(No Model.)

J. R. MASURY.

RHEOSTAT.

No. 472,062. Patented Apr. 5, 1892.

Fig. 1.

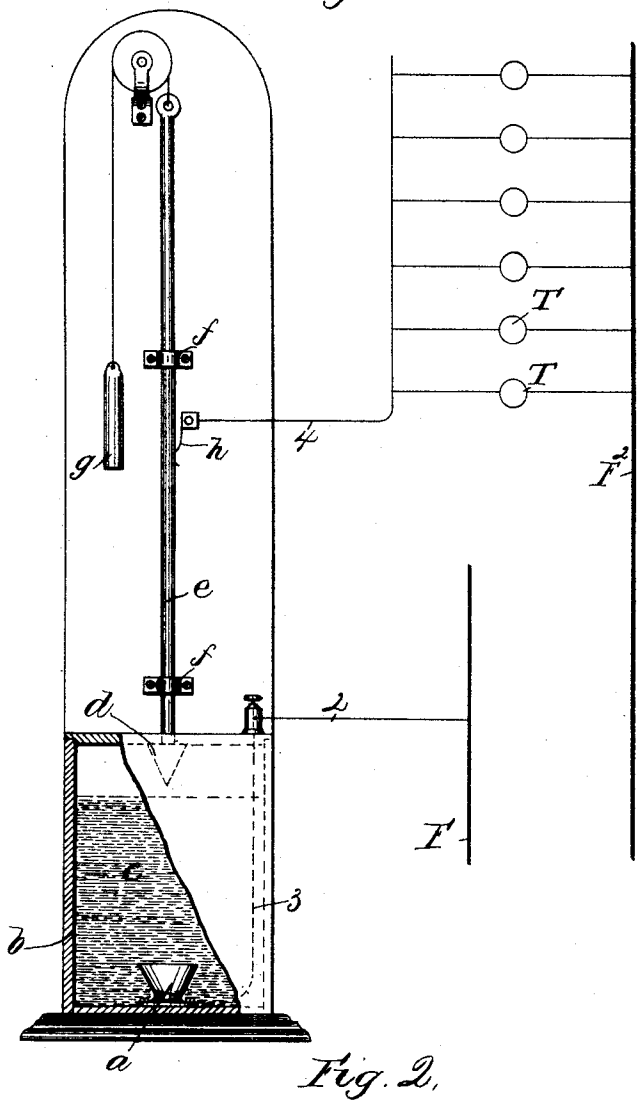
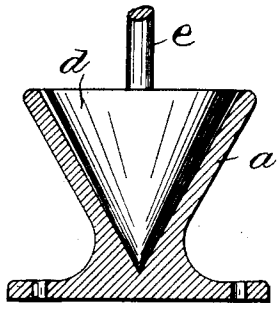


Fig. 2.



Witnesses
Jas. F. Maloney.
John A. McDonald.

Inventor.
James R. Masury.
by Jno. P. Livermore
Atty.

UNITED STATES PATENT OFFICE.

JAMES R. MASURY, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF TO LAWRENCE J. McCARTY, OF BOSTON, MASSACHUSETTS.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 472,062, dated April 5, 1892.

Application filed June 29, 1891. Serial No. 397,826. (No model.)

To all whom it may concern:

Be it known that I, JAMES R. MASURY, of Providence, county of Providence, State of Rhode Island, have invented an Improvement in Electric-Current Regulators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to a regulator for electric currents suitable for use in connection with incandescent electric lamps, said regulator enabling resistance of any desired amount and capable of gradation of any desired minuteness to be interposed between the feeding-circuit and the lamps or devices to be supplied with the current, so that the current acting upon the lamp may be controlled and graduated as desired.

The regulator is of very simple construction and inexpensive and when used with lamps enables the light to be controlled and gradually varied from the condition of maximum light to the condition in which the lights are completely extinguished, said devices thus being very valuable for controlling the lights used in producing scenic effects, as the light may be gradually diminished or increased without producing sudden changes in brilliancy, as is the case with most of the regulating devices heretofore used, by which definite amounts of resistance are thrown into or removed from the circuit by the operation of switches or similar instruments.

The regulator comprises two electrodes capable of relative movement and a conducting-liquid in which the said electrodes are immersed, said electrodes being so constructed and arranged that at the moment when contact between them is broken each has a large surface area in close proximity to a corresponding surface area on the other, the space between said surfaces thus containing a very thin but widely-extended film of conducting-liquid, so that, although the specific resistance of the liquid-conductor is high in relation to that of a metallic conductor, the said liquid in fact interposes only a slight resistance in the circuit. Then as the electrodes are separated more and more widely from one another the length of the liquid-conductor to be traversed by the current increases, thus producing an increase in resistance in the circuit, which increase may be made as gradual as the movement of the movable electrode, so that no sudden changes need be produced in the current and consequent illuminating effect. The movement of the movable electrode may continue until it begins to emerge from the liquid, and it is so constructed and arranged that as it emerges from the liquid the amount of surface of the movable electrode that is in contact with the liquid gradually diminishes until finally, when the movable electrode is just leaving the liquid, it has only a point or extremely small portion of its surface in contact with the liquid, so that the resistance increases gradually as the movable electrode is withdrawn from the liquid, and finally becomes substantially an infinite resistance at about the time when the electrode is withdrawn from the liquid, and the circuit thus wholly opened. Consequently there can be no sudden rupture of the circuit while it is carrying any considerable current, and there is consequently no sparking nor any of the objectionable effects that arise from sudden breakage of the circuit and interruption of a strong current.

Figure 1 is a front elevation, partly in section, of a current-regulator embodying this invention, the parts being shown in the position occupied when the circuit is wholly open; and Fig. 2, a detail showing one of the metallic electrodes in section and the co-operating electrode in elevation in the position occupied when the circuit is closed and the electrodes in metallic contact, so as to afford no appreciable resistance to the current.

The apparatus comprises an electrode *a*, which may be a cup-shaped piece of metal, preferably copper or some highly-conducting composition, said electrode being supported in the lower portion of the reservoir *b*, containing a conducting-liquid *c*. It is necessary for obtaining the best results that the liquid *c* should have considerable conductivity, should not be subject to any considerable amount of change from electric action, and should not become heated by the passage of an electric current, and the following liquid has been found to possess the requisites for

effective operation. The liquid consists of a solution of common salt and sal-ammoniac in water, containing pulverized carbon in suspension. This solution is prepared by dissolving about two ounces of sal-ammoniac and one-half ounce of common salt in two quarts of water, and incorporating in the said solution about one-half an ounce of pulverized carbon of the kind commonly used in electric-arc lamps. The said solution is then heated, not above the boiling-point, which causes the ingredients to be thoroughly compounded and ready for use. The regulator also comprises a movable electrode *d*, consisting of a tapering plunger of conducting material supported at the end of a slide-rod *e*, having a longitudinal movement in suitable guides *f*, by which the said plunger *d* may be moved toward and from the co-operating electrode *a*.

The adjacent surfaces of the electrodes *a* and *d* are so shaped and arranged with relation to one another, as best shown in Fig. 2, as to afford a large superficial area on each, in close proximity to the corresponding surface of the other, when the electrodes are in actual contact or have just broken contact by the movement of the electrode *d* from the electrode *a*. As shown in this instance, the adjacent surfaces are conical or tapering, the electrode *a* having a conical cavity or recess, and the electrode *d* being a cone, the angle at the apex of which is slightly less than the corresponding angle of the concave conical surface of the electrode *a*, so that when the electrode *d* is moved into contact with the electrode *a*, as shown in Fig. 2, actual metallic contact is made only at and near the apex, the space between the base portions of the conical surfaces being filled with the conducting-liquid. This difference in the taper of the surfaces prevents the complete expulsion of the liquid from between the surfaces when the electrodes are brought into contact, and thus enables them to be more easily separated and the liquid to remain constantly between them over nearly the entire extent of their adjacent surfaces, so that it immediately occupies the entire space between their adjacent surfaces the moment that the plunger *d* is lifted out of contact with the cup *a*. The guide-rod and guides for the plunger *d* keep its axis in line with that of the conical recess of the cup *a*, so that the parts make contact accurately at the apex, and so that a very small upward movement of the plunger *d* separates such metallic contact, while leaving, however, a very thin film of liquid between the two, having a large surface in contact with the surface of each electrode. Such a film of conducting-liquid, owing to its great thinness and broad extent, opposes but slight resistance to the passage of the current, so that the increase in resistance which takes place when the metallic contact is broken is so slight as to produce no sudden change in the condition of the current, and owing to the tapering shape of the metallic surfaces the longitudinal movement of the slide-rod *e* and plunger *d* produces only a relatively small extent of separation between the adjacent surfaces or lengthening of the liquid-conductor, so that the increase in resistance by the upward movement of the plunger is very gradual and the current can be regulated without such sudden changes as take place when definite increments in resistance are thrown into and removed from the circuit by the use of resistance-coils, such as commonly employed in current-regulators. The upward movement of the electrode *d* in the liquid will produce a corresponding lengthening of the liquid-conductor to be traversed by the current, and a corresponding gradual increase in the resistance up to the time when the plunger *d* begins to emerge from the liquid, and owing to the tapering shape of said plunger its surface in contact with the liquid will be gradually diminished and the resistance to the passage of the current from the plunger to the liquid gradually increased up to the moment when the apex of the plunger arrives at the surface of the liquid, when the resistance will be very great and the current therefore almost entirely stopped just as the plunger is withdrawn from the liquid and thus wholly opens the circuit. The opposite or downward movement of the plunger produces the opposite effect, first closing the circuit through a very high resistance and then gradually decreasing the resistance without sudden change until finally the electrodes are in contact and produce no appreciable resistance to the passage of the current. The plunger *d* and rod *e* are shown in this instance as connected with a counter-weight *g* by a cord passing over a pulley, the said weight substantially balancing that of the plunger and guide-rod, so that the latter will remain in any position at which it may be put and may be gradually moved in one or the other direction according as it is desired to turn up or down the lights, and said movement may be made of any desired degree of slowness, so as to produce very gradual dimming or increasing in the light controlled by the instrument.

The regulator may be interposed between the supplying-circuit and the circuit to be supplied in any suitable manner. As shown in this instance, the electrode *a* is connected by wire 2 3 with one of the main feed-wires F, and the current may be taken off from the plunger *d* and guide-rod *e* by any suitable connector, herein shown as a spring or brush *h*, making a rubbing contact with said rod *e*, which is itself a conductor. The said brush or current-collector *h* is connected by wire 4 with the branches containing the lamps or translating devices T, to be supplied with the current between the said wire 4 and the other feed-wire F^2 in any usual manner.

The herein-described current-regulator is very efficient and durable and may be used with currents of wide range in quantity and with any of the usual systems of supplying

currents to the lamps or translating devices to be operated thereby.

I claim—

1. A current-regulator composed of a reservoir of conducting-liquid combined with an electrode supported therein having a tapering recessed surface, and a co-operating movable electrode having a tapering exterior surface slightly smaller at the base than the recessed surface of the first-mentioned electrode, whereby said electrodes make contact only at the apexes of said surfaces and when in contact have a thin film of conducting-liquid of large extent between them, substantially as and for the purpose described.

2. The current-regulator comprising electrodes, one movable with relation to the other, and a reservoir containing a conducting-liquid in which said electrodes are immersed, said liquid consisting of a solution of common salt and sal-ammoniac in water, containing pulverized carbon in suspension in substantially the proportions specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES R. MASURY.

Witnesses:

JOS. P. LIVERMORE,

M. E. HILL.