

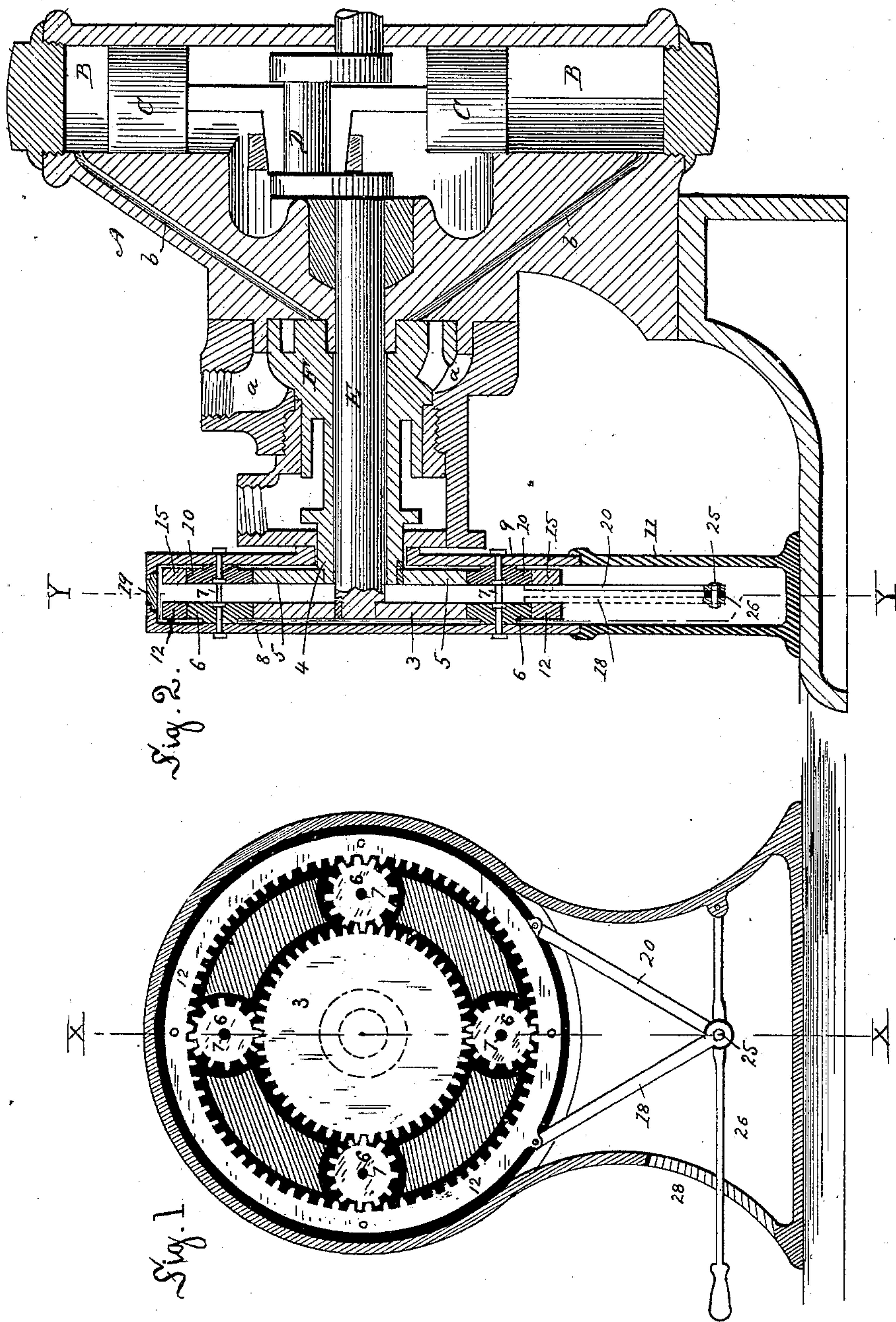
(No Model.)

E. B. BENHAM.

VALVE GEAR.

No. 401,730.

Patented Apr. 23, 1889.



Witnesses,

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UNITED STATES PATENT OFFICE.

ELIJAH B. BENHAM, OF PROVIDENCE, RHODE ISLAND.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 401,730, dated April 23, 1889.

Application filed June 29, 1888. Serial No. 278,599. (No model.)

To all whom it may concern:

Be it known that I, ELIJAH B. BENHAM, a citizen of the United States of America, residing at Providence, in the county of Providence and State of Rhode Island, have invented new and useful Improvements in Valve-Gear, of which the following is a specification.

This invention relates to a mechanical movement for securing, from a reciprocating motion of a lever, a rotary motion of a sleeve-like part, with relation to a shaft embraced thereby, and a rotary motion of the said shaft with relation to the said sleeve, said mechanical movement being applicable in a variety of situations and particularly as a means for operating a rotary valve—such as is comprised in multiple-cylinder steam-engines and water-motors, described in various Letters Patent of the United States granted to me April 10, 1888, and in an application for Letters Patent filed by me December 19, 1887, Serial No. 258,280; and the invention consists in the construction and combination of parts substantially as will be hereinafter more fully described, and set forth in the claims.

Reference is to be had to the accompanying drawings, in which the parts constituting the mechanical movement of the present invention are shown as applied on and in relation to the crank-shaft and valve of a multiple-cylinder engine of the class above referred to, Figure 1 being an end view thereof, with the casing shown as in section on the line Y Y, Fig. 2, said Fig. 2 being a longitudinal vertical section on the line X X, Fig. 1.

In the drawings, A represents the head of a multiple-cylinder engine, provided with radial cylinders B, wherein pistons C are provided, acting upon the common crank or wrist pin D of the driving-shaft E, a valve, F, of sleeve form being placed about the said shaft for rotation thereon to control the passage of steam from the steam-supply chamber *a* to the passages *b*, leading to said cylinders, and to permit of the passage of the exhaust therefrom, all substantially as set forth in said application, filed under said Serial No. 258,280. The said driving-shaft is rearwardly extended, as shown, to the outer end of which a spur-gear, 3, is secured, and the tubular shank 4

of the sleeve-shaped valve is also rearwardly extended into proximity with the end of the driving-shaft, where it is provided with a similar spur-gear, 5, fixed thereon, and two sets of pinions, 6 6 and 10 10, mesh, respectively, with the shaft-gear 3 and the valve-gear 5, the opposing pinions of each set being carried by, but capable of an independent rotation on, pintles 7, common to both such opposing pinions, said pintles being supported at each end in the rear and front walls, 8 and 9, of the inclosing-casing; and the said casing-walls 8 and 9 are mounted on the center rim, 19, of a suitable supporting-standard, 11, and are free for rotation, but constrained to move the one with the other, being joined by the pinion-pintles 7.

Circular racks 12 and 15, or gears having their teeth internally disposed, mesh with the pinions 6 and 10 of each series, and are supported thereon and thereby concentrically with the gears 3 and 5.

To the lower side of one circular rack, 12, at a point thereof outside of a vertical line drawn through its center, the upper end of a link-lever, 18, is connected, and a similar link-lever, 20, by its upper end, is also connected to the other circular rack, 15, at a similar distance the other side of its central vertical line, as indicated in Fig. 1, both of said link-levers being, by their lower ends, pivoted at a common intermediate point, 25, of a handle-lever, 26, pivotally hung by its inner end to an ear-piece of the standard 11, a suitable ratchet portion, 28, of the said standard, with which the outer end of the handle-lever may engage, serving as means for retaining the levers and the connected internal gears in any adjusted position.

Under the rotation of the driving-shaft the gear 3, carried thereby, is rotated, and a revolution of each of the pinions 6 is secured about the shaft-axis, for by their meshing with the teeth of the then immovable internal gear and rotated by the said gear 3 they must travel with their axes in a circular path, and the pinions 6 of one set being joined by their axial pintles 7 with the pinions 10 of the other set the pinions of the said latter set are revolved or caused to move in a circular path in unison with the first-named set, and said latter set

10 being in mesh with the rotatable valve-gear 5 and also with the teeth of the then immovable internal gear, 15, said valve-gear is necessarily rotated, and with it the valve, at a
5 corresponding rate and in consonance with the main shaft; but on a movement of the lever-handle in the proper direction the racks are partially rotated in reverse directions, and the movement of the one rack will retard the
10 rotation of the pinion or secure its rotation in the reverse direction, the rotation of the shaft being retarded or reversed, while the other series of axially-joined pinions are at the same time by the other rack given an accelerated
15 rotation, securing a corresponding action on the valve-gear, the result being in substance that the valve partially rotates on and with relation to the shaft, and the shaft partially rotates in and with relation to the valve, the
20 change of the relative positions effecting a reversal of the motor, it being understood that at the time of the rotation of the shaft the side walls, 8 and 9, of the casing carrying the pinions rotate, as said pinions supported therein
25 are caused to revolve and travel around the internal track of the rack-gears 12 and 15.

What I claim as my invention is—

1. A shaft and a sleeve thereon, each provided with a gear, the rotatable walls 8 and 9,
30 one or more pinions, 6, and one or more pinions, 10, supported and capable of an independent rotation on pintles 7, which are extended between and supported in said walls 8 and 9,

the said pinions respectively meshing with said shaft and sleeve-gears, combined with the
35 internal gears, 12 and 15, normally immovable, having their teeth in engagement with said pinions, and means, substantially as described, for securing a partial rotation of said internal gears in reverse directions, substantially as
40 described.

2. The crank-shaft E and sleeve-valve F, each provided with a gear, 3 and 5, the standard 11, having the circular rim 19 and the
45 ratcheted edge 28, the walls 8 and 9, rotatable on said rim 19, two series of pinions, 6 and 10, supported and capable of an independent rotation on pintles 7, which are extended between and supported on said walls 8 and 9,
50 the said pinions meshing with said gears 3 and 5, combined with the internal gears, 12 and 15, normally immovable, having their teeth in engagement with said pinions, the handle-lever 26 by its inner end pivoted to said standard and capable of engagement by its handle
55 end with said ratcheted face 28, and the link-levers 18 and 20, each pivoted by one end to the said handle-lever and by their other ends pivoted to the said internal gears, 12 and 15, respectively, all substantially as and for the
60 purpose described.

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Witnesses:

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