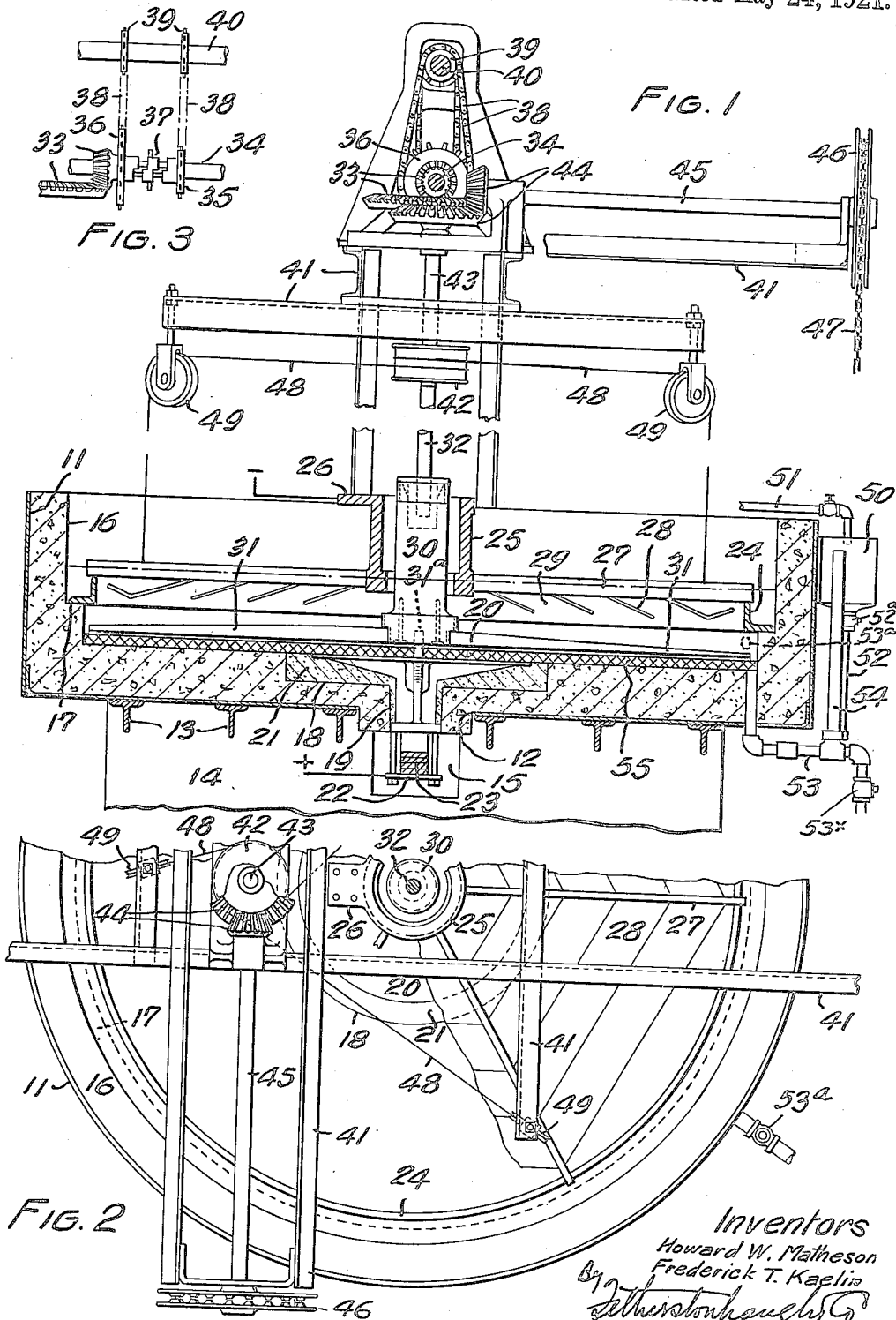


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ELECTROLYTIC CELL.

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1,379,467.



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ELECTROLYTIC CELL.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, HOWARD W. MATHE-
SON and FREDERICK T. KAE LIN, both sub-
jects of the King of Great Britain, and resi-
dents of Shawenegan Falls, in the Province
of Quebec and Dominion of Canada, have
invented certain new and useful Improve-
ments in Electrolytic Cells, of which the
following is a full, clear, and exact descrip-
tion.

This invention relates to improvements in
electrolytic cells, and particularly to cells
used for oxidizing mercury and the like.

The object of the invention is to provide
a device for the purpose named, which may
be cheaply and easily constructed, and in
which the oxidization may be carried on on
a large scale.

A further object is to provide means for
easily and quickly moving an electrode out
of the cell for the purpose of cleaning or
repairing the same.

The device consists essentially of a re-
ceptacle having an anode in the bottom
thereof and a cathode suspended in the re-
ceptacle, the receptacle being so constructed
that the current flow is only between the
cathode and the anode. Means are provided
for easily and quickly raising and lowering
the cathode. A stirring device is also pro-
vided having means for rotating the same at
different speeds.

In the drawings which illustrate the in-
vention:—

Figure 1 is a vertical sectional view of
a cell constructed according to this inven-
tion.

Fig. 2 is a partial plan view of the cell.

Fig. 3 is a fragmentary side elevation
showing the change speed gear of the stir-
ring device.

Referring more particularly to the draw-
ings, 11 designates a receptacle casing or
shell, preferably of metal and circular in
form having a central opening 12 in the
bottom. The casing is carried on support-
ing beams 13 mounted on any suitable num-
ber of pedestals 14, each of which is pro-
vided with an opening 15 in line with the
center of the receptacle for the passage of
an electric conductor. This shell or cas-
ing 11 is provided with a lining 16 of con-
crete or other suitable material, which cov-
ers the side and bottom and which may

project slightly through the central open-
ing 12. This lining is formed with a step
a short distance above the bottom and
also with a central depression 18, having a
concentric opening 19 through the bottom.
An anode 20 which is preferably in the
form of a suitably ribbed plate is set in
the recess 18, and is held in position by a
grouting 21 of cement. The ribbing of the
plate extends through the opening 19, and
is provided with a clamping device 22 for
the attachment of an electric conductor 23
to the anode. The anode is preferably in
the form of a nickel casing but may be of
iron or steel or other metal, nickel-plated
or not, as desired. The surface of the
anode is exactly level with the inner bottom
surface of the lining.

The cathode comprises preferably a cen-
tral hub 25 of nickel or other metal, nickel-
plated or not, as desired, having a lip
for the attachment of an electric conductor.
A plurality of arms or spokes 27 radiate
from the hub and rest at their extremities
on the support 24. Inclined blades or plates
28 are connected between the spokes 27 pre-
ferably in overlapping relation. The in-
clination of the blades 27 provides laterally
directed gas vents 29 between the blades.

A stirring device is provided between the
cathode and the anode, and is spaced away
from each. This stirring device is prefer-
ably in the form of a hub 30, which may be
of wood suitably reinforced with metal and
carrying radial blades 31 of wood or other
suitable material which are suitably pitched,
so that when the stirring device is rotated
in the cell, the electrolyte will be given an
up and down movement as well as a circular
movement. The hub of the stirring device
passes through the hub of the cathode and
is supported by a pin 31^a projecting from
the anode, so that the stirrer hub is held
out of contact with the cathode hub. The
stirring device is revolubly mounted and is
driven through a spindle 32 connected by
bevel gears 33 with the counter shaft 34.
This counter shaft is provided with small
and large sprockets 35 and 36 respectively,
revolubly mounted thereon and adapted to
be engaged singly by a clutch 37 slidably
but irrevolubly mounted on the counter
shaft. These sprockets are connected by
chains 38 with pinions 39 mounted on the

main drive shaft 40. It will thus be seen that by shifting the clutch 37, the stirring device may be driven at either high or low speed. It will be understood that the invention is not limited to the particular type of change gear shown (which is very elementary) but may be provided with any form of change speed gear. The shaft 40 and counter shaft 34 are mounted on a superstructure 41 of any suitable form.

The apparatus previously referred to for raising and lowering the cathode comprises a winding drum 42, mounted on a spindle 43 journaled in the superstructure and connected by bevel gears 44 with an operating shaft 45 having a chain wheel 46 and endless chain 47, such as is in common use in chain hoisting blocks. A plurality of hoisting cables 48 are each attached at one end to the drum 42 and pass over guide pulleys 49 and thence downwardly to the cathode arms 27 to which they are attached. These hoisting ropes are preferably attached at three equidistant points to the cathode, so that the cathode will be readily lifted without danger of turning over.

The mercury measuring cup 50 is provided on the side of the shell and is supplied with mercury, through a valve controlled pipe 51. This cup is located some distance above the bottom of the cell and is connected by a pipe 52 with a drain pipe 53 leading from the cell and controlled by a valve 53^x, the connection being between the cell and the drain pipe valve. A pipe 54 is also provided leading from the drain pipe between the cell and the valve and serves as a mercury level gage. This cup is for the purpose of charging the cell without cutting off the current and for this purpose, the connecting pipe 52 and valve 52^a are of hard rubber. When the valve of the mercury line is opened and mercury run into the cup, the rubber valve should be closed; otherwise, the cell will be short circuited. In addition to the drain pipe 53, a draw off pipe 53^a is provided about one inch above the surface of the mercury for the purpose of removing the oxid, which is done at intervals of say half an hour. The drain pipe 53 is used only when it is desired to clear out the cell, or to introduce mercury.

When in operation and used for oxidizing mercury, the bottom of the cell is covered with a layer of metallic mercury, designated 55. This mercury is in contact with the anode but is separated from the cathode. The depth of the mercury is regulated, so that the stirring device swings just clear of the surface, in order that oxid formed on the surface of the mercury may be removed without disturbance of the mercury itself. The cell is charged with electrolyte to a depth sufficient to submerge or nearly

submerge the cathode, for example, as indicated by the dot and dash line Fig. 1. To prevent the mercury working through the pores of the concrete lining, the concrete may be coated with asphalt or other bituminous matter, or any substance which will resist penetration by the mercury, will not be acted upon by the electrolyte, and will not form an electric connection between the anode and the cathode. It will be readily seen that the anode and the mercury in connection therewith are completely out of contact with the metal shell of the container, and that the cathode is also out of contact with the shell. The electric discharge is therefore confined between the anode and cathode, and does not take place between the cathode and the sides of the receptacle. In order to prevent leakage, the cup 50 may be insulated from the shell or a portion of the discharge pipe 53 may be made of vulcanite or other insulating material.

The operation of the device is extremely simple. Mercury is placed to a suitable depth in the cell and the electrolyte, which is preferably an aqueous solution of caustic soda, added. A suitable electric current is passed through the cell, so that a discharge takes place from the anode to the cathode through the electrolyte. Hydrogen is liberated at the cathode and oxygen at the surface of the mercury, which is, electrically speaking, part of the anode. The oxygen combines with the mercury to form mercuric oxid. The hydrogen and any uncombined oxygen escape through the openings 29 between the cathode blades. The stirring device is operated at its low speed, approximately three revolutions per minute, and sweeps the oxid from the surface of the mercury as fast as it forms and keeps it in suspension in the electrolyte. When the process has been carried on for a considerable time, the electrolyte becomes very heavy with oxid, and the speed of the stirrer is then increased to approximately ten revolutions per minute. When the oxid is thoroughly stirred up in the electrolyte, the drain-off pipe 53^a is opened and a part at least of the electrolyte run off into any suitable receiver. The oxid is allowed to settle out of the electrolyte and the latter then returned into the cell for continuation of the process. The overflow pipe 54 will provide an exit for the electrolyte if the cell should be overcharged therewith, or if ebullition arising from the heat of the reaction or frothing by confinement of gases should raise the level of the electrolyte.

Having thus described the invention, what is claimed is:—

1. In a device of the class described, a receptacle, an anode in the bottom thereof, a cathode supported in the shell above the

anode, and means for raising and lowering the cathode including a winding drum, a plurality of cables connected to said drum and to equidistant points on the cathode, and means for rotating the drum.

2. In a device of the class described, a receptacle, an anode bedded in the bottom thereof, a cathode supported above the anode, a stirring device between the anode and cathode, and means for rotating the stirring device at different speeds.

3. A device according to the preceding claim, in which the stirring device passes through the cathode, and a center pin on the anode engaging the stirrer and holding the same out of contact with the cathode.

4. In a device of the class described, an electrolytic cell comprising a pan, an anode in the bottom thereof, a cathode above the anode, and a lining in the pan electrically separating the anode and cathode from one another and from the pan, said lining being also adapted to separate the liquid contents of the cell from the pan and to expose the anode and cathode to the liquid, whereby electric discharge will be confined between the anode and cathode through the liquid.

5. A device according to claim 4, in which the lining is adapted to retain a layer of mercury for oxidation in contact with the anode and out of contact with the pan.

6. A device according to claim 4, in which the cathode covers substantially the whole bottom area of the pan and in which the lining is adapted to retain a layer of mercury for oxidation over the whole bottom area of the cell and out of contact with the pan but in contact with the anode, whereby electric discharge may take place between

the mercury and cathode over the whole bottom area of the cell.

7. In a device of the class described, a cathode comprising a hub, radial supports projecting therefrom, and inclined plates secured between said supports in spaced overlapping relation.

8. In a device of the class described, a horizontally disposed cathode, and gas escape passages therefrom so positioned as not to reduce the available discharge surface of the cathode.

9. In a device of the class described, a horizontally disposed cathode, and inclined gas escape passages therethrough.

10. In a mercury oxidizing apparatus, means for supporting an anode and a layer of mercury in contact therewith, a cathode supported above the mercury, an electrolyte stirring device between the mercury and the cathode adapted to keep the surface of the mercury clear of oxid and means for admitting mercury to replace that oxidized.

11. A device according to claim 10, in which the mercury supporting member is an electric conducting element and is provided with an electric non-conducting lining excluding the electrolyte from contact with the supporting member, whereby discharge is confined between the mercury and the cathode.

12. In a device according to claim 10, means for preventing electric discharge directly between the cathode and the mercury support.

In witness whereof, we have hereunto set our hands.

HOWARD W. MATHESON.
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