No. 813,671. PATENTED FEB. 27, 1906.

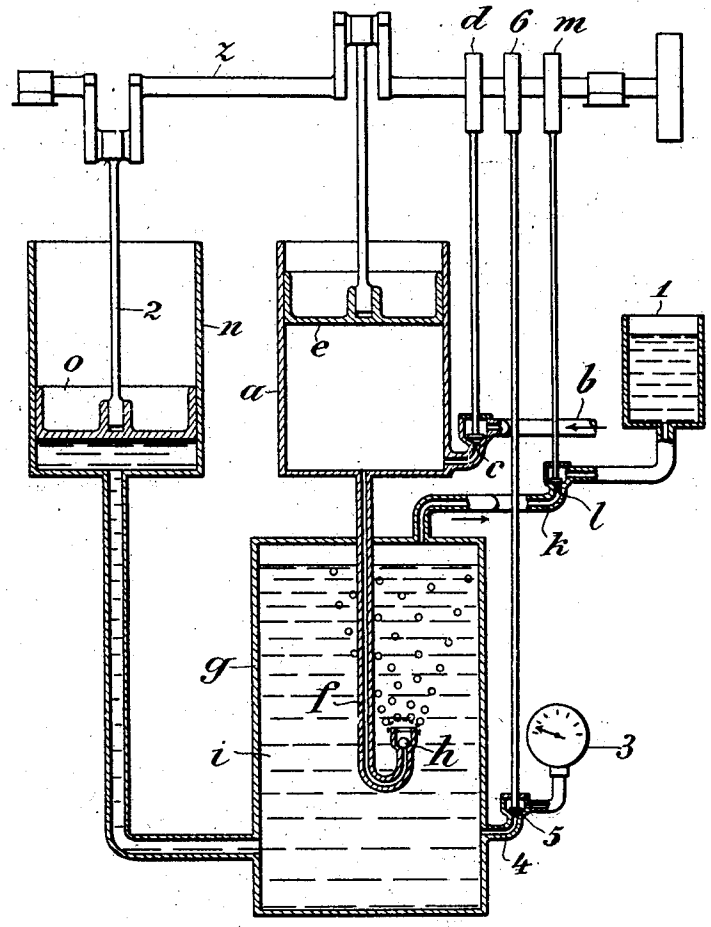
A. SCHLATTER & L. DEUTSCH.

APPARATUS FOR ANALYSIS OF GASES.

APPLICATION FILED OCT. 6, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



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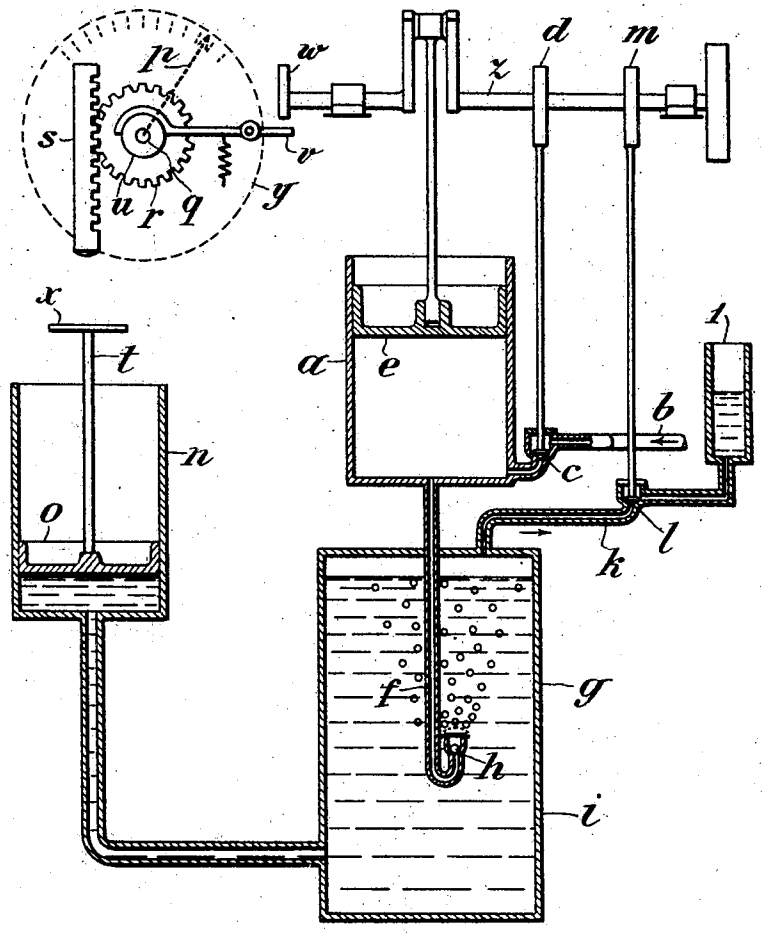
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APPARATUS FOR ANALYSIS OF GASES.

APPLICATION FILED OCT. 6, 1905.

2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR ANALYSIS OF GASES.

No. 813,671. Specification of Letters Patent. Patented Feb. 27, 1906.

Application filed October 6, 1905. Serial No. 281,640.

To all whom it may concern:

Be it known that we, ALFRED SCHLATTER, professor, residing at 72 Váczi-út, and LUDWIG DEUTSCH, engineer, residing at 72 Váczi-út, Budapest, Austria-Hungary, subjects of the Emperor of Austria-Hungary, have invented certain new and useful Improvements Relating to Apparatus for Indicating the Amount of Carbonic Acid Contained in Combustion-Gases, of which the following is a specification.

The invention has for its object an apparatus for indicating the proportion of carbonic acid contained in the combustion-gases of furnaces of all kinds, in which the gas serving for analysis is introduced into the absorption-chamber mechanically by means of a piston-pump, from which it is likewise expelled by a rigid piston after the measurement has been effected.

The purpose of the present invention is to effect the suction and forcing in of the gas to be analyzed by means of rigid pistons continuously operated mechanically with so considerable a velocity as to render it possible to make from six to ten analyses per minute, whereby the results always give the heating conditions prevailing at the moment, thus indicating the kind of stoking to be adopted, so that it may be regulated by means of these indications, which are constantly shown and which may be readily read at a distance.

Two constructional forms of the apparatus are diagrammatically illustrated in the accompanying drawings.

In the apparatus shown in Figure 1 the combustion-gases are sucked by the piston-pump *a* from the pipe *b*, the valve *c* being held by the gear *d* (an eccentric or the like) in the open position. After the completion of the suction-stroke of the piston *e* the valve *c* is closed by means of the gear *d*. During the pressure-stroke of the piston *e* the gases sucked in are forced through the pipe *f* into the absorption-chamber *g*. The mouth of the pipe *f*, provided with a valve *h*, is arranged underneath the surface of the absorption liquid *i*, (potash or soda-lye, milk of lime, or the like,) so that the gases are forced to pass through the absorption liquid in the form of small bubbles, whereby a speedy and complete absorption is produced.

Upon the cover of the vessel *g* is mounted a waste-pipe *k*, in which is arranged a valve *l*. This valve *l* is operated by gear *m* and is closed during the pressure-stroke of the piston *e*. A cylinder *n* communicates with the vessel *g*, and in this cylinder a well-fitting piston *o* is mounted. A connecting-rod 2 connects this piston with the crank-shaft *z*. The cranks of the pistons *e* and *o* are displaced relatively to each other by one hundred and eighty degrees. The capacities of the two cylinders *a n* are alike, so that the volume between the two pistons remains constantly the same during the whole of their operation. A vacuum-gage 3 is mounted on the vessel *g*, a valve 5 being arranged in the connecting-pipe 4 and actuated by the gear 6.

Owing to the fact that a portion of the gases introduced into the vessel *g* are absorbed by the liquid *i*, a reduction of pressure will exist in the vessel *g* at the end of the pressure-stroke of the piston *e*, and its amount will be indicated by the vacuum-gage 3, for which reason the gear 6 is so arranged that the valve 5 shortly before the completion of the pressure-stroke of the piston *e* is opened and upon the lower dead-point being reached it is closed.

According as the quantity of carbonic acid contained in the gases is larger, a greater quantity of the same will be absorbed, thus producing so much the greater diminution of pressure, which the vacuum-gage will indicate.

After the completion of the pressure-stroke of the piston *e* its suction-stroke begins, the valves *c* and *l* being opened, while the valve *h* automatically closes. During the suction-stroke of the piston *e* the piston *o* descends and forces the gases contained in the vessel *g* out through the pipe *k* and valve *l*. The arrangement is such that the vessel *g* is in the inoperative condition completely filled with the absorption liquid. In order that any liquid which may have been vaporized may be automatically replenished, the vessel 1 is provided, from which upon the opening of the valve *l* the required quantity of liquid flows into the absorption vessel. The gases are driven through the liquid contained in the vessel 1.

In the modified form of the apparatus illustrated in Fig. 2 the suction and introduction of the gases into the absorption vessel is effected in the manner described above. In this apparatus, however, the indication of

the quantity of carbonic acid is effected by measuring the quantity of the gases remaining after the absorption of the carbonic acid. To this end the piston *o* is not connected with the crank-shaft *z*, but is lifted by the absorption liquid displaced by the gases, and by the intermediary of the rack *s* and gear-wheel *r* acts upon the index *p*. According as the quantity of carbonic acid contained in the gases is greater a larger quantity of the same will be absorbed by the liquid *i*, so that the piston *o* will be lifted to a proportionately less height, and vice versa.

In order that the index *p* may not participate in the entire displacement of the piston *o*, but only indicate the volume after the completion of an absorption, a brake-disk *u* is keyed upon the shaft *q* of the index, the end of a two-armed lever *v*, formed as a brake-block, resting upon this disk. The lever *v* is acted upon by an eccentric disk or cam *w* in such a manner that the brake-block shortly before the completion of the forcing stroke of the piston *e* or the attainment of the highest position of the piston *o* is lifted from the brake-disk, so that the rack *s* falls upon the plate *x* of the rod *t* and is set by the latter in accordance with the volume of the gases remaining after the absorption of the carbonic acid. As soon as the piston *o* again begins to descend the lever *v* is released by the eccentric *w*, so that the brake-block either under the influence of gravity or of a spring *y* falls upon the brake-disk *u* and holds the index. By means of this arrangement the index indicates the result of the preceding measurement during the entire suction and forcing period.

As shown, the apparatus are actuated by a crank-shaft maintained in continuous rotation, its velocity amounting to, say, six to ten revolutions per minute.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is—

1. In apparatus for indicating the proportion of carbonic acid contained in combustion-gases, a piston-pump of determinated stroke volume, means for continually driving the pump, an absorption vessel, means for connecting the absorption vessel with the piston-pump and means for expelling the analyzed gases out of the absorption vessel.

2. In apparatus for indicating the proportion of carbonic acid contained in combustion-gases, a piston-pump of determinated stroke volume, means for continually driving the pump, means for introducing the gases to be analyzed in the suction-pipe of the piston-pump, means for connecting the absorption vessel with the pressure-pipe of the piston-pump and means for expelling the analyzed gases out of the absorption vessel.

3. In apparatus for indicating the proportion of carbonic acid contained in combustion-gases, a piston-pump of determinated stroke volume, means for continually driving the pump, an absorption vessel, means for connecting the absorption vessel with the piston-pump and a cylinder having a piston for expelling the analyzed gases out of the absorption vessel.

4. In apparatus for indicating the proportion of carbonic acid contained in combustion-gases, a piston-pump of determinated stroke volume, means for continually driving the pump, an absorption vessel, means for connecting the absorption vessel with the piston-pump, a cylinder having a piston, means for connecting the cylinder with the liquid-space of the absorption vessel and means for indicating the stroke of the piston of the cylinder.

5. In apparatus for indicating the proportion of carbonic acid contained in combustion-gases, a piston of determinated stroke volume, means for continually driving the pump, an absorption vessel, means for connecting the absorption vessel with the piston-pump, a cylinder having a piston, means for connecting the cylinder with the liquid-space of the absorption vessel, means for indicating the stroke of the piston of the cylinder, means to brake these indicating means and means to release the indicating means at the end of the stroke of the piston.

6. In apparatus for indicating the proportion of ca bonic acid contained in combustion-gases, a piston-pump of determinated stroke volume, means for continually driving the pump, an absorption vessel, means for connecting the absorption vessel with the piston-pump, means for expelling the analyzed gases out of the absorption vessel and means for replenishing the consumed absorption liquid.

In testimony whereof we affix our signatures in presence of two witnesses.

ALFRED SCHLATTER.
LUDWIG DEUTSCH.

Witnesses:
FILIP SCHÖN,
F. E. MALLETT.