(No Model.) 2 Sheets—Sheet 1.

N. C. LOCKE.

REGULATOR.

No. 443,051. Patented Dec. 16, 1890.

Fig. 2.

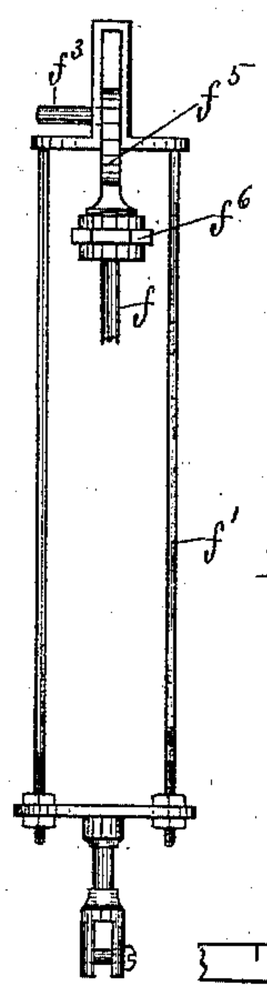
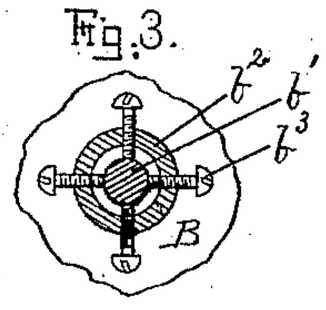


Fig. 1.

Fig. 3.



Witnesses.
Edward S. Beach.
John R. Snow,

Inventor.
Nathaniel C. Locke
by J. R. Maynadier
his Atty

(No Model.) 2 Sheets—Sheet 2.

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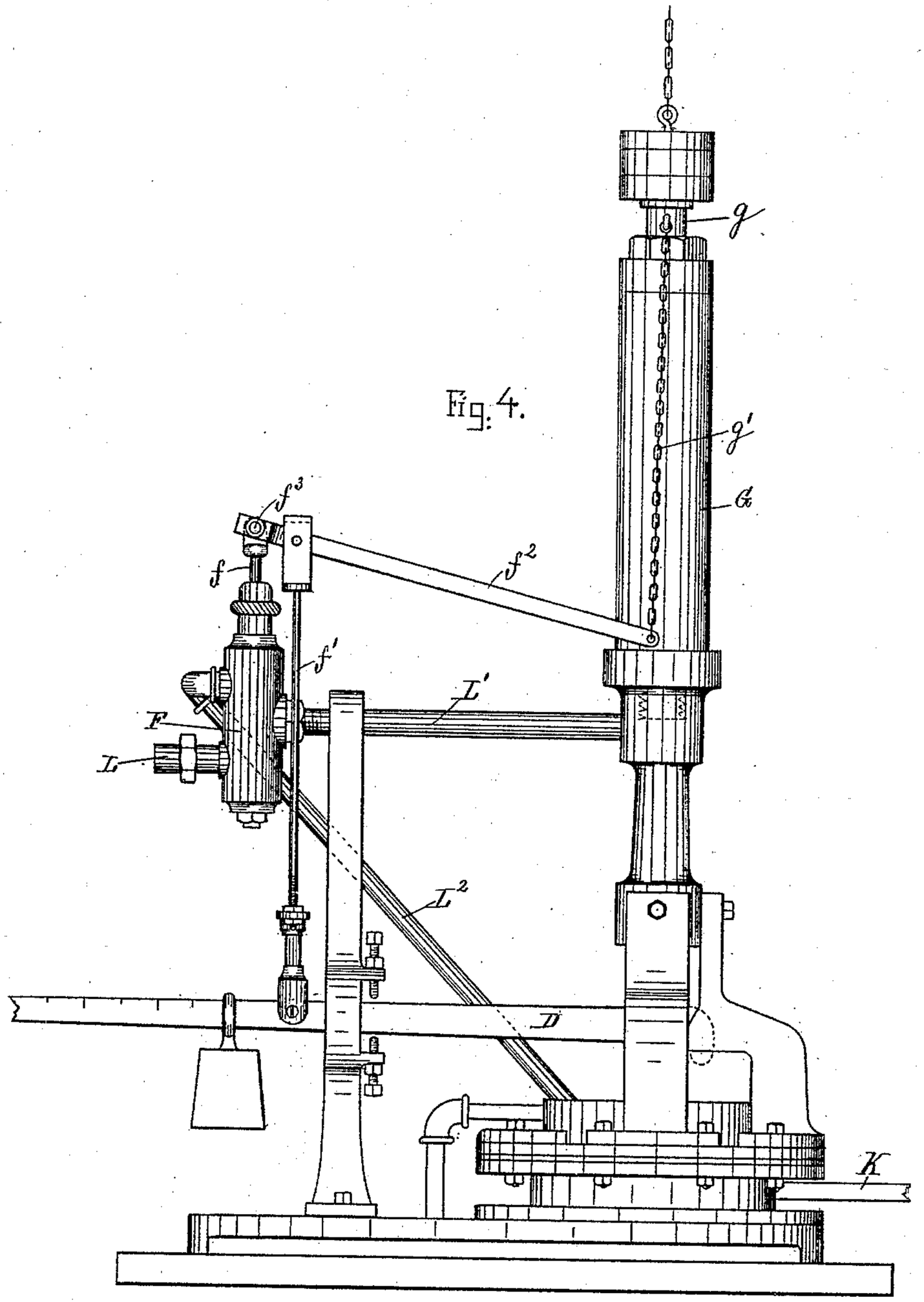
Fig. 4.



Witnesses.
Edward S. Beach.
John R. Snow,

Inventor.
Nathaniel C. Locke
by J. R. Williamson
his Atty

UNITED STATES PATENT OFFICE.

NATHANIEL CHASE LOCKE, OF SALEM, MASSACHUSETTS.

REGULATOR.

SPECIFICATION forming part of Letters Patent No. 443,051, dated December 16, 1890.

Application filed October 20, 1888. Serial No. 288,616. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL CHASE LOCKE, of Salem, in the county of Essex and State of Massachusetts, have invented an Improvement in Regulators, of which the following is a specification, reference being had to the accompanying drawings, making a part thereof, in which—

Figure 1 is a side elevation, partly in section, showing one form of apparatus embodying all the features of my invention. Fig. 2 is a detail showing in side elevation the yoke and one form of device for connecting the valve-stem with the yoke. Fig. 3 is a sectional detail taken at line 3 3 of Fig. 1, and Fig. 4 a side elevation of a modification.

In my patent, No. 335,080, dated January 26, 1886, I show a pressure-regulating apparatus composed of a steam-weighing apparatus and a motor which are combined by means of the scale-beam of the steam-weighing apparatus and the valve of the motor; and my present invention relates to apparatus of this class, and consists, first, in a contrivance for rendering the steam-weighing apparatus sensitive, and, secondly, in a contrivance for increasing the delicacy of operation of the valve.

In the drawings, A is the diaphragm-chamber of the steam-weigher, and *a* its diaphragm.

B is the piston of the diaphragm; *b*, its strut; D, the lever or scale-beam.

Heretofore in the construction of steam-weighing apparatus of this class it has been practically impossible to so adjust the lever D, the strut *b*, and the piston B as to make the apparatus uniformly sensitive to variations of pressure under the diaphragm *a*, and I have discovered that this is because the strut *b* should not always be exactly concentric with the piston B, as was formerly thought to be necessary. My theory is that the diaphragm *a* cannot be made exactly uniform in thickness and strength, and that the pressure under it, therefore, tends to slightly cant the piston B and the strut *b*, and that the lower end of the strut should be nicely adjusted, not with the view of making it exactly concentric with the piston B; but of making it stand in such relation to the piston B as to remedy the slight defects in the diaphragm; and this feature of my invention consists in combining the strut *b* with the piston B by means of the step *b'*, which is adjustable with relation to the piston B, so that the pressure of this strut *b* will not tend to cant the piston B. The most convenient way of mounting the step *b'* is that shown in the drawings, where a box b^2 is formed upon the piston B, which box receives within it the step *b'*, the step being adjusted by means of set-screws b^3, as clearly shown in Figs. 1 and 3, Fig. 3 being a cross-section of the box b^2, showing the set-screws b^3 and the step *b'*. The step *b'* is conveniently held in place before it is finally adjusted by the stem b^4 of piston B, as shown in Fig. 1. After the pressure-weighing apparatus is set up and the pipe K is connected to the boiler or other source of pressure the stem b^4 will cant when the pressure under the diaphragm *a* is counterbalanced by the lever D, and the set-screws b^3 are then adjusted until the stem b^4 ceases to cant, when it will be found that the pressure-weighing apparatus is exceedingly sensitive to minute variations in the pressure under the diaphragm *a;* but what is still more important is that the difficulty heretofore experienced in making such pressure-weighing apparatuses uniform in sensitiveness no longer exists.

Another feature of my invention relates to the valve-stem *f* of the motor-valve F, and this feature of my invention consists in combining the valve-stem *f* with both the steam-pressure device and the piston *g* of motor G, in order that the valve-stem *f* may be moved by motion of the piston *g*, as well as by the steam-pressure device, the motion of the valve-stem *f* from the steam-pressure device being opposed to the motion of valve-stem *f* by the piston *g* of motor G.

In practical operation, where the pressure-weighing device is extremely sensitive, as it should be for the best results, a very slight rise in the pressure to be regulated will operate the valve-stem *f*, the piston B being moved upward by the slight rise of pressure under the diaphragm *a*, and as piston B acts upon lever D by means of strut *b*, the valve-stem *f*, which is attached by yoke *f'* to lever D, will be moved and allow water to flow through the pipes L L' into the cylinder of motor G, and

the water being under pressure will move the piston *g* of motor G; but for the best results the motion of valve-stem *f*, imparted from piston B through strut *b* and lever D, should be sufficient to allow water to flow through the pipes L L′ into the cylinder of motor G, so as to start the piston *g;* but the valve-stem *f* should then move to shut off the flow of water through pipes L L′ while the piston *g* is moving up. In order to obtain this peculiar motion of valve-stem *f*, I connect the valve-stem *f* not only with the piston B, but also with the piston *g* of motor G, but reduce the action of piston *g* upon the valve-stem *f*, so that a considerable motion of piston *g* will give only a slight motion of valve-stem *f*.

It will be obvious that the mechanical details of the connection between the piston *g* and the valve-stem *f* may be widely varied, and that this feature of my invention consists in the combination of valve-stem *f* with both the piston B and the piston *g* of motor G, the valve-stem *f* being thereby given an additional motion opposed to the usual motion in apparatus of this class.

In Fig. 1 the lever f^2 is fast to shaft f^3, and the shaft f^3 is also fast to the eccentric f^4, the eccentric-strap f^5 being connected by the coupling f^6 with the valve-stem *f*. The shaft f^3 is journaled in the upper cross-piece of the yoke *f′*, the lower cross-piece of that yoke being pinned to lever D, (or otherwise connected with piston B.) When the lever D rises, the yoke *f′* is moved up and carries with it the shaft f^3, eccentric f^4, the strap f^5, coupling f^6, and valve-stem *f*, thereby opening the valve and allowing the water to flow through the pipes L L′ and actuate the motor G; but as the piston *g* of motor G rises lever f^2, which is connected with it by the chain *g′*, moves shaft f^3 and eccentric f^4, and thereby forces strap f^5, coupling f^6, and valve-stem *f* downward until the inlet-port of valve F is just closed, so that no more water can flow through pipes L L′, thereby bringing the piston *g* to rest. Should the pressure then further increase under diaphragm *a*, the lever D is again raised by piston B, carrying with it the valve-stem *f*, and the operation is repeated. On the other hand, after the lever D has been raised by piston B, either partially or to its full extent, a decrease of pressure under diaphragm *a* will allow it to fall, and it will carry with it the valve-stem *f*, and thereby open the outlet-port, which connects with the pipe L^2, so that the water from the cylinder of motor G will flow out through the pipes L′ L^2 and the piston *g* will move downward; but the weight of lever f^2 will cause shaft f^3 and eccentric f^4 to partially rotate as the piston *g* moves downward, and thus the valve will close the outlet L^2 and bring the piston *g* to rest, the operation during the downward motion of piston B and of the piston *g* being the reverse of operation during the upward motion of piston B and of the piston *g*.

In Fig. 4 I have modified the lever f^2 by mounting its fulcrum f^3 on the valve-stem *f* and connecting the yoke *f′* by a pin to lever f^2; but this is different in detail of construction merely, as will be plain.

I am aware of Billings's patent, No. 24,608, dated July 5, 1859, and Woodruff's patent, No. 13,711, dated October 23, 1855, and disclaim all that is shown in them.

What I claim is—

1. In a regulator, piston B and strut *b*, in combination with the adjustable step *b′*, all substantially as described.

2. In a pressure-regulating apparatus having a pressure-motor, an auxiliary motor, and a valve controlled by the pressure-motor and controlling the auxiliary motor, the combination of both motors with the spindle of the valve, and with connections to cause the pressure-motor to move the valve-spindle in one direction and the auxiliary motor to move the valve-spindle in the opposite direction, all substantially as and for the purpose specified.

NATHANIEL CHASE LOCKE.

Witnesses:
EDWARD S. BEACH,
JOHN R. SNOW.