

THE FORMATION OF ALPHA-RAY TRACKS BY SIMPLE MEANS.

CHAS. T. KNIPP and N. E. SOWERS, University of Illinois.

Alpha-ray tracks for lecture table demonstrations, and also for quantitative study, may be formed by means of exceedingly simple apparatus. A glass containing vessel blown into form from a pyrex crystallizing dish, a tiny source of alpha rays mounted in a protected cavity at the inner end of an aluminum plug, a battery syringe bulb, a 100 to 200 volt B-battery, and a lantern for general illumination, constitute the essential parts.

This simplified apparatus is built along the lines of a modified cloud apparatus described by one of the authors a number of years ago.¹ It is entirely of pyrex glass. Figure 1 (a) shows a vertical section through the axis of the expansion chamber and bulb RB, while figure 1 (b) is a view from the top downward. Several ray tracks are indicated as issuing from the tip of the plug P. In figure 1 (a) also are shown the electrical connections. The main body of the expansion chamber is made of a crystallizing dish since these vessels have square corners and the bottoms are quite plane and free from undulations which might produce troublesome distortions when viewing the ray tracks from above. To the lip of the crystallizing dish is fused a narrower tube, some 15 cm. in length, to the lower end of which is attached a rubber syringe bulb, RB, as shown in figure 1 (a).

The expansion chamber, MN, constitutes the upper end of the apparatus. Two binding posts, C and D, making electrical connections to the electrostatic field plates M and N respectively, are shown. The upper plate is the inside bottom of the inverted crystallizing dish, and electrical connection is made by a loop of fine platinum wire laid flat on the glass and fused to it at six or eight points, as shown in figure 1 (b). The lower plate is simply the surface of the water which is slightly acidulated to render it a better conductor. A tap, T, for admitting water into the vessel is attached. The alpha-rays emerge through a thin aluminum window at the inner end of the aluminum plug P. By making the walls of the plug heavy the rays are confined to a beam proceeding directly across the expansion chamber as shown in figure 1 (b). The plug P is ground into the glass seat and held in position by stopcock grease.

The necessary electrical connections are shown in figure 1 (a). For best results 200 volts should be placed in the circuit, though good results are obtained by connecting directly to a 110 D.C. source. In making the electrical connections it is not necessary to pay any attention to

¹ Science, III, Dec. 24, 1909, p. 930.

Note.—Experiments conducted since writing the above show that a pyrex beaker should be used instead of a crystallizing dish. The latter is not rugged enough to withstand the pressures.

polarity or to earthing one pole of the battery, nor is it necessary, as commonly supposed, to arrange for *closing* or *opening this circuit* at proper intervals when producing the alpha-ray tracks. Hence a shorting key K is included in the circuit for closing the electric circuit permanently while operating the apparatus. The electrostatic field between M and N sweeps away continuously the ions formed by impact of the alpha-particles, while the ions formed just at the instant the expansion is right, acting as nuclei for condensation of water vapor, grow rapidly and become visible. Because of their increased mass they are but little, if any, affected by the electrostatic field, remain stationary for a brief instant and then settle down under the action of gravity. For purposes of illumination and making the tracks visible a flat beam of light from a lantern should pass horizontally between the plates M and N.

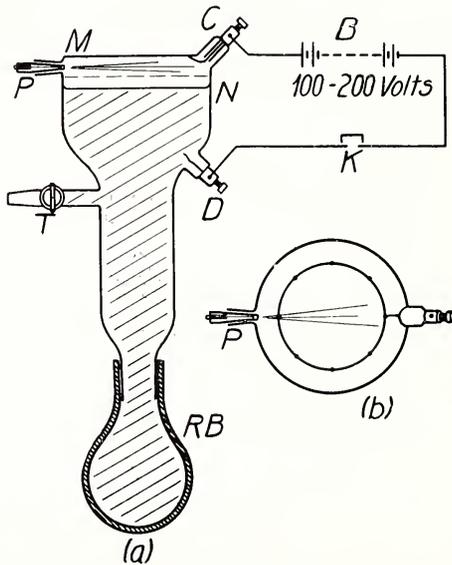


Fig. 1. Apparatus used for demonstrating Alpha-ray tracks. (a), vertical section; (b), cross section at the top.

The procedure in operating the apparatus is briefly as follows: Fill the bulb and containing vessel with water up to the level N. Insert the plug P, and connect the source of D.C. potential to the binding posts C and D, including a key K. Before closing the key the vessel should be tipped so as to wet the surface M, thus forming the upper electrostatic field plate as a film of moisture, which, since the water was made slightly conducting, makes connection to the binding post C by the platinum wire loop previously referred to. With the illumination on and the key K closed compress the bulb RB and release it alternately until the proper expansion ratio is obtained, whereupon the tracks will

appear freely, being very distinct and persisting for some moments. The expansion chamber MN being of large diameter and small height (the ratio being approximately 8:1), and free from projections or curved surfaces within, insures minimum turbulency. When the expansion is just right (and this is readily gotten by trial) and the tracks appear exceedingly clear cut, oftentimes extending entirely across the expansion chamber. The tracks may be projected upon a screen.

