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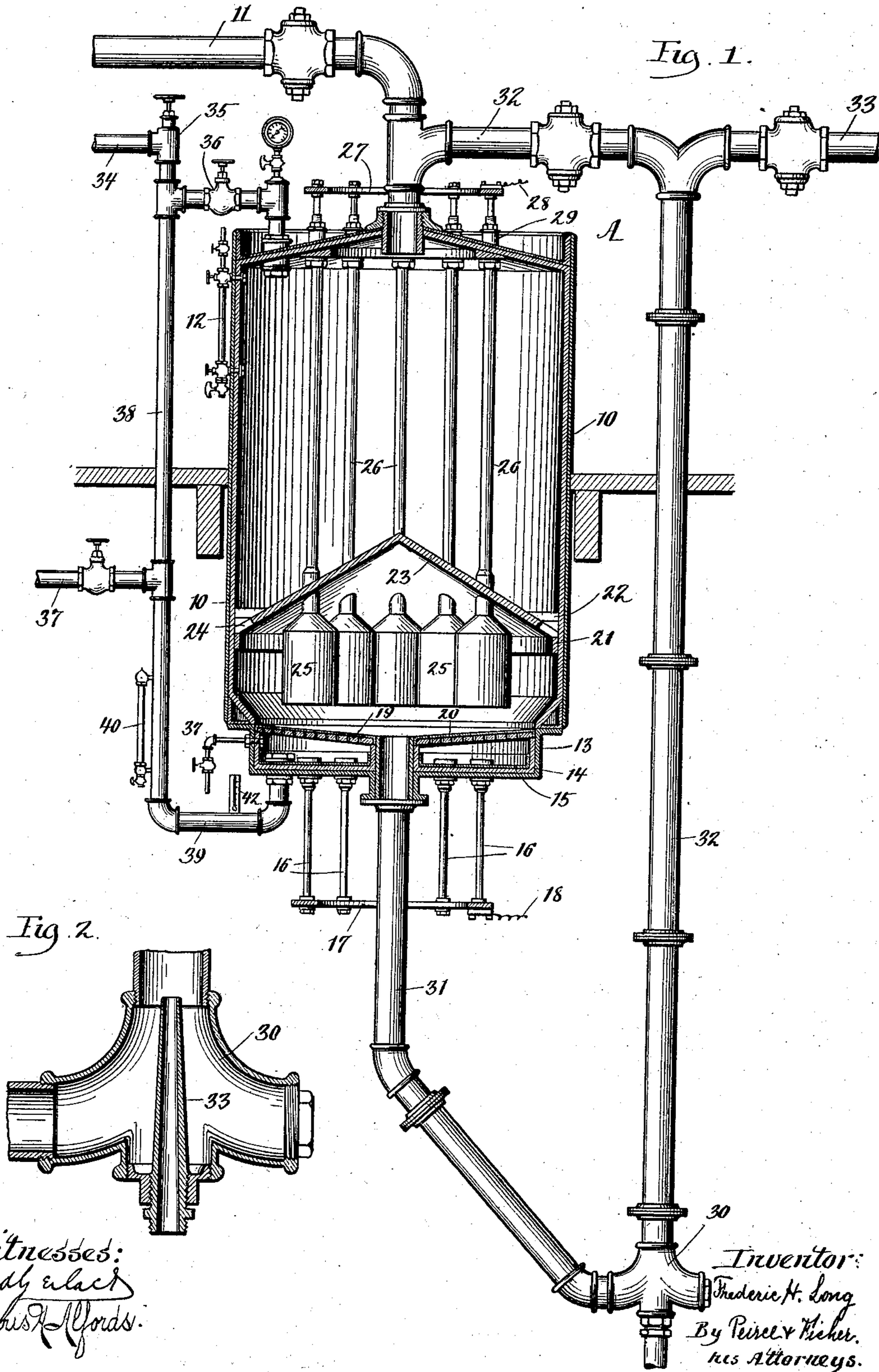
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F. H. LONG.

METHOD OF BLEACHING PAPER PULP, &c.

(Application filed June 24, 1901.)

(No Model.)



UNITED STATES PATENT OFFICE.

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METHOD OF BLEACHING PAPER-PULP, &c.

SPECIFICATION forming part of Letters Patent No. 702,142, dated June 10, 1902.

Application filed June 24, 1901. Serial No. 65,742. (No specimens.)

To all whom it may concern:

Be it known that I, FREDERIC H. LONG, a resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Methods of Bleaching Paper-Pulp and the Like, of which the following is declared to be a full, clear, and exact description.

The invention aims to provide an efficient and economical electrochemical process for bleaching paper-pulp and the like, and in particular chemically or mechanically prepare wood-pulp from which paper is to be made.

The nature of the invention is set forth in the following description, and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a view in longitudinal vertical section of a preferred form of apparatus to be used in carrying out my improved method or process. It will be understood, however, that any other suitable or desired form of apparatus may be used. Fig. 2 is a detail view, in cross-section, of a part of the apparatus.

In most prior electrochemical processes for bleaching a chlorid solution is electrolyzed in one tank and then run into the bleaching-tank containing the paper-pulp or other material to be acted upon. In such methods much of the noxious chlorin gas escapes and is wasted. The bleaching agent is inefficiently applied and the electrolyzing tanks or cells quickly become polarized. By my improved method the paper-pulp or the like is mixed with the salt solution and the mixture or charge is directly subjected to an electrolyzing-current in a closed tank or vessel under pressure, while the charge is maintained in circulation between the anode and cathode elements. In this manner the nascent chlorin and other bleaching agents formed act very efficiently and direct upon all parts of the pulp or other material and there is no danger of escape and waste of the evolved chlorin. Preferably, also, the cathode products formed are constantly separated from the body of the charge and are removed from the cell to avoid polarization and to prevent a reduction in the amount of effective bleaching agent by the chemical reunion of the electrolytic products.

The electrolytic vessel or cell A receives the paper-pulp to be bleached diluted with a solution of common salt, (sodium chlorid.) Other chlorids may be used—as, for example, magnesium chlorid. The salt solution is preferably of a density of 12° to 18° Baumé and is added in sufficient volume to render the charge of the consistency of thick cream. A small amount of quicklime is preferably supplied in the proportion of five to ten pounds to each four thousand pounds of salt solution in order to insure alkalinity of the charge during electrolyzation and for other purposes, as hereinafter indicated.

The vessel or cell A is formed of a wood-lined metal tank-body 10, which is provided with a valved inlet-pipe 11, through which the charge is admitted to the desired level, as shown by the gage-glass 12. The cup-shaped bottom 13 is provided with a wooden lining 14, which supports a shallow copper pan 15, constituting the cathode element of the cell. The pan is in metallic connection with a depending circular series of copper rods 16, extending through the bottom 13 and uniting at their outer ends to a copper ring 17, having a wire terminal 18 connected therewith. Supported on the lining 14 of the bottom is a dished diaphragm consisting of a perforated wooden grid 19, a cotton-duck or canvas cover 20, and interposed layers of bibulous paper, which serve to exclude the solid, while the liquid portions of the charge may pass through. Supported upon a ring 21 and held in place thereon by blocks 22, intermediate the ends of the vessel, is a conical partition or spreader 23, having notches 24 at intervals in its outer rim. The anodes consist of hard-carbon pole-heads 25, arranged in circular series beneath the partition 23 and each united by a long copper rod 26, extending upwardly through the top of the cell to a copper ring 27, which is connected by a wire 28 with the source of the electricity. The rods 26 are insulated from the top by suitable sleeves 29.

The charge is maintained in forced circulation to thoroughly agitate the mass to aid the chemical action of the bleaching element to keep the surface of the diaphragm or pad free from accumulated solid matter and to direct

the charge to flow along between the anodes and the diaphragm, so as to successively expose all parts of the charge to the disruptive influence of the electric current. This circulation is preferably effected by means of an ejector 30, the inlet-port of which is connected to a bent pipe 31, projecting through the bottom of the vessel and extending above the diaphragm. The outlet-port of the ejector is connected by a valved return-pipe 32 with the top of the vessel, which pipe connects for convenience with the inlet or feed pipe 11. Compressed air or steam under pressure is supplied to the ejector-nozzle 33, and by this means the cell contents are constantly withdrawn from the bottom and returned into the top, from which they flow over the partition or spreader 23 through notches 24 and between the anodes 25 and the diaphragm. A vent-pipe 34, preferably leading outside of the building and provided with a shut-off cock 35 and regulating-valve 36, serves to relieve any excessive pressure of gases or vapors evolved during the process. In this way all portions of the charge are exposed to the disruptive influence of the electric current, the chlorid is decomposed, and the bleaching agents are directly applied in a nascent condition to all portions of the pulp, the bleaching of which thus proceeds rapidly and efficiently. By carrying on the process in a confined space under pressure the efficiency is considerably increased, the bleaching agents formed are more readily maintained in solution in intimate contact with the pulp, all danger of a wasteful escape of noxious gases is avoided, and the cell rendered less liable to polarization. An excess of free chlorin present in the charge would have a deleterious effect upon the strength of the fiber; but the lime present not only insures the alkalinity of the charge, but prevents the presence of an excess of free chlorin, which, together with the released anions, is effective for the decomposition of the resinous and other coloring-matters of the paper-pulp. The cathode products, together with the decomposed coloring-matters in solution, are continuously isolated from the charge beneath the diaphragm and prevented from reuniting with the bleaching elements. The liquid cathode products thus formed and separated are drawn off periodically or continuously, if desired, through the petcock 37, opening into the vessel beneath the diaphragm. The gases and vapors evolved by the chemical and calorific effects at the cathode element unless removed will accumulate and be entrapped beneath the diaphragm of cotton duck and bibulous paper and would increase materially the resistance to the passage of the current between the cathode and anode through the electrolyte, and so interfere with the electrolytic action. Means are therefore provided for removing the gaseous cathode products, and for this purpose a pipe 38 is preferably employed, which pipe connects with the space beneath the dia-

phragm and extends upwardly above the level of the solution contained in that space. This pipe is preferably connected to the vent-pipe 34, intermediate the valves 35 and 36, as indicated in the drawings. I also preferably bend the lower end of the pipe in the form of a U-shaped portion the end of which projects to some extent through the bottom of the vessel and affords a suitable location for a gage-glass 40 and a thermometer 42, by which the condition of the solution below the diaphragm may be noted and the electric current regulated accordingly. This U-shaped portion will not act as a trap to prevent the escape of the gas or vapor, since the liquid beneath the diaphragm is in a state of violent ebullition and the gas or vapor is developed under sufficient pressure to overcome the short hydrostatic column in this U-shaped portion 39 and is removed practically as soon as found. The long upwardly-extending pipe 38 acts as a separator to prevent any of the liquid from being entrained and carried off by the escaping gas; but a valved branch pipe 39 is provided, leading to a suitable receptacle and will serve to collect any small portion of liquid so forced up into the pipe. By this means the liquid and gaseous cathode products, consisting, chiefly, of sodium hydroxid and hydrogen gas, together with the decomposed coloring-matters in solution, are effectively isolated from the charge and removed from the cell. This forms an important feature of my invention, since the removal of the gas diminishes the resistance of the cell and its liability to become polarized, and the separation and removal of the sodium hydroxid prevents it from diffusing upwardly through the charge and weakening the effect of the bleaching agents by combining chemically therewith. So, also, the separation and removal of the decomposed coloring-matters in solution aids materially in obtaining a well-bleached product, which with previous electrochemical processes is often discolored and full of black specks.

It is obvious that changes may be made in the details of the improved process without departure from the essentials of the invention and that any suitable form of apparatus may be employed in carrying it into effect. Other halogen salts of the alkali and alkaline earths could be employed in the place of common salt or of magnesium chlorid; but the latter are the most available.

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

1. The process of bleaching pulp and the like in a closed vessel, which process consists in subjecting a mixed charge of pulp and dilute chlorid solution to an electrolyzing-current and, while confined under pressure, maintaining the whole charge bodily in circulation between the anode and cathode elements, substantially as described.

2. The process of bleaching pulp and the

like in a closed vessel, which process consists
in subjecting a mixed charge of pulp and di-
lute chlorid solution to an electrolyzing-cur-
rent, simultaneously isolating the gaseous
5 and other refuse cathode products from the
body of the charge and, while confined un-
der pressure, maintaining the whole charge
bodily in circulation between the anode and
cathode elements, substantially as described.
10 3. The process of bleaching pulp and the
like in a closed vessel, which process consists
in subjecting a mixed charge of pulp and di-
lute chlorid solution to an electrolyzing-cur-
rent, expelling the gaseous and other refuse
15 cathode products and, while confined under
pressure, maintaining the whole charge bodily

in forced circulation between the anode and
cathode elements, substantially as described.

4. The process of bleaching paper-pulp and
the like in a closed vessel, which process con- 20
sists in subjecting a mixed charge of pulp and
dilute chlorid solution with a neutralizing ad-
dition to an electrolyzing-current, and while
confined under pressure, maintaining the
whole charge bodily in forced circulation be- 25
tween the anode and cathode elements, sub-
stantially as described.

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Witnesses:

ALBERTA ADAMICK,
HARRY L. CLAPP.