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APPARATUS FOR ANALYZING GAS.

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922,086. **Patented May 18, 1909.**

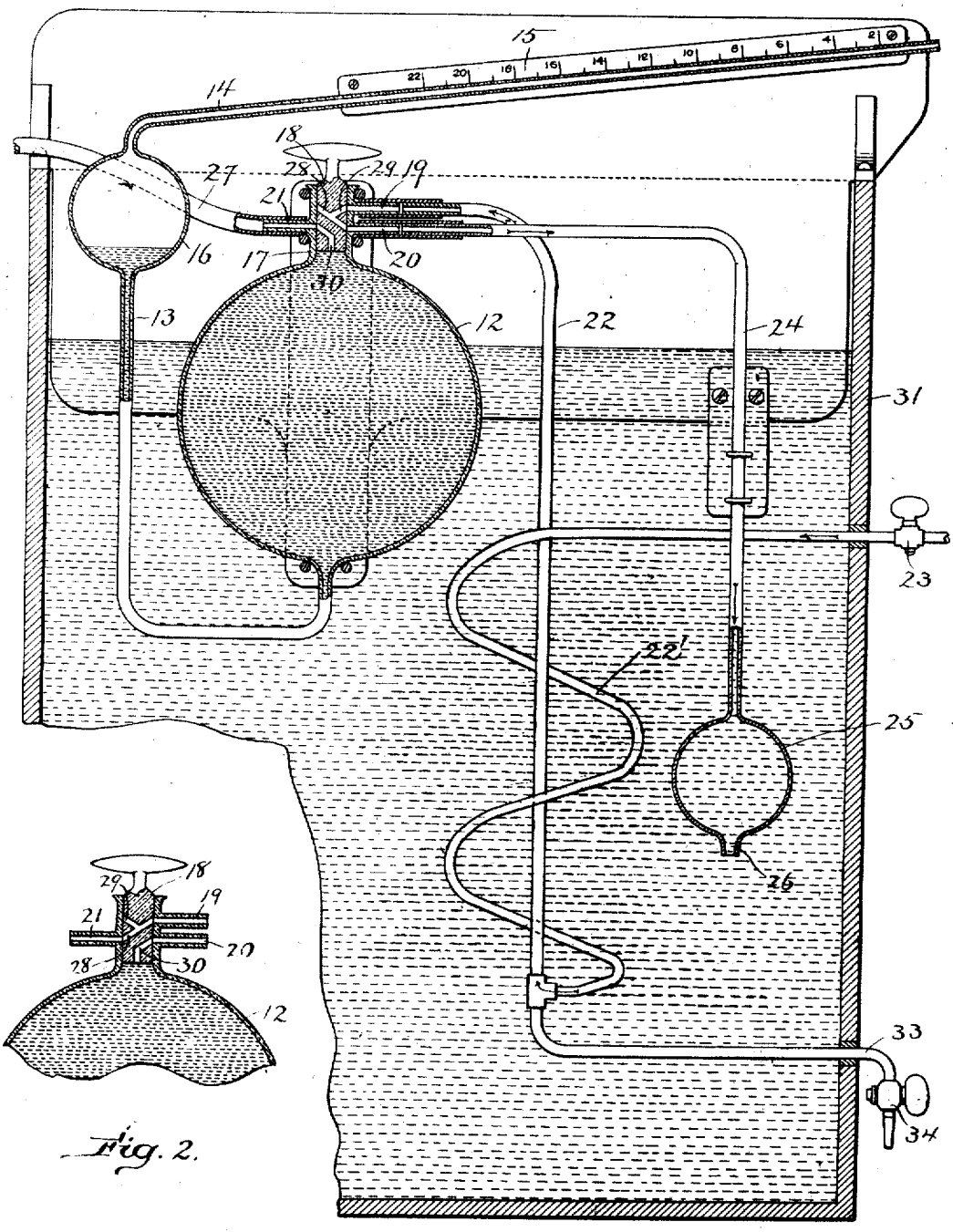

Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR ANALYZING GAS.

No. 922,086. Specification of Letters Patent. Patented May 18, 1909.

Application filed November 11, 1908. Serial No. 462,152.

To all whom it may concern:

Be it known that we, HERBERT N. CHENEY and HARRY L. VON R. NICKERSON, both of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Analyzing Gas, of which the following is a specification.

This invention relates to apparatus for determining the percentage of carbon dioxid in combustible gases for illuminating and other purposes, and it has for its object to provide a simple and effective apparatus adapted to quickly and accurately test samples of gas in rapid succession, so that a large number of tests may be made in a relatively short space of time.

Another object of the invention is to enable each sample to represent accurately the condition of the gas in the source of supply from which the sample is taken, without admixture with any part of a previously taken sample.

The invention consists in the improvements which we will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification,—Figure 1 represents a sectional view of an apparatus embodying our invention. Fig. 2 represents a view of a portion of Fig. 1, showing a different adjustment of the controlling valve, hereinafter referred to.

The same reference characters indicate the same parts in both figures.

In the drawings, 12 represents an absorption chamber, which is or may be of spherical form, and is preferably made of glass, said chamber being adapted to contain a suitable absorbent of carbon dioxid, the absorbent being, for example, a solution of potash. The absorption chamber is provided in its lower portion with a vent or outlet tube 13, which is extended upwardly above the upper portion of the chamber, and terminates in an inclined calibrated portion 14, which is so related to a graduated scale 15 as to indicate the quantity of the solution displaced from the chamber by a sample of gas introduced into the chamber. The tube 13 is here shown as provided with a bulb or enlargement 16, the whole being preferably formed of glass. Communicating with the upper portion of the chamber 12 is a neck 17 which constitutes a casing for a rotary plug valve 18. One side of the casing is provided with ports 19 and 20, and the opposite side is provided with a port 21. The port 19 communicates with a gas conduit 22, which communicates with a source of gas supply under pressure, and is provided with a shut-off cock 23. The port 20 communicates with a sample conduit 24 which enters the upper portion of a sample chamber 25, the lower portion of said chamber having a vent or outlet 26. The port 21 constitutes a waste gas outlet, and preferably communicates with a conduit 27 which may conduct the waste gas to any point desired. The valve 18 is provided with a passage 28 extending across it, and a branch 29 extending therefrom to the periphery of the valve at a point in alinement with one end of the passage 28. The valve is provided with another passage 30 extending from the inner end of the valve to the periphery thereof at a point in alinement with the opposite end of the passage 28. The arrangement of the ports in the valve casing and the passages is such that when the valve is in the position shown in Fig. 1, the part of the passage 28 and the branch 29 constitute a connection between the ports 19 and 20 so that gas passing through the supply gas conduit 22 will flow through the valve and through the sample conduit 24 to the sample chamber 25, the passage 30 at the same time registering with the outlet port 21, and serving as a vent for the upper portion of the absorption chamber. When the valve is in the position shown in Fig. 2, the passage 28 connects the inlet port 19 with the waste port 21, and the sample conduit 24 with the absorption chamber 12.

31 represents a tank adapted to hold a body of liquid, such as water, in position to entirely submerge the sample chamber 25, and to cover the greater portions of the surfaces of the gas conduit 22 and of the absorption chamber 12.

In operating the apparatus, the valve 18 is turned to the position shown in Fig. 1, so that gas passes from the source of supply through the conduit 22, the valve 18, and the sample conduit 24 to the sample chamber 25. The gas expels from the sample chamber the liquid which normally rises therein, after each operation the gas being allowed to escape through the vent 26 until enough gas has gone to waste to insure the removal of all the gas of a previous sample remaining in the sample conduit 24 above

the liquid level in the tank 31. The valve is then turned to the position shown in Fig. 2, so that the gas from the source of supply then passes through the passage 28 and goes to waste, while the gas in the sample chamber, or the greater part of the same, is forced by the pressure of the liquid in the tank 31 into the absorption chamber. The gas sample thus transferred to the absorption chamber displaces a portion of the absorbent contained therein. The carbon dioxid in the gas is absorbed by the absorbent so that the rise of the absorbent in the tube 13 and its calibrated extension 14 will be dependent upon the volume of the sample of gas minus the volume of the carbon dioxid which it contained, and which has chemically united with the absorbent. Although the amount of gas forced from the sampling chamber into the absorption chamber by the confining liquid varies with the difference in level between the surface of the liquid in the absorption chamber and in the calibrated tube, for any definite difference in level, or percentage of carbon dioxid absorbed, the amount is always the same, and the tube is calibrated to offset the varying amounts of gas analyzed. Although the carbon dioxid which has united with the absorbent still has volume and adds to the bulk of the solution, this addition is only very slight as compared with the bulk of the uncombined carbon dioxid.

The scale 15 is graduated and positioned so as to indicate the percentage of carbon dioxid by the rise of the displaced absorbent in the inclined tube 14. The greater the percentage of carbon dioxid in the gas, the less the rise of the absorbent in the tube 14, because a larger amount of the volume of the sample has been absorbed by the absorbent. A reading is taken when the displaced absorbent has come to rest, and then the described operation is repeated, the gas remaining in the absorption chamber passing to the outlet port through the passage 30 when the valve is turned to the position shown in Fig. 1.

The normal liquid level in the tank 31 is considerably above the sample chamber, so that the liquid rises in said chamber and in a considerable part of the sample conduit 24. The gas remaining in the conduit 24 above the liquid level is forced out by the next charge of gas introduced, the gas being allowed to go to waste through the vent 26 until the gas left over from the previous sample in the upper part of the conduit 24 has been expelled through the vent 26 of the sample chamber.

It will be seen that while each sample is being tested, gas is allowed to flow continuously through the supply conduit 22 and the waste conduit 27 so that no gas is at any time left standing in the supply tube, each sample taken being consequently fresh and representative of the main volume of gas in the source of supply. The body of liquid in the tank 31 enables the temperature of the absorbent and of the gas samples to be regulated and kept substantially uniform, the liquid employed absorbing heat from or giving heat to the contents of the various conduits and chambers. A portion of the gas conduit 22 is preferably arranged in the form of a coil 22′ to increase the surface of the conduit in contact with the temperature regulating liquid. Said conduit is preferably provided with a branch 33 having a cock 34 to permit the escape of liquid resulting from the condensation of water in the conduit.

We claim:

1. An apparatus for analyzing gas comprising an absorption chamber, means for indicating the displacement of the absorbent therein, a gas supply conduit, a sample chamber having a gas vent, a sample conduit communicating with the sample chamber, a waste outlet, and means for connecting the supply conduit alternately with the sample conduit and with the waste outlet, said means having provisions for connecting the sample conduit with the absorption chamber when the supply conduit is connected with the waste outlet, and means for confining a body of liquid around the sample chamber and in position to seal the gas vent thereof and act through said vent to force the gaseous contents of the sample chamber into the absorption chamber.

2. An apparatus for analyzing gas comprising an absorption chamber, means for indicating the displacement of the absorbent therein, a gas supply conduit, a sample chamber having a gas vent, a sample conduit communicating with the sample chamber, a waste outlet, and means for connecting the supply conduit alternately with the sample conduit and with the waste outlet, said means having provisions for connecting the sample conduit with the absorption chamber when the supply conduit is connected with the waste outlet, and means for confining a body of liquid around the sample chamber and in position to seal the gas vent thereof and act through said vent to force the gaseous contents of the sample chamber into the absorption chamber, said liquid confining means being adapted to hold the liquid body in contact with the supply conduit and the absorption chamber.

3. An apparatus for analyzing gas comprising an absorption chamber, a valve casing communicating therewith, a gas supply conduit, a sample conduit, a waste outlet communicating with said casing, a valve in said casing having passages adapted to connect the supply conduit alternately with the sample conduit and with the waste outlet,

and to connect the sample conduit with the absorption chamber when the supply conduit is connected with the waste outlet, a sample chamber connected with the sample conduit and having a gas vent, means for indicating the displacement of the absorbent in the absorption chamber, and means for confining a body of liquid in position to seal the vent of the sample chamber and to act through said vent to force the gaseous contents of the sample chamber into the absorption chamber.

4. An apparatus for analyzing gas comprising an absorption chamber, a valve casing communicating therewith, a gas supply conduit, a sample conduit, a waste outlet communicating with said casing, a valve in said casing having passages adapted to connect the supply conduit alternately with the sample conduit and with the waste outlet, and to connect the sample conduit with the absorption chamber when the supply conduit is connected with the waste outlet, a sample chamber connected with the sample conduit and having a gas vent, means for indicating the displacement of the absorbent in the absorption chamber, and means for confining a body of liquid in position to seal the vent of the sample chamber and to act through said vent to force the gaseous contents of the sample chamber into the absorption chamber, said valve being also adapted to vent the absorption chamber when the supply and sample conduits are connected.

5. An apparatus for analyzing gas comprising an absorption chamber, a calibrated tube communicating with the bottom portion thereof and adapted to receive the absorbent displaced therefrom by gas samples admitted to the chamber, a gas supply conduit, a sample chamber having a gas vent, a sample conduit communicating with the sample chamber, a waste outlet, and means for connecting the supply conduit alternately with the sample conduit and with the waste outlet, said means having provisions for connecting the sample conduit with the absorption chamber when the supply conduit is connected with the waste outlet, and means for confining a body of liquid around the sample chamber and in position to seal the gas vent thereof and act through said vent to force the gaseous contents of the sample chamber into the absorption chamber.

In testimony whereof we have affixed our signatures, in presence of two witnesses.

HERBERT N. CHENEY.
HARRY L. VON R. NICKERSON.

Witnesses:
JOHN SHEA,
WILLIAM P. LYONS.