

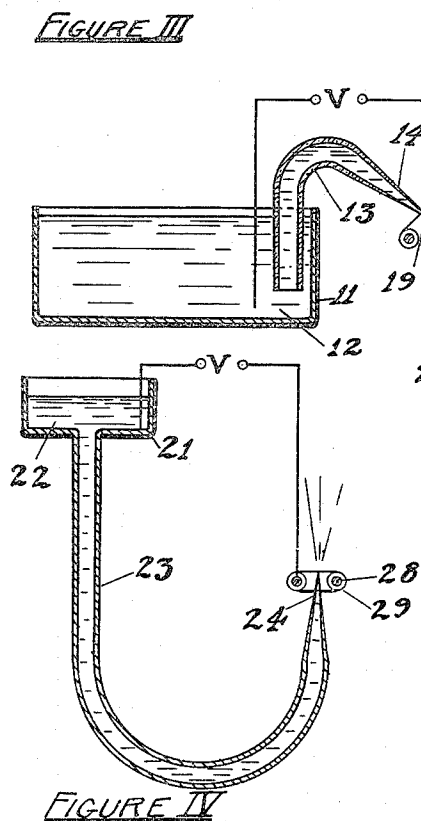
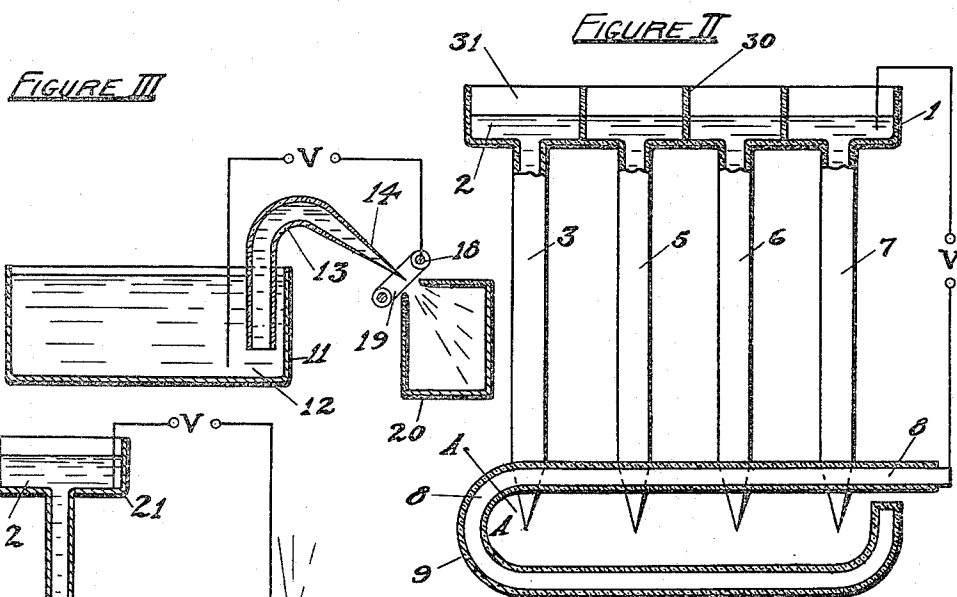
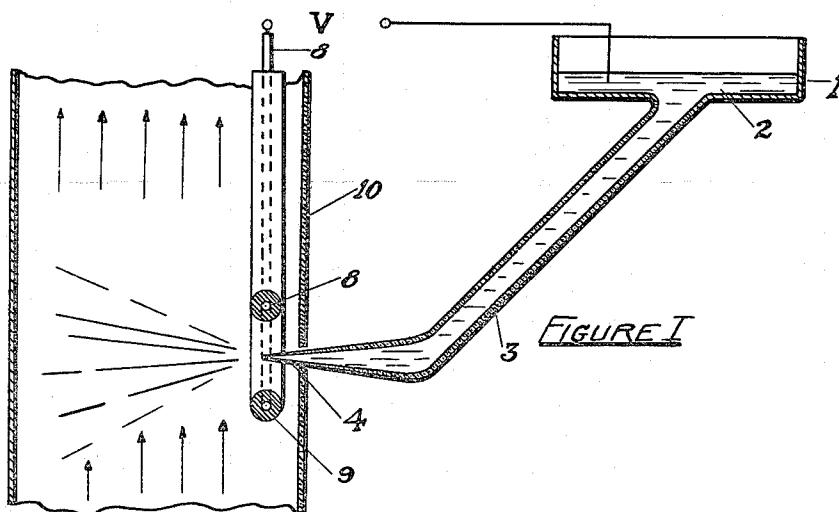
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ELECTRICAL SPRAYING DEVICE

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ELECTRICAL SPRAYING DEVICE

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9 Claims. (Cl. 299—1)

This invention relates to electrical equipment which may be used for moving, spraying, atomizing or treating fluids and probably more nearly resembles an atomizer than any other type of common equipment, although it differs therefrom in many essential points.

One of the objects of this device is to produce a finely divided liquid spray by electrical forces and without the assistance of moving air streams or other means which are commonly employed for this purpose.

Another object of this invention is to provide a means for causing an action which may be either physical or chemical between gases and liquids.

Another object of this invention is to provide means for collecting or precipitating dust or suspended particles in gases.

Other objects will appear from the following description, claims and attached drawing.

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawing and described in the following specifications, and it is more particularly pointed out in the appended claims.

In the drawing:—

Fig. I shows a side elevation partly in section of one arrangement of this device;

Fig. II is a front elevation also partly in section showing a portion of the device illustrated in Fig. I;

Figure III shows a modified arrangement of this equipment;

Fig. IV shows a further modification.

Referring to the drawing, (1) represents a reservoir or container for liquid which is indicated by (2). The liquid may be either a conductor or an insulator as the results appear to be substantially the same. (3) represents a tube or pipe extending from reservoir (1) and may be of any desired material although I prefer an insulating substance. Tube (3) is drawn out into an extending point or nozzle (4) preferably relatively long and thin and with walls which are preferably thin. It is desirable to use insulating material for the nozzle (4).

A series of similar tubes (5), (6) and (7) are shown in Fig. II. Obviously as many tubes as are required may be employed. A conductor (8) is positioned near the end of nozzle (4) and may either be in the form of a circle or loop or a single straight or curved conductor as designed. Inasmuch as relatively high potentials are employed with this equipment I have found it convenient to insulate conductor (8) with a shell (9) although this feature is optional and depends upon the design of the equipment as well as its use. A source

of potential which may be either direct current or alternating current is indicated by the letter "V" and is connected so that one terminal makes contact with conductor (8) and the other terminal with the fluid (2) in container (1). A duct or housing (10) is shown surrounding the end of nozzle (4) and the conductor (8). The object of duct or housing (10) is to confine the flow of gases or fluids which are subjected to the action of the spray produced by the equipment here described. The duct may be of either conducting or insulating material as desired. For the ordinary obvious reasons of electrical design it is desirable to have the portion of the duct (10) which is adjacent to the conductor, nozzle, etc., of insulating material.

Referring to Fig. III (11) indicates a container filled with fluid (12) into which tube or pipe (13) is placed. A nozzle (14) is formed at the end of pipe (13) and a conductor (18) is placed adjacent to the end of nozzle (14) as previously described. A source of potential "V" is connected as shown and a duct (20) is placed adjacent to the end of the nozzle (14) to confine the spray produced and direct the fluids which may come in contact with the spray. (19) indicates insulation applied around conductor (18).

Referring to Fig. IV (21) indicates a container holding fluid (22) and communicating to pipe (23) which is formed with a nozzle (24) at its end. A conductor (28) is shown adjacent the end of nozzle (24) surrounded with insulation (29) and connected to a source of potential "V" in the manner shown.

I have found that when equipment is assembled in substantially the manner indicated on the attached drawing, or with the obvious equivalent or modifications an exceedingly fine spray of drops of liquid or fluid particles are produced and many of the drops appear to carry a considerable electrical charge. The effect appears to be obtained with either direct current or alternating current. I have obtained results with potentials as low as one thousand volts applied between the conductor (8) and the liquid (2). I prefer to use much higher voltages preferably of 20,000 to 50,000 volts and the effects thus produced are very much more pronounced. The diameter of the nozzle at its tip may be varied over quite a large range, the effect being apparently merely to modify the size of the drops which are produced and, therefore, the quantity of fluid which passes through the nozzle. The quantity of fluid which passes through the nozzle is also very greatly increased by increasing the potential dif-

ference applied between the fluid in the nozzle and the conductor (8). I have also found that applying potential to only one of the two terminals will permit the production of the spray outlined

5 above, but obviously with greatly reduced volume.

I have been able to spray such materials as water, various solutions of materials in water, alcohol, oils, dextrine and some low melting point alloys and metals.

10 I have found that the position of the conductor (8) with reference to the nozzle (4) is of considerable importance in effecting the volume, nature and direction of the discharge of the spray. In general I have secured best results when the conductor forms a loop around the terminal of nozzle

15 (4) the loop being in a plane which is approximately perpendicular to the axis of the nozzle and located a small fraction of an inch back from the end of the nozzle. I do not wish to be confined to the location here described for the reason that the spray may be produced in large volume when the relative position of the conductor and nozzle have practically an infinite number of different locations from that described above.

20 I have found that satisfactory results may be obtained with a single conductor as for example the portion of conductor (8) in Fig. II between the line A-A and its terminal.

It would appear that when the proper difference of potential is applied between the fluid in nozzle (4) and the conductor (8) that electrostatic forces cause the rapid throwing of small particles of liquid from the end of the nozzle. I have produced particles of liquid so small that

35 they appear to remain suspended indefinitely in air at ordinary room conditions and so charged that they will oscillate in phase with variations in potential from a nearby electrical conductor. Such particles may be made to move so as to appear like ellipses or sine waves and appear to have an unusual resistance to evaporation partly due to the charge which they carry, and also the cooling effect.

Such particles I have found have the property of separating suspended materials floating in gases. For example smoke is almost instantaneously removed from gases by subjecting the smoke to the action of the spray produced by this equipment. Further the effect appears to be present

50 whether alternating current or direct current is employed and for many commercial reasons I, therefore, prefer to use alternating current with this equipment.

I have noticed that more marked results are obtained when conductor (8) has a relatively small radius as for example similar to a fine wire. I have also noticed that better results appear to be obtained when the insulation (9) which surrounds conductor (3) is of only sufficient thickness to provide proper insulation. I have found that greater thickness of insulation around conductor (8) appears to distort the lines of electric force reducing the effect desired. In fact substituting a tube of insulating material substantially concentric with nozzle (4) of the insulating shell (9) around conductor (8), considerably reduces the spray effect.

On the other hand, the thickness of the wall of the nozzle (4) should be as small as possible. It would appear that thicker walls of nozzle (4) tend to distort the lines of electric force and distribute them over a considerable area instead of concentrating them near the end of nozzle (4).

I have found that the spray produced by this

75 equipment is in good condition for rapid chemi-

cal action. For example oil sprayed with this equipment burns quite readily or if a spray of oil produced in this manner is directed into an atmosphere of reacting gas such as chlorine, the oil drops are quite completely chlorinated. Naturally effects of this kind can be controlled to some extent as far as degree and time is concerned by the temperature of the reacting materials, pressure and other obvious factors. Oil and chlorine are mentioned here merely as typifying the broad class of reactions which can readily be made to take place between liquids and gases with this equipment. Other examples of this location may be found in such materials as phenols and related compounds which may be oxidized, chlorinated or otherwise combined under conditions which will be obvious.

As a general illustration of the operation of this equipment it may be stated that smoke or other dust containing gases may be passed through duct (10) as for example in the direction of the arrows and subjected to the action of one or more spray devices of the type here described. Duct (10) may, of course, be vertical or horizontal and the flow of gases may be in any desired direction as best suits the specific case at hand.

The particles which compose the spray travel in approximately straight lines for a short distance after leaving the nozzle and then may be deflected or directed if desired by bringing conductors in close proximity to them. If left to themselves they frequently appear to take a parabolic course due apparently to the action of gravity. A slowly moving stream of gas or air, however, will readily carry the particles along with it and by placing conductors at desired points the moving particles may be directed in almost any desired direction.

It will be obvious from the description which has been given that this invention relates to a basic principle and a great many obvious modifications may be made in the specific arrangement of equipment or of portions, shape or size of the equipment, and still fall within the scope of this invention.

It will be obvious that I may equip container (1) as illustrated in Fig. II with one or more partitions as shown at (30) in which case I may have sprays carrying different materials from a multiple of nozzles and thus obtain a reaction between electrified sprays of different materials. Under these conditions electrical combination seems to take place with peculiar ease, and chemical reactions not readily obtained under normal conditions, may be obtained in this manner. If partition (30) is made of a conducting material no other electrical connection is necessary. If partition (30) is made of insulating material I may make individual contacts with each portion of container (1), thus causing two sprays of different materials to carry either like or unlike electrical charges as I prefer. Many obvious modifications of this arrangement will be apparent such as the use of two separate containers or the use of several sprays directed in any desired angle, for obtaining the most satisfactory admixture.

This equipment may be employed to obtain the oxidation of various materials, using a spray of the material to be oxidized introduced into an atmosphere of oxygen or gases containing oxygen. Considerable quantities of hydrogen peroxide may be produced by spraying water with this equipment into a current of air.

In a similar manner reducing reactions may

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be carried out such as the addition of hydrogen to various compounds sprayed into it. Another example of the use of this equipment is the spraying of a solution of alkali such as hydroxide of soda into an atmosphere of carbonmonoxide when the usual addition products such as oxalates, etc., may be obtained.

When this equipment is used as a means of collecting or precipitating dust or suspended particles it will be apparent that the dust is collected on the electrified spray and may then be allowed to fall to the bottom of a collector or made to adhere to walls or other desired portions where it may be readily removed. It will be apparent that this method of removing suspended particles from gases is much more practical than the present methods.

When alternating current is applied to this device the size of the drops is smaller when the frequency is higher and vice versa.

Having now fully described my invention what I claim as new and wish to secure by Letters Patent in the United States, is as follows:

1. A device for spraying fluids consisting of a nozzle of insulating material, formed with a point at one end and a conductor spaced therefrom and extending transversely to said point, said conductor being entirely surrounded with an unbroken layer of insulating material, a source of liquid storage communicating with said nozzle and a device for creating a difference of electric potential between the fluid in said nozzle and said adjacent conductor.

2. A device for spraying fluids consisting of a pointed nozzle of insulating material and an electrically charged conductor entirely surrounded by an unbroken layer of insulation, said conductor being located adjacent the point of said nozzle and arranged to diffuse the discharge from said nozzle.

3. A device for spraying fluids consisting of a pointed nozzle connected to a source of liquid, a conductor completely surrounded with an unbroken layer of insulation, and arranged in a plane substantially perpendicular to said nozzle and adjacent thereto, and a device for creating an electric difference of potential between said conductor and the fluid of said nozzle.

4. In a device for spraying fluids a nozzle member of insulating material ending in a point, and a conductor completely surrounded by an unbroken layer of solid insulation located near the pointed end of said nozzle and arranged to diffuse the discharge from said nozzle.

5. In a spraying device an attenuated nozzle of insulating material, a conductor adjacent thereto and completely surrounded with an un-

broken layer of solid insulation, and a device for creating an alternating electric field, between said conductor and said nozzle, said nozzle and said adjacent conductor being arranged to diffuse the discharge from said nozzle.

6. The combination of a fluid conducting nozzle of insulating material terminating in a point and an electric conductor distributed over a relatively large area, but spaced away from said point, and serving with said fluid in said nozzles as the terminals of a high tension electric field with the portions of said conductor forming the terminals of said field, completely surrounded with an unbroken layer of insulation.

7. A fluid conducting nozzle of insulating material having a fine discharge point with a single opening, a reservoir containing fluid connected to said nozzle and an electric conductor covering a large area and spaced away from said nozzles and forming with the fluid therein the terminals of an electric field, the portions of said electric conductor forming with said nozzles the terminals of an electric field being insulated from the fluid within said nozzle by means of an unbroken layer of solid insulating material, thereby preventing arcing discharge.

8. The combination of a liquid container, a fluid conducting nozzle of insulating material terminating in a point and connected to receive liquid from a container, an electric conductor spaced away from said nozzle and extending over a considerable area, thereby dispersing the discharge from said nozzle, said conductor serving with said fluid in said nozzle as the terminals of a high tension electric field, said electric conductor being completely surrounded with an unbroken layer of solid insulation to prevent arcing discharge between said conductor and said fluid in said nozzle, and a housing surrounding the point of said nozzle.

9. The combination of a liquid container, a fluid conducting nozzle of insulating material terminating in a point and connected to receive liquid from said container, an electric conductor spaced away from said nozzle and extending over a considerable area, thereby dispersing the discharge from said nozzle, said conductor serving with said fluid in said nozzle as the terminals of a high tension electric field, said electric conductor being completely surrounded with an unbroken layer of solid insulation to prevent arcing discharge between said conductor and said fluid in said nozzle, a housing adjacent the point of said nozzle and arranged to receive the fluid passing therefrom.

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