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RADIUM APPLICATOR.

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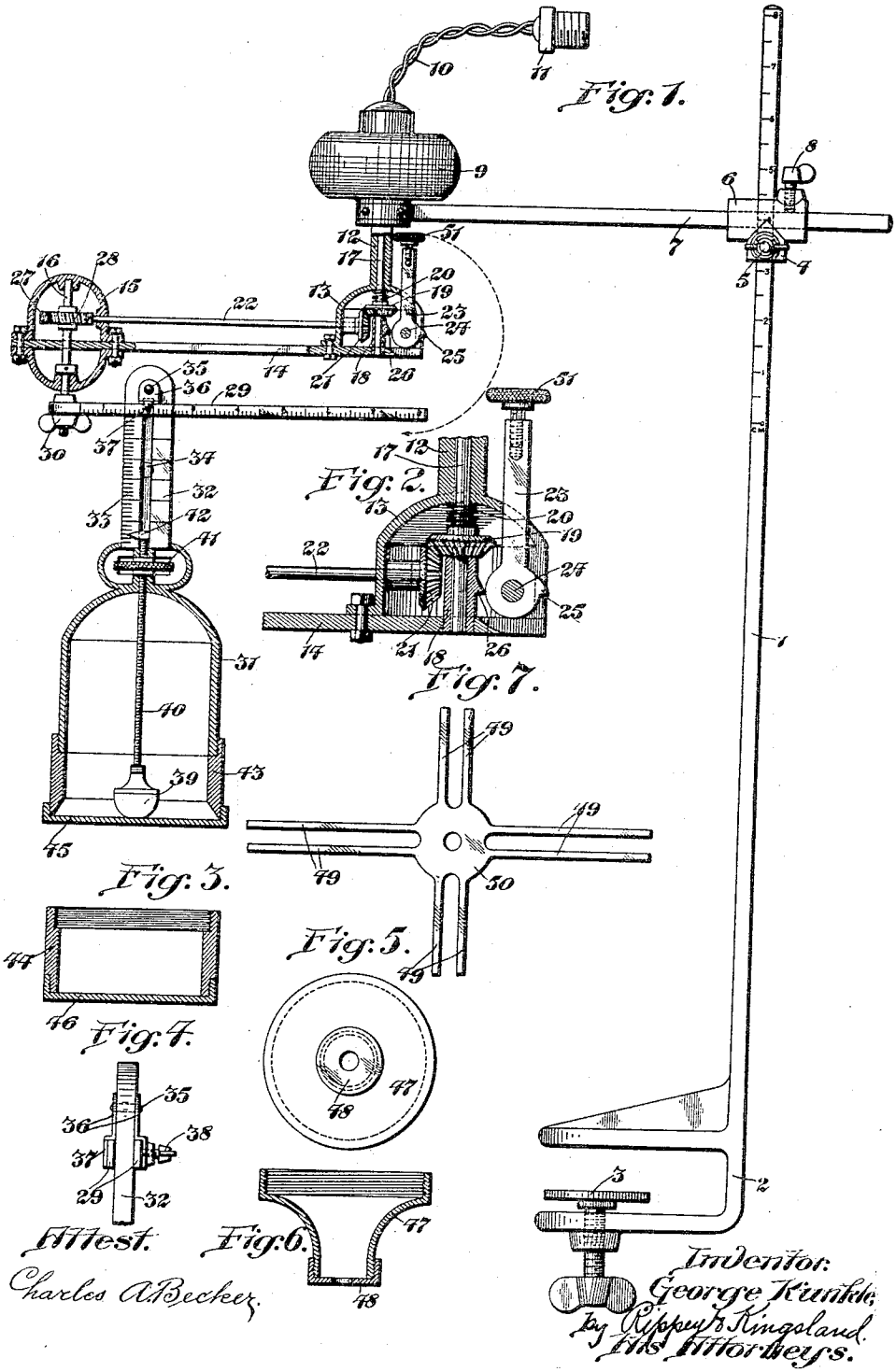


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# UNITED STATES PATENT OFFICE.

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## RADIUM-APPLICATOR.

1,288,048. Specification of Letters Patent. Patented Dec. 17, 1918.

Application filed March 21, 1917. Serial No. 156,515.

*To all whom it may concern:*

Be it known that I, GEORGE KUNKLE, a citizen of the United States, residing at Grand Junction, Mesa county, and State of Colorado, have invented a new and useful Radium-Applicator, of which the following is a specification.

This invention relates to radium applicators adapted for use as applicators of radium and other radio-active salts.

The utilization of the radiations or rays of radium and other radio-active salts in the treatment of disease, by exposure to, or irradiation of such diseased parts, is an approved and well established procedure of radium therapy.

The extent of therapeutical use of the radiations of radium and other radio-active salts has been restricted because the various applicators that have been designed heretofore possess no method by which the operator can conveniently determine and control the degree or intensity of such radiations.

The electroscope and electrometer as instruments for measuring radio-activity are not adaptable to such applicators, and the present methods of using screens over salts of known activity requires and pre-supposes on the part of the operator, an extensive knowledge of the physics of radio-activity.

The applicators now in use must be operated entirely by hand, consequently the scope of their usefulness has been limited to small areas, and where areas of moderate dimensions are treated, the applicator requires constant attention, such as timing, moving and marking of the areas irradiated; therefore, an applicator that will dispense with these tedious and cumbersome manipulations will do much to advance, encourage, and enlarge the now limited scope of radium therapy.

An object of the present invention is to provide an applicator properly calibrated in advance and arranged so that the physician using it can accurately measure and administer the approved dosage at any moment by simple adjustment of its parts.

Another object is to provide an applicator, automatic in its movements and eliminating, as far as possible, the disadvantages inherent in the older devices.

Specifically the instrument which is the subject-matter of this invention automatically and evenly irradiates surfaces of widely variable areas, as, for instance, areas from one millimeter to thirty-two centimeters in diameter; and the dosage can be instantly measured and administered by any of the approved methods by a simple adjustment of its standardized parts.

In the accompanying drawings, in which I have illustrated a preferred embodiment of the invention,

Figure 1 is a vertical sectional view of the internal mechanism of the instrument, the supporting and actuating mechanism being in elevation.

Fig. 2 is an enlarged sectional view illustrating the releasable actuating gearing of the instrument.

Fig. 3 is a sectional view of a detachable nozzle which can be secured to the radium applicator, and which may be equipped with a cap or screen of any bore and thickness.

Fig. 4 is a view showing the adjustable support for the applicator.

Figs. 5 and 6 are plan and sectional views respectively of another form of detachable nozzle which can be secured to the applicator, and which may be equipped with a removable cap or screen of any bore and thickness.

Fig. 7 is a view of another form of support upon which two, three or four applicators may be suspended and revolved simultaneously.

The instrument in the embodiment in which I have illustrated it comprises a standard 1 provided with a bracket 2 adapted to engage the edge of a table or other support of that character, and being equipped with a clamping device 3 whereby the standard may be securely fixed in any position. A collar 4 is mounted for vertical movement upon the standard 1 and carries a set screw clamp 5 adapted to engage with the standard to hold the collar in its adjusted positions. A scale is formed on the standard as shown to guide the operator in the adjustment of the collar.

The collar 4 supports a sleeve 6 in which a rod 7 is adjustably carried, said rod being retained in any of its adjusted positions relative to the standard 1 by a clamping device 8 operating through the sleeve to

engage the rod. A small electric motor 9 is carried by the rod 7 and the circuit wires 10 from the motor are connected with a plug 11 of the usual construction for engagement in the socket of an electric lamp, whereby electric energy is admitted to the motor. The motor drives a hollow shaft 12 which terminates in and supports a housing 13. An arm 14 is in connection with the housing and revolves therewith when the motor is in operation. The outer extremity of the arm 14 supports a housing 15 in which a small vertical shaft 16 is journaled.

The motor 9 also supports a shaft 17 which is rigid with the motor and does not revolve. The shaft 17 is within the hollow shaft 12 and constitutes the axis around which said shaft 12 revolves. The lower end of the shaft 17 is encircled by a sleeve or collar 18 which revolves with the housing 13 and the arm 14. A beveled pinion 19 is keyed for sliding movement upon the shaft 17, being actuated downwardly against the upper extremity of the sleeve 18 by a spring 20 encircling the shaft 17 and abutting at its lower end against the pinion 19 and at its upper end against the end of the revoluble shaft 12. The pinion 19, when in its lower adjustment meshes, with a pinion 21 secured to the end of a horizontal shaft 22, the same being journaled in bearings in the housings 13 and 15.

As a result of this arrangement, when the motor is in operation, the shaft 12 is rotated while the shaft 17 and the pinion 19 remain stationary, thus causing the shaft 22 to be rotated as the latter swings around the stationary shaft 17.

In some uses of the instrument it is desirable to use the applicator without revolving the same, and this may be accomplished by disengaging the pinion 19 from the pinion 21. For this purpose I have provided a lever 23 supported upon a pivot 24 in the housing 13 and arranged to rest in an upright position as shown, when it is desired to have the pinion 19 mesh with the pinion 21. The lever 23 is formed with a shoulder 25 adapted to engage with a shoulder 26 on the sleeve 18 when said lever 23 is turned to a depending position from the pivot 24. The parts are so arranged that when the lever 23 is turned downwardly, the shoulder 25 will engage the shoulder 26 on the sleeve 18 and move the latter upwardly a distance sufficient to disengage the pinion 19 from the pinion 21 against the tension of the spring 20. This leaves the shaft 12 free to revolve without revolving the shaft 22.

The shaft 22 extends into the housing 15 and carries a warm 27 engaging with a pinion 28 on the shaft 16, so that said shaft 16 will be revolved when the shaft 22 is operated by the pinion 19. It is obvious, however, that when the pinion 19 is disengaged from the pinion 21 the shaft 16 will not be revolved, although the arm 14 will continue to swing in accompaniment with the rotation of the shaft 12.

A bar comprising two parallel arms 29 (Fig. 4) is removably supported on the lower end of the shaft 16 by means of a detachable nut 30. It is obvious that when the shaft 16 is rotated by the connections above described, the bar 29 will be rotated with the shaft 16 as an axis, and will also be carried around with the arm 14.

One of the arms 29 is provided with a scale as shown in Fig. 1 in order to guide the user of the instrument in the adjustment of the applicator which is suspended from said arm, so that the applicator may be adjusted or positioned to irradiate widely variable areas. In the present instance the instrument is designed and is adjustable for the irradiation of areas varying from one millimeter to thirty-two centimeters in diameter, and by observing the proper adjustment the dosage can be instantly measured and administered by any of the approved methods.

In the embodiment illustrated the radium applicator is in the form of a bell-shaped device 31 which may be lined with lead of appropriate thickness for the protection of the operator, or constructed of aluminum or any other material adapted for such use. The applicator is supported by a handle 32 vertically graduated in millimeters as shown at 33 and provided with a vertical slot 34. The handle is supported upon a pivot 35 carried by brackets 36 mounted for adjustment upon the two arms 29 between which the handle extends, as shown in Fig. 4. A pointer 37 in connection with the handle, and in the form shown constituting an attenuated projection of one of the brackets 36, operates adjacent to the scale on one of the arms 29 to guide the user of the instrument in the adjustment of the applicator. Being suspended in this manner, the applicator may be swung in either direction upon its pivot in order to irradiate larger or smaller areas as may be required, and may also be adjusted in different positions upon its support consisting of the two arms 29. It is preferable that the supporting bracket for the applicator be provided with a clamp 38 whereby the brackets may be securely retained in any adjustment in which they may be placed.

The radio-active salt is contained within a receptacle 39 supported by a rod 40 which extends through an opening in the top of the member 31. A hand wheel 41 is in threaded connection with the rod 40 and held from vertical movement so that when the wheel is turned the rod will be raised or lowered to any desired adjustment. A

pointer 42 on the rod coöperates with the scale 33 to indicate to the user the position in which the rod is placed. Thus, when the quantity and radio-activity of a salt contained in the receptacle 39 is known the millimeter value of the scale on the handle 32 can be given, since the intensity of the rays is diminished as the square of the distance increases. The maximum radio-activity of the salt may be stamped, or otherwise indicated, at the bottom of the scale and the diminishing values inserted at intervals, or otherwise designated, on one side of the slot 34, thus enabling the operator instantly to gage the number of units of radio-activity desired.

The applicator device 31 supports a removable nozzle 43 which confines the irradiation to the diseased parts. The nozzle 43 may be removed and a form of nozzle 44, illustrated in Fig. 3, may be substituted if desired. The nozzle 43 is formed for connection with a rubber cot 45 which may be applied thereto when the diseased parts are of a superficial character and do not require deep penetration of the irradiation. The rubber cot may be removed and destroyed.

If treatment of a deep-seated disease is required, involving long exposure to the hard penetrating gamma rays, it becomes necessary to filter out part or all of the beta radiation, the interchangeable nozzle 44 is employed. The nozzle 44 is provided with a detachable screen 46 composed of any appropriate material, such as silver, lead, platinum, aluminum or rubber, or the like. From the absorption coefficients of these metals the thickness required to reduce the radiation to any fraction of its initial value can be calculated. In the production of the screens these values will be stamped thereon. For example, if it is desired to occlude all beta radiation a lead screen one millimeter thick for instance would contain the symbol "O" in connection with the words "Beta rays", as they are for the most part absorbed by this thickness of lead. There are, however, secondary beta rays formed along the path of the gamma rays which increase with the atomic weight of the filtering medium, and these may be occluded by small cotton filters placed over the nozzle of the screen. If it is desirable to reduce the gamma radiation, for instance, to one-half of its initial value, then a lead screen 1.4 centimeters thick would be stamped "Gamma rays 50%", or the actual activity could be given if desired.

When irradiation of an area is desired by what is known as "cross-fire", the interchangeable nozzle illustrated in Figs. 5 and 6 is substituted for the nozzle 43. The nozzle for "cross-fire" purposes includes a tapering member 47 provided with a flange at its larger end for engagement with the member 31. A removable screen 48 is provided for the nozzle 47 for reducing the radiation. By manipulating the handle 32 the applicator may be given any inclination desired, and while supported in an inclined position the arm 14 may be revolved, with the support 29 stationary relative to said arm 14, and the root of a tumor may be automatically subjected to an evenly distributed "cross-fire" which affords heavy irradiation at the root where the rays intersect and comparatively light irradiation of the more easily penetrated surface at the center.

From the foregoing it will be understood that the instrument is designed and adapted for treatment of diseased parts requiring varying intensity of irradiation, and that the instrument is easily adjusted and operated to subject largely varying areas to treatment. The instrument is simple in construction and operation and may be operated wherever electrical energy is available for the motor.

In some instances it may be desired to employ a number of applicators at the same time. For this purpose I provide a series of spaced arms 49 (Fig. 7) supported by a central hub 50 adapted to be supported by the shaft 16 and operated thereby in the same manner that the bar 29 is supported. An applicator may be supported by each pair of arms 49 in the same manner that the applicator is supported by the bar 29. As illustrated in Fig. 7, there are four pairs of arms 49, but it is obvious that the number may be varied as desired.

When it is desired to irradiate a small area, the lever 23 is turned downwardly in order to disengage the pinion 19 from the pinion 21. In this adjustment the lever 23 is placed between the two arms constituting the support 29 and the screw 51 is set or adjusted to support the end of the bar 29 and retain the lever 23 in connection therewith. Thus, the bar 29 will be held stationary relative to the arm 14 which continues to revolve as long as the motor is energized. The applicator may be adjusted in any position along the bar 29 and may be inclined as required to give "cross-fire" treatment, or for other purposes desired.

It is apparent that the construction and arrangement of the various parts of the instrument may be varied largely without departing from the principle of the invention. Therefore, in describing the preferred embodiment of the instrument I am not restricting myself to the specific features thereof, but contemplate such variations in the construction and arrangement as the circumstances may require.

I claim:

1. An instrument of the character described, comprising an applicator for confining the rays of radiation, a support on which said applicator is adjustable for sup-

porting the applicator in different adjusted positions, a receptacle for the radio-active salts, a device supporting the receptacle within the applicator, and means for operating the applicator in any of its adjusted positions.

2. An instrument of the character described, comprising an adjustable applicator, a receptacle within the applicator for radio-active salts, means for adjusting the receptacle in different positions in the applicator, a support for the applicator, and means for operating the support to carry the applicator to different positions.

3. An instrument of the character described, comprising an applicator arranged to contain a radium salt, a revoluble shaft, an arm supported by said shaft, an additional shaft carried by said arm, a support carried by said additional shaft for supporting the applicator, and means for revolving said additional shaft from the first-named shaft.

4. An instrument of the character described, comprising a receptacle for the radio-active salts, an applicator within which the receptacle is supported for confining the rays, a device for adjusting and supporting said receptacle in different adjusted positions within the applicator, a support upon which the applicator is adjustable in different selected positions, a shaft to which said support is connected, and mechanism for revolving said shaft and thereby said support and the applicator.

5. An instrument of the character described, comprising an applicator arranged to contain a radium salt, an adjustable support for supporting the applicator in different adjusted positions and for indicating accurately the extent of movement of said applicator from a predetermined starting point, and mechanism for revolving the applicator.

6. An instrument of the character described, comprising an applicator arranged to contain a radium salt, a support therefor, a revoluble shaft on which said support is mounted, means for revolving said shaft to swing the applicator around the same as an axis, a support for said shaft, and means for revolving said support.

7. An instrument of the character described, comprising an applicator arranged to contain a radium salt, an arm, means for moving said arm, a shaft supported by said arm, means for revolving said shaft as an incident to the movement of said arm, a bar supported by said shaft, and means for supporting said applicator in different adjusted positions on said bar.

8. An instrument of the character described, comprising an applicator arranged to contain a radium salt, an arm, means for moving said arm, a shaft supported by said arm, means for revolving said shaft as an incident to the movement of said arm, a bar supported and operated by said shaft, means for supporting said applicator from said bar, and means for supporting the radium salt in different positions in said applicator.

9. An instrument of the character described, comprising an applicator, a receptacle in the applicator arranged to support a radium salt within the applicator, means for adjusting and supporting said receptacle in different adjusted positions within the applicator, a detachable screen in connection with the applicator, and mechanism for operating the applicator.

10. An instrument of the character described, comprising an applicator arranged to contain a radium salt, a support therefor, means for revolving said support, and a handle whereby the applicator may be held at an angle whereby the afflicted part may be subjected to radiation from different angles.

11. An instrument of the character described, comprising an applicator arranged to contain a radium salt and capable of use to provide filtered or unfiltered radiation as desired, a receptacle within the applicator arranged to support the radium salt within the applicator, means for supporting said receptacle in different adjusted positions within the applicator, a device for indicating the adjusted positions of the receptacle, a support for said applicator, means for moving said support and thereby the applicator to different positions, and means for optionally varying the intensity of the radiations.

12. An instrument of the character described, comprising an applicator, a receptacle within the applicator arranged to support a radium salt within the applicator, means for supporting the receptacle in different adjusted positions within the applicator, a device for indicating the different positions in which the receptacle is supported within the applicator, and a series of interchangeable parts adapted to be connected to the applicator for optionally varying the intensity of the radiations.

13. An instrument of the character described, comprising an applicator arranged to contain a radium salt, and means for imparting to the applicator a revolving movement of adjustable dimensions under the control of the operator.

14. An instrument of the character described, comprising a revoluble support, an arm supported and revolved by said support, a shaft supported by said arm, means for revolving said shaft as an incident to the movement of said arm, an arm extending from said shaft and revolved thereby, an

applicator supported by said last-named arm, and a receptacle within the applicator for containing the radio-active salts.

15. An instrument of the character described, comprising a revoluble support, an arm supported and revolved by said support, a shaft supported by said arm, means for revolving said shaft as an incident to the movement of said arm, and an applicator supported by said revoluble shaft and arranged to contain a radium salt.

16. An instrument of the character described, comprising a revoluble support, an arm supported by and moving with said support, a revoluble shaft supported by said arm, means for revolving said shaft as an incident to the movement of said arm, means for preventing said shaft from revolving relative to said arm, and an applicator supported by said shaft and arranged to contain a radium salt.

17. An instrument of the character described, comprising a revoluble shaft, an arm supported by said shaft, a stationary element co-axial with said shaft, a shaft supported by said arm, a connection from said last-named shaft to said element, whereby the last-named shaft is rotated as an incident to the movement of said arm by said revoluble shaft, a support carried by the shaft which is supported by said arm, and an applicator supported by said support and arranged to contain a radium salt.

In witness whereof I have signed this specification.

GEORGE KUNKLE.