

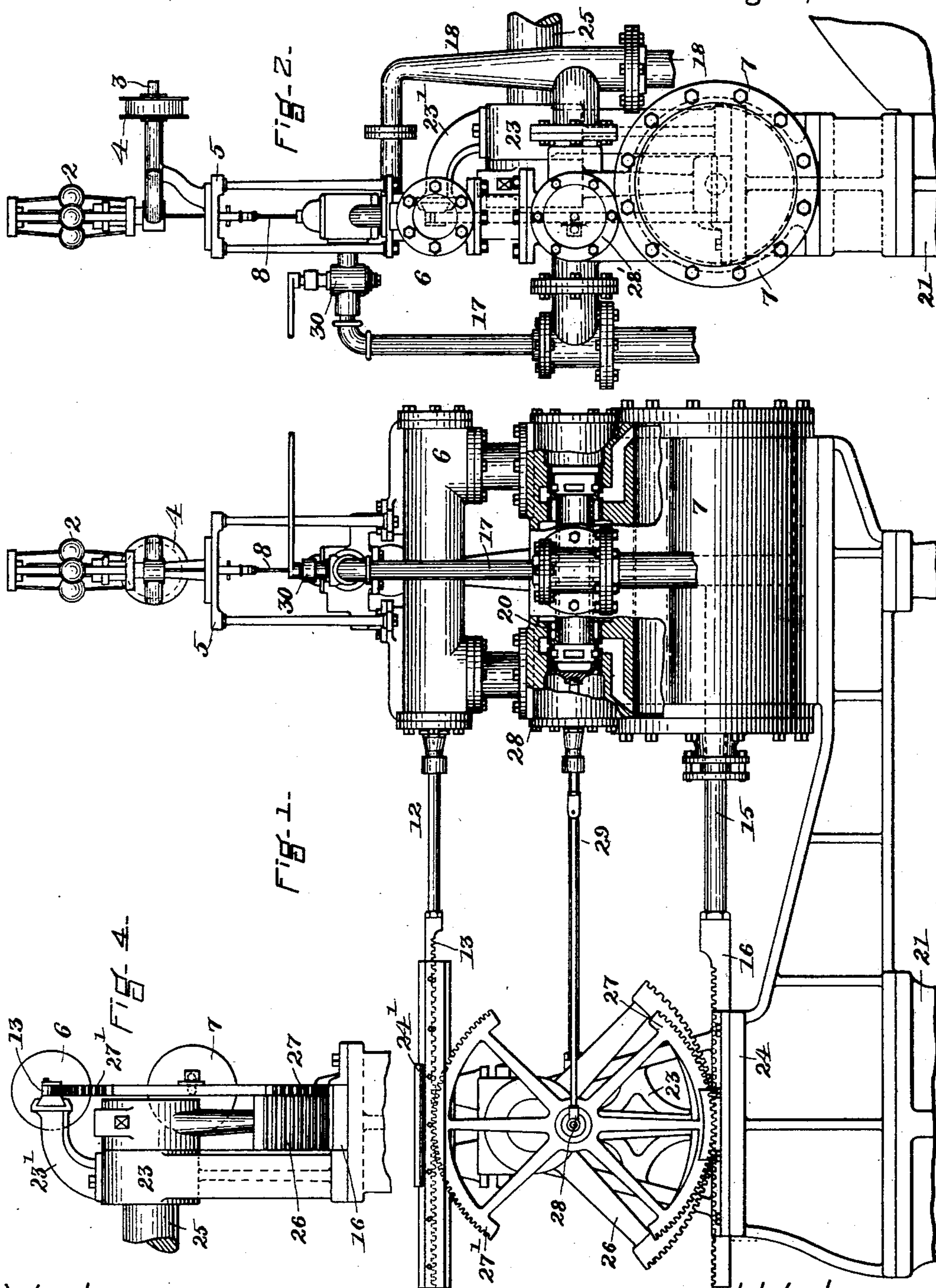
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3 Sheets—Sheet 1.

N. LOMBARD.
ATTACHMENT FOR SPEED GOVERNORS.

No. 587,675.

Patented Aug. 3, 1897.



WITNESSES.
A. D. Brown.
Fred C. Dorr.

INVENTOR.
Nathaniel Lombard.
H. C. Lodge Atty.

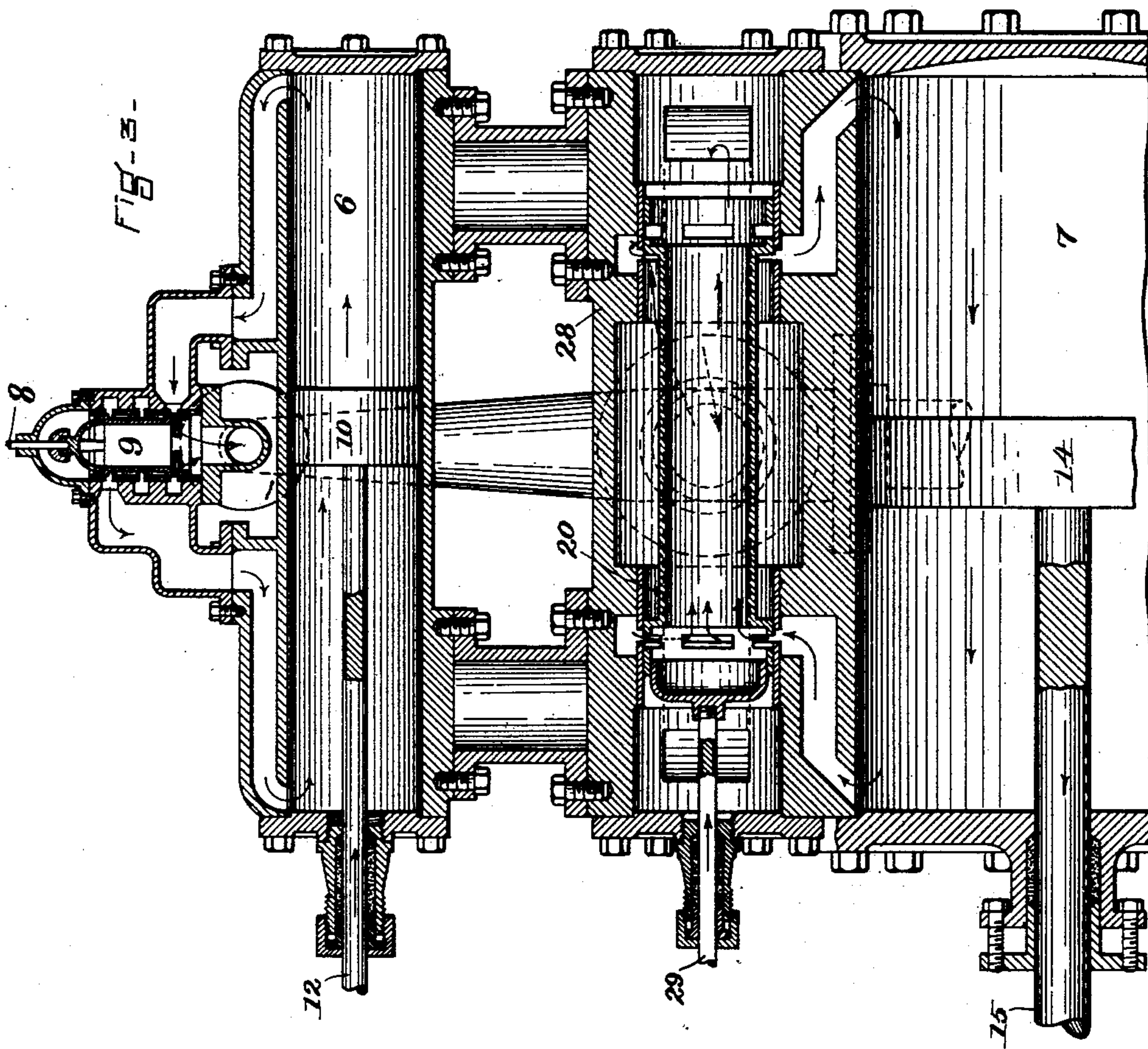
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A. D. Grover.

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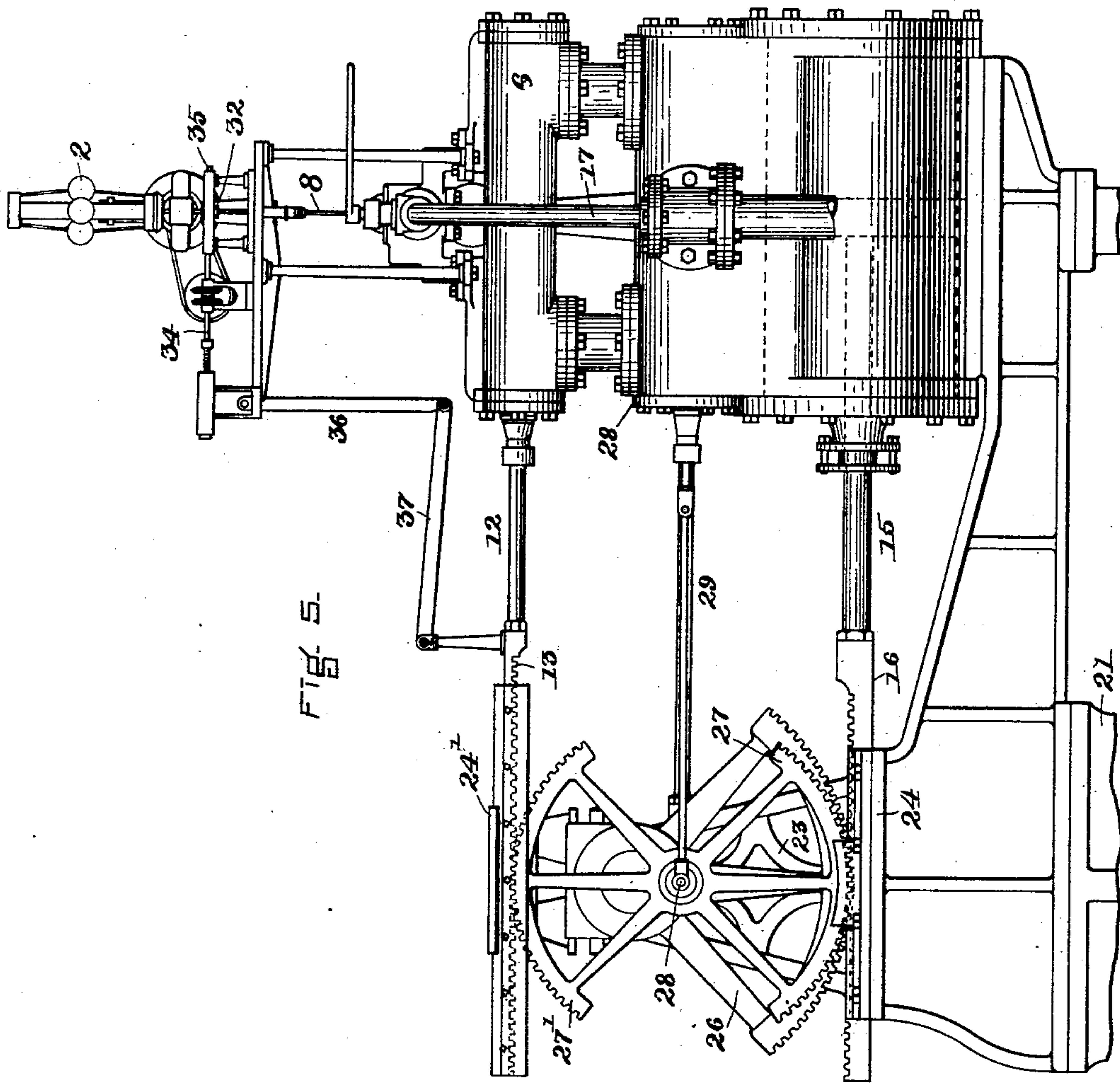
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UNITED STATES PATENT OFFICE.

NATHANIEL LOMBARD, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO
THE LOMBARD WATER WHEEL GOVERNOR COMPANY, OF SAME
PLACE AND PORTLAND, MAINE.

ATTACHMENT FOR SPEED-GOVERNORS.

SPECIFICATION forming part of Letters Patent No. 587,675, dated August 3, 1897.

Application filed December 15, 1896. Serial No. 615,784. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL LOMBARD, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Attachments for Speed-Governors; and I do hereby 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 figures of reference marked thereon, which form a part of this specification.

15 This invention relates to governors, more particularly such as are designed to control water-wheels.

My invention relates to that class of governors in which the gate-actuating devices 20 comprise a fluid-filled cylinder fitted with a reciprocating piston and a piston-rod, the latter terminating in a toothed rack which is employed to open and close the gate.

My improvements are embodied in the arrangement of parts by which the efficiency 25 of the apparatus is improved and by means of which powerful apparatus may be employed to control the gate and yet at the same time the disadvantages which arise from the use 30 of large valves are overcome.

My invention is embodied in the arrangement of a primary gate-actuating piston within a cylinder, a valve therefor, and a secondary piston to control the valve to the cylinder 35 of the primary piston, the valve of the secondary piston being governed by the regulator-weights; furthermore, in the use of two toothed sectors or an oscillating toothed wheel which engages the racks attached, respectively, to the rods of the primary and secondary pistons, and, furthermore, in the manner of uniting the valve-rod of the primary cylinder to the center of the toothed wheel. In this way a strong leverage is exerted on 45 the primary valve, because when one piston is in motion the other is generally stationary, and as a consequence the part of the toothed wheel in engagement with the rack on the stationary piston is a fixed point while the other 50 corresponding point is rocking. Hence the

center of the wheel is reciprocated in right lines and the primary valve, even if of larger area, is readily controlled.

Briefly described, my invention is embodied in the combination, with centrifugal weights, 55 of a secondary gate-controller connected directly with the weights, a primary gate-controller united with the gate-shaft, and an intermediary gate-controller which is at stated intervals actuated by both the primary and 60 secondary controllers and by its movements controls the travel of the primary gate-controller.

The drawings represent, in Figure 1, a side elevation of a governor embodying my invention applied to an ordinary type of governor. 65 Fig. 2 is an end elevation of the same, facing the cylinder. Fig. 3 is a vertical central section longitudinally of the cylinders. Fig. 4 is an end view facing the toothed racks. Fig. 70 5 is a side elevation of a governor embodying my invention, showing one form of attachment for maintaining the governor-rod neutral or inactive during the return of the balls to a normal position. 75

In the governor herewith illustrated I propose to employ centrifugal weights in connection with fluid-filled cylinders as one form of mechanism by which the main gate of the prime motor is to be controlled and shifted to 80 open or close more or less and to be locked in place. In the present instance 2 represents the weights, operated centrifugally in the ordinary manner by means of the shaft 3 and pulley 4 to the prime motor, which is 85 supplied by the gate to be controlled. These several parts are suitably mounted and assembled on a standard 5, while beneath are arranged two cylinders 6 7, respectively secondary and primary, one above the other with 90 a valve-casing between them. Vertically and centrally of the regulator-weights is positioned a governor-rod 8, adapted to be reciprocated by changes in the position of the weights due to variation in the speed of the 95 prime motor. The lower end of said rod is united with a valve 9, (see Fig. 3,) by which the to-and-fro movements of a piston 10 in the secondary cylinder 6 are regulated. Said piston is furnished with a rod 12, which ter- 100

minates in a toothed rack 13. The primary cylinder 7 is similarly equipped with a piston 14, having a rod 15, also with a rack 16.

One purpose of my invention is to enable the regulator-weights to be easily influenced by slight changes in the speed of the prime motor. Now these elements have little or no active force, and accordingly it would be impossible to operate the main gate of the prime motor, especially of water-wheels, as many such require very powerful agencies to operate them. Hence I have provided the secondary cylinder 6 with a small valve, and consequently little or no difficulty is had in regulating its movements. In connection with this valve is a fluid system under any suitable pressure, and this fluid by means of the valve 9 serves to actuate and regulate the travel of the piston 10. As fluid enters on one side an equal quantity is discharged from the opposite end of the cylinder. Hence the piston is constantly held locked except during such intervals as the valve allows circulation to go on. The main supply-pipe of this system is at 17, the discharge at 18, and both supply and discharge are common to the two cylinders. In connection with this secondary piston and its valve is a primary piston and valve, as before premised. As this piston 14 is to move the gate it is of large area, and its valve 20 is proportioned accordingly.

In Fig. 3 the arrows indicate the operation of the pistons and their valves. The valve 9 has been shifted by the weights and fluid is now entering the cylinder 6 at the left end and is discharging from the right end. The piston is accordingly advancing, as indicated by the arrows. This movement has impelled the valve 20 of the primary cylinder in the same direction, but with the result to cause liquid to enter the right-hand end of the said cylinder and discharge from the left-hand end, with the result that the main gate controller or piston 14 is moving oppositely to that of the secondary gate controller or piston 10. In order to interconnect these several instrumentalities, whereby the movement of one shall directly affect the other and at the same time to properly and powerfully operate the main valve 20, I have arranged the following parts: Mounted upon a suitable casting 21, which constitutes a part of the general support, is an upright standard 23, to which are attached parallel guide-bars 24 24', adapted to receive the toothed racks 13 16. Transversely of said standard is the rocking shaft 25 to the main gate, and this is operated by a toothed sector 26, meshing in the rack 16 of the primary piston. Interconnecting the two racks 13 16 is a mutilated toothed wheel or two similar sectors 27 27', acting as a unit. Said sectors engage with and are held in position by plates which overlap the guide-bars, and the said wheel is adapted for oscillations.

The valve-casing 28 to the main valve 20 is positioned between the two cylinders, and a

valve-rod 29 extends therefrom to the center of the sectors. With the valves in position as shown in Fig. 3 and with the pistons moving as indicated by the arrows the resultant action upon the several instrumentalities, as last described, is as follows: Travel of the secondary piston 10 rocks the top of the sector 27' to the right, the lower sector acting as a fulcrum because the rack 16 is now held fixed by the main piston, which is stationary, the valve 20 being closed. This sector 27' continues to rock until its central point 28 has advanced sufficiently to open the main valve 20. The action of the regulator-weights is to open the secondary valve a short distance for variations in speed and with certain arrangement of parts, such as are shown in Fig. 5, and then immediately to close said valve. This closure is produced by the movement of the secondary piston due to the opening of its valve. Consequently when the main valve has opened the secondary valve may be closed or is in the act of closing, and the piston 6 will then become stationary. Consequently the top sector is now a fixed point or fulcrum, and the main piston now rocks the sector 27 with the result to close the main valve. Thus it will be seen that for a small movement of a large valve the piston 14 travels a long distance. In some instances where the secondary piston has made a large movement the primary valve is opened and so continues after the main piston has commenced its travel. At such times both the pistons are in motion simultaneously. The valve 30 is to be used when the regulator is to be shut down in case of repairs or otherwise. In Fig. 5 the governor-rod is to have axial rotation by means of a toothed wheel 32. A shaft 34, arranged to have endwise thrust and likewise rotation, is attached to a rack 35, meshing with the wheel 32. Motion of the connecting-rods 36 37 to the secondary gate-controller serves to rotate the rod 8 and stop further travel of the secondary controller, occasioned by the departure of the weights from their normal. This stopping of the secondary gate-controller is produced by the endwise thrust of the shaft 34. Rotation of the said shaft acts to reversely and slowly revolve the rod 8 and in this way counteract the action of the weights as they return to the normal, such reverse rotation of the rod 8 serving to maintain the secondary controller from movement except at proper times.

It will be seen that the outer extremity of the main-valve rod 29 is secured to the center of the sectors 27 27'. Hence the travel of the piston 10 serves to open the main valve, while the motion of the main piston 14 is always tending to close the same.

In Figs. 1 and 2 of the drawings my invention is applied to a governor of the usual type in which the governor-rod 8 is merely designed to reciprocate, while in Fig. 5 my invention is to cooperate with a governor in which the rod 8 is to have axial rotation as well as the usual

reciprocatory movement. This peculiar and novel function of the said rod is fully set forth and described in United States Letters Patent No. 533,656, issued in my name on February 5, 1895.

In the application of my invention I do not wish to be confined to the peculiar and specific elements for controlling and operating the main gate in the form of fluid-filled cylinders with pistons, since other instrumentalities may be assembled in lieu thereof to perform similar functions. In the present instance the gate-controlling mechanism is merely one form, the preferred one, of illustrating my invention.

What I claim is—

1. A governor comprising centrifugal weights, a secondary gate-controller operated directly by the weights, a primary gate-controller united to the gate, and an intermediary gate-controller operated by the secondary gate-controller, to impart travel to the primary controller, substantially as specified.

2. In regulators, centrifugal weights, a secondary gate-controller operated directly by said weights, an intermediary gate-controller, and a main gate-controller, combined with mechanism which interconnects the three controllers, in such manner that activity of the intermediary controller is mutually governed by the primary and secondary controllers, as described.

3. In water-wheel governors, the combination with one or more centrifugal weights, of a secondary piston controlled by the weights, a primary piston, and a piston-valve therefor, combined with mechanism which interconnects said pistons to compel opposite movements of the same, and a rod to unite the piston-valve with the mechanism which

interconnects said pistons, substantially as stated.

4. In centrifugal governors, one or more revolving weights, a gate-shaft, a fixed standard, movable toothed racks therein, and an oscillating toothed wheel to interconnect said racks, combined with primary and secondary gate-controllers, united with the racks, and an intermediary controller, attached to the wheel center, substantially as set forth.

5. In speed-governors, one or more rotary weights, a fixed standard, movable toothed racks in parallelism thereon, a gate-shaft, a toothed sector on said shaft to engage one of the racks, and an oscillating toothed wheel to engage said racks, the points of oscillation being on the racks, combined with a secondary gate-controller connected directly with the weights, a primary gate-controller united to the gate-shaft, and an intermediate gate-controller, interconnected with the center of the toothed wheel, substantially as explained.

6. In a speed-governor, revoluble weights, a rack-actuating secondary gate-controller, a governor-rod, and a valve operated thereby, combined with a rack-actuating primary gate-controller, a toothed gear to interconnect the primary and secondary gate-controllers, an intermediate gate-controller united to the center of the toothed wheel, and mechanism which interconnects the governor-rod with the secondary controller, whereby rotation is imparted to the rod, substantially as described.

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

NATHANIEL LOMBARD.

Witnesses:

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FRANCIS C. STANWOOD.