

(No Model.)

3 Sheets—Sheet 1.

G. LUNGE.

APPARATUS FOR TREATING LIQUIDS WITH GASES.

No. 485,126.

Patented Oct. 25, 1892.

Fig. 1.

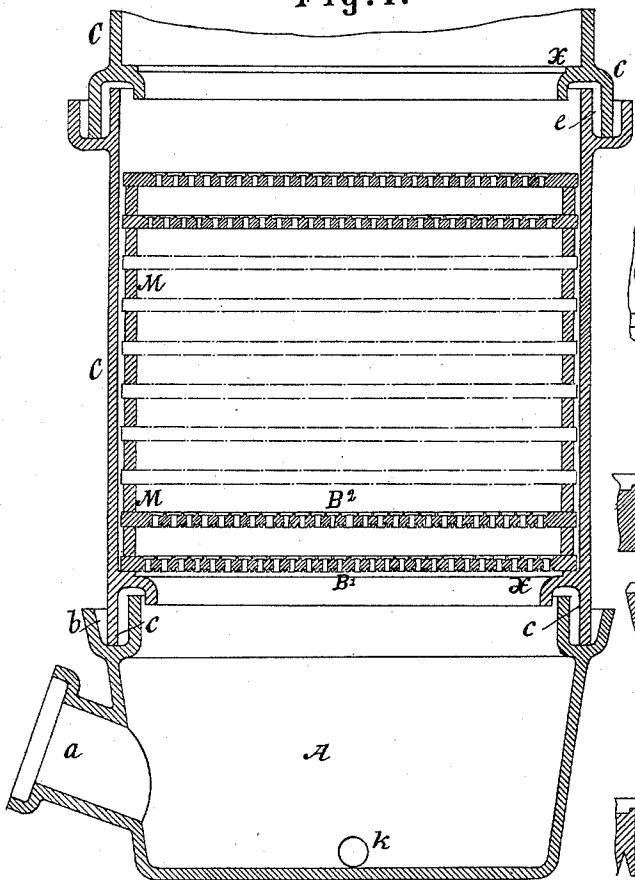


Fig. 2.

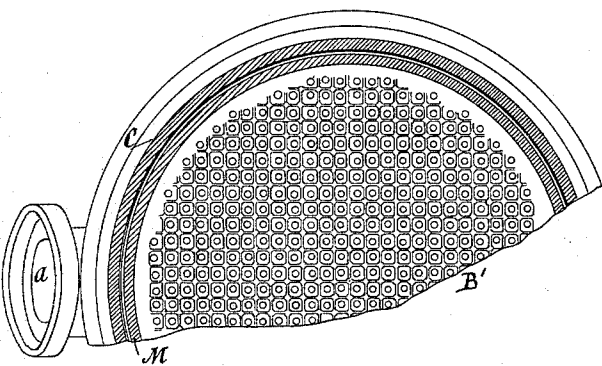


Fig. 3.

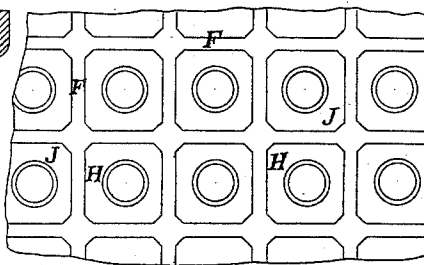


Fig. 4.

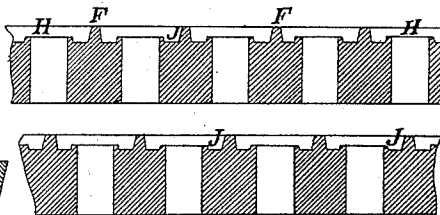


Fig. 5.

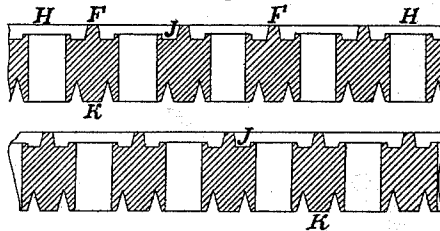
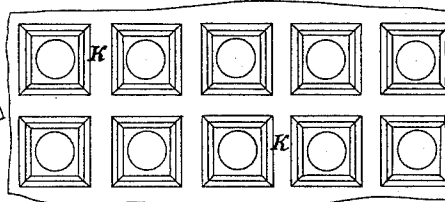


Fig. 6.



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Fig. 7.

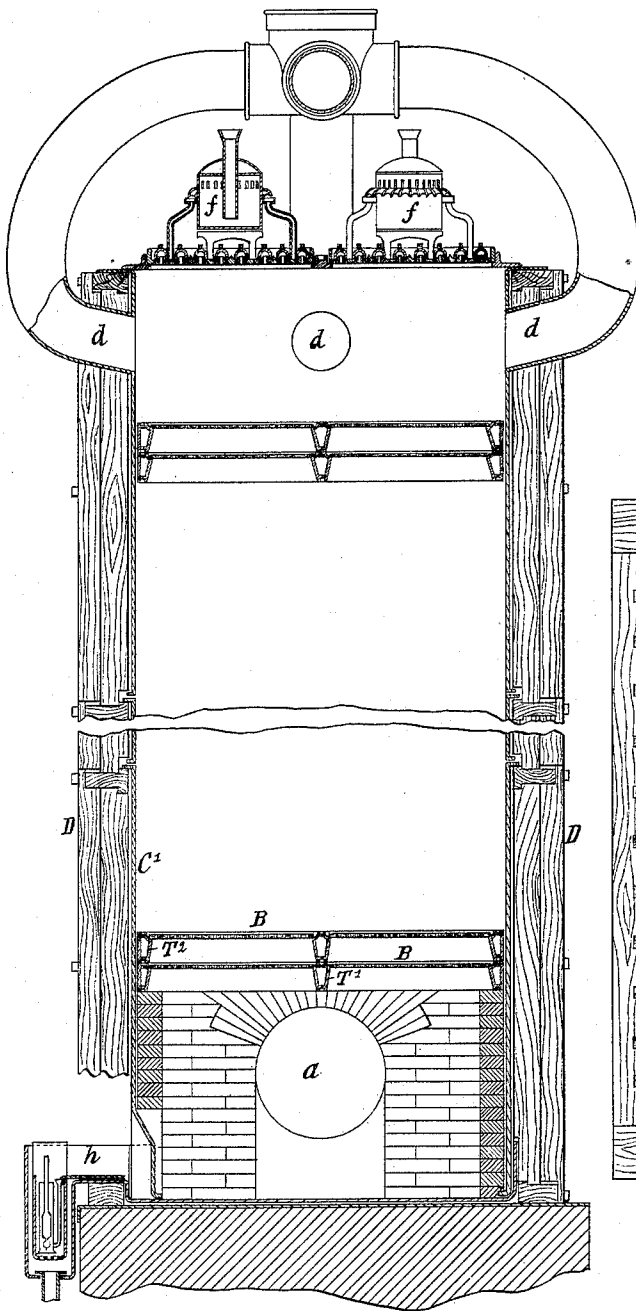
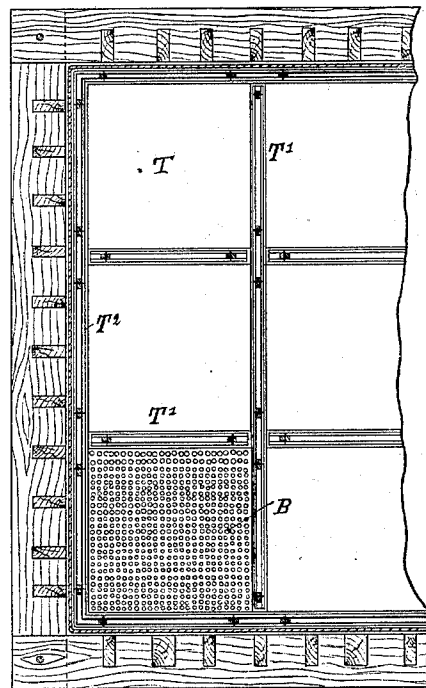


Fig. 8.



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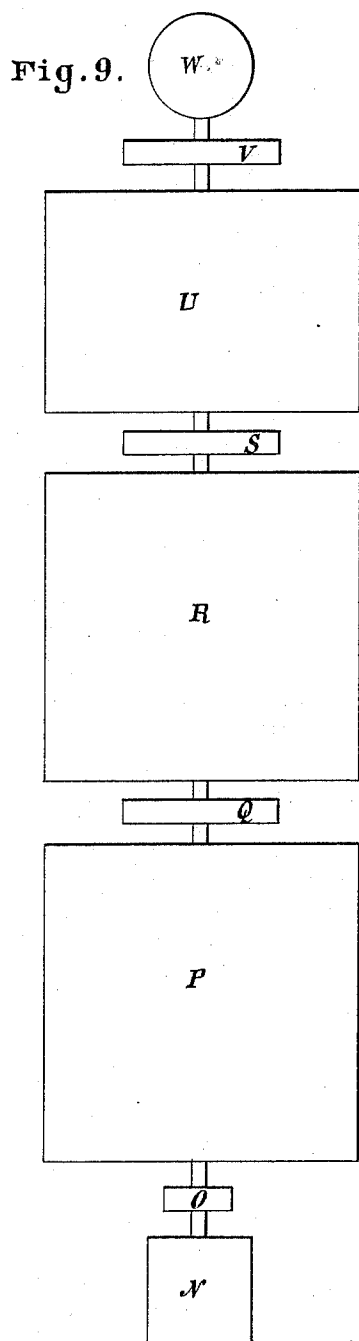
3 Sheets—Sheet 3.

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APPARATUS FOR TREATING LIQUIDS WITH GASES.

No. 485,126.

Patented Oct. 25, 1892.



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UNITED STATES PATENT OFFICE.

GEORGE LUNGE, OF ZURICH, SWITZERLAND.

APPARATUS FOR TREATING LIQUIDS WITH GASES.

SPECIFICATION forming part of Letters Patent No. 485,126, dated October 25, 1892.

Application filed February 16, 1892. Serial No. 421,723. (No model.) Patented in France August 29, 1885, No. 170,897, and July 20, 1886; in Belgium September 4, 1885, No. 70,124, and July 30, 1886, No. 74,046; in Germany June 5, 1886, No. 40,625, and in England August 5, 1886, No. 10,037, and April 26, 1889, No. 6,989.

To all whom it may concern:

Be it known that I, GEORGE LUNGE, a citizen of the United Kingdom of Great Britain and Ireland, residing in Zurich, Switzerland, have
5 invented certain new and useful Improvements in Apparatus for Treating Liquids with Gases, (for which I have obtained the following patents: in Germany, No. 40,625, dated June 5, 1886; in France, No. 170,897, dated
10 August 29, 1885, and July 20, 1886; in Belgium, No. 70,124, dated September 4, 1885, and No. 74,046, dated July 30, 1886; in England, No. 10,037, dated August 5, 1886, and No. 6,989, dated April 26, 1889,) of which the following
15 is a specification.

The first part of this invention relates to an improvement in plate columns for use in industrial chemistry for the purpose of bringing gases into intimate contact with liquids
20 in order to produce the desired reactions.

The second part of the invention relates to an improved plant for the manufacture of sulphuric acid in which a multiplicity of lead chambers are combined with interposed plate
25 columns.

The drawings are as follows: Figure 1 is a central vertical section of the lower part of my improved plate column. Fig. 2 is a horizontal section affording a top view of a portion of one of the plates. Fig. 3 is a top view,
30 upon an enlarged scale, of a portion of one of the plates. Figs. 4 and 5 are vertical sections, respectively, showing two forms of plates. Fig. 6 is a view of the under side of the form of plate represented in Fig. 5. Fig. 7 is a central vertical section of a modification of the
35 plate column. Fig. 8 is a horizontal section of the plate column shown in Fig. 7. Fig. 9 is a diagram symbolically illustrating an example of my improved plant for manufacturing sulphuric acid.
40

The plate column herein shown and described embodies several improvements upon the apparatus for the treatment of liquids
45 and gases, for which Letters Patent of the United States, No. 344,322, were issued to me June 22, 1886.

The object of the first part of my invention is to bring about the most intimate possible contact of gases with liquids in order to cause
50

them to react upon each other in the most perfect way. This object is attained by arranging in a tower or column, as illustrated in Fig. 1, a series of superposed perforated plates B' B'' , &c., and in introducing the
55 liquid at the top of the column and admitting the gases at the bottom. The gas is introduced through the pipe a into a tank A at the bottom of the column. The gas ascends in the column in a zigzag path through the
60 holes in the successive plates, which are staggered for the purpose of causing the gaseous currents to be constantly deflected and broken up. The liquid descending in the column and meeting the gases cannot drop straight
65 through the system of plates because the holes in the plates are not in vertical alignment with each other. Hence the liquid falling through a hole in one plate strikes against the solid portion of the plate beneath, and so
70 on. A film of liquid is constantly maintained upon each plate by means of a peculiar network of ledges upon the top of the plate, as hereinafter more fully described. The liquid is discharged from the tank A through the
75 outlet k .

In the structure shown in Letters Patent No. 344,322 the shell of the cylindrical column is formed by the hydraulic joints of the plates with each other. For the purpose of
80 forming such joints each plate has erected around its edge an annular trough, the bottom of which is provided with a downwardly-projecting vertical flange. The downwardly-projecting flange of each trough is immersed
85 in the sealing fluid contained in the trough of the plate beneath it. Hence there are as many hydraulic joints as there are plates.

In the present case I form the column by superposing a series of cylinders CC , each of
90 which is surrounded at its upper end by an annular trough e and is provided at its lower end with an inverted trough, the exterior wall c of which is wider than the inner wall and is immersed in the sealing fluid con-
95 tained in the trough e of the cylinder next below. The lower end of the lowest cylinder is immersed in the sealing fluid contained in the annular trough b , surrounding the upper edge of the bottom tank A .
100

The number of superposed cylinders employed will vary according to the requirements of each special case. The uppermost cylinder of the column is provided with a cover and with suitable devices for carrying away the gases and subdividing the liquid, as shown in Fig. 7. Within each cylinder is a series of perforated plates B' B², &c., the lowest of which rests upon the annular ledge X. The other plates are supported upon the annular bearers M M, which are respectively interposed between the adjacent plates and serve to keep the plates at the proper distances from each other.

The construction of the perforated plates is shown in detail in Fig. 3, 4, 5, and 6. As illustrated in Fig. 3, the upper surface of each plate is provided with a network of small ledges F F, separating the holes from each other, and is also provided with upwardly-projecting annular flanges surrounding the holes, respectively, and serving as dams therefor. There are thus formed a series of small basins J J, each having a hole in its central portion surrounded by a dam H. As the dam is of less height than the height of the ledges F, a certain quantity of liquid is retained in each of the basins; but this liquid is constantly renewed by the fresh liquid dropped down from the next higher plate. The falling liquid splashes upon the ledges and upon the surface of the liquid contained in the basins J J, which is thus caused to overflow the dams H and fall to the next lower plate, and so on. This device secures the advantage of keeping the surface of each plate substantially covered with a shallow layer of liquid, which is constantly being agitated and renewed, and also secures the advantage of uniformly distributing the liquid throughout the column without allowing it to flow more on one side than the other, even though the plates should not be perfectly level. The resulting uniform distribution of the liquid and the constant splashing incident to the maintenance of the thin layers of liquid upon the surfaces of the plates operate to assist the subdivision and intermingling of the currents of gas and afford the most favorable conditions for the action of the gases and liquids upon each other.

It will of course be seen that the basins J or spaces between the ledges F may be provided with more than one hole without departure from the invention.

The under surfaces of the plates B' B², &c., may either be plain, as shown in Fig. 4, or be provided with systems of grooves K, as illustrated in Figs. 5 and 6, which afford the advantage of more perfectly insuring that every drop of liquid falling from one plate will strike upon a solid part of the next lower plate.

The cylindrical plate column shown in Figs. 1 and 2 is especially adapted for being entirely constructed of acid-proof earthenware, and is particularly intended for use in the man-

ufacture of hydrochloric, nitric, and acetic acids and for all purposes in which any contact of the liquids and gases with metals must be avoided. This involves keeping the sectional area of the columns within the comparatively-narrow limits compelled by the difficulty of manufacturing earthenware cylinders of great diameter. When, therefore, apparatus of greater sectional area is required and a certain contact with metals is permissible, the superposed tiers of plates shown in Figs. 7 and 8 are employed. In this construction each tier is composed of two or more plates B B, made, preferably, of square or rectangular shape, permitting the plates of the several tiers, respectively, to be conveniently supported upon the intervening systems of bearers T' T² in such a way that the entire weight of the plates is carried by the bearers and each plate has only to support its own weight. The intersecting bearers T' are so shaped as to support the edges of the two adjoining plates. The exterior bearers T² are so shaped as to form a casing for the whole column. If the joints are made secure with suitable cement, a metallic casing for the column may be dispensed with; but it will usually be desirable to employ a continuous metallic casing, such as the casing C', (shown in Fig. 7,) which may be made of any metal not subject to be acted upon by the substances passing through the column T. It is to be observed that in any case the casing C' is to a great extent protected by the bearers T², which form an almost continuous casing.

When the plate column is to be employed for the manufacture of sulphuric acid, the casing is made of lead and is supported by wooden framework D D.

Fig. 7 shows the gas-inlet *a*, the gas-outlets *d d*, the liquid-feeding devices *f f*, and the overflow *h* for the liquid at the bottom, all of which parts may of course be shaped in different forms from those shown, if desired.

That part of my invention which relates to my improved plant for manufacturing sulphuric acid embraces the employment of a multiplicity of lead chambers with interposed plate columns, an example of which is shown in Fig. 9. The plant symbolically represented in Fig. 9 includes, first, the ordinary Glover tower N; second, the first plate column O for completing the action of the Glover tower; third, the first lead chamber P; fourth, the second plate column Q; fifth, the second lead chamber R; sixth, the third plate column S; seventh, the third lead chamber U; eighth, the fourth plate column V for aiding in the recovery of niter, and, ninth, the ordinary Gay-Lussac tower W. The plate column O is fed with nitrous vitriol and chamber acid, the plate columns Q and S with water or dilute sulphuric acid, and the plate-column V with concentrated sulphuric acid. It is to be understood that the organization shown in Fig. 9 is to be regarded merely as illustrative and

that the place, size, shape, and material of the plate columns can always be adapted to the requirements of each particular case.

The improvement embodied in the organization illustrated in Fig. 9 is based upon the following considerations: The reactions involved in the manufacture of sulphuric acid in lead chambers are energetic in those parts of the chambers into which the gases are first introduced, and which for distinction I call the "first" part of the lead chamber. In the last part of the lead chamber the reactions become sluggish, because of the reduction in concentration of the gases. Hence the second part of my improvement consists in cutting off the last part of the lead chamber and in conducting the gases from the remaining first part into a plate column, in which the reactions are "livened up," so to speak. Now if it should be attempted to carry on the whole process of manufacturing sulphuric acid in plate columns or similar apparatus the heat thereby necessarily evolved would be injurious both to the material of the apparatus and to the process; but by combining a series of comparatively-short lead chambers with interposed plate columns not only is a great saving effected in the cost of the lead chambers by reason of their reduction in size, but the greatest efficiency of action is attained by reason of the facts that those parts only of the lead chamber which are most efficient—to wit: the first parts—are employed, while the injurious consequences of the excessive heat which would result from the exclusive employment of plate columns are avoided.

What is claimed as the invention is—

1. In a column or tower, superposed perforated plates B' B², &c., whose upper sur-

faces are provided with networks of ledges F F, forming systems of shallow basins J J, the bottoms of which are provided, respectively, with one or more holes surrounded by raised dams H H, the said systems of basins being staggered or arranged to break line vertically, substantially as specified.

2. In a column or tower, superposed perforated plates whose upper surfaces are provided with networks of ledges F F and whose lower surfaces are provided with grooves K K around each perforation, substantially as specified.

3. A series of superposed cylinders having their joints protected by liquid seals, each of said cylinders containing a series of superposed plates provided with systems of perforations, the said systems being so arranged as to be out of vertical alignment with each other, substantially as set forth.

4. In apparatus for making sulphuric acid, the combination of a series of plate columns with an interplaced series of lead chambers, substantially as and for the purposes herein set forth.

5. In apparatus for making sulphuric acid, the combination, as herein set forth, of a series of plate columns with an interplaced series of lead chambers and a Glover tower at one end and a Gay-Lussac tower at the other end, the whole connected to form a continuous system, substantially as set forth.

Signed at the United States consulate at Zurich, Switzerland, this 23d day of January, 1892.

GEORGE LUNGE.

Witnesses:

HENRY LABHART,
ADAM LOHR.