(No Model.) 2 Sheets—Sheet 1.

R. CREUZBAUR.

STEAM ENGINE.

No. 332,499. Patented Dec. 15, 1885.

Fig. 1.

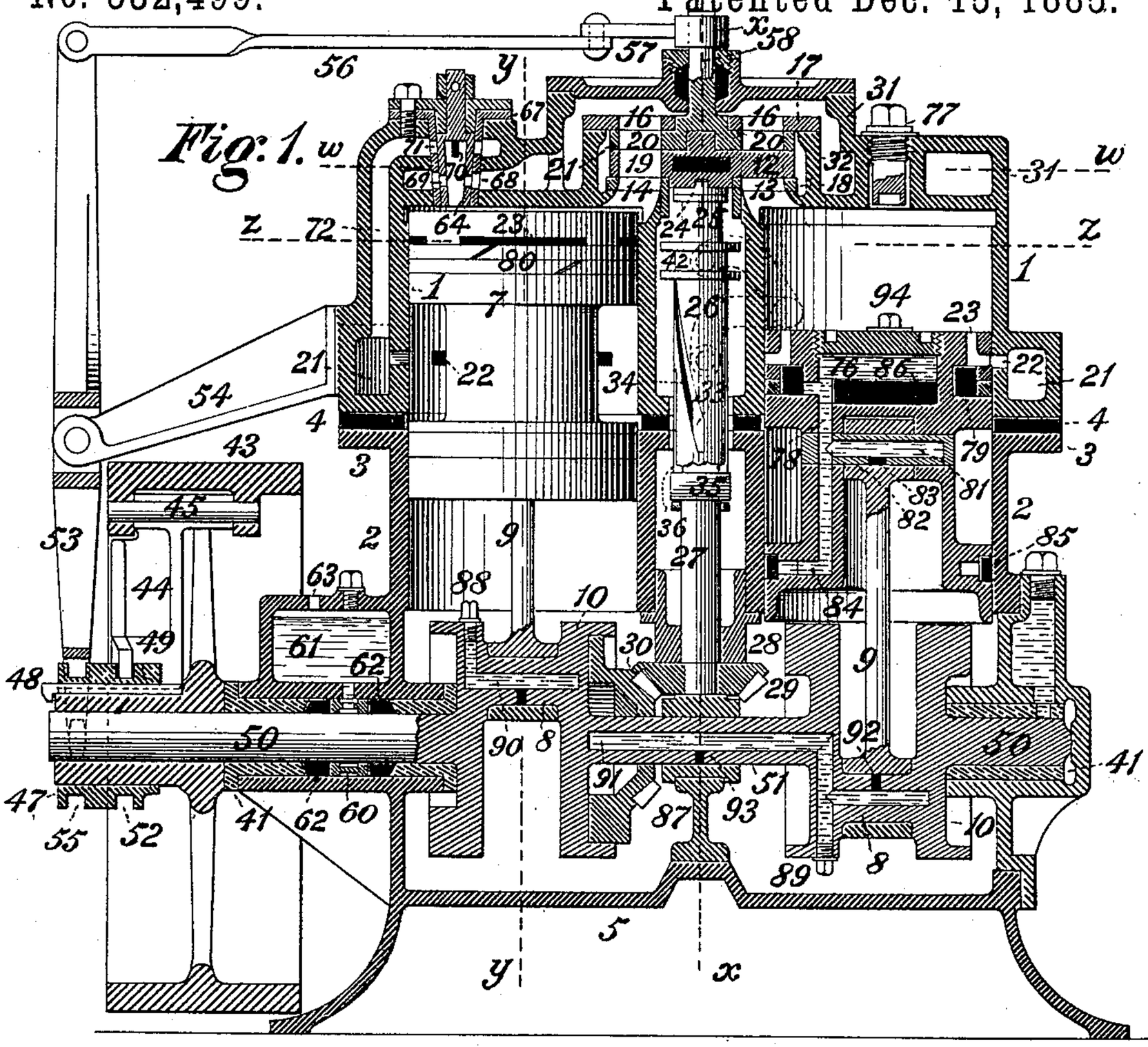
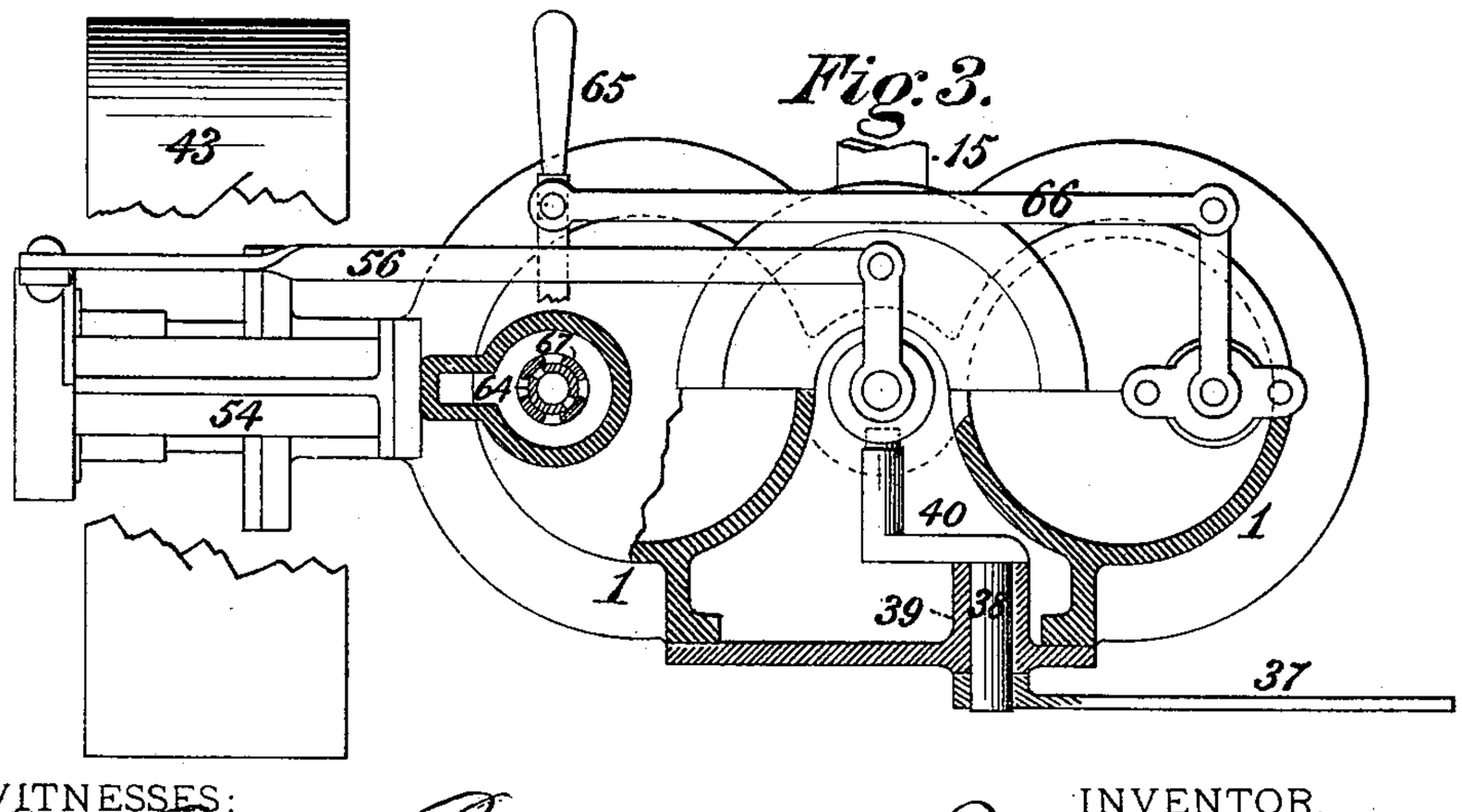


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

R. CREUZBAUR.

STEAM ENGINE.

No. 332,499. Patented Dec. 15, 1885.

Fig: 2.

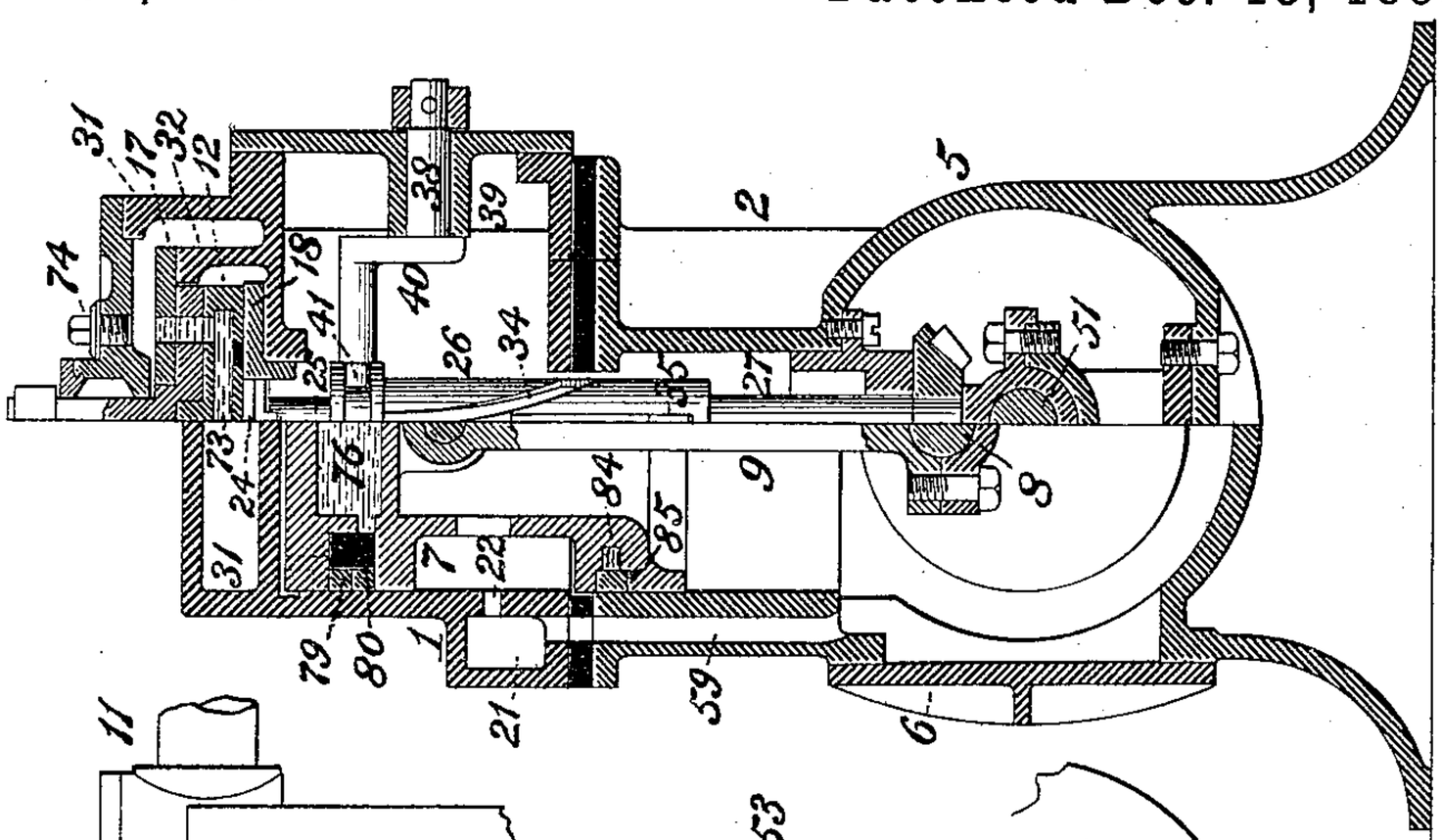


Fig: 5.

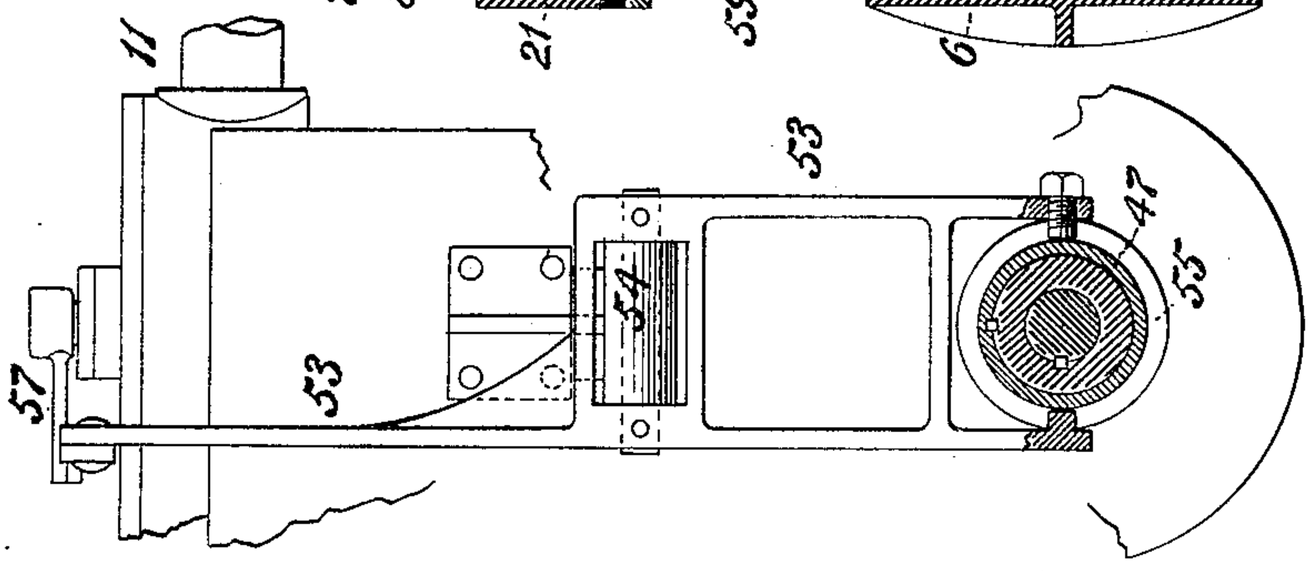


Fig: 4.

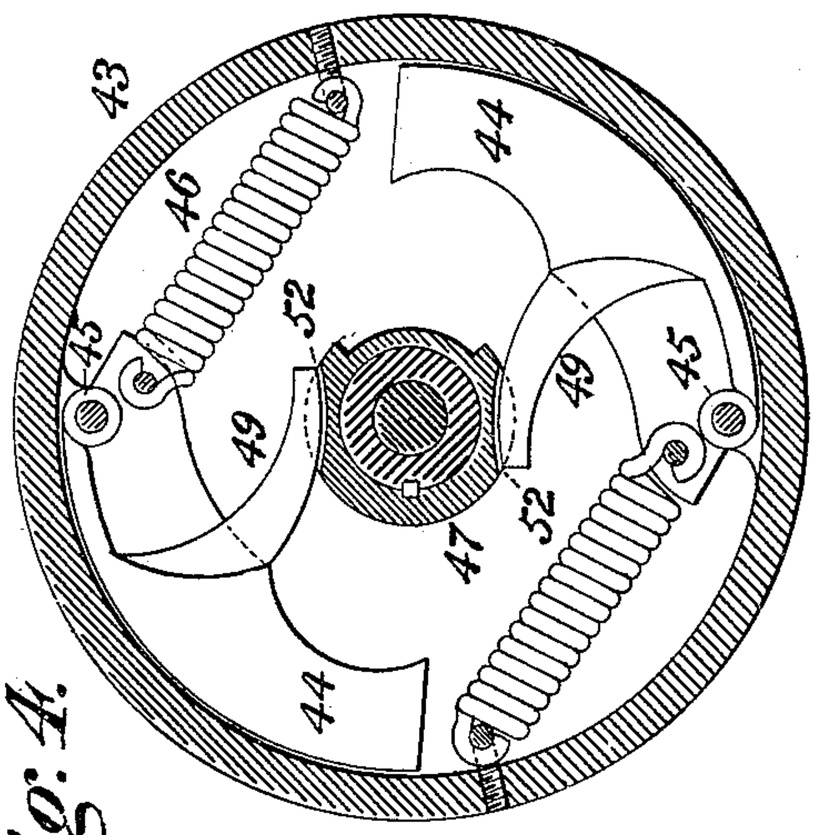


Fig: 7.

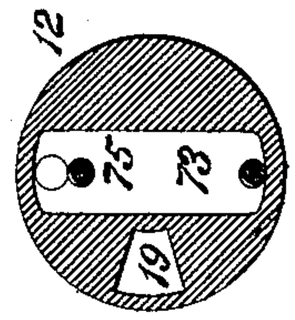
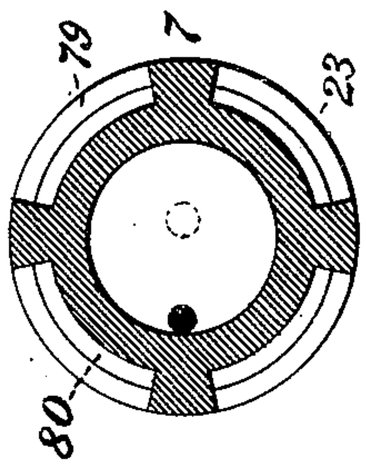


Fig: 6.



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STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 332,499, dated December 15, 1885.

Application filed August 31, 1885. Serial No. 175,717. (No model.)

To all whom it may concern:

Be it known that I, ROBERT CREUZBAUR, residing at Brooklyn, in the county of Kings and State of New York, a citizen of the United States, have invented or discovered certain new and useful Improvements in Steam-Engines, of which improvements the following is a specification.

In the accompanying drawings, which make part of this specification, Figure 1 is a vertical longitudinal central section through a steam-engine embodying my invention; Fig. 2, a vertical transverse section, the right-hand half being taken at the line *x x* of Fig. 1, and the left-hand half at the line *y y* of same figure; Fig. 3, a plan view, partly in section; Fig. 4, a face view of the governor; Fig. 5, a partial end view, as seen from the left; Fig. 6, a section through one of the pistons at the line *z z* of Fig. 1, and Fig. 7 a horizontal section through the main valve at the line *w w* of Fig. 1.

My invention relates to steam-engines of the single-acting type, having two or more cylinders located side and side—that is, in parallel planes at right angles to a common crank-shaft; and its objects are, to provide novel and improved means for (*a*) facilitating the action and enhancing the economy of the engine by carrying off the exhaust-steam through the sides of the cylinders at the termination of the working-stroke; (*b*) automatically controlling the cut-off valve by a governor; (*c*) preserving the constant direction of strain when used as a condensing-engine by connecting the crank-case with the exhaust-passage or condenser, and (*d*) reversing and starting the engine by simple mechanism.

The improvements claimed are hereinafter fully set forth.

In the practice of my invention I provide two or more single-acting cylinders, each preferably composed of an upper higher-temperature section, 1, and a lower lower-temperature section, 2, which sections are bored out to substantially equal diameters, and are firmly secured together by bolts passing through flanges 3, between which is interposed a heat-intercepting packing, 4, of any suitable material which is substantially a non-conductor of heat. The cylinders are located side and side—that is to say, with their axes in parallel planes—and are secured to the top of a closed crank case or chamber, 5, having end bearings, 41, for the journals 50 of a crank-shaft, 51, which is mounted in said bearings at right angles to the axes of the cylinders. Access to the interior of the crank-case is permitted by a removable head or bonnet, 6, closing an opening in one of its sides, and suitable lateral and end flanges are formed upon the lower side of the case, through which it may be secured upon the foundation on which the engine rests when in operation. Each cylinder is open at its lower end, and is fitted with a long piston, 7, of the trunk class, and said pistons are coupled by connecting-rods 9 9 with crank-pins 8 8, which are set opposite one to the other, or at one hundred and eighty degrees apart, upon a pair of double cranks, 10 10, formed upon the crank-shaft 51. Steam from the boiler is supplied through a steam-pipe, 11, to a steam-jacket, 31, which covers the heads of the upper sections, 1, of the cylinders, and incloses a valve case or chest, 32, located above and centrally between the cylinders. The steam from the jacket enters the valve-case through supply-ports 16 in a pressure-relieving plate, 17, which is fixed to and closes the top of the valve-case, said ports corresponding in position and dimensions with cylinder-ports 13 14, formed in the valve-seat 18, and leading therefrom into the upper ends of the cylinders.

The admission of steam to and its exhaust from the cylinders is effected by a disk or block main or distribution valve, 12, adapted to be rotated, as presently to be described, upon the valve-seat 18, and fitting between the same and an adjustable cut-off plate, 21, said cut-off plate fitting between the top of the valve and the pressure-relieving plate 17, and having cut-off ports 20, communicating with the supply-ports 16 thereof. In the rotation of the valve 12, steam passing through the ports 16 and 20 is supplied alternately to the cylinder-ports 13 and 14 through a steam-port, 19, in the valve, and is exhausted from the cylinders through exhaust-channels 21, which surround the major portion of the upper sections,

1, of the cylinders, and communicate with a series of cylinder-exhaust ports, 22, formed in the shells of the cylinders in such position as to be open to a series of exhaust-ports, 23, in the pistons 7 for the full width of said ports 23 when the pistons reach the lower terminals of their strokes. The exhaust-steam passes from the channels 21 through an exhaust-pipe, 15, connected thereto to the atmosphere or to a condenser. The main valve 12 is connected by a coupling, 24, to an upper valve-spindle section, 25, which is connected through a sleeve, 26, with a lower spindle-section, 27, journaled in a bearing, 28, in the crank-case 5, and having secured upon its lower end a miter-gear, 29, which engages a corresponding gear, 30, fixed upon the crank-shaft 51. To admit of the reversal of the engine, the sleeve 26 is fitted with the capacity of end movement upon the valve-spindle section 25, which rotates in unison with the main valve 12, and said section is coupled to the sleeve 26 by a key, 33, fixed in the section 25, and having its ends fitting in opposite helical grooves 34 in the sleeve 26, which sleeve is in turn connected with the lower spindle-section, 27, by a key, 35, fixed in the section 27, and having its ends fitting in opposite straight longitudinal grooves 36 in the sleeve 26. By moving the sleeve 26 downwardly from the position shown the ends of the key 33, following the helical grooves 34, effect the rotation of the upper spindle-section, 25, and the connected main valve 12 into position for reversing the direction of rotation of the crank-shaft, a reverse operation being effected by the upward movement of the sleeve into the position shown. The sleeve is moved by means of a reversing-lever, 37, fixed upon a shaft, 38, journaled in a bearing, 39, and carrying a crank, 40, on the horizontal arm of which is formed a pin, 41, which engages a circumferential groove, 42, on the upper end of the sleeve 26. The crank and its attachments may be duplicated on the opposite side of the engine. It will be evident that both sets of grooves in the sleeve may be made helical, with one-half the pitch required when one set is straight, the latter construction, however, being of less cost; and it will be further obvious that, if desired, in lieu of using keys, as shown, lugs may project from the inside of the sleeve into grooves in the spindle-sections. The degree of expansion is varied by the adjustment of the cut-off plate 21, steam being cut off at a less or greater fraction of the stroke, respectively, accordingly as the cut-off plate is turned in direction opposite to or in correspondence with the direction of rotation of the main valve 12. Automatic regulation is effected by a governor carried by the main driving-pulley 43 of the crank-shaft, and coupled, as presently to be described, with the cut-off plate. The governor is composed of a pair of weights, 44, pivoted by pins 45 to the pulley 43, the centrifugal action of said weights being opposed by springs 46, by which they are coupled between their pivots and their free ends to their supporting-pulley. The inward and outward movements of the weights, under variations of centrifugal force induced by variations of pressure or resistance, or both, impart longitudinal movement in one or the other direction, respectively, to a sleeve, 47, which is fitted to move endwise on a key, 48, fixed in the hub of the pulley 43, such movement being effected by the engagement of helical arms 49, projecting inwardly from the weights 44, with corresponding grooves, 52, in the sleeve 47. The motion of the sleeve 47 is transmitted to the cut-off plate through a double-armed lever, 53, journaled to a bracket, 54, fixed to one of the cylinders, said lever engaging, by its forked lower end, a circumferential groove, 55, in the sleeve 47, and being coupled at its upper end to a bar, 56, the opposite end of which is in turn coupled to an arm, 57, fixed upon the stem 58 of the cut-off plate. Upon the completion of the working-stroke of the pistons, as illustrated on the right of Fig. 1, steam is exhausted through the exhaust-ports 23 of the pistons, cylinder-exhaust ports 22, exhaust-channels 21, and exhaust-pipe 15. In order to main a pressure below the pistons as low as or lower than that of the exhaust-steam above them, communication is established between the crank-case and the exhaust-channels 21 by a passage, 59, as shown in Fig. 2, and such maintenance of low pressure in the crank-case is furthered by the employment of a leak-proof packing around the crank-shaft 51. An annular lantern-gland, 60, perforated to admit lubricating packing-fluid from a chamber, 61, partially surrounding the crank-shaft, is located between two bodies of packing 62, atmospheric pressure being admitted to the chamber 61 by an opening, 63, therein. The air which tends to enter the crank-case along the crank-shaft is obstructed by the packing-fluid surrounding the crank-shaft under atmospheric pressure. Porous packing may be employed in lieu of the lantern-gland 60, if desired.

To facilitate the starting of the engine, each cylinder may be provided with a starting-valve, 64, the two valves being simultaneously controlled by a hand-lever, 65, fixed to the stem of one valve and coupled by a connecting-rod, 66, to the stem of the other. The starting-valves are fitted in casings 67, which communicate with the jacket 31 by opposite steam-ports 68, the valves being provided with corresponding ports, 69. The engine may be started by said valves, the exhaust taking place through the cylinder-exhaust ports 22, before specified. The valves may further be provided with special exhaust-ports 70, which are adapted to be brought into communication with exhaust-ports 71 in the valve-casings, leading into channels 72, communicating with the main exhaust-channels 21. The relative positions of the ports in the two valves and their casings are such that when the steam-ports in one valve deliver steam to its cylinder the exhaust-ports of the other valve are open to

the main exhaust-channel, and vice versa, there being a dead-space between the steam and exhaust ports, which permits both valves to be cut off from the cylinders, as indicated in Fig. 3.

I am aware that the employment of valves for affording direct admission of steam to the low-pressure cylinders of compound engines is not new, and do not therefore herein claim a direct-steam-admission valve, either broadly or in the combination with other members in a specific construction which is set forth in another application filed by me July 13, 1885, Serial No. 171,413.

In instances where it may be desirable to prevent as far as practicable the admixture of the steam with water-vitiating lubricants, as in condensing marine engines, such object is attained as follows: A lubricating-chamber, 73, is formed in the body of the main valve 12, to which access may be had for the insertion of lubricant by the removal of a screw-plug, 74, closing an opening in the cap of the jacket surrounding the valve-chamber. The lubricant percolates from the chamber 73 through one or more porous plugs, 75, Fig. 7, to the valve-seat. The oscillations of the steam into and out of the chamber 73 will lubricate the top of the valve in contact with the cut-off plate, and the lubricant escaping upon the sleeve 26 will enter between said sleeve and the spindle-sections 25 27, and thereby effect the lubrication of said members. The pistons 7 are provided with lubricating-chambers 76, to which access is afforded by screw-plugs 77 and 94, and from which the lubricant passes through channels 78 to porous packing 79, which backs the packing-rings 80. The lubricant is also conducted through channels 78 to the interior 81 of the wrist-pins 82 of the connecting-rods, from which it percolates through porous plugs 83 to the surfaces to be lubricated, and likewise passes through prolongations of the channels 78 to annular chambers 84 in the lower ends of the pistons, whence it percolates through porous packing 85, to lubricate the lower sections of the cylinders. A disk of heat-intercepting packing, 86, is inserted in each piston below its lubricating-chamber 76, to prevent the passage of heat through the piston. The crank-pins 8 and central shaft-bearing, 87, are similarly lubricated, the lubricant being introduced through openings closed by plugs 88 89 into central chambers, 90 91, in the crank-pins and shaft, and passing therefrom to the frictional surfaces through porous plugs 92 93.

The means above described for affording lubrication to the cylinders, pistons, distribution-valve, and crank-pins and shaft-bearing, being desirably applicable to an engine embodying my improvements, are illustrated in connection therewith, but are not herein claimed, as the same will constitute the subject-matter of a separate application or applications to be filed by me in due time.

I claim herein as my invention—

1. The combination of two or more single-acting cylinders located side and side at right angles to a common crank-shaft, pistons fitting said cylinders and coupled to crank-pins on said shaft, a steam-distribution valve governing the supply of steam to said cylinders and having no exhaust-port, and exhaust-ports formed in the pistons and adapted to communicate with exhaust-ports in the shells of the cylinders, leading into channels or passages on the exterior thereof, substantially as set forth.

2. The combination of two or more single-acting cylinders located side and side at right angles to a common crank-shaft which rotates in a closed crank case or chamber, pistons fitting said cylinders and coupled to crank-pins on said shaft, a distribution-valve governing the supply of steam to said cylinders, an exhaust-passage serving to convey steam exhausted from the cylinders through the sides thereof to a condenser, and an unobstructed channel connecting the crank-case and exhaust-passage, substantially as set forth.

3. The combination of two or more single-acting cylinders located side and side at right angles to a common crank-shaft, pistons fitting said cylinders and coupled to crank-pins on said shaft, a distribution-valve rotated by gearing from the crank-shaft and governing the supply of steam to the cylinders, and a reversing mechanism consisting of two spindle-sections, one coupled to the valve and the other geared to the crank-shaft, a sleeve having end motion and inclosing said spindle-sections at their adjacent ends, keys or lugs engaging the spindle-sections and diverging grooves in the sleeve, and a hand-lever and crank-arm for imparting end movement to the sleeve, substantially as set forth.

4. The combination of two or more single-acting cylinders located side and side at right angles to a common crank-shaft, pistons fitting said cylinders and coupled to crank-pins on said shaft, a distribution-valve governing the supply of steam to said cylinders, and inlet-valves operated by a hand-lever and governing-ports leading from a steam-jacket into the cylinders, substantially as set forth.

5. The combination of two or more single-acting cylinders located side and side at right angles to a common crank-shaft, pistons fitting said cylinders and coupled to crank-pins on said shaft, a distribution-valve governing the supply of steam to said cylinders, and a hand-operated inlet-valve for each cylinder, said valves governing alternately passages leading from a steam-jacket to the cylinders and from the cylinders to the exhaust-pipe, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ROBERT CREUZBAUR.

Witnesses:
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W. L. MCCULLAGH.