

J. H. GUGLER.  
ELECTRIC BATTERY CELL.  
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979,153.

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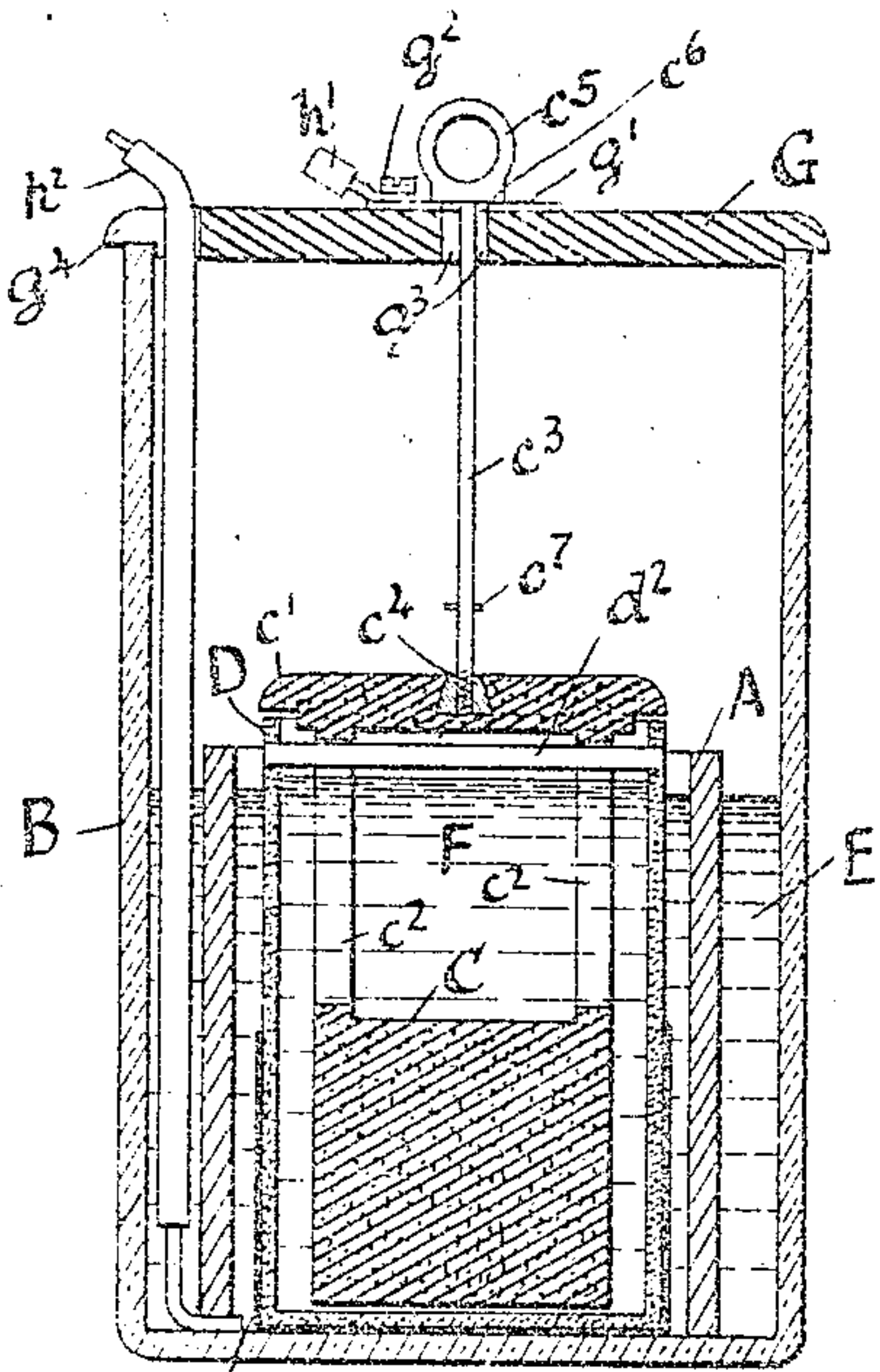


Fig. 1

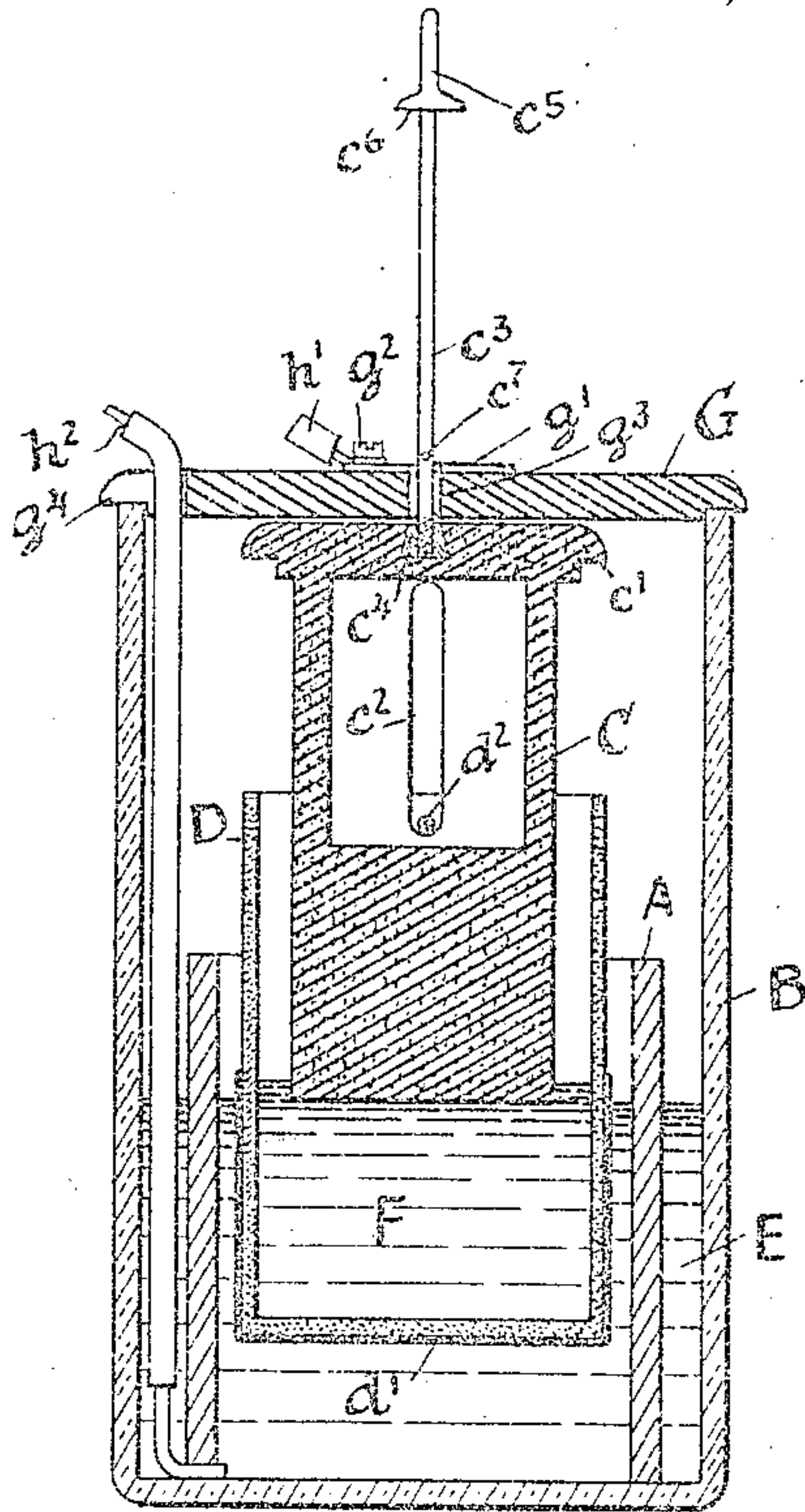


Fig. 2

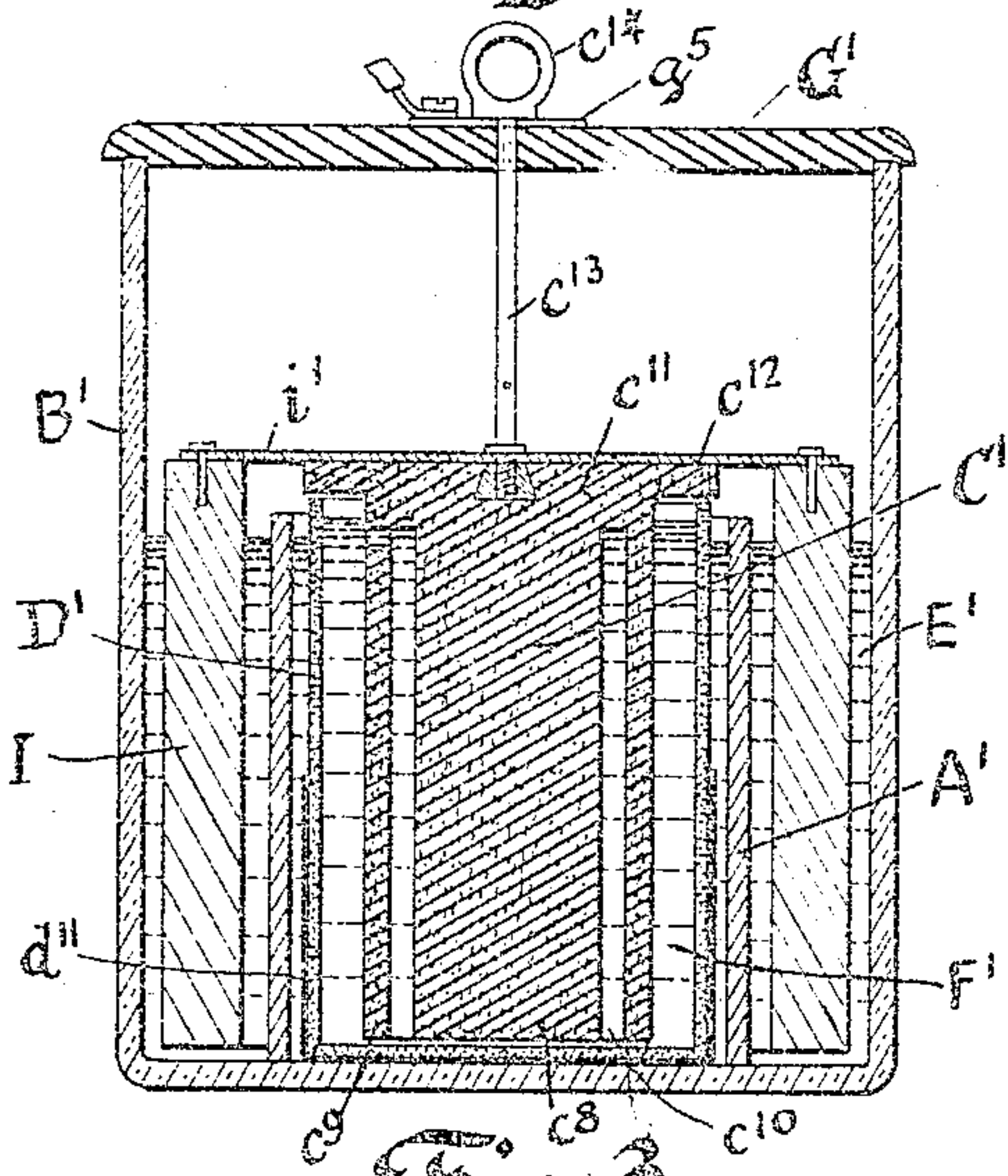


Fig. 3

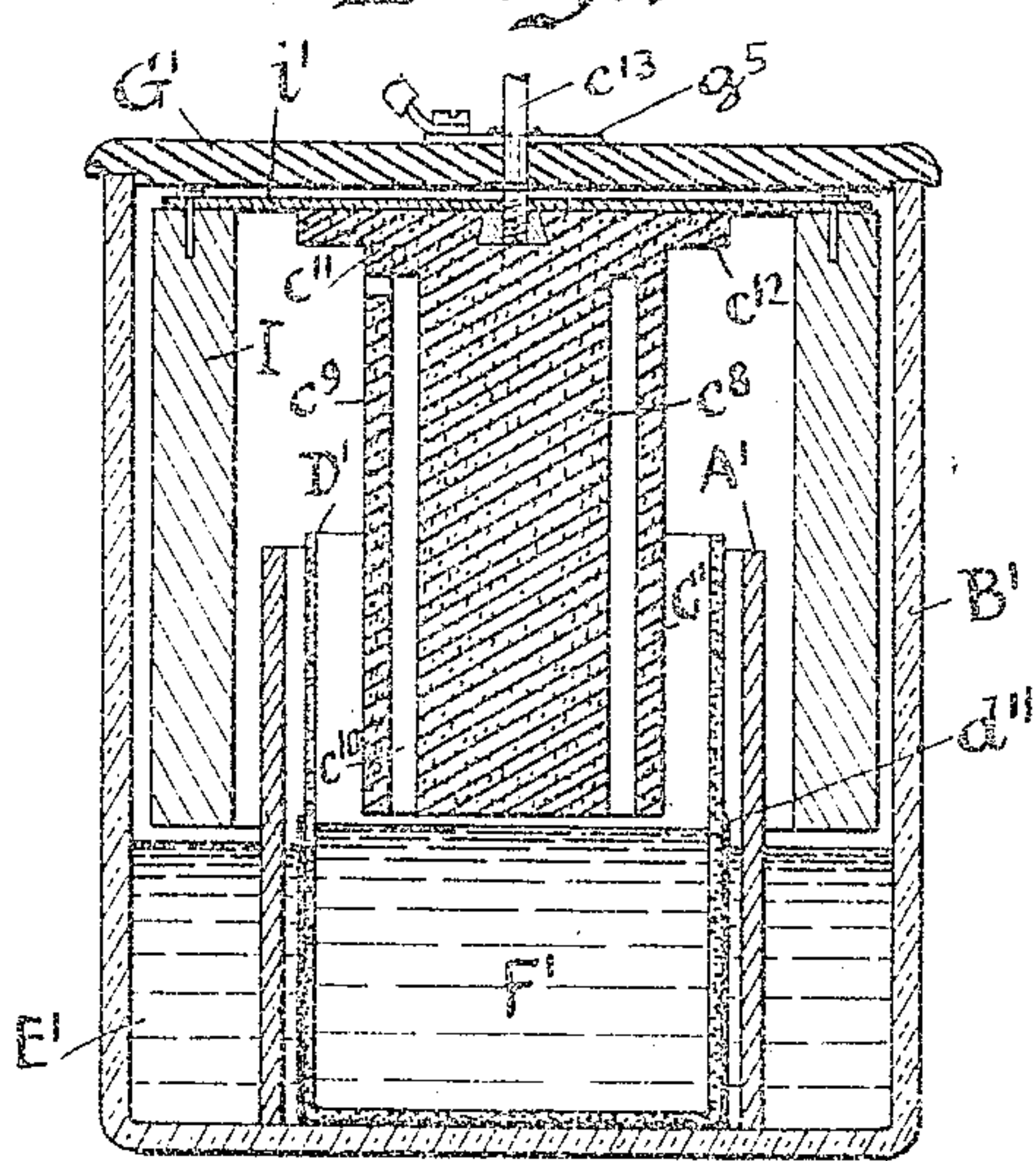


Fig. 4

Witnesses

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# UNITED STATES PATENT OFFICE.

JULIUS H. GUGLER, OF MILWAUKEE, WISCONSIN.

## ELECTRIC-BATTERY CELL.

979,153.

Specification of Letters Patent.

Patented Dec. 20, 1910.

Application filed June 21, 1909. Serial No. 503,277.

*To all whom it may concern:*

Be it known that I, JULIUS H. GUGLER, of Milwaukee, Wisconsin, have invented an Electric-Battery Cell, of which the following is a specification.

This invention relates to electric battery-cells and more particularly to primary-cells of the two-fluid type, in which the inactive element is surrounded by a depolarizing liquid which is inclosed in a porous cup and the outside element and working liquid are disposed within the battery-jar outside of said cup. Cells of this type as actually constructed have the disadvantage that when not in use the two liquids diffuse through the cells of the porous cup and thus mingle so as to rapidly destroy the positive element, vitiate the working-liquid and disturb the proper level, since according to the laws of diffusion one of the two liquids diffuses faster than the other.

The object of the present invention is to prevent such intermingling of the two liquids when the battery is not in use, thus minimizing the expense and prolonging the usefulness of the battery.

The essential feature of my construction consists in an arrangement whereby the cathode is given a displacement-volume within the porous cup to displace a large quantity of liquid, and means for raising it sufficiently out of the liquid to bring the surface of the latter below a predetermined level at and below which the walls of the cup are made nonporous. At the same time means may be provided for correspondingly lowering the level of the working-liquid in the anode-chamber, and in the most improved form of my invention this is accomplished by making the porous cup itself the displacing-element and by raising it a sufficient distance to bring the surface of the working-liquid in the outer chamber below said predetermined line of porosity.

The particular construction by which I carry out my invention will best be understood from a consideration of the accompanying drawings wherein,

Figures 1 and 2 are longitudinal sections at planes at right angles to each other of one form of my battery-cell, Fig. 1 showing the elements in depressed or active, and Fig. 2 in raised or inactive position; and Figs. 3 and 4 are similar longitudinal sections

through another form of my invention, Fig. 3 showing the elements in depressed or active, and Fig. 4 in raised or inactive position.

In these drawings the same part is designated by the same reference-letter or numeral in each figure.

In the first form illustrated, A designates the anode, B the jar or container, C the cathode, D the diaphragm or porous cup separating the anode and cathode, E the working-liquid (generally dilute sulfuric-acid) and F the oxidizing or depolarizing liquid, for example nitric-acid. The lower part of the element C is formed solid or substantially so as shown to give a great displacement, which results without serious corresponding loss of working-surface because of the lower portion of the cup D being made nonporous, which can be accomplished in various ways, as for example by vitrification, impregnation with paraffin or like material, or a covering of insulating-paint or gutta-percha, and is represented graphically by the heavy line  $d'$  in the drawing. The upper end of the cathode C is preferably formed with a marginal rim  $c'$  which overlies the edge of the cup D; and the upper tubular portion of the cathode may be traversed with a pair of longitudinal slots  $c^2$  at opposite sides to admit a transverse bar  $d^2$ , the ends of which are engaged in holes in the opposite sides of the cup D as shown. The effect of this arrangement is that, when the cathode is raised a sufficient distance, as illustrated in Fig. 2, the liquid F sinks to a level below the edge of the nonporous portion  $d'$ , and therefore cannot diffuse through the wall of the cell. At this point the bottoms of the slots  $c^2$  strike the bar  $d^2$  and upon further raising the cathode the cup D is raised with it until the liquid E also sinks to a level below the edge of the nonporous portion  $d'$  as shown in Fig. 2. The raising of the elements may be effected in various ways, but as here shown comprises a lifting-rod  $c^3$  which is sealed into the upper end of the element C by means of a plug  $c^4$ , or in any other suitable manner connected thereto, said rod passing through a central aperture in the cover-plate G and having a handle  $c^5$  on the upper end thereof. Upon the upper face of the cover-plate may be placed a terminal-plate



$g'$  provided with a binding-post  $g^2$  to which the circuit-wire  $h'$  may be connected, and the ring  $e^2$  has a suitable face  $e^3$  adapted to rest upon the plate  $g'$  when the apparatus is in use and make electrical connection therewith as shown in Fig. 1. To maintain the elements in raised position as in Fig. 2, a cross-pin  $e^7$  is inserted in the stem  $e^3$  and is adapted to pass through notches  $g^3$  on the sides of the central hole in the plates  $G$  and  $g'$ , so that when the stem  $e^3$  is raised the pin  $e^7$  passes through the notches  $g^3$ , and when the rod is rotated said pin rests upon the edges of the central hole. Other means may be provided for raising and supporting the elements consistently with my invention. The circuit-connection with the anode  $A$  may be made by any suitable or known method; for instance, by a wire  $h^2$  which passes through a notch  $g^4$  on one side of the cover-plate and is connected to the anode  $A$  at the bottom thereof.

In Fig. 3 the battery-jar is designated  $B'$ , the anode  $A'$ , the cathode  $C'$ , and the diaphragm or porous cup  $D'$ , rendered non-porous over the lower portion, as represented by the layer  $d''$ . In this case I have shown a cathode-element of somewhat different form, comprising a substantially solid cylinder  $e^8$  concentric within a tubular cylinder  $e^9$ , and separated therefrom by an annular space  $e^{10}$ ; the whole being molded together with an upper solid portion  $e^{11}$  and which is provided with a rim  $e^{12}$  overlying the upper edge of the cup  $D'$ . The raising and supporting-rod  $e^{13}$  is substantially the same as the rod  $e^3$  of Fig. 1, passing through the cover-plate  $G'$  and terminal-plate  $g^5$ , and having a ring  $e^{14}$  on its upper end. In this case however the cup  $D'$  is not raised, but the liquid  $E'$  in the outer chamber is displaced by means of an annular cylindrical filler  $I$  which is mounted upon a cross-bar or spider  $i'$  secured to the base of the rod  $e^{13}$  as shown. When the rod  $e^{13}$  is raised the displacements in the two chambers are simultaneously removed and the levels of the two liquids  $E'$  and  $F'$  are correspondingly lowered until they sink below the edge of the nonporous portion  $d''$  of the cup  $D'$ .

Various changes and modifications in the constructions as herein shown may be made without departing from the spirit of my invention, and I wish it understood therefore that the latter is not otherwise limited than by the reasonable scope of my claims.

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

1. In an electric battery-cell, the combination of a porous cup having its lower portion nonporous, a battery-element forming a variable displacing means within said cup, and means for raising said battery-element

a distance sufficient to bring the level of the liquid therein below the porous portion of said cup.

2. In a battery-cell, the combination of a porous cup having its lower portion non-porous, a cathode-element within said cup, means for raising said cathode-element until the level of the liquid therein is below the porous portion of said cup, and a depolarizing liquid within said cup which is displaced by said cathode in descending so as to raise its level within said cup.

3. In an electric battery-cell, the combination of a container, a quantity of liquid therein, a porous cup the lower portion of which is rendered nonporous, displacing said liquid, a second liquid within said cup, a battery-element within said cup displacing said liquid, and means acting to raise said element partially out of said cup and thereafter to raise said cup, so as to lower the level of liquid in said cup and also to lower the level of the liquid outside said cup.

4. In an electric battery-cell, the combination of a container containing a working-liquid and an anode, a porous cup displacing said liquid and containing a depolarizing liquid, the lower portion of said cup being rendered nonporous, a cathode-element within said cup, and means acting to raise said cup a distance sufficient to bring the level of the working-liquid below the porous portion thereof and also to raise said cathode a further distance, thereby lowering the surface of said depolarizing liquid a sufficient distance to bring it below the porous portion of said cup.

5. In an electric battery-cell, the combination of a container, a liquid therein, a porous cup within said container and displacing said liquid, the lower portion of said cup being rendered nonporous, a second liquid within said cup, means for displacing said second liquid, means for raising said cup a sufficient distance to lower the surface-level of said first-named liquid below the edge of said nonporous portion, and means for raising said displacing-means a still further distance thereby lowering the level of the liquid within said cup.

6. In an electric battery-cell, the combination of a container, a liquid therein, a porous cup within said container and displacing said liquid, the lower portion of said cup being rendered nonporous, a second liquid within said cup, a battery-element displacing said second liquid, means for raising said cup a sufficient distance to lower the surface-level of said first-named liquid below the edge of said nonporous portion, and means for raising said battery-element a still further distance thereby lowering the level of the liquid within said cup.

7. The combination of a jar or container, a working-liquid therein, an anode disposed



in said working-liquid, a porous-cup with-  
in said container displacing said liquid and  
having its lower portion rendered nonpor-  
ous, a depolarizing liquid contained with-  
5 in said cup, a cathode mounted in said cup  
and displacing said depolarizing-liquid,  
means for raising said cathode, and a con-  
nection between said cathode and said cup  
adapted to engage and raise the latter when  
10 said cathode has been raised a certain dis-  
tance.

8. The combination of a jar or container,  
a working-liquid therein, an anode disposed  
in said working-liquid, a porous-cup with-  
15 in said container displacing said liquid and  
having its lower portion rendered nonpor-  
ous, a depolarizing liquid contained within  
said cup, a cathode mounted in said cup  
and displacing said depolarizing-liquid, a  
20 lifting-rod mounted on said cathode, means  
for supporting said lifting-rod in the ele-  
vated position of said cathode, and engag-  
ing-elements between said cathode and said  
porous-cup adapted to allow said cathode to

be raised individually through a certain 25  
distance and when raised further to carry  
with it said cup.

9. In an electric battery-cell, the combi-  
nation of a container containing a liquid  
and a battery-element, a porous cup displac- 30  
ing said liquid and containing a second liq-  
uid, the lower portion of said cup being  
rendered nonporous, a battery-element with-  
in said cup, and means acting to raise said  
cup a distance sufficient to bring the level 35  
of said first liquid below the porous portion  
of the cup and also to raise said second ele-  
ment a further distance, thereby lowering  
the surface of said second liquid a sufficient  
distance to bring it below the porous por- 40  
tion.

In witness whereof I have hereunto set  
my hand this 14th day of June 1909.

JULIUS H. GUGLER.

Witnesses:

A. H. BLATCHLEY,  
JAS. C. PETERSON.