

No. 771,833.

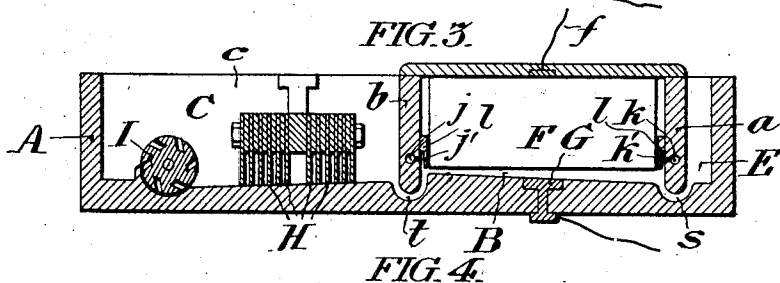
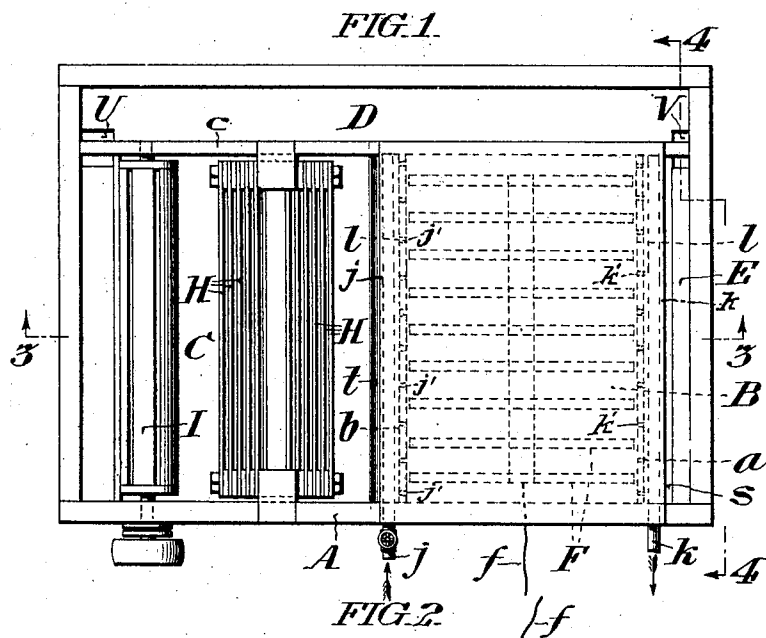
PATENTED OCT. 11, 1904.

C. W. ROEPPER & W. E. HARMON.
 APPARATUS FOR MERCURIAL ALKALINE PROCESSES.

APPLICATION FILED JAN. 30, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



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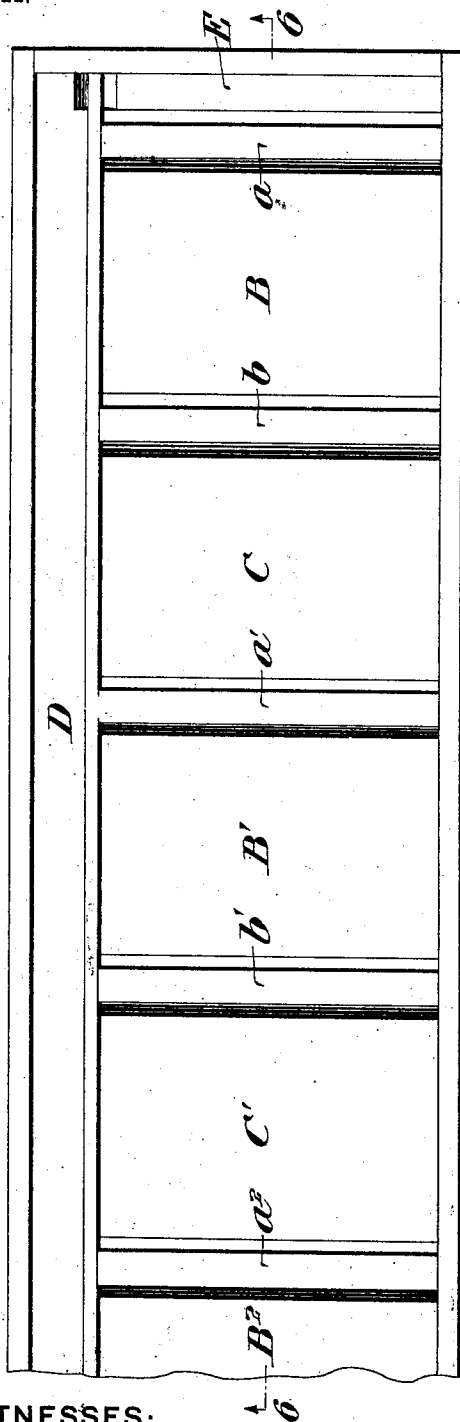
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3 SHEETS—SHEET 2.

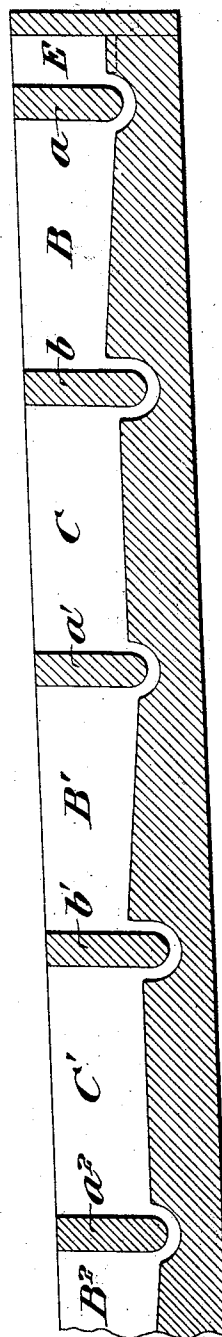
FIG. 5.



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FIG. 6.



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3 SHEETS—SHEET 3.

FIG. 7.

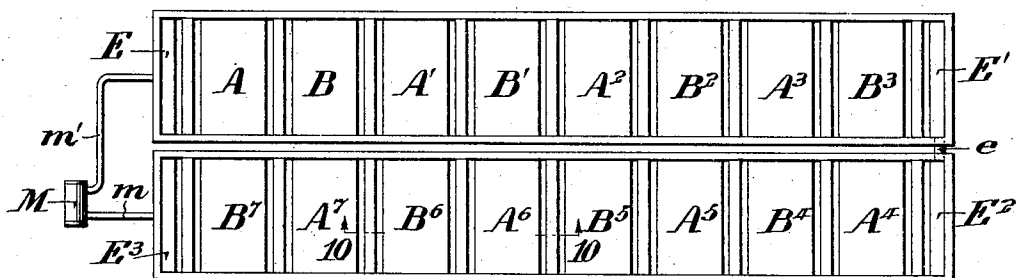


FIG. 8.

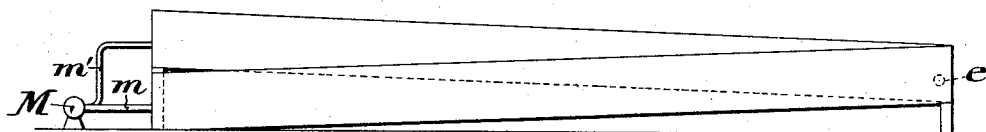


FIG. 9.

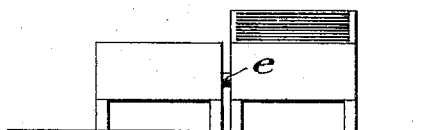
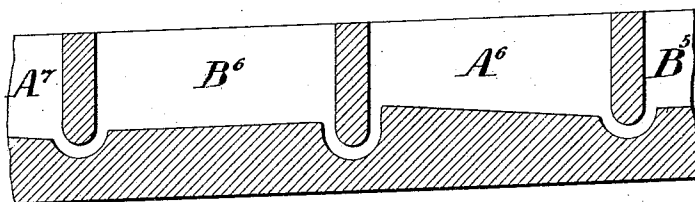


FIG. 10.



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APPARATUS FOR MERCURIAL ALKALINE PROCESSES.

SPECIFICATION forming part of Letters Patent No. 771,833, dated October 11, 1904.

Application filed January 30, 1903. Serial No. 141,107. (No model.)

To all whom it may concern:

Be it known that we, CHARLES W. ROEPPER, residing at 133 Phil-Elena street, Germantown, Philadelphia, State of Pennsylvania, and WILLIS E. HARMON, residing at Mechanics Falls, State of Maine, citizens of the United States, have invented certain new and useful Improvements in Apparatus for Mercurial Alkaline Processes, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to an apparatus applicable for use in those alkaline processes which are known as "mercurial." Such processes depend for their operation upon the transference of a body of liquid metal, usually mercury, from an amalgamating to a deamalgamating compartment, in the former of which by electrolytic action the mercury is caused to take up alkaline metal, while in the latter compartment it is caused to give off this alkaline metal, usually to a superincumbent body of water, which thereby becomes a solution of alkaline hydroxid. It is usual in such processes to continuously return the mercury after it has given off its alkaline metal in the deamalgamating-compartment back to the amalgamating-compartment, a more or less continuous circulation or agitation of the mercury being resorted to for this purpose.

The present invention has special reference to the control and regulation of the circulation of the mercury in these processes in such a way as to best facilitate the actions which proceed in the two compartments and also to economize expense by limiting the quantity of mercury required. To this end in the apparatus described in this specification the bottoms of the successive compartments over which the mercury flows are arranged in a special manner, as will be described.

The invention also has reference to the means provided for insuring the proper circulation of the alkali-yielding solution in the amalgamating-compartment with an even flow across the width thereof.

In the accompanying drawings, Figure 1 is a

plan view of an apparatus furnished with a single amalgamating and a single deamalgamating compartment. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical longitudinal section of the same through the line 3 3, Fig. 1. Fig. 4 is a vertical cross-section of the same through the line 4 4, Fig. 1. Fig. 5 is a partial plan of an apparatus containing a series of amalgamating and deamalgamating compartments. Fig. 6 is a vertical longitudinal section taken on the line 6 6, Fig. 5. Fig. 7 is a plan view of an apparatus combining a series of amalgamating and deamalgamating compartments somewhat differently arranged. Fig. 8 is a side elevation of the same. Fig. 9 is an end elevation of the same. Fig. 10 is a partial longitudinal vertical section taken along the line 10 10, Fig. 7.

Referring to Fig. 1, A is a containing-box of wood or slate or suitable material. It is divided by vertical partitions into an amalgamating-compartment B, a deamalgamating-compartment C, a return-way D, and a sluiceway E, the partitions between these compartments being disposed as shown in the plan. The partition *b*, which separates the amalgamating-compartment from its deamalgamating-compartment, is termed in this specification the "main" partition to distinguish it from the other partitions. Beneath partition *a*, which separates the amalgamating-compartment from the sluiceway, the bottom of the box has a groove *s* cut in it coincident with the length of the partition, so that the partition fails to reach the bottom, thereby establishing free communication between the sluiceway and amalgamating-compartment beneath the partition for its entire length. A similar groove *t* and similar means of communication exist beneath the main partition *b*, which separates the amalgamating from the deamalgamating compartment. The deamalgamating-compartment connects with the return-way beneath the partition *c* by way of a partial groove U, and the return-way connects with the sluiceway beneath the same partition by way of a partial groove V. The amalgamating-compartment B is fitted with a lid

from which depend a series of anode-plates F, electrically connected to the wire *f*. This wire is in circuit with a cathode G, which may conveniently be placed at the bottom of the amalgamating-compartment, as seen in Fig. 3. The deamalgamating-compartment contains the means for causing the alkaline amalgam which it contains to yield up its contained alkali to a superincumbent body of water, which in this instance consist in a series of discharging plates or shoes H, reaching to the bottom of the compartment through and between which the amalgam circulates by means of holes or channels pierced near their bottom edges. In the apparatus shown the circulation of the mercury is induced by means of a wheel I, mounted near the rear end of the deamalgamating-compartment, the buckets of which lift the mercury from the bottom of the compartment upon one side and discharge it upon the other side, near the opening U, through which it flows back into the return-way. It will be understood that the containing-box has placed within it a sufficient quantity of mercury and that by virtue of the rotation of the wheel I this body of mercury is continuously circulated, so as to pass from the amalgamating to the deamalgamating compartment, thence to the return-way, thence to the sluiceway, and thence back again into the amalgamating-compartment. The amalgamating-compartment, above the mercury, which rests upon its bottom, contains a solution of an alkaline salt, usually brine. A supply-pipe *j* for this solution enters the side of the containing-box alongside of the main partition *b* and traverses this partition. It is fitted with a series of apertures *j'*, opening into the amalgamating-compartment above the level of the mercury and spaced along the whole length of the partition *b*. A similar exit-pipe *k* for this solution traverses partition *a*, communicating with the amalgamating-compartment by a series of apertures *k'*, which open into the compartment above the level of the mercury, and are similarly spaced across the width of the compartment. The openings from the supply-pipe *j* and the supply-pipe *k* may be further protected by aprons *l l*. This arrangement distributes the flow of the liquid over the width of the compartment and compels it to flow in the vicinity of the bottom edges of the anode-plates, thus assisting in keeping the bottoms of the anode-plates free from adherent gas-bubbles. The passage of the electric current through the amalgamating-compartment decomposes the solution, causing it to yield up its alkaline element to the mercury. The deamalgamating-compartment contains water resting upon the surface of the mercury to which, with the assistance of the shoes, the alkaline amalgam gives off its alkaline element in the form of hydrated oxid. It is important that the body of mercury or amalgam

in the amalgamating-compartment shall be comparatively thin and free from any waves or agitation notwithstanding its circulation. The surface of this body of mercury, being the portion which immediately takes up the alkaline metal, must always take part in the circulation, and the entire body must move steadily forward into the deamalgamating-compartment. It is also important that the layer of mercury, although thin, be at no point broken. To accomplish these ends, the edge of the groove under the main partition is lower on the side of the deamalgamating-compartment than on the side of the amalgamating-compartment. The bottom of the amalgamating-compartment slopes down from the edge of this groove toward the sluiceway. The bottom of the deamalgamating-compartment slopes away from the main partition down to the wheel. The bottom on the far side of the wheel is higher than on the near side, but usually not so high as its highest point in the amalgamating-compartment, (next to the main partition.) This construction compels the maintenance of enough mercury in the amalgamating-compartment to cover its bottom, while at the same time the very gradual slope of this bottom prevents the maintenance of any considerable or stationary body of mercury in this compartment, limiting the amount of mercury therein to a comparatively thin wedge-shaped film, which is constantly progressing toward its apex and passing therefrom over the edge of the groove and under the partition into the deamalgamating-compartment. There is therefore a fall of the mercury as it flows under the main partition, which prevents any waves caused by the circulating-wheel or other agitation in the deamalgamating-compartment from being communicated by way of the groove to the mercury in the amalgamating-compartment. The slope of the bottom of the deamalgamating-compartment from the groove down toward the wheel facilitates circulation at this point, as it is not necessary in this compartment to maintain the mercury at the bottom of the compartment entirely free from bare spots. It will further be noted that both compartments, by reason of their sloping bottoms, have within them the minimum amount of mercury to enable them to perform their functions.

Referring now to Figs. 5 and 6, there is here illustrated a form of apparatus in which the amalgamating and deamalgamating compartments alternate with each other. B B' B² are amalgamating-compartment. C C', &c., are deamalgamating-compartment, each communicating with those on either side by means of grooves at the bottom of the containing-box coincident with the partitions *a b a' b' a²*, &c., by which the compartments are separated. This series may be indefinitely continued, as indicated by the broken edge to

the left of Fig. 5. From the last of the compartments the mercury is passed by means of a wheel or other circulating agency into the return-way D, from whence it finds its way to the sluiceway E and passes under the partition *a* back into the first of the amalgamating-compartments B. As before, the partitions *b**b'*, &c., which separate each amalgamating-compartment from its succeeding and corresponding deamalgamating-compartment, are termed the "main" partitions. The arrangement of the levels at the bottom of this series of compartments is illustrated in the vertical section of Fig. 6. The highest point in the entire system of circulation occurs in compartment B at the edge of the groove under the main partition *b*, the bottom of the compartment sloping back from this point toward the sluiceway. From this highest point the mercury passes over the edge into the groove under partition *b*, the opposite edge of which is at a somewhat lower level. In compartment C the bottom slopes down to the groove under partition *a'*. On the opposite side of this groove, in amalgamating-compartment B', the bottom slopes up to the edge of the groove under the main partition *b'*, which is the next highest point encountered by the mercury after leaving the still higher point previously referred to. Over this edge the mercury falls into the groove under the partition *b'*, where the construction repeats itself, the successive points where the bottom is high being always situated in the amalgamating-compartments at the edge of the groove under the main partitions and each of such high points being in succession a little lower than the preceding one. In every case the bottom of the amalgamating-compartment slopes downwardly from this high point back toward the preceding deamalgamating-compartment, while the bottom of each deamalgamating-compartment slopes down in the direction of the flow of the mercury. In this way there is obtained a very thin, continuous, and smoothly-flowing body of mercury at the bottom of each amalgamating-compartment.

In Fig. 7 there is illustrated a somewhat different arrangement of the apparatus. As before, there is here a continuous series of amalgamating and deamalgamating compartments which succeed each other in alternation. The amalgamating-compartments are lettered, respectively, A A' A² A³, &c., and the deamalgamating-compartments are lettered, respectively, B B' B², &c. This series is arranged in a double row, of which the first row slopes down from the left to right, while the second row slopes down from right to left. These two rows are immediately alongside of each other and at both ends of both rows there are sluiceways E E' E² E³. At the right-hand end of Fig. 7 the sluiceways E' E² connect directly by a pipe *e*. At the left-hand end the mercury is withdrawn from

the lowest sluiceway E³ by way of a pipe *m* and conveyed to a pump M, by which it is pumped by a pipe *m'* back to the highest sluiceway E. As illustrated in Fig. 10, the levels at the bottom of these two rows of compartments present a contour similar to that represented in Fig. 6 and described in explaining the preceding type of apparatus.

Having thus described our invention, we claim--

1. In an apparatus for the practice of mercurial alkaline processes, the combination of an amalgamating-compartment; a deamalgamating-compartment; a main partition between the two; and a passage-way under the partition; the bottom of the amalgamating-compartment sloping downwardly from this passage-way toward its other end, substantially as described.

2. In an apparatus for the practice of mercurial alkaline processes, the combination of an amalgamating-compartment; a deamalgamating-compartment; a main partition between the two, and a groove in the bottom under the partition; the edge of the groove under the main partition on the side of the amalgamating-compartment being higher than the edge of the same groove on the side of the deamalgamating-compartment, substantially as described.

3. In an apparatus for the practice of mercurial alkaline processes, the combination of an amalgamating-compartment; a deamalgamating-compartment; a main partition between the two; and a passage-way under the partition; the bottom of both compartments sloping downwardly away from this passage-way, substantially as described.

4. In an apparatus for the practice of mercurial alkaline processes, the combination of an amalgamating-compartment; a deamalgamating-compartment; a main partition between the two; a groove in the bottom under the partition; the bottoms of both compartments sloping downwardly away from the edges of the groove under the main partition; and the edge of the groove under the main partition on the side of the amalgamating-compartment being higher than the edge of the same groove on the side of the deamalgamating-compartment, substantially as described.

5. In an apparatus for the practice of mercurial alkaline processes, a pathway for the mercury, comprising successively an amalgamating-compartment; a deamalgamating-compartment; a return-way; and a sluiceway; the partition between the sluiceway and amalgamating-compartment, and also the main partition between the amalgamating-compartment and the deamalgamating-compartment, having grooves or passage-ways under the partitions for the passage of the mercury, substantially as described.

6. In an apparatus for the practice of mer-

curial alkaline processes, an alternating and gradually-descending series of amalgamating and deamalgamating compartments, separated by partitions with grooves in the bottom under them; the highest point in each pair of compartments being the edge of the groove under the main partition on the side of the amalgamating-compartment, and this highest point of each pair being lower down in each succeeding pair, substantially as described.

7. In an apparatus for the practice of mercurial alkaline processes, an alternating and gradually-descending series of amalgamating and deamalgamating compartments, separated by partitions with grooves in the bottom under them; the sides of each of the grooves under the main partitions being higher in the amalgamating-compartment than in the deamalgamating-compartment, substantially as described.

8. In an apparatus for the practice of mercurial alkaline processes, an alternating and gradually-descending series of amalgamating and deamalgamating compartments, separated by partitions with grooves or passage-ways under them, the bottoms of all the compartments sloping downwardly away from their main partitions, substantially as described.

9. In an apparatus for the practice of mercurial alkaline processes, an alternating and gradually-descending series of amalgamating and deamalgamating compartments, separated by partitions with passage-ways under them; having a successively lowered series of high points at the bottom of each amalgamating-compartment next to the passage-way under the main partitions; in combination with means for returning mercury from the bottom of the series back again to the top, substantially as described.

10. In an apparatus for the practice of mercurial alkaline processes, a series of amalgamating and deamalgamating compartments alternating with each other; said series being arranged in two rows, placed alongside of each other and sloping in opposite directions; the compartments of each row being separated by partitions with communication by way of grooves in the bottom under the partitions;

the edges of each of said grooves being higher on the side of the amalgamating-compartment than on the side of the deamalgamating-compartment; together with means for returning the mercury from the lowest level at the extremity of one row to the highest level at the extremity of the other row, substantially as described.

11. In an apparatus for the practice of mercurial alkaline processes; an amalgamating-compartment separated by partitions from both preceding and succeeding compartments, and in communication with said compartments by way of grooves in the bottom under the partitions; a body of mercury occupying the bottom of said compartment; in combination with inflow and outflow pipes for the solution to be electrolyzed, traversing the partitions across their entire length, and communicating with the amalgamating-compartment by a series of apertures spaced along the whole length of the partitions above the level of the mercury in said compartment, whereby flow of the said solution to be electrolyzed is evenly distributed across the width of the amalgamating-compartment, substantially as described.

12. In an apparatus for the practice of mercurial alkaline processes, an amalgamating-compartment, separated from both preceding and succeeding compartments by partitions with grooves or passage-ways under them; in combination with inflow and outflow pipes, for the solution to be electrolyzed, traversing these partitions, and communicating with the amalgamating-compartment by a series of apertures, above the level of the mercury in said compartment; with aprons protecting the apertures and guiding the flow of the electrolytic solution, substantially as described.

In testimony whereof we, the said CHARLES W. ROEPPER and WILLIS E. HARMON, have signed our names to this specification, this 28th day of January, 1903, in the presence of two subscribing witnesses.

CHARLES W. ROEPPER.
WILLIS E. HARMON.

Witnesses:

JAMES H. BELL,
LEWIS R. KEEGAN.