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S. SCOGNAMILLO & C. DOMINICI.

ROTARY ENGINE.

No. 544,595. Patented Aug. 13, 1895.

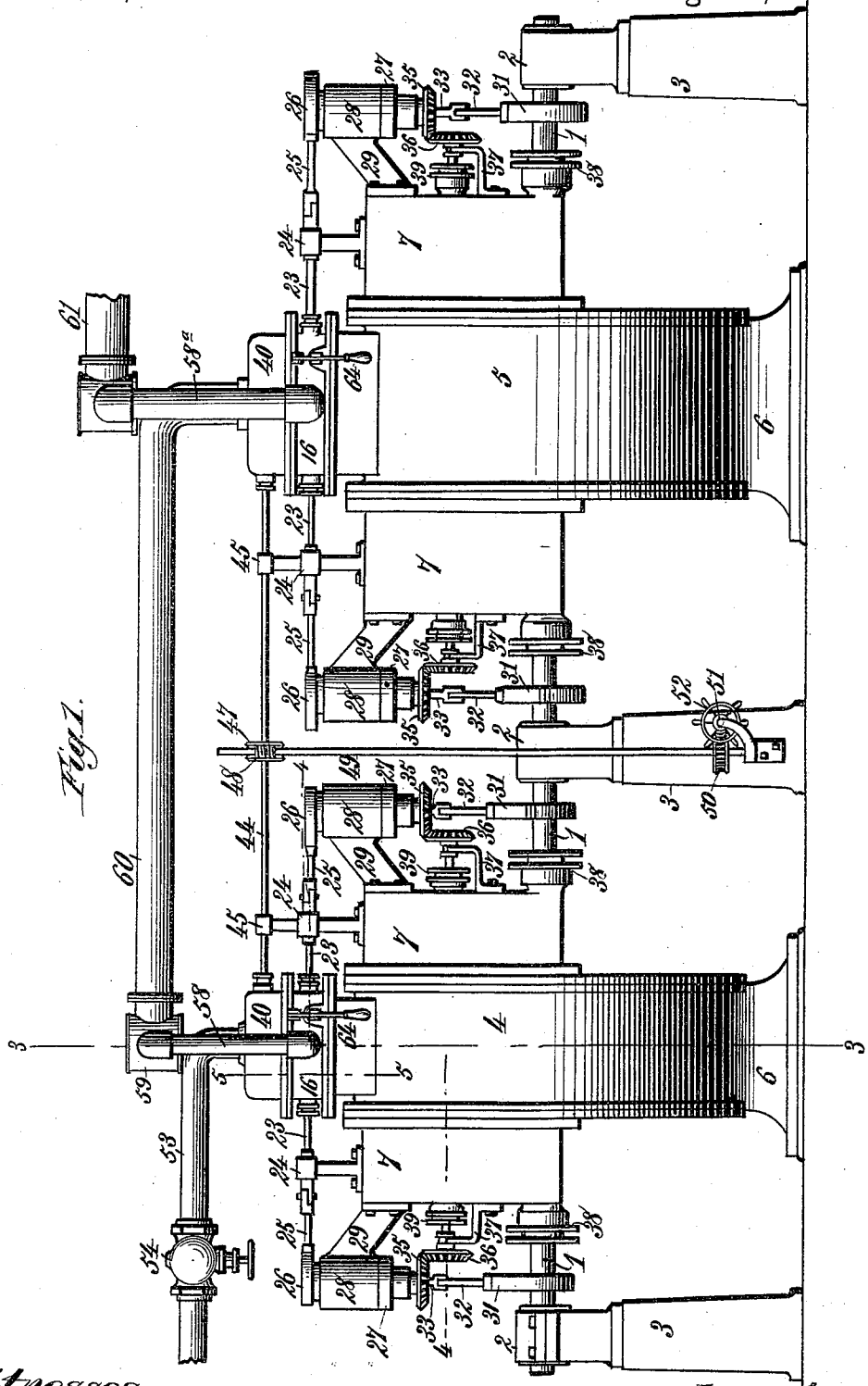

Fig. 1.

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(No Model.) 4 Sheets—Sheet 2.

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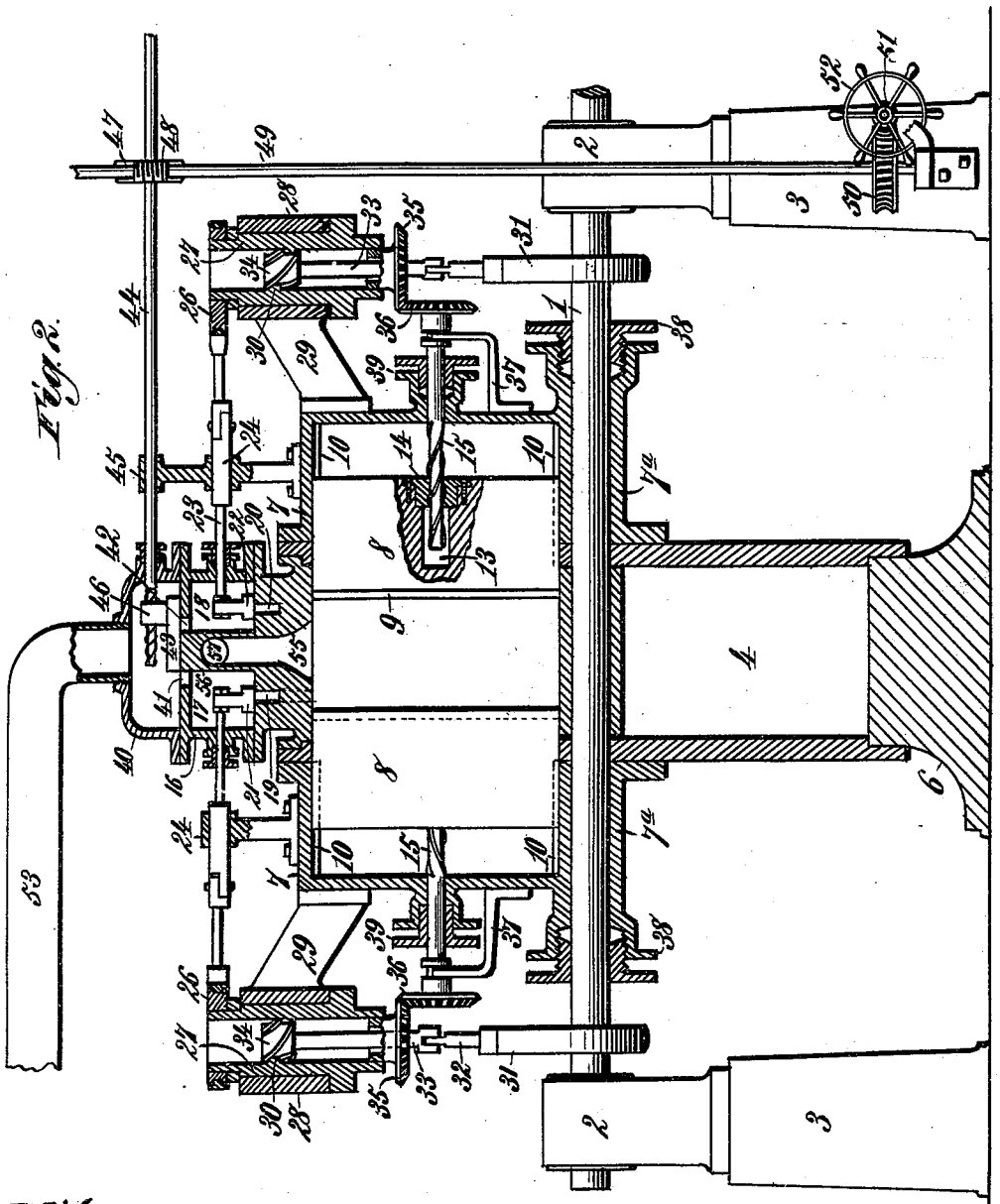
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

S. SCOGNAMILLO & C. DOMINICI.

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Fig. 3.

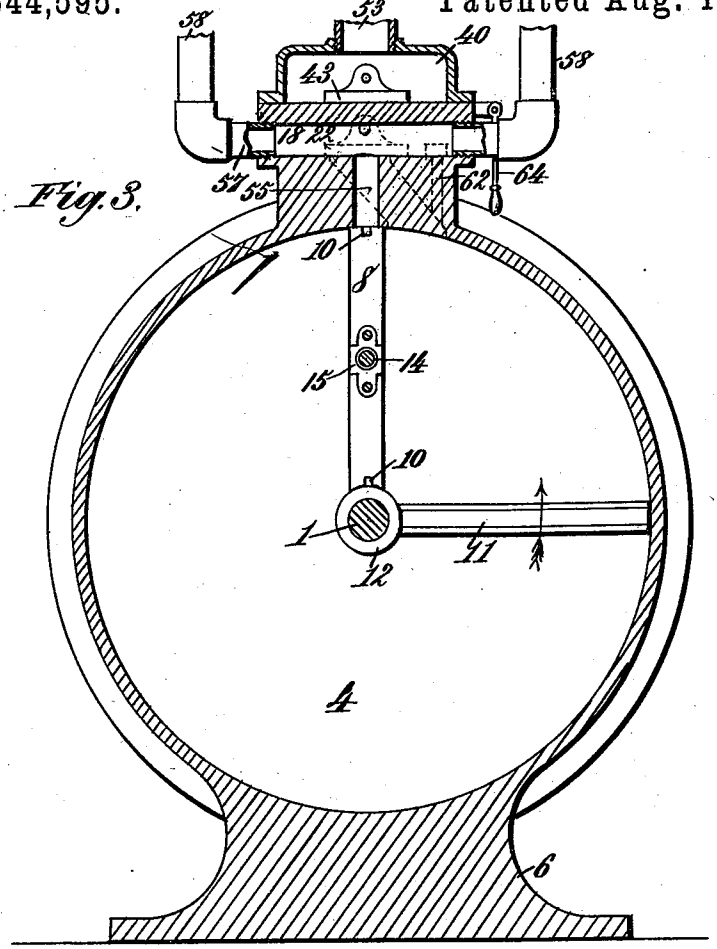

Fig. 4.

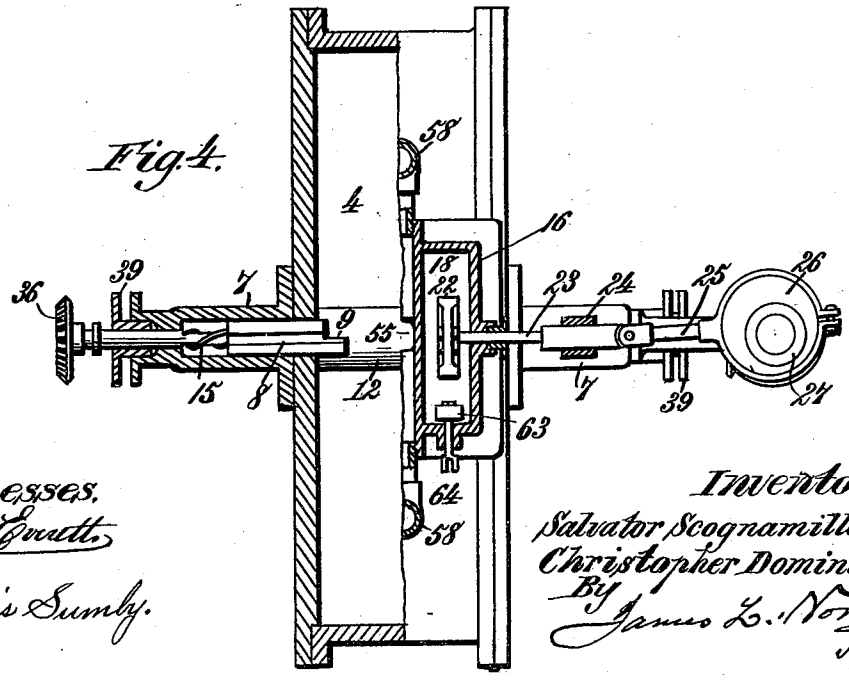

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Fig. 5

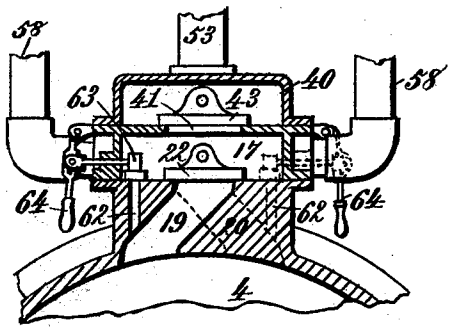


Fig. 6.

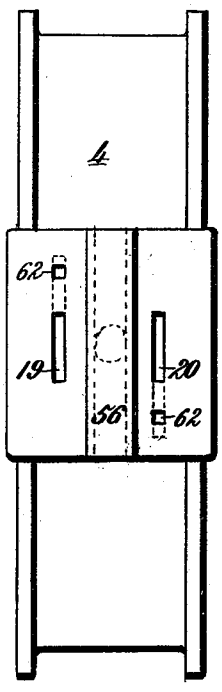


Fig. 7.

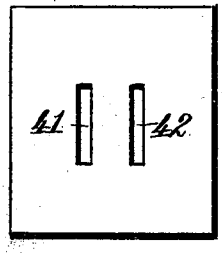


Fig. 8.

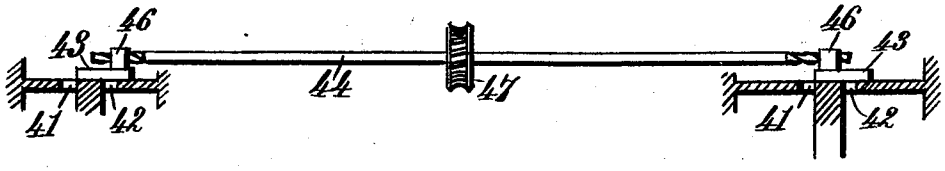
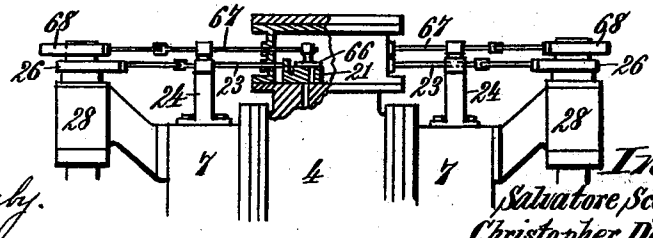


Fig. 9.



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UNITED STATES PATENT OFFICE.

SALVATORE SCOGNAMILLO AND CHRISTOPHER DOMINICI, OF RICHMOND, VIRGINIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 544,595, dated August 13, 1895.

Application filed February 21, 1895. Serial No. 539,248. (No model.)

To all whom it may concern:

Be it known that we, SALVATORE SCOGNAMILLO and CHRISTOPHER DOMINICI, citizens of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented new and useful Improvements in Duplex-Cylinder Rotary Engines, of which the following is a specification.

This invention relates to rotary engines, either single-acting or compound; and it consists in features of construction and novel combinations of parts and devices, as hereinafter more particularly described and claimed.

In the annexed drawings, Figure 1 is an elevation of a compound rotary steam-engine embodying our invention. Fig. 2 is a vertical longitudinal section illustrating a single-acting rotary engine of our invention or the high-pressure cylinder and accompanying parts of a compound rotary engine. Fig. 3 is a vertical transverse section of the engine on the line 3 3 of Fig. 1. Fig. 4 is a horizontal section on two separate planes designated by the lines 4 4 in Fig. 1. Fig. 5 is a vertical transverse section of a portion of the engine on the line 5 5 of Fig. 1; Fig. 6, a plan of the top of a rotary steam-engine at the base of the cut-off-valve chambers, showing the upper ends of the ports for admitting steam into the cylinder. Fig. 7 is a plan of the bottom of the main steam-chest and its ports that lead to the cut-off-valve chambers. Fig. 8 is a partly-sectional detail view illustrating the main slide-valves and their connecting-shaft. Fig. 9 is a partly-sectional detail view illustrating a slide-valve provided with a regulating-port controlled by an auxiliary slide-valve for giving a quick opening and closing of the steam-port.

Referring at first more particularly to Figs. 1 and 2, the numeral 1 designates the engine-shaft journaled in bearings 2 on the standards 3, that form part of the engine-frame. In Fig. 1 the reference-numeral 4 designates the high-pressure cylinder or chamber of a compound rotary engine, and 5 designates the low-pressure cylinder or chamber. These cylinders or chambers 4 and 5 are of the same character, differing only in area, and each is supported on a pedestal 6 at a suitable height.

The cylinders 4 and 5 are each provided on their opposite sides with vertically-oblong housings 7, each of which comprises a lower horizontally-cylindrical portion 7^a, Fig. 2, for passage of the engine-shaft, while in the upper or main portion of each housing is inclosed one of the two simultaneously approaching and receding slide gates or abutments 8 with which each cylinder or chamber 4 and 5 is furnished. On their meeting edges the sliding abutments 8 are formed with rabbets 9, Figs. 2 and 4, so as to partly lap when brought close together, thereby forming a tight joint to prevent the passage of steam. At their upper and lower edges they may be grooved to run on guides 10, Figs. 2 and 3, and each sliding gate or abutment may be provided at required points with any suitable packing.

The rotary piston 11, Fig. 3, has on its inner end a tubular portion or sleeve 12, through which it is secured to the engine-shaft. At its outer end and along its side edges the piston may be suitably packed, as usual, to prevent the passage of steam.

For the purpose of providing means to operate the sliding gates or abutments 8 there is formed in about the center of each of these parts a tubular recess 13, Fig. 2, extended inward from the outer vertical edge of each slide or abutment, parallel with and between its opposite sides. In the outer end of each tubular recess 13 is fixed a stationary nut 14, Fig. 2, secured by screws or otherwise. Each fixed nut 14 is constructed and arranged to engage a screw-shaft 15, Figs. 2, 3, and 4, having a quick thread formed thereon that will be adapted to cause, on rotation of such screw-shafts, a rapid inward or outward movement of the two coacting slides or abutments, according to the direction in which the screw-shafts 15 are rotated. Along their lower edges the sliding gates or abutments 8 run in close contact with the periphery of the sleeved or tubular portion 12 of the rotary piston, so as to prevent any leakage of steam at that point, but without obstructing a free movement of the piston. The sliding gates or abutments 8 must open promptly to permit passage of the rotary piston at proper intervals and then immediately close or come together, in close contact with each other, to form a solid and impervious abutment for expansion of a fresh

supply of steam in rear of the moving piston. They must also operate in proper time movements with the cut-off valves through which the supply of steam is controlled. The cut-off valve or valves and the actuating mechanism for the sliding gates or abutments may therefore be conveniently operated in proper time movements from a single point and through mechanism that will now be described.

It will be more convenient to describe the operating mechanism for the cut-off valves and the sliding gates or abutments with direct reference to the sectional view illustrated in Fig. 2, showing only one engine cylinder and its accompanying parts; but it must be understood that the construction and arrangement of such mechanism are precisely the same for both the high-pressure and low-pressure cylinder, and therefore the same description will apply to both in all essential particulars.

In a casing 16 on the top of each engine cylinder or casing 4 and 5 are two valve-chambers 17 and 18, Fig. 2, which are adapted to communicate with the piston cylinder or chamber through steam-ports 19 and 20, respectively. These ports 19 and 20 are parallel at their upper ends, as shown in Figs. 5 and 6, but their lower ends are divergent and open into the cylinder 4 or 5, as the case may be, on opposite sides of the closed sliding gates or abutments 8, to which reference has before been made. This arrangement of the steam-ports 19 and 20 is designed to provide for reversing the engine, as hereinafter explained, only one port being used at a time for supplying steam to rotate the piston 11 in the required direction. The steam-ports 19 and 20 are controlled by cut-off slide-valves 21 and 22, respectively.

Each cut-off slide-valve 21 and 22 is carried by a valve-rod, as 23, Fig. 2, both valve-rods being alike and both supported in guide-bearings 24, suitably located on the housings for the sliding gates or abutments. At their outer ends the valve-rods 23 are pivotally connected to eccentric-rods 25, that are each strapped to its appropriate eccentric 26, Figs. 1, 2, and 4, carried on one end of an axially oscillatory sleeve or tubular rocker 27. (More clearly illustrated by the section shown in Fig. 2.) These oscillatory sleeves or rockers 27 are supported in tubular bearings 28 on the ends of bracket-arms 29, projecting from the housings 7 or other suitable portions of the engine-frame. A portion of the interior of each oscillatory sleeve or rocker 27 is formed intermediate its ends as a nut or spirally-inclined way 30, Fig. 2, in which the threads or spiral inclines have a rapid pitch.

On the engine-shaft 1 are mounted eccentrics 31, carrying eccentric-rods 32, that are jointed or pivotally connected to reciprocating rods 33, which carry non-rotating screw heads or bosses 34, Fig. 2, having threads of rapid pitch engaged with the corresponding threads or spirally-inclined ways 30 in the oscillatory sleeves or tubular rockers 27. It is evident that when the engine is in operation the eccentrics 31 will impart reciprocating movements to the rods 33, and these through the engaged spirally-inclined threads or ways 34 and 30 will cause an axial oscillation or rocking of the sleeves 27 and eccentrics 26, connected thereto. Thus from the eccentrics 26 the cut-off slide-valves 21 and 22 will receive the required movements for controlling the steam-ports of the engine cylinder or cylinders.

To one end of each oscillatory sleeve or tubular rocker 27 is secured a miter-gear 35, and through the center of each of these gears the reciprocating rods 33 are passed. The miter-gears 35 mesh with similar gears 36 on the ends of the screw-shafts 15, which, as before mentioned, are provided with threads of rapid pitch that are engaged in the correspondingly-threaded nuts 14, secured at the outer ends of the tubular recesses 13 in the sliding gates or abutments. Through the movements of the oscillatory sleeves or rockers 27, therefore, the required reciprocations are imparted at proper intervals to the cut-off slide-valves and to the sliding gates or abutments. The outer portions of the screw-shafts 15 may be supported by brackets 37 on the outside of the housings 7, in which the sliding abutments are inclosed when retracted or drawn apart for passage of the rotary piston. On the housing 7 are suitable stuffing-boxes 38 for the engine-shaft 1 and stuffing-boxes 39 for the screw-shafts 15 of the sliding gates or abutments.

The conjoint arrangement of the spirally-inclined ways 30 in the oscillatory sleeves or tubular rockers 27 and the screw-threaded portions 34 of the reciprocating rods 33 is such that by reason of the limited extent of the ways 30 the said sleeves or rockers 27 will not oscillate during the whole of the reciprocations imparted to said rods 33, but will have a period of rest at intervals corresponding with those portions of the rod reciprocations during which the threads or inclined ways 30 and 34 become disengaged. The sleeves or rockers 27 thus have an intermittingly-oscillatory movement and their intervals of rest correspond with the periods during which the cut-off valves are to remain open, while the slides or abutments are closed together and during the time that the valves are closed while the slides or abutments are open for passage of the rotary piston.

Steam is supplied to each cylinder, primarily, through a chest or chamber 40 above the casing 16, inclosing the compartments 17 and 18, in which the cut-off valves 21 and 22 are located. The steam-chest 40 communicates through ports 41 and 42, Figs. 2 and 7, with the compartments or valve-chambers 17 and 18, respectively. In each steam-chest or main valve-chamber 40 is a main slide-valve 43, Figs. 2 and 8, for controlling the two ports

41 and 42, which are parallel with each other, as shown in Fig. 7. The main slide-valves 43 are of such area that they may be made to cover and close both ports 41 and 42, or they may be shifted in such direction as will open either of these ports according to the direction in which the rotary engine is to be operated. They will, therefore, serve as reversing-valves, in connection with the arrangement of ports, as shown. In a compound engine the two main slide-valves 43 will be connected by a single valve rod or shaft 44, Figs. 1, 2, and 8, mounted to revolve in bearings 45, provided at suitable points. The opposite ends of the valve rod or shaft 44 are screw-threaded and engaged in threaded lugs or nuts 46, fixed onto the two valves 43, so that by rotation of the shaft or rod 44 the said main slide-valves will be moved the required distance and in the desired direction, according to the direction and extent of rotation imparted to the valve rod or shaft. On this rod or shaft 44 is secured a worm-wheel 47, meshing with a worm-gear 48 on a shaft 49, Figs. 1 and 2. The shaft 49 is connected by worm-gearing 50 with a shaft or spindle 51, provided with a hand-wheel 52, located at a convenient point for manipulation in operating the rod or shaft 44 and connected main valves.

Steam for the cylinder or chamber 4, which in a compound engine will represent the high-pressure cylinder, may be supplied to the appropriate chest 40 through a steam-pipe 53, that may be provided with a hand-valve 54, as shown in Fig. 1. If the main slide-valve 43 is in the position shown in Fig. 2, so that it will cover or close the port 42 and leave the port 41 standing open, the steam from the pipe 53 and chamber or chest 40 will be admitted only into the valve-chamber 17 and thence into the cylinder through the port 19, controlled by the cut-off slide-valve 21, and by expansion of the steam against the closed abutments 8 the piston 11 will be rotated, say, in the direction indicated by the arrow in Fig. 3. When the piston nearly completes its revolution the valve 21 will close the port 19 and the sliding gates or abutments 8 will be drawn back or opened to allow the piston to pass. The opening or moving apart of the sliding gates or abutments 8 will open or uncover the narrow lower end of an exhaust-port 55, that is located in the thickened top of the cylinder intermediate the steam-ports 19 and 20 and extended partly into a raised bridge portion or wall 56, Figs. 2 and 6, that separates the valve-chambers 17 and 18 from each other. By this construction the upper edges of the sliding gates or abutments 8 will serve as a valve for the exhaust-port, which will be open only when said gates or abutments are drawn apart or retracted.

The exhaust-port 55 leads to a horizontal and transversely-arranged exit-pipe 57, Figs. 2 and 3, that may have one or more vertically-extended branches or outlets 58, Figs. 1, 3, and 5, and in a compound engine these may connect through a coupling 59, Fig. 1, with a pipe 60, leading to the steam-chest 40 of a low-pressure cylinder 5. The exhaust-passages of the said low-pressure cylinder 5 may lead to a similar pipe or pipes 58^a, Fig. 1, which may connect with a pipe 61 for conveying the exhaust to any desired point or to still another engine-cylinder.

In reversing the engine it is only necessary to rotate the hand-wheel 52 in proper direction to cause the valve rod or shaft 44 to move the main slide valves 43 a sufficient distance to cover the ports 41 and uncover the ports 42, and if desired these valves may be stopped at such points as will cover or close both the main ports 41 and 42, thereby cutting off steam entirely. The valve-rods 23 and 44 may be provided with suffing-boxes, as shown.

For the purpose of facilitating the starting of the engine after it has been at rest or "dead" it is preferable to provide for establishing communication between the valve-chambers 17 and 18 and ports 19 20, respectively, through auxiliary or starting ports 62, Figs. 3 and 5, controlled by slide-valves 63, Figs. 4 and 5, operated by a suitable lever mechanism 64, Figs. 1, 3, 4, and 5, connected with each starting-valve and located at suitable points on the outside of the engine.

Through the axially-oscillatory sleeves or rockers 27 and their connections with the engine-shaft 1, cut-off valves 21 22 and sliding gates or abutments 8, the said valves and abutments will be operated promptly and in proper time movements to meet the requirements of the engine, whether arranged as single-acting or compound and whether the rotary piston is to be driven in one direction or the other. The lap-joints of the sliding gates or abutments will enable them to furnish a suitable abutment for expansion of steam even before they are tightly closed together, and the action of the engine in all its parts will be smooth and regular. It is evident that by disconnecting the cylinders 4 and 5 either one may be employed alone as a single-acting rotary engine, or two or more of such cylinders may be connected and operated as a compound engine. It will be seen that the ports and their valves are so arranged that the rotary piston will receive a fresh supply of steam once in each revolution and in a regulated volume sufficient to cause the piston to make a complete revolution. The slide-valves 21 and 22 are so operated that the steam-ports 19 and 20 will be open while the sliding gates or abutments 8 and exhaust-port 55 are closed, and vice versa, as heretofore explained. In some cases it may be desirable to provide each slide-valve 21 and 22 with a regulating-port 65, Fig. 9, controlled by an auxiliary slide-valve 66, having its rod 67 connected with an additional eccentric 68 on the oscillatory sleeve or rocker 27, the two coacting slide-valves, one superposed on the other, as shown, being arranged to be operated in proper time movements

through their eccentric connections and in such manner that the cylinder will receive at proper intervals no more than the required quantity of steam for driving the rotary piston through a complete revolution. This arrangement of valves may be applied to both cylinders and will give a quick opening and closing of the steam-port, whereby a sudden expansion of the steam is effected and its force expended upon the piston without waste and with greater economy in the volume of steam required.

A rotary steam-engine of this construction may be applied to advantage in the propulsion of vessels and for the usual purposes of marine engines, and the construction described is also applicable to all the purposes of stationary engines and for the economical application of steam-power wherever needed.

What we claim as our invention is—

1. In a rotary engine, the combination of a cylinder provided with inlet and exhaust ports, the engine shaft having a rotary piston mounted thereon, a sliding gate or abutment, a cut-off slide-valve, a tubular oscillatory rocker having a spiral way therein, a reciprocating screw threaded rod adapted to engage said spiral way, means for actuating said rod from the engine shaft, eccentric mechanism connecting said rocker with the cut-off slide valve, and a screw shaft geared with the rocker and engaged in a fixed nut on the sliding gate or abutment, substantially as described.

2. In a rotary engine, the combination of an engine shaft having a rotary piston thereon, a cylinder provided with sliding gates or abutments and with steam inlet ports opening into the cylinder on opposite sides of the closed abutments, cut-off slide valves controlling the steam inlet ports and located in separate steam inlet chambers provided with ports a reversing valve for controlling the ports of said chambers, axially oscillatory rockers actuated from the engine shaft, and mechanism connecting said rockers with the cut-off slide valves and with the sliding abutments, substantially as described.

3. In a rotary engine, the combination of a cylinder having housings on opposite sides and provided with a rotary piston and with steam inlet and exhaust ports, sliding gates or abutments supported in said housings and adapted to be moved toward and from each other across the interior of the cylinder and in the path of the rotary piston, said sliding gates or abutments being also adapted to control the exhaust port, cut-off valves for the steam inlet ports, axially oscillatory sleeves or rockers of tubular form and having inclined ways therein, reciprocating rods having screw-threaded ends engaged with said inclined ways, eccentrics mounted on the engine shaft and connected to said reciprocating screw threaded rods, whereby an axial oscillation will be imparted to the said sleeves or rockers, eccentrics carried by said sleeves or rockers and connected with the cut-off valves, and screw shafts geared with the oscillatory sleeves or rockers and engaged in nuts secured to the sliding gates or abutments, substantially as described.

4. In a rotary engine, the combination of a cylinder having a rotary-piston and provided on opposite sides with housings that inclose sliding gates or abutments adapted to be moved simultaneously toward and from each other across the interior of the cylinder and in the path of the piston, steam ports opening into the cylinder on opposite sides of the closed sliding gates or abutments, an exhaust port controlled by said sliding gates, cut off slide valves controlling the steam inlet ports, tubular, oscillatory rockers having inclined ways of limited extent formed therein, reciprocating screw-threaded rods adapted to engage said inclined ways and actuated from eccentrics on the engine shaft, mechanism connecting said rockers with the cut-off slide valves, screw-shafts geared with said rockers and engaged in fixed nuts on the sliding gates or abutments, and a main steam chest or chamber provided with ports and a reversing valve, substantially as described.

5. In a rotary engine, the combination with a cylinder provided with a rotary piston, sliding gates or abutments adapted to be moved simultaneously to and from each other across the interior of the cylinder, steam inlet ports opening into said cylinder on opposite sides of the closed abutments, and an exhaust port controlled by said sliding gates or abutments, of cut-off slide valves controlling the steam inlet ports, mechanism actuated from the engine shaft to cause the sliding gates or abutments and the cut-off valves to operate in time movements, starting valves controlling ports that connect the cut-off valve chambers with the steam inlet ports of the cylinder, lever mechanism for actuating said starting valves, and a main steam chest provided with ports controlled by a reversing valve, substantially as described.

6. In a rotary engine, the combination of a cylinder provided with sliding abutments, and with inlet and exhaust ports, an engine shaft having a rotary piston thereon, slide valves provided with regulating ports, auxiliary slide valves for controlling said ports, axially oscillatory rockers actuated from the engine shaft, eccentric mechanism connecting said rockers with the slide valves and their auxiliary valves, and gearing connecting the oscillatory rockers with the sliding abutments, substantially as described.

7. In a rotary engine, the combination of a high pressure cylinder, a low pressure cylinder, a rotary piston and sliding gates or abutments for each cylinder, valve chambers having ports leading into said cylinders, cut-off slide valves located in said chambers, axially oscillatory rockers geared with the sliding

abutments and with said cut-off slide valves, eccentrically actuated mechanism through which said rockers receive an axial oscillation from the rotation of the engine shaft, main steam chests connected by ports with the cut-off valve chambers of the respective cylinders, slide-valves located in said main steam chest and connected by a shaft, gearing for operating said shaft to reverse the engine, and steam passages leading from the exhaust of one cylinder to the steam chest of another cylinder, substantially as described.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

SALVATORE SCOGNAMILLO.
CHRISTOPHER DOMINICI.

Witnesses:
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C. B. FITZWILSON.