No. 712,891. Patented Nov. 4, 1902.

H. A. ABENDROTH.

APPARATUS FOR FREEING AMMONIA FROM GAS LIQUOR.

(Application filed Dec. 20, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

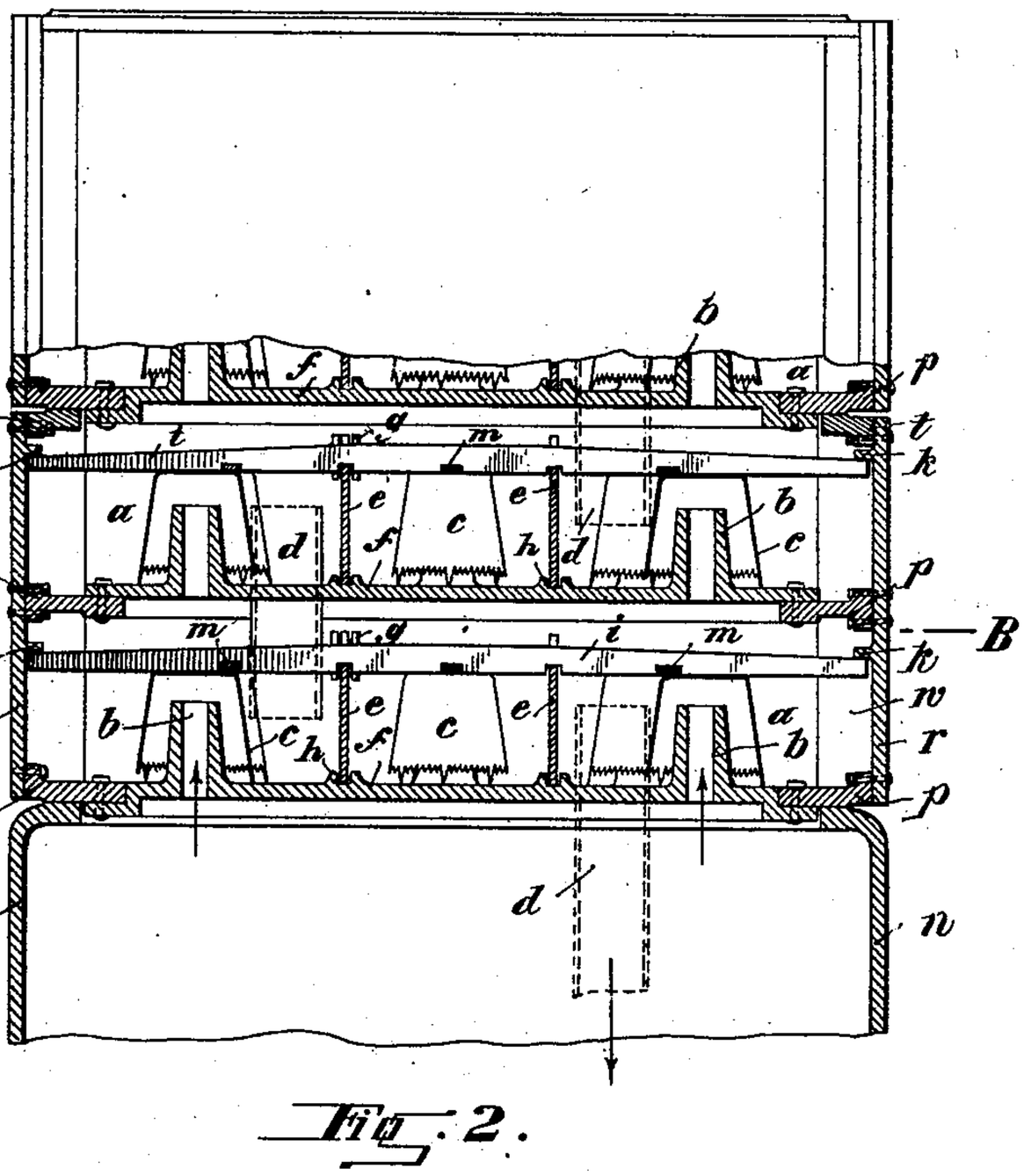
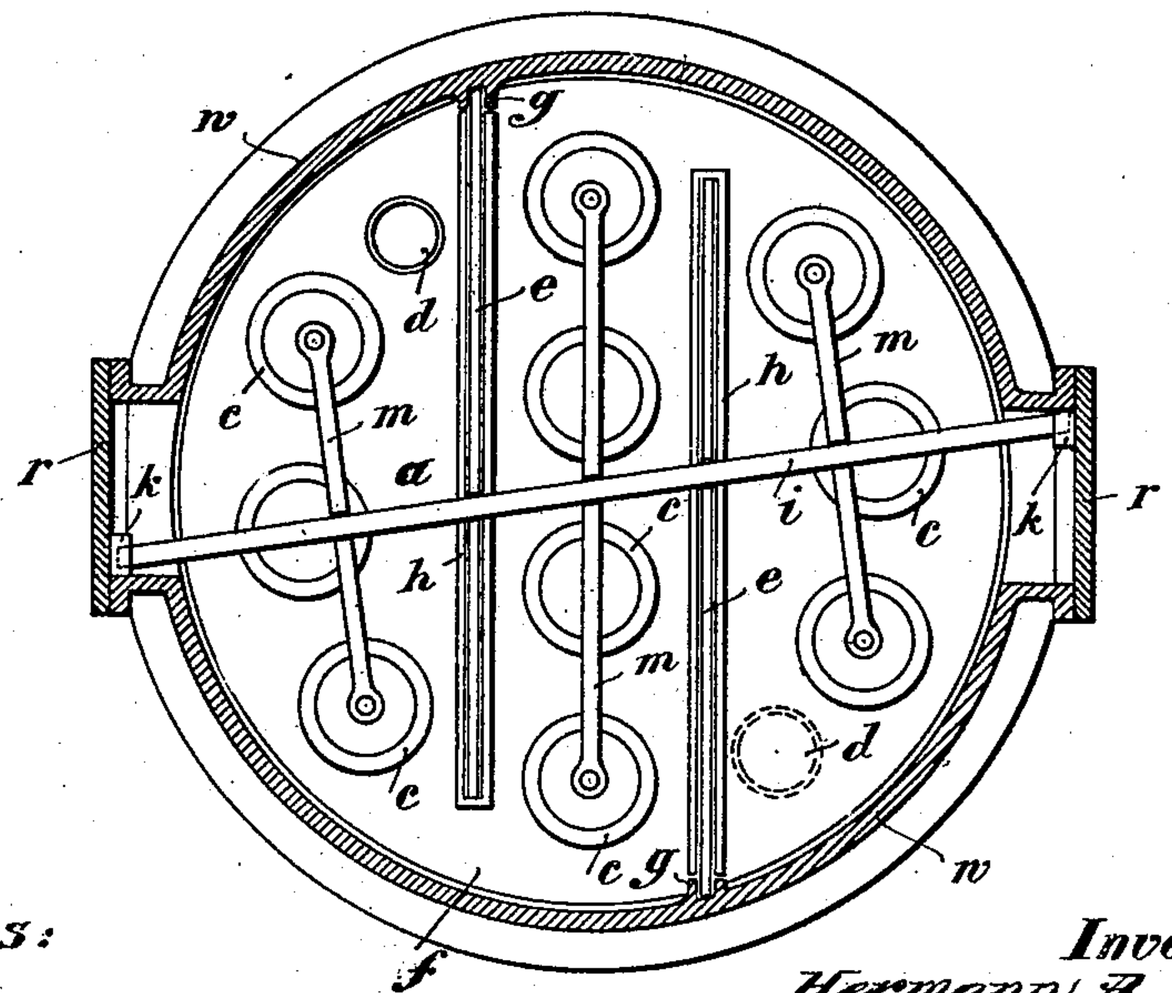


Fig. 2.



Witnesses:

John Lotka

Julius Lutz.

Inventor

Hermann A. Abendroth.

per

Munn & Co.

Attorneys.

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Fig. 3.

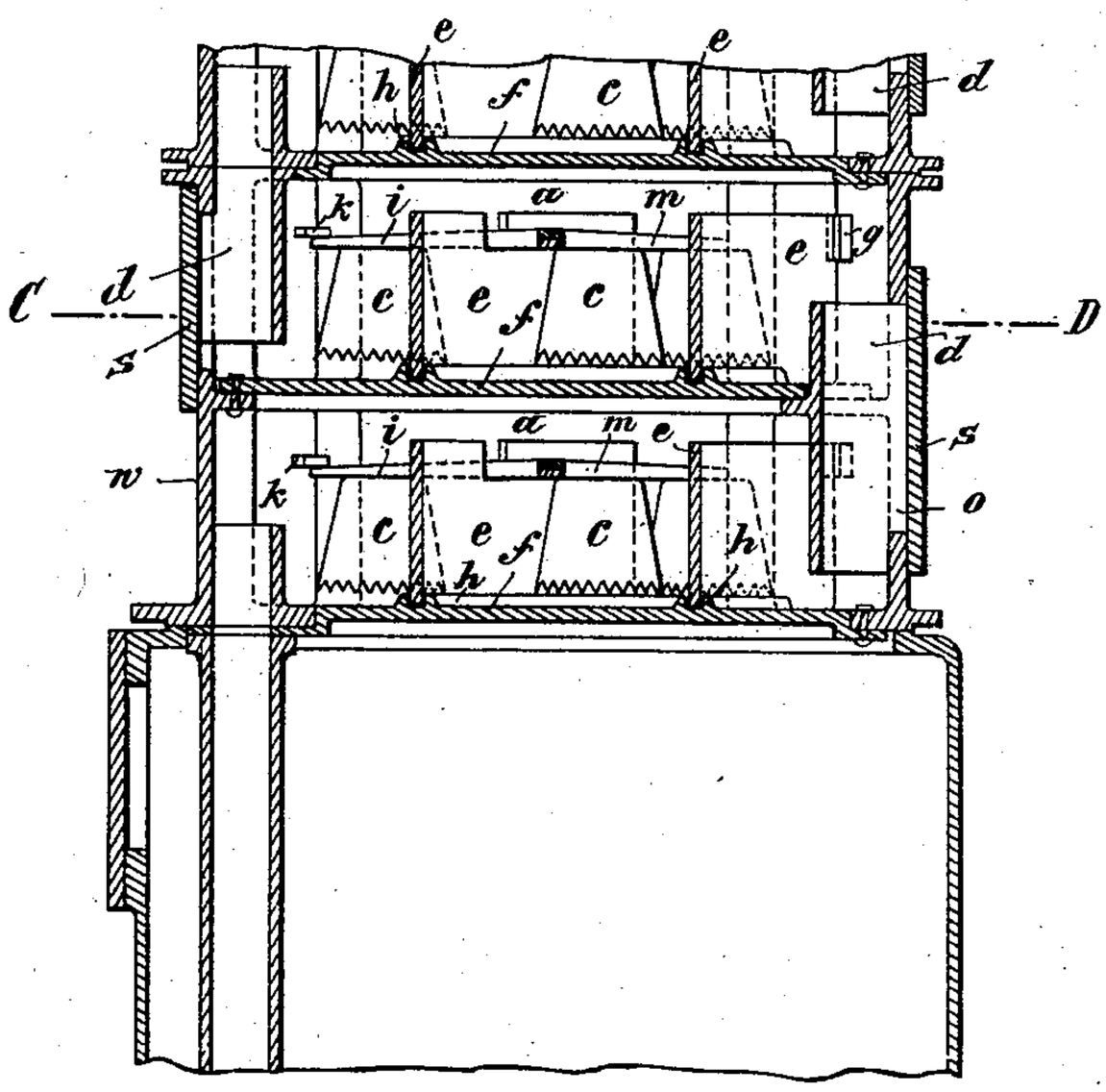
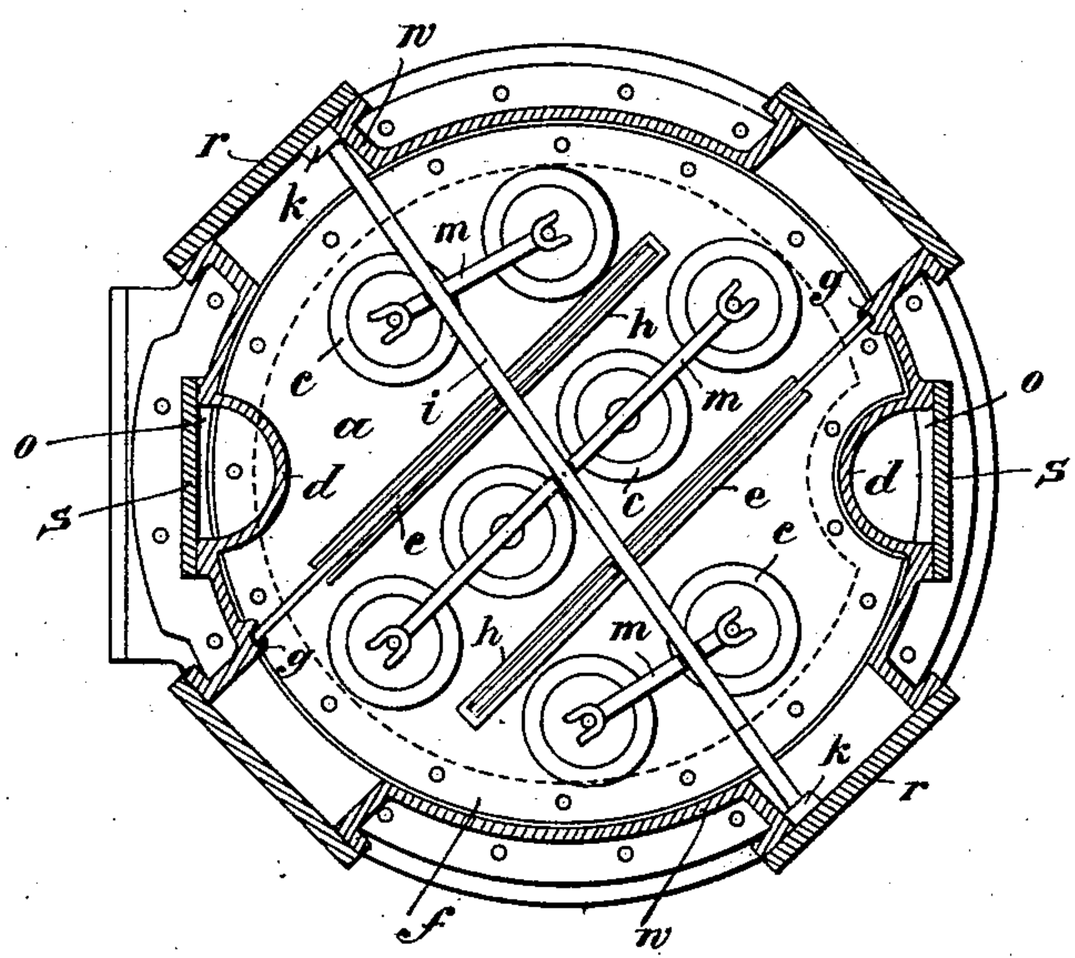


Fig. 4.



Witnesses:

John Lotka

Julius Lotka

Inventor
Hermann A. Abendroth.
per Munn & Co.
Attorneys.

UNITED STATES PATENT OFFICE.

HERMANN ARTHUR ABENDROTH, OF BERLIN, GERMANY.

APPARATUS FOR FREEING AMMONIA FROM GAS LIQUOR.

SPECIFICATION forming part of Letters Patent No. 712,891, dated November 4, 1902.

Application filed December 20, 1900. Serial No. 40,585. (No model.)

To all whom it may concern:

Be it known that I, HERMANN ARTHUR ABENDROTH, a subject of the Emperor of Germany, and a resident of the city of Berlin, in the Province of Brandenburg, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Apparatus for Freeing Ammonia from Gas Liquor, of which the following is a full, clear, and exact specification.

The present invention relates to improvements in that class of apparatus for the treatment of gas liquor which consists of a number of superposed cells or compartments, in the uppermost of which the crude gas liquor enters to be brought into contact with steam passing upward from underneath. In this treatment the incoming crude liquor is heated to such a degree that some of the ammonia-gas is driven off by causing the liquor to descend through the heated column, while at the base of the latter the liquor is mixed with milk of lime in order to liberate the fixed ammonia contained in the liquor and to cause it, together with the evolved steam or vapor, to ascend the column.

In order to compel the gas liquor being treated to pass through the cells or compartments in a zigzag path, and thus fully utilize all the surface of the cells, partition-walls are arranged in the cells, so as to direct the course of the fluid after its entry toward its exit. The steam rising from underneath, which mixes itself with the ammonia-gas, is passed through a number of vertical tubes covered with hoods into the cells or compartments in such a way that the gas liquor passing down must come into intimate contact with the steam passing upward. Hitherto the partition-walls in the cells or compartments of such apparatus have been fastened to the bottom of the cell or compartment or have been cast in one piece with same, while the hoods covering the vertical tubes through which the steam enters have been held in position by round-headed screws or by weights. The disadvantage of these arrangements is that the interior parts of the apparatus, which, on account of deposits of lime and other substances, must be frequently cleaned, are only accessible with difficulty and necessitate the apparatus being completely taken to pieces to clean it. It is then found that the removal of the hoods where they are held by round-headed screws is a most difficult matter, owing to the heads of the screws being eaten away on their outer sides, so as to leave no gripping-surface, and the threaded portion is made immovable by rust. On the other hand, the weighting of the hoods has the disadvantage that by the action of the rising steam where the course of the gas liquor is stopped up or blocked the position of the hoods is easily altered, and they may even be thrown off altogether.

The object of the present invention is to do away with these advantages by improvements in the construction of apparatus of the above-indicated class, which will now be explained with reference to the accompanying drawings, in which—

Figure 1 is an elevation of the upper part of the apparatus, partly in section. Fig. 2 is a cross-section on line A B of Fig. 1. Figs. 3 and 4 are corresponding elevations of another form of the apparatus.

The apparatus shown in Figs. 1 and 2 is separable into sections to permit it to be readily taken apart or put together; and it consists of a suitable number of superposed cells or compartments *a*, in which vertical tubes *b* for the admission of the steam or vapor, covered with hoods *c*, having serrated edges and also outlet-pipes *d* for the descent of the liquor, are arranged in the usual way. Each cell or compartment *a* has a floor or bottom *f*, resting on or fastened to annular flanges *p*, which are connected with the inner wall *w* of the column in any suitable manner. The upper section of the apparatus (shown in Fig. 1 of the drawings) rests on the annular flange *t*, secured to the wall *w* of the lower section, and the said lower section is supported by a suitable base or standard *n*. The partition-walls *e*, regulating the course of the water to be driven off, consist of plates extending from opposite sides of the compartments, as shown in the drawings, and arranged to cause the fluid to pass in a zigzag direction through the compartments. These partition-walls are not, as hitherto, made integral with the bottom *f* of the cell or compartment *a*, but are slid loosely in channel-irons *g*, fastened to the inner wall of the compartment, and in channel-irons *h*

on the cell-bottom *f*, being held in their positions by a cross-rod *i*. The cross-rod *i* has slots or notches fitting into corresponding notches in the partition-walls *e* and is fastened in its place by being pressed or latched under a nose-piece or projection *k*, arranged on the cell-wall *w* or cleaning cover or door *r*. The rod *i* serves at the same time for pressing all the hoods *c* in the cell against the bottom *f* and for securing them in position over the tube ends, and this is effected by means of rods *m*, engaging the hoods *c*, being pressed down and held by the cross-rod *i*. The rods *m* are connected in a similar way to the cross-rod *i* to that of the connection of the cross-rod to the partition-walls *e*. As shown in Fig. 1, sundry of the teeth at the bottom of the hoods *c* may extend below the other teeth and engage the bottom *f*.

By means of the arrangement described the cells *a* of the apparatus can be easily and quickly cleaned in case of need, since on removing the rods *i* and *m* both the partition-walls and the hoods can be taken out, while the hoods are always kept in their normal position while the apparatus is at work.

In order to make the outlet-tubes for the fluid from one cell to another easily accessible in order to clean them of the deposits, the arrangement shown in Figs. 3 and 4 is adopted, wherein part of the wall or shell *w* of the apparatus serves as a wall for the tube, so that by means of the opening *o*, normally covered by the cover *s*, the tubes *d* can be easily made accessible for cleaning from the outside of the apparatus. For this purpose it is preferable to give the tubes a trough-like form, Fig. 4.

The constructional details of the invention, as described, can of course be altered in many ways without departing from the scope of the invention.

The operation of the apparatus is as follows: The gas liquor is admitted to the upper compartment of the column and passes downward from one compartment to the other through the tubes *d*, connecting the compartments, the partitions *e* causing the liquor to pass in a zigzag manner through each compartment before it is discharged therefrom. During the passage of the gas liquor through the apparatus the liquor becomes heated by the steam, which passes up through the inlet-tubes *b*, and some of the ammonia-gas is driven off. The liquor containing the fixed ammonia passes to the base of the column, where it is mixed with milk of lime in order to liberate the fixed ammonia, which, as before stated, with the evolved steam or vapor ascends the column.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an apparatus for freeing ammonia from gas liquor, the combination of the cell *a*, the hoods *c*, the partitions *e*, cross-pieces *m* resting on the hoods, and suitable catches or nose-pieces *k* on the inner wall of the cell, with a cross-bar *i* engaging said partitions, cross-pieces and catches, as and for the purpose shown and described.

2. In an apparatus for freeing ammonia from gas liquor, the combination of superposed cells or compartments separated from one another by means of suitably-supported floors *f* provided with steam-inlet pipes *b*, with trough-like tubes *d* open at top and bottom, arranged at the periphery of said cells and closed by suitable covers *s*, as and for the purpose shown and described.

HERMANN ARTHUR ABENDROTH.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.