No. 675,749 Patented June 4, 1901.

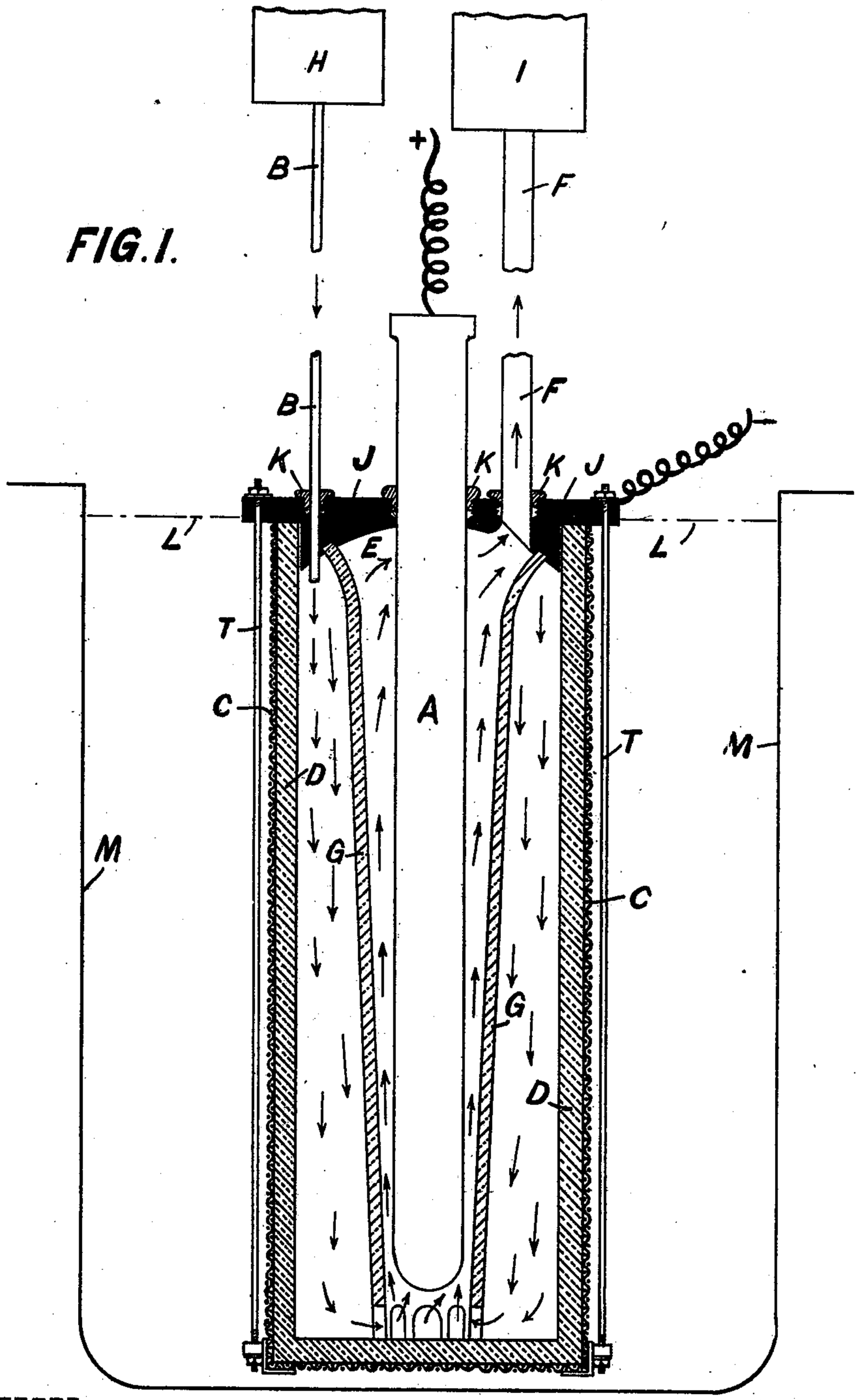
A. MERRY & J. H. NOBLE.

ELECTROLYTIC CELL.

(Application filed Nov. 19, 1900.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.



WITNESSES

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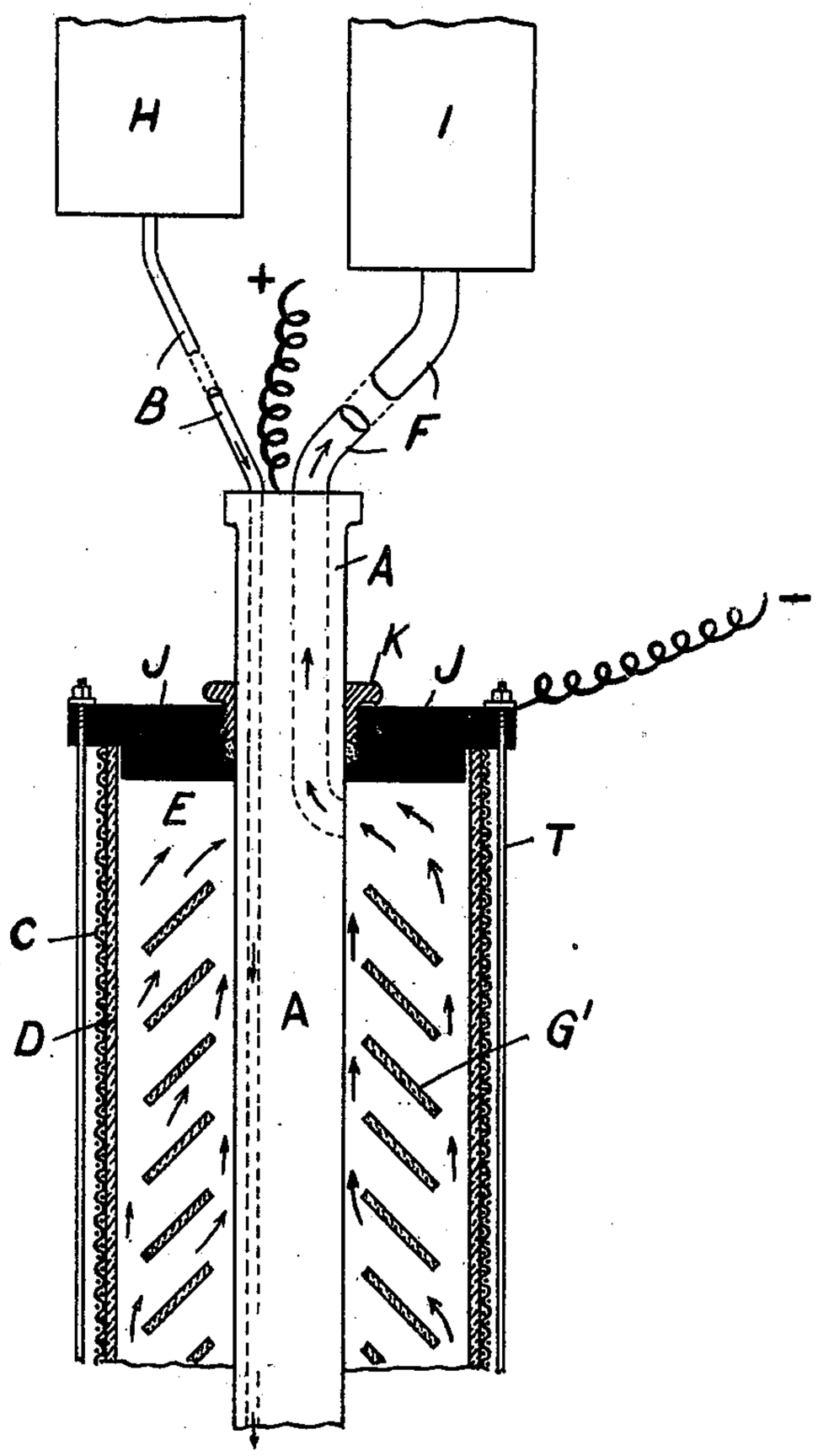

FIG. 2.

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UNITED STATES PATENT OFFICE.

ALFRED MERRY, OF LISCARD, AND JOHN H. NOBLE, OF LIVERPOOL, ENGLAND.

ELECTROLYTIC CELL.

SPECIFICATION forming part of Letters Patent No. 675,749, dated June 4, 1901.

Application filed November 19, 1900. Serial No. 37,014. (No model.)

To all whom it may concern:

Be it known that we, ALFRED MERRY, residing in Liscard, in the county of Chester, and JOHN HALL NOBLE, residing at Liverpool, in the county of Lancaster, England, subjects of the Queen of Great Britain, have invented certain new and useful Improvements in Electrolytic Cells, of which the following is a specification.

This invention has for its object an apparatus for electrolyzing solutions, and is more especially designed for the electrolysis of sodium chlorid.

The object of the invention is to gain much more of the theoretic power of the electricity than has hitherto been considered possible.

The invention is best described by aid of the accompanying drawings, in which—

Figure 1 is a vertical section of our latest design of electrolytic cell. Fig. 2 is a modification of a portion of this cell.

Referring first to Fig. 1, A is an anode, formed, usually, of carbon. B is the inlet-pipe for introducing the brine, and C a cathode, formed, preferably, of metallic gauze not easily corrodible with the chemicals employed, but preferably copper. This is wrapped around the porous cell and held thereto by any convenient means, such as by binding-wire or being formed into a sleeve fitting tightly around the cell. D is a porous earthenware cell. Other porous material, however, ordinarily used for porous cells in electrolyzing plants can be used. This porous cell, if there be no great difference in pressure between the fluids on its inside and outside, is preferably enameled or glazed near the top or saturated there with shellac, pitch, or other varnish, so as to make it impervious to chlorin. Where, however, a considerable difference of pressure is used and the cell is kept perfectly full of liquid and, further, when the cap of the cell is as shown in the drawings, this precaution of glazing the upper end need not be employed. We find, however, that cells not provided with all our improvements and where an atmosphere of chlorin collects near the top of the cell, unless this glazing be adopted to a line below the level of the liquid in the cell, chlorin is very apt to percolate through the cell to or beyond the cathode. E is a space filled with the electrolyte; F, exit for the chlorin and the exhausted electrolyte; G, a second porous cell surrounding the anode and scalloped or perforated near the bottom, so as to allow the free passage of the electrolyte at this point, and H and I two columns or reservoirs—H that of the brine or original electrolyte, and I containing exhausted electrolyte. The head of water or chemical in these two columns can be regulated to suit the amperage brought to bear upon the cell. + and — are the two wires connecting the cell with the electric generator. The arrows show the direction in which the electrolyte travels. J is a cap formed of earthenware or other insulating material, and K K the glands of stuffing-boxes forming a water-tight seal around the pipes B and F and the anode A. T T are tie-rods uniting the bottom and top of the cell. L is the ordinary level of the water or saponifiable material in an outside tank M, which can be of any form. The cell is suspended in the tank M in any convenient manner or can, if desired, rest on the bottom of said tank. In place of the inner cell G ordinary louvers can be employed, formed of glass or other convenient material. A portion of these are shown as G′ in Fig. 2.

In Fig. 2 the anode is shown bored with two holes, through which the exit and entrance pipes pass—one to the bottom of the anode, the other passing out into the anode close to the top of the cell. In place of the sleeve or internal porous cell a series of glass louvers P are employed.

The mode of action is as follows: Brine or any other fluid to be electrolyzed is filled into tank H and exhausted electrolyte or, at the commencement, the ordinary electrolyte allowed to rise in column I to the same height. The tank M is filled to the level L with water, and a current of electricity is passed through by wires + and —. The object of having a head on the anode-cell superior to that on the cathode compartment or tank is to cause a free passage of the caustic alkali or other base through the porous cell C′, for we have found that when the liquid in both cells is at the same level for the first few minutes nearly the full power of the electricity is exerted, but after a time that power gradu-

ally comes down until a useful effect of only forty per cent. is secured. This, in our opinion, is in consequence of a layer of the electrolyte in the porous cell and adjoining thereto becoming exhausted or very poor in chlorid of sodium or other salt to be electrolyzed. Where, however, there is a pressure put upon the internal cell, it has a constant tendency to force the solution through the pores of the porous cell, and consequently there is always a strong solution in the walls of the porous cell and the maximum effect of the electricity is produced. The reason for using the central cell G or its mechanical equivalent or substitute (the glass louvers) is to cause the chlorin generated around the anode to have a free passage upward, but an impeded passage sidewise. Consequently the chlorin passes upward and out with the exhausted brine or other electrolyte instead of passing to the outer porous cell C and thence through to the cathode. For this reason also we introduce the virgin electrolyte close to the top of the cell and on the outside of the central cell or louvers, or, if louvers be used and a hollow anode, we may introduce it practically at the bottom of the cell, so that it has to rise up to the top before it is discharged. In our latest cell, however, we have entered it at the top, as shown in Fig. 1, and have used a porous diaphragm instead of louvers. In the outer cell ordinary clean water or oil or other material for making soap or any acid which it is desired to unite to the base so as to form a salt is inserted. The cap J is bell-shaped and the pipe F brought from as high a point in this bell as practicable, so as to carry off the chlorin or other anion as quickly as possible.

We claim as our invention—

1. In an electrolytic cell, the combination of an anode A, a pervious diaphragm G surrounding the same but inclosing a space between, and open near the bottom of the cell, and having a space surrounding this diaphragm, a cathode, and a second porous diaphragm separating the cathode from the anode, an outer cell inclosing the cathode and said porous diaphragm and an outlet-pipe entering the space immediately surrounding the anode and an inlet-pipe entering near the top, the space separating the two porous diaphragms whereby when an electrolyte is introduced or taken out of the anode-compartment a narrow current of electrolyte passes upward close to the anode and thus carries off the gaseous or aqueous anion as it is formed, while a descending current of fresh electrolyte passes down the outer side between the two diaphragms.

2. In an electrolytic cell, in combination with the anode, a porous tube or cell surrounding but not touching the same, practically impervious to ascending globules of chlorin or other gaseous anion, while pervious to the electrolyte, an exit for exhausted electrolyte from the top of the space immediately surrounding the anode and an entrance for fresh electrolyte in the space outside the said porous tube or sleeve, a cathode, a porous diaphragm separating the cathode from the anode and the electrolyte surrounding it, and a cell containing the whole substantially as described.

3. In an electrolytic cell, the combination of an anode; a porous sleeve G surrounding but spaced away from the anode; the top J having an outlet F opening into the sleeve and the said sleeve having openings at the bottom; a porous cell; a cathode surrounding said cell; an entrance B for electrolyte opening into the porous cell outside the sleeve; an otherwise-closed cover to the porous cell, whereby when the head on the opening B is greater than that on the opening F the electrolyte can form an upward current in the narrow space in the sleeve around the anode; and a vessel containing the whole, substantially as described.

In witness whereof we have hereunto signed our names, this 10th day of November, 1900, in the presence of two subscribing witnesses.

A. MERRY.
JOHN H. NOBLE.

Witnesses:
CHARLES LESLIE,
F. P. EVANS.