

No. 821,655.

PATENTED MAY 29, 1906.

H. LIEBER.
RADIUM SURFACE.
APPLICATION FILED JULY 30, 1904.

Fig. 1.

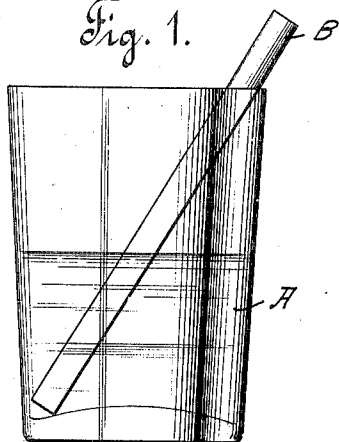


Fig. 2.

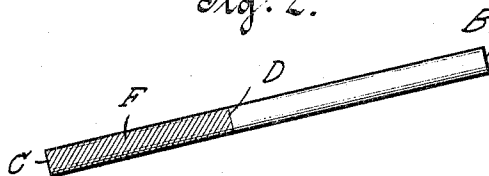


Fig. 3.

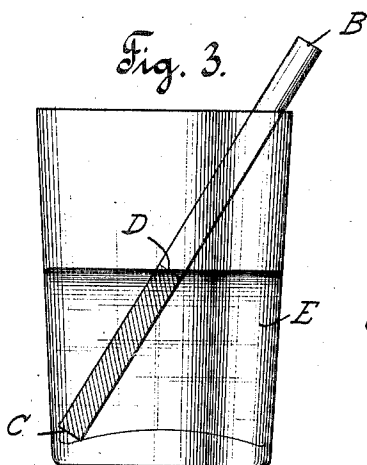


Fig. 4.

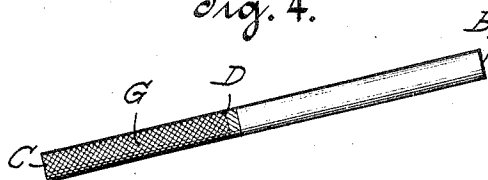


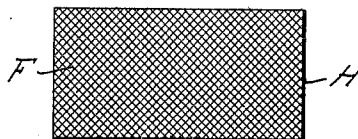
Fig. 5.



Fig. 6.



Fig. 7.



Witnesses
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UNITED STATES PATENT OFFICE.

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RADIUM SURFACE.

No. 821,655.

Specification of Letters Patent.

Patented May 29, 1906.

Application filed July 30, 1904. Serial No. 218,861.

To all whom it may concern:

Be it known that I, HUGO LIEBER, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Radium Surfaces, of which the following is a specification.

This invention relates to radium surfaces, and has for its object the securing of the effect of all the rays and of the emanations of radium, the securing of greater effects than have heretofore been secured from radium, greater convenience in the use of radium by reason of the form and manner in which it is used according to this invention, and greater economy in the use of radium by reason of the smaller quantity of radium necessary to be used for a given purpose according to this invention than has heretofore been necessary for the same purpose and by reason of the effective manner in which the radium used according to this invention is protected and preserved.

As is well known, radium has been obtained in exceedingly small quantities, and the value and cost of radium has been and is correspondingly large. It is therefore of the utmost importance, utility, and value to prepare radium in such form that the maximum effect can be secured from a minimum quantity of radium, that the radium can be conveniently as well as effectively used, and that the radium can be protected and preserved. Radium is an extraordinary substance, the effects of which are secured through its rays and emanations. It is therefore essential that radium be so disposed that the effects of its different rays, and especially of its alpha rays and of its emanations may be secured, and secured without the danger of injury to the human body—for instance, from contact with the radium itself. Such effects are secured by means of this invention.

My invention is illustrated in the drawings forming part of this specification.

In the drawings, Figure 1 shows a rod inserted into a solution of radium. Fig. 2 shows a rod coated with an exceedingly thin film of radium according to this invention. Fig. 3 shows the rod of Fig. 2 inserted into a solution suitable for coating the exceedingly thin film of radium. Fig. 4 shows a rod coated with an exceedingly thin film of radium and an exceedingly thin film of a suitable protecting material upon the film of radium according to this invention. Fig. 5 shows an

end view of the rod of Fig. 2. Fig. 6 shows an end view of the rod of Fig. 4. Fig. 7 shows a flat surface coated with an exceedingly thin film of radium and an exceedingly thin film of a suitable protecting material according to this invention.

In the drawings, Fig. 1 shows a vessel containing a solution A of radium or radium dissolved in some suitable solvent. In Fig. 1, B is a rod or stick of some suitable material, such as celluloid, partially dipped into the solution A of radium.

Fig. 2 shows the rod or stick B (shown in Fig. 1) after it has been dipped into and withdrawn from the solution A of radium. (Shown in Fig. 1.) In Fig. 2 the part of the rod B between C and D which was dipped into the solution A of radium, as shown in Fig. 1, is coated with an exceedingly thin film F of radium, the solvent of radium contained in the solution A, (shown in Fig. 1,) having evaporated or been otherwise removed.

Fig. 3 shows a vessel containing a solution E of some material, such as pyroxylin, suitable for coating, and thus protecting and preserving the thin film of radium deposited by the solution A (shown in Fig. 1) upon the part of the rod B between C and D, as shown in Fig. 2. The suitable material, such as pyroxylin, of the solution E (shown in Fig. 3) is dissolved in some solvent or solvents suitable for the purpose. Alcohol, ether, and acetone, as is well known, are solvents suitable to dissolve pyroxylin.

Fig. 4 shows the rod or stick B (shown in Fig. 2) after the part of the rod or stick between C and D has been dipped into the solution E (shown in Fig. 3) and coated with an exceedingly thin film G of pyroxylin or other suitable material, the solvent of the pyroxylin or other suitable material having evaporated or been otherwise removed.

Fig. 5 shows an end view of the rod or stick B (shown in Fig. 2) and shows in exaggeration the exceedingly thin film F of radium surrounding the rod or stick B.

Fig. 6 is an end view of the rod or stick B (shown in Fig. 4) and shows in exaggeration the exceedingly thin film F of radium surrounding the rod or stick B and the exceedingly thin film G of pyroxylin or other suitable material surrounding the thin film F of radium.

Fig. 7 shows the flat surface of a sheet H coated with an exceedingly thin film F of radium and of suitable protecting material ac-

cording to my invention. The material of which the sheet H is composed may be celluloid or any other suitable material. It may, for instance, be composed of some material, such as a material fibrous in character, which will enable the radium surface or film F to be conveniently spread or placed upon or about some part of the human body in the treatment of disease.

10 Radium is a radio-active substance which emits and radiates rays usually called "Becquerel" rays. In addition to the emission of the rays radium gives off emanations of gaseous particles. The rays discharged by radium are of several kinds, and three rays discharged by radium are known and designated as the "alpha" rays, the "beta" rays, and the "gamma" rays. The alpha rays have little penetrating power and do not penetrate glass, for instance. The beta rays have greater penetrating power, but penetrate glass to a limited extent only. The gamma rays have still greater penetrating power and penetrate glass freely. The rays and emanations emitted and given off by radium proceed from throughout the mass of the radium; but the alpha rays emitted by the inner portion as distinguished from the surface of the radium mass are largely absorbed by the surrounding particles or atoms of the radium mass, and in like manner the beta rays emitted by the inner portion as distinguished from the surface of the radium mass are largely absorbed by the surrounding particles or atoms of the radium mass. When absorbed, the energy of the alpha and of the beta rays is changed to heat, and the absorbed alpha and the absorbed beta rays are not available for use. Such absorption of the rays will take place at one-tenth of a millimeter beneath the surface of the radium mass. With regard to the emanations given off by the radium mass the emanations to an extent collect on the surface of the surrounding particles or atoms of the radium mass and are occluded, just as when a piece of platinum is placed in an atmosphere of hydrogen atoms of hydrogen collect on the surface of the platinum and are occluded. The occlusion of the emanations given off by the inner portion as distinguished from the surface of the radium mass is greater, but to a limited extent only, than is the occlusion of the emanations given off by the surface of the radium mass.

55 Heretofore radium has been kept and applied for use in tubes or containers made of such material as glass or aluminium, usually sealed or air-tight. This method of using radium does not permit the securing of the best effects from radium, because, for instance, the alpha and the beta rays emitted by the inner mass of the radium are largely absorbed as above explained, because the material of the container in which the radium mass is held is of such character or thickness that the

radiations do not all penetrate freely through the walls of the container and because the emanations are occluded to a limited extent, as above explained, by the radium mass and are unable to pass through the walls of the container in many cases because of their thickness or of their material. The effects of the alpha rays and of the emanations are lost when radium is held and applied for use in sealed containers of glass, for example.

In order to prepare radium surfaces embodying my invention and for the objects stated, I dissolve a given quantity of radium, generally in the form of bromid or chlorid of radium, in a suitable solvent—such as water, acetone, wood or grain alcohol, or ether—thereby obtaining a solution of radium. In the solution of radium I dip or immerse some suitable solid material—such as, for instance, celluloid—having a sufficient surface and then withdraw the dipped solid material from the solution of radium or otherwise spread the solution of radium upon the surface of the solid material. I then cause the solvent of the solution of radium to be driven off, as by evaporation or drying, and there remains upon the surface of the solid material, adhering to it, an exceedingly thin film of radium. Other means may be employed to spread upon the surface of the solid material the exceedingly thin film of radium. For instance, a paste or other adhesive substance containing radium, preferably dissolved radium, and composed of material suitable for a coating to protect the radium, as hereinafter described, may be employed and spread in any convenient manner upon the surface of the solid material, serving as a support or carrier; but I prefer to dip the solid material into the solution of radium. An advantageous method of spreading the thin film of radium upon the surface of the solid material is to dissolve the radium in a solvent which will soften the surface of the solid material when the solid material is brought in contact with it. For instance, if the radium is dissolved in alcohol and ether or in alcohol and acetone and if the solid material employed is celluloid the surface of the celluloid will be temporarily softened by the action of the solvents of the radium when the celluloid is brought in contact with the solvents, and upon the evaporation of the solvents after the solution of radium has been spread upon the surface of the celluloid the thin film of radium remaining upon the softened surface of the celluloid will adhere advantageously and permanently to it. When the solvents have evaporated, the softened surface of the celluloid will become hard again.

In order to protect and preserve the thin film of radium spread upon the surface of the solid material, I coat the thin film of radium with an exceedingly thin film or skin of some suitable material, such as pyroxylin. For

this purpose the pyroxylin is dissolved in the usual solvents—such as alcohol, ether, and acetone—and the solid material, with the exceedingly thin film of radium spread upon its surface, is dipped into the solution of pyroxylin and withdrawn or the solution of pyroxylin is in any other convenient or suitable manner spread upon the thin film of radium upon the surface of the solid material. Upon the evaporation of the solvents of the pyroxylin an exceedingly thin film or skin will remain, coating and protecting and preserving the thin film of radium upon the surface of the solid material. The thin film or skin coating the radium will also prevent the radium from coming in contact with bodies exposed to the action of the rays and emanations given off by the radium.

The spreading of the exceedingly thin film of radium upon the surface of the solid material and the coating of the film of radium thus spread upon the solid material may also be accomplished by dissolving the radium and the coating material in suitable solvents in one solution and then dipping the solid material into the solution or otherwise spreading the solution upon the surface of the solid material or by making a rod or solid body in any suitable or convenient shape from the radium and solid material dissolved together in the solvents through the evaporation of the solvents and forming the solid material and radium finely distributed throughout it into a body of such shape; but I prefer to apply the thin film of radium to the surface of the solid material and then to coat the thin film of radium.

The material used for coating the thin film of radium must be such as will permit one or more of the different rays emitted by the film of radium beneath to penetrate or such as will permit some or all of the emanations given off by the film of radium beneath to pass through or such as will permit both the rays and the emanations to pass through, and the film or skin of the coating should be exceedingly thin to permit the rays and emanations freely to pass through. The coating left by the solution of pyroxylin, above described, upon the evaporation of the solvents is exceedingly thin and of such character that not only the gamma and beta rays, but also the alpha rays emitted by the thin film of radium beneath freely penetrate or pass through it, and so do most of the emanations emitted by the thin film of radium beneath the coating.

By the use of the spinthariscopes of Sir William Crookes the bombardment against a screen coated with zinc sulfid produced by the rays emitted permanently and spontaneously by radium is shown. The screen of zinc sulfid appears under the bombardment of the radium rays covered by a multitude of small brilliant points which scintillate and appear to

displace one another. These small brilliant points are caused by the alpha rays of the radium bombarding the zinc sulfid. If the same quantity of radium which may have been used to produce the rays bombarding the screen of zinc sulfid in Crookes's spinthariscopes be spread in an exceedingly thin film upon the surface of a piece of celluloid and if the exceedingly thin film of radium be coated with an exceedingly thin film of pyroxylin according to my invention and as above described and if then a screen of zinc sulfid be subjected to the bombardment of the rays emitted by the exceedingly thin film of radium spread upon the celluloid and coated as above described, the screen of zinc sulfid will be covered with small, brilliant, and scintillating points far more multitudinous than when the screen of zinc sulfid was bombarded by the rays of the same quantity of radium before it was spread in an exceedingly thin film upon the surface of the celluloid. The existence of the brilliant and scintillating points proves that the alpha rays have penetrated the thin coating surrounding the thin film of radium, and the increased multitude of the brilliant and scintillating points proves that the effect secured from the same quantity of radium has been greatly increased. Another method of proving that the effect of a given amount of radium is greatly increased by spreading it in a thin film upon a surface of solid material according to my invention is by comparing the times within which it will discharge the electroscope when in the form in which it has heretofore been used and when in the form of an exceedingly thin film according to my invention. When the radium is in the form of an exceedingly thin film, it will discharge the electroscope in a fractional part of the time required for the discharge of the electroscope by the same radium when in the form in which radium has heretofore been used.

By spreading the radium in an exceedingly thin film upon the surface of some solid material the absorption of the alpha and of the beta rays and the occlusion of the emanations by the inner portion of the radium mass are obviated, and the radium is put into such form that the maximum effect can be secured from it and that for a given purpose the minimum quantity only of radium need be used. The solid material upon which the thin film of radium is spread may be of any shape and size suitable or convenient for use in the treatment of disease or for other purposes. The solid material used may consist of celluloid, wood, metal, glass, rubber, fibrous material, and the like.

I am aware that it has been stated that a cardboard screen covered with Sidot's hexagonal blende which is said to be very sensitive to projected atoms, but not to electrons, was painted over with nitrate of radium, the

word "Radium" being in the middle, and that the light from this screen was of considerable intensity, the word "Radium" being very prominent. Such is not my invention. According to my invention radium is not spread upon the surface of hexagonal blende or other like material, but upon the surface of indifferent material, which serves merely as a carrier or support for the radium distributed upon or throughout its surface for the purpose stated.

What I claim is—

1. A radio-active body containing a radio-active substance protected by suitable protecting material, substantially as described.
2. A radio-active body, containing radium protected by suitable protecting material, substantially as described.
3. A surface of indifferent solid material provided with an adhering radio-active coating of an exceedingly thin film of radium in a finely-divided state, substantially as described.
4. A surface of solid material provided with an adhering radio-active coating of an exceedingly thin film of radium in a finely-

divided state and an exceedingly thin coating of suitable material protecting the film of radium, substantially as described.

5. A surface of celluloid provided with an adhering radio-active coating of an exceedingly thin film of radium in a finely-divided state, substantially as described.

6. A surface of celluloid provided with an adhering coating of an exceedingly thin film of radium in a finely-divided state, and an exceedingly thin coating of suitable material protecting the film of radium, substantially as described.

7. A support provided with a radio-active surface, carrying a radio-active substance protected by a film of suitable protecting material, substantially as described.

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

HUGO LIEBER.

Witnesses:

J. BERLINICKE,
FRANCIS E. CASH.