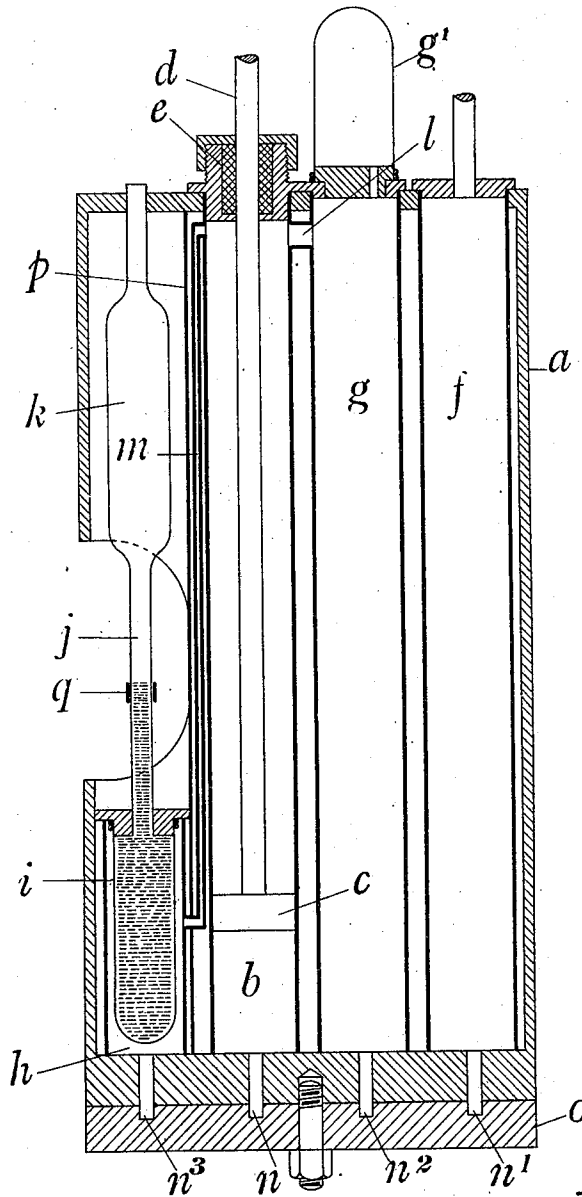


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 ABSORPTION APPARATUS FOR ANALYZING GASES.
 APPLICATION FILED APR. 6, 1920.

1,390,488.

Patented Sept. 13, 1921.



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ABSORPTION APPARATUS FOR ANALYZING GASES.

1,390,488.

Specification of Letters Patent. Patented Sept. 13, 1921.

Application filed April 6, 1920. Serial No. 371,702.

To all whom it may concern:

Be it known that I, PERCIVAL RAYMOND BOULTON, a subject of the King of Great Britain and Ireland, residing at 8 Holly Lane, Erdington, in the city of Birmingham, England, have invented certain new and useful Improvements Relating to Absorption Apparatus for Analyzing Gases, of which the following is a specification.

10 This invention relates to absorption apparatus for analyzing gases and particularly to apparatus for determining the amount of carbon dioxide in the flue gases from steam generators or other furnaces. The invention
15 has for its object to provide improved portable means whereby the required determination can be effected in a simple and expeditious manner.

20 The accompanying drawing illustrates diagrammatically a portable absorption apparatus constructed in accordance with this invention.

In carrying the invention into effect as shown, a case *a* has arranged within it a
25 pump cylinder *b*. A piston *c* sliding within the cylinder is operated by a rod *d* projecting through a gas-tight stuffing box *e*. Within the case is arranged a desiccating chamber *f* which is charged with any convenient solid material such as calcium chlorid for absorbing moisture from the gas sample. At its upper end the chamber is provided with any convenient pipe connection through which gas can be admitted to
30 the chamber. Also within the case as arranged a chamber *g* containing any suitable solid absorbent for the gas constituent to be estimated. For carbon dioxide soda lime may be used as the absorbent. Preferably the
35 upper end of the absorbent chamber is fitted with a collapsible rubber or other impervious bulb *g'* to prevent the occurrence of any relatively large diminution of pressure in the said chamber.

40 Under the ordinary pressure variations found in practice no appreciable action occurs in the said bulb as it is made stiff enough to resist normal variations, but an abnormal diminution of pressure will cause
45 it to sag slightly and so neutralize to some extent the effect of the reduced pressure.

A closed gage chamber *h* within the case is fitted with a collapsible rubber or other

55 gage bulb *i* containing colored water or other liquid and connected to a glass gage tube *j* which is visible through an aperture in the case. The tube *j* opens into an overflow enlargement *k* which is open at its upper end to the atmosphere. To prevent accidental
60 spilling of the gage liquid when the apparatus is not in use the upper open end of the gage tube may be closed by a cap. The upper ends of the cylinder *b* and absorbent chamber *g* communicate with each other by a passage *l*, and with the gage chamber *h*
65 by a pipe *m*.

The cylinder *b* and chamber *f*, *g* and *h* have their lower ends arranged over apertures *n*, *n'*, *n*², *n*³ respectively in the base, these apertures being controlled by a rotatable valve disk *o*. The latter is formed in
70 any convenient manner with passages by which the said apertures can be opened or closed or put into the required communication as hereinafter described. The valve passages are not shown in the drawing as the arrangement will be obvious from the following description.

In operation the valve is first set to connect the passages *n*, *n'* and open the passage
80 *n*³ to atmosphere. The piston is then pulled out to the limit of its movement thereby drawing in a full sample of gas through the chamber *f*. The valve is now moved to close *n'*, and open *n* to atmosphere, enabling
85 the piston to discharge to atmosphere the previously drawn in gas. By repeating this process several times a charge of gas not diluted by the air initially contained in the apparatus can be obtained. Subsequently
90 a proper charge is drawn into the cylinder and the valve is moved to close the chambers *f* and *h* and put the cylinder *b* into communication with the absorbent chamber *g*. The piston is now returned and caused to
95 discharge the gas sample through the absorbent into the opposite side of the cylinder. An increase of pressure will by this operation usually be produced in the gage chamber *h* owing to the capacity of the cylinder being less on the upper side of the
100 piston than the lower side.

If no gas has been absorbed it will be necessary to withdraw the piston to its original position at the upper end of the cylinder
105 to restore the original pressure in the cham-

ber, but if absorption has occurred a smaller movement dependent on the amount of gas absorbed will suffice to restore the original pressure as indicated by the gage. The movement of the piston can therefore be used as a measure of the gas absorbed and the piston rod can be graduated accordingly. If desired the increase of pressure produced in the gage chamber when the sample is discharged from the pump can be used as the required measure, but the former method is more convenient as the gage is then only needed to indicate a zero condition. An adjustable index q is mounted on the tube j for use in indicating the initial level of the gage fluid.

Preferably the portion of the case containing the parts b , f , g , and divided off by the partitions p is filled with water and the case is covered with material having a low thermal conductivity to maintain a constant temperature within the apparatus. In the drawing the parts b , f , and g , are shown in the plane of section for convenience of illustration. Actually they are arranged in different planes within a case of circular or other cross section.

Having thus described my invention what

I claim as new and desire to secure by Letters Patent is:—

In portable absorption apparatus for analyzing gases, the combination comprising a vertical reciprocatory pump, absorption chamber, and pressure gage chamber, the absorption chamber being permanently open at its upper end to the upper side of the pump and to the gage chamber, a vertical desiccating chamber, a gas inlet at the upper end of the desiccating chamber, a collapsible bulb forming part of a fluid pressure gage in the gage chamber, a vertical gage tube in conjunction with the bulb, a case containing the above mentioned parts, said case being formed with an aperture through which the gage tube is visible, a base formed with passages communicating with the lower ends of the aforesaid chambers and pump, and a rotary valve disk on the underside of the base whereby the lower end of the pump can be connected with the lower end of the desiccating chamber or the absorption chamber, and the gage chamber opened or closed to the atmosphere, substantially as described.

In testimony whereof I have signed my name to this specification.

PERCIVAL RAYMOND BOULTON.