G. T. GEER.

ROTARY ENGINE.

APPLICATION FILED MAY 6, 1910.

971,671. Patented Oct. 4, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

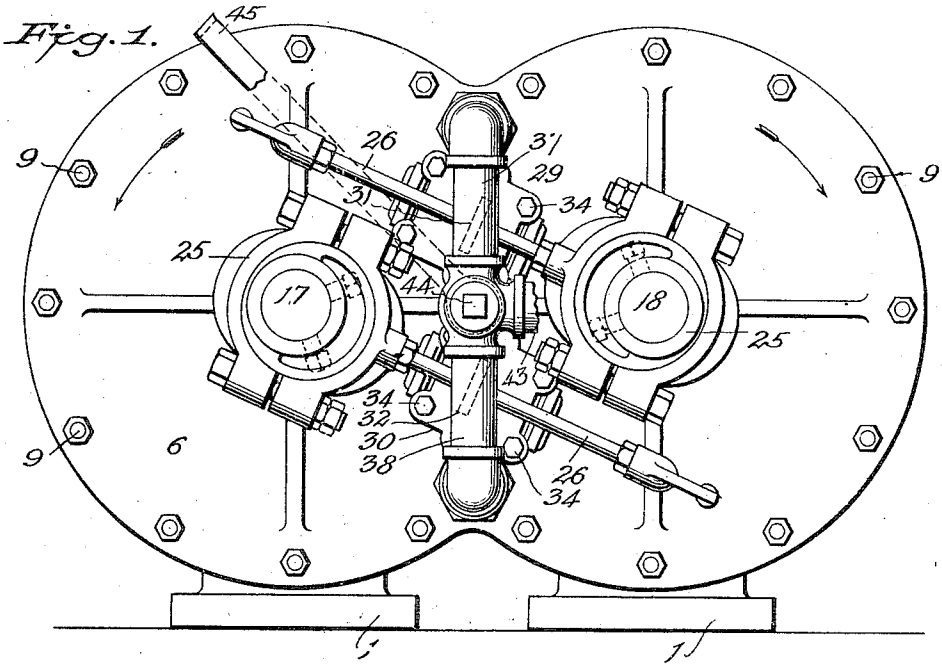
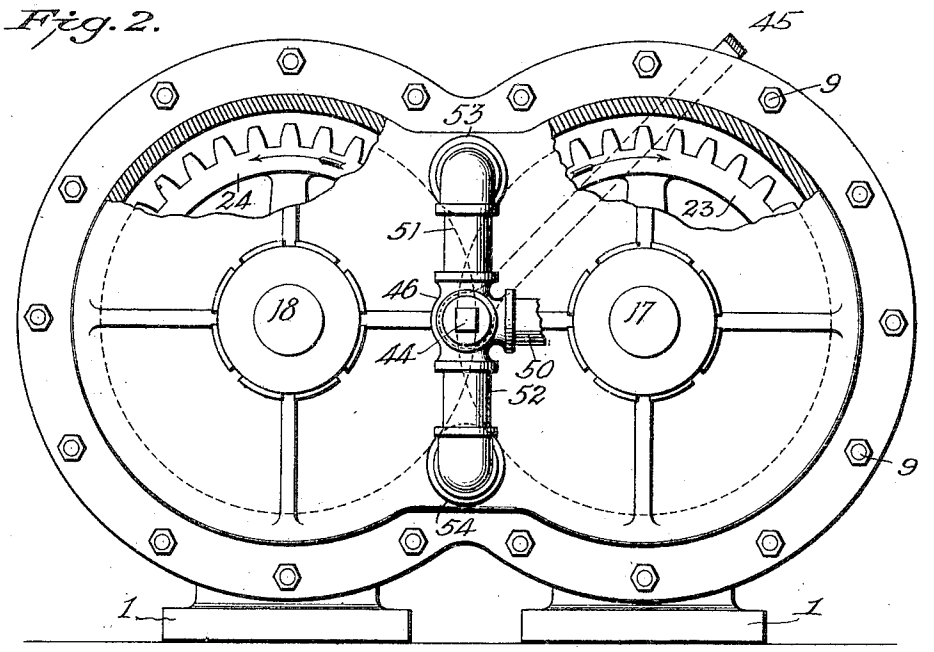


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 6.

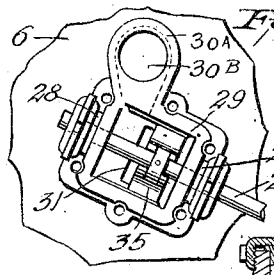


Fig. 5.

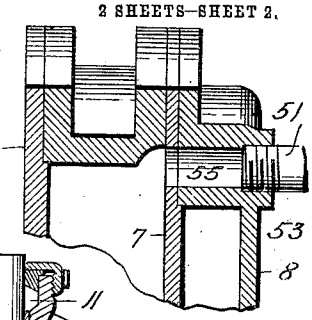
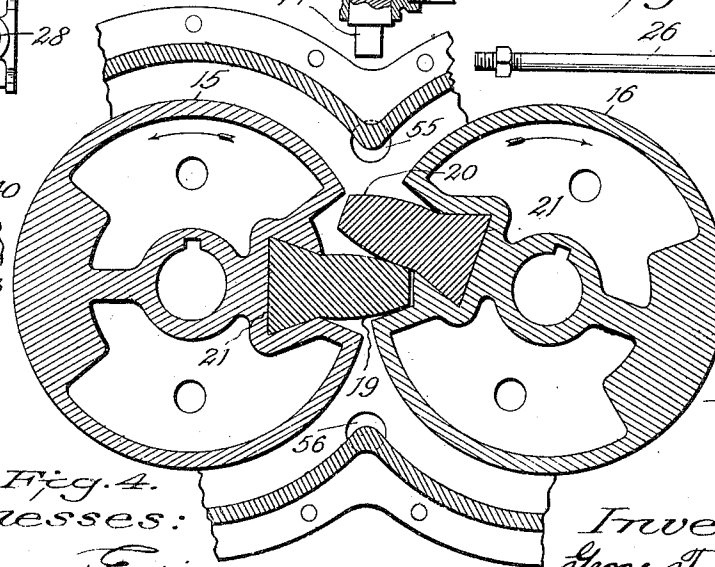


Fig. 5.

Fig. 7.

Fig. 8.



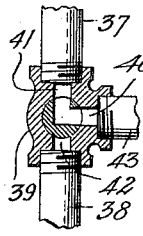


Fig. 9.

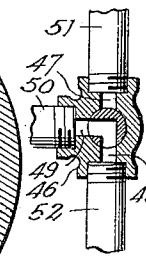


Fig. 10.

Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE T. GEER, OF DENVER, COLORADO.

ROTARY ENGINE.

971,671. Specification of Letters Patent. Patented Oct. 4, 1910.

Application filed May 6, 1910. Serial No. 559,667.

To all whom it may concern:

Be it known that I, GEORGE T. GEER, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented a new and useful Rotary Engine, of which the following is a specification.

My invention relates to improvements in rotary engines, and the objects of my invention are: first, to provide a rotary engine having a pair of engaging drums that are provided with intermeshing piston portions, and with an independent gear mechanism which causes the piston drums to move in unison. And second, to provide a simple, practical, and efficient reversible rotary engine that is provided with an incased gearing mechanism that is adapted to move the piston disks in rotative unison, and that is adapted for use as a marine engine and for all other purposes for which a reversible engine can be used. I attain these objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of the improved rotary engine. Fig. 2, is a rear view of the same, the casing being broken away to show the intermeshing gears. Fig. 3, is a central, horizontal, sectional view thereof. Fig. 4, is a sectional view of the two piston drums, a portion of the inclosing casing being shown. Fig. 5, is a vertical, sectional view through the upper exhaust port, a fragment only of the casing being shown. Fig. 6, is a front view of one of the steam chests, the cover therefor being removed. Fig. 7 is an end view of the same. Fig. 8 is a side view of one of the connecting rods. And Figs. 9 and 10 are sectional views respectively of the inlet and exhaust valves, the same being in the relative positions they occupy when steam is being admitted through the upper chest.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates two independent but similar base plates that form the foundation bed or base plates of my engine.

2 designates the casing. This casing 2 comprises a pair of vertically arranged disk-shaped cylinders 3 and 4, which are arranged in alinement and intersect each other at an arc of their edges so as to form an integral casing casting. This casing 2 is provided with two flanges 5, which are formed on its outside edges. The cylinder is provided with cylinder heads 6, 7 and 8, which are secured to its flanges 5 by any suitable means, preferably by cap screws 9. The cylinder heads 6 and 8 are outside heads, and they are provided with driving shaft supporting hubs 10, which are provided with stuffing box chambers 11 and glands 12, which are adjustably secured in the hubs in any suitable manner but preferably by threaded caps which are screwed upon the ends of the hubs. The head 7 is a partition head and it comprises a thin disk which is arranged and adapted to form a partition wall between the heads 6 and 8. The head 8 and partition 7 form a pair of intersecting gear inclosing chambers 13 and 14, which are arranged parallel and concentric with the cylinders 3 and 4.

The cylinders 3 and 4 contain piston drums 15 and 16 respectively, which are rotatably mounted in them on driving shafts 17 and 18, which extend through the cylinder and heads and their hubs, the said drums being adapted to rotate in contact with each other at the center of the point of intersection of the two cylinders 3 and 4. These piston disks are made enough less in diameter than the diameter of the cylinders to leave a clear space between them and the annular surface of the cylinders sufficient to form an ample steam passage around the pistons in which travel projecting teeth which are carried by the pistons. These projecting teeth 19 and 20 are in the form of gear teeth and project beyond the peripheral surfaces of the pistons and their peripheral edges are machined to fit closely but rotatively in the circumferential wall of the cylinders. These teeth are adapted to contact with and pass each other as the pistons rotate, and they form piston surfaces against which the steam pressure acts to rotatively drive the pistons. The teeth may be made integral with the piston disks, but I preferably form them independent of the disk and insert them tightly in dove-tailed recesses 21, formed in the pistons to receive them. The peripheral surfaces of these piston drums are finished smooth and are adapted to have a steam-tight engagement with each other.

In order to cause the pistons to rotate positively together in such relation that the piston teeth will always intermesh in operative rotative order, I provide the driving shafts with a pair of intermeshing gears 23 and 24, which are mounted on and are secured to these shafts within the intersecting chambers of the cylinder head 8. These gears are both of the same pitch diameter, and they are arranged on the shafts to intermesh with each other. They are partitioned from the piston disks by the partition head 7, and are arranged and adapted to hold and keep the piston teeth of the piston disks in intermeshing rotative relation. While I have illustrated these gears in chambers within the cylinder head, my invention contemplates placing them either within or without the cylinder or cylinder head. Thus they might be placed on the shafts outside of the cylinder heads.

An eccentric 25 is mounted and secured on one of the projecting ends of each of the driving shafts. Both of these eccentrics are positioned on the same side of the casing, and are provided with rods 26, which extend to and are pivotally connected to valve stems 27, which project through stuffing box hubs 28, that form a part of a pair of steam and valve chests 29 and 30, which are formed on or secured to the side of the casing, midway between the axial centers of the shafts 17 and 18; one of said chests being above the horizontal plane of the axial centers of the said shafts, while the other is below the said plane. As illustrated, the chests comprise four sided rectangular structures, which are provided with removable covers, and which are formed with hollow extensions 30^A, which communicate with the interior of the chests, and which are provided with threaded holes 30^B, in which the steam supply pipes—to be presently described—are screwed. These chests are positioned at a suitable inclination to a horizontal plane, so that their valve stems are in operative alinement with the rods of the eccentrics. These valve chests surround steam inlet ports 31 and 32, which are formed in the head 6, and enter the piston cylinders at the intersecting central vertical plane of the two cylinders. The valve chests are provided with covers 33, which together with the chests are secured to the cylinder head by any suitable means, preferably by bolts 34. These steam inlet ports 31 and 32 are opened or closed in alternate order to drive the piston drums in opposite directions, as will be fully described hereinafter. Around the ports in the bottoms of each of the valve chests valve seats are formed, on which are seated valves 35.

I preferably use for controlling the steam at its point of admission to the cylinder a flat form of slide valve. These valves are each provided with a projecting lug portion 36, through which the valve stems pass, and to which they are secured in any suitable manner.

The valve stems extend entirely through the lugs 36 of the valves, and also through the opposite ends of the steam or valve chest, and are supported in the stuffing box hubs. The valve chests are connected by steam inlet pipes 37 and 38, which are connected at one of their ends to the valve chests and at their opposite ends to the casing of a three-way valve 39, having an inlet port 40 and outlet ports 41 and 42. One end of a steam inlet pipe 43 is connected to the casing of the valve, the opposite end of which is adapted to be extended by piping to a supply of steam.

This steam inlet valve may be of any suitable type, but I preferably use the common form of plug valve, which is provided with a square or other form of wrench receiving hub portion 44, to which one end of a yoke lever 45 is secured. The opposite end of this controlling lever extends over the top of the casing of the engine and is connected to an exhaust valve 46. The steam inlet plug valve is provided with two ports, which are arranged at about a quarter angle and are adapted to register with the steam supply pipe and with either one or the other of the steam pipes that extend to the valve chests, depending on which way the plug valve is turned by the controlling lever, as will be fully explained hereinafter.

The exhaust valve to which the controlling lever is connected may also be of any suitable type, but I preferably use an ordinary form of plug valve, the same as in the inlet steam pipes. The steam controlling valve 39 is positioned in horizontal axial alinement with the exhaust valve and admits steam to the cylinders in the direction in which it is desired to have the pistons rotate.

The exhaust controlling valve is a three-way valve similar to the valve 39, being provided with entrance ports 47 and 48, and with an outlet port 49, to which an exhaust pipe 50 is connected that is open to the atmosphere, and its plug valve is provided with two ports, which are arranged to control either one or the other of the two entrance ports 47 and 48 and the outlet port 49 of the plug valves' casing at the same time.

The entrance ports 47 and 48 are connected to pipes 51 and 52, the opposite ends of which are threaded to two hubs 53 and 54, which are formed on the opposite sides of the engine casing from the valve chests, in which are formed exhaust steam ports 55 and 56, which extend into the intersecting zone of the two cylinders and are positioned in a vertical plane above and below the intermeshing arcs of the drum pistons.

These exhaust ports 55 and 56 are always open to the entrance of exhaust steam into them from the cylinders, but they are opened and closed to the atmosphere by the exhaust controlling valve 46, the plug of which is provided with two ports which are placed at about a quarter angle to each other and are so arranged relatively to each other and to the ports 47 and 48 that a movement of the controlling lever across the top of the casing of the engine will open one set of steam inlet and exhaust ports and close the other set. The valve chests being similar in arrangement, and the exhaust ports being also similar, I have illustrated in Fig. 5 the upper exhaust port, and in Fig. 6 the upper steam chest; it being understood that the admittance of steam through the upper chest causes the pistons to move in the direction of the arrows in Fig. 2, while a reverse motion is obtained by admitting the steam through the lower chest. Therefore when the steam is admitted through the upper chest, the lower chest is cut out by the position of the valve 39—see Fig. 9—and at the same time the pipe from the upper exhaust port is closed, while the pipe from the lower exhaust is open, as will be seen by reference to Fig. 10.

The operation is as follows: Assuming that the controlling or reversing lever is in the position shown in Figs. 1 and 2, the steam inlet valve 39 admits steam to the steam chest 29 through the pipe 37 and the steam inlet valve 35 is moved to alternately close and open the steam inlet port 31, the chest 30 being cut off from the supply of steam when the valve 39 is in the position as shown by Fig. 9. The exhaust plug is moved at the same time to open the exhaust ports 48 and 49, which connect with the pipes 50 and 52, and open the lower exhaust port 56 to the atmosphere, and to close the exhaust passage 47 connecting with the upper exhaust port 55 through the pipe 51. If the controlling lever is moved in the opposite direction, the steam inlet valve 39 closes the port 41 connecting with the steam chest 29 and its port 31 and opens the port 42 connecting with the steam chest 30 and its inlet port 32, while simultaneously the exhaust valve 46 is moved to close the port connecting with the lower exhaust port 56 and to open communication between the upper exhaust port 55 and the atmosphere.

Steam entering the steam port 31 exerts its expansive pressure against the side faces of the large piston teeth and drives the disks in the direction of the arrows shown in Fig. 1, and as the disks rotate the eccentrics 25 are rotated by the shafts of the pistons and the eccentric rods, and valve stems and the slide valves are reciprocated and the slide valve 35 is adjustably set to cut off the steam at a predetermined part of the rotative stroke of the piston that will give the best results from the use of the expansive force of the steam, the adjustment of these slide valves being arranged to give variable degrees of cut-off relative to the operative rotative movement of the toothed pistons.

When it is desired to reverse the direction of the rotary movement of the engines, the controlling lever is grasped by the operator and moved to the opposite end of its throw, and the opposite inlet and exhaust ports are opened, as hereinbefore described.

My invention provides a simple, inexpensive and practical variable cut-off slide valve rotary engine that is positive in its action and that is arranged to practically prevent the leakage of steam between the two piston disks, and while I have illustrated the preferred construction and arrangement of my improved rotary engine I do not wish to be limited to the construction and arrangement shown, as many changes might be made without departing from the spirit of my invention.

My present invention embodies improvements over the rotary engine patented to me March 29, 1910, No. 953,328.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a rotary engine as specified, the combination with a pair of intersecting cylinders; shafts extending through the cylinders; contacting drums on the shafts and projections on said drums, extending to the radial surfaces of the cylinders, said cylinders having inlet ports on one side, one above and one below the horizontal center line of the shafts, and exhaust ports on the opposite side, one above and one below the horizontal center line of the shafts, all of said ports being on the line of intersection of the cylinders; removable steam chests surrounding the inlet ports; slide valves in said chests having stems extended through said chests; eccentrics on the ends of the shafts; an L-shaped connecting rod extending from each of said eccentrics over one of the steam chests and secured to the farther end of the valve stem projecting from the said chest; pipes connected to the steam chest; a three-way valve connecting the opposite ends of the pipes, and a pipe connecting said valve with a source of steam; a three-way valve, and pipes connecting said valve with the exhaust ports; a yoke-shaped lever for operating said valves, and gears on said shafts for causing the drums to rotate in unison.

2. In a rotary engine as specified, the combination with a pair of intersecting cylinders, shafts extending through the cylinders; contacting drums thereon; projections on the drums and gears for causing the drums to rotate in unison, duplicate inlet and exhaust ports being positioned on the

line of intersection of the cylinders, of steam chests surrounding the inlet ports; slide valves in the chests; stems connected to the slide valves and extending out through the ends of the chests; eccentrics on the shafts, L-shaped connecting rods which extend over the chests and connect the eccentrics with the ends of the piston stems farthest from the eccentrics; pipes connecting the chests and exhausts with independent valves; pipes connecting the valves with a steam supply and with the atmosphere respectively; and a lever for turning the valves in unison.

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

GEORGE T. GEER.

Witnesses:
G. SARGENT ELLIOTT,
ADELLA M. FOWLE.