No. 706,321. Patented Aug. 5, 1902.

J. E. JOHNSON.

SPEED REGULATOR.

(Application filed Dec. 16, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1

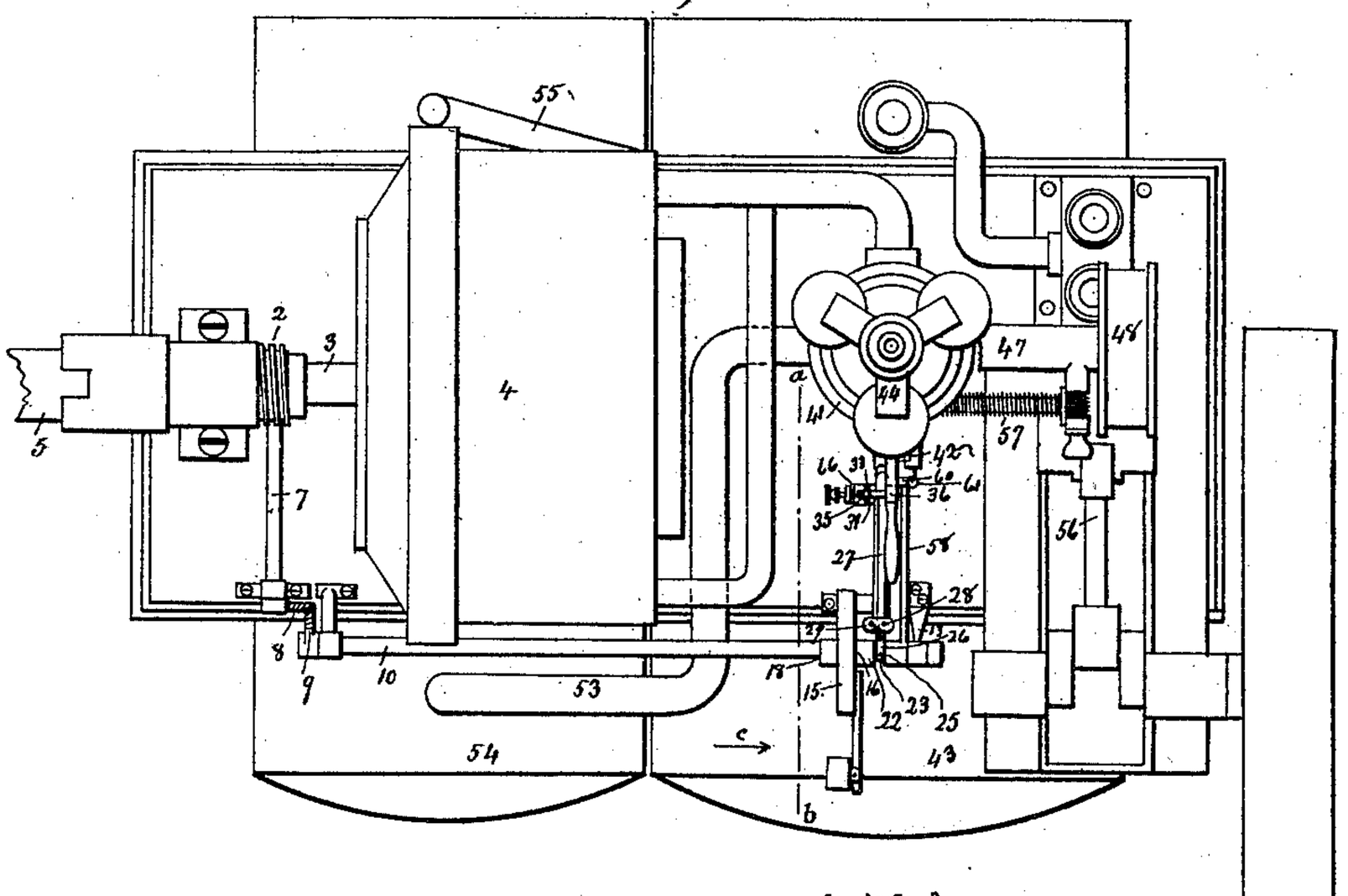
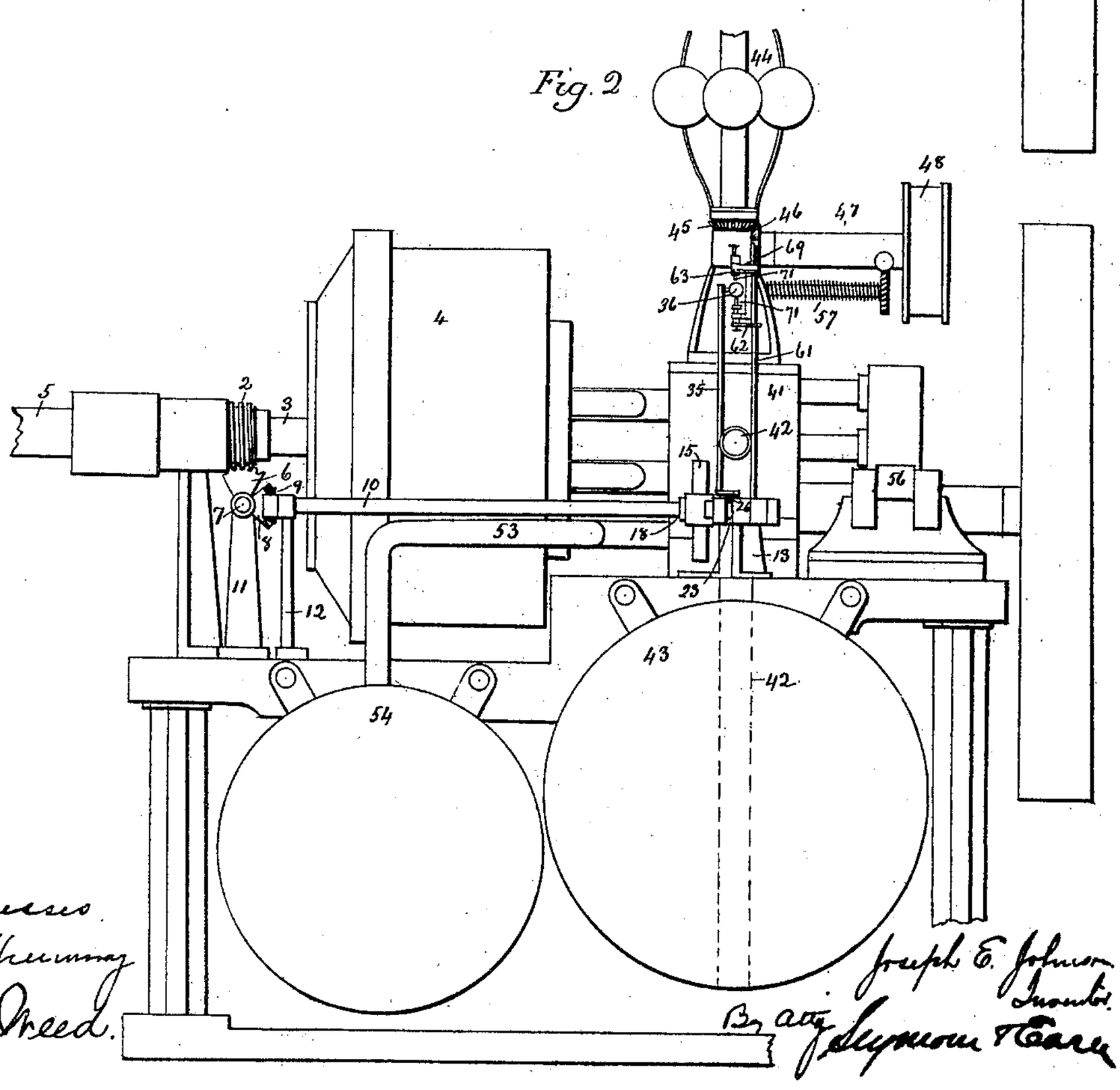


Fig. 2



Witnesses.
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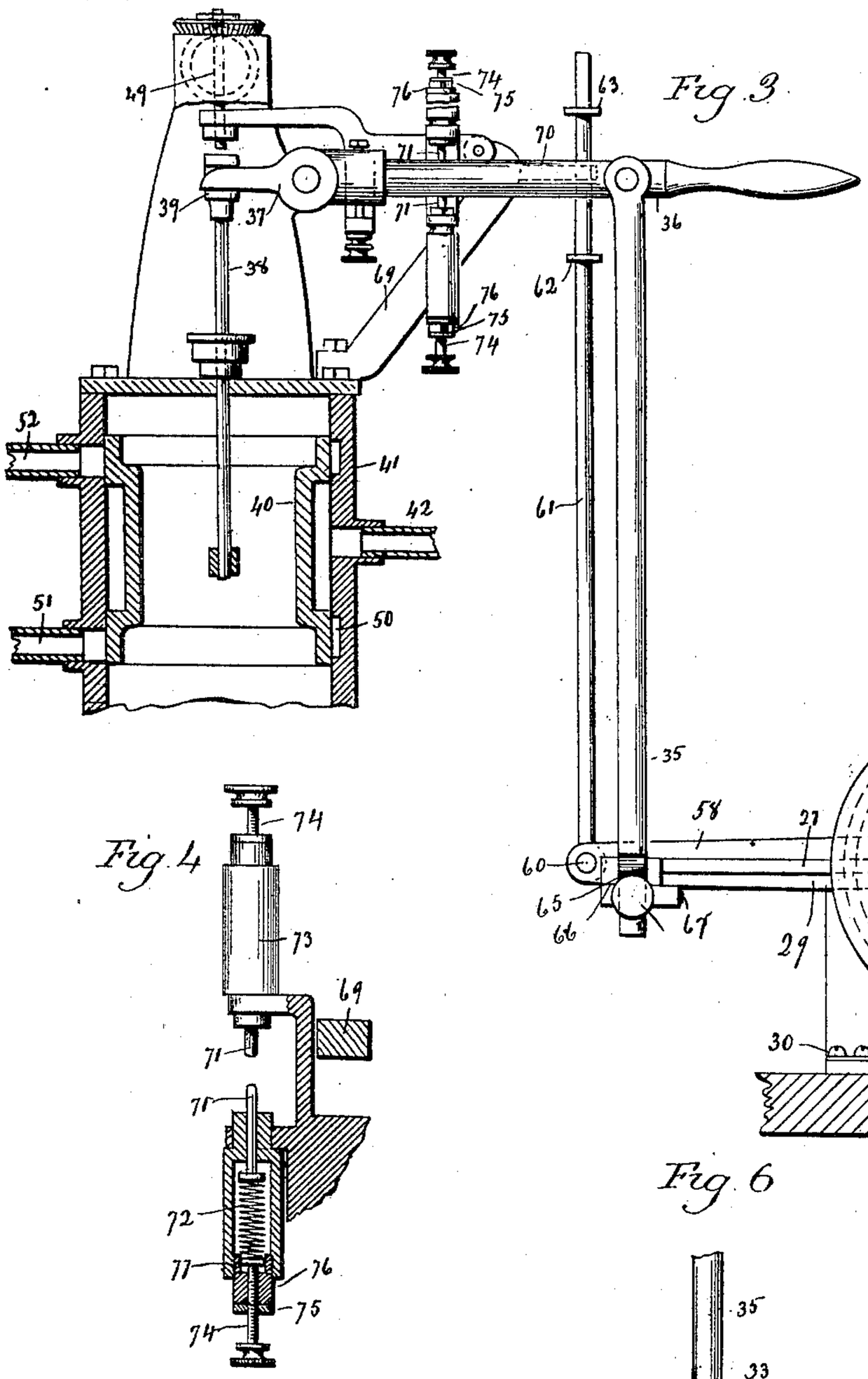

Fig. 3.

Fig. 4.

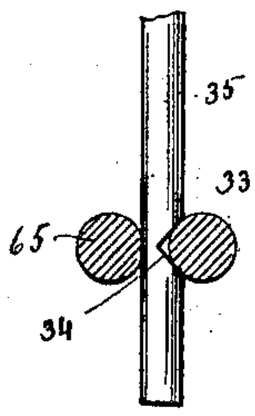

Fig. 6.

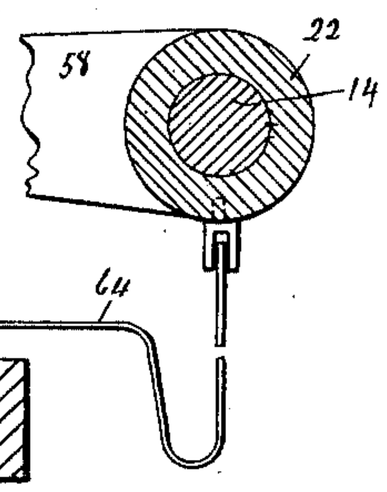

Fig. 5.

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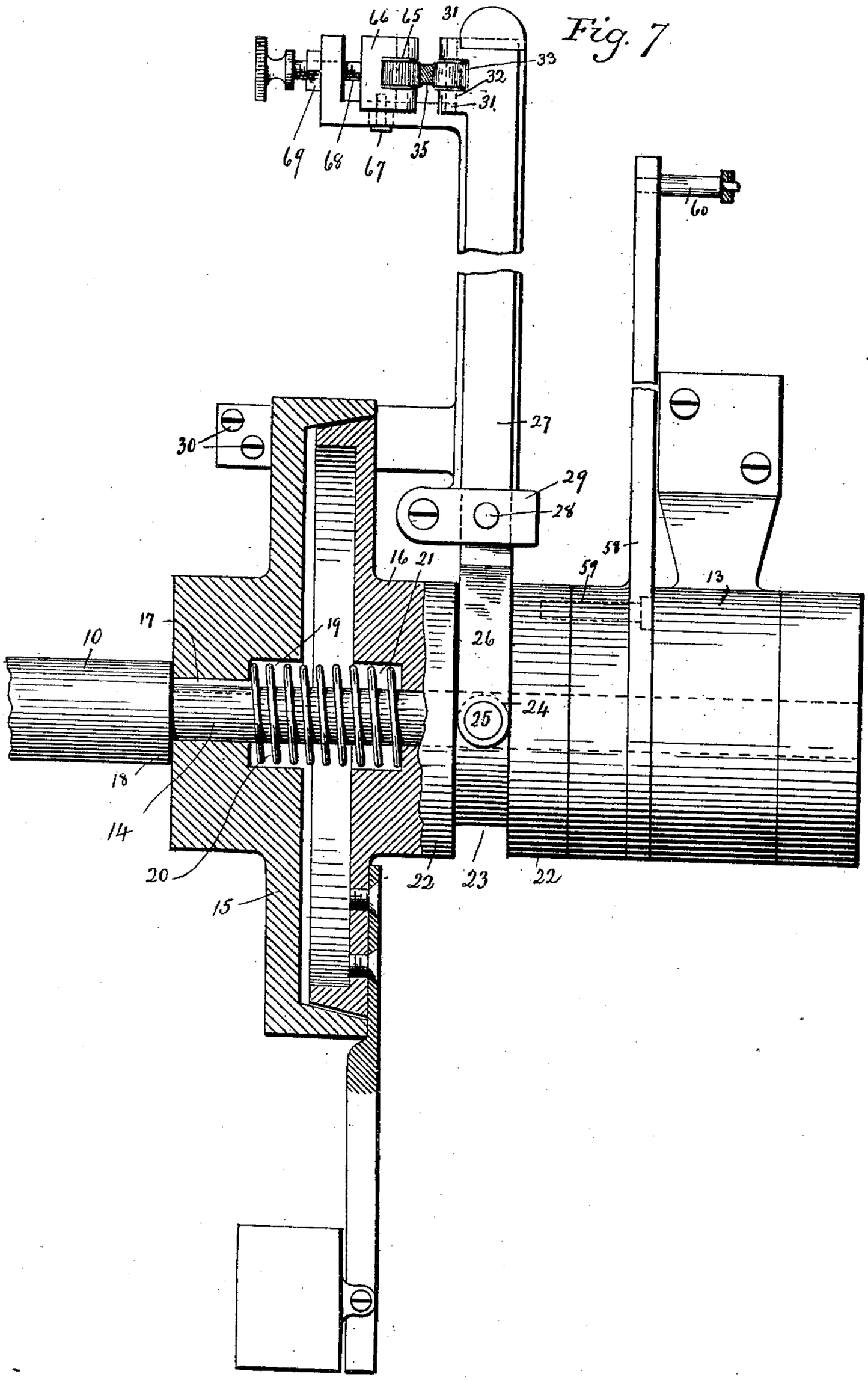
(No Model.)

3 Sheets—Sheet 3.

Fig. 7



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UNITED STATES PATENT OFFICE.

JOSEPH E. JOHNSON, OF MERIDEN, CONNECTICUT.

SPEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 706,321, dated August 5, 1902.

Application filed December 16, 1901. Serial No. 86,079. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. JOHNSON, of Meriden, in the county of New Haven and State of Connecticut, have invented a new and useful Improvement in Speed-Regulators; and I do hereby declare the following, when taken in connection with the accompanying drawings and the characters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a plan view of a speed-regulator containing my improvement; Fig. 2, a broken view thereof in front elevation; Fig. 3, a detail view, partly in elevation and partly in vertical section, on the line *a b* of Fig. 1 looking in the direction of the arrow *c;* Fig. 4, a detached broken view, partly in section and partly in elevation, of the adjustable tension device for preventing undue vibration in the speeder-lever under normal conditions; Fig. 5, a detached broken view, partly in section and partly in elevation, showing the spring employed for restoring the rock-arm to its normal position; Fig. 6, a detached broken view showing the notch in the lower end of the operating-rod which is connected with the speeder-lever, the said notch being shown in its relation to the two rollers with which it coacts; Fig. 7, an enlarged plan view, in horizontal section, showing the friction-clutch of my improvement together with its allied parts.

My invention relates to an improvement in speed-regulators for controlling the opening and closing movements of water-wheel gates operated by mechanism under the control of a centrifugal governor, the object of the invention being to provide comparatively simple and reliable means for preventing a too-marked movement of a water-wheel gate in either direction at any one time, whereby too-marked fluctuation in the speed of the wheel is prevented.

Before beginning the detailed description of my improvement and setting forth the operation thereof I may state that it may be applied to any speed-regulator having a centrifugal governor. I do not, therefore, limit myself to embodying my improvement in mechanism of the particular construction shown and described. I will not, therefore, describe that mechanism any further than necessary to make my invention clear.

In carrying out my invention as herein shown I locate a worm 2 upon the shaft 3 of a motor 4, employed to effect the opening and closing movements of a water-wheel gate, (not shown,) which is connected with the said motor-shaft 3 through a water-wheel-gate shaft 5. The motor 4 is the gate-controller of the apparatus and will be so called hereinafter. It may be replaced by any other means adapted to perform the same function. The said worm meshes into a segmental gear 6, located directly beneath it and mounted upon the inner end of a horizontal rock-shaft 7, the outer end of which is provided with a segmental miter-gear 8, meshing into a corresponding segmental miter-gear 9, mounted upon the adjacent end of a horizontal rock-shaft 10. The said shaft 7 is supported in two upright supports 11, only the outer one of which is shown, while the said rock-shaft 10 is supported at one end in an upright 12 and at its opposite end in an upright 13. It is obvious that the shaft 10 will be rocked in one direction or the other according to the direction in which the motor-shaft or gate-controller shaft 3, and hence the worm 2, are being rotated at the time. The inner end of the said shaft 10 is, as shown, reduced in diameter to form a long stem 14, though this is not essential, and provided with a friction-clutch comprising two cups 15 and 16, having coacting beveled flanges, the cup 15 being the larger of the two, and being rigidly secured by a key 17 or in any other suitable manner to the stem 14 and abutting against the shoulder 18, formed between the same and the body of the rock-shaft 10. The inner face of the cup 15 is formed with a central socket 19 for the reception of one end of a spiral spring 20, encircling a portion of the stem 14 and having its opposite end inserted into a corresponding socket 21, formed in the center of the inner face of the smaller cup 16, which is loose upon the stem 14 and provided with a large hub 22, containing a circumferential groove 23, receiving antifriction-rollers 24, virtually corresponding to it in width and mounted upon pins 25, projecting from the inner faces of the lower ends of the two arms 26 of a fork

formed at the inner end of a horizontally-arranged operating-lever 27, swinging upon a pivot 28, located in a bracket-like frame-piece 29, secured to the main frame of the machine by screws 30. The outer end of the forked lever 27 is provided with two lugs 31, carrying a pin 32, upon which an antifriction-roller 33 is mounted. This roller coacts with a cam-notch 34, formed in the lower end of a vertically-arranged operating-bar 35, the upper end of which is pivoted to the speeder-lever 36, which is connected with a fork 37, connected with the upper end of the valve-rod 38 by means of a slotted block 39, attached to the upper end of the said rod. The beveled walls of the notch 34 act as cams upon the roller 33 for swinging the operating-lever 27. The bar 35, therefore, has the function of a cam and might with propriety be called a cam. The said valve-rod 38 is connected at its lower end with a vertically-movable valve 40, located within a casing 41, to which oil is supplied through the pipe 42 from a pressure-tank 43.

The centrifugal regulator 44 is of ordinary construction and provided with a miter-pinion 45, meshing into a corresponding pinion 46, mounted upon a shaft 47, carrying a pulley 48, driven in any convenient way from a shaft, (not shown,) but itself driven by the water-wheel and partaking of the fluctuations of the speed thereof. The centrifugal regulator, like other regulators of its class, is provided with a spindle 49, which when the balls are thrown outward by the raising of the speed beyond the normal point is pushed downward, so as to press the valve-rod 38 downward and hence move the valve 40 downward sufficiently to open the port 50, which permits the oil supplied through the pipe 42 to flow through the pipe 51 into the motor or gate-controller 4, from which the oil is exhausted through the pipe 52 back into the upper end of the valve-casing 41 and into the inside of the valve 40, from which it is delivered to the pipe 53 and returned to the tank 54, from which it is pumped through the pipe 55 and into the tank 43 by means of the pump 56. On the other hand, when the speed of the centrifugal regulator falls below the normal speed the spring 57 lifts the valve-rod 38, and hence the valve 40, and causes the oil to pass in the opposite direction through the system, whereby the motor or gate-controller is reversely operated.

I do not, as I may state here, limit myself to any particular form of centrifugal regulator or valve or valve connections or gate-controller, the forms shown and described being merely illustrative of what I may employ.

It will be understood that when the action of the centrifugal regulator presses the valve-rod downward the speeder-lever 36 will be lifted above its normal position, while when the centrifugal regulator falls below its normal speed the spring 57 will immediately act to cause the depression of the speeder-lever 36 below its normal position. These movements of the speeder-lever up and down will be participated in by the operating or cam bar 35, already described, causing it to virtually act as a cam upon the antifriction-roller 33, and so move the forked lever 27, which whether the bar 35 is moved in one direction or the other will swing the lever 27 so as to overcome the tension of the spring 20 and force the smaller friction-clutch cup 16 into engagement with the larger friction-clutch cup 15, whereby the two cups will be frictionally coupled together. At this time the larger cup 15 is being rocked in one direction or the other with the rock-shaft 10, which has been started in rocking movement by the action of the motor or gate-controller, which is normally at rest, but which has been itself started up by the operation of the valve 40 in one direction or the other, owing to the change of speed above or below the normal speed, due to changes in the load or to other causes. The rocking movement of the cup 15 will now be communicated through the cup 16 to a rock-arm 58, which is attached by screws 59 to the outer face of the hub 22 of the cup 16. The outer end of this rock-arm 59 carries a pin 60, by which the said arm is pivotally connected with the lower end of a speeder-lever-restoring rod 61, provided at its upper end with two adjustable fingers 62 and 63, respectively arranged above and below the speeder-lever 36. When the speeder-lever 36 has been depressed below its normal position by the spring 57, it is brought into position to be operated upon by the finger 62, which lifts it back into its normal or middle position. On the other hand, when the speeder-lever 36 is lifted above its normal or middle position by the action of the centrifugal regulator it is brought into position to be pulled down into its normal or middle position by the finger 63. The restoration of the speeder-lever 36 to its normal position by means of the fingers 62 and 63 tends to restore the valve 40 to its normal position, in which it cuts off the oil from the motor or gate-controller and tends to arrest its momentum, and hence the movement of the water-wheel gate. When the speeder-lever 36 returns to its normal position, the operating or cam bar 35 is moved so as to bring its notch 34 into registration with the roller 33, which enters it again, whereupon the spring 20 asserts itself to disconnect the cups 15 and 16, so as to break the connection between the motor or gate-controller and the speeder-lever. When the cup 16 is uncoupled from the cup 15, a spring 64, connected with the hub 22, immediately acts to restore the rock-arm 58 to its normal position, in which its fingers 62 and 63 are correspondingly distant from the speeder-lever 36.

The operating or cam bar 35 is held up against the antifriction-roller 33 by means of a roller 65, mounted in a head 66, secured to the frame-piece 29 by a screw 67 and adjustable by means of the adjusting-screw 68, fur-

nished with a check-nut 69. By means of the adjusting-screw 68 the pressure of the roller 65 upon the operating or cam bar 35 may be adjusted as desired and in accordance with the conditions surrounding the individual use of the apparatus, for, as will be readily understood, in some situations it will be desirable to have less resistance to the movement of the bar 35, and hence to the speeder-lever 36, than in others.

It will be understood, of course, that sufficient time elapses between the elevation or depression of the speeder-lever above or below its normal position and its restoration thereto to permit the increased or decreased volume of water passing by the gate, as the case may be, to correct the initial departure from the normal running of the system, that departure being manifested in the action of the centrifugal governor. It may be noted also that the friction developed by the friction-clutch counter-balances in a sense the power represented by the springs and weights entering into the action of the governor, the amount of friction developed by the clutch being dependent upon the extent to which the walls of the cam-notch 34 are brought into play, and that in turn being dependent upon the vertical movement of the bar 35, and that being dependent upon the extent to which the speeder-lever is raised or lowered, and that being dependent upon the action of the centrifugal governor which reflects the slow or fast running of the system. When the variation from the normal speed is slight, the power of the friction-clutch will be correspondingly slight, and vice versa.

In order to prevent undue vibration of the speeder-lever 36 in the ordinary and normal operation of the speed-regulator, I employ a tension device which, as shown, is mounted upon a bracket 69, secured to the frame of the machine, and provided, as shown, with an arm 70, which forms a bearing for the upper end of the operating-rod 61. This tension device is furnished with two yielding pins 71 71, which bear upon the upper and lower faces of the speeder-lever 36 and in a sense absorb the vibrations thereof and prevent the same from "flapping," so to speak, and communicating its flapping movement to the valve 40 and starting the motor or gate-controller. These pins 71 are held up against the speeder-lever 36 by means of spiral springs 72, located within sleeve-like casings 73 and controlled in tension by screws 74, furnished with check-nuts 75, the outer ends of the casings 73 being closed by cupped nuts 76, receiving the outer ends of the springs 72 and also receiving washers 77, which are interposed between the outer ends of the springs and the inner ends of the adjusting-screws 74. The inner ends of the pins 71 are provided with heads against which the inner ends of the springs 72 impinge. This tension device, as before described, takes care of the minor and what might be called "normal" fluctuations of the device and prevents those fluctuations from racking the other parts of the apparatus and bringing them into play unseasonably, while the system of connections between the motor or gate-controller and the speeder-lever, including the friction-clutch, take care of the larger fluctuations of the device due to changes in the load or to other corresponding causes.

It is apparent in carrying out my invention and in embodying it in different speed-regulators it may undergo more or less changes from the form herein shown and described, and I would therefore have it understood that I do not limit myself thereto, but hold myself at liberty to make such changes therefrom as fairly fall within the spirit and scope of my invention.

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

1. In a speed-regulator for water-wheels, the combination with a water-wheel-gate controller, of a governor, operating connections between the governor and controller, and connections between the controller and the governor, including a friction-clutch.

2. In a speed-regulator for water-wheels, the combination with a water-wheel-gate controller, of a governor, operating connections between the said governor and controller, connections between the controller and the governor including a friction-clutch, and an operating-bar connected with and operated by the governor to cause the friction-clutch to come into action.

3. In a speed-regulator for water-wheels, the combination with a water-wheel-gate controller, of a governor, operating connections between the governor and controller, connections between the controller and the governor including a friction-clutch, an operating-bar connected with and operated by the governor to cause the friction-clutch to come into action, and an operating-lever operated by the said bar to bring the friction-clutch into play.

4. In a speed-regulator for water-wheels, the combination with a water-wheel-gate controller, of a governor, operating connections between the governor and controller, connections between the controller and the governor including a friction-clutch, an operating-bar connected with and operated by the governor to cause the friction-clutch to come into action, an operating-lever operated by the said bar to bring the friction-clutch into play, and means operated through the friction-clutch for restoring the speeder-lever to its normal position.

5. In a speed-regulator for water-wheels, the combination with a water-wheel-gate controller, of a governor, a speeder-lever operated by the governor, and connections between the said controller and the speeder-lever including a friction-clutch, an operating-lever, an operating-bar between the said operating-lever and the speeder-lever, a rock-

arm, and a rod operated by the said arm and operating to restore the speeder-lever to its normal position.

6. In a speed-regulator, the combination with a gate-controller, of a centrifugal governor, connections between the governor and controller, a speeder-lever operated by the governor, and connections between the controller and speeder-lever, including means for adjusting the resistance of those connections to operation by the speeder-lever.

7. In a speed-regulator, the combination with a gate-controller, of a centrifugal governor, connections between the governor and gate-controller, a speed-lever operated by the said governor, and connections between the said controller and speeder-lever, including a clutch, an operating-lever, an operating-bar connected with the speeder-lever and formed with a cam operating upon the operating-lever, and means brought into play by the friction-clutch for restoring the speeder-lever to its normal position and arresting the gate-controller.

8. In a speed-regulator, the combination with a gate-controller, of a centrifugal governor, connections between the governor and controller, a speeder-lever, connections between the gate-controller and the speeder-lever, whereby the gate-controller is arrested, and means for absorbing or nullifying the minor fluctuations of the speeder-lever or gate-controller.

9. In a speed-regulator, the combination with a gate-controller, of a centrifugal governor, connections between the governor and controller, a speeder-lever, connections between the gate-controller and the speeder-lever, whereby the gate-controller is arrested, and a tension device for nullifying the minor fluctuations of the speeder-lever, including two pins engaged with the said lever, springs coacting with the said pins, and means for varying the tension of those springs.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOSEPH E. JOHNSON.

Witnesses:
FREDERIC C. EARLE,
C. L. WEED.