

958,726.

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# UNITED STATES PATENT OFFICE.

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VOLUME REGULATOR AND INDICATOR.

958,726.

Specification of Letters Patent.

Patented May 24, 1910.

Application filed December 30, 1908. Serial No. 470,055.

To all whom it may concern:

Be it known that I, FRANK L. CROSS, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Volume Regulators and Indicators, of which the following is a specification, reference being had therein to the accompanying drawings.

In the manufacture of certain kinds of illuminating and fuel gases, and the like wherein steam is admitted to the generating system at some stage or step in the process, it is necessary, in order to obtain uniformity in the product, that a definite volume of steam be delivered to the apparatus during a certain period of time and that it be readily ascertained by the operator that this required volume is being provided.

This invention relates to a volume regulating and indicating apparatus for air, gas or steam adapted for use in a gas generating or other like system which is adapted to be read directly in units of volume without calculation on the part of the operator.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

The drawing is a view, largely diagrammatic, of a volume regulator and indicator embodying features of the invention.

The drawing is herein illustrated in connection with a gas producer indicated at 1, of the type wherein steam is forced into it from its ends alternately, as through an inlet 2 and outlet 3, an intake 4 and exhaust 5, suitable shut-off valves 6 with tee 7 and conventional fittings being used to accomplish this, and the steam being supplied from any convenient source of generation through a main 8.

A constant pressure regulator 9 of any preferred type receives the steam from the main and discharges it at a uniform initial pressure through a throttle valve 10 into a steam separator 11 of any suitable form. A disk or diaphragm 12 with apertures 13, is placed in the outlet of the separator and a registering pressure gage 14 set to read in

absolute pressure is connected to the separator interior to indicate the pressure maintained therein at all times.

The weight or pounds per minute of gas, steam or the like passing through an orifice is expressed by the following formula

$$w = \frac{6}{7} a p c$$

in which  $w$  = pounds per minute,  $a$  is the area of the orifice,  $p$  the pressure and  $c$  a constant depending on the nature of the orifice, and, in a thin disk, being .63. If  $w$  be made equal to  $p$  in the formula, a definite value for  $a$  or a certain definite area is found for the orifice. This area is given the aperture 13 in the disk 12 and the weight per unit of time delivered therethrough, or pounds of steam per minute, is consequently equal to the initial pressure, or pounds pressure at which the steam is delivered to the disk. As the latter is registered by the pressure gage, the operator can, by a glance at the dial of the gage, instantly see how much steam is passing through the disk, a reading of ten pounds, for example, on the gage meaning that ten pounds of steam per minute is passing through the disk. Furthermore, the size of the main is so proportioned in relation to the orifice that the pressure of steam as it issues from the orifice is not more than three fifths of the initial or gage pressure, as under this arrangement, any fluctuations in the back pressure in the system beyond the disk will not affect the velocity of the steam passing through the orifice.

The throttle valve 10 is preferably adapted to be locked when set at any point. It is used as a convenient means for increasing or decreasing the pressure of steam entering the separator, instead of re-adjusting the automatic pressure regulator 9 in case it is desired to change the volume of steam which may be done by increasing or decreasing the pressure of steam delivered to the separator.

While the steam separator herein shown is a convenient place for attaching the self-

registering pressure gage, it is not necessary that it be placed here, as it may be connected to the main anywhere between the throttle valve and the diaphragm. The separator itself may be omitted where dry gas is to be used, or where the disk is placed in a vertical means, the diaphragm being placed in a suitable fitting in the main itself. By this arrangement the operator is enabled to set the apparatus to deliver any required amount of steam and can also see how much steam is being forced into the producer.

The disk may be replaced by any form of reductor whose constant is known or is readily determined, and other changes in the details of the construction may be made without departing from the spirit of the invention and I do not care to limit myself to any particular form or arrangement of parts.

What I claim as my invention is:—

1. A volume regulator for steam or gas comprising in combination a supply main, regulating means constructed to automatically maintain a constant initial pressure in the main, means constructed to automatically indicate the initial absolute pressure in the main, and a reducing means located in the main beyond the pressure indicator means constructed to discharge units in weight, per unit of time, equal in number to the units of absolute pressure indicated by the pressure gage.

2. A volume regulator and indicator for steam or gas comprising in combination a supply main, regulating means constructed to automatically maintain a constant initial pressure in the main, means located in the main for changing the pressure beyond the regulating means to any desired point, means adapted to automatically indicate the initial absolute pressure in the main, and a diaphragm in the main beyond the registering means having an aperture through which the contents of the main is discharged, adapted to discharge units of weight per unit of time equal in number to the units of absolute pressure shown by the indicating means.

3. A volume regulator and indicator for steam or gas comprising in combination a supply main, regulating means constructed to automatically maintain a constant initial pressure in the main, means located in the main for changing the pressure beyond the regulating means to any desired point, means adapted to automatically indicate the initial absolute pressure in the main, and reducing means through which the contents of the main is discharged, adapted to discharge units in weight per unit of time equal in number to the units of absolute pressure shown by the indicating means.

4. A volume regulator and indicator for steam or gas comprising in combination a supply main, a regulating valve in the main adapted to automatically maintain a constant initial pressure in the main, means adapted to change the pressure beyond the regulating valve in the main to any desired point, means beyond the reducing means adapted to automatically indicate the pressure in the main, and a diaphragm in the main beyond the registering means having an aperture through which the contents of the main is discharged adapted to deliver units of weight per unit of time equal in number to the units of absolute pressure shown by the indicating means.

5. A volume regulator and indicator for steam or gas comprising in combination a supply main, an automatic pressure regulating valve in the main, a throttle valve in the main, beyond the regulating valve, an automatic pressure indicating gage connected to the main beyond the throttle valve, and a diaphragm in the main beyond the gage having a restricted aperture through which the contents of the main is discharged, adapted to deliver units of weight per unit of time equal in number to the units of absolute pressure indicated by the gage.

6. The combination with a gas producer of means for introducing a definite volume of steam thereto comprising a supply main, a steam separator connected to the producer into which the main discharges, means located in the main and adapted to automatically maintain a constant initial pressure in the steam supplied to the separator, means adapted to indicate the pressure in the separator, and means governing the discharge from the separator to the producer adapted to deliver units in weight of steam per unit of time equal in number to the units of absolute pressure shown in the indicating means.

7. The combination with a gas producer of means for introducing a definite volume of steam thereto in a predetermined period of time comprising a supply main, a steam separator connected to the producer into which the main discharges, means located in the main adapted to automatically maintain a constant initial pressure in the steam supplied to the separator, means adapted to indicate the pressure in the separator in pounds of absolute pressure, and a diaphragm in the separator having a restricted outlet adapted to deliver pounds weight per minute into the producer equal in number to the pounds of absolute pressure shown on the recording gage.

8. The combination with a gas producer of means for introducing a definite volume of steam thereto, comprising a supply main, an automatic pressure regulating valve therein, a reducing throttle valve in the main

beyond the regulating valve, a steam separator beyond the throttle valve, a self-registering pressure gage on the separator reading in pounds of absolute pressure, and a diaphragm in the separator having a restricted opening through which the steam passes into the producer, adapted to deliver the same number of pounds in weight per minute as

are indicated in pounds of absolute pressure on the recording gage. 10

In testimony whereof I affix my signature in presence of two witnesses.

FRANK L. CROSS.

Witnesses:

C. R. STICKNEY,  
ADOLPH BARTHEL.