APPARATUS FOR GAS ANALYSIS
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Fig. 2.

Fig. 3.

Witnesses:

Inventor:

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To all whom it may concern:

Be it known that I, Emil Schatz, a subject of the German Emperor, and a resident of Dannenstrasse 30, Frankfort-on-the-Main, Germany, have invented certain new and useful Improvements in Apparatus for Use in Analyzing Gas, of which the following is a specification.

This invention has reference to improvements in apparatus for use in analyzing gas, and more particularly in that class of apparatus in which the analysis is carried out in the known manner by ascertaining what proportion of a measured volume of gas is taken up in passing through an absorbing fluid.

In my improved apparatus the gas is not, as heretofore, forced into the measuring-chamber, but is sucked or drawn therein by means of a suitable pump, so that in filling that chamber there is no compression of gas, and, further, the proportion of the gas absorbed is very easily and exactly ascertained by means of simple devices without having to regulate the absorbing fluid, as is necessary in the known apparatus of this kind.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 shows the complete apparatus diagrammatically, and Figs. 2 and 3 show variations in the construction and arrangement of one part of said apparatus.

Referring to the drawings, b is the measuring-chamber, into which the gas is sucked through the pipe a by a suitable pump of usual construction, said chamber having no connection with the atmosphere. This sucking in of the gas into the measuring-chamber is preferable to forcing it in, as, in the first place, it obviates any compression of the gas, and, secondly, the pumps generally used for this purpose act quicker as suction than as force pumps.

The measuring-chamber b is mounted in a tank d, into which water runs slowly from a reservoir e through a pipe f. When the water rises in the tank d to the semicircular water seals g and enters the chamber b, the gas-inlet a and the pipe m are simultaneously sealed at the level k, and an exact predetermined volume of gas—say one hundred cubic centimeters—is thus shut in the chamber b. As the water rises further it forces this gas through the pipe i into the absorption-chamber k, the arrangement being such that the gas is discharged from the pipe i at the bottom of said chamber near one end, so that it must bubble up through the absorbing fluid contained therein into the small space between the surface of said fluid and the roof 60 of the absorbing-chamber, to pass thence over the surface of the absorbing fluid along the whole length of the chamber, and in so doing is partly absorbed. From said space over the absorbing fluid, which is as small as possible, the gas passes up into a bell l, suspended in a tank containing a liquid which is not easily evaporated and does not thicken.

The bell is perfectly balanced, so that as the gas enters the bell is raised by the upward pressure, and a scale n, marked on the bell, enables the percentage of gas that has been absorbed to be easily read off when the measured volume has passed through the absorbing-chamber. The water forces some air free from carbonic acid into the pipe m toward the absorbing-chamber, and the volume of this must of course be considered in marking the scale on the bell.

In order that the movements of the bell shall not affect the level of the liquid, the bell is connected with a cylinder q or the like, the cross-section of which corresponds to that of the part of the bell immersed in the liquid in such a manner that said cylinder q sinks in the liquid as the bell rises. The bell being perfectly balanced is very easily raised by the gas, and there is no compression of the gas under it.

In order that the gas shall remain a sufficient long time in the absorbing-chamber, I connect a second water-tank s with the tank d by means of a pipe r, situated below the level marked z, and the bends of the respective siphon-pipes z' and z'', which empty said tanks s and d, so that the water is only drawn off from the tank d after the tank s has been filled therefrom and the water has then risen up to the mark z.

In rising in the tank s the water raises a float f, which acts on a one-arm lever u and lifts it up, thus releasing the lever v of a registering device, so that the forked end w of said lever v is lowered upon a stop x on the belt-rod p, and at the same time the volume of gas absorbed is registered by the length of line drawn on a slowly-rotating indicator-cylinder q by a pencil carried by said lever.

When the siphon z'' is emptying, the tank d and the level of the water falls below the mark k, the tube m is unsealed, and the gas which has been used can escape through this
pipe, thus allowing the bell \( l \) to return to its original position. If the apparatus is to be used for testing for oxygen, the tube \( m \) must be led into the measuring-chamber, as shown in dotted lines, so as to prevent oxygen from the atmosphere entering.

In the variation shown in Fig. 2 the absorbing-chamber \( k \) is entirely filled with the absorbing liquid and the pipe \( k \) is led under the bell-mouth of a tube \( o \), which leads up into the bell \( l \) and through the liquid in which the gas bubbles up into the bell. In this case the tube \( m \) is connected to the tube \( o \) outside of the absorbing-chamber.

The variation shown in Fig. 3 differs from that just described only in that the tube \( o \) winds up through the absorbing-chamber, so that the gas bubbling up through the liquid has farther to travel and is therefore better subjected to the action of said liquid.

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

1. In a device of the character described, a measuring-chamber, an absorption-chamber, connections between the measuring-chamber and the absorption-chamber, a balanced bell, a tube connection between the bell and the absorption-chamber, said tube extending within the chamber and having its end within the chamber bell-shaped.

2. In a device of the character described, a measuring-chamber, an absorption-chamber, connections between the measuring-chamber and the absorption-chamber, a balanced bell, a tube connection between the bell and the absorption-chamber, said tube extending within the chamber and having its end within the chamber bell-shaped, the connection between the absorption-chamber and the measuring-chamber discharging within the tube.

3. In a device of the character described, a measuring-chamber, an absorption-chamber, connections between the measuring-chamber and the absorption-chamber, a balanced bell, a tube connection between the bell and the absorption-chamber, said tube extending within the chamber and having its end within the chamber bell-shaped, the portion of the tube within the absorption-chamber being tortuous.

4. In a device of the character described, a tank, means for supplying fluid to the tank, a second tank in communication with the first-named tank and receiving its supply therefrom, a measuring-chamber in the first-named tank, an absorption-chamber, a connection between the absorption-chamber and the measuring-chamber, an indicating means in communication with the absorption-chamber, a registering device, and means controlled by the rise of fluid within the second-named tank for permitting the operation of the registering device.

5. In a device of the character described, a tank, a measuring-chamber therein, means for supplying gas to the measuring-chamber, means for supplying fluid to the tank, said measuring-chamber being provided with openings to permit the entrance of the fluid therein, an absorption-chamber, a connection between the absorption-chamber and the measuring-chamber through which the gas is forced by the rise of the fluid within the measuring-chamber, a connection between the absorption-chamber and the tank to permit the escape of gas within the absorption-chamber upon the fall of the fluid within the tank, and means for emptying the fluid.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

**Emil Schatz.**

**Witnesses:**

Jean Grund;

Carl Grund.