No. 637,851. Patented Nov. 28, 1899.

# H. CARMICHAEL.

## LIQUID FEED DEVICE FOR ELECTROLYTIC OR KINDRED APPARATUS.

(Application filed May 11, 1899.)

(No Model.)

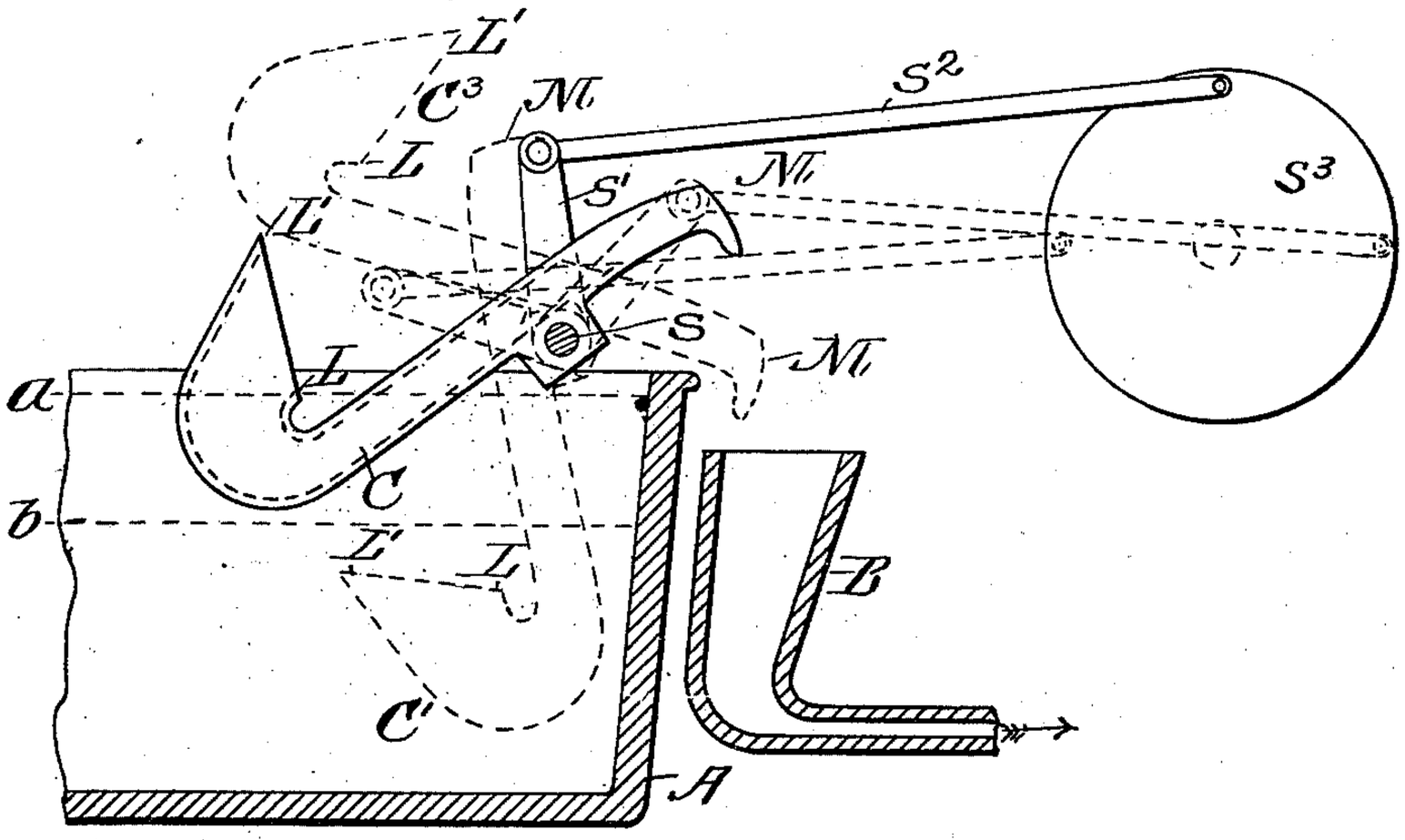


Fig. 1.

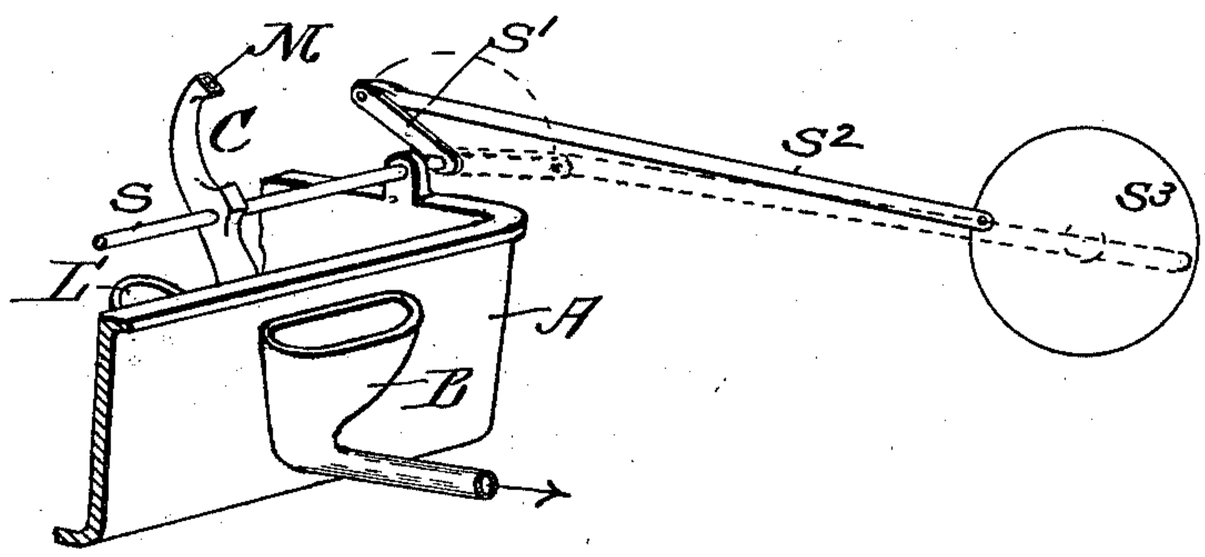


Fig. 2.

WITNESSES

Robert Cushman

C. F. Gall

INVENTOR

Henry Carmichael

# UNITED STATES PATENT OFFICE.

HENRY CARMICHAEL, OF MALDEN, MASSACHUSETTS, ASSIGNOR TO S. D. WARREN & CO., OF BOSTON, MASSACHUSETTS.

## LIQUID-FEED DEVICE FOR ELECTROLYTIC OR KINDRED APPARATUS.

SPECIFICATION forming part of Letters Patent No. 637,851, dated November 28, 1899.

Application filed May 11, 1899. Serial No. 716,374. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY CARMICHAEL, a citizen of the United States of America, and a resident of Malden, county of Middlesex, and State of Massachusetts, have invented certain new and useful Improvements in Liquid-Feed Devices for Electrolytic or Kindred Apparatus, of which the following is a specification.

This invention relates to devices for feeding liquid to electrolytic apparatus or to any vessels where such electrical conditions prevail that it is important to guard against accidental leakage of electricity through the liquid contact of a continuous stream to an external supply-tank and elsewhere, and where also the nature of the process carried on demands a substantially constant supply of liquid. A situation where these conditions prevail is described in connection with Figure 10 of Patent No. 518,710, issued to me April 24, 1894. The invention hereinbelow described accomplishes this object and insures a feed-supply of constant volume at all times, no matter how much the level of liquid in the reservoir from which the supply is drawn may vary above a predetermined lower limit.

This invention is an improvement also upon the feed apparatus described in my patent aforesaid in connection with Fig. 10 thereof, and, broadly speaking, involves the idea of regularly rotating or oscillating feeding scoops or tubes.

In the drawings attached hereto, Fig. 1 shows in elevation and partly in cross-section one of the improved feeding devices with the tank and receiving-funnel, and Fig. 2 shows in perspective one of the feeding devices with the actuating-shaft and the mechanism whereby the shaft is given a regular rotative or oscillating movement.

A is the reservoir, over which the shaft S is suspended in suitable bearings. Upon the shaft S pipes C are securely mounted, so that as the shaft rotates or oscillates the pipe will be carried with it. As many feeding devices as are required may be attached to the shaft S; but as this involves mere reduplication only one of the feeding devices is shown in the drawings. The scoop or pipe is so proportioned with reference to the shaft on which it is mounted and the reservoir into which it is to dip that the bowl or scoop of the pipe shall always pass beneath the surface of the liquid in the reservoir so long as that level does not fall below a reasonable working-point. The dipping end of the pipe is bowl or scoop shaped, the mouth of the bowl or scoop being at L L′, the bowl or scoop being curved up from the pipe in much the same manner as the bowl of a Dutch tobacco-pipe curves up from its stem. The stem of the pipe P extends from the bowl to and beyond the shaft S and terminates in the delivery-opening M, the entire pipe having a continuous and uninterrupted bore. In order that the pipe shall, notwithstanding variations in the level of liquid in reservoir, invariably deliver a uniform quantity to the receiving-funnel B, which leads to the electrolytic or other apparatus, the volumetric capacities of the scoop and stem parts of the pipe are so proportioned that the volume of contained liquid in the pipe at that point in its rotation or oscillation when the delivery-opening M begins to spill into the funnel B shall not be greater than the volume of contained liquid standing in the pipe at all points in its rotation or oscillation between the beginning of delivery spill and the point where the mouth of the pipe at the scoop end emerges from the liquid in the reservoir. This may be explained by reference to Fig. 1. Assuming the level of the liquid in the reservoir to be at the dotted line *a*, the pipe C (shown in solid lines) is just at the point of emersion from the liquid in its oscillation from the lowest position (shown in dotted lines at C′) toward its highest extreme position. (Shown in dotted lines at $c^3$.) The scoop part and stem part should be so proportioned as to their relative volume that the contained liquid at the position of emersion shall be at least as great in quantity as the contained liquid when the pipe reaches that angle when the liquid begins to spill from the outlet-opening M. If this proportion is observed, the quantity of liquid delivered at each oscillation of the pipe C will be the same, even though the liquid in the reservoir A should fall as low as the dotted line *b*, for, as is obvious from a glance at Fig. 1, more liquid

will be contained in the scoop part of the pipe as it emerges from the level B than is contained in the scoop part at the point of emersion when the level is at *a*, while in the stem part of the pipe C a larger proportion of liquid is contained at the point of emersion with the level at *a* than with the level at *b*. So if these two parts—the scoop and stem—are so proportioned that the stem part cannot accommodate the liquid which flows from the scoop part as the angular position of the pipe is changed then when the pipe reaches the point of spill from the delivery end M the liquid in the scoop part will be just level with the inner side L of the mouth or lip of the scoop, no matter what the level of the liquid in the reservoir may be. A simple manner in which to insure this proper disparity in proportion between the scoop part and stem part of the pipe P is to make the scoop part much larger than the stem part and then to cut the mouth of the scoop at an acute angle, so that the outer side L′ of the lip or mouth in the movement of emersion of the scoop is considerably in angular rotative advance of the inner edge of the scoop-opening L, which is nearer to the axis S than the protruding part L′. With this arrangement the scoop will pick up a liberal surplus when the liquid is at a low level, and this surplus as the scoop rises will be spilled back into the reservoir.

In Fig. 2 the shaft S, to which the pipes C are attached, is shown with a crank S′ at its outer end, whereby the shaft is given an oscillating movement by means of the connecting-rod $S^2$ and wheel $S^3$. An oscillating movement is substantially, however, the same as a complete rotative movement, and the liquid-feed apparatus may easily be adapted for use on a continuously-rotating shaft with slight modifications to provide for a proper delivery to receiving-funnels, which in that case would be inside instead of outside the tank. Fig. 10 of my patent aforesaid illustrates the manner in which such a modification may be arranged.

What I claim, and desire to secure by Letters Patent, is—

1. In a liquid-feed apparatus, the combination of a reservoir, a pipe having an axis of rotative movement, a scoop end, a stem and a delivery-opening, and so mounted with reference to the reservoir that the rotative movement of the pipe carries the scoop end below the level of liquid in the reservoir, the relative proportions of the scoop and stem parts of the pipe being such that the volume of contained liquid in the pipe at and after emersion from the liquid in the tank is at least equal to the volume of contained liquid in the pipe when the pipe is at that point in its rotative movement when the delivery-opening begins to spill.

2. In a liquid-feed apparatus, the combination of a reservoir, a pipe having an axis of rotative movement, a scoop end, a stem and a delivery-opening, and so mounted with reference to the reservoir that the rotative movement of the pipe carries the scoop end below the level of the liquid in the reservoir, the scoop end having its opening so placed with reference to the rotative movement of the pipe that, in the movement of emersion, the part of the scoop-opening farthest from the axis is in angular rotative advance of that part of the scoop-opening which is nearest to the axis.

Signed at Boston, Massachusetts, this 5th day of May, 1899.

HENRY CARMICHAEL.

Witnesses:
ROBERT CUSHMAN,
E. F. GROLL.