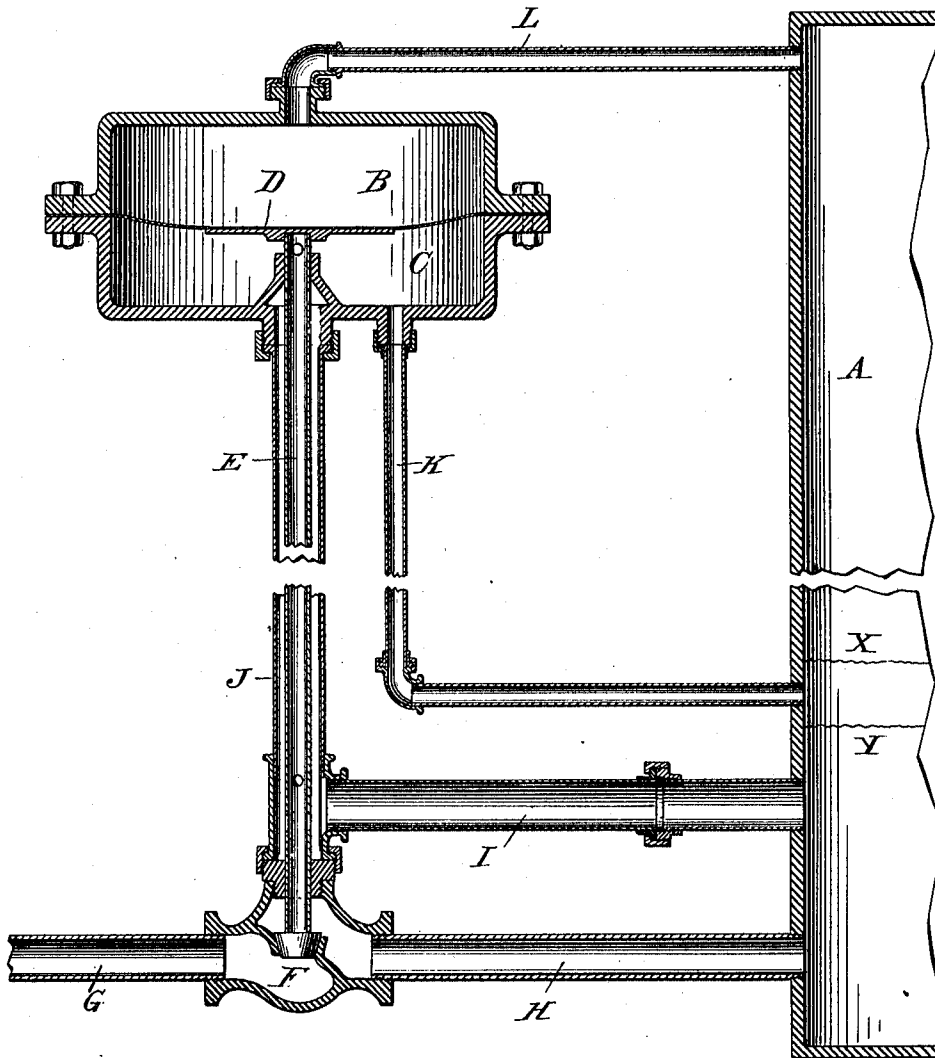


S. COOK.
APPARATUS FOR CONTROLLING THE FLOW OF LIQUIDS OR GASES.
APPLICATION FILED DEC. 14, 1908.

1,004,629.

Patented Oct. 3, 1911.



Witnesses:
Edward Douglas,
M. F. Keating

Inventor
Samuel Cook
By Attorney
Charles J. Kintner

UNITED STATES PATENT OFFICE.

SAMUEL COOK, OF WILMERDING, PENNSYLVANIA, ASSIGNOR TO MARTIN ERGENZINGER, OF ATLANTA, GEORGIA.

APPARATUS FOR CONTROLLING THE FLOW OF LIQUIDS OR GASES.

1,004,629.

Specification of Letters Patent.

Patented Oct. 3, 1911.

Application filed December 14, 1908. Serial No. 467,549.

To all whom it may concern:

Be it known that I, SAMUEL COOK, a citizen of the United States, and resident of Wilmerding, county of Allegheny, and State of Pennsylvania, have made a new and useful Invention in Apparatus for Controlling the Flow of Liquids or Gases, of which the following is a specification.

My invention is directed particularly to a novel apparatus for controlling the flow of a liquid or a gas under pressure into a water or gas tight chamber through the combined agencies of proportional and differential pressures, and the pressure of the water or gas itself as the same enters such chamber, the proportional and differential pressures being exerted by a liquid and a vapor or gas held within the chamber and in such manner as to alternately admit the liquid or gas being controlled into the chamber, or stop the flow thereof as the same alternately assumes different points of level in the chamber, my improved method and apparatus being especially applicable in connection with systems of energy, such as steam boiler plants or systems of gas consumption, or having use generally where it is desired to periodically regulate the admission of a liquid or gaseous agent under pressure into a chamber or boiler from which the vapor or gaseous agent is to be utilized at a point or points extraneous to the containing chamber or boiler.

My invention will be fully understood by referring to the accompanying drawing which is a sectional view of the preferred form of my novel apparatus, illustrating the same as attached to a steam boiler on one side and provided with means for attaching it on the other side with a source of water supply under pressure, as a tank, a steam force pump, or the like.

Referring to the drawing in detail, A represents in the present instance a steam boiler, B—C the two chambers of a pressure regulator separated from each other by an elastic or yielding diaphragm D secured in turn through a metallic plate to a hollow or tubular valve stem E sustaining at its lower end a valve F adapted to be seated in a valve seat in a coupling connected on one side to a water pipe G running to a source of water supply under pressure, as a tank or a steam pump, and on the other to a

similar pipe H running to the bottom of the boiler.

I is a water circulating pipe operatively connecting the boiler A with a tube or stand pipe J which surrounds the valve stem E and is connected in turn at its upper end to the base of the pressure regulator and at its lower end to the coupling in which the valve F is seated. K is a second pipe of smaller cross section than the pipe I, said pipe connecting the boiler A at a point above the level of the pipe I and the lower chamber C of the pressure regulator, L being a pipe entirely similar to the pipe K connecting the upper interior surface of the boiler with the upper chamber B of the regulator. The valve stem E is tubular in form, as before stated, to give it the necessary lightness and is provided at its opposite ends with holes for permitting of the free circulation of the water therethrough and thereby giving to it sufficient strength with lightness of structure, the arrangement being such that there is a free circulation of water through the circulating pipe I, the stand-pipe J, valve stem E, chamber C and pipe K.

The operation, if used for the purpose of feeding water to a steam boiler A, is as follows:—A cock, not shown but located in the water supply pipe G, is first opened and water allowed to enter, the pressure thereof being sufficient to lift the valve F off its seat, thus allowing the water to enter the boiler A through the pipe H and it thus continues to flow until the water reaches the desired starting level at X above the inlet to the pipe K, as will be indicated on the usual glass level indicators on boilers, but not shown in the drawing. The cock is now closed and a fire built under the boiler. As soon, therefore, as pressure enough, due to the generation of steam on the surface of the water at the level X, is exerted, such steam will flow through the upper pipe L and into the upper chamber B of the pressure regulator, ultimately seating the valve F, so that when pressure is had to the desired limit the cock in the pipe G may be opened and the valve will be held seated against the incoming water dependent upon the pressure of the steam in the boiler A and the elevation of water in J, and after the cock is thus opened the operation will be automatic, it being ap-

parent that when steam enough has been used in the external plant, to which the boiler is connected, to cause the water to drop from the level X to a lower level approximating the level Y, there will be equal or differential pressures upon the top and bottom of the diaphragm D from opposite sides thereof so that the elasticity of said diaphragm, acting with the pressure of the water in the pipe G, unseats the valve F and water is again allowed to flow through the pipe H into the boiler A until the level X is again reached.

The height to which the water will ascend in the chamber or boiler under the initial pressure by which it is forced into the same through the pipe G and valve F will depend upon the steam pressure in the chamber as compared with the initial pressure by which the water is forced therein. The water, however, will cease to flow into the chamber or boiler when the pressure in the chamber B is greater than the pressure against the valve F, and this will only occur when the pressure required to lift the volume of water into the chamber C is such as to allow the predominant pressure upon the upper face of the diaphragm D to act upon the valve. When the water falls to the level Y in the chamber or boiler, as before stated, the pressure being equal on opposite sides of the diaphragm will be balanced, thus allowing the valve to be opened in the manner already described. As the water ascends during the filling of the chamber or boiler a certain volume of water will naturally be found in the pipe K; at least in the horizontal portion thereof and in the vertical portion equaling the level of the water in the boiler, and at this time it is probable that condensation of such steam as had entered the chamber C takes place, thereby making it possible for the increased pressure in the chamber B to act as before stated. As the steam in the boiler is utilized from time to time in the exterior plant the water, of course, will descend again ultimately to the lower level Y, when the differential pressures, as before described, on the opposite faces of the diaphragm D will permit the pressure in the pipe G to again open the valve F, so that this operation will be automatically repeated by the successive steps described and in the manner indicated. By such an arrangement, therefore, I am enabled through differential and proportional pressures, of the steam on one side and the water on the other, to effect the automatic regulation of water to a boiler.

By the expression "differential pressures" hereinbefore used, I wish to be understood as meaning the opposing pressures in the chambers B and C through the agency of a

confined vapor or gas under pressure when simultaneously acting in said chambers and in such manner that the force of the liquid or gas being admitted through the valve F will unseat the same. By the expression "proportional pressures" I wish to be understood as meaning the pressures exerted in one of the chambers, as B, by the force of a confined gas or steam, and the diminished pressure acting in the other chamber C, due to the energy required of the confined gas or steam in elevating the liquid through the pipes K and J in such manner as to give a diminished pressure, so that the valve F will be seated when the pressure of the gas or vapor in the upper chamber B overcomes the diminished pressure in the lower chamber C to such an extent as to enable the regulator to effectually seat the valve F in the pipe G against the constantly acting pressure of the liquid or gas flowing there-through.

My novel apparatus is equally effective in all places where it is desired to use gases under pressure, and my invention is, therefore, applicable to various uses in the arts, it being apparent to those skilled in the art of such regulators that for uses generally I may substitute a liquid chamber in place of the boiler A and connect such chamber to the source of gas or liquid supply on one side and the source of regulation on the other, and my invention is intended to be of such scope as to be applicable generally in the arts where the regulation of the flow of either a gas or a liquid is to be effected automatically through differences and proportions of pressure. To illustrate the various uses to which my invention may be put, it may be so constructed and arranged as to constitute a gas regulator, or a means of regulation for a feed water heater, or a means of regulation for a steam-trap, or a water-wheel governor; in short, anywhere where differential and proportional pressures may effect the regulation of the flow of a liquid or a gas designed to be efficiently used in the arts, and my claims are designed to be of such scope as to include all such uses.

In the practice of my novel method and the use of the apparatus hereinbefore described in connection with confined gases, where it is desired to utilize gas from the chamber A at a lower pressure than the supply pressure of the gas stored in the supply chamber connected with the pipe G, the mode of operation is slightly different, to the extent that the gas is never permitted to enter the pipes K and J. To illustrate, suppose it is desired to supply gas at say 20 pounds pressure from the chamber A to an outlying plant of gas lamps, the original or supply chamber connected to the pipe G

holding a supply of gas at a pressure of 200 pounds. The chamber A is first filled with a liquid, as oil or water, preferably a light oil, to some definite point above the point X; the
 5 cock in the pipe G is opened and gas permitted to flow therethrough until the supply in the chamber A has attained the pressure of twenty pounds per square inch, in which event this pressure acting in chamber B will
 10 force the valve F to its seat, in spite of the slight retarding pressure of the oil in pipes J and K upon the confined air or gas in chamber C. As the pressure, therefore, decreases in the exterior service pipes the
 15 valve will be successively opened and in like manner will be successively closed when the pressure has attained the proper proportions in the chamber A. It will be apparent, therefore, that the application of my method
 20 and the use of my apparatus hereinbefore described is equally efficacious with gases under pressure.

I do not limit myself to the use of the especial structural arrangement illustrated in the drawings for practicing my novel method; that is to a regulator in which the variable pressures are utilized upon the opposite faces of a diaphragm, as obviously this structural arrangement might be departed
 25 from and still come within the scope of my claims hereinafter. To illustrate, a piston secured to the upper end of the valve stem E might supplant the diaphragm, said piston having movement back and forth within
 30 the cylindrical inner surface of the pressure regulator; such an arrangement, however, I would not deem as efficient as the diaphragm structure owing to the friction of such piston, but such an arrangement I should deem
 35 as coming fully within the scope of my claims.

Having thus described my invention what I claim and desire to secure by Letters Patent of the United States is—

45 1. In a device of the character described, the combination of a vessel, fluid inlet and outlet pipes therefor, a valve in one of said pipes, and a casing having a movable partition therein, said partition being connected
 50 to said valve, a pipe connecting said vessel and said casing above said partition, and a plurality of pipes connecting said vessel and said casing below said partition, substantially as described.

55 2. In a device of the character described, the combination of a vessel, fluid inlet and outlet pipes therefor, a valve in one of said pipes, a casing having a movable partition therein, said partition being connected to
 60 said pipes, a pipe leading from the top of said casing into said vessel near its top, and a plurality of pipes connecting the bottom of said casing with said vessel, said pipes en-

tering said vessel at different levels and near the bottom of said vessel, whereby when the
 65 pressure in said vessel is diminished below a predetermined limit, said valve is opened and fluid under pressure is allowed to flow into said vessel, and whereby when the pressure in said vessel has been restored to a
 70 predetermined limit, said valve is automatically closed, substantially as described.

3. Means for effecting the flow of a liquid or gas under pressure into a chamber containing a liquid and a vapor or gas under
 75 lower pressure; comprising a pipe operatively connecting the chamber with the source of liquid or gas supply; a valve seated in said pipe and operatively connected by a valve stem with the movable part of a
 80 regulator embracing a two-part chamber; in combination with a tube or stand pipe operatively connected at one end with the chamber into which the liquid or gas is being admitted and at the other with the lower
 85 chamber of the regulator, each chamber of the regulator being operatively connected by additional pipes with the first-named chamber, substantially as described.

4. Means for effecting the flow of a liquid or gas under pressure into a chamber containing a liquid and a vapor or gas under lower pressure; said means consisting of a valve having a stem operatively connected
 90 with the movable part of a regulator provided with a plurality of chambers, each of which is connected by a pipe to the first-named chamber; in combination with a water circulating pipe and a tube or stand pipe
 95 operatively connecting the lower chamber of the regulator with the first-named chamber, substantially as described.

5. In a system of energy a steam boiler; a pressure regulator therefor having a two-part
 100 chamber and a movable part located therein; a source of water supply under pressure and operatively connected by a pipe with the boiler; a valve in said pipe and a valve stem operatively connecting the valve with the movable part of the regulator; a tube or
 110 stand pipe surrounding said valve stem and a water circulating pipe operatively connecting said stand-pipe with the boiler; in combination with steam pipes which operatively connect the boiler respectively with the two
 115 chambers of the regulator, the upper one of said steam pipes connecting the upper chamber of the regulator with the boiler at the upper edge thereof, and the lower one connecting the lower chamber of the regulator with the boiler at a point slightly
 120 above the inlet to the water circulating pipe, whereby the balancing effect due to the elevation of the water and of the steam in the two pipes upon the movable part of the
 125 regulator permits the water under pressure

to open the valve when the water in the boiler reaches a point below the lower end of the lower steam pipe and permits water to enter the boiler until the lower steam pipe is filled with water, substantially as described.

In testimony whereof I have signed my

name to this specification in the presence of two subscribing witnesses.

SAMUEL COOK.

Witnesses:

MARTIN ERGENZINGER,
C. J. KINTNER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
