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J. BARTON.

STEAM ENGINE.

No. 571,034. Patented Nov. 10, 1896.

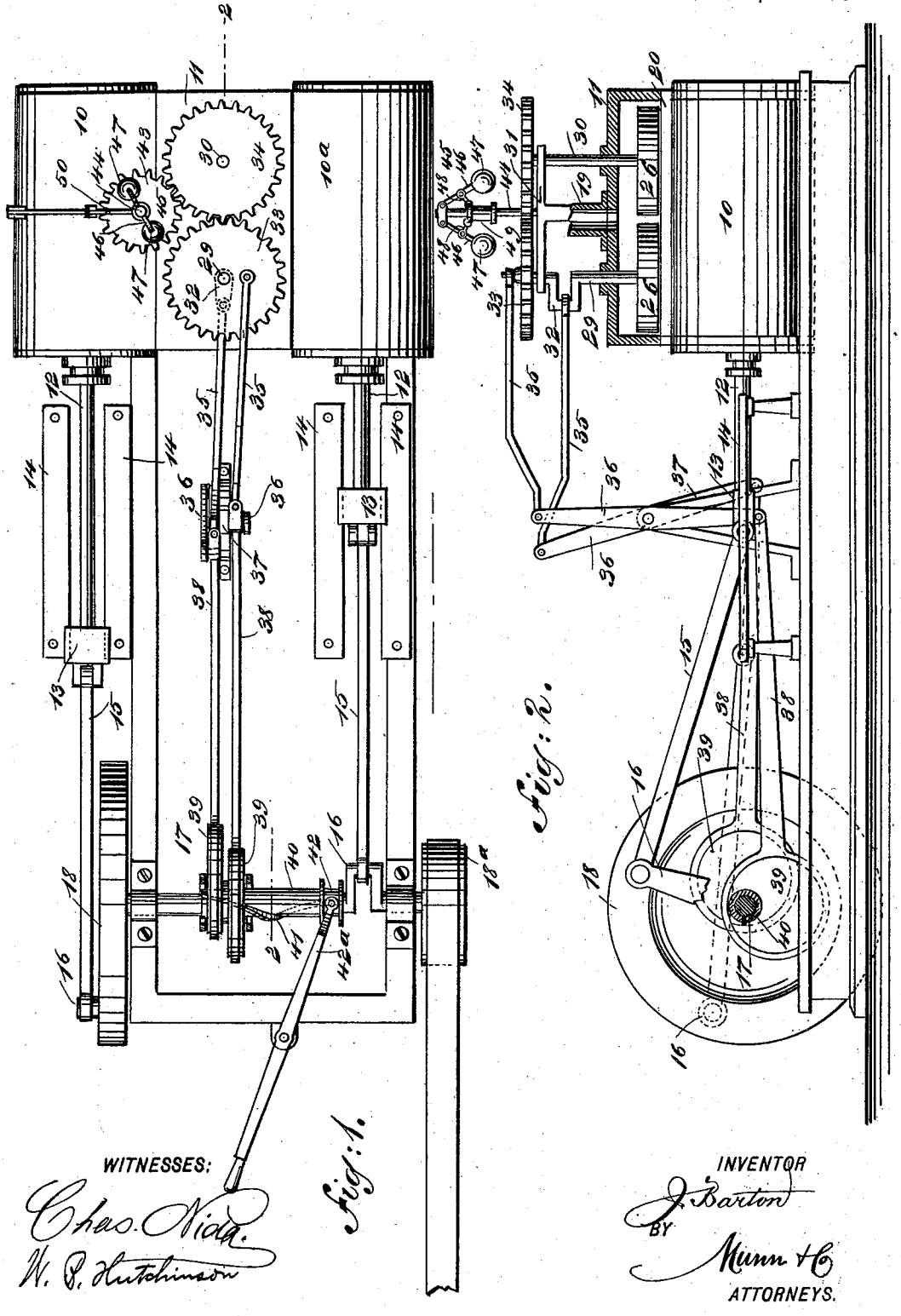

Fig. 1.

Fig. 2.

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Fig. 3.

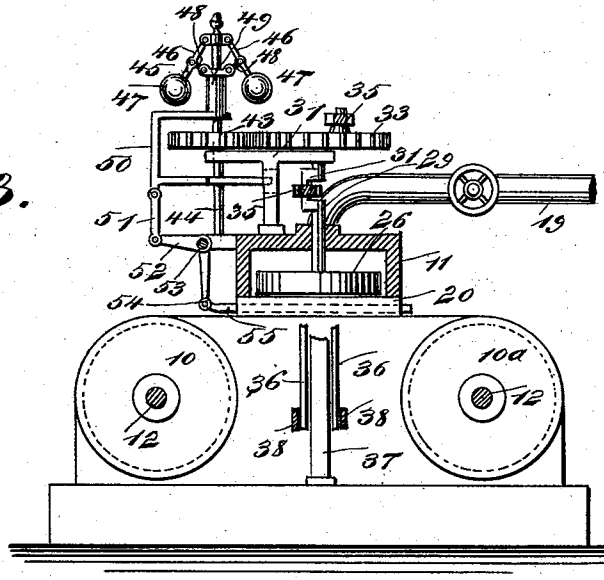

Fig. 4.

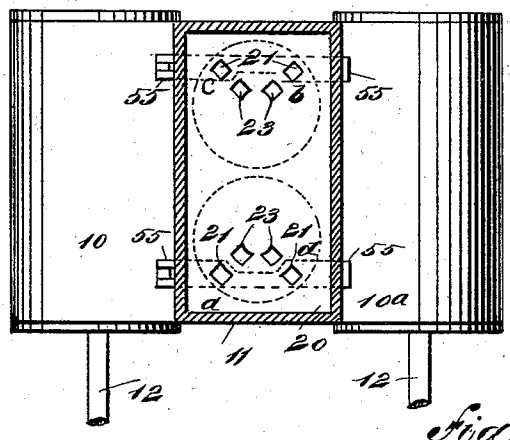

Fig. 5.

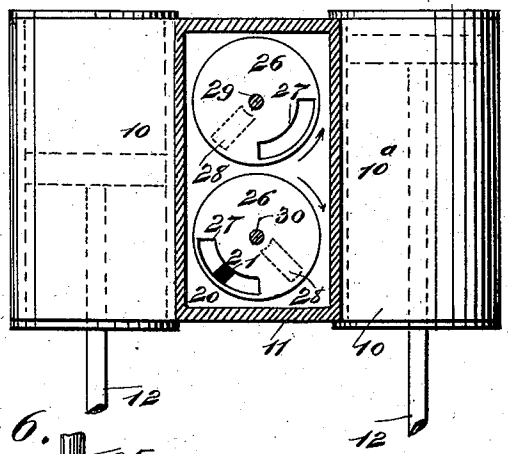

Fig. 6.

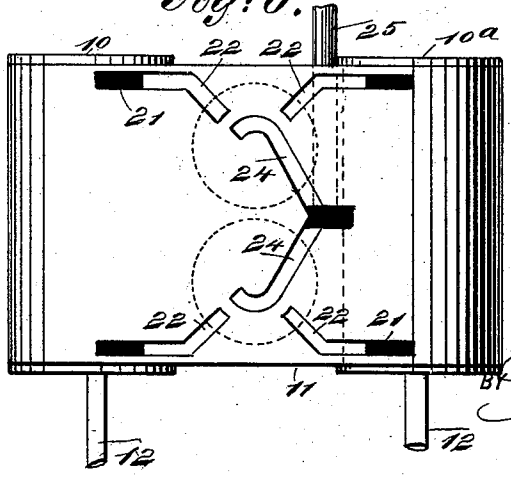

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Fig: 7.

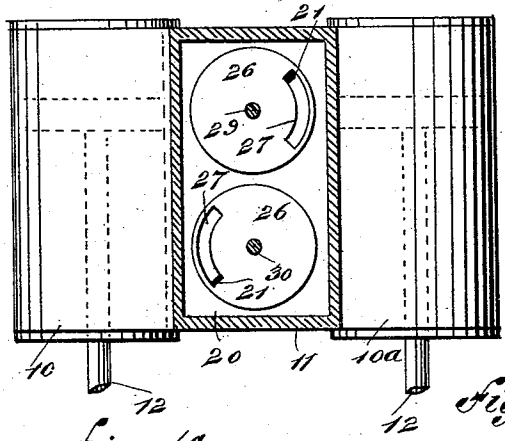

Fig: 8.

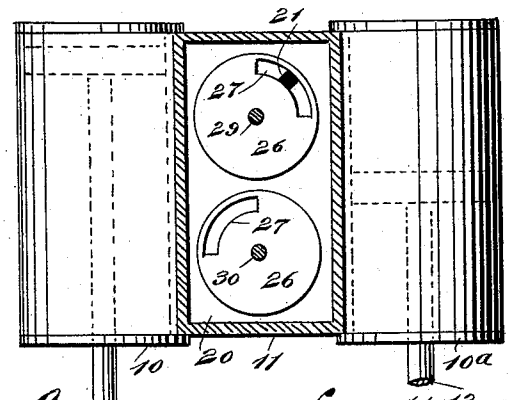

Fig: 9

Fig: 11

Fig: 10.

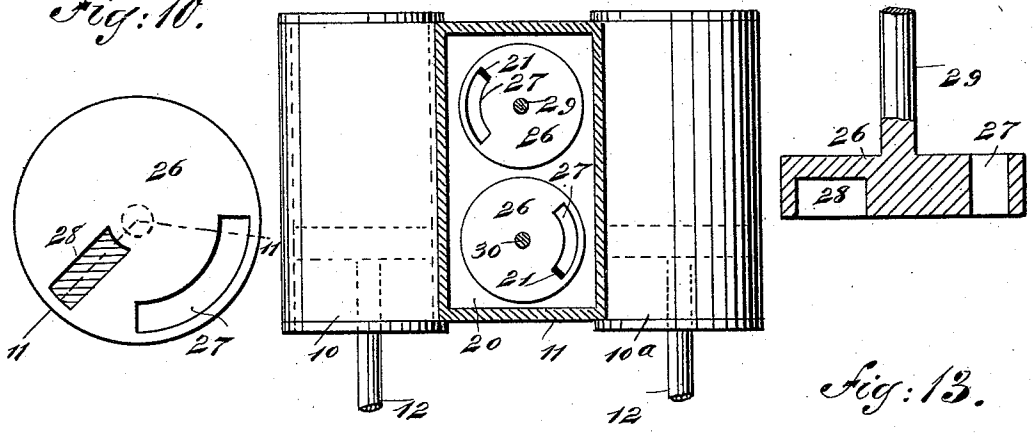

Fig: 13.

Fig: 12.

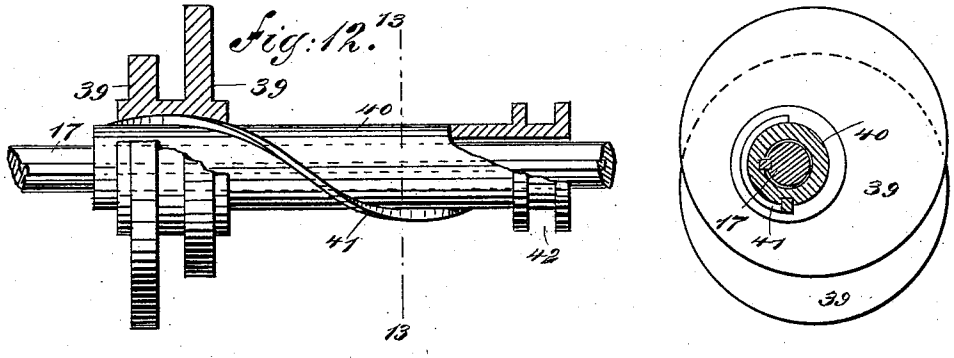

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Fig: 14.

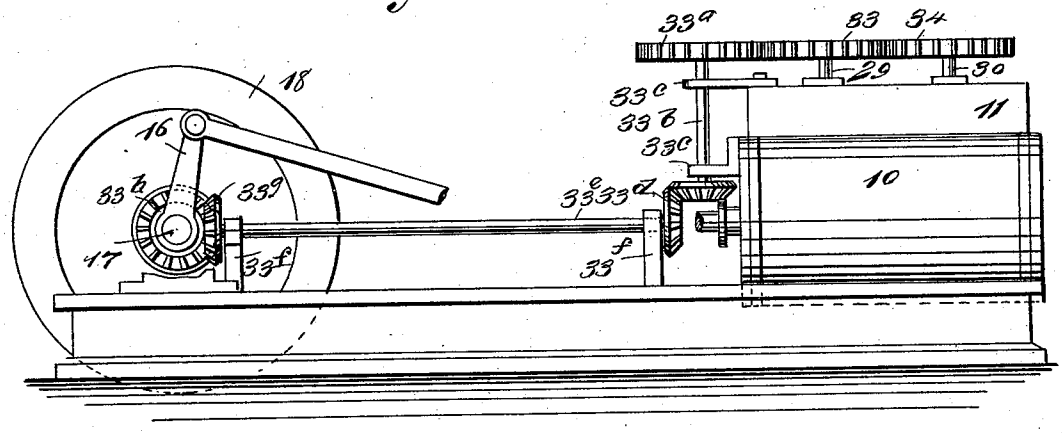


Fig: 15.

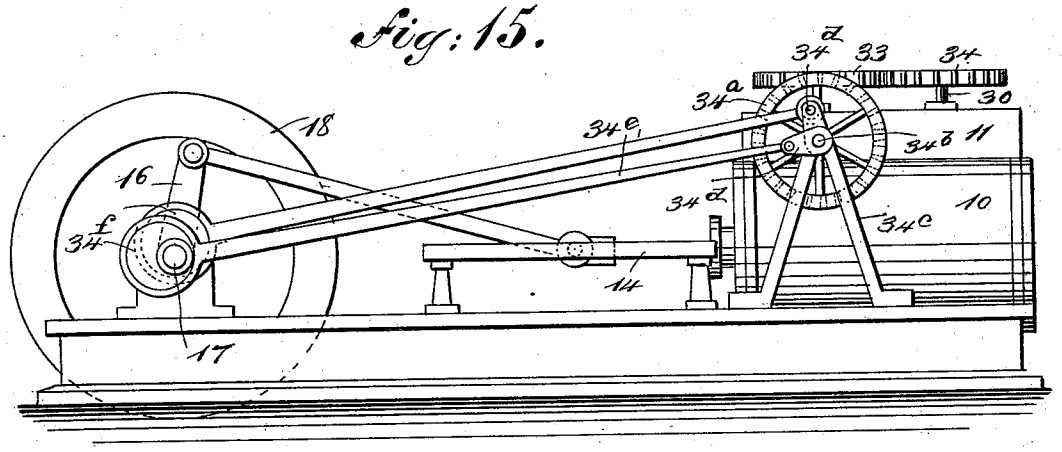


Fig: 16.

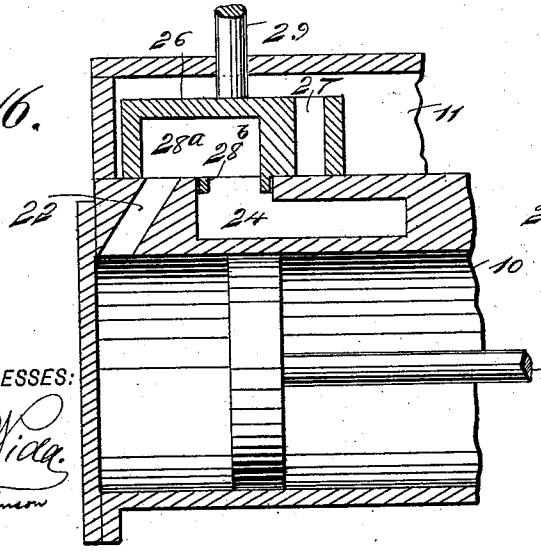
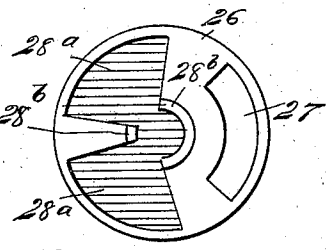


Fig: 17.



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UNITED STATES PATENT OFFICE.

JAMES BARTON, OF CLEARWATER, MONTANA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO HIMSELF AND HIRAM S. BLANCHARD, OF SAME PLACE, AND SIMON J. MORRISS, OF ATLANTA, TEXAS.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 571,034, dated November 10, 1896.

Application filed March 31, 1894. Serial No. 505,834. (No model.)

To all whom it may concern:

Be it known that I, JAMES BARTON, of Clearwater, in the county of Deer Lodge and State of Montana, have invented a new and Improved Steam-Engine, of which the following is a full, clear, and exact description.

My invention relates to improvements in that class of steam-engines known as "duplex" engines, in which two cylinders are arranged side by side and have their piston-rods connected to a common crank-shaft.

The object of my invention is to produce a durable, simple, and comparatively inexpensive engine of this class which is constructed in such a manner that it has no dead-center, which has rotary valves arranged to cut off and cut in the steam in such a manner that a volume of one full port will always be exerted on a piston, which has the valves and cranks arranged in such a way that the full power of the steam will be applied when the crank is on the quarter and there is the greatest leverage in favor of the engine, which has the said parts arranged in such a manner that there is no steam-pressure exerted and energy lost when a crank is on the center, which has the exhaust ports and valves arranged in such a manner that the steam is exhausted when it is exerting no power on the piston, which has a governor connected to steam-controlling valves in such a way that the steam supply is very nicely and automatically regulated and is entirely shut off in case anything breaks, thus stopping the engine, which is provided with a very simple mechanism for reversing the engine, and, in general, to produce an engine of the class named which shall operate effectively with the least possible consumption of steam.

To these ends my invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of the engine embodying my invention. Fig. 2 is a longitudinal section on the line 2 2 of Fig. 1. Fig. 3 is an end view of the engine with parts in section. Fig. 4 is a detail sectional plan showing the arrangement of the steam and exhaust ports in the bed-plate of the steam-chest. Fig. 5 is a detail sectional plan illustrating the first position of the rotary valves in the steam-chest. Fig. 6 is a diagrammatic plan showing the arrangement of the steam and exhaust leads or channels. Fig. 7 is a detail sectional plan showing the second position of the valve, the inlet-port to one cylinder being closed, while the other is being opened. Fig. 8 is a similar view illustrating a further progressive movement of the valves. Fig. 9 is a similar view illustrating the valves in still another position, which will be described and explained later on. Fig. 10 is a detail inverted plan of one of the rotary valves used in the steam-chest. Fig. 11 is a cross-section of the valve on the line 11 11 of Fig. 10. Fig. 12 is a broken detail view of the sliding sleeve used to shift the position of the eccentrics and reverse the motion of the engine. Fig. 13 is a cross-section on the line 13 13 of Fig. 12. Fig. 14 is a broken side elevation showing a modified means of turning the steam-valves. Fig. 15 is a side elevation illustrating another modification of this mechanism. Fig. 16 is a detail sectional view of a preferred construction of one of the steam-valves and connections, showing means for a quick exhaust; and Fig. 17 is an inverted plan of the valve shown in Fig. 16.

The engine is provided with a pair of cylinders 10 and 10^a, of the usual kind, which are arranged side by side and which have a common steam-chest 11, the cylinders having the usual pistons and piston-rods 12, which rods connect with sliding cross-heads 13, moving in the usual way in slides 14 and connecting by rods 15 with the cranks 16 of the common crank-shaft 17, the cranks being placed at an angle of ninety degrees to each other, so that when one is on the center the other will always be on the quarter, where it may be effectively worked, and one crank is arranged directly on the shaft, while the other

is on the fly-wheel 18 of the shaft; but both may be attached directly to the shaft. The shaft is provided with the usual pulley 18^a, from which power may be taken; but of course it may be connected with machinery to be driven in any ordinary fashion.

The steam-chest 11 is located midway of the cylinders 10 and 10^a, and it is provided with a valve-controlled inlet-pipe 19, which supplies it with steam, and has in the bottom a base-plate 20, in which are ports 21, (see Fig. 4,) arranged in pairs near the opposite ends of the steam-chest and connected with the channels or leads 22, which deliver into the end portions of the cylinders 10 and 10^a, (see Fig. 6,) and it is also provided with ports 23, connecting with the channels 24, which lead to the exhaust-pipe 25. The plate 20 serves as a valve-seat for the rotary valves 26, which revolve above the groups of ports in each end of the steam-chest, and it will be noticed from the description to follow that these valves have a constant and steady motion in one direction, the valves moving, however, opposite to each other, and thus the loss of energy and the pounding occasioned by oscillating or sliding valves is avoided.

Each valve 26 is provided with a segmental port or opening 27, which is arranged near the circumference of the valve and which extends through just a quarter of a circle, and the valve-openings are arranged with relation to each other, as shown in Fig. 5, so that they will operate successively, as will be pointed out below. The valves 26 turn above the inlet-ports 21, and when one of the openings is above one of the ports it lets the steam pass from the steam-chest down through the valve and port to one of the cylinders.

Each valve 26 is also provided with an exhaust-port 28, which is arranged in the under side and does not extend through the valve, this port being adapted to connect one of the ports 21 with one of the exhaust-ports 23, so as to permit the connected cylinder to exhaust. It is desirable to have a quick exhaust, and hence the valve is preferably made, as shown in Figs. 16 and 17, with enlarged exhaust-ports 28^a, adapted to connect with one of the channels 22 and with the exhaust-passage 24, and with a central rib 28^b, adapted to enter the exhaust-passage and steady the valve. The valves 26 are carried by stems 29 and 30, which are arranged vertically, as shown in Figs. 2 and 3, these stems projecting upward through the steam-chest and being supported in the arms of a post 31, and the stem 29 is provided with a crank 32 (see Fig. 2) and with a gear-wheel 33, which meshes with a gear-wheel 34 on the stem 30. Power is applied to the stem 29, and as the gear-wheels are of the same size it will be seen that the two valves 27 will be rotated at the same speed, but in reverse directions.

The gear-wheel 33 is provided with a crank which corresponds to the crank 32, but extends in the opposite direction, and these two cranks are connected by rods 35 with oscillating levers 36, which are arranged in a nearly vertical position (see Fig. 2) and are fulcrumed near the center on a support 37, which is secured to the bed of the engine, and the lower ends of the levers are pivoted to the eccentric-rods 38, which connect in the usual way with eccentrics 39 on the crank-shaft 17; but these eccentrics instead of being secured directly to the shaft are mounted loosely on a sleeve 40, which is keyed to the shaft, so as to turn with it, as shown in Fig. 12, but may slide longitudinally on it. The sleeve 40 is provided with an exterior rib or key 41, which extends spirally around the sleeve and projects through the hubs of the eccentrics 39, and the sleeve is provided with a groove 42 to engage one end of the forked shifting-lever 42^a, which is fulcrumed in an adjacent support, and it will be seen that by moving the lever and sliding the sleeve the rib 41 will shift the position of the eccentrics, thus changing the position of the valves 26, which are connected therewith, as above described, so that by this means the engine may be easily and instantly reversed. The eccentrics are actuated by the turning of the shaft and sleeve, and through the medium of the lever and gear mechanism described above impart a constant rotary movement to the valves 26.

The valves may be turned in many ways, for instance, as illustrated in Figs. 14 and 15. In Fig. 14 the gear-wheel 33 meshes with a gear-wheel 33^a on a vertical shaft 33^b, which turns in bearings 33^c and has at its lower end a pinion geared to a pinion 33^d on the shaft 33^e, this shaft turning in supports 33^f and having at one end a pinion 33^g, which engages a pinion 33^h on the crank-shaft 17, and the rotation of the latter actuates the gearing described and turns the valves.

In Fig. 15 the gear-wheel 33 is geared to a vertically-rotating gear-wheel 34^a on a shaft 34^b, which is journaled in a support 34^c and has crank 34^d connecting by pitman 34^e with eccentrics 34^f in the crank-shaft 17, from which shaft the valves are turned.

The gear-wheel 34 is geared to a pinion 43, although the gear-wheel 33 may be geared thereto as well, this pinion 43 being secured to the vertical shaft 44 of the governor 45, which is substantially like the ordinary ball-governor; but it is applied to the controlling-valve in a different way, as will appear below. The shaft 44 of the governor is provided with the usual swinging arms 46, which have at their free ends the customary weight-balls 47, and the arms 46 are connected by short arms 48 with a sliding sleeve 49 on the shaft 44, this sleeve being secured to an angle-lever 50, and this is at its lower end pivotally connected by means of a link 51 with a crank 52 of the shaft 53, which is journaled on one side of the steam-chest and has arms 54 connected with the slide-valves 55, which move in the bed-plate 20, opposite the steam-inlet

ports, the valves 55 being provided with ports to register with the steam-ports, which they do under normal conditions; but if the engine goes at too great a speed the spreading of the balls actuates the levers described and pulls out the valves, so as to partially close the ports, thus reducing the steam supply and slackening the speed of the engine, while if the speed lessens the dropping of the balls has the reverse effect, so as to open the ports wider. It will be observed that the spreading of the balls lifts the sleeve 49, link 50, and crank 52, thus swinging out the arms 53 and pulling out the valves 55, while the lowering of the balls has the reverse effect.

The operation of the engine is as follows: Supposing the pistons to be in the positions shown by dotted lines in Fig. 5 and the valves 26 in the positions there shown, with the opening 27 of one valve directly above the inlet-port 21, (marked *a* in Fig. 4,) steam will be let into one end of the cylinder 10, and this of course starts the engine. As the piston moves under the impetus of the steam which has entered the cylinder the parts of the engine will be correspondingly moved and the valves turned to the position shown in Fig. 7, in which position the port 21 (marked *a*) is just closing and the port 21 (marked *b*) is just opening to admit steam to the cylinder 10^a at the end opposite that to which steam has been admitted to the cylinder 10. A continued movement of the valves opens the port 21 at *b* wide open, as shown in Fig. 8, and the still further movement of the valves causes the port 21 at *c* to open and also the port 21 at *d* to open, the latter opening while the former closes, as shown in Fig. 5, and in this way the ports are all successively opened, while when one is closing another connecting with the opposite cylinder is opening, and thus the full volume of a port is maintained and the steam effectively applied to the pistons.

The exhaust-ports 28 are arranged so as to connect the ports 21 with the ports 23 after the steam has expended its energy, and the exhaust takes place in the usual way. The valves are arranged and moved in such a way that the steam is always cut off from a cylinder when the crank is on the center and the full power of the steam is applied when the crank is at the quarter, so that when the piston is moved the power is applied with the best possible effect and economy to the crank-shaft.

Each cylinder begins to take steam when the crank-arm is about at an angle of forty-five degrees off dead-center and when the piston has traveled about one-tenth the length of the cylinder. But one cylinder is in power at a time, and it remains in power while the crank-arm is passing through an arc of about ninety degrees or one-quarter of a circle. Steam is then shut off from the first cylinder and admitted to the other cylinder, which is in power the same length of time and while the crank-arm is traveling through an arc of about ninety degrees.

Each cylinder is allowed to use steam expansively in finishing its stroke to overcome the inertia of the parts of the machinery.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with the cylinders, the steam-chest having ports leading to the cylinders, and the valves controlling the said ports, of slide-valves arranged to move beneath the controlling-valves and regulate the flow of steam through the ports, a ball-governor, and means for moving the slide-valves by the shifting of the governor-balls, substantially as described.

2. The combination, with the cylinders, the steam-chest having ports leading to the cylinders, and the revoluble valves controlling the steam-ports, of a ball-governor geared to the valves, slide-valves arranged between the controlling-valves and the steam-ports, and means for shifting the slide-valves by the swinging of the governor-balls, substantially as described.

3. The combination, with the cylinders, the steam-chest having ports leading to the cylinders, and the valves moving over the ports, of a ball-governor, slide-valves moving over the ports and beneath the controlling-valves, a vertically-movable sleeve on the governor, actuated by the swinging of the governor-balls, and the lever mechanism operatively connecting the sleeve with the slide-valves, substantially as described.

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HIRAM S. BLANCHARD.