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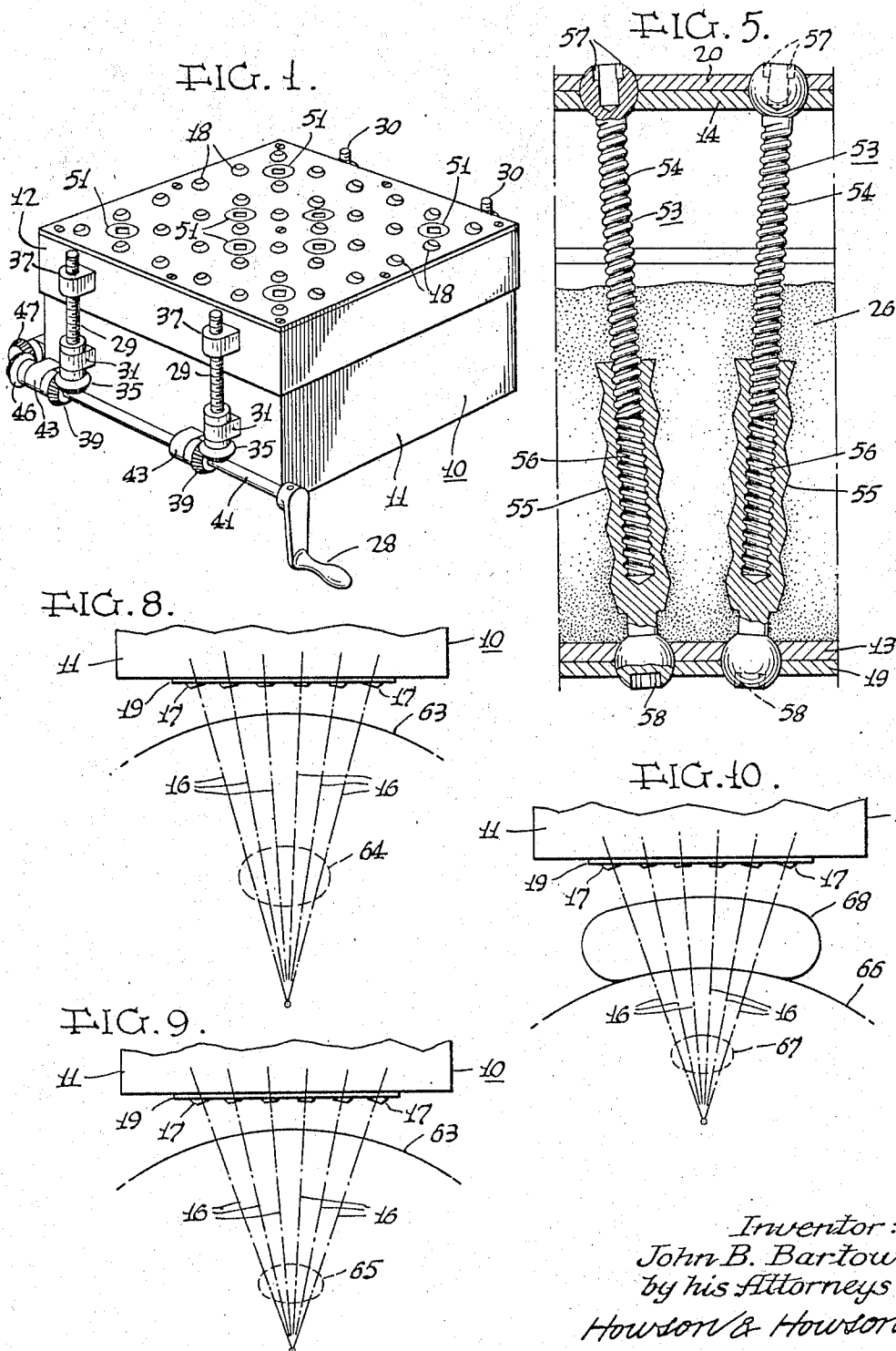
J. B. BARTOW

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RAY DIRECTING DEVICE

Filed Feb. 12, 1951

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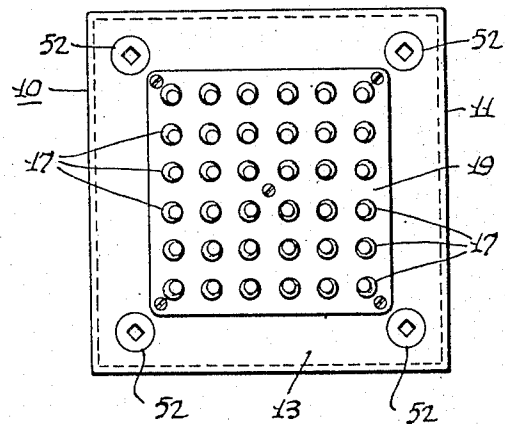
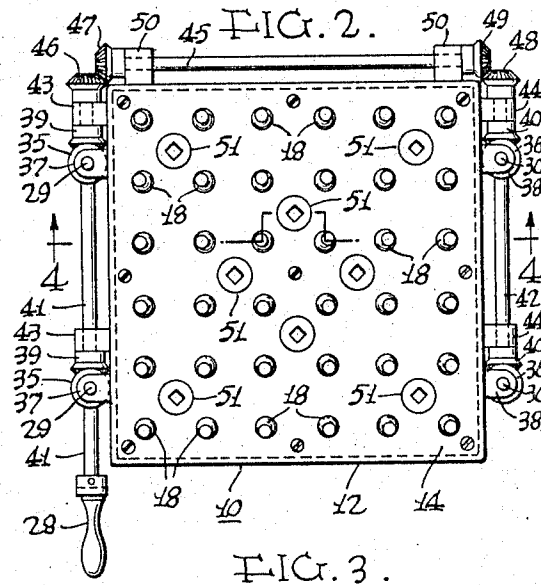
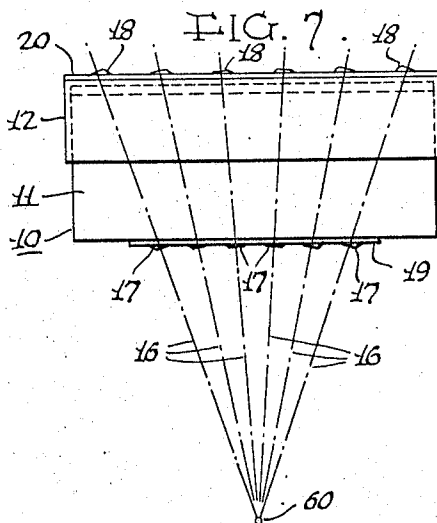
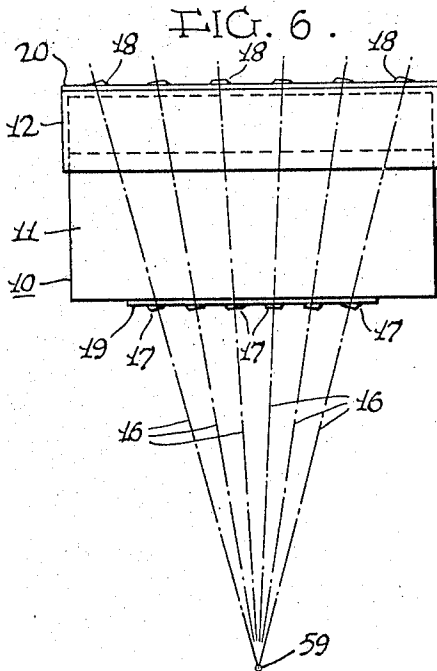
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RAY DIRECTING DEVICE

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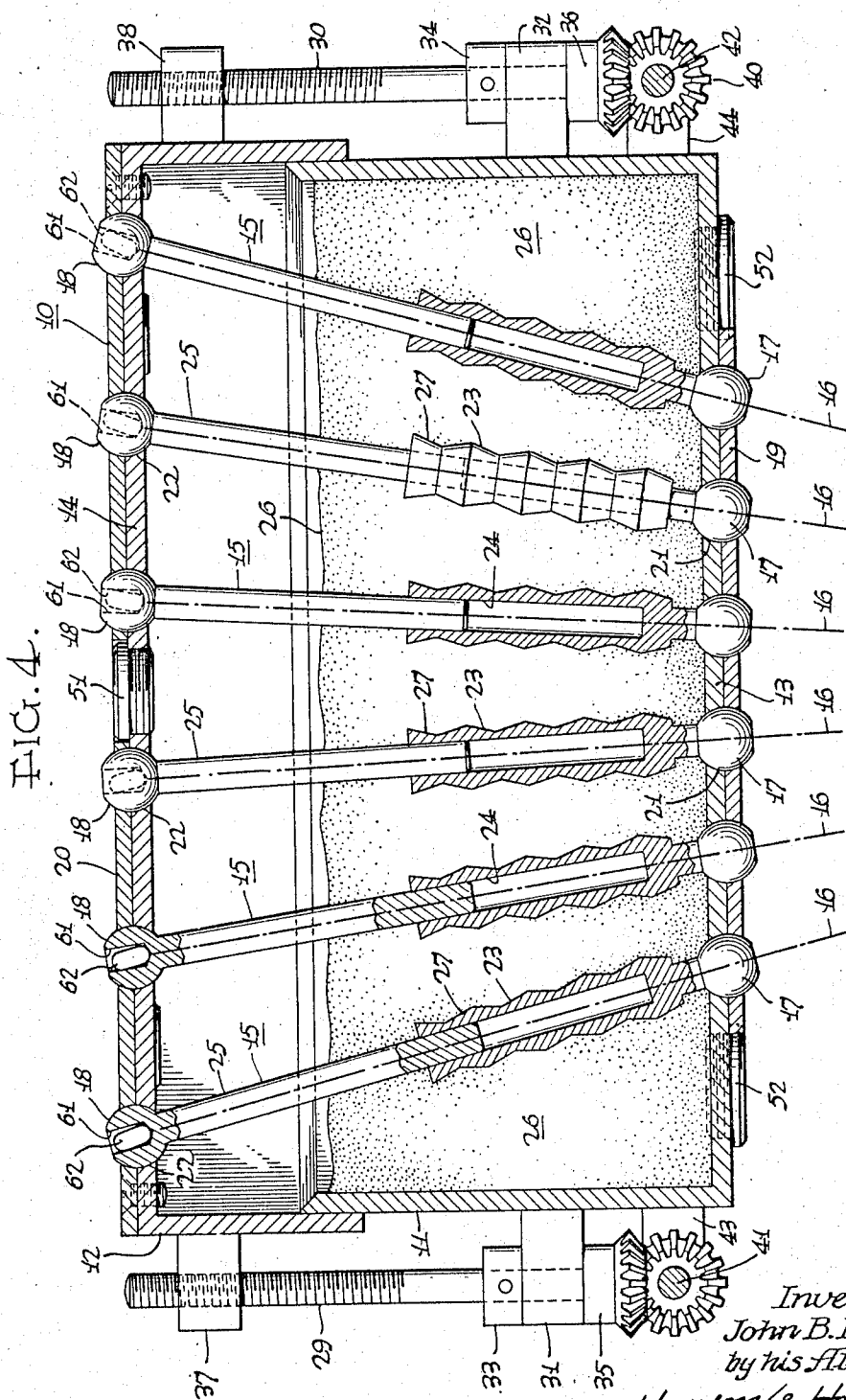
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J. B. BARTOW  
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2,659,017

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3 Sheets-Sheet 3



## UNITED STATES PATENT OFFICE

2,659,017

## RAY DIRECTING DEVICE

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14 Claims. (Cl. 250-105)

1

This invention relates to ray directing devices for X-rays and the like, and more particularly to a novel ray directing device which is characterized by the provision of longitudinally extensible and contractible ray transmissive elements as hereinafter described.

X-rays have been used to an increasing extent in diagnosis and treatment of ailments of the human body, and the present invention is especially useful in that field, although it is not limited thereto. In the treatment of ailments by means of X-rays, it is desirable to be able to concentrate a large number of such rays upon a particular spot or local area of the body. In the diagnosis of ailments, it is desirable to be able to collect radiation given off by parts of the body after introduction of radioactive substances into the body. The device provided by the present invention is well adapted for such purposes.

An object of the invention is to provide a ray directing device which is readily adaptable for use in any instance in which it is desired to provide for directivity control of X-rays and the like.

Another object of the invention is to provide a device which may function generally in the manner of a lens and which is readily adjustable to give different focal lengths and also to give different sizes and shapes of the focal area.

Another object of the invention is to provide a device which may be manufactured at low cost and which may be constructed in any desired size.

A further object of the invention is to provide a device which is novelly characterized in that it comprises a pair of spaced supports, preferably of planar form, which are relatively movable toward and away from each other, and longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby.

A still further object of the invention is to provide a device which is well suited for use of radioactive elements, such as isotope capsules, needles or the like, to project directed rays from such elements.

Still another object of the invention is to provide a device which may be used with an X-ray tube having associated means for producing spot sources of X-rays as described hereinafter.

Other objects and features of the invention will be apparent from the following detailed description with reference to the accompanying drawings wherein:

Fig. 1 is a perspective view of one form of the device;

2

Fig. 2 is a plan view of the same;

Fig. 3 is a bottom view of the same;

Fig. 4 is a cross-sectional view, on larger scale, taken along line 4-4 of Fig. 2;

Fig. 5 is a partial sectional view of a modified form of the device;

Figs. 6 and 7 are simplified elevational views showing different adjustments of the device, giving different focal points of the directed rays; and Figs. 8 to 10 are explanatory illustrations.

Referring first to Figs. 1 to 4 there is provided a box-like supporting structure 10 comprising a lower part 11 in the form of an open top box and an upper part 12 in the form of a fairly deep cover, the two parts being telescopically related as may be seen in Fig. 4. While the box-like structure 10 may be of any desired shape, it is preferably substantially square horizontally, and it is suitably adapted to provide any desired range of depth adjustment as described hereinafter. As may be seen in Fig. 4 the two parts of the box-like supporting structure provide a pair of spaced supports 13 and 14 which are preferably of planar form and which constitute the bottom and top respectively of the structure. A plurality of ray transmissive elements, designated generally by reference numeral 15, extend between the supports 13 and 14 and are supported thereby. Preferably, the elements 15 are arranged convergently toward a focal point or area external to the device, the paths of ray transmission being represented by the dot-and-dash lines 16 in Fig. 4. Each of the elements 15 is longitudinally extensible and contractible, and the ends of the elements 15 are swivelly connected to the supports 13 and 14 in any suitable manner. To this end, each of the elements 15 may have spherical end portions 17 and 18 retained by the supports 13 and 14. The latter are provided with supplemental plates 19 and 20 suitably secured to the box-like supporting structure as by means of fastening screws, and helping to retain the spherical end portions of elements 15. It will be noted that the composite supports 13 and 14 have spherical recesses 21 and 22 to accommodate the spherical portions 17 and 18. The plate members 19 and 20 not only provide additional thickness for the supports but also enable assembly.

In the form of the device shown in Fig. 4, each of the elements 15 comprises a lower part 23 having a longitudinal passage 24, and an upper rod-like part 25 extending into passage 24, the two parts being relatively slidable. The space within the lower box part 11 is substantially completely filled with a material 26, such as powdered lead,

3

which has such low transmissivity to the X-rays or other rays to be directed as to effectively prevent transmission of the rays. The part 23 of each of the ray transmissive elements 15 has its outer surface 27 formed as illustrated to trap any softer rays that may be produced at the wall formed by the powdered lead 26.

The parts of elements 15 may be formed of any suitable material which is transmissive to the rays to be directed. For example, in the case of X-rays, the parts of these elements may be formed of a plastic material which is highly transmissive to X-rays. If desired, the parts of these elements may be hollow throughout their length, thus providing air passages throughout the length of the elements for transmission of the X rays.

In the form of the device shown in Figs. 1 to 4, provision is made for relatively adjusting the parts 11 and 12 of the box-like structure by rotation of a crank 28. At opposite sides of the structure there are vertical screw shafts 29 and 30 which are rotatably supported in bearing extensions 31 and 32 provided on part 11, the screw shafts being oppositely threaded. On these screw shafts are collars 33 and 34 and miter gears 35 and 36, which prevent longitudinal movement of the screw shafts. The shafts threadedly engage extensions 37 and 38 on part 12.

The miter gears 35 and 36 mesh with corresponding gears 39 and 40 on horizontal shafts 41 and 42 which are rotatably supported by bearing extensions 43 and 44 on part 11. The horizontal shafts 41 and 42 are interconnected by a shaft 45 through miter gears 46, 47 and 48, 49. Shaft 45 is rotatably supported by bearing extensions 50 on part 11. The crank 28 is connected to shaft 41, and it will be seen that rotation of the crank will cause movement of part 12 upwardly or downwardly depending upon the direction of rotation of the crank.

Fill and drain caps 51 and 52 are provided in the top and bottom of the structure 10 to enable insertion and removal of the material 26. If desired or necessary, the material 26 may be removed to facilitate adjustment of the device and may be reinserted after adjustment. Suction means may be employed, if desired, to facilitate removal of the material 26, and the material may be inserted by blowing it into the box-like structure. The material 26 may be inserted to any desired height or depth, but of course there should be sufficient space within the box-like structure to enable adjustment within the desired range.

In Fig. 5 there is shown a modification of the device in which the ray transmissive elements 53 are individually adjustable, the crank-operated mechanism being eliminated. Each of the elements 53 comprises an externally threaded upper part 54 and a lower part 55 having a threaded recess 56. The outer ends of parts 54 and 55 are provided with recesses 57 and 58 for engagement by a tool such as a wrench or screw driver. By holding part 55 stationary and turning part 54, the elements 53 may be lengthened or shortened. Longitudinal extension and contraction of the elements 53 is permitted by the relative movability of supports 13 and 14 which are parts of a telescopic box-like structure as above described. Plate 20 may be removable to enable easy turning of the parts 54.

Figs. 6 and 7 show how the focal point of the directed rays changes with adjustment of the device. In Fig. 6, the parts 11 and 12 of the box-

4

like supporting structure are adjusted so that the ray lines 16 come to a focus at a focal point 59. In Fig. 7, the parts 11 and 12 are differently adjusted so that the ray lines 16 come to a different focal point 60 which is closer to the device.

From the foregoing description, it will be seen that the device is variously adjustable within a certain range to focus the directed rays at various focal points. It will be apparent that this result is achieved by virtue of the extensibility and contractibility of the ray transmissive elements, and their swivel connections with the relatively movable parts 11 and 12 of the supporting structure.

As previously stated, the device may be used in any desired manner. For example, it may be used in conjunction with an X-ray tube and the latter may have an associated means for producing spot sources of X-rays. Typical of this is an arrangement disclosed in copending application Serial No. 119,734, filed October 5, 1949. In such arrangement, the X-ray tube produces a broad electron stream directed toward an X-ray producing surface, and a negatively charged screen or grid is arranged adjacent said surface and serves to concentrate the electrons at spots or small areas of said surface. In that arrangement, there is also provided a ray directing device having ray transmissive elements aligned with the spots or small areas at which the X-rays are produced. The device of the present invention may be employed as the ray directing device in such an arrangement.

Instead of employing an X-ray tube, the ray transmissive elements may be provided with individual X-ray sources. Thus, as shown in Fig. 4, the elements 15 may be provided with recesses 61 to accommodate isotope capsules 62 or the like.

As previously stated, an important application of the present device is in connection with X-ray treatment of the human body. It is now known that the treatment effects of X-rays in the human body is due to the fact that ionization takes place after an X-ray of a given wave length has passed through a definite thickness of body tissue. Moreover it should be borne in mind that the internal area of the body to be treated may vary in size and shape from one case to another. The device provided by the present invention is especially adapted and useful for treatment of internal areas of the human body, as will now be shown.

Referring to Figs. 8 and 9, suppose the surface of the body is represented at 63, and that in one case (Fig. 8) it is desired to treat a relatively large internal area 64, while in another case (Fig. 9) it is desired to treat a relatively smaller area 65, both areas being located at the same distance from the body surface 63, and the distance being appropriate for the X-ray wave length to give ionization at the desired area. It will be apparent from the illustrations that the adjustment of the device in Fig. 8 gives impingement of the directed rays over the relatively larger area 64, while the adjustment in Fig. 9 gives impingement of the rays over the relatively smaller area 65, the quantity of dosage being governed by the time of application.

In some instances, the distance between the surface of the body and the internal area to be treated may not be sufficient to cause ionization to take place at said area, with a given wave length of the X-rays. For example, suppose that the surface of the body were located at 66 in Fig. 10

5

and that it were desired to treat an area 67 so located that ionization would not take place at that area. In such case, the ray-transmitting space adjacent the body surface may be occupied by a material 68 having the same X-ray transmissivity as the body tissue to a depth such as to cause ionization to take place at area 67.

It should be noted also that the device may be modified for treatment of areas of any shape. For example, by making the ray transmissive elements hollow, certain of these elements may be plugged with non-transmissive material to provide a desired shape, or as an alternative some of the elements could be removed and the space occupied thereby could be filled with non-transmissive material.

As previously mentioned, the device is also capable of use for diagnosis purposes, after introduction of radioactive substances into the body. Thus the rays from a spot or area within the body will be transmitted by the device and may be detected by suitable detecting means.

While certain embodiments of the invention have been illustrated and described, it will be apparent that the invention is not limited thereto but is capable of various other modifications and embodiments.

I claim:

1. A ray directing device for X-rays and the like, comprising a pair of spaced supports relatively movable toward and away from each other, and longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, each of said elements having ridges on the outer surface thereof to prevent transmission of secondary X-rays, said elements being recessed at their entrance ends to receive radioactive elements.

2. A ray directing device for X-rays and the like, comprising a supporting structure including a pair of spaced supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means on said supporting structure preventing ray transmission except through said elements, each of said elements having ridges on the outer surface thereof to prevent transmission of secondary X-rays.

3. A ray directing device for X-rays and the like, comprising a supporting structure including a pair of spaced supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means on said supporting structure preventing ray transmission except through said elements, the latter being convergent and being swivelly connected to said supports, whereby said elements may be adjusted to direct rays to different focal points, each of said elements having ridges on the outer surface thereof to prevent transmission of secondary X-rays.

4. A ray directing device for X-rays and the like, comprising a box-like supporting structure composed of two telescopically-related parts providing a pair of spaced parallel planar supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means within said box-like supporting structure preventing ray transmission except through said elements.

6

5. A ray directing device for X-rays and the like, comprising a box-like supporting structure composed of two telescopically-related parts providing a pair of spaced parallel planar supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means within said box-like supporting structure preventing ray transmission except through said elements, the latter being convergent and being swivelly connected to said supports, whereby said elements may be adjusted to direct rays to different focal points.

6. A device according to claim 5, wherein each of transmissive elements comprises telescopically-slidable sections, and said device further includes means for relatively adjusting the parts of said box-like supporting structure.

7. A device according to claim 5 wherein each of transmissive elements comprises threadedly interengaged sections.

8. A ray-directing device for X-rays and the like, comprising a pair of spaced parallel planar supports relatively movable toward and away from each other, and longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, each of said elements being recessed at its ray entrance end to receive a radioactive element.

9. A ray-directing device for X-rays and the like, comprising a supporting structure including a pair of spaced parallel planar supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means on said structure preventing ray transmission except through said elements, said elements being convergent and being swivelly connected to said supports, and said elements being recessed at their entrance ends to receive radioactive elements.

10. A ray directing device for X-rays and the like, comprising an enclosure composed of two telescopically-related parts providing two spaced supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and means within said enclosure preventing ray transmission except through said elements.

11. A device according to claim 10, wherein each of said elements is formed to provide ridges on the outer surface thereof to prevent transmission of secondary X-rays.

12. A ray directing device for X-rays and the like, comprising an enclosure composed of two telescopically-related parts providing two spaced supports relatively movable toward and away from each other, longitudinally extensible and contractible ray transmissive elements extending between said supports and supported thereby, and flowable material within said enclosure having low transmissivity to said rays and effectively preventing ray transmission except through said elements.

13. A ray directing device for X-rays and the like, comprising an enclosure composed of two telescopically-related parts providing two spaced supports relatively movable toward and away from each other, telescopically-adjustable convergent ray transmissive elements extending between said supports and swivelly connected

thereto, and means within said enclosure preventing ray transmission except through said elements.

14. A ray directing device for X-rays and the like, comprising a supporting structure including a pair of spaced supports, ray transmissive elements extending between said supports and supported thereby, and means on said supporting structure preventing ray transmission except through said elements, each of said elements having ridges on the outer surface thereof to prevent transmission of secondary X-rays.

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# References Cited in the file of this patent

## UNITED STATES PATENTS

| Number    | Name          | Date          |
|-----------|---------------|---------------|
| 1,550,197 | Berry -----   | Aug. 18, 1925 |
| 2,139,966 | Loebell ----- | Dec. 13, 1938 |

## FOREIGN PATENTS

| Number  | Country       | Date          |
|---------|---------------|---------------|
| 283,858 | Germany ----- | Feb. 11, 1914 |