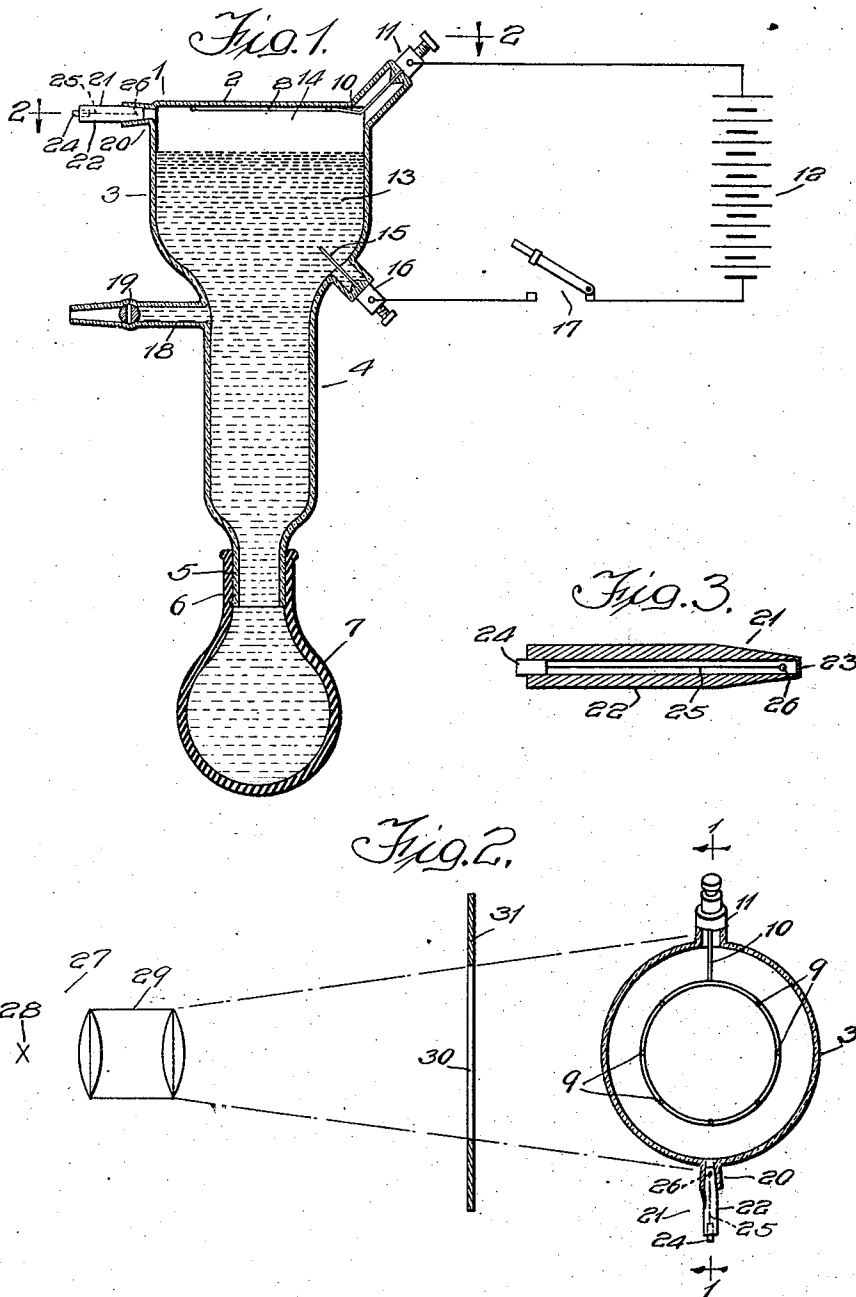


Feb. 15, 1927.

1,617,397

C. T. KNIPP
METHOD OF AND MEANS FOR DEMONSTRATING AND VISUALIZING
THE TRACK OF ALPHA RAYS
Filed Dec. 19, 1924



Witnesses:
W. F. Kilroy
Harry R. White

Inventor:
Charles T. Knipp
Brown Porter Stinner
By J. M. S.

UNITED STATES PATENT OFFICE.

CHARLES T. KNIPP, OF URBANA, ILLINOIS.

METHOD OF AND MEANS FOR DEMONSTRATING AND VISUALIZING THE TRACK OF ALPHA RAYS.

Application filed December 19, 1924. Serial No. 757,081.

My invention relates to a method of and means for demonstrating and visualizing the track of alpha rays.

About fifteen years ago Mr. C. T. R. Wilson of Cambridge, England, constructed a so-called "Cloud apparatus" for making visible the traces or tracks of alpha particles thrown off from radio active materials. His device operated as follows. Dust free air saturated with water vapor was suddenly expanded at the same instant that alpha ray particles were allowed to pass through it. The ions, formed along the path of a particular particle, acted as little centers or nuclei of condensation for moisture, which grew rapidly into droplets and became visible under a strong beam of light. The path of a particle thus was made visible as a streak of illuminated droplets of vapor. The apparatus required heretofore has been complicated, expensive, and difficult to maintain in operative condition.

I provide, according to the present invention, a simple mode of operation and simple apparatus for producing the conditions necessary to make such rays visible.

In the preferred form of my invention, I provide a glass containing vessel blown into the form of a pyrex beaker inverted and having a lateral opening in which there is seated a source of alpha rays. This takes the form of a small plug of aluminum seated in the lateral opening, the plug having at its inner end a tiny source of alpha rays as, for example, bromide of radium, seated in a protected cavity in the plug.

To the main opening or neck of the glass bottle or inverted beaker I attach a battery syringe bulb of india rubber. The vessel and bulb are then filled with liquid to within substantially an inch or so of the closed top. An electrode is mounted in the closed top and another electrode is connected with the liquid, which liquid is slightly acidulated water to make it conductive so that in effect it becomes the lower electrode. A source of current, of say from 100 to 200 volts direct current, is connected to said electrodes for establishing an electrostatic field in the region where the alpha particles move. The purpose of this field is to sweep the space between said plates or electrodes free of ions between successive operations or demonstrations.

To assist in making the track visible, I

provide a lantern or projector and arrange to throw a strong beam of light into the space between the plates.

To operate the apparatus, the hand bulb of the syringe is squeezed to produce a pressure in the cavity or field between the plates which cavity or field is filled with air and water vapor. Then the bulb is quickly released and just at the instant when the proper conditions of expansion prevail, the tracks of the alpha particles appear plainly as small streaks of water particles, and they appear with sufficient persistence so that they are plainly visible.

The water itself forms both the plunger for raising and lowering the pressure, and also one of the plates between which the electrostatic field is formed, and also serves as a source of water vapor.

For demonstration purposes I may provide a foot switch for automatically controlling both the light and the electrostatic field circuits. Also, I may project the paths of the particles on a screen, as is well understood by those skilled in the art.

Now in order to acquaint those skilled in the art with the manner of constructing and operating a device according to my invention, I shall describe in connection with the accompanying drawings a specific embodiment of the same.

In the drawings:

Figure 1 is a vertical sectional view through a device embodying my invention;

Fig. 2 is a horizontal section taken on the irregular line 2-2 of Fig. 1 and showing also the projector and screen for illuminating the space within the bottle; and

Fig. 3 is a longitudinal section of the aluminum plug which contains the source of alpha rays or particles.

I provide a glass bottle 1, which is preferably made of pyrex glass, having a substantially flat bottom 2 and a fairly short body 3. The body 3 has a relatively long neck 4, the end of which is reduced at 5 to receive the co-operating neck 6 of a rubber bulb 7, this bulb being of elastic rubber such as is employed for the bulb of a syringe.

On the inside of the bottom 2 I have provided a metallic ring 8 which forms an electrode, this being preferably a platinum wire which is tacked or fused at a half dozen points, as indicated at 9, to the bottom wall 2. As a matter of fact, I may dispense with

the ring electrode 8 and simply depend upon a film of water, which may be connected as by means of a connecting wire 10 to the external binding post 11. A binding post 11 is
 5 connected to one terminal of the battery 12, which should be, for my purposes, between 100 and 200 volts direct current. The opposite plate is formed by a body of acidulated water 13, which fills the bulb 7, the
 10 neck 4, and the body 3 of the bottle, up to within a short distance of the bottom 2. An electrostatic field 14 is formed between the electrodes 8 and 13. The body of water 13 is connected through a wire 15 to the external
 15 binding post 16, which in turn is connected to the opposite pole of the battery 12.

I have discovered that the polarity of the electrodes is immaterial and that the potential may remain upon the field constantly.
 20 I provide, therefore, a switch 17 which may be closed permanently or, if desired, it may be operated by means of a foot switch, so that the observer when he approaches the apparatus, may close the foot switch to
 25 throw on the potential to form an electrostatic field in the space 14 and may also close the electric circuit for the projector or other source of illumination, as will be described later.

The liquid 13 is introduced into the bottle through a lateral connection 18 which contains a suitable valve 19 for closing off such connection. In the apparatus which I have
 30 employed, I have used a rubber tube and a pinchcock with a plain nipple instead of the valve 19.

Near the bottom wall 2 and projecting from the side walls of the bottle 3, I provide a ground and tapered seat 20, in which there
 40 is placed an aluminum plug 21 fitting closely the ground tapered seat and held therein with stopcock grease or merely by friction. This plug 21, which is illustrated on an enlarged scale in Fig. 3, comprises a hollow
 45 plug or body 22, having a thin aluminum window at its front end as indicated at 23. The rear end of the body 22 is closed by a plug 24 which has a wire stem 25 secured thereto. Upon the front end of this stem
 50 and closely adjacent the window 23, there is mounted a small body 26 of radio active material, in this case radium bromide.

In order to illuminate the space 14, I provide a lantern or projector 27 comprising a
 55 suitable source of light 28 and condensing lens 29 for projecting a beam of light through the slit 30 of a screen 31, into said space 14 between the electrodes 8 and 13.

In operation, the apparatus is mounted in the position shown in Fig. 1, and the projector 27 is arranged to throw a beam of light into the space 14, preferably from the
 60 side, as indicated in Fig. 2.

In operation, the switch 17 is closed and
 65 the projector 27 is excited to throw light

into the space 14 between the electrodes 8 and 13. An electrostatic field is formed between these plates or electrodes 8 and 13 in said space 14 for the purpose of sweeping out
 ions as fast as they are formed from any
 70 cause whatever.

The electrode 8 is preferably formed in the shape of a fine wire ring so as not to obscure the visibility of the phenomena
 75 which occur in the space 14. The light is projected in from the side and the observer stands with his eye above the apparatus and substantially normal to the flat transparent bottom wall 2 of the bottle or
 80 cylinder 3. The plug 21, being in place so that alpha particles are projected into the electrostatic field, and the valve 19 being closed, the bulb 7 is grasped in the hand and compressed firmly to force the liquid piston
 85 13 up towards the bottom wall 2, the air and vapor in the space 14 being compressed at this time. Then the pressure on the bulb 7 is suddenly released to permit of a rapid drop in pressure on the water vapor contained in said space 14.

Immediately a number of very fine streaks or trails appear within the space 14, these
 90 trails proceeding mostly from the plug 21, although, after the apparatus has been in use, it will be found that they appear to lead in every direction, these trails when they
 95 first become visible appearing as very faint straight lines which rapidly enlarge and are warped by the turbulence within said space 14 and disappear just as the trail of steam
 100 issuing from a moving locomotive as viewed from a great distance.

The explanation of this phenomenon is well known to those skilled in the art.

It appears that particles of air and water
 105 vapor, which are encountered by the particle in its movement, become charged with positive electricity and serve, when the conditions are correct, as nuclei for the formation
 110 of drops of water or raindrops and this sudden release of pressure produces the right conditions for such formation of droplets and particles which are moving at the time
 115 when the right conditions occur plainly leave their trace or pathway marked with the condensing vapor which, under the effects of the light projected laterally into the space, are clearly visible to the observer.

Obviously the bulb 7, or equivalent means for moving the liquid piston 13 may be
 120 placed at a distance from the cylinder or bottle 3, and this may be done so that the mechanical effort of contacting and expanding the bulb 7 may not be directly transmitted to the bottle or cylinder 3.

It will at once be apparent to those skilled in the art that modifications and changes
 125 may be made which, however, I consider to come within the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In combination, a cylinder having a closed upper end wall, said end wall being transparent, a piston of conductive liquid in the lower part of said cylinder, said liquid leaving a space containing vapor, means for establishing an electrostatic field in said vapor, means for illuminating the space in which the electrostatic field is formed, and means for projecting alpha particles into the electrostatic field.

2. In combination, a cylinder having a glass end wall, an electrode mounted on said glass end wall, a piston of conductive water in the lower part of the cylinder, said water leaving a space containing water vapor, means for establishing an electrostatic field between said electrodes and the body of water, means for illuminating the space in which the electrostatic field is formed, and means for projecting alpha particles into the electrostatic field.

3. In combination, a cylinder having a closed upper end wall which end wall is transparent, a piston of conductive liquid in the lower part of the cylinder, said liquid leaving a space between it and the end wall, which space contains a vapor of said liquid, means for establishing an electrostatic field in said vapor, means for projecting alpha particles into the electrostatic field, and means for operating said liquid piston to raise and lower the fluid pressure on said vapor.

4. In combination, a closed inverted bottle having a transparent bottom wall and having a bulb connected to the neck of the same, a body of conductive water in said bottle filling the same to a point adjacent said bottom wall, means for establishing an electrostatic field in the space between said bottom wall and said body of water, and means for projecting alpha particles into the said space.

5. In combination, a closed inverted glass bottle having a rubber bulb connected to the neck of the same, an electrode lying against the bottom wall of the bottle, a body of conductive water in the bottle filling the same to a point adjacent the bottom wall and leaving a space charged with water vapor, a source of potential connected to said electrode and said body of water, said source of potential forming an electrostatic field between said electrode and the body of water, and means for projecting alpha particles into the space in which said electrostatic field is formed.

6. In combination, a glass bottle having a substantially flat bottom uppermost and having a rubber bulb connected to the neck of the same, an electrode disposed on the inside of the bottom wall, an opening in

the side wall adjacent the top, a source of alpha particles mounted in and closing said opening, a body of water in said bulb and bottle, said water leaving a space charged with water vapor between it and the bottom wall of the bottle, a source of direct current connected to the electrode and to said body of water, and means for projecting a beam of light into said space through the side wall of the bottle.

7. In combination, an inverted glass bottle having a substantially flat bottom wall, an electrode mounted on the inside of the bottom wall, a conical seat formed about an opening in the side wall of the bottle adjacent the bottom wall, a plug in said seat, said plug having a source of alpha particles, a body of liquid substantially filling the bottle to leave a small space between the liquid and the electrode, a terminal connected to the electrode, a terminal connected to the liquid and means connected to the bottle for raising and lowering the liquid to raise and lower the pressure in said space between the liquid and the electrode.

8. The method of making visible the paths of alpha particles which comprises establishing an electrostatic field, confining a body of vapor in said field, compressing the body of vapor, projecting alpha particles into the body of vapor and into the electrostatic field, and suddenly expanding the body of vapor while said alpha particles are being projected.

9. The method of making visible the paths of alpha particles which comprises forming an electrostatic field, confining a body of vapor in said field, compressing the vapor, and contracting the field, expanding the field and reducing the vapor pressure, and projecting alpha particles through the body of vapor during the expansion thereof.

10. The method of making visible the paths of alpha particles which comprises maintaining an electrostatic field, confining a body of vapor in said field, compressing said vapor in said field, rapidly expanding said vapor, and during said compression and expansion continuously projecting alpha particles into said body of vapor in said field.

11. The method of making visible the paths of alpha particles which comprises establishing an electrostatic field, confining a body of vapor in said field, then simultaneously contracting the field and compressing the vapor, then simultaneously expanding the field and expanding the vapor, and projecting continuously alpha particles into said vapor during expansion.

In witness whereof, I hereunto subscribe my name this 16th day of December, 1924.

CHARLES T. KNIPP.