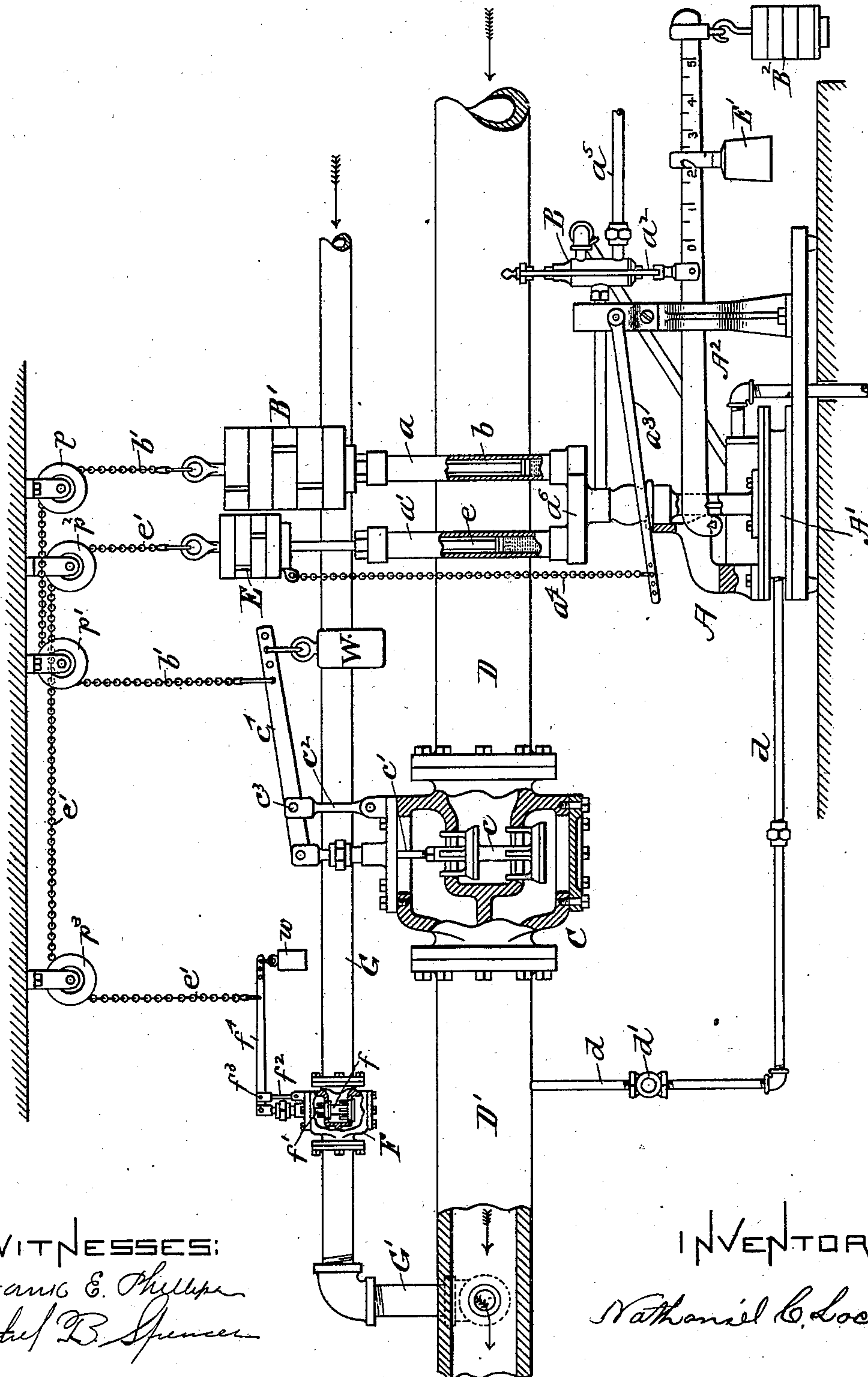


No. 724,481.

PATENTED APR. 7, 1903.

N. C. LOCKE.  
PRESSURE REGULATOR.  
APPLICATION FILED JUNE 25, 1900.

NO MODEL.



WITNESSES:  
Francis E. Phillips  
Ethel B. Spencer

INVENTOR:  
Nathaniel C. Locke



# UNITED STATES PATENT OFFICE.

NATHANIEL C. LOCKE, OF SALEM, MASSACHUSETTS, ASSIGNOR TO LOCKE  
REGULATOR COMPANY, OF SALEM, MASSACHUSETTS, A CORPORATION  
OF MAINE.

## PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 724,481, dated April 7, 1903.

Application filed June 25, 1900. Serial No. 21,474. (No model.)

*To all whom it may concern:*

Be it known that I, NATHANIEL CHASE  
LOCKE, a citizen of the United States, and  
a resident of the city of Salem, county of Es-  
sex, and State of Massachusetts, have invent-  
ed new and useful Improvements in Pressure-  
Regulators, of which the following is a speci-  
fication.

My invention relates to that class of regu-  
lating-valves in which there is a pressure-  
weighing device combined with motors for  
operating the valves to be controlled.

The object of my invention is to produce an  
apparatus having two fluid-motors controlled  
by a single regulator and adapted to control  
the supply of direct and exhaust steam and  
also to produce a very delicate apparatus, so  
that a definite pressure can be maintained at  
a desired point, exhaust-steam being used so  
far as it will go and this being supplemented  
when necessary by direct steam.

To these ends my invention consists of a  
pressure-regulating apparatus the construc-  
tion and arrangement of which will be here-  
inafter described and claimed.

Reference is to be had to the accompanying  
drawing, forming part of this specification,  
in which similar letters of reference refer to  
similar parts.

The figure is an elevation, partly in sec-  
tion, showing a single regulator combined  
with and connected to two motor-valves, one  
controlling the direct and other exhaust  
steam.

In carrying out my invention I use a regu-  
lator A of a well-known type having the  
usual pressure-chamber A' and weighing-le-  
ver A<sup>2</sup>, the latter being fitted with the usual  
weights E' and B<sup>2</sup>. The apparatus has also  
the cut-off lever a<sup>3</sup>, which connects with the  
weights E, hereinafter referred to, so that  
when the weights are raised the cut-off lever  
will be operated so as to control the water-  
pressure in the regulator and in this way pre-  
vent the supply and exhaust of water to the  
motor and the direct valve, hereinafter re-  
ferred to, from being continued too long, so  
as to create too much travel of the steam-valve,  
as this would cause wide fluctuations of pres-  
sure.

Two motor-cylinders a and a' are used, hav-  
ing pistons e and b, which pistons work against  
the weights E and B'. The apparatus is  
shown in connection with an exhaust-pipe D  
and with a direct-steam pipe G, which con-  
nects with the pipe D' by a connection G'.  
The pipe D' can be made to deliver to any de-  
sired chamber, such as the chamber of a pa-  
per-drying machine, where it is desired to  
have a definite steam-pressure.

In the pipe D is a double balance-valve c,  
having a casing C, which connects by means  
of the stem c' with the lever c<sup>4</sup>, which is piv-  
oted, as shown at c<sup>3</sup>, to the swinging support  
c<sup>2</sup>. The lever c<sup>4</sup> has a suitable weight W and  
connects by a chain b'; running over pulleys  
p and p', with weights B'.

The valve f in the casing F is like the valve  
c, except that it is smaller, and it is provided  
with the stem f, connecting through the link  
f' with the lever f<sup>4</sup>, which is fulcrumed and  
supported, as shown at f<sup>3</sup> and f<sup>2</sup>, and pro-  
vided with a weight w. The lever f<sup>4</sup> of the  
valve connects by a chain e', running over  
guide-pulleys p<sup>2</sup> and p<sup>3</sup>, with the weights E.  
The regular is shown in operation and set to  
maintain five pounds of pressure in a hori-  
zontal position by pressure through the pipe  
d, which connects with the exhaust-pipe D'  
and chamber A', where it acts under the dia-  
phragm in the usual manner. The pipe d is  
provided with a suitable check-valve d'.

The motor-piston e and weights E are sup-  
ported in an intermediate position which  
holds the direct-steam valve f closed while  
the exhaust-valve c is fully open and its  
motor-piston b at the bottom of the cylinder a.

When the valves f and c are both open, all  
the exhaust is being used and some direct  
steam to keep up the desired pressure. Should  
less steam be required to maintain the pres-  
sure, the change would be indicated by an in-  
crease of pressure in the pipe D', which  
would be exerted in the chamber A', caus-  
ing the lever A<sup>2</sup> to rise, thus moving up the  
yoke a<sup>2</sup> and opening a passage in the valve  
B for water under pressure from the pipe  
a<sup>5</sup> to the chamber a<sup>6</sup> and under piston e,  
raising the weights E and allowing the  
weight w to fall and close the direct-steam



valve *f*. When the weights *E* are raised fully, they lift the lever  $\alpha^3$  and cut off the pressure to the valve *B* in any well-known manner or as set forth in my United States Patent No. 393,164 of November 20, 1888.

If shutting off the direct steam be sufficient to reduce the pressure in the pipe *D'* to five pounds, the lever  $A^2$  would fall to a horizontal position, closing both the supply and exhaust in the valve *B*, preventing the water from escaping from the cylinder  $\alpha'$ , and supporting the weights *E*, at the same time preventing the valve *f* from opening by reason of the pressure from the weight on the piston *b*; but should this prove insufficient to reduce the pressure to five pounds the water-pressure in the chamber  $\alpha^6$  would increase until it raised the piston *b* and weights *B* and partially or wholly closed the exhaust-valve *c*.

The construction of the pressure device, with exception of the double motors, is similar to that shown and described in United States Patent No. 393,164, issued to me November 20, 1888. One important and indispensable feature of these improvements consists in heavily weighting the piston operating the exhaust-valve, while the piston connected with the direct-steam valve would carry only a small amount of weight. Without this arrangement of weights the regulator would be inoperative. As the weights on the exhaust-valve are the heavier, the exhaust-valve would be the first to open. When a further discharge of water had caused the lighter-weighted piston in connection with the direct valve to fall, it would be the first to rise upon the admission of water, thereby shutting off the direct steam before any movement was made tending to close the exhaust-valve. It will be understood that springs can be substituted for weights on the motor-cylinders without changing the nature of the invention.

From the foregoing description and by reference to the drawing it will be seen that this apparatus is a regulator having the function of two separate machines, for the reason that while its pressure-weighting device is single and is always operated by one pressure or the pressure at one point, yet it is capable of controlling and regulating two independent sources of fluid-supply through the medium of the two hydraulic motors described. These two independent motors are made to perform the office of controlling the admission of steam from two different sources by the differential arrangement of weights. If they were weighted alike, they would both open at once and derange and destroy the function of the regulator, because while one regulator would be operating the large valve *c* for the admission of exhaust-steam the other would at the same time be admitting live

steam, which would not be needed. Usually the live steam would be controlled by, say, a two-inch valve, while the exhaust-steam would be controlled by a six or seven inch valve or valves about in the ratio given. The live steam is simply a reserve supply at a much higher pressure to be drawn on only when it is needed or when the exhaust-steam fails to do its work. Consequently the regulator operates the exhaust-valve through the motor *A B* until the valve is fully opened. Then if the full supply is not sufficient to support the weights on the lever of the steam-weighting device water is exhausted from the cylinder *e*, connected with the live steam, and the valve *f* is opened more or less, according to need.

In order that the smaller valve *F* may not be opened or operated until necessity demands, the weights upon the motor  $\alpha' e$ , controlling this valve, are much less than the weights on the motor connected with the exhaust-valve. It will be readily understood that when the water is exhausted from the base  $\alpha^6$  of the two motors the piston having a larger amount of weight will first begin to fall, and the pressure cannot be possibly reduced sufficient to allow the one with the light weight to fall until after the heavier-weighted motor-piston has reached the bottom of the cylinder. Then the water-pressure will immediately fall low enough to allow the weight on the other motor to begin to operate.

It will be clearly seen, then, that the regulating device performs the functions of two separate machines, and by reason of the nicety of regulation it will be observed that a very accurate pressure can be maintained at the point where the steam is delivered by the pipe *D'*.

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

An apparatus of the kind described, comprising two independent valve-controlling motors, direct and exhaust steam pipes discharging into a common pipe, a valve in each pipe controlled by the motors, one of said motors being inoperative until the other has operated to its limit, whereby the valve in the direct pipe remains closed until the valve in the exhaust-pipe is entirely open, the motors being controlled by the pressure in the common pipe, and controlling means operated by the direct valve-operating motor to cut off the pressure common to the motors.

In testimony that I claim the foregoing as my invention I have hereunto subscribed my name in the presence of two witnesses.

NATHANIEL C. LOCKE.

Witnesses:

FRANK E. LOCKE,  
LILLIE V. HARDING.