

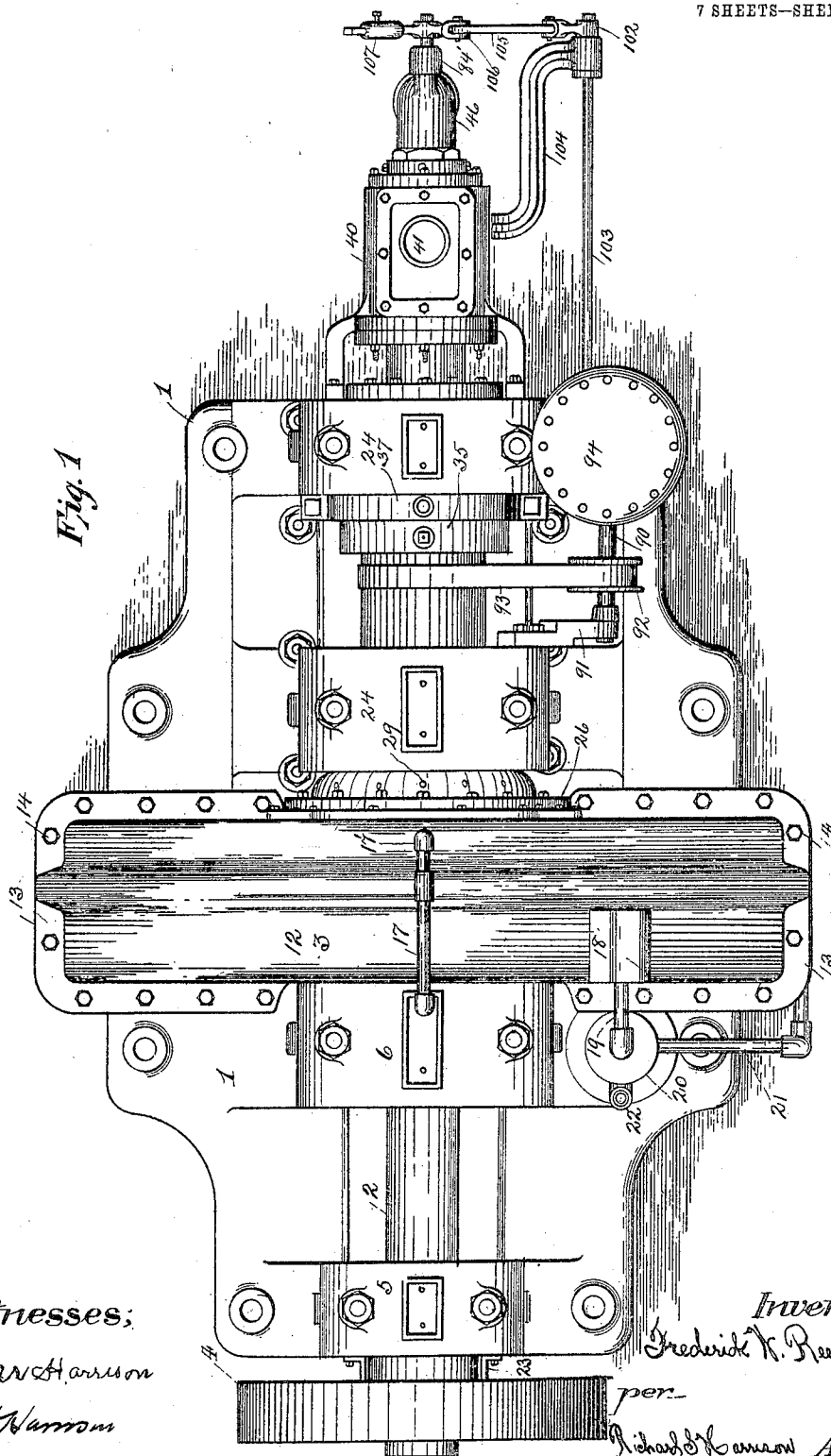
No. 812,527.

PATENTED FEB. 13, 1906.

F. W. REEVES.
RECIPROCATING ROTARY ENGINE.

APPLICATION FILED AUG. 27, 1904.

7 SHEETS—SHEET 1.



Witnesses:
James Harrison
W. H. Harmon

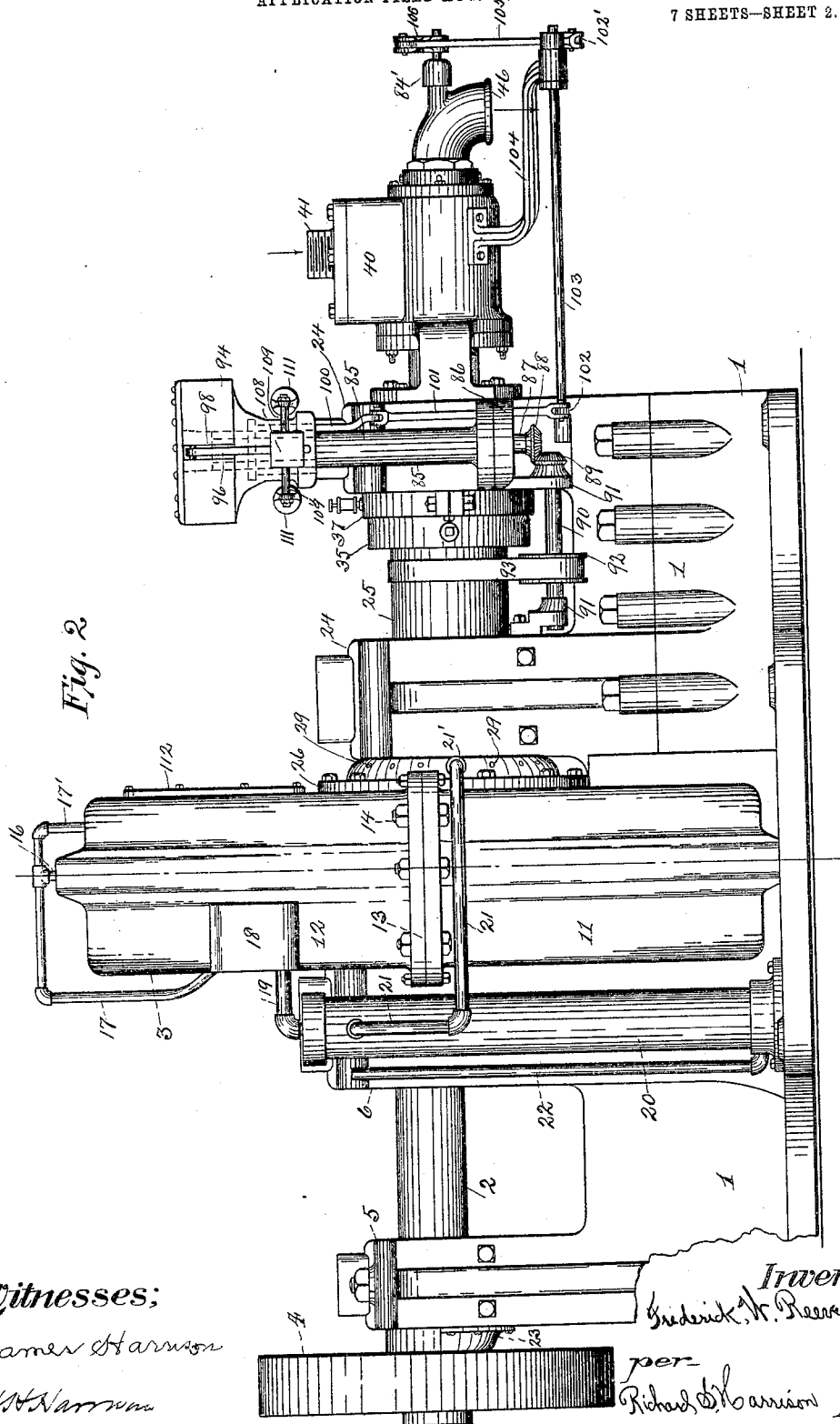
Inventor:
Frederick W. Reeves
per
Richard W. Harmon Atty.

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7 SHEETS—SHEET 2.



Witnesses;

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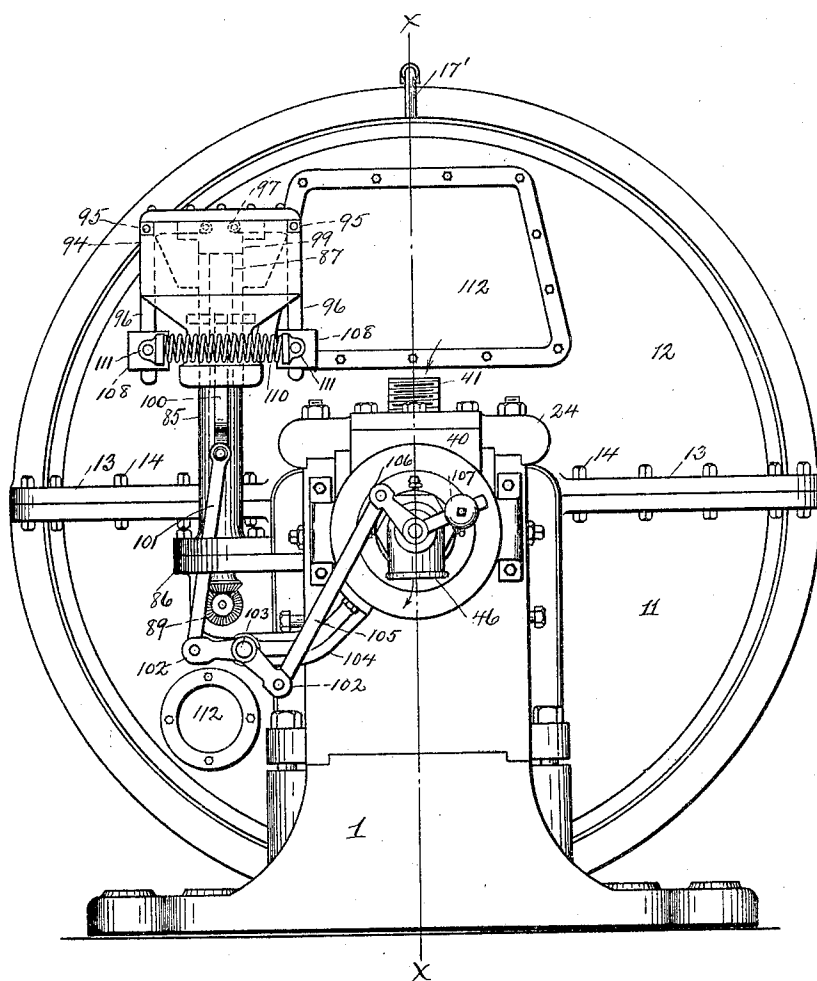
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7 SHEETS—SHEET 3.

Fig. 3



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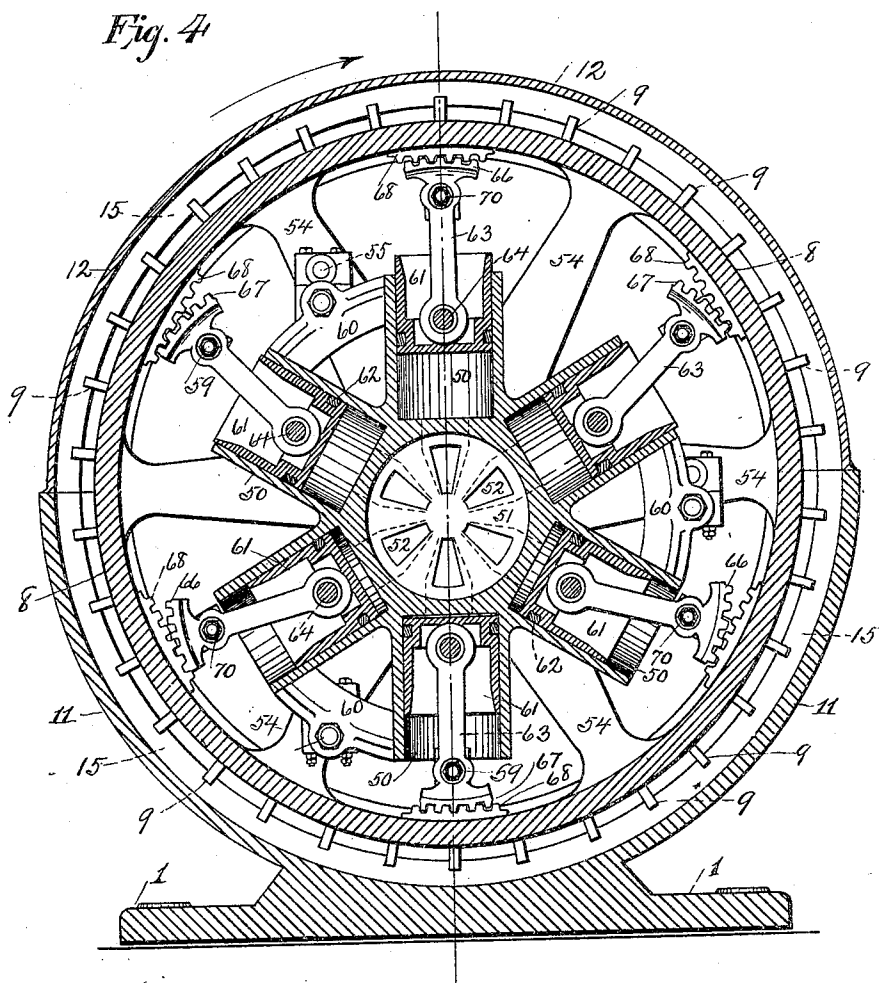
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7 SHEETS—SHEET 4.



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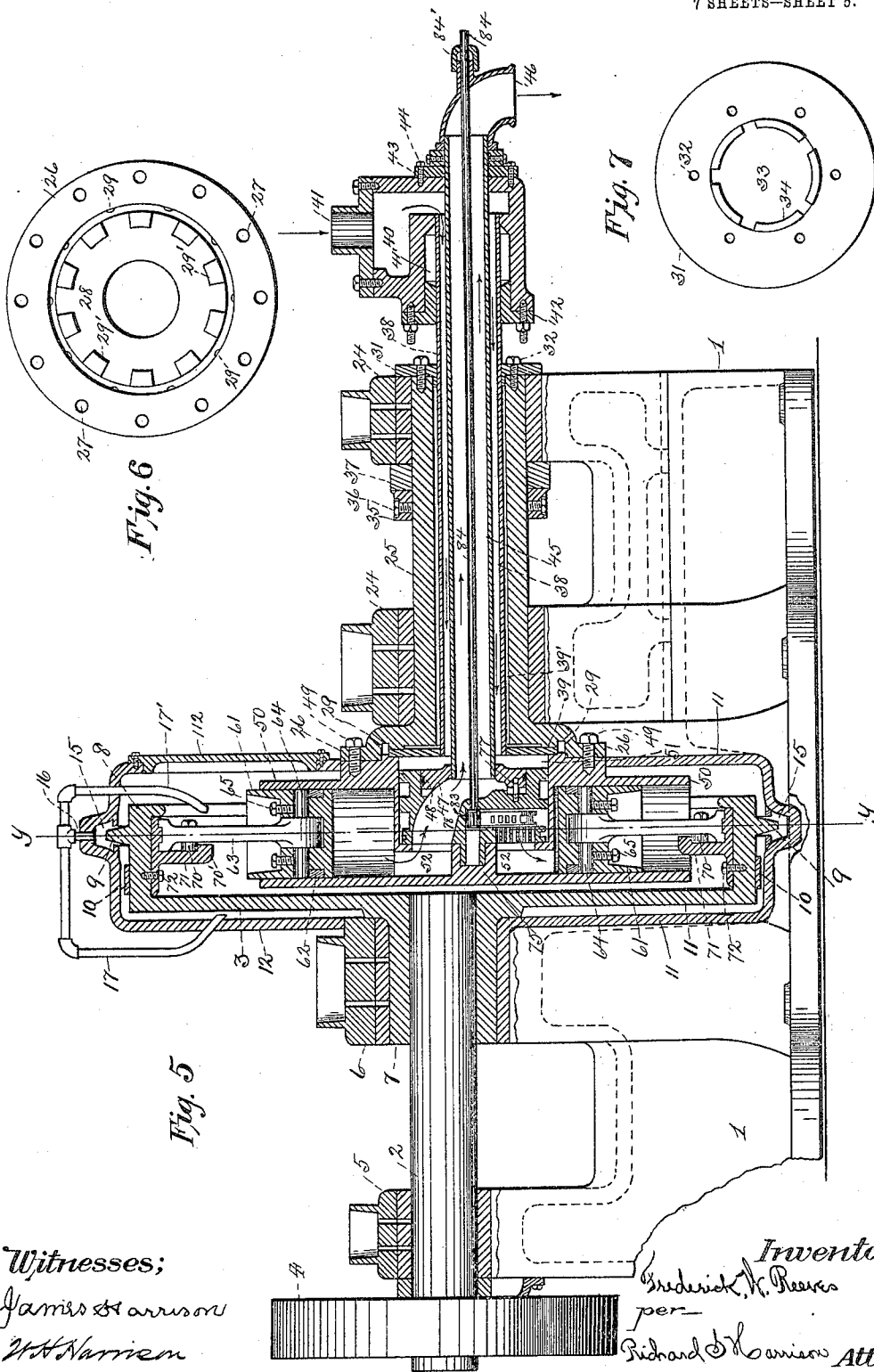
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7 SHEETS—SHEET 5.



Witnesses;
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7 SHEETS—SHEET 6.

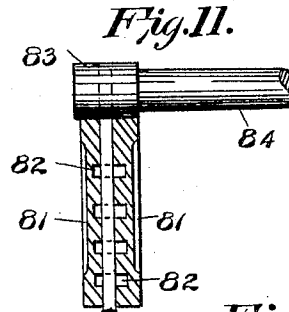
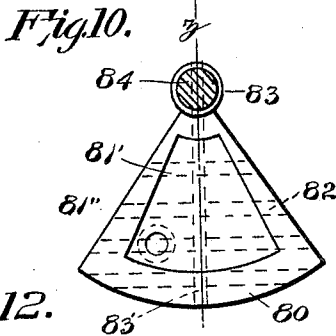
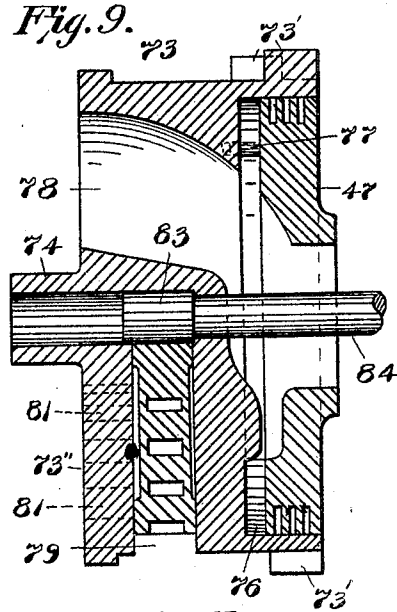
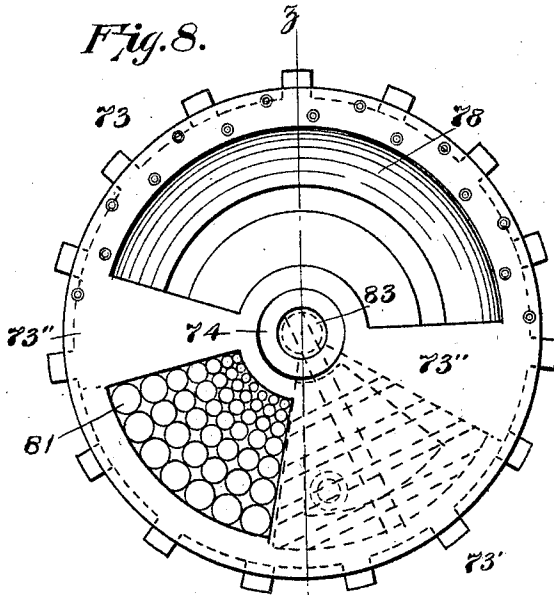


Fig. 12.

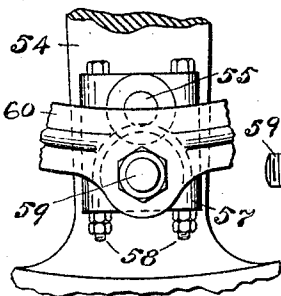


Fig. 13.

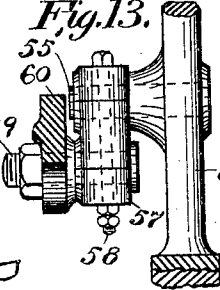


Fig. 14.

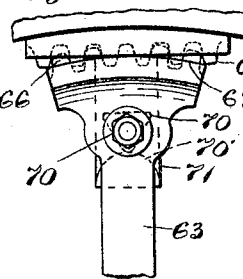
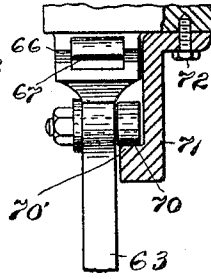


Fig. 15.



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UNITED STATES PATENT OFFICE.

FREDERICK W. REEVES, OF ALLEGHENY, PENNSYLVANIA, ASSIGNOR TO
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RECIPROCATING ROTARY ENGINE.

No. 812,527.

Specification of Letters Patent.

Patented Feb. 13, 1906.

Application filed August 27, 1904. Serial No. 222,378.

To all whom it may concern:

Be it known that I, FREDERICK W. REEVES, a citizen of the United States, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Reciprocating Rotary Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

The object of my invention is to provide a steam-engine of reciprocating rotary character adapted for service for driving dynamos and other machinery where constant power and high speed are essential.

The engine is so constructed and arranged as to be durable and compact and is provided with a series of single-acting cylinders with a positive quick-acting boiler-pressure expansion-balance-valve mechanism capable of giving as early a compression or exhaust as may be desired, which, taken with other new and novel features, make the same admirably adapted for the purpose for which it is intended.

In the accompanying drawings I have illustrated an operative engine embodying the essential features, with detailed parts thereof, in which drawings—

Figure 1 is a plan view of the complete engine and its connected parts. Fig. 2 is a side elevation of the same. Fig. 3 is an end elevation of the engine, showing the mechanism operating the governor for regulating speed of the same. Fig. 4 is a vertical sectional end elevation through the steam-cylinders, said section taken on the line Y Y of Fig. 2. Fig. 5 is a longitudinal sectional elevation taken on the line X X of Fig. 3. Fig. 6 is a face view of the flange of the hollow shaft, showing the position of the air passages or openings. Fig. 7 is a similar view of the end plate, showing radial openings or air-passages. Fig. 8 is an enlarged face view of the valve for controlling the engine. Fig. 9 is a sectional elevation of the same. Fig. 10 is a face view of the sector-valve. Fig. 11 is a sectional end elevation of the same. Fig. 12 is an enlarged detailed elevation of one of the connec-

tions made between the fly-wheel and the cylinders. Fig. 13 is an end elevation of the same. Fig. 14 is a side elevation of one of the racks of the fly-wheel in mesh with a segmental rack form on the outer end of the pitman, together with means for holding the mesh. Fig. 15 is an end elevation of the same. Fig. 16 is a detailed sectional elevation of the parts to form a reversing-engine. Fig. 17 is a face view of the same. Fig. 18 is a face view of the modified form of the steam-valve used on the reversible engine. Fig. 19 is a sectional side elevation of the same.

In order that others may fully comprehend the nature of my invention, I deem it advisable to briefly and plainly describe the details of construction and then in like manner describe the operation and advantages.

Again referring to said drawings for a detailed description of the engine, the numeral 1 designates a suitable bed-plate, upon one end of which is a shaft 2, carrying a fly-wheel 3 and band-wheel 4, said shaft being supported in bearings 5 and 6. This fly-wheel 3 is rigidly attached to the shaft 2 by means of an integral hub 7, which forms a bearing for the inner end of said shaft, and said wheel being formed with a peripheral flange 8, about the perimeter of which are arranged a series of radial projecting portions 9, prismatic in form and spaced in regular intervals the one in line with the other, also with a series of segmental projections 10, located at one side of the aforesaid portions 9 and parallel thereto for the purpose of forming part of a centrifugal lubricating device, as will be fully described hereinafter. This fly-wheel 3 is inclosed within a casing formed in two sections, the lower section 11 of which is integral with the bed-plate 1 and the upper section 12 in the form of a semicircular hood with flanges 13, which, together with bolts 14, provides a means for securely attaching the two together. Opposite the radial portions 9 of the fly-wheel is a groove 15, located in the inner periphery of the casing and extending about the entire circle, in which the said portions 9 project a short distance, as will be best seen by reference to Figs. 4 and 5 of the drawings. At the top of the upper section 12 of the casing a short tube is arranged to communicate with the interior groove 15, from which tube branches 17 and 17' extend to conduct the lu-

bricant to the mechanism inclosed by the casing and to the bearings at the walls thereof.

At one side of the upper section 12 of the casing in line with the segmental projections 10 is a receptacle 18, or what I term a "slush-box," the purpose of which is to receive the surplus oil or lubricating fluid and water leaking from the cylinders and other parts of the engine, which surplus oil and water is carried to said box by means of the segmental projections 10 of the fly-wheel within the casing during rotation. This slush-box 18 is in communication with the interior of the casing 11 and 12 by means of a port or opening (not shown) and is fitted with a drain-pipe 19, leading to a vertically-arranged stand-pipe 20, which pipe is closed at the top and bottom. At a point near the top of this stand-pipe 20 is an outlet-pipe 21, which leads to and enters the casing at any suitable point 21' for reconveying the oil separated from the water to the interior thereof, said stand-pipe being also provided with an overflow-tube 22, by means of which the surplus water may escape therefrom.

The operation of the above-described mechanism is such as to keep a constant circulation of oil or other lubricating fluid placed in the stand-pipe to the bearings, cylinders, and other parts of the engine during the working period of the same, due to the rapid rotatable movement of the radial projections 9 of the fly-wheel carrying the oil in the groove 15 upward, forcing the same into the tube 16 to be distributed by its connections 17 and 17' to the several parts of the engine. This oil eventually finds its way back to the casing through the medium of drain-pipes connected to drip-pans 23 and other suitable means, where it is mingled with water resulting from the condensation of the steam in the cylinders of the engine, and this combination of oil and water when in sufficient quantities will be forced into the slush-box 18 and permitted to settle in the stand-pipe 20, where the oil, being of less specific gravity, will collect upon the top of the water, being cleansed of impurity by the same, to be again conducted to the interior of the casing through the pipe 21, while the surplus water escapes from the overflow-pipe 22.

Upon the forward part of the bed-plate 1 in line with the shaft 2 of the fly-wheel 3, but at an elevation or distance from said shaft equal to one-half of the piston-stroke of the cylinders of the engine, is mounted in bearings 24 a hollow shaft 25, having at one end thereof a large circular flange 26, (see Fig. 6,) formed with bolt-openings 27, an annular recessed portion 28, a series of projecting lugs 29', and a number of perforations or vents 29. This shaft 25 is held in rotatable position by means of two bearings 24, formed with the bed-plate 1, and is confined in said bearings by a thrust-collar, the purpose of which is to

compensate for the inequality or end thrust within said shaft caused by the balance-valve, said collar consisting of two rings, one of which, 35, is firmly attached to the shaft by screws 36, and the other, 37, formed in two sections with flanges and adjusting-screws, whereby the longitudinal movement of the shaft resulting from wear may be taken up. A disk 31 (see Fig. 7) is firmly attached to the end on the shaft 25 by stud-bolts 32, the said disk being formed with a central opening 33, surrounded with a series of inwardly-projecting lugs 34. Centrally arranged within the hollow shaft 25 is a tube 38, the same being fitted at its forward end with a disk 39 and passed through openings 33 of the disk 31 in a manner that will leave an intervening space 39' between said tube and the hollow shaft to permit a current of air to freely circulate and keep the parts comparatively cool, the said current entering the space through the openings between the lugs 34 and escaping through the vents 29 in the flange of the hollow shaft. This tube above mentioned is covered with asbestos or other suitable non-conducting material 38' (see Fig. 20) in order that the heat may be confined therein and prevent its transmission to the bearings 24. Attached to the outer end of the above-mentioned tube 38 is a steam-inlet hood or box 40, having a means for connection with a steam-supply pipe, a stuffing-box 41, and a gland 42, which is adapted to form a steam-tight connection with said tube 38, and an annular flange 43, attached by bolts 44, to provide a support for an inserted exhaust-tube 45, fitted at its outer end with an elbow 46 to conduct the exhaust from the engine and deflect the same downward. This exhaust-tube 45 is attached to a disk 47, forming a part of the steam-valve, for balancing the said valve by reducing the live-steam area on the back of the same, the said disk or piston being fitted with a packing-ring 48 and arranged in a recess formed in the back of said valve.

Securely attached by means of bolst 49 to the flange 26 of the hollow shaft is a series of steam-cylinders 50, arranged in the same vertical plane and in lines radiating from the center of said shaft, each of said cylinders being open at their outer end and communicating, by means of ports 52, with a common valve-chamber 51, annular in form and located at the radial center common to each cylinder. Any number of these cylinders 50 may be used suitable to the size and proportion of the engine and may be cast integral the one with the other, as shown in the drawings, or formed in sections, and in which drawings six of such cylinders are shown, each of single-acting type. These cylinders 50 are pivotally suspended to the arms 54 of the fly-wheel at points equidistant from each other, said points arranged in the form of an

equilateral triangle, the sides and angles of which are equal, each of the connections being made (see Figs. 12 and 13) by pins 55, rigidly secured to and projecting from said arms 54, connecting-blocks 56, having journal-bearings at either end fitted with caps 57, said caps held in position by bolts 58, whereby pivotal connections may be made with pins 59, firmly attached to webs 60, formed integral with adjacent cylinders and arranged in triangular form, the angles and sides of which are identical with that of the connection made with the fly-wheel in a manner that if lines are drawn through the pivotal points of one connection to the pivotal points of another the said lines will either coincide or form a parallelogram at all points of the revolution of the cylinders and fly-wheel, thereby permitting the said parts to compensate for the differential and eccentric motion due to the rotatable movement of the said cylinders and fly-wheel upon different centers. These pivotal points of the connecting-blocks 56 are distant one from the other equal to one-half the piston-stroke or a distance equal to the difference between the centers of the two main shafts. Each of these open-ended cylinders 50 is fitted with a piston 61, having the usual packing-rings 62, rendering the said pistons steam-tight, and each piston provided with a pitman 63, pivoted within the hollow end of the pistons by means of transverse pins 64, held in place by short set-screws 65, and said pitmen having at their outer ends segmental racks 66, the pitch-lines 67 of which are drawn from the pivot of said pitmen. These segmental racks 66 of the pitmen are adapted to engage with straight racks 68, either attached to or forming a part of the inner periphery of the fly-wheel and at points equidistant the one from the other and of a number corresponding to the number of cylinders used in the construction of the engine. Each pair of racks 66 and 68 are held in mesh by means of small triangular blocks 70, (see Figs. 14 and 15,) secured by bolts 69, passed through the pitmen and operating over semicircular bearings 70', formed on brackets 71, integral with the peripheral racks 68 and held in position by bolts 72. Each of these racks 66 and 68 are made double with intermediate webs corresponding with the pitch-lines of said racks in order that the weight or thrust of the pitmen may be in part removed from the teeth of said racks, and by this construction and arrangement the points of tangency of said pitmen will always be in line with the centers and axis of suspension of said cylinders.

Arranged in the valve-chamber 51 is a valve 73, (see Figs. 8, 9, 10, and 11,) annular in form and provided upon its periphery with segmental projections 73', adapted to remain stationary and centered therein by a boss 74,

arranged in a bearing 75, forming a part of the cylinder-casting, and is further held in position by a disk or piston 47, connected to the inner end of the exhaust-tube 38 to form a steam-balance, the connection being made by a recess 76 in the back of said valve and a short pin 77 in such a manner as will permit a slight longitudinal movement of the valve and disk to take up the expansion and contraction of said exhaust-tube. This valve 73 is provided with an exhaust-opening 78 in the proper position and proportion, also a hollow or recessed cavity 79, a part of the wall 73' of which is provided with a series of perforations 81, arranged in radial lines, said perforations increasing in diameter from the center of the valve outwardly and communicating with said recessed cavity 79. Within this recess 79 is placed a sector-valve 80, operated by the governor of the engine. This sector-valve 80 consists of a segment of a disk neatly fitted within the recess 79, having a recessed portion 81' at either side, a small opening 81'' through the same from one recess to the other, and a series of core-openings 82 extending from end to end, which construction will permit the steam to surround the segment and balance the same. This sector-valve when the engine is at rest is entirely within the recess 79 and is connected to a head 83 by a pin 83' to a rod 84, extending throughout the length of the exhaust-tube 45 and its connected elbow 46, at which point a stuffing-box 84' is arranged to form a bearing and support the free end, where connection is made with the mechanism of the governor. It will be seen by this construction of a valve and its inclosed sector that the parts are such that a perfect steam-balance is obtained, thereby reducing the friction to the minimum, preventing excessive wear of the parts.

Placed in a suitable position at the front of the engine is a governor for regulating the speed of the same in accordance with the work or load, and in this case consists of a hollow standard 85, attached by bolts to a bracket 86, formed with the bed-plate 1 and in which is arranged a vertical shaft 87, fitted at its lower end with a small bevel-wheel 88 in mesh with another, 89, mounted on a counter-shaft 90, said counter-shaft being supported in bearings 91 and provided with a band-wheel 92, driven by a belt 93, engaged with the cylinder-shaft 25, whereby the governor-shaft 87 may be driven at a high speed. Arranged and supported upon the top of the standard 85 is a head 94, attached to and rotated by the said shaft 87, said head having pivoted thereto at opposite sides two bent levers 96, the inner ends of which are fitted with rollers 97 and project within said head through vertical-arranged slots 98 and bear upon the cap-piece 99 of a vertically-arranged rod or bar 100, mounted in slides and capable

of a limited movement in the direction of its length, said rod being connected by a bar 101 to a crank 102, attached to a shaft 103, placed in bearings 104, one of which is attached to the steam-box 40. The other end of this last-mentioned shaft is fitted with a crank 102' and said crank joined by a connecting-bar 105 to a bell-crank 106, attached to the sector-rod 84, the said bell-crank being provided with a balance-weight 107 to counter-balance the weight of its connected parts. The other or lower ends of the bent levers 96 are fitted with adjustable blocks or weights 108, with transverse pins 109 projecting at either side of said blocks and attached to stout spiral springs 110, fitted with swivels or heads 111.

In setting the sector-valve 80 relative to the governor above described it is necessary that the same assume its extreme normal position within the recess of the valve proper, being entirely within the cavity, as will be seen by reference to Fig. 8 of the drawings.

The casing 11 12 is provided with openings fitted with lids or covers 112, by means of which the operator or mechanic may have access to the inner working parts of the engine.

Having thus described the details of construction, I will now proceed to plainly set forth the operation and effect. Assuming that the steam-supply pipe is connected to the steam-box 40 and the engine is in a position such as shown in the several views of the drawings with the exhaust-port open for the upper and adjacent cylinders to the right and the receiving-port likewise open to the lower cylinder and those to the left, the valve being constructed to cut off at five-eighths of the stroke. When these conditions are established, the steam upon being turned on enters the box 40, passing through the tube 45 and between the segmental projections 73' to the cavity 79 and valve-ports 81 through ports 52 to the inner end of the lower cylinders 50 and others to the left, exerting its force on the pistons 61, thrusting the same forward, pushing the fly-wheel to the left, the pitman-racks 66 rolling about the mesh of those of the fly-wheel, thereby imparting a rotatable movement to the same, the leverage thus exerted upon the pitmen being applied at all times in a direct line with the centers and axis of suspension of the cylinders. This leverage upon the fly-wheel is continued until the steam is cut off by reason of the rotatable movement of the cylinders about the valve, after which the ports of said cylinders are brought opposite the exhaust-port of the valve and will continue in this open position until exhausted of all steam therein, which exhaust finds an outlet to the atmosphere through the tube 38.

It will be seen by reason of the rotatable movement of the cylinder 50 about the valve 73 that each cylinder is presented in succes-

sion to receive steam and continue to exert its force upon the fly-wheel with a powerful leverage in direct lines to force the said wheel in the proper direction, and when the expansive force of the steam is spent the end of the stroke is reached, and the continuous rotary movement will drive the pistons back, forcing the exhaust from the cylinders in rotation as the pitman-racks 66, operating with the fly-wheel racks 68, drives the pistons inward, ready to again receive steam at the starting-point. This movement of the fly-wheel imparts motion to the band-wheel and an equal and corresponding motion to the hollow shaft 25 through the medium of the cylinders 50, connected to said fly-wheel, causing continuous rotation of both members, the one being tied to the other in parallel relation.

The sector-valve 80 is capable of being oscillated within the recess or cavity of the valve proper by the rod 84 thereof and its connection with the governor. The rapid rotatable movement of the governor-head 94 will cause the weighted ends of the levers 96 to spread farther apart in the direction toward the arcs of circles or about their pivotal points, thereby depressing the inner ends of said levers, forcing the bar 100 downward, which movement acting upon the rock-shaft 103 imparts a corresponding movement to the sector-valve rock-shaft 84 through the medium of its crank 106 and connections. This movement of the rod 84 will be transmitted to the sector-valve and a like movement toward the perforations 81 of the valve proper, cutting out each consecutive radial series, thereby regulating the quantity of steam direct from the boilers to the cylinders in proportion to the speed of the engine, as the centrifugal force acting on the weights 108 will overcome the resistance offered by the springs 110, thereby moving the sector-valve to admit sufficient steam to maintain a given speed without respect to the work or load placed upon the engine. In this form of valve as early a compression or exhaust may be attained by establishing the proper area or proportion of the exhaust-port 78.

The pivotal points 55 and 59 of each connection between the fly-wheel and cylinders are equidistant between their respective centers, and pivotally connected in parallel relation to the wheel and cylinders and equidistant points thereat a series of parallelograms are formed at all times except when the lines of one converge and coincide. It is evident that the fly-wheel and cylinders are rotated by the action of the reciprocating pistons. Said parallelograms will rotate therewith and at the same time maintain a vertical position, the centers of which will be equal to vertical lines drawn from infinite points commensurable points of two equal intersecting circles described from the respective axes of suspen-

sion of the cylinders and fly-wheel. The parallelograms remain truly such, no matter what the angle of deflection may be in performing their rotatable motion, except when the individual sides of one coincide, as above noted.

To convert my invention into a reversing-engine, the governor and its connected parts are dispensed with and an exhaust-chamber 113 attached by bolts 114 (see Figs. 16 and 17) to the end of the steam-hood 40, the said chamber being provided with an outlet 46, and incloses the exhaust-tube 45, the said tube being formed with a number of openings 45' and extended through the end of the chamber and rendered steam-tight by a stuffing-box 115. The outer end of the exhaust-tube is fitted with a screw-cap 116, carrying a stuffing-box 117, through which the sector-valve rod 84 projects. Intermediate of the stuffing-box 115 and the cap 116 is the hub 120' of a lever 120, which is rigidly attached to the exhaust-tube 84, the said lever operating in connection with a segmental guide 124, supported by a bracket 121, attached to the exhaust-chamber 113, said segmental rack being provided with notches 124' at either end, which, together with a locking-bolt 125, operating in a bearing 126, serves as a means of locking said lever at these two points. Attached to or forming a part of this segmental rack or guide 124 is another, 122, of less diameter and arranged eccentric thereto, said latter guide being formed with a slot 123, extending its length. Attached to the projecting end of the sector-rod 84 is a small crank 119, having attached thereto a connecting-bar 118, the other end of which is connected by a pin 118' with the slot 123 of the guide and with a slot 120', formed in the lever 120, in a manner that the said pin will be free to move in either direction of the said slots.

The valve 72 is slightly modified for use in this class of engine, said modification consisting of extending the area of the radial-arranged inlet-openings 81, the said extension being equal to the area of the sector-valve 80, whereby steam may be supplied to the cylinders at either side of said valve by change of its position.

In operation the lever 120 is locked at one of the notches 124' at either side of the segment 124 and the sector-valve covering one-half of the steam-openings 81 of the steam-valve 80, which position of the parts will rotate the engine in a certain direction in the manner heretofore described. To reverse the rotatable movement, it is only necessary to move the lever 120 from the one notch to the other at the opposite end of the segment. This movement of the lever will turn the exhaust-tube 45 and its connected steam-valve 80 nearly one-half revolution and at the same time shifting the sector-valve to the opposite end of its recess through the medium of the

crank 119, connecting-rod 118, and eccentric set-slot 123 to cover the opposite set of steam-openings 81. This movement of the valve and its inclosed sector admits steam to the cylinders in opposite relation, thereby reversing the rotatable movement of the engine, as is obvious.

Having thus described an operative apparatus capable of producing the desired result, it is plain that the detailed parts thereof may be changed or modified without departing from the spirit of the invention.

I claim—

1. In a steam-engine, a plurality of cylinders revoluble about the same axis and provided with reciprocating pistons, a rotatable wheel the axis of which is parallel with but out of line with the revoluble axis of said cylinders, members yieldingly connected to said piston and said wheel, means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

2. In a steam-engine, a plurality of cylinders revoluble about the same axis and provided with reciprocating pistons, adapted to receive and exhaust steam at one end, a rotatable wheel the axis of which is parallel with but out of line with the revoluble axis of said cylinders, members yieldingly connected to said piston and said wheel, and means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions.

3. In a steam-engine, a plurality of cylinders revoluble about the same axis and provided with reciprocating pistons, a rotatable wheel the axis of which is parallel with but out of line with the revoluble axis of said cylinders, members yieldingly connecting said cylinders with said wheel, members yieldingly connected to said piston and said wheel, and means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions.

4. In a steam-engine, a plurality of cylinders revoluble about the same axis and provided with reciprocating pistons adapted to receive and exhaust steam at one end, a rotatable wheel the axis of which is parallel with

but out of line with the revoluble axis of said cylinders, members yieldingly connecting said cylinders with said wheel, members yieldingly connecting to said piston and said wheel, means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

5. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating with a valve-cavity located at the revoluble axis of said member, a receiving and exhaust valve mechanism located in said cavity, reciprocating pistons in cylinders, a revoluble wheel the axis of which is out of line but parallel with the revoluble axis of said cylinder member, members yieldingly connected to said piston and said wheel, means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

6. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating at one end with a valve-cavity located at the revoluble axis of said member, a receiving and exhaust valve mechanism located in said cavity, reciprocating pistons in said cylinders, a revoluble wheel the axis of which is out of line but parallel with the revoluble axis of said cylinder member, members yieldingly connected to said piston and said wheel, semicircular bearings carried by said wheel, and laterally-disposed members carried by the pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

7. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating with a valve-cavity located at the revoluble axis of said member, a receiving and exhaust valve mechanism located in said cavity, reciprocating pistons in said cylinders, a revoluble wheel the axis of which is out of line but parallel with the revoluble axis of said cylinder member, members yieldingly connecting said cylinders with said wheel, members yieldingly connected to said piston and said wheel,

semicircular bearings carried by said wheel, and laterally-disposed members carried by the pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

8. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating at one end with a valve-cavity located at the revoluble axis of said member, a receiving and exhaust valve mechanism located in said cavity, reciprocating pistons in said cylinders, a revoluble wheel the axis of which is out of line but parallel with the revoluble axis of said cylinder member, members yieldingly connecting said cylinders with said wheel, members yieldingly connected to said piston and said wheel, means carried by the said wheel and outer extremities of said members and engaging one another, the point of engagement therebetween being at all times in direct line with the centers of the cylinders and the axis upon which they revolve irrespective of their positions, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

9. In a steam-engine, rotatable cylinders provided with reciprocating pistons, a rotatable wheel the axis of which is out of line but parallel with that of said cylinders, members yieldingly connecting said wheel with said cylinders, whereby a uniform rotary motion is established, a casing inclosing said wheel, a circumferential groove formed within said casing and means connected to said wheel whereby a lubricating fluid entering said casing will be carried to said groove and distributed within said casing to the mechanism inclosed thereby.

10. In a steam-engine, rotatable cylinders provided with reciprocating pistons, a rotatable wheel the axis of which is out of line but parallel with that of said cylinders whereby a uniform rotary motion is imparted to said wheel and cylinders, a casing inclosing said wheel and cylinders, a circumferential groove formed within said casing, means connected to said wheel whereby a lubricant entering said casing will be carried to and distributed therein to the mechanism inclosed thereby by the centrifugal motion of said wheel, and a slush-box to receive the surplus lubricant and water arranged in connection with said casing, a reservoir connected to said slush-box, said reservoir being provided with an overflow or means for separating the water from the oil, and means for returning the lubricant collected therein to the casing.

11. In a steam-engine, rotatable cylinders provided with reciprocating pistons, a rotatable wheel the axis of which is out of line but parallel with that of said cylinders, a stationary valve provided with a movable gov-

ernor-controlled cut-off member adapted to receive and exhaust steam therethrough, and, a disk or piston connected with said valve carrying an exhaust-tube whereby compensating movement is permitted and a steam-balance is formed.

12. In a steam-engine, a valve having a movable governor-controlled cut-off member, cylinders rotating thereabout with ports leading therethrough adapted to successively receive and exhaust steam, a disk member or pitman loosely connected to said valve having an endwise movement, a steam-exhaust tube connected to said disk, a steam-inlet pipe surrounding said exhaust-tube, a non-conducting covering placed about said steam-inlet tube, and means for centrally locating said tube within said hollow shaft, whereby an air-passage is formed to keep said shaft cool.

13. In a steam-engine having a plurality of revoluble cylinders, a valve having a movable governor-controlled cut-off sector-valve operating within a recess formed within the same, a series of radially-arranged openings through the valve, said sector-valve operating to close said openings, whereby steam direct from the boiler may be cut off or supplied to said valve in radial series to the cylinders.

14. In a steam-engine having a plurality of revoluble cylinders, a valve having a movable governor-controlled sector-valve operating within a recess formed therein, means arranged to admit steam about said sector to balance the same and a series of radially-arranged openings through the valve, whereby steam direct from the boiler may be supplied to said valve and cylinders in radial series.

15. In a steam-engine, rotatable cylinders provided with reciprocating pistons adapted to receive and exhaust steam at one end thereof, a rotatable wheel the axis of which is out of line but parallel with that of said cylinders, and members yieldingly connecting said pistons and cylinders with the wheel, a valve provided with a sector operating therein and means whereby said valve and sector may be shifted and set to admit steam to the cylinders in opposite relation to reverse the rotatable motion of the engine.

16. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating with a valve-cavity located at the axis of said member, a stationary valve located in said cavity adapted to permit steam to enter into and exhaust from said cylinders, a governor-controlled cut-off-valve member operating in said valve, reciprocating pistons in said cylinders, a revoluble wheel the axis of which is parallel but out of line with that of said cylinder member, members yieldingly connecting said cylinders or member with said wheel, members yieldingly connected with said pistons and engaging with said wheel the points of contact with

the wheel being at all times in direct line with the cylinders and the revoluble axis thereof irrespective of position, a casing inclosing said wheel and the cylinders and attending parts the periphery of which is provided with a groove, and members carried by said wheel whereby a lubricant placed therein will by the centrifugal motion of said wheel carry said lubricant about said casing and cause its distribution to the working parts inclosed by said casing.

17. In a steam-engine, a revoluble member carrying a plurality of radially-disposed cylinders each communicating with a valve-cavity located at the axis of said member, a stationary valve located in said cavity adapted to permit steam to enter into and exhaust from said cylinders, a governor-controlled cut-off-valve member operating in said valve, reciprocating pistons in said cylinders, a revoluble wheel the axis of which is parallel but out of line with that of said cylinder member, members yieldingly connecting said cylinders or members with said wheel, members yieldingly connected with said pistons and engaging with said wheel the points of contact with the wheel being at all times in direct line with the cylinders and the revoluble axis thereof irrespective of position, a casing inclosing said wheel and the cylinders and attending parts the periphery of which is provided with a groove, members carried by said wheel whereby a lubricant placed therein will by the centrifugal motion of said wheel carry said lubricant about said casing and cause its distribution to the working parts inclosed by said casing, a receptacle communicating with said casing to receive the surplus oil therefrom delivered therein by the said centrifugal motion of said wheel, and means communicating with said receptacle and casing to receive said surplus lubricant and resultant water from steam condensation and returning said lubricant to said casing.

18. In a steam-engine, a revoluble wheel, a member carrying a plurality of radially-disposed cylinders revoluble upon a hollow shaft whose center is out of line but parallel with that of said wheel which member is provided at its axis with a cavity communicating with said cylinders, a steam-supply tube extending through said shaft and communicating with said cavity, an exhaust-tube extending through said supply-tube, a valve arranged on said exhaust-tube and extending into said cavity, a governor-controlled cut-off-valve member operating in said valve, reciprocating pistons in said cylinders, members yieldingly connected with said pistons and engaging with said wheel the points of contact with the wheel being at all times in direct line with the cylinders and revoluble axis thereof irrespective of position, a casing inclosing said wheel the cylinders and attending parts the periphery of which is provided

with a groove, and members carried by said wheel whereby a lubricant placed therein will by the centrifugal motion of said wheel carry said lubricant about said casing and cause its distribution to the working parts inclosed by said casing.

19. In a steam-engine, a revoluble wheel, a member carrying a plurality of radially-disposed cylinders revoluble upon a hollow shaft whose center is out of line but parallel with that of said wheel which member is provided at its axis with a cavity communicating with said cylinders, a steam-supply tube extending through said shaft and communicating with said cylinders, a steam-supply tube extending through said shaft and communicating with said cavity, an exhaust-tube extending through said supply-tube, a valve arranged on said exhaust-tube and extending into said cavity, a governor-controlled cut-off-valve member operating in said valve, reciprocating pistons in said cylinders, members yieldingly connected with said pistons and engaging with said wheel the points of contact with the wheel being at all times in direct line with the cylinders and revoluble axis thereof irrespective of position, a casing inclosing said wheel the cylinders and attending parts the periphery of which is provided with a groove, members carried by said wheel whereby a lubricant placed therein will by the centrifugal motion of said wheel carry said lubricant about said casing and cause its distribution to the working parts inclosed by said casing, a receptacle communicating with said casing to receive the surplus oil therefrom delivered therein by the centrifugal motion of said wheel, and means communicating with said receptacle and casing to receive said surplus lubricant and resultant water from steam condensation and returning said lubricant to said casing.

20. In a rotary engine of the class set forth provided with a revoluble member such as a wheel and inclosed within a casing, a peripheral groove in said casing, means carried by said revoluble member to carry the lubricant

about said casing-groove, and conductors communicating with said groove and interior of the casing to convey the lubricant to the working parts inclosed by said casing.

21. In a rotary engine of the class set forth provided with a revoluble member such as a wheel and inclosed within a casing, a peripheral groove in said casing, means carried by said revoluble member to carry the lubricant about said casing-groove to permit distribution thereof to the working parts inclosed by said casing, a receptacle communicating with said casing to receive the surplus oil therefrom delivered therein by the centrifugal motion of said wheel, and means communicating with said receptacle and casing to receive said surplus lubricant and resultant water from steam condensation and returning said lubricant to said casing.

22. In an engine of the class set forth, the combination with the pitman-rods and wheel, of rockers on the outer ends of the said pitmen, and contacting members therefor carried by said wheel, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

23. In an engine of the class set forth, the combination with the pitman-rods and wheel, of rockers on the outer ends of the said pitmen, contacting members therefor carried by said wheel, means to maintain operative contact between said pitman-rockers and wheel members, semicircular bearings carried by said wheel, and laterally-disposed members carried by said pitman-rods and engaging said bearings, adapted to maintain the said rods in operative engagement with said wheel.

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

FREDERICK W. REEVES.

Witnesses:

CLARA S. JONES,
WILLIAM JONES, Jr.