No. 719,659. PATENTED FEB. 3, 1903.

H. HALSEY.

GALVANIC BATTERY.

APPLICATION FILED SEPT. 21, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

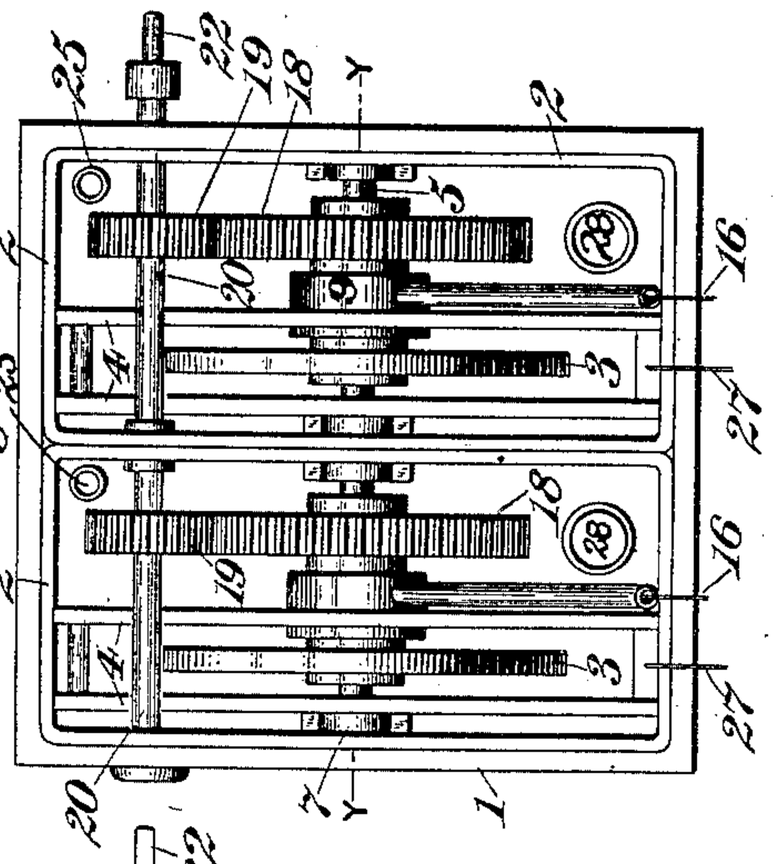


Fig. 4.

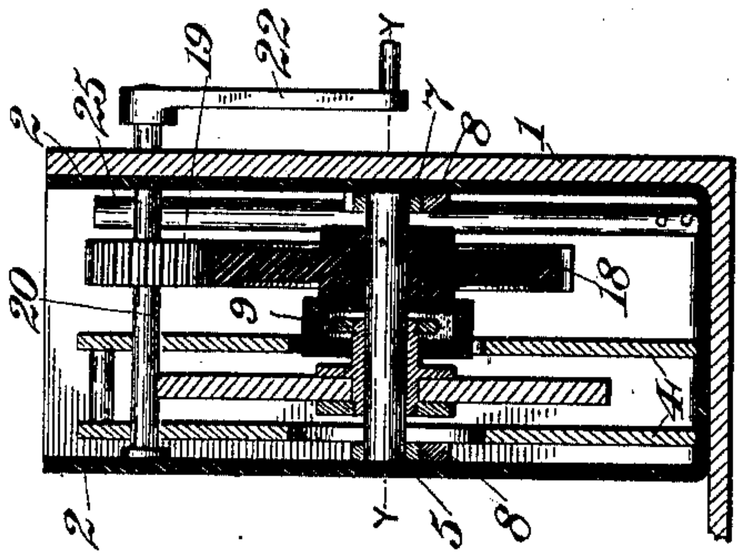


Fig. 2.

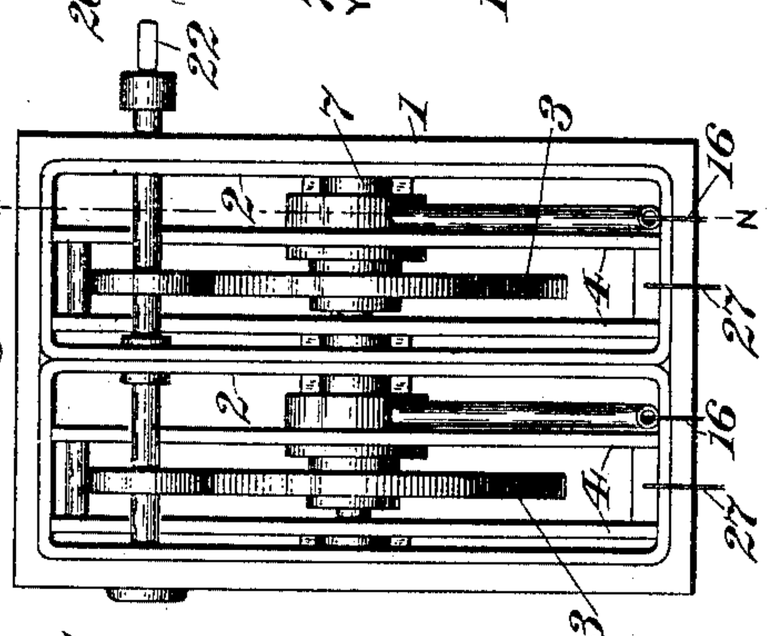


Fig. 5.

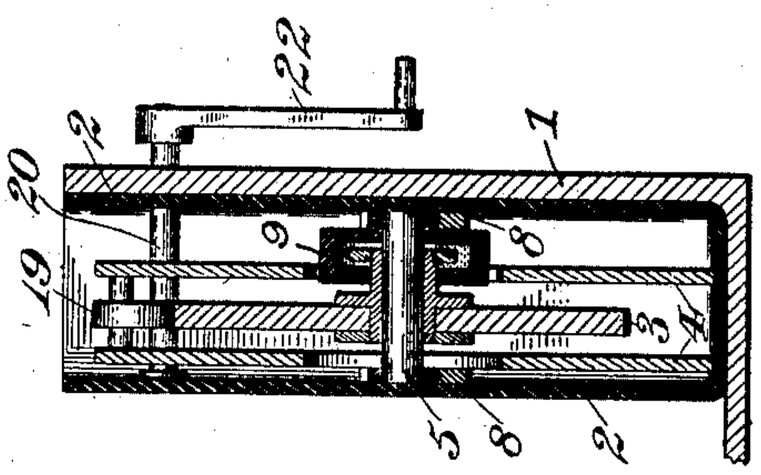


Fig. 3.

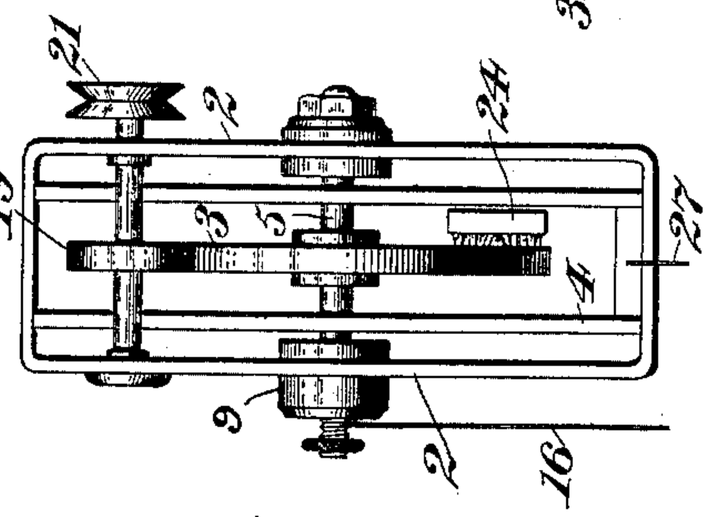


Fig. 6.

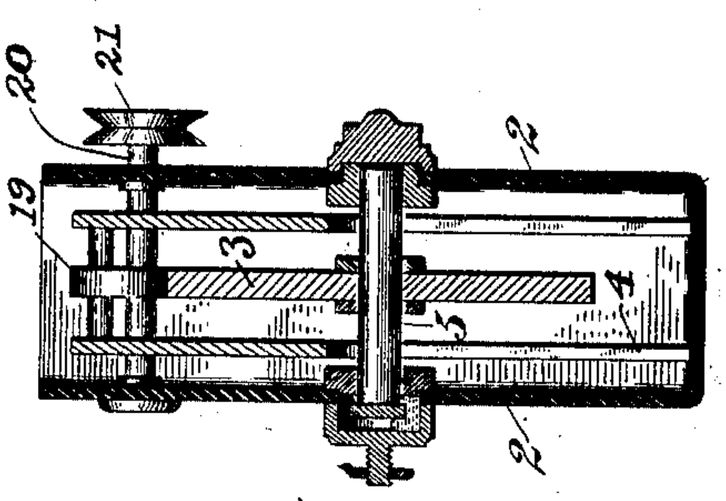


Fig. 8.

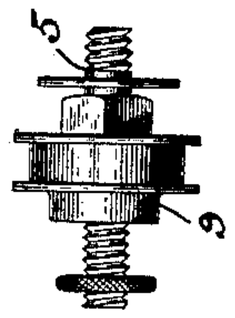


Fig. 7.

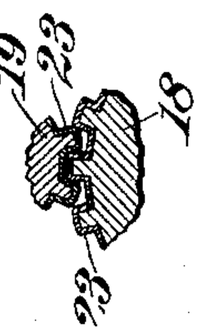
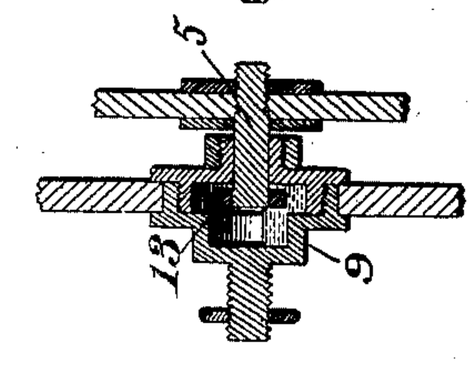


Fig. 9.



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GALVANIC BATTERY.

APPLICATION FILED SEPT. 21, 1901.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 11.

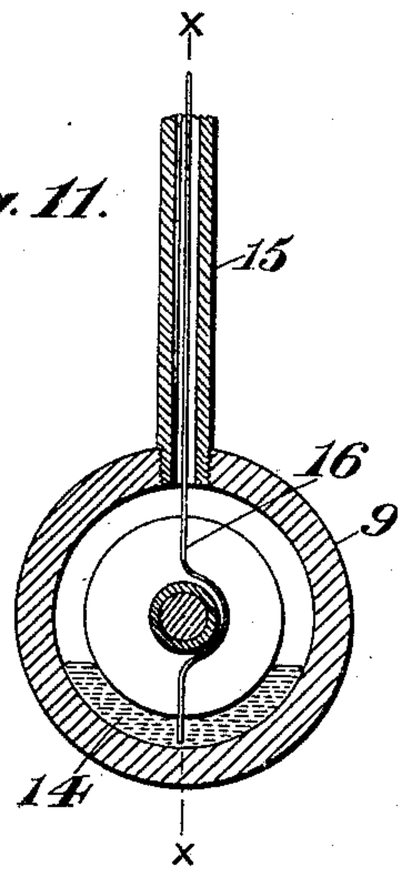


Fig. 10.

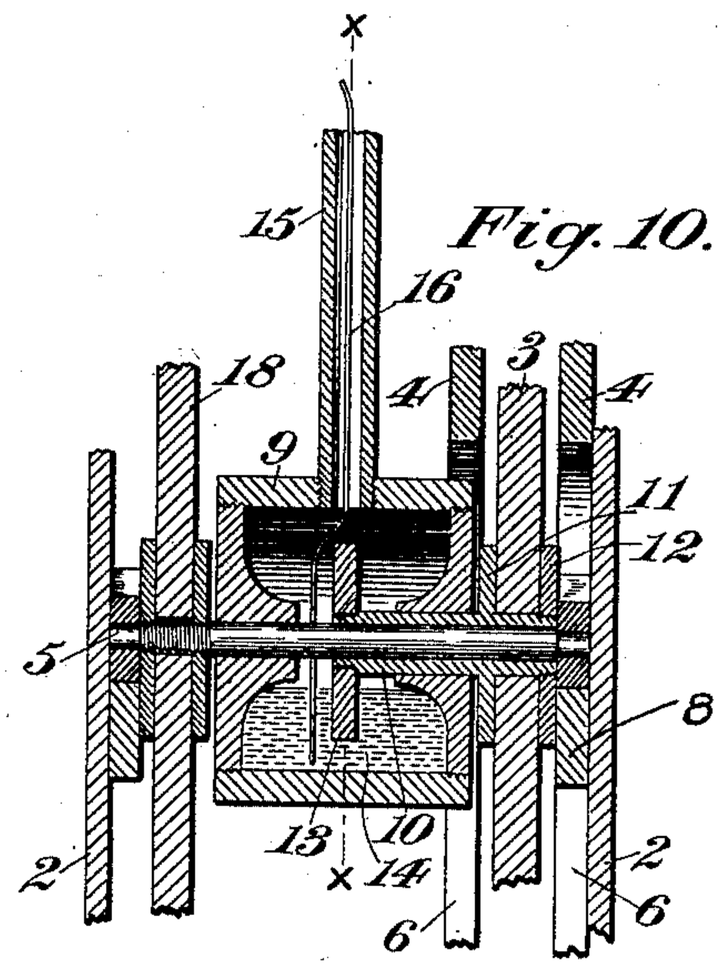


Fig. 14.

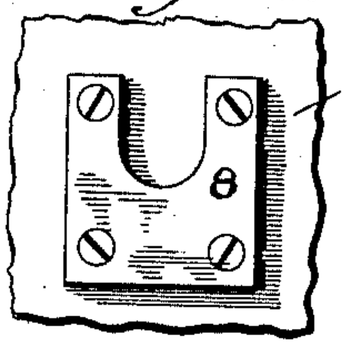


Fig. 12.

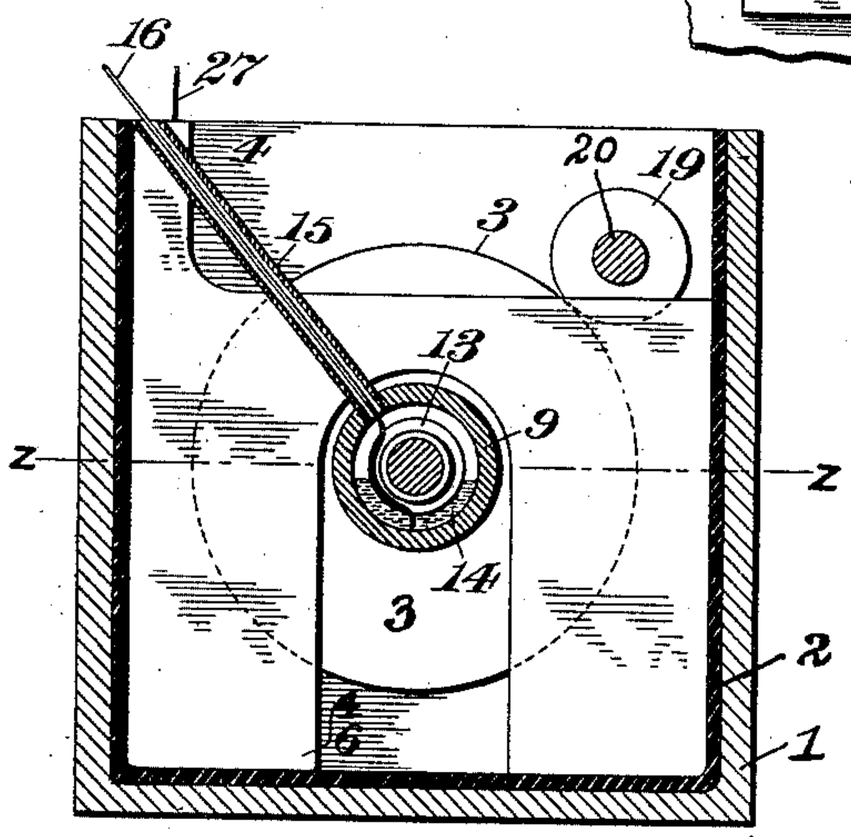
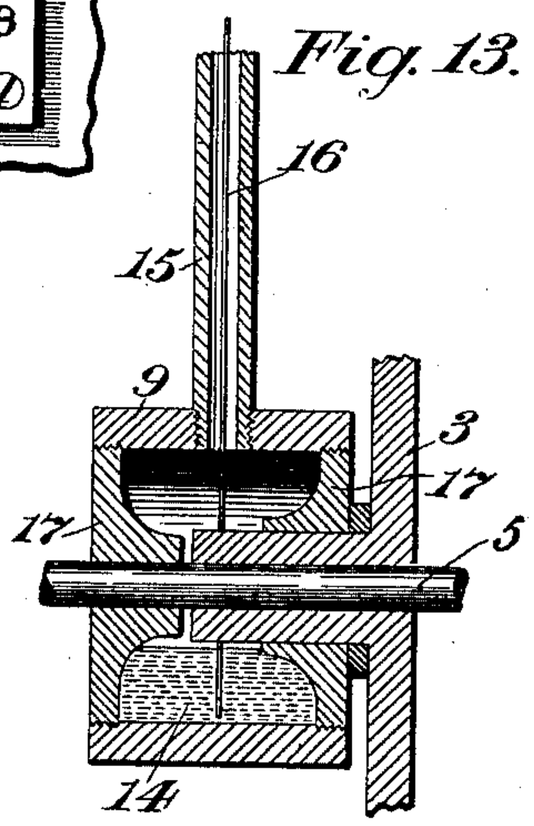


Fig. 13.



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HENRY HALSEY, OF NEW YORK, N. Y.

GALVANIC BATTERY.

SPECIFICATION forming part of Letters Patent No. 719,659, dated February 3, 1903.

Application filed September 21, 1901. Serial No. 76,104. (No model.)

To all whom it may concern:

Be it known that I, HENRY HALSEY, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Galvanic Batteries, of which the following is a full, clear, and exact specification.

My invention relates to galvanic batteries; and its object is to provide a battery of simple construction and of high efficiency.

To that end the invention comprises various features of construction and operation, which will be referred to in detail hereinafter.

In the accompanying drawings, Figure 1 is a top view of two battery-cells embodying my invention. Fig. 2 is a similar view of two cells, illustrating a modified arrangement for rotating the carbon elements. Fig. 3 is a similar view of a cell equipped with a modified form of contact device and with a solid depolarizing agent. Figs. 4, 5, and 6 are end sectional views of the respective cells shown in Figs. 1, 2, and 3. Fig. 7 is a detail view illustrating the construction of the gear-teeth of the carbon element in Fig. 5. Figs. 8 and 9 are respectively perspective and sectional detail views of a modified form of contact device. Fig. 10 is a detail sectional view of the contact device employed in the construction shown in Figs. 1 and 2. Fig. 11 is an end elevation taken on the line *x x* in Fig. 10. Fig. 12 is an end elevation of the cell shown in Figs. 1 and 4. Fig. 13 is a detail sectional view of a further modification of the contact device, and Fig. 14 is a detail showing one of the bearings for the shaft upon which the revoluble elements are mounted.

Referring more particularly to the drawings, 1 represents a suitable case or box, in which the various cells 2 2 may be contained, these cells being made of any suitable material for the purpose—such, for example, as hard rubber. The carbon and zinc elements are respectively indicated by the reference-figures 3 and 4. These elements may both be stationary or both movable, or one may be stationary and one movable, as shown in the drawings. The latter is my preferred construction, and to this end the carbon element 3 is in the form of a disk and is suitably mounted on a shaft 5, while the zinc plates 4 are provided with a slot 6, which permits the plate to straddle shaft 5 and rest upon the bottom of the cell or be otherwise supported in suitable raised position. The shaft 5 in each cell is preferably provided at its ends with circular bushings 7 7, which rest in the slotted bearings 8 8, mounted upon the respective sides of the cell. Any other suitable bearing, preferably, however, an anti-friction-bearing, may be employed for the purpose.

In order to secure an electrical contact between the revolving element or elements without friction, and consequently loss of energy, between the parts and without exposing parts of the contact to the action of the excitant solution, I provide my improved contact device. This comprises, broadly speaking, an inclosed receptacle of non-corrosive material, preferably carbon, containing a non-corrosive conducting material, such as mercury, and a connection from the revolving element and from the pole of the battery each leading into the mercury. In the drawings, referring more particularly to Fig. 10, the inclosed receptacle 9 is suitably mounted either upon the shaft 5, as shown in Fig. 10, or upon the side of the cell, as shown in Fig. 5. The shaft 5 passes through the sides of the receptacle and may turn without rotating the latter if the revolving element be mounted directly upon the shaft, as shown in Fig. 6, or if the driving power be applied to the shaft, as hereinafter noted, or may be stationary and carry a revoluble sleeve 10, upon which the revolving element, in this instance the carbon 3, is mounted between the flanges 11 and 12. Upon the sleeve 10 or, if preferred, upon the shaft 5 is carried a flange 13, which is sufficiently wide to insure that it will at all times be partially immersed in the mercury 14 contained within the receptacle 9. Instead of forming a flange 13 upon the end of the sleeve 10 the same result may be attained by sufficiently increasing the diameter of sleeve 10 or providing an enlarged hub

on the carbon element projecting into the receptacle, as is shown in Fig. 13.

The sleeve 10 or the corresponding parts of shaft 5 will be made of suitably non-corrosive but electrically-conductive material. I prefer a metal plated with gold or a carbon. A tube 15 communicates with the receptacle 9 and leads from the receptacle to some part of the battery beyond the ends of the excitant solution. Through the tube a wire 16, comprising one pole of the battery, leads into the mercury 14. An equivalent construction would embrace any suitable conductor from the mercury properly protected. In order to reduce the possibility of the mercury leaking out around the bearings of shaft 5, as might occur where the battery is carried upon a vehicle and subject to constant change of position, I provide the bushings 17 17 upon the sides of the receptacle 9 and surrounding the shaft 5 or sleeve 10, as the case may be. When these bushings are present, if the battery be tilted the inclination must be greater in order to bring the mercury into contact with the shaft than would be the case if the bushings were not provided.

Upon shaft 5 is rigidly mounted a gear-wheel 18, preferably made of hard rubber or other suitable non-corrosive material. This gear-wheel meshes with a pinion 19, mounted upon shaft 20. Shaft 20 extends through all of the cells where a plurality of cells is employed, and of course suitable devices are provided whereby the pinions may be loosened upon the shaft 20 and shaft 20 withdrawn from the battery in order to separate the cells. Upon the end of shaft 20 is carried a pulley 21 or crank 22 or other suitable means whereby power is imparted to shaft 20 to rotate the same. The gear-wheel 18 may be dispensed with, if preferred, and any suitable gearing provided, such as a friction-gearing, or the pinions 19 arranged to mesh directly with a gear cut upon the revolving element. Such a construction is illustrated in Figs. 2, 3, 5, and 6. In such construction, however, in order to prevent stripping the gears of the carbon I provide the reinforcing-strip 23 of suitable material, preferably a pliable material, such as lead, which can be bent into position upon the gear-teeth after they have been cut.

In Fig. 9 the flange 13 is shown as mounted directly upon the shaft 5, and the revolving element is similarly mounted. In other respects this construction is substantially the same as that before described. The depolarizing agent may be in solid form and arranged to make contact with the revolving element, as illustrated at 24 in Fig. 3, or the depolarizing agent may be in liquid form and introduced into the solution from time to time as it may be needed. I prefer the use of a liquid depolarizing agent, and in following out my invention any suitable solution may be employed. In order to regulate the quantity of depolarizing solution introduced, I employ the receptacles 25 25, each of which contains a depolarizing agent—such, for example, as potassium bichromate in solution—and one of which is contained in each cell. The top of the receptacle may be left open, in which case, owing to the constant splashing of the excitant fluid caused by rotation of the battery elements, quantities of the depolarizing agent will constantly be displaced by reason of the excitant elements splashing into the receptacle.

In the operation of the battery the wire 27, attached to the zinc element, and the wire 16, which is in contact with the mercury 14 and carbon element 3, form the respective poles of the battery. The proper excitant and depolarizing elements are introduced, respectively, into the cell and into the tubes 25, and power is applied to shaft 20, which causes rotation of the carbon element 3. The constant rotation of element 3 not only constantly stirs the excitant fluid and maintans a uniform intensity throughout the same, but also acts, as before described, to regulate the introduction of the depolarizing fluid.

The receptacles 28 are open at the top and are adapted to contain concentrated sulfuric acid, which, owing to its heavier specific gravity, will not flow out of the receptacle except when displaced by splashing of the excitant.

By reason of the fact that the driving-gear in each cell is independent the walls of the cells are not cut at or near the bearings of the revoluble elements, and therefore the battery solution may immerse all or any desired portion of the elements, correspondingly increasing the power of the battery without increasing its size.

It will be understood, of course, that the construction above described may be varied in numerous ways and various substitutions of equivalent parts made without departing from my invention, and I therefore do not limit myself herein to the specific form of apparatus shown. It will also be understood that I have used the terms "gearing" and "elements" in their broadest sense, and thereby intend to include all equivalent forms of connection between the driving-shaft 20 and the rotatable part.

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

1. In a battery, the combination of a case containing a plurality of independent cells, each of which contains an excitant, a horizontally-mounted revoluble shaft, and an independent rotatable element comprising a disk vertically mounted upon said shaft and immersed in said excitant, an independent driving-shaft mounted upon said case and crossing the upper ends of all of said cells, independent gearing between said driving-shaft and each of the revoluble elements in said cells, whereby movement of the shaft causes movement of all of said elements, and means for gradually feeding a chemical de-

polarizing agent to the excitant solution, substantially as described.

2. In a battery having a revoluble element, the combination of a shaft upon which said element is mounted, a pinion mounted in the cell immediately below the cover thereof, means for rotating said pinion, gearing for communicating the movement of the pinion to the shaft, electrical conductors from the respective elements, and an excitant, substantially as described.

3. In a battery having a revoluble element, the combination of a pinion mounted in the cell immediately below the cover thereof, means for rotating said pinion, gearing between the pinion and revoluble element, electrical conductors from the respective elements, and an excitant, substantially as described.

4. The combination of a plurality of independent cells each of which contains a revoluble element, an excitant and conductors from the respective elements; of a shaft common to all of said cells, means for rotating the same, and gearing between said shaft and the revoluble element in each of said cells, substantially as described.

5. The combination of a plurality of independent cells each of which contains a revoluble element, an excitant and conductors from the respective elements; said revoluble elements being substantially wholly immersed in the excitant, and a shaft common to all of said cells and located at the upper end thereof, and gearing between said shaft and the revoluble element in each of said cells, substantially as described.

6. In a battery, the combination of the opposite elements, an excitant solution, an open-ended receptacle containing a fluid to be gradually mixed with said solution, and means for splashing the excitant into said receptacle to displace the fluid, substantially as described.

7. In a battery having a revoluble element, the combination of a shaft upon which said element is mounted, a pinion mounted in the cell immediately below the cover thereof, means for rotating said pinion, gearing for communicating the movement of the pinion to the shaft, electrical conductors from the respective elements, an excitant, and an open-ended receptacle containing a depolarizing solution, substantially as described.

8. In a battery having a revoluble element, the combination of a conductor attached to and revolving with said element, a stationary conductor, a receptacle inclosing the terminals of said conductors, a body of non-corrosive conducting material contained in said receptacle and surrounding said terminals, and bushings upon the interior sides of said receptacle surrounding said shaft, substantially as described.

9. In a battery, the combination of a revoluble carbon element having gear-teeth cut in its circumference, and excitant solution immersing said carbon element, a pinion meshing with said gear-wheel, means for driving said pinion, and a reinforcing-strip of non-corrosive material bound around the gear-teeth of the carbon disk, substantially as described.

10. In a battery, the combination of a revoluble carbon element having gear-teeth cut in its circumference, a pinion meshing with said gear-wheel, means for driving said pinion, and a reinforcing-strip of lead bound around the gear-teeth of the carbon disk, substantially as described.

11. The combination of a battery-cell having bearings in its opposite sides, a shaft journaled in said bearings, one or more battery elements mounted on said shaft, an excitant solution, depolarizing means, and a second shaft passing through and journaled in the sides of the cell at the upper end, means for rotating said last-named shaft and gearing between the latter shaft and the revoluble element or elements, substantially as described.

12 The combination of a plurality of independent cells, each of which contains a pair of bearings, a rotatable shaft journaled in said bearings, one or more elements mounted upon said shaft, an excitant solution immersing said elements, a shaft common to all of said cells, means for rotating the same, gearing between said common shaft and the independent shaft in said cells, a receptacle containing a body of mercury, which mercury is in electrical contact with said independent shaft, and a conductor in contact with the mercury, substantially as described.

13. In a battery, the combination of a revoluble carbon element, a pinion, means for driving the pinion, and a strip of non-corrosive material carried by said carbon element and having gear-teeth formed therein, said gear-teeth meshing with said pinion, substantially as described.

14. In a battery the combination of a plurality of independent cells, each containing an excitant and an independent movable element immersed in said excitant, an independent driving-shaft common to all of said cells, independent connections from said driving-shaft extending into each cell to the movable element therein, whereby movement of the shaft causes movement of the elements of all the cells, and a plurality of receptacles of porous material each containing a fluid to be gradually mixed with the excitant extending into each of said cells, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY HALSEY.

Witnesses:
C. V. EDWARDS,
RALPH JONAS.