No. 640,671. Patented Jan. 2, 1900.

T. J. LENDE.

SPEED GOVERNOR FOR MOTORS.

(Application filed May 16, 1899.)

(No Model.) 2 Sheets—Sheet 1.

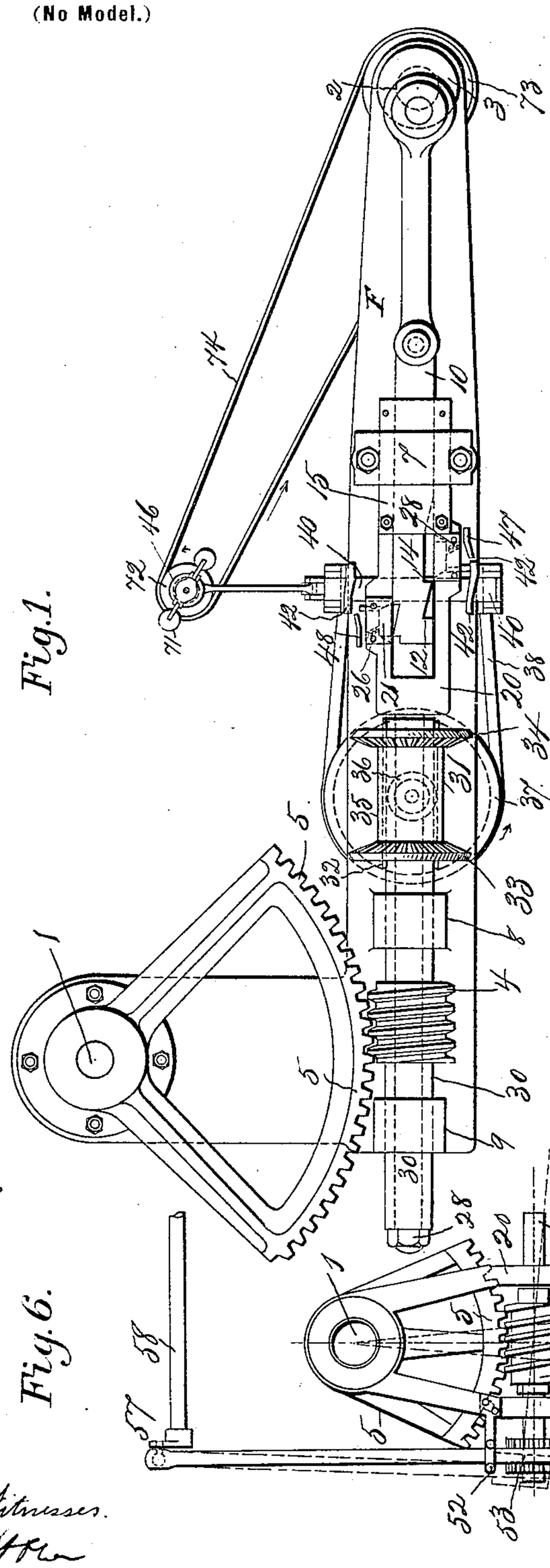

Fig. 1.

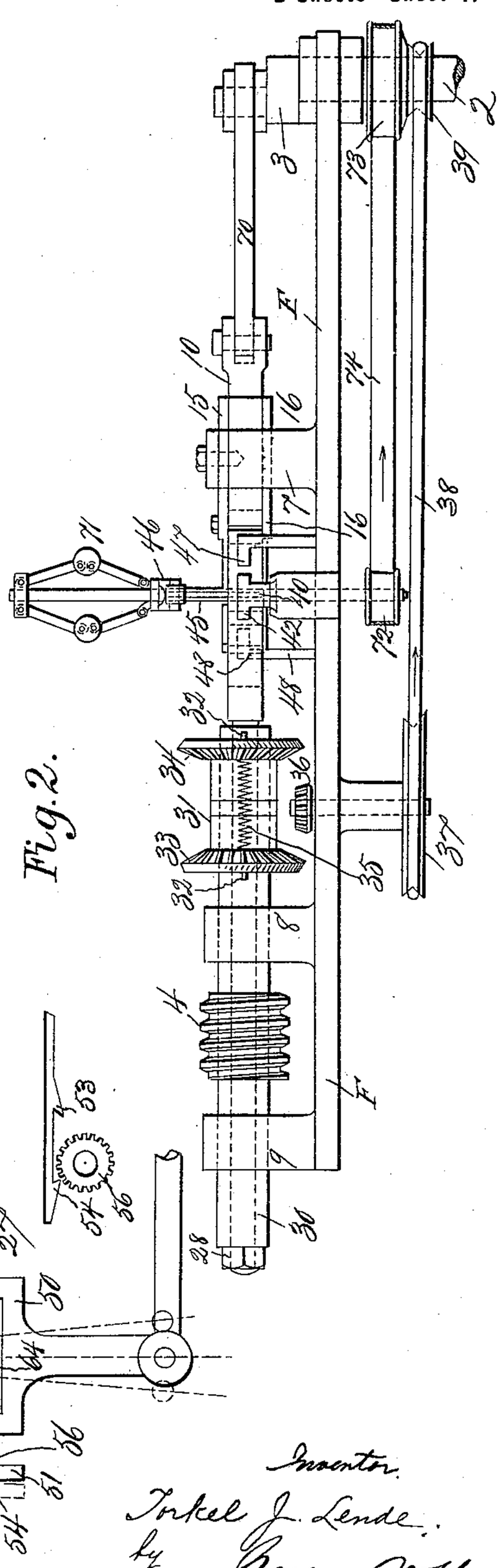

Fig. 2.

Fig. 6.

Witnesses.
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B. W. Sommers

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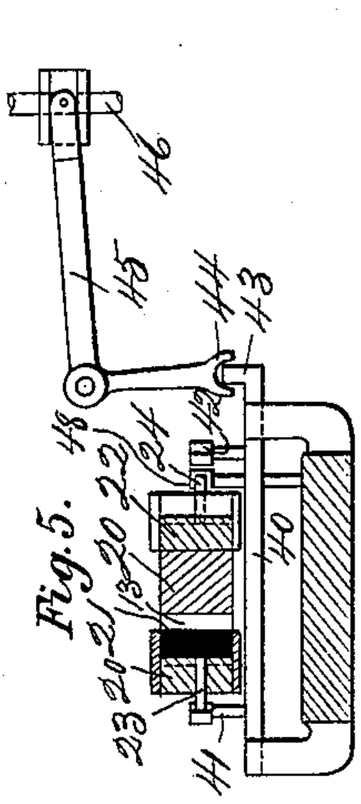

Fig. 5.

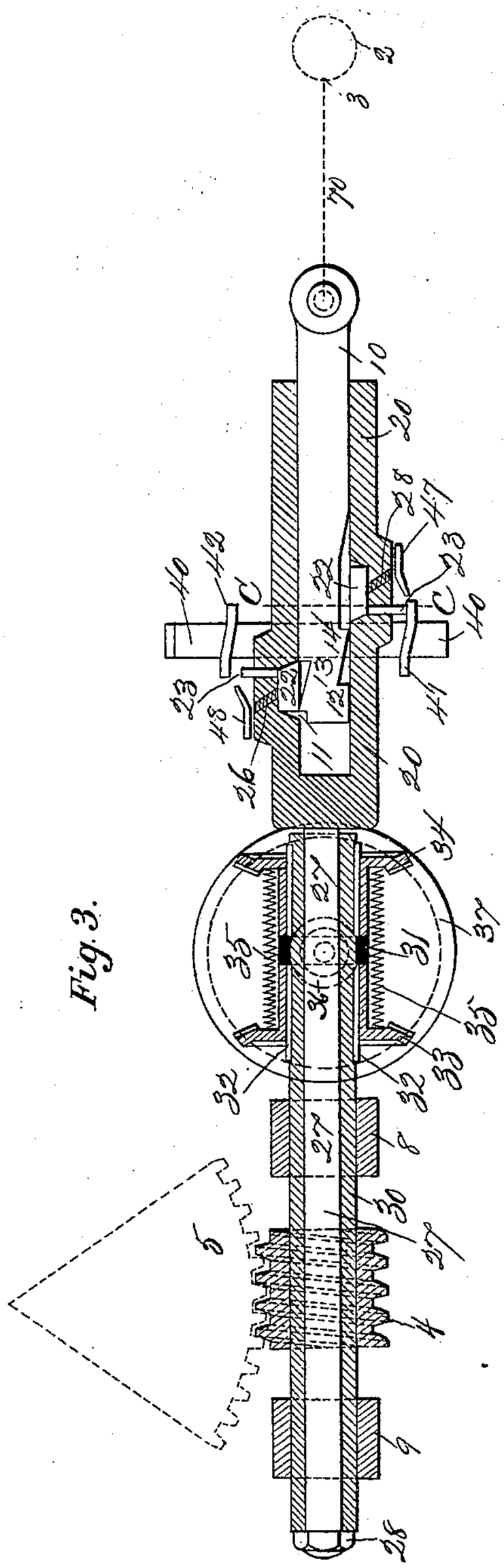

Fig. 3.

Fig. 4.

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UNITED STATES PATENT OFFICE.

TORKEL J. LENDE, OF STAVANGER, NORWAY.

SPEED-GOVERNOR FOR MOTORS.

SPECIFICATION forming part of Letters Patent No. 640,671, dated January 2, 1900.

Application filed May 16, 1899. Serial No. 717,029. (No model.)

To all whom it may concern:

Be it known that I, TORKEL J. LENDE, a subject of the King of Sweden and Norway, residing at Stavanger, in the Kingdom of Norway, have invented certain new and useful Improvements in Speed-Governors for Motors, of which the following is a specification.

My invention relates to motor-regulators for governing the speed of water-power motors, and is specially applicable to governing turbines, embracing that class of governors which are operated from a moving element and controlled by centrifugal-force cut-off devices.

In the accompanying drawings, illustrating my invention, in which like parts are similarly designated, Figure 1 is a plan view, Fig. 2 an elevation, and Fig. 3 a horizontal section, thereof. Fig. 4 is a view similar to Fig. 3, illustrating rough adjustment. Fig. 5 is a cross-section on line C C of Fig. 3, and Fig. 6 is a modification.

Many governing devices do not respond quickly to the centrifugal governor, and in many the effect on the motor to be regulated lags considerably behind the action of the governor.

The object of my invention is to cause as rapid a response to the controlling device as possible and at the same time produce an effect somewhat larger than that called for by the machine, which effect will gradually be reduced to requirements by means of what I have designated as a "fine adjustment."

I have illustrated my invention as applied to a turbine and operated from the shaft thereof and operating the flume-gate, but it may be operated by any convenient moving element.

The end of the turbine-shaft 2 passes through a framing F, that forms a bed for the adjusting and regulating mechanisms, and below this bed, on the shaft 2 of the turbine, I have shown two pulleys, one of which, 39, operates, by means of a belt 38 and driven pulley 37, the fine adjustment of the flume-gate, while the other, 73, by means of a belt 74 and pulley 72, drives the controller 71, (here shown as a ball-governor.)

On the end of the turbine-shaft 2, above the framing F, is an eccentric 3, connected to a notched reciprocating element or rod 10, that slides in a sleeve or fork 20 (cover-plates 15 16 holding the rod in the required position) and is adapted to be coupled thereto and uncoupled therefrom by the governor and intermediate mechanism, said fork and the engaging devices forming a clutch.

Attached to the fork 20 is a rod or shaft 27, carrying a rotatable sleeve 30, which is secured thereon by a nut 28. This sleeve is supported and rotates in two pillow-blocks 8 and 9 and has mounted on it between them a worm-wheel 4, that engages the sector 5, secured to the spindle 1 of the flume-gate or other cut-off. Secured to this sleeve 30 is a stop-collar 31, which has on either side thereof bevel-gears 33 34, secured on the sleeve by cotters 32, which allow of longitudinal motion of the bevel-gears while they rotate the sleeve. These two gears are secured together and held against the stop-collar by means of springs 35. Below and between these bevel-gears is a pinion 36, which is adapted to engage and drive either of the gears, so as to impart rotation to the sleeve 30. This pinion 36 is driven by a pulley 37, hereinbefore referred to.

The governor 71, driven by pulley 72, as described, whose spindle is suitably supported from the framing F, carries the usual reciprocating sleeve 46, Fig. 5, which operates the bell-crank 45, whose notched end 44 engages a projection 43 to operate the reciprocable slide 40. This slide carries beveled tappets 41 42, one on either side of the fork 20, that are adapted to engage pins 23 24, respectively, said pins operating dogs or pawls 21 22, held normally retracted by springs. These dogs or pawls are adapted to engage notches 11 13 and 12 14 on either side of the reciprocating rod 10 and are held in position in these notches when the pins have been moved during the regulation out of range of the tappets 41 42 by stationary bevel-faced guides 47 48.

Fig. 6 shows a modification in which the rod 27, connected to the fork 20, is pivoted to one end of a shift-lever 50, the other end of which is revoluble about the end of the stem 1 of the flume-gate. This shift-lever is forked or formed with a stirrup and has journaled therein the worm-gear 64, engaging the sector 5, that operates the flume-gate, and on the

axle or stub-shaft of the worm is a ratchet-wheel 56, which is adapted to be engaged by a double pawl 53 54 on the end of a rod 51. This rod 51 is connected by a ball-and-socket or universal joint to a crank 57 on a rod 58, continuously driven from a moving element. A shifting fork or link 52 connects the rod 51 to the shift-lever 50, so that a movement of the shift-lever will carry the pawls with it, and by reason of the radial position of the pawls and the shifting of the ratchet-wheel 56, carried on the stub end of the worm-gear axle, either the one or the other of the pawls 53 54 will operate the ratchet, which in turn moves the worm, sector, and flume or sluice gate.

The operation of the device is as follows: Under normal working, where no regulation is required, the position of the parts will be that shown in Fig. 1, where the rod 10 is free to slide in both directions in the fork or sleeve 20. Any increase in speed due to a decrease of load will cause the balls of the governor 71 to separate, thereby lifting the sleeve 46, Fig. 5, whereby the horizontal arm of the bell-crank lever is lifted and the jaw or yoke 44 pulls the slide 40 toward the governor-spindle, thus causing the tappet 41 to shove the pin 23 and pawl 21 against the stress of the spring 28 toward the reciprocating rod 10, when the pawl will engage one of the notches—say notch 11—and lock the fork 20 to the rod 10 during its movement to the right and pull the connected mechanisms with it a distance equal to the throw of the eccentric, and in the next revolution of the turbine-shaft the tooth will ride over the dog 21 and allow it to drop into the next notch 13, whereby the connected parts are carried still farther to the right a distance of one throw of the eccentric plus the distance between the notches and not more than twice the eccentricity of the operating crank or eccentric; but in the latter case the beveled tappet 41 no longer acts on the pin 23, which during the travel of the whole mechanism to the right was shifted with it, but instead the pin is slid under the beveled stop 47, which keeps the pawl in position, thus locking the rod 10 and sleeve 30 together during motion to the right. This movement of course carries with it the worm 4, which now acts simply as a pawl to pull the sector 5 around, and also carries along the two bevel-gears, one of which, 33, will engage the pinion 36 and be under the stress of the springs 35. By reason of the springs 35 the bevel-gears remain for a much longer time in contact with the pinion than would be the case if they were rigidly mounted on the sleeve, enabling the fine adjustment to take place through a longer period. Motion will be communicated from the pinion 36 through the gear 33 to the sleeve 30, thus rotating the worm 4 and turning the sector 5 back toward normal position and decreasing the power-supply, say, from one to two per cent.

The rough regulation or throw of the eccentric will be varied to suit requirements, but for turbines it will be such as to give an increase of about thirty per cent. of power.

It is obvious that if the speed is decreased below normal by abnormal loads the sleeve 46 will drop and move the slide 40 away from the spindle of the governor, so as to actuate the pawl 22 on the opposite side of the rod 10 and cause it to engage the notches 12 14 and push the mechanism to the left to close the flume-gate and bring the gear 34 into engagement with the pinion 36, so as to return the sector to its normal position, an operation in all respects similar to that for decreasing the speed.

In Fig. 6 it will be seen that movement of the rod 27 in either direction will move the pinion and worm in an arc around the shaft 1 as a center and simultaneously the pawls 53 54 in an arc of greater radius about the crank-pin as a center, thus moving the pinion 56 into engagement with one or the other of the pawls.

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

1. In a governing mechanism, a reciprocating element driven from a moving part, and power-supply-controlling devices, in combination with centrifugally-operated clutch mechanism adapted to engage the same and thereby operate the devices controlling the power-supply and mechanism thereby placed in operation to gradually and partially return the mechanism controlling the power-supply to normal position, substantially as set forth.

2. In a governing mechanism, a reciprocating element driven by a moving part, in combination with centrifugally-operated clutch mechanism adapted to engage the same, a worm-gear adapted to move longitudinally and operate a power-supply-controlling device, and mechanism adapted to revolve said worm and partially return the power-supply-controlling device to normal position.

3. In a governing mechanism, a reciprocating element and centrifugal governor operated from a moving part, a sleeve surrounding the reciprocating element, clutches operated by the governor and carried by said sleeve and adapted to engage the reciprocating element, a shaft having endwise motion connected to the sleeve, a worm thereon adapted to operate by endwise motion, and mechanism for controlling the power-supply, substantially as set forth.

4. In a governing mechanism, a reciprocating notched element and centrifugal governor driven by a moving part, in combination with a fork or sleeve surrounding the reciprocating element, a pawl controlled by said governor and adapted to lock said sleeve and notched element together during motion in one direction, a shaft carried by said fork or sleeve, a hollow shaft on the aforesaid shaft, a worm thereon having endwise motion therewith, said worm controlling and operating

power-supply mechanism, substantially as set forth.

5. In a governing mechanism, a reciprocating element, a governor and pinion driven from a moving part, in combination with a fork, a shaft, a worm and two bevel-gears thereon adapted to have endwise motion and rotate with said shaft, said worm engaging cut-off mechanism, mechanism controlled by the governor adapted to enable the reciprocating element to move the fork and shaft longitudinally and cause one of said gears to engage the pinion, and thereby revolve the worm and shaft and move the cut-off mechanism toward normal position.

6. In a governing mechanism, a pinion and a governor operated from a moving part, in combination with a shaft, a worm-wheel, stop, and bevel-gears on either side of said stop spring-connected and mounted on the shaft, said worm controlling cut-off devices, mechanism controlled by the governor to cause longitudinal motion to be imparted to the shaft and operate the cut-off, cause one of said gears to engage and revolve the pinion-shaft and worm thereon and partially return the cut-off to normal position, and devices for allowing axial motion of the gears on the shaft while spring-held in gear with the pinion, substantially as set forth.

7. In a governing mechanism, the combination with a reciprocating notched element and a centrifugal governor both operated from a moving part; of a sleeve or fork adapted to receive endwise motion from said element and operate cut-off mechanism, a slide operated by the governor, tappets on the slide adapted to operate pawls carried by the fork and cause them to engage the reciprocating element, and stops adapted to hold said pawls in position after having been moved out of range of the tappets, substantially as set forth.

8. In a governing mechanism a reciprocating element driven from the motor-shaft, a sleeve thereon and clutch mechanism adapted to lock said sleeve and element together, a shaft, and devices for controlling cut-off, in combination with a stop on said shaft, bevel-gears on either side thereof yieldingly connected and having axial motion along the shaft, and a bevel-pinion driven from the motor-shaft and adapted to engage and operate the gears to turn said shaft, substantially as set forth.

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

TORKEL J. LENDE.

Witnesses:
L. T. ONE,
PEDER BRŸNE.