

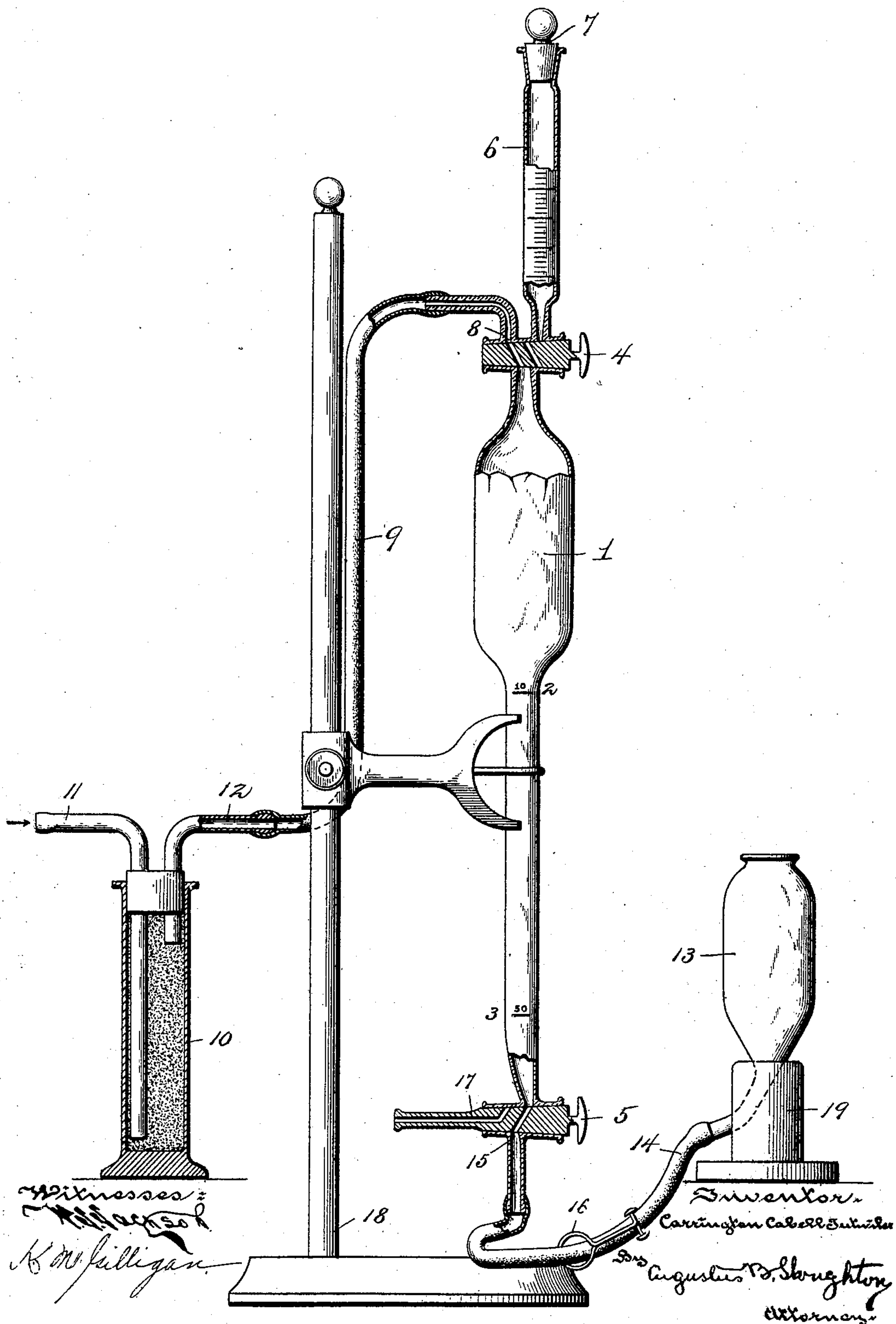
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Patented Dec. 10, 1901.

C. C. TUTWILER.
APPARATUS FOR THE ANALYSIS OF GAS.

(Application filed Aug. 3, 1900.)

(No Model.)



UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE ANALYSIS OF GAS.

SPECIFICATION forming part of Letters Patent No. 688,449, dated December 10, 1901.

Application filed August 3, 1900. Serial No. 25,822. (No model.)

To all whom it may concern:

Be it known that I, CARRINGTON CABELL TUTWILER, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Apparatus for the Analysis of Gas, of which the following is a specification.

One object of the present invention is to provide titration apparatus by means of which a quantitative analysis of gases may be rapidly made.

To this and other ends hereinafter described the invention comprises the apparatus hereinafter explained and claimed.

The nature, characteristic features, and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawing, forming part hereof, and in which is illustrated in elevation apparatus embodying features of the invention.

In the drawing, 1 is a burette graduated, as at 2 and 3, for accurately measuring definite quantities of gas. At the top and bottom of the burette 1 are provided three-way valves or cocks 4 and 5.

6 is a graduated vessel having communication when desired, by way of the valve or cock 4, with the interior of the burette.

7 is a stopper or closure for the vessel 6, and the latter is graduated so as to indicate its contents volumetrically. Another passage 8 of the cock or valve 4 is arranged to communicate, for example, by way of the tube 9 with the tar-arrester 10. The latter consists of a suitably-closed vessel filled with cotton or other fibrous material and equipped with an inlet-pipe 11, extending nearly to its base, and with an outlet-pipe 12, extending from comparatively near its top.

13 is a mercury-leveling bulb having communication, for example, by way of the tube 14 with one of the passages 15 of the valve or cock 5.

16 is a valve or clip for closing the tube 14.

17 is the other passage of the cock or valve 5.

18 and 19 indicate stands for the various parts of the apparatus and from which the

apparatus can be readily removed and on which it can be conveniently replaced.

For the sake of clearness of description of the mode of operation of the apparatus reference will be made to its use for the partial analysis of illuminating-gas and for the quantitative determination of the sulfureted hydrogen present in it by using iodine as the titrating solution and starch as an indicator. The stop-cocks or valves 4 and 5 are so positioned that the passages 8 and 15 communicate with the interior of the burette 1, the rubber tube being removed from 15. The gas to be tested after traversing the tar-arrester 10 is permitted to flow, for example, by way of the tube 9 through the burette 1 and to escape, for example, at 15, so as to displace the air in the burette by the gas to be tested, in the present instance, for sulfureted hydrogen. The valve 5 is then positioned to close the burette 1 at its base and to permit 15 to communicate with 17 for a purpose to be presently described, and the valve 4 is positioned to close the top of the burette, and the tube 9 and gas-supply are disconnected. The burette 1 is then filled with gas, which may be allowed to stand until its temperature corresponds with that of the surrounding atmosphere, and the latter may of course be noted. The mercury-leveling bulb 13 is then made to communicate with the passage 15, for example, by way of the tube 14, and the leveling-bulb is lifted until mercury appears at the opening 17. In this way the passages are cleared of air. The valve 5 is then positioned in such a way that mercury passes it and enters the burette, thus compressing the gas until the mercury reaches the graduation 2. The valve 5 is then positioned to close the burette, and the valve 4 is positioned to momentarily permit the interior of the burette to communicate by way of 8 with the atmosphere in order to bring the gas in the burette to atmospheric pressure, it being understood that the tube 9 is disconnected for this purpose. The valve 5 is then positioned to permit the interior of the burette to communicate with the mercury-bulb 13, and the latter is lowered until the mercury is

drawn back to the stop-cock 5. The valve 4 is of course closed during this operation, and upon its completion the valve 5 is positioned to close the burette and to bring the passage 5 15 into communication with the passage 17. The result of this is that the burette contains a definite volume of gas measured at atmospheric pressure and under a negative pressure or in a somewhat attenuated condition. The 10 clip 16 is caused to prevent the further passage of mercury, and the tube 14 is disconnected. The tubes 9 and 14 having been disconnected from it, as described, the burette is thus isolated from the leveling-bulb and 15 the tar-arrester and is then taken from its stand and there is drawn into it, for example, through 8, some test solution, which in the present instance comprises a solution of starch. This may be done by dipping the 20 part 8 into such a solution and manipulating the valve 4 to establish and disestablish communication with the interior of the burette by way of the part 8. The vessel 6 is then filled with a standard solution, which in the 25 present instance consists of a solution of iodine. By manipulating the valve 4 small quantities of the standard iodine solution are admitted into the burette, which is shaken between each addition of three or four drops 30 of the standard solution, and this operation is continued until the starch solution assumes a permanent blue color. Reference to the scale upon the vessel 6 shows the quantity of the standard solution introduced into the 35 burette. The quantity so introduced is proportional to the quantity of sulfureted hydrogen contained in the burette, or, in other words, in the measured volume of gas which it contains. Consequently the vessel 6 may 40 be graduated so as to show the amount of

sulfureted hydrogen contained in the volume of gas inclosed in the burette. In this way the readings are direct and the determination is exceedingly rapid. The iodine reacts when the sulfureted hydrogen producing hydrogen iodide and the starch solution indicates the presence of uncombined iodine. This reaction is of course well understood and is so set forth merely for the sake of a clear explanation. 50

It will be obvious to those skilled in the art to which my invention appertains that modifications may be made in details without departing from the spirit thereof. Hence I do not limit myself to the precise construction 55 and arrangement of parts hereinabove set forth, and illustrated in the drawings; but,

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is— 60

Apparatus for use in the analysis of gas mixtures, comprising in combination, a tar-arrester, a graduated burette, a stoppered graduated vessel arranged to drop its contents into the top of the burette, means for 65 establishing and disestablishing communication between the top of the burette and the tar-arrester and the atmosphere, and between the measuring vessel and the burette, a mercury-leveling bulb, and means for controlling communication between the base of the 70 burette and the leveling-bulb and between the bulb and the atmosphere, substantially as described.

In testimony whereof I have hereunto signed 75 my name.

CARRINGTON CABELL TUTWILER.

In presence of—

W. J. JACKSON,
K. M. GILLIGAN.