W. M. DAVIS.

Galvanic Battery.

No. 162,806. Patented May 4, 1875.

Fig. 1.

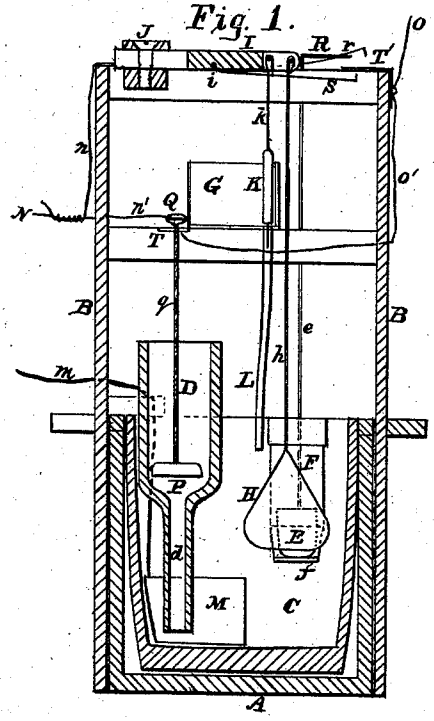


Fig. 3.

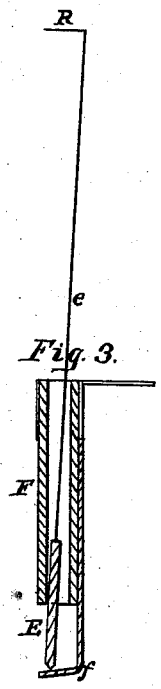
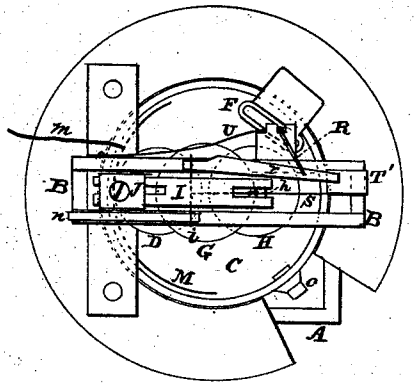


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

WILLIAM M. DAVIS, OF CLEVELAND, OHIO.

IMPROVEMENT IN GALVANIC BATTERIES.

Specification forming part of Letters Patent No. **162,806**, dated May 4, 1875; application filed March 9, 1874.

To all whom it may concern:

Be it known that I, WILLIAM M. DAVIS, of Cleveland, Cuyahoga county, Ohio, have invented a certain new and useful Improvement in Galvanic Batteries; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others versed in their use and construction to make and use the same, reference being had to the accompanying drawings, forming part of this specification:

My invention relates to that class of batteries termed self-feeding, and consists in making them more perfectly self-feeding than any heretofore constructed. In addition to this it is also designed to be self-discharging and want-announcing—that is, it will discharge itself of the too dense liquid, as well as give notice by a common call-bell whenever any of the necessary ingredients become nearly exhausted, these ingredients being supplied to it in large quantities.

The apparatus is here shown in its application to a copper and zinc battery, but may be applied in whole, or in part, to other kinds of batteries. Although the entire invention operates together as a unit, it may, for convenience of description, be divided into three parts, viz: First, the automatic feeding apparatus; second, the automatic discharging apparatus; third, the automatic want-indicating apparatus.

The means by which these desirable ends are accomplished are more particularly described in the following specification:

Figure 1 is a front elevation of this battery partly in section; and Fig. 2 is a plan view of the same, also partly in section. Fig. 3 is a vertical section of the zinc-cell, and the supporting-shelf below it.

A is a box to hold the jar, and B is a frame attached thereto, to support some of the operative parts hereinafter to be described. C is a battery-cup to hold the solutions; *c* is a common discharge-spout near its top. D is a common sulphate-of-copper reservoir, and *d* is its long neck. E is a zinc plate, and *e* is a slender stem attached to it. F is the zinc reservoir or cell to hold and guide the zinc to the shelf below, and *f* is the supporting-shelf attached to cell F to sustain the weight of the zinc. G is a water-reservoir, supported by frame B. H is the hydrometer-bulb, and *h* is its slender stem attached to beam I. I is a balance-beam, and *i* is its metallic fulcrum. J is an adjustable counterpoise to bulb H. K is a valve in reservoir G, and *k* is its rod attached to beam I. L is a pipe to conduct water into cup C. M is a copper-plate for the battery, and *m* is its attached conductor. N and O are portions of a common call-circuit. P is the call-weight resting on crystals in reservoir D. Q is a spring circuit-maker, which the weight P operates. *q* is a pliable cord, which connects weight P with spring Q. R is a call-catch on zinc stem *e*, and *r* is the circuit-maker which it operates. S is a circuit-maker attached to beam I. T and T′ are contact-plates in the call-circuit. Wires R and *m* constitute the poles of the battery. *n* is a branch of call-circuit leading to springs *r* and *s*, through the metallic fulcrum *i*. *n′* is another branch of the same circuit leading to spring Q. Wire O is attached directly to plate T. Plate T is connected with O by wire *o′*. The cup C is of the ordinary form, into which the necessary ingredients are automatically fed, in the following manner:

Sulphate-of-Copper Feed.—The reservoir D differs a little in form from those heretofore used, as shown at D *d*, Fig. 1, and is designed to hold a large supply of the crystals.

Zinc-Feed.—The zinc-cell F is suspended in the cup by any of the ordinary means, and may be of any form required to suit the shape of the column of zinc E to be used in it. In the drawing it is represented as a flattened tube, and is given this shape in order to use thick sheet zinc in it.

This cell is designed to receive a long bar of zinc, and to guide the same to the shelf below, and, at the same time, to protect all but the lower end of the bar from the solvent action of the surrounding acid. The supporting-shelf *f* may be secured to cell F, as represented in the drawing, or, it may be supported by any other means; but it must be fixed at such a distance below the lower end of cell F as will expose sufficient surface of the zinc to generate the quantity of electricity required. The zinc-bar must be of such size that it will slide freely through the cell, so as to descend by its own

weight, whenever the lower portions are dissolved away, and thus be self-feeding.

Water-Feed.—The water-reservoir G is here represented as a circular vessel. It may, however, be of any convenient form, either open or closed, and may be supplied with water by any of the ordinary means. The hydrometer-bulb H is suspended from one end of beam I, so that it may float in the liquid in cup C to such a depth that nearly half an inch of stem *h* shall be submerged when the bulb is properly balanced in the liquid. That this may be easily accomplished, the bulb is so weighted as to readily sink in a liquid of the maximum density required. The function of this bulb is to regulate the supply of water to the cup by means of valve K, which is attached to the end of beam I by its slender stem *k*, and which is designed to let water into the cup whenever the liquid within has attained the required maximum density. To attain this end the bulb must first be balanced in a liquid of the required density by means of the adjustable counterpoise J, so that the bulb will rise in this liquid with just sufficient force to lift valve K, which is so attached as to rise with it; then, when the liquid in this cup has reached the maximum density required, the bulb will rise and open the valve, and thus feed water to the cup. The water thus supplied reduces the density of the liquid within, which causes the bulb to sink, and thus to stop the water-feed. The valve K is made very small, so as to be easily opened and closed by the rise and fall of the bulb. This valve may be replaced by many of the ordinary water-vents, and still act with equal efficiency. The water-pipe L is designed to conduct the water from valve K into the cup, or the reservoir may be placed directly over the cup, so that the water may fall into it without a guide whenever the valve is opened. To preserve the vertical position of the hydrometer-stem, the balance-beam and counterpoise are used in preference to fixed guides, because less friction is involved by the former method.

The Discharge.—The discharge is effected by the simple overflow of the too dense liquid at the discharge-spout *c* whenever water or other liquid is poured into the cup. This discharge-spout is so constructed that the overflowing liquid will fall into a suitable trough permanently placed there to conduct it to a proper receptacle. The copper plate M, by preference, is placed in its edge, so as not to be obstructed by the offals of the dissolving zinc. It may extend around the inside of the cup.

The following is a description of the want-indicating apparatus:

Sulphate-of-Copper Call.—The call-weight P is a flat disk laid on the top of the copper crystals, and descends with them as the lower portions are dissolved away. This weight is connected with the spring circuit-maker Q by a cord, *l*, of such length that when the crystals are nearly exhausted it may draw down spring Q so as to touch plate T, and thus close the call-circuit.

Zinc-Call.—The upper end of stem *e* is bent over so as to form the call-catch R, while, at the same time, it constitutes one pole of the battery. This stem is held in a vertical position by spring U. As the lower end of the zinc bar E is dissolved away, the upper portions descend, till finally, when the zinc is nearly consumed, catch R presses spring *r* onto plate T′, and thus closes the call-circuit.

Water-Call.—If the supply of water should fail, notice thereof will be given as follows: As liquid in cup C becomes more and more dense bulb H rises in it till valve K is opened. If, now, no water be admitted into the cup, bulb H continues to rise by the increasing density of the liquid around it till spring S touches plate T′, and closes the call-circuit, announcing a want.

I claim as my invention—

1. In combination with the zinc bar E of a galvanic battery, the guiding-cell F and its supporting-shelf *f*, substantially as and for the purpose specified.

2. The combination, in a galvanic battery, of a water-reservoir, G, a hydrometer, H, and valve K, operating together substantially as and for the purpose specified.

3. The combination, with the reservoir D and a common call-circuit, of the call-weight P and the contact-spring Q, substantially as and for the purpose specified.

4. In combination with the descending bar of zinc E of a galvanic battery and a common call-circuit, the call-catch R and the contact-spring *r*, operating together substantially as and for the purpose specified.

5. In combination with the ascending bulb H, in the liquid of a galvanic battery and a common call-circuit, the contact-spring S on beam I, or their mechanical equivalents, operating together substantially as and for the purpose specified.

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Witnesses:
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