

Jan. 5, 1954

J. B. BARTOW
RAY DIRECTING DEVICE

2,665,387

Filed Dec. 14, 1950

3 Sheets-Sheet 1

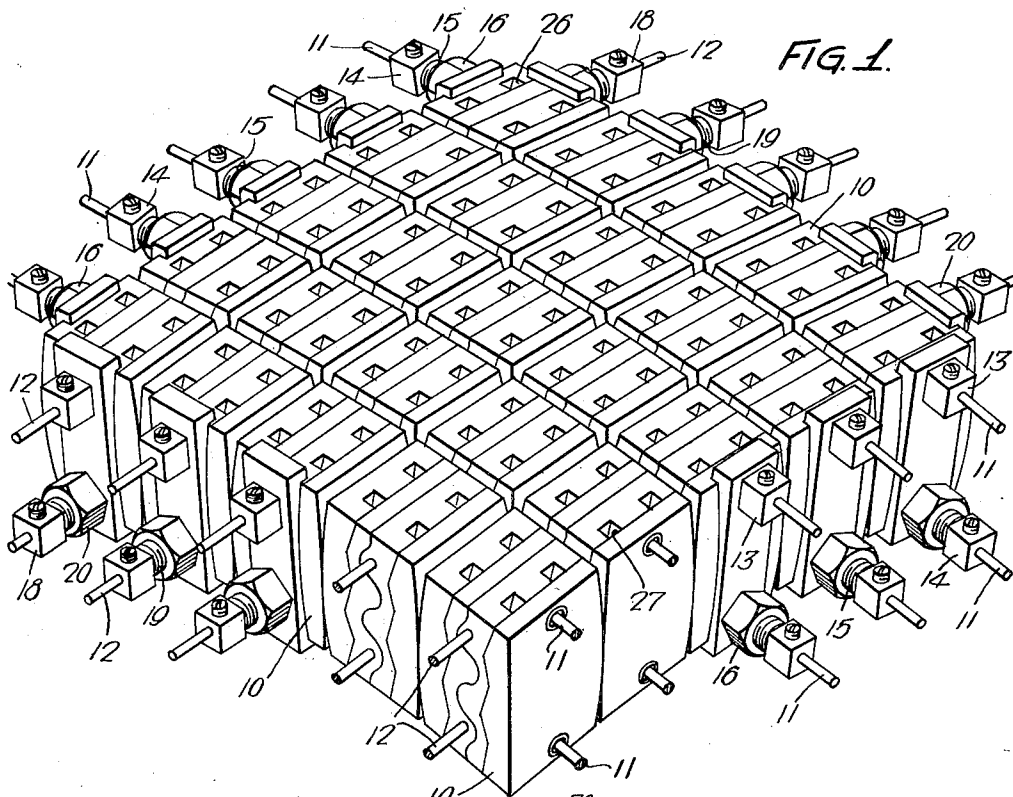


FIG. 1.

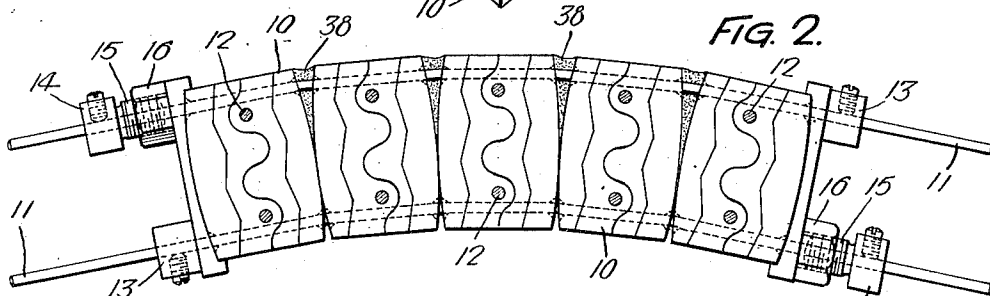


FIG. 2.

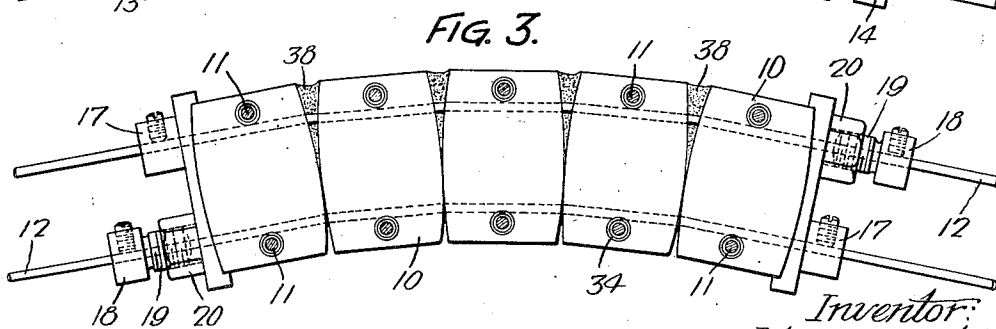


FIG. 3.

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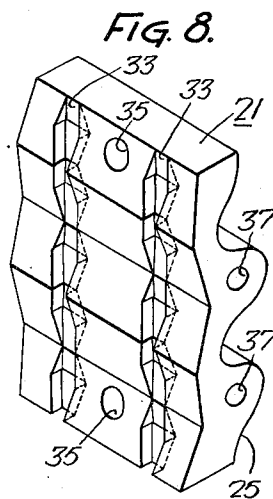
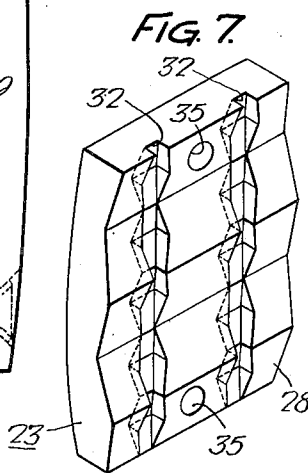
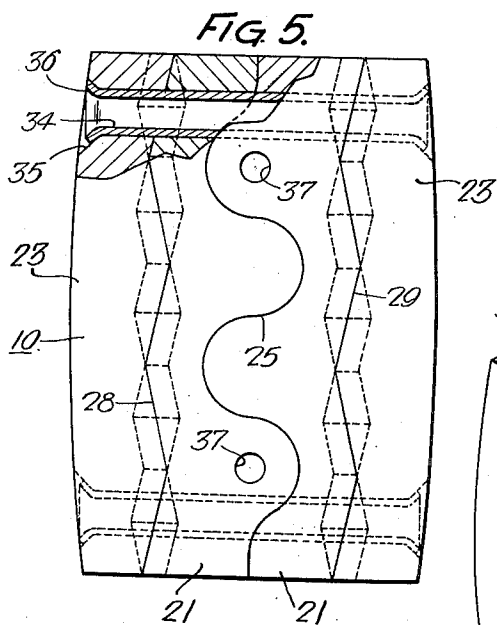
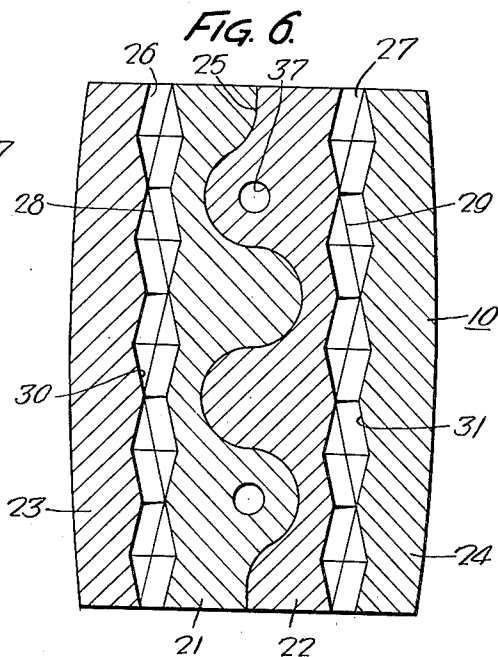
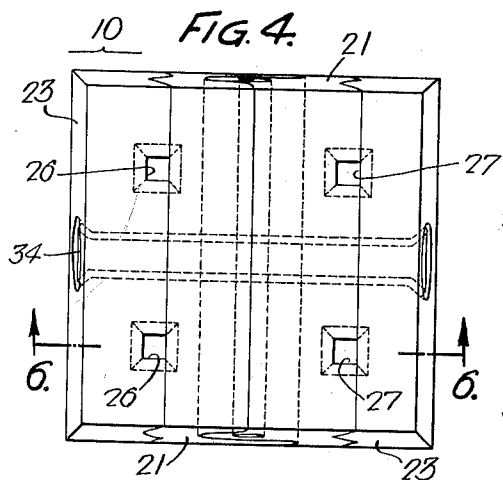
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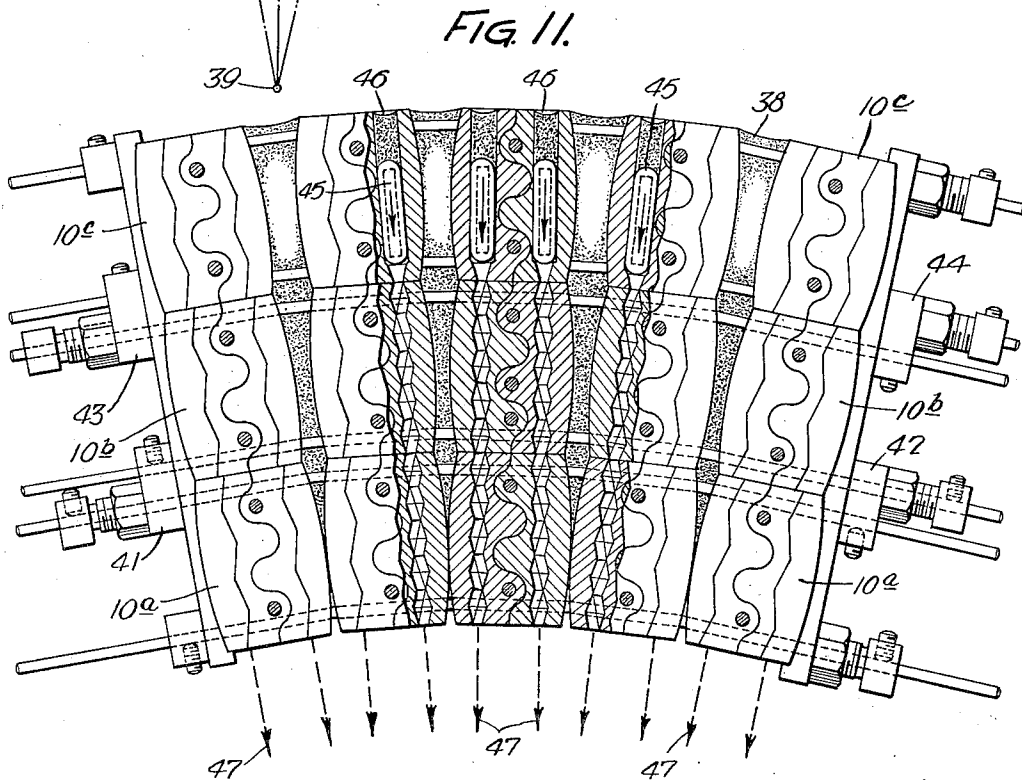
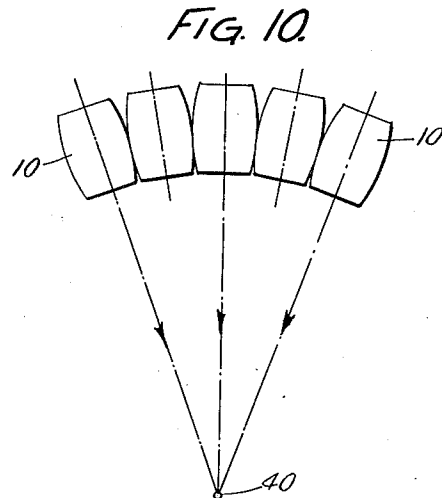
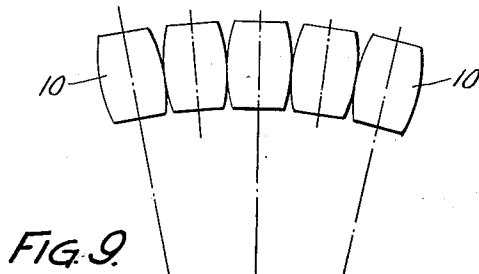
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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RAY DIRECTING DEVICE

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6 Claims. (Cl. 250-105)

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This invention relates to ray directing devices for X-rays and the like, and more particularly to a novel ray directing device composed of component members which are arranged in an assembly to constitute the complete device.

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 made up of a plurality of similar units, and the size of which is determined by the number of units assembled in any particular instance.

A further object of the invention is to provide a structure which is adapted for use of multiple layers of units.

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 or the like, to project directed rays from such elements.

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 a device constructed according to the invention;

Fig. 2 is a side elevational view taken from one side of the device shown in Fig. 1;

Fig. 3 is a side elevational view taken from another side of the device shown in Fig. 1;

Fig. 4 is a top view of one of the component members of the device;

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Fig. 5 is an elevational side view of such member;

Fig. 6 is a sectional view taken along line 6-6 of Fig. 4;

Figs. 7 and 8 are perspective views of two of the sections of a component member;

Figs. 9 and 10 illustrate different adjustments of the device to give different focal lengths; and

Fig. 11 is a side elevational view of a multi-layer arrangement.

Referring first to Figs. 1 to 8 of the drawings, the device comprises a plurality of component members 10 which are assembled in any desired number, as shown in Fig. 1. Each of the members 10 is of block-like form and has slightly convex sides, as may be seen more clearly in Figs. 2 and 3. This enables the assembly to be curved and thus enables change of the focal length, area or shape, and also precludes any direct radiation path through cracks or joints. As shown in Figs. 1 to 3, the members 10 may be secured together by means of two sets of flexible rods extending through apertures provided in said members, one set of flexible rods 11 extending in one direction and the other set 12 extending at right angles to the first direction. As may be seen in Fig. 2, rods 11 have associated with them set screw blocks 13 and also set screw blocks 14 which carry a threaded extension 15 to accommodate a tightening nut 16. As shown in Fig. 3, the rods 12 have similar associated elements designated by reference numerals 17 to 20. By means of the arrangement shown, the assembly may be fixed with any desired degree of curvature within the limits established by the convexity of the component members.

As may be seen more clearly in Figs. 4 to 8, each of the members 10 is formed of a plurality of sections which collectively form the block-like member with rectangular passages therein for the transmission of X-rays and the like. The parts or sections of each member 10 are formed of a material which is nontransmissive to X-rays, for example lead. As may be seen in Figs. 5 and 6, each member 10 comprises a pair of interfitting inner sections or parts 21 and 22, and a pair of outer sections or parts 23 and 24. The interfitting faces of the inner sections 21 and 22 are non-planar, for example they may take the form shown at 25, the purpose of this being to preclude any possibility of passage of X-rays at the junctures of said sections. The outer face portions of the inner sections 21 and 22, and the inner face portions of the outer sections 23 and 24 are complementary and are so formed as to cooperatively provide X-ray trans-

missive elements which may be in the form of the passages 26 and 27. Preferably, there are four passages, as may be clearly seen in Fig. 4. Furthermore, the meeting faces of the inner and outer sections or parts are of zig-zag form, as shown at 28 and 29, to preclude any possibility of passage of X-rays between said faces, and X-ray transmissive passages are formed to provide ridges or shoulders 30 and 31 to prevent transmission of secondary X-rays. The ridged formation of the passages is accomplished in a manner which will be clear from Figs. 7 and 8. These figures show the outer section 23 and the associated inner section 21 which have grooves 32 and 33 formed in their complementary face portions of the shape shown.

The construction described above provides traps within the X-ray passages which effectively prevent passage of secondary X-rays produced by a primary ray striking a surface. As may be seen from Fig. 6 such secondary rays will be dissipated or absorbed within the device.

The trap feature is claimed in this application only in the particular construction provided by the present invention. Such feature is broadly claimed in copending application Serial No. 319,382, filed November 27, 1952, which is a division of application Serial No. 119,734, filed October 5, 1949.

With the four sections or parts of a component member assembled as shown in Figs. 5 and 6, they may be held together by means of tubular members 34 extending through apertures 35 provided in the sections or parts, the ends of the tubular members 34 being flared outwardly, as at 36, to secure the sections together. The tubular members 34 also accommodate the rods 11 shown in Figs. 1 and 2. The inner sections 21 and 22 are also provided with apertures 37, extending at right angles to the apertures 35 to accommodate the rods 12 shown in Figs. 1 and 3. With the component members assembled to the desired form, such as shown in Figs. 1 to 3, the outer spaces between the component members may be sealed with lead wool 38 or the like to prevent any passage of X-rays between the said members.

From the foregoing description, it will be seen that the device as shown in Fig. 1 is composed of a plurality of component members arranged in side-by-side relation and each of which has a plurality of relatively long and narrow parallel rectangular X-ray transmissive elements or passages. In the illustrated embodiment, each of the component members 10 has a group of four mutually parallel passages. By shaping the entire assembly to concavo-convex form, as shown in Figs. 1 to 3, the groups of passages of the component members are directed toward a predetermined area on which it may be desired to concentrate X-rays or from which it may be desired to collect X-rays.

By adjusting the curvature of the device, it is readily possible to obtain different focal lengths and also to provide for different areas of concentration at different distances from the device. By way of illustration, Fig. 9 shows a number of the component members 10 arranged with a degree of curvature to establish a focal point 39 at a certain distance from the device. Fig. 10 shows the same component members arranged with a greater degree of curvature to establish a focal point 40 at a smaller distance from the device. Adjustment of the curvature of the component members also enables coverage of a

desired area at a particular distance from the device. Where it is desired to provide for concentration on a small area, the device may be composed of a certain number of component members arranged with a degree of curvature so that they all concentrate on a small focal area. Where the same degree of concentration is desired over a larger area, the device may be composed of a larger number of component members arranged with a different degree of curvature to give the desired concentration over the larger area.

It will be apparent from the foregoing description that the manufacture and assembly of the device provided by the invention is greatly facilitated by the fact that similar component members are used, and furthermore the sections or parts of said members are the same. Moreover, manufacturing tolerances are not at all critical.

The description thus far has been with reference to an embodiment comprising a single layer of component members or units as shown in Figs. 1 to 3. However, a further important feature of the invention resides in the fact that the device may be composed of more than one layer, with the layers arranged in superposed relation. Such an arrangement is desirable where relatively hard rays are involved, as it provides a thicker body which will not be penetrated by such rays. Furthermore, it enables a change in the size of the affected area. Further still, it is possible in such an arrangement to utilize radioactive isotope capsules, radium needles or the like in cooperative association with the device so that a radiation source is provided in association with each of the ray passages.

Fig. 11 illustrates both a multi-layer arrangement and the adaptation of such an arrangement for use of isotope capsules or the like. Referring to this figure, there are shown a first layer composed of component members 10a and a second layer superimposed on the first layer and composed of component members 10b, each of said layers being similar to the single layer in the device of Figs. 1 to 3. As shown in Fig. 11, the layers may be secured together by means of the same fastening devices which hold the component members in assembled relation. Thus, the fastening devices may include special members 41 and 42 which serve as interlinks between the two layers above mentioned. It will be apparent that the passages of the layers must be aligned to provide the desired ray passages.

As mentioned above, a multi-layer arrangement enables use of isotope capsules or the like in association with the individual ray passages. This is also shown in Fig. 11 wherein a third layer is provided composed of component members 10c. The fastening devices 43 and 44 serve to secure the third layer to the second layer. As may be seen from the cross-sectional showing in Fig. 11, the passages in the component members 10c have been drilled almost to the bottom to accommodate isotope capsules 45 or the like which are simply dropped into the passages and are retained therein by virtue of the restricted lower ends of the passages. The spaces above the isotope capsules are filled with lead wool 46 or the like. With this arrangement, each of the isotope capsules constitutes a radioactive source which is individual to the ray passage with which the capsule is associated. The rays given off by the isotope capsules traverse the passages and emerge therefrom, as shown by the arrows 47.

While certain embodiments of the invention

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have been illustrated and described, it will be apparent that various modifications and other embodiments are possible within the scope of the invention.

I claim:

1. A ray directing device for X-rays and the like, comprising an assembly of component block-like members in side-by-side relation, each of said members being composed of material which is non-transmissive to said rays, and each of said members comprising complemental sections or parts forming rectilinear passages for transmission of said rays, said sections being formed to provide ridges or shoulders in said passages to prevent transmission of secondary X-rays.

2. A ray directing device for X-rays and the like, comprising a curved assembly of component block-like members in side-by-side relation, each of said members being composed of material which is non-transmissive to said rays, and each of said members comprising complemental sections or parts forming parallel rectilinear passages for transmission of said rays, the degree of curvature of said assembly determining the focus of the device, said sections being formed to provide ridges or shoulders in said passages to prevent transmission of secondary X-rays.

3. A ray directing device for X-rays and the like, comprising a plurality of block-like members having longitudinally convex sides and arranged in side-by-side relation, each of said members having parallel longitudinal rectilinear ray transmissive elements but being otherwise non-transmissive to said rays, and means comprising flexible rods extending through said members for holding them in assembled relation.

4. A ray directing device for X-rays and the like, comprising a plurality of block-like members having longitudinally convex sides and arranged in side-by-side relation, each of said members being composed of material which is non-transmissive to said rays, and each of said

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members comprising complemental sections or parts forming parallel longitudinal rectilinear passages for transmission of said rays, and means comprising flexible rods extending through said members for holding them in assembled relation.

5. A device according to claim 4, wherein said sections or parts are formed to provide ridges or shoulders in said passages to prevent transmission of secondary X-rays.

6. A ray directing device for X-rays and the like, comprising a plurality of block-like members having longitudinally convex sides and arranged in side-by-side relation, each of said members being composed of material which is non-transmissive to said rays, and each of said members comprising a pair of interfitting inner sections or parts and a pair of outer sections or parts complemental to said inner sections and forming therewith parallel longitudinal rectilinear passages for transmission of said rays, and means comprising flexible rods extending through said members for holding them in assembled relation.

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