(No Model.) 2 Sheets—Sheet 1.

J. D. CULP.

ELECTROPHORUS.

No. 383,105. Patented May 22, 1888.

FIG. I.

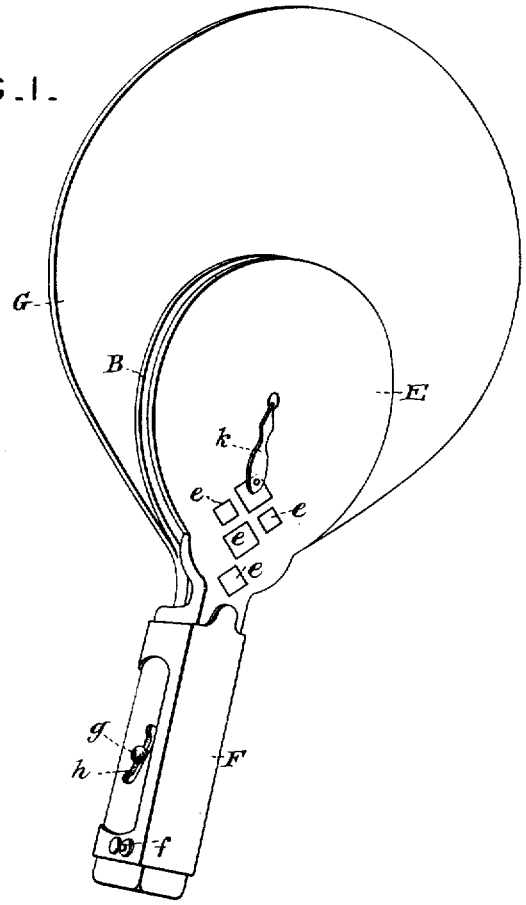


FIG. III.

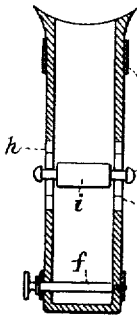


FIG. II.

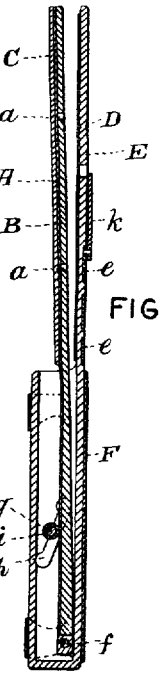
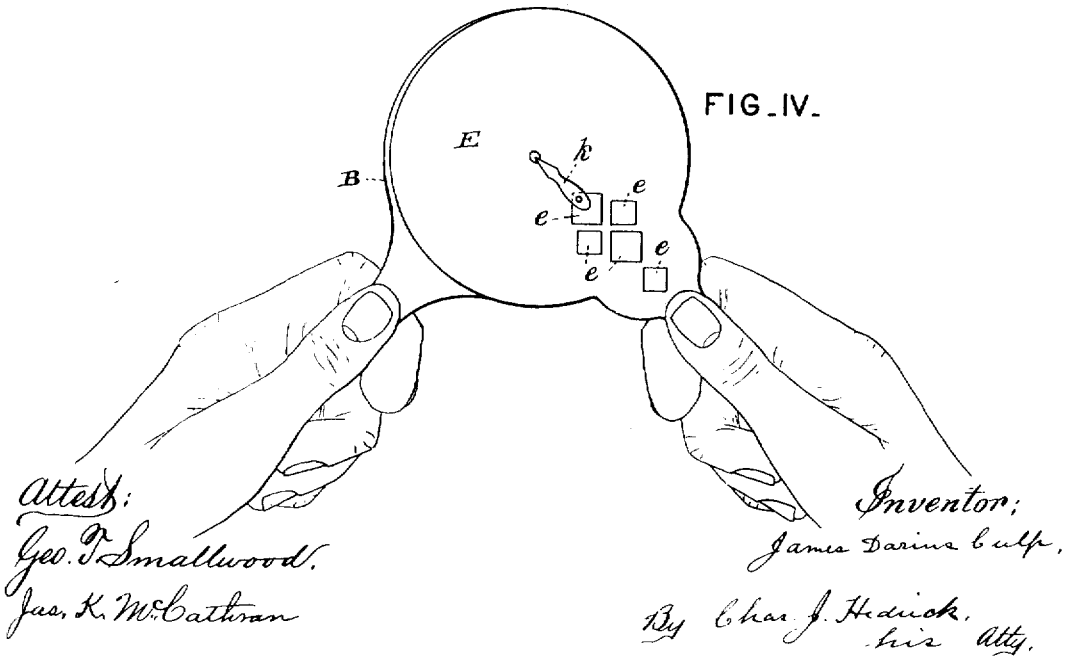


FIG. IV.



Attest:
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James Darius Culp,
By Chas. J. Hedrick,
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N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. D. CULP.

ELECTROPHORUS.

No. 383,105. Patented May 22, 1888.

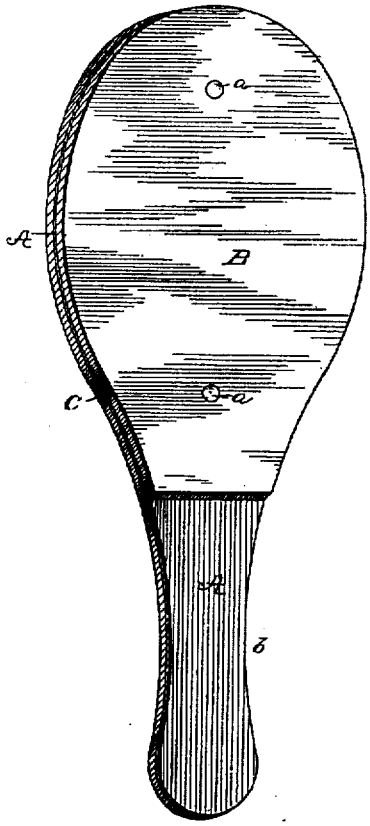


FIG. 5.

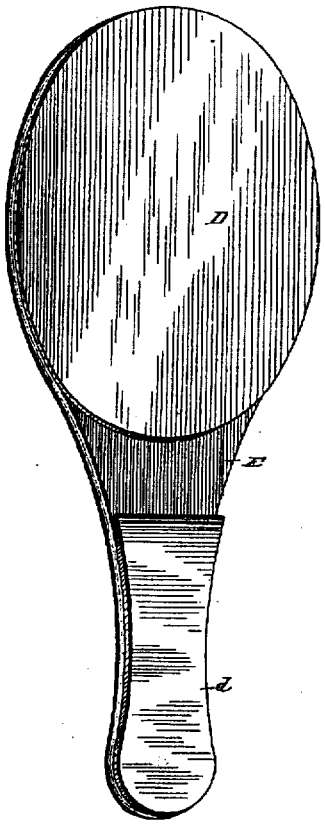
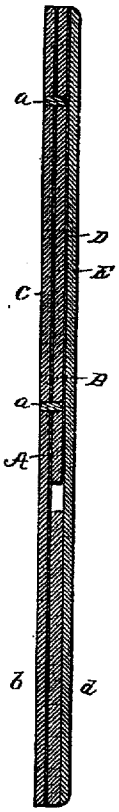


FIG. 6.



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ATTY.

UNITED STATES PATENT OFFICE.

JAMES D. CULP, OF SAN FELIPE, CALIFORNIA.

ELECTROPHORUS.

SPECIFICATION forming part of Letters Patent No. 383,105, dated May 22, 1888.

Application filed September 10, 1886. Serial No. 176,696. (No model.)

To all whom it may concern:

Be it known that I, JAMES DARIUS CULP, a citizen of the United States, residing at San Felipe, in the county of Santa Clara and State of California, have invented certain new and useful Improvements in Electrophori and Applications of the Same, of which the following is a specification.

This invention relates to the construction and application of the apparatus known as the "electrophorus" for generating electricity, by the inductive action of an electrified plate of non-conducting material upon a metal plate which is alternatively applied to and removed from the inducing non-conductor.

The object of the invention may be considered as threefold: first, to increase the efficiency of the electrophorus as an electrical generator; second, to employ it as a means for generating ozone, and, thirdly, to fit it for certain special uses as an ozone-generator or otherwise.

In the accompanying drawings, which form part of this specification, Figure I is a perspective view of a combined fan and electrophorus, which embodies the several improvements in apparatus forming part of this invention, and is adapted for carrying the methods of the invention into effect. Fig. II is a longitudinal section of the electrophorus, which may of course be employed independently of the fan as a separate article or in various connections or combinations. Fig. III is a partial longitudinal section in a plane at right angles to that of Fig. II, and Fig. IV is a plan illustrating another mode of using the electrophorus. Fig. V is a face view showing the two parts of a hand-electrophorus adapted for use after the mode represented in Fig. IV; and Fig. VI is a longitudinal section of the same parts placed together face to face, as they would commonly be placed when not in use.

In all the figures the metal plate or sole A is placed between the non conducting inducing-plate B, of hard rubber or other suitable material, and the insulating back plate, C, for which wood will answer. By having the back of the sole thus covered with insulating material it is believed that the power of the electrophorus is increased in consequence of reciprocal induction between the inducing-plate B, the sole A, and the back plate, C. Two pins, *a*, commonly known as "earth-pins," extend from the sole A through the inducing-plate B, and have their upper ends flush with the surface of said plate B. Preferably each pin is placed about midway between the center and the edge of the inducing-plate. It is believed that there is considerable advantage in the use of the two pins over the use of the single pin generally employed, or of three or more pins arranged at the angles of a triangular or other closed figure, the superiority residing in the ease with which the electrophorus is charged in all conditions of atmosphere, the quantity of electricity developed, and the length of time during which it retains its charge. The earth-pins are each the center of a field of varying potential, and when the two pins are used the fields seem to strengthen each other. Such a reciprocal action could, of course, not take place with a one-pin electrophorus, as there would be but a single field, and with three or more pins arranged as stated the action of the fields upon one another appears rather to weaken than to strengthen them.

The induced plate D is in the form of a metal sheet or foil mounted upon a backing, E, of insulating material. This construction has the advantage of permitting a reciprocal induction between the inducing-plate B, the induced plate D, and its backing E, and thereby increasing the power of the electrophorus. It also has the further advantage of permitting very thin metal to be used for the induced plate and of furnishing an insulator for holding it.

For many special uses it is desirable to have the two parts of the electrophorus hinged together. One of these parts comprises the induced plate, with any accessories which may be used—such as the backing E, for example—and the other part comprises the inducing-plate and sole, with any accessories. It is most convenient and advantageous to connect the hinge with a non-conducting plate on one part of the electrophorus, so that said plate will insulate the sole from the induced plate. The backing E may be utilized as such non-conducting plate.

Referring to Figs. I to III, the inducing-plate B and the backing E are each provided with a lateral extension, and are hinged together at the outer ends of said extensions by means

of the journal screw-pin *f*. The extension of the backing E, which forms a handle to the instrument, is provided with a conductor, F, in the form of a metal sheath, which, as shown in these figures, is in electrical connection with the sole A through the journal-pin *f* and an extension of the sole along the under side of the extension of the inducing-plate B. The object of using a sheath is to strengthen the handle. As a conductor it establishes an electrical connection with the hand of the user, and by having it in electrical connection with the sole A the latter is likewise in connection with the hand of the user. The conductor F, and consequently the sole A also, are insulated from the induced plate D by the body of the backing E.

The pin *f* is made removable, so that the two parts of the instrument can be separated, and the extension of the sole A is left exposed, so that when the parts are separated the said extension, being grasped by the user, (see Fig. IV,) may connect the sole electrically with his hand. It would suffice if only a small portion—say the edges—of the conductor or extension were exposed. When they are hinged together, the motion of the two parts of the electrophorus away from each other is limited by a stop, *g*, which, as shown, is made adjustable, so that the amount of motion may be regulated. It consists of a pin set in an inclined slot, *h*, which is provided with a number of notches, in any one of which the pin may be set. A rubber sheath, *i*, on the pin serves as a buffer.

On the outside of backing E are placed a series of sparking-electrodes, *e*, and a switch, *k*, whereby said electrodes may be placed in or out of the circuit, the gap being made less or more than the striking distance of the electric spark. The electrodes *e* might of course be omitted, the switch being connected directly with the conductor F; but by the use of a number of sparking-points a more pleasing effect is produced. The electrodes *e*, moreover, it will be observed, are so arranged that the electricity has two paths of about equal resistance open to it. It will dart sometimes across one and sometimes across the other.

In Fig. I a fan, G, is fastened to the back plate, C, and extends beyond the electrophorus. By working the fan in the ordinary way the induced plate D is alternately applied to and removed from the inducing-plate B. The same effect is likewise produced by wagging the electrophorus alone, and it is also evident that the plates of the electrophorus would act as a fan and might be made as large as desired.

Referring to Figs. V and VI, the back plate, C, and the backing E are each provided with a lateral extension, which serves as a handle, *b d*, respectively. The sole A is also provided with an extension, as in Figs. I to IV, which is sufficiently exposed to establish an electrical connection with the hand of the user. In this instrument the handle *d* is left unprovided with an exposed conductor and the backing E is without the sparking-electrodes or switch; but it is evident that these things could be supplied the same as shown in Figs. I to IV, if it were desired to use them.

In using the instrument shown in all or any of the figures the inducing plate B is electrically excited in any ordinary or suitable way—as by rubbing with a silk handkerchief—and the plate D is alternately applied to and removed from said inducing-plate B. When it is applied, it becomes charged with electricity of opposite sign by the action of the electrified inducing-plate B, the transfer of electricity between the induced plate and the sole being ordinarily evidenced by a spark to or from one of the earth-pins *a*. When it is removed, the electric charge, being no longer under the attraction of the inducing-plate, seeks to escape. It may discharge instantaneously as a spark or slowly as a brush. For the production of ozone the instrument is repeatedly discharged after the slow or brush-like manner at regular or irregular intervals. Ozone is generated in small quantities by means of the sparks; but the generation is much less efficient. The slow or brush-like discharge employed for the production of ozone takes place with either of the instruments shown; but in the instruments shown in Figs. I to IV the switch *k* must be turned so as to put its point out of striking distance from the pin *e*. The induced plate D and any conductor connected with it must of course be kept out of striking distance of the ground or the sole, or any conductor leading to either of them, when the said induced plate D is moved away from the inducing-plate. The slow or brush-like discharge of the electricity takes place in virtue of the extremely high tension, and it is facilitated by having the induced plate and metal parts connected with it of such form that the electric charge, when released from the attraction of the electrified plate B, will, under the well-known laws for the distribution of free electricity on conducting surfaces, accumulate in great density at certain points—say the edges of the foil, for example.

When it is desired to use the instrument of Figs. I to IV for the exhibition of sparks, the switch *k* is turned so that the resistance between itself and other parts of the discharging-circuits is not so great as to prevent the passage of the sparks—that is to say, it is placed within striking distance of the pin *e*. Of course an instrument could be made with the sparking points or electrodes and without any switch or circuit-changer; but in that case it would not have the like capacity for use as an ozone-generator.

The instrument can be operated with the parts connected as in Figs. I to III, or separated and held one in each hand, as in Fig. IV, for the generation of ozone by the slow discharge, or for the exhibition of sparks.

Modifications may be made in the details without departing from the spirit of the in-

vention, and parts of the invention may be used separately.

I claim as my invention or discovery—

1. In an electrophorus, and in combination with the inducing and induced plates thereof, the sole provided with an insulating plate or cover on the opposite side from the inducing-plate, substantially as described.

2. An electrophorus having two pins extending from the sole through the inducing-plate, substantially as described, in contradistinction to an electrophorus with a single pin, or with more than two pins, arranged at the corners of a triangular or other figure.

3. In an electrophorus, and in combination with the sole and the inducing-plate, the induced plate formed of a thin metal sheet or foil and the non-conducting backing to the same, substantially as described.

4. In an electrophorus, and in combination with the sole and the inducing-plate, the induced plate formed of a thin metal sheet or foil and the non-conducting backing to the same, having a handle insulated from the induced plate formed on said backing, substantially as described.

5. An electrophorus having the two parts thereof, one containing the induced plate and the other the inducing-plate and the sole, hinged together, and provided with a non-conducting plate, with which said hinge is connected, and whereby the induced plate is insulated from the sole, substantially as described.

6. An electrophorus comprising the inducing-plate, the sole, the insulating plate or cover on the opposite side of the sole from the inducing-plate, the induced plate, and the backing of said induced plate, substantially as described.

7. An electrophorus having the two parts, whereof one part comprises the induced plate and the other the inducing-plate and sole, provided each with a lateral extension which serves or may serve as a handle, that on the induced plate being insulated therefrom, and that on the other part having an exposed conductor connected with the sole, substantially as described.

8. An electrophorus having the two parts, whereof one part comprises the induced plate and the other the inducing-plate and sole, provided one with a hollow handle and the other with an extension into said handle, and having a hinge between said parts, substantially as described.

9. An electrophorus provided with a handle and having the two parts hinged together, one part being free to move toward and away from the other when the instrument is wagged, substantially as described.

10. An electrophorus having the two parts provided each with a lateral extension which may serve as a handle, and detachably connected by a hinge-joint, so that said electrophorus may be used with the parts detached or connected, the handle or extension on the one part being insulated from the induced plate and on the other provided with an exposed conductor electrically connected with the sole, substantially as described.

11. An electrophorus having two parts, each provided with a lateral extension which may serve as a handle, one part comprising the induced plate and the backing therefor and having the handle insulated from the induced plate, and the other part comprising the inducing-plate, sole, and cover, and having in the handle an exposed conductor electrically connected with the sole, substantially as described.

12. The combination, with the two parts of an electrophorus hinged together, of an adjustable stop for limiting the motion of said parts away from each other, substantially as described.

13. The combination, with the two parts of an electrophorus, of a hollow handle on one part, an extension of the other part into said handle, and the adjustable stop or pin, substantially as described.

14. An electrophorus having one of the two parts provided on the back or outside with two or more points or electrodes separated by a suitable space to be leaped by the spark when the induced plate is discharged, substantially as described.

15. The combination, with the electrophorus, of two or more sparking points or electrodes and a switch, all in the discharging-circuit of the electrophorus, substantially as described.

16. An electrophorus having in the discharging-circuit points or electrodes arranged to leave two at the least paths of about equal resistance for the sparks to pass, substantially as described.

17. In combination with a fan, an electrophorus having a portion free to vibrate under the to-and-fro motion of the fan for the generation of ozone or production of sparks or other purpose, substantially as described.

18. The method of working an electrophorus for the generation of ozone by applying at intervals the induced plate of a suitable electrophorus to the inducing non-conductor thereof and removing said plate from said non-conductor after each application, and causing the electrical charges thus repeatedly induced to be discharged slowly or as brushes, substantially as described.

19. An electrophorus having the two parts hinged together and provided with an inducing-plate disconnected from sparking points or electrodes, substantially as described.

20. An electrophorus having the two parts provided each with a lateral extension which may serve as a handle, and the induced plate disconnected from sparking points or electrodes, substantially as described.

21. An electrophorus having the two parts hinged together and provided on the back or outside with sparking points or electrodes, substantially as described.

22. An electrophorus having the two parts

hinged together and provided on the back or outside with sparking points or electrodes, and provided also with a switch or circuit-changer in circuit with said points or electrodes, substantially as described.

23. An electrophorus having a non-conducting backing on the induced plate and sparking points or electrodes on the said backing in the discharging-circuit of said induced plate, substantially as described.

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

J. D. CULP.

Witnesses:
PHILIP MAURO,
WM. RHEEM.