaging edge of greater width than the spaces between the separated portions of the piston, and adapted to span and close said spaces, substantially in the manner set forth for the purpose described.

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

ROLLIN S. CASE.

Witnesses:
GIDEON S. CASE,
ANN E. DEAN.