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PATENT



SPECIFICATION

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COMPLETE SPECIFICATION.

**Improvements in Means for Measuring and Registering the Flow of Gases.**

(Communicated by **POULENC FRÈRES**, of 92, rue Vieille du Temple, Paris, and **JEAN GOHIN**, of 10, Avenue de Paris, Choisy-le-Roi, both in the Republic of France, Manufacturers and Chemist respectively.)

I, **WILLIAM PHILLIPS THOMPSON**, F.C.S., M.I.M.E., Agent for Foreign Patent Solicitors, of 12, Church Street, Liverpool, in the County of Lancaster, Civil Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improved device for measuring and registering the flow of gases of the type operated by a difference in pressure along a pipe due to a constriction therein, this difference in pressure controlling the flow of a liquid, the total volume of which becomes a function of the total volume of gas passing along the pipe.

The measuring and registering device of the present invention has a constriction interposed in the passage of the fluid the change of pressure due to which is adapted to cause a change of level between two reservoirs of liquid communicating with the passage before and after the constriction respectively, which variation of level is compensated for at each moment by a retrograde circulation of this liquid provided by external agency, the integral volume of which as measured by a totalizing meter as a direct reading, is a function of the total flow of the gaseous fluid.

The invention is more particularly described with reference to the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of a complete arrangement.

Figure 2 is a cross section elevation of part of the apparatus.

A pair of chambers 1 and 2 are each connected at their upper part with the conduit 3 through which passes the fluid the discharge or flow of which is to be measured. Between the two connections 1' and 2' there is a constriction 4.

Water is introduced into the chambers 1 and 2 which are connected by the pipe 5, up to the level of the line X—X marked in the reservoir 1 by an overflow with a tap 6.

The fluid flowing in the main 3 in the direction indicated by the arrow, a fall of pressure occurs beyond the constriction or contraction 4 and a rise in front thereof so that the water level between 1 and 2 tends to change. A pump arrangement 7, however, of any suitable kind, constantly re-establishes the level X—X by sending by the pipe 8 an excess of water from 2 to 1. This

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pump 7 draws from the chamber 2 at the same level as the overflow from the chamber 1.

It is by measuring the flow of the water which is thus set in circulation that the flow of the gas is obtained by reading off the result on a liquid meter of any suitable kind, interposed at 9. 5

In fact the discharge of the fluid passed through the constriction 4 is given as a function of the pressure  $P$  of the fluid and of the difference in pressure  $\delta$  before and after passage through the constriction by a formula which is quite sufficiently exact in all cases.

Where  $Q$  is the volume of the fluid passing in the pipe 3 when it remains 10 at a constant pressure  $P$ , then

$$Q = K\sqrt{P\delta}.$$

On the other hand the flow of water returned from 2 to 1 is a function of the pressure  $\delta$  according to the formula, whereby the volume

$$q = C\sqrt{\delta}. \quad 15$$

If it is a question of dealing with a fluid  $P$  under constant pressure, the formula may be written as

$$\begin{aligned} Q &= K^1\sqrt{\delta} \\ q &= K^{11}Q \end{aligned}$$

that is to say the flow of the water is proportionate to the flow of the fluid. 20

It is easy also to modify the characteristics of the apparatus in order that

$$q = Q.$$

In case the pressure  $P$  is not constant, recourse must be had to a supplementary arrangement, shown in Fig. 2, in which a slide valve acts on the section of a contraction or constriction 14 inserted in the pipe 5 through which 25 the water flows.

The density of the gas is assumed to be proportional to the pressure, the temperature not varying.

It may, in fact, be stated that the constant  $C$  is connected to the section  $\Omega$  of the contraction 14 by a simple formula. 30

$$C = K^{111}\Omega.$$

Consequently to obtain  $q = Q$  it is necessary that

$$K\sqrt{P} = K^{111}\Omega$$

that is to say  $\Omega = \lambda\sqrt{P}$ .

It is, therefore, sufficient that the section of the constriction 14 shall vary 35 as the square root of the pressure  $P$  of the fluid which passes through the main conduit in order that the flow of liquid registered at 9 shall be the measure of the flow of liquid passed through 4.

A grooved piston 10 moving in a cylinder 11 is subjected on the one hand, directly (in the arrangement shown, through the pipe 5) or otherwise, to the 40 action of the fluid passing along the pipe 3 and on the other hand to atmospheric pressure assisted by the action of an opposing spring 12, to automatically displace a slide valve 13 whereby the open area of the valve 14 is maintained proportional to the value of  $\sqrt{P}$ .

Under these conditions the flow of water will remain proportionate or equal 45 to that of the fluid which circulates in the main conduit, that is to say, that the readings at the meter 9 will give the amount of flow sought for.

If the fluid to be measured is steam, and condensation at 1 or 2 might falsify the readings, were it not that the over-flow with its valve 6 maintains 50 the total quantity of water to the exact volume necessary.

As has been stated the pump may be of any suitable kind, centrifugal steam turbo-pump, or a steam pump actuated by the fluid itself which is to be measured.

Similarly the meter 9 may be of any suitable kind.

5 Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, as communicated to me by my foreign correspondents, I declare that what I claim is:—

1. A measuring and registering device for the flow of gaseous fluids (air, steam, and the like) in which a constriction interposed in the passage of the  
10 fluid the change of pressure due to which is adapted to cause a change of level between two reservoirs of liquid communicating with the passage before and after the constriction respectively, which variation of level is compensated for at each moment by a retrograde circulation of this liquid provided by external agency, the integral volume of which as measured by a totalizing meter as a  
15 direct reading is a function of the total flow of the gaseous fluid, substantially as described.

2. A measuring and registering device as claimed in Claim 1 in which a slide valve uncovering a sectional opening proportionate to the square root of the pressure of the gaseous fluid is arranged to control the liquid flow to com-  
20 pensate for variations of this pressure, substantially as described.

3. A measuring and registering device substantially as described with reference to the accompanying drawings.

Dated this 26th day of May, 1919.

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Fig.1.

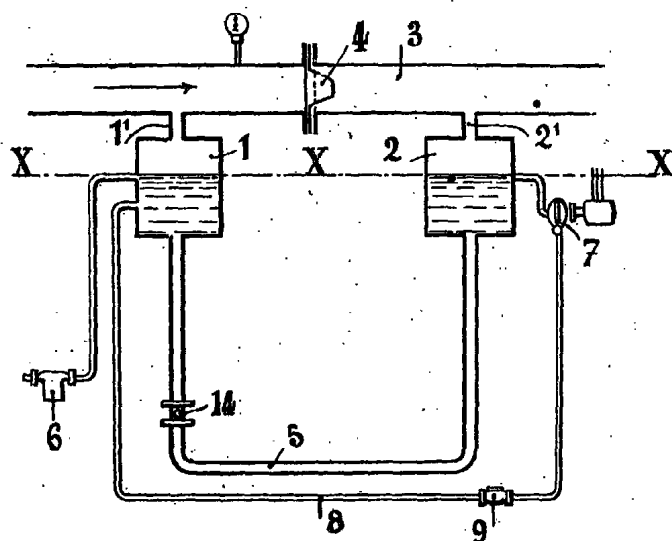
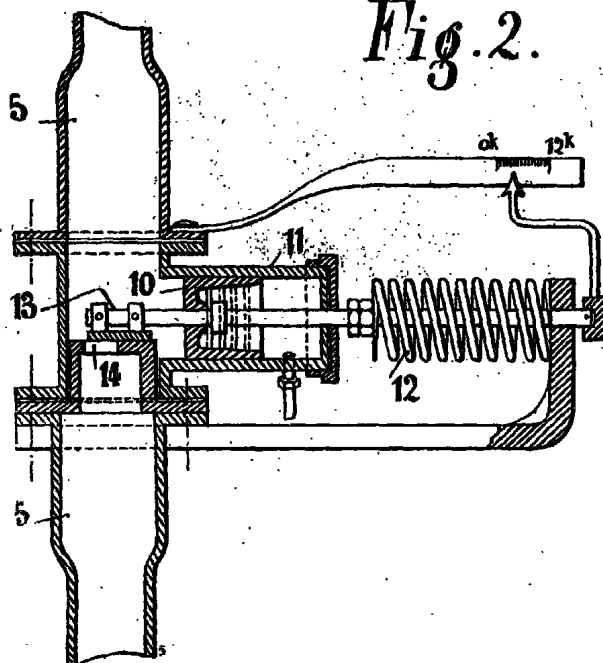


Fig.2.



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