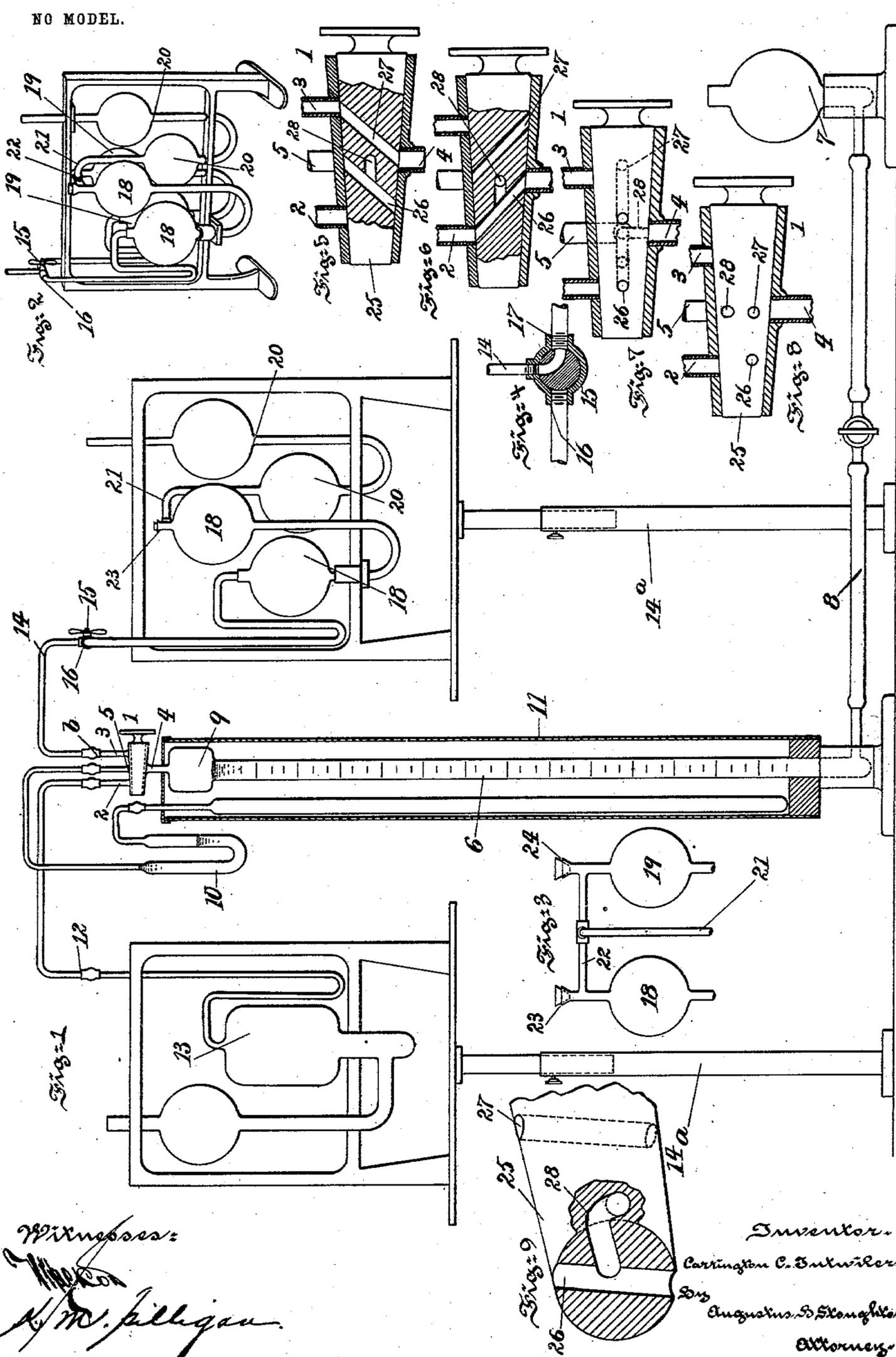


C. C. TUTWILER.  
APPARATUS FOR ANALYZING GASES.

APPLICATION FILED MAY 3, 1902.

NO MODEL.



Witnesses:  
*[Signature]*  
*H. M. Sullivan*

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 By  
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# UNITED STATES PATENT OFFICE.

CARRINGTON C. TUTWILER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR  
TO THE UNITED GAS IMPROVEMENT COMPANY, OF PHILADELPHIA, PENN-  
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## APPARATUS FOR ANALYZING GASES.

SPECIFICATION forming part of Letters Patent No. 744,132, dated November 17, 1903.

Application filed May 3, 1902. Serial No. 105,742. (No model.)

*To all whom it may concern:*

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

In the analysis of gas a measured quantity thereof is subjected to the absorptive influences of various reagents, and the gas during such treatment by absorption is frequently measured; and it is one of the objects of the present invention to provide an apparatus in which this kind of analysis can be made with greater facility and rapidity than heretofore and in which the various parts are sufficiently well supported mechanically to obviate such defects as sagging of certain parts, which heretofore occurred.

To these and other ends hereinafter explained the invention comprises the improvements to be presently set forth and finally claimed.

The nature, characteristic features, and scope of the invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a view, principally in side elevation, of an apparatus embodying features of the invention. Fig. 2 is a perspective view illustrating a portion of the apparatus shown in Fig. 1. Fig. 3 is a detached view illustrating a portion of the apparatus shown in Fig. 2. Fig. 4 is a detail view of the three-way valve shown in Fig. 2. Figs. 5, 6, 7, and 8 are sectional views illustrating different positions of a four-way valve shown in Fig. 1, and Fig. 9 is a diagrammatic perspective view illustrating some of the passages of the plug shown in Figs. 5 to 8.

In the drawings, 1 is a four-way cock. Its seat or casing is provided with four ports or openings. Three of them, 2, 3, and 4, are arranged in one vertical plane, and 2 and 3 are located at the top, and 4 is located at the bottom. 5 is another port or opening at the back of the casing and located ninety degrees from or midway between ports 4 and 2 and 3. The

port 4 is connected with a burette 6, having a leveling-bulb 7 connected with it by a valved flexible connection or tube 8. The burette 6 may be somewhat enlarged, as at 9, so that its height may be somewhat diminished, while its capacity is not changed. The burette is of course graduated in the ordinary and well-understood manner.

The port or opening 5 has connection, as by a properly-bent capillary tube, with the manometer 10, which is graduated and the Petteson tube of which extends into the water-jacket 11, which also contains the burette and which serves to insure uniform conditions of temperature.

The port or opening 2 communicates by means of a capillary or other appropriate tube 12 with the pipette 13, which is commonly designated the "potash-absorption" pipette. The pipette 13 is shown as supported upon an adjustable stand 14<sup>a</sup>.

The opening or port 3 communicates, as by a tube 14, with one part of a three-way valve 15, Fig. 4. The other ports 16 and 17 of this three-way valve 15 communicate, respectively, with one of the two double absorption-pipettes, (designated, respectively, 18 and 19.) Suitable bent tubes or pipes are employed for this purpose. The double absorption-pipettes of each of the two may be caused to both cooperate with a common seal 20, as by means of a pipe 21, which is connected with the cross-pipe 22. The cross-pipe 22 can be provided with stoppered openings 23 and 24, of which one appertains to each of the two double absorption-pipettes and affords means by which the proper reagent or reagents can be introduced into it. The plug 25 of the valve 1 is provided with two parallel diagonal passages 26 and 27, arranged in the same plane, and these are so arranged that two of their openings are in a plane transverse to the axis of rotation of the plug. The purpose of this arrangement is that the passage 27 may communicate with the port 4, as shown in Fig. 5, and that the passage 26 may also communicate with the port 4, as shown in Fig. 6. The passage 26 is provided with a branch passage 28, which extends axially of the plug and then radially thereof, so as to penetrate the periph-

ery of the plug in the plane of the ports 4 and 5. The purpose of this arrangement of passages in the plug is to provide for connecting the burette 6 with the manometer 10, or with the pipette 13, or with the set of pipettes 18 and 19, or with none of these without disconnecting any of the apparatus and by the simple operation of turning or positioning the plug.

As shown in Fig. 5, the burette has connection by way of 4, 27, 3, and 14 with the valve 15. This latter may be positioned to bring 14 into communication with the double absorption-pipette 19, as shown, or by turning the plug of the valve 15 14 can be brought into communication with the double absorption-pipette 18. In this way advantage may be taken of the reagents contained in either 18 or 19, as the circumstances may require. In putting these reagents into the pipettes air is admitted to them by properly positioning the valve 15 and disconnecting the tube 14 at the tubular coupling *b*. Thus by the described manipulation of the plugs of the valves 1 and 15 gas may be submitted to two kinds of reagents contained in the parts 18 and 19.

As shown in Fig. 6, the burette 6 is in communication by way of 4, 26, 2, and 12 with the absorption-pipette 13, and advantage in this way can be taken of the reagents which this pipette contains. By positioning the valve shown in Fig. 7 communication is established from the burette 6 by way of the branch 28 and part of the passage 26 and the port or opening 5 on the back of the valve-casing with the manometer 10. By positioning the valve as shown in Fig. 8 none of the openings or passages in its plug communicate with the openings or passages in the casing, so that the burette and all other parts of the apparatus are isolated from each other.

From the foregoing description it is obvious that the described manipulation of the valves 1 and 15 greatly facilitates the completion of a gas analysis and effects a material saving in time and, further, that the apparatus is all well and evenly supported and is therefore not likely to sag or get out of adjustment.

It will be obvious to those skilled in the art to which the invention relates that modifications may be made in details without departing from the spirit thereof. Hence I do not

limit myself to the precise construction and arrangement of parts hereinabove set forth, and illustrated in the accompanying drawings; but,

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

1. Gas-analyzing apparatus comprising the combination of a burette, a manometer, a pipette, two double absorption-pipettes having a common seal and valved pipe connections for directing gas to either of the two, a four-way cock for establishing communication between the burette, the pipette, the two double absorption-pipettes and the manometer and for isolating the burette from the same, and pipe connections, substantially as described.

2. In a gas-analyzing apparatus the combination of two double absorption-pipettes having a common seal, a burette having a plug-valve, and a single tube communicating with the burette through a single opening in the plug-valve and having a valve and branches to each of the two pipettes, substantially as described.

3. In a gas-analyzing apparatus the combination of two double absorption-pipettes, a seal common to both pipettes, and stoppered branch-pipe connections between the seal and the pipettes, substantially as described.

4. In a gas-analyzing apparatus and in combination with the burette, the manometer and the pipettes, a four-way cock comprising a casing fitted with three openings in the same plane whereof two extend upward and one extends downward and with a fourth opening arranged in a plane at right angles to the first-mentioned plane, a plug fitted with two parallel inclined passages arranged in the same plane and with the end of one vertically in line with the end of the other and fitted with a branch passage which extends axially and radially and communicates with one of the first-mentioned passages substantially as described, and pipe connections, substantially as specified.

In testimony whereof I have hereunto signed my name.

CARRINGTON C. TUTWILER.

In presence of—

WM. J. JACKSON,  
K. M. GILLIGAN.