

(No Model.)

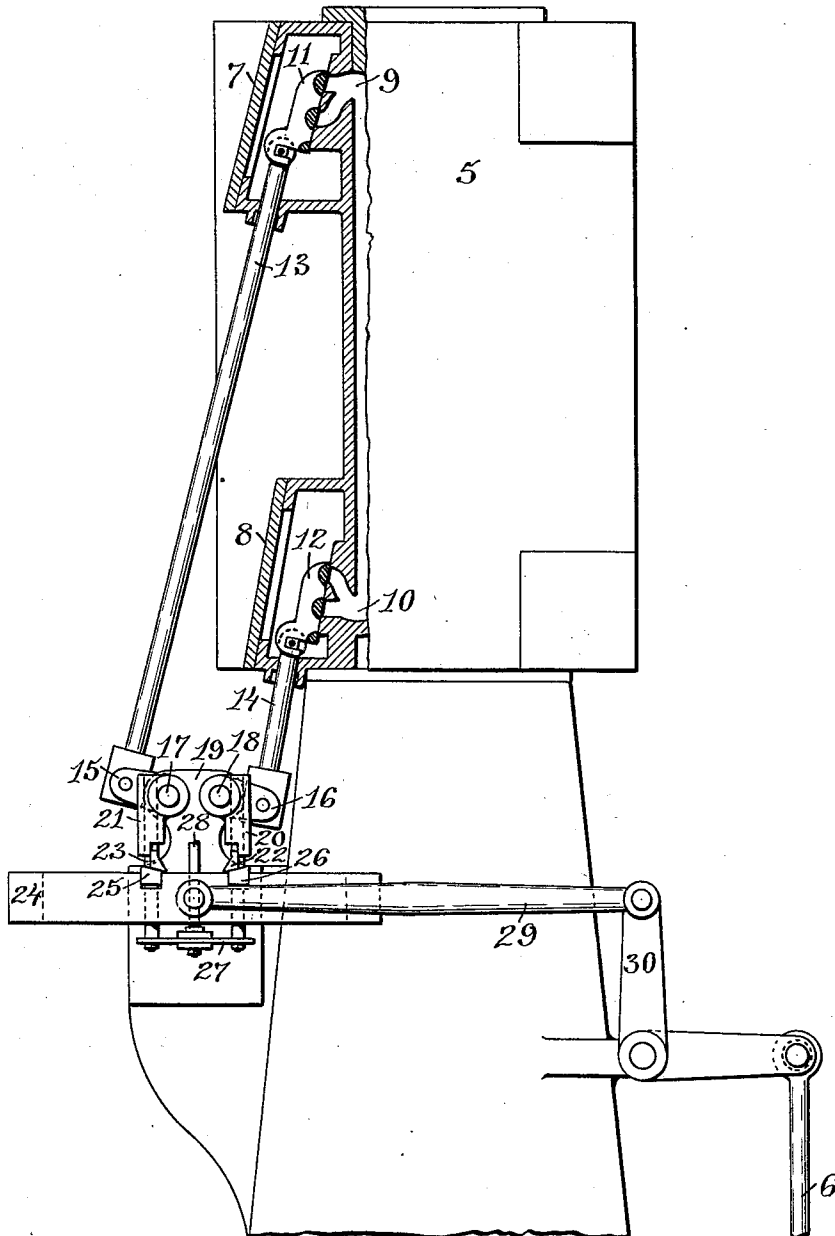
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W. B. WATERMAN.
VALVE GEAR.

No. 508,588.

Patented Nov. 14, 1893.

FIG. 1.



WITNESSES:

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Fig. 2.

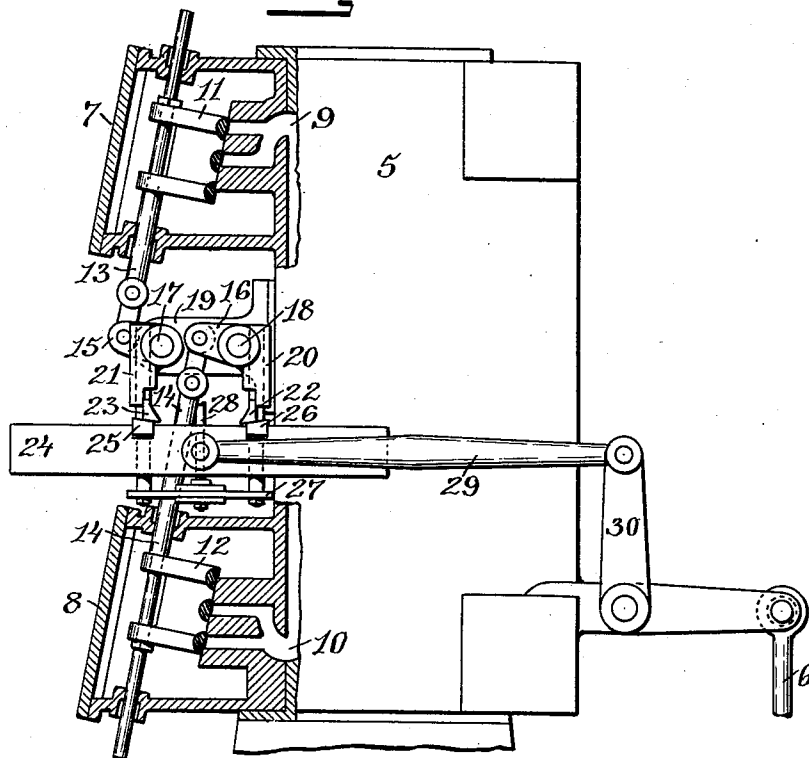
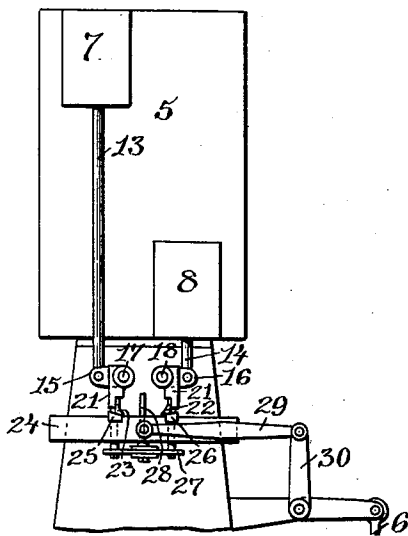


Fig. 3.



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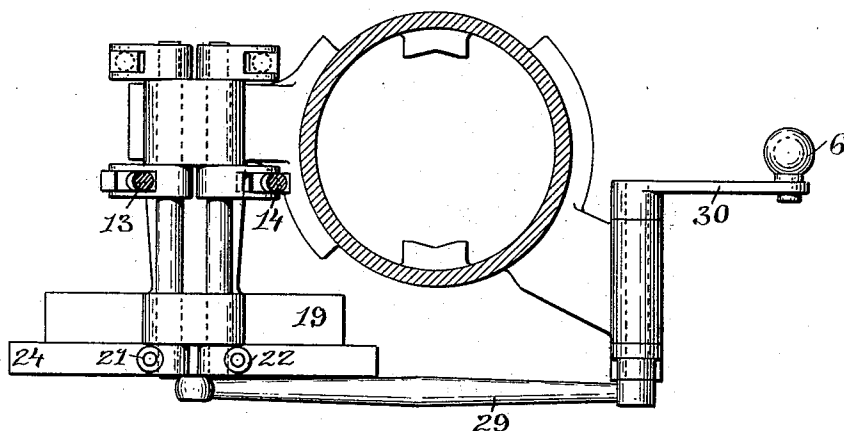
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Fig. 4.



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UNITED STATES PATENT OFFICE.

WILLIAM B. WATERMAN, OF PROVIDENCE, RHODE ISLAND.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 508,588, dated November 14, 1893.

Application filed December 29, 1892. Serial No. 456,629. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. WATERMAN, of the city of Providence, in the county of Providence and State of Rhode Island, have
5 invented certain new and useful Improvements in Valve-Gears; and I hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part
10 of this specification.

This invention has reference to improvements in valve-gear for vertical engines.

The object of this invention is to so construct a vertical steam-engine that the valve-gear controlled by a sliding tappet-bar may
15 be used to regulate the admission of steam to the upper and lower ends of the cylinder.

Another object of the invention is to provide a valve-gear for vertical-engines in
20 which oscillating gravity-toes, operated by reciprocating tappets, may be utilized to control the induction valves.

The invention consists in constructing the inlet ports and valves of a vertical steam-engine so that the valve-stems may be off-set
25 to connect each with a gravity-toe and be operated by a horizontally-sliding tappet-bar.

The invention also consists in the peculiar arrangement of the valves and valve-rods
30 and the novel combination therewith of the sockets carrying gravity-toes, together with the adjustable tappets, supported in a reciprocating bar, for operating the gravity-toes.

The invention also consists in the peculiar
35 arrangement of the connections, between the reciprocating tappet-bar and the eccentric by which the same is driven, whereby the valve-gear is adapted to a vertical engine.

Figure 1 represents a side view, partly in
40 section, of a vertical engine showing the improved valve-gear applied thereto. Fig. 2 represents a similar view showing the valve-gear located between the valves. Fig. 3 indicates a modified arrangement of the valve-gear and valve connections. Fig. 4 represents
45 a cross-sectional view, taken below the valves, to more clearly indicate the construction.

Similar numbers of reference designate corresponding parts throughout.

50 In the drawings 5 indicates the cylinder of a vertical engine. This cylinder has the usual exhaust-valves and is furnished with a

piston the rod of which is connected with the crank of a drive-shaft, and on the drive-shaft is mounted an eccentric for operating the
55 valve-gear by means of a reciprocating-rod 6. The valve-chests 7 and 8, located respectively at the upper and lower portions of the cylinder 5, are connected with the same by ports 9 and 10 and are supplied with steam in the
60 usual manner. The valve-chests are each furnished with valves, 11 and 12, for closing the ports 9 and 10 and regulating the flow of steam into the cylinder; these valves are of
65 any usual and well-known construction and are operated by valve-stems 13 and 14 which are free to reciprocate through stuffing-boxes in the ends of the valve-chests.

Pivoted to ends of the valve-stems 13 and 14, or to the connecting-links shown in Fig. 2,
70 are the crank-arms 15 and 16 which are in turn rigidly secured to the rock-shafts 17 and 18 journaled in parallel bearings in the bracket 19; this bracket may be a standard, as shown in Fig. 1, and form part of an extension from
75 the engine base, or it may extend outward from the cylinder, being located between the valve-chests, as is indicated in Fig. 2.

On the ends of the rock-shafts 17 and 18, opposite to those on which arms 15 and 16 are
80 secured, are keyed, or otherwise fixed, the sockets 20 and 21 and within these sockets are contained the reciprocating shanks of the gravity-toes 22 and 23, the lower surfaces of the toes being beveled outward at an upward
85 angle.

Supported in guides is the horizontal reciprocating tappet-bar 24 through vertical perforations in which extend the shanks of the beveled-tappets 25 and 26. The lower
90 ends of the tappet-shanks are secured to the gage-plate 27 to which is also secured the governor-rod 28 connected by any usual means with the governor and operated thereby to
95 elevate or depress the tappets 25 and 26 to increase or diminish the time contact of the tappets against the ends of the toes 22 and 23. The tappet-bar is reciprocated by the connecting-rod 29 pivoted to the bar and to one arm of the bell-crank 30 the other arm of
100 which is pivoted to the eccentric-rod 6, this bell-crank serving to change the vertical reciprocation of the eccentric-rod to a horizontal reciprocation of the connecting-rod 29.

The shaft, connecting the two arms of the bell-crank, is journaled in a bearing extending from the engine base or cylinder as the case may be and is sufficiently long to transmit the motion from the vertical plane of the eccentric-rod to that of the connecting-rod 29. As the tappet-bar is reciprocated the beveled-toes 22 and 23 will ride over the beveled surfaces of the tappets being moved upward in their sockets and will drop by gravity when the tappets have passed. On the return movement of the bar the tappets will engage the lower edge of the toe and tend to oscillate the same, thus partially rotating the rock-shaft on which the toe-socket is mounted and causing the reciprocation of the valve through the medium of the crank-arm connected with the stem thereof; it is obvious that the oscillation of the toes will be regulated by the height of the tappets and that these will be automatically elevated or depressed by the action of the engine-governor.

It will be observed on examining the drawings that in Figs. 1 and 2 the ports are arranged so that the valve-face slides on an inclined surface and the valve-stems are placed at an angle with the bore of the cylinder so as to secure the two valve-stems to the two gravity-toes and operate both by a horizontal tappet-bar. In Fig. 3 the valves are placed on opposite sides of the axis of the cylinder and thus the valve-rods are placed a sufficient distance apart to connect them each to a gravity-toe and operate them by one horizontal tappet-bar.

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

1. In an engine having a vertical cylinder provided with induction valves arranged in different planes, and a piston connected with a horizontal drive-shaft carrying an eccentric, the combination with valve-stems pivotally connected with crank-arms mounted on rock-shafts which are journaled in bearings, sockets secured to these rock-shafts, and gravity-toes having shanks free to reciprocate within the sockets, of a horizontal reciprocating tappet-bar carrying adjustable tappets for engaging the gravity-toes, a connecting-rod pivoted to the tappet-bar, a bell-crank pivoted to the connecting-rod, and a reciprocating-rod pivoted to the bell-crank and connected with the eccentric, as described.

2. In an engine having the cylinder 5, and a piston the rod of which is connected with a crank-shaft carrying an eccentric, the combi-

nation with the valve-chest 7 and 8 arranged in different planes connected with the cylinder by the ports 9 and 10, the valves 11 and 12 contained within the chests and furnished with valve-stems, the crank-arms 15 and 16, mounted on the rock-shafts 17 and 18, pivoted to the ends of the stems, the sockets 21 and 22 also mounted on the rock-shafts, and the gravity-toes 22 and 23 the shanks of which are movable within the sockets, of the tappet-bar 24, the tappets 25 and 26 mounted in said bar, the gage-plate 27 supporting the lower ends of the tappet-shanks, the rod 28 for elevating and depressing the same, the bell-crank 30 the shaft of which is journaled in bearings, the rod 29 connecting one arm of the bell-crank with the tappet-bar, and the reciprocating-rod 6 connecting the remaining arm of the bell-crank with the eccentric, as and for the purpose described.

3. In a vertical engine, the combination with a cylinder, the vertically-reciprocating piston, and the usual connections between the piston and crank-shaft, of a horizontal reciprocating tappet-bar carrying adjustable tappets, rock-shafts arranged side by side operated by said tappets, and induction-valves arranged and constructed in order to connect the valve-stem of each valve with one of the two rock-shafts, whereby the upper and lower valves are operated by the horizontal tappet-bar, as described.

4. A vertical engine in which the induction valve at the upper end of the cylinder and the valve on the lower end of the cylinder are both connected, by means of valve-stems, with the sockets of two gravity-toes operated by a horizontal tappet-bar to regulate the admission of steam, as described.

5. In a vertical engine, the combination with the cylinder, the piston, and connections with the crank-shaft, of a tappet-bar moving transversely to the axis of the cylinder, two pivoted tappet-toes operated by the tappet-bar and connected to the valve-stems, and two induction-valves, one at the upper and one on the lower end of the cylinder, having one or both of the valve-seats inclined at an angle to the axis of the cylinder to permit both tappet toes to be connected with the two valve-stems and operated by the tappet-bar.

In witness whereof I have hereunto set my hand.

WILLIAM B. WATERMAN.

Witnesses:

JOSEPH A. MILLER,
HENRY J. MILLER.