No. 699,294. Patented May 6, 1902.

H. E. DOLPHIN.

APPARATUS FOR AERATING OR AGITATING LIQUIDS.

(Application filed Jan. 17, 1902.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

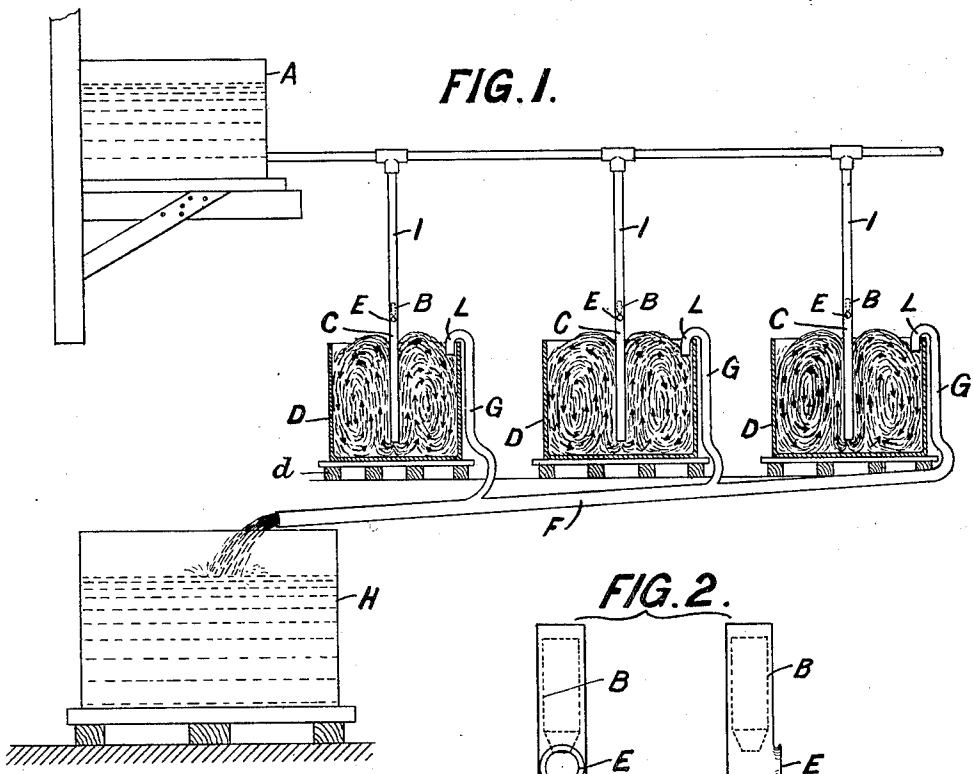
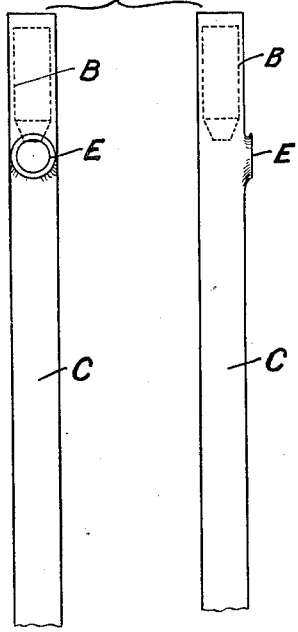


FIG. 2.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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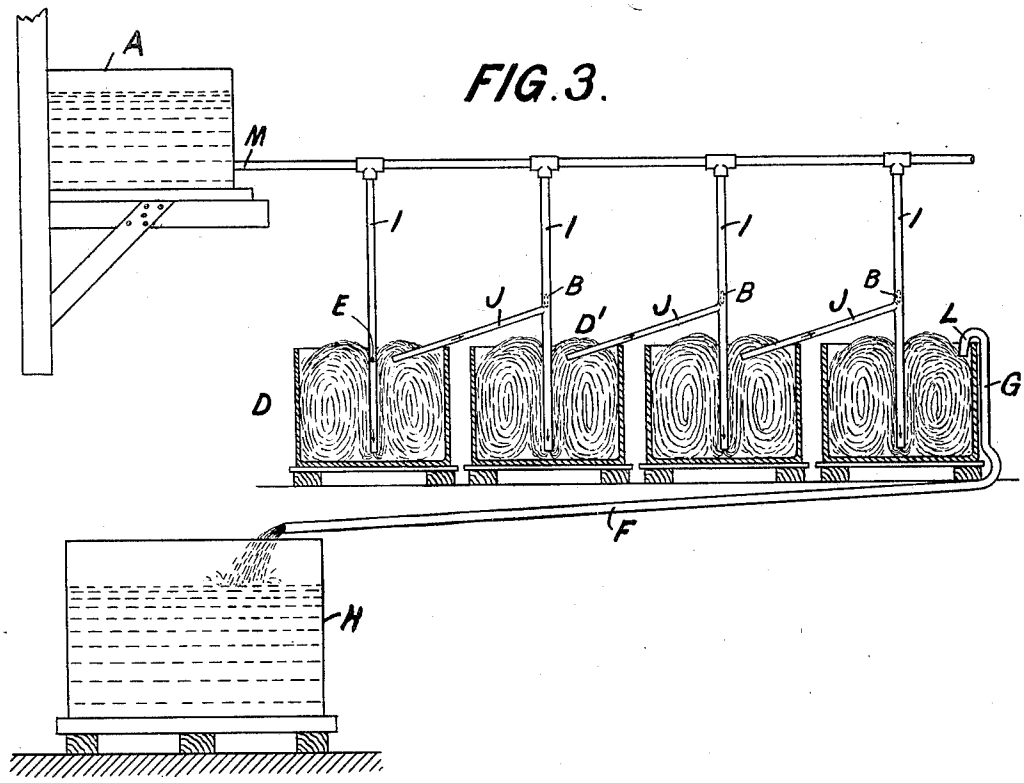
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(No Model.) 2 Sheets—Sheet 2.

FIG. 3.



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UNITED STATES PATENT OFFICE.

HAROLD EVELYN DOLPHIN, OF CRESSINGTON, NEAR LIVERPOOL, ENGLAND.

APPARATUS FOR AERATING OR AGITATING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 699,294, dated May 6, 1902.

Application filed January 17, 1902. Serial No. 90,212. (No model.)

To all whom it may concern:

Be it known that I, HAROLD EVELYN DOLPHIN, a subject of the King of Great Britain, residing at Cressington, near Liverpool, in the county of Lancaster, England, (whose full postal address is 10 St. Mary's Terrace, Cressington, near Liverpool,) have invented certain new and useful Improvements in Apparatus for Aerating or Agitating Liquids, (for which application has been made in Great Britain, No. 12,442, dated June 18, 1891,) of which the following is a specification.

This invention has for its object to provide an arrangement for agitating liquids without the employment of mechanical or other stirrers.

I will describe my invention as applied to electrolytic processes for deposition of metals, reference being had to the accompanying drawings, in which—

Figure 1 is a general view of my apparatus. Fig. 2 is an enlarged view of the nozzles or jets; Fig. 3, another general view with their inlets dispensed with.

In electrolytic processes, especially during the deposition of metals by the electric current, I have found that it is of great importance that the liquid in the vat or cell should be constantly agitated in order to insure a smooth and at the same time homogeneous deposition at the cathode and to enable a higher current density to be used, and, furthermore, it is of the greatest importance that the liability of short-circuiting through the liquor-supply tubes from vat to vat be minimized.

The present invention is designed to secure the above objects and, furthermore, to secure a more rapid deposition than hitherto.

Referring to Figs. 1 and 2, D represents the glass vats or cells, supported on insulating-blocks *d*, and I the glass pipes for feeding the liquor thereto. The liquid under pressure is compelled to pass from pipes I through contracted nozzles or jets B, by which its velocity is increased. The necessary pressure is obtained by a head of liquid contained in a suitable cistern or tank A or even the pressure of a force-pump or otherwise. The orifice of these nozzles or jets B is diminished to one thirty-second of an inch, or thereabout, so as to discharge the liquid into the vat or cell in a fine stream, the object being to increase the velocity of the liquid at the nozzle and also to insure that the stream of liquid will have very small sectional area, thus minimizing the liability of short-circuiting and the liability of metal of the salt being deposited in the tubes practically nullified. The said nozzles or jets B discharge into tubes or barrels C of larger diameter than the nozzles B, the barrels being made in suitable proportion, which barrels discharge into the bottom of vats or cells D, the barrels C forming annular spaces surrounding the nozzles B. At a point slightly below the injecting-nozzle B there is an air-admission orifice E. The discharge of liquid through the injecting-tube B past the end of the air-inlet orifice E will draw in air, which is carried forward in the liquid into the bottom of the vat or cell D, the air giving the liquid a tendency to rise immediately to the surface, thereby insuring a uniform density of the liquid employed and setting up also a vigorous circulation or agitation, which is very effective in rendering the deposited metal smooth and free from nodules and at the same time allowing a very much higher current density to be used.

In cases where a very smooth deposit is desirable, such as in electroplating, this agitation or circulation of the liquor is exceedingly effective. In fact, the continual motion set up in the vats prevents any particles of organic matters present in the liquid from adhering to the surface of the cathode, and thus the formation of nodules is absolutely prevented. The injector might be formed in any well-known manner. For instance, air can be admitted by a series of holes in the tubes above the injector or the liquid jet might be made to surround the air-inlet, and thus draw in air therefrom. The liquid must of course pass into the injector under pressure, and this is best obtained by arranging, as aforesaid, a cistern A, containing a supply of liquid above the level of the vats or cells, thus utilizing the fall of the liquid to give the required pressure.

F is a run-off pipe, with branch pipes G leading from the respective cells D. This pipe delivers into the cistern H, from which

the liquid is again pumped into the cistern A, the arrows showing the circulation of liquid in the cells.

In cases where the admission of oxygen is a disadvantage the air-supply may be dispensed with and the circulation of the liquid set up by the liquid from one vat or cell being drawn into another vat or cell with the inflowing liquid. This is shown in Fig. 3, in which A is the supply-cistern, as before, and J the branch pipes leading from one cell to the down-pipe I of the adjacent cell. The main outlet M of the supply-cistern A supplies liquid through the down-tubes I to the contracted nozzles B of the cells. The head of liquid gives the necessary flow of liquid under pressure through the nozzles, and this induces a current of liquid to flow through the pipes J from the cell D and discharge it, together with the flow, through the nozzles into the bottom of cell D′, from whence it rises immediately to the surface, insuring uniform density of the liquid employed and also setting up a circulation or agitation of the liquid in the vat D′. This goes on through an unlimited series of cells, it being necessary to have only one outlet L from the end of each row to carry off the supply. This saves pumping power and insures a good circulation of the liquid in each cell. The first cell D in each row could have an orifice E in the pipe below the surface of the liquid in the vat, in which case the jet or nozzle will draw in liquid through the said orifice instead of air and discharge it, together with the flow, through the nozzles into the bottom of the cell. This latter arrangement of the orifice E below the level of the liquid could be supplied to each vat in the row, if preferred, instead of using the pipes J.

The mode of action is as follows: The liquid from the supply-tank A, issuing from the nozzles B at high velocity, sets up an induced current of air through the air-nozzles E, (or of liquid, as the case may be,) with which the jets of liquid mingle, and is delivered through pipes C to the bottom of the vat or cell, causing a very efficient and constant agitation and insuring a very rapid deposition. Suitable valves can be provided to regulate the velocity of the jets of the liquid discharged, and consequently the degree of agitation can be increased or decreased at pleasure. I can of course provide any suitable number of tanks or injectors, all fed from the one system. The same arrangement of fluid-inlets and injecting-nozzles for setting up an induced current of fluid through the said inlets can be applied to various kinds of apparatus where the aeration or agitation of the liquid therein is desired.

I declare that what I claim is—

1. In apparatus for aerating or agitating liquids, the combination with the vats or cells of a feed-pipe for delivering liquid under pressure into the bottom of each cell, a run-off pipe for discharging liquid from the cells, an injecting-nozzle in the feed-pipe, and a fluid-orifice arranged immediately adjacent to said nozzle in such a manner, that the liquid issuing from the nozzles at high velocity sets up an induced current of fluid through the fluid-inlet, with which the jets of liquid mingle and is delivered into the cell, causing a very efficient and constant agitation therein, substantially as described.

2. In apparatus for aerating or agitating liquids, the combination with the vats or cells of a feed-pipe for delivering liquid under pressure into the bottom of each cell, a run-off pipe for discharging liquid from the cells, an injecting-nozzle in the feed-pipe and a branch pipe leading from the adjacent cell to the said feed-pipe at a point adjacent to the nozzle in such a manner that the liquid issuing from the nozzles at high velocity sets up an induced current of liquid through the branch pipe, with which the jet issuing through the nozzle mingles and is delivered into the cell, causing a very efficient and constant agitation therein, substantially as described.

3. In an apparatus for aerating or agitating liquids, the combination of a storage-tank for the liquid, a series of vats, a main supply-pipe leading from said storage-tank, a depending feed-pipe for each vat connected with the main pipe, the nozzle of the feed-pipe being contracted, a casing surrounding the nozzle and leading into the vat, an orifice in said casing contiguous to the nozzle of the feed-pipe for causing an induced current of air, and a duct for each cell communicating with a main pipe for discharging the liquids in the cell, substantially as described.

4. In an apparatus for aerating or agitating liquids, the combination of a storage-tank for the liquid, a series of vats, a main supply-pipe leading from the storage-tank, a feed-pipe for each vat connected with the main supply-pipe, the nozzle of the feed-pipe being contracted, whereby the liquid will issue from the nozzle at high pressure, a casing or barrel surrounding the nozzle of the feed-pipe, orifices in the casing contiguous to said nozzle, whereby the liquid issuing from the nozzles at high pressure will cause an induced current of fluid through said orifices, substantially as described.

In witness whereof I have hereunto signed my name, this 8th day of January, 1902, in the presence of two subscribing witnesses.

HAROLD EVELYN DOLPHIN.

Witnesses:

G. C. DYMOND,

JOHN MCLACHLAN.