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PORT STRUCTURE FOR X-RAY DEVICES

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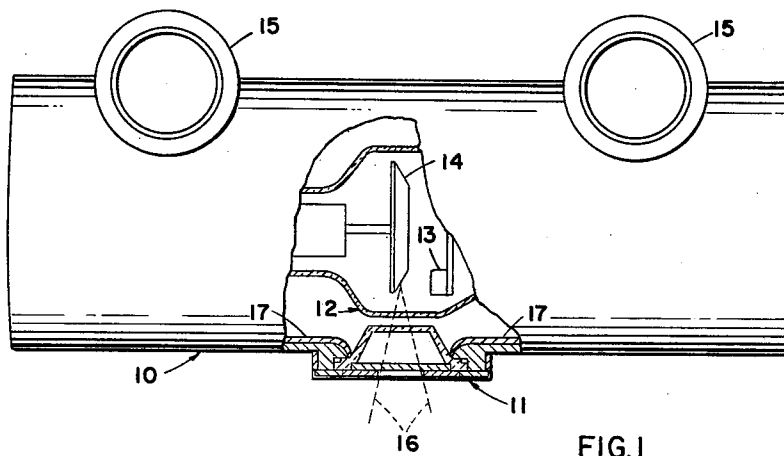


FIG. 1

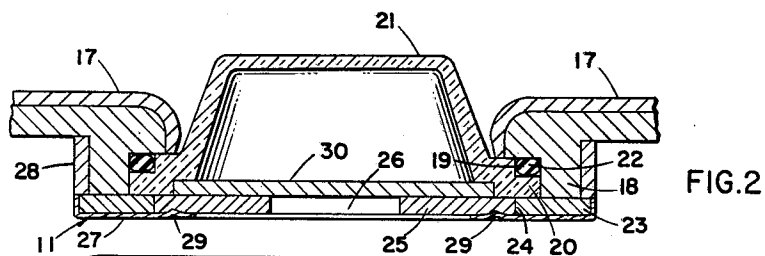


FIG. 2

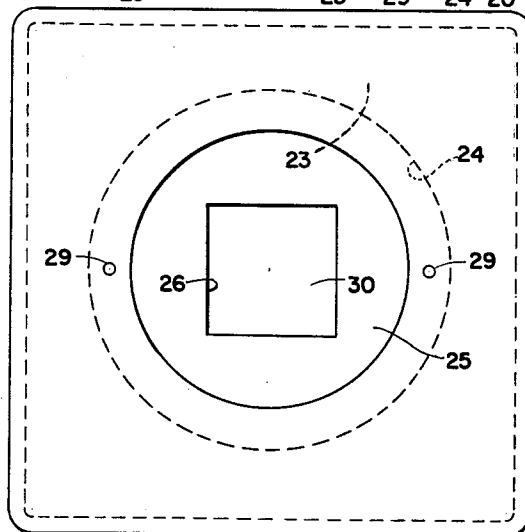


FIG. 3

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PORT STRUCTURE FOR X-RAY DEVICES

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This invention relates to improvements in X-ray devices and has particular reference to housings for X-ray tubes. More specifically this invention is concerned with novel port structures for X-ray tube housings.

In X-ray devices, such as are commonly used in medical therapy or diagnostic work such as photoroentgenography, cineradiography, serialography, fluoroscopy, angiography, or the like, the X-ray generator is intended to be located in a housing which is constructed and arranged so as to contain all of the X-radiation except the particular cone of radiation which is to be used and which is permitted to escape from the housing. This requires ray-proofing of the housing to prevent emission of stray radiation which could undesirably affect either an operator of the device or a patient.

To permit exit of the usable cone of radiation, the housing is ported in the selected area, and the inner wall of the housing is lined with ray-proofing material to intercept and absorb the unusable radiation. While the aperture in the port is generally constructed to permit emission only of the selected cone of radiation, there is often some amount of stray radiation which escapes through the portions of the port which lie outside the cone.

Additionally, the cone of radiation escapes through an aperture in the port structure which is generally circular so that the cone has a round cross-section. When using the device for radiographic purposes, the X-ray sensitive film is usually comprised of conventional rectangular frames. Thus, in order to form a rectangular image corresponding to the frame, the round cone of radiation must entirely encompass the rectangular frame, resulting in considerable wasted X-rays.

In accordance with the present invention these and other disadvantages of the prior art are overcome by the provision of a port structure which has improved ray-proofing characteristics and which emits radiation which may be entirely superimposed upon a film frame. Improved ray-proofing is accomplished by providing the port structure itself with ray-proofing characteristics, as well as the adjacent parts of the structure. The aperture is rectangular in shape so as to properly shape the cone of radiation with respect to the film, and the plate in which the aperture is located is easily interchangeable. Furthermore, the apertured plate is adjustable about the center of the aperture, and indexing means is provided for proper rotary alignment of the plate. Additionally, means is provided for adding filters to the port structure without increasing the distance which the structure projects from the wall of the housing.

Accordingly, it is a primary object of this invention to provide a novel port structure for X-ray tube housings which has improved ray-proofing characteristics.

Another object is to provide a port structure with novel means for filtering selected wavelengths of X-radiation.

Another object is to provide a port structure with an adjustable member having an opening shaped to permit emission of a cone or beam of radiation which is square in cross-sectional shape whereby the entire cone will be superimposed within a rectangular film frame.

Further objects are to provide an improved means for connecting together and sealing the associated parts of the port structure to prevent leakage through the structure of oil which is contained within the housing.

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Other objects will become apparent from the following description taken in connection with the accompanying drawings, wherein

FIG. 1 is an elevation of an X-ray tube housing with part of the housing broken away to show the X-ray tube and port structure in section;

FIG. 2 is an enlarged sectional view of the port structure and adjacent portions of the housing; and

FIG. 3 is a front elevational view of the port structure.

Referring more particularly to the drawings, numeral 10 designates an oil-filled housing which is substantially cylindrical in shape and has a port structure 11 in one wall through which X-rays emanate from an X-ray tube 12 within the housing. The X-ray tube comprises a cathode 13 which directs a stream of electrons onto a rotating anode 14 for the generation of X-rays. The anode and cathode of the tube are provided with suitable operating potentials by means of cables (not shown) which are connected into horns or receptacles 15 mounted on and forming part of the housing 10, and which are suitably connected to the anode and cathode whereby the tube may be operated in the normal manner of a device of this type.

The X-rays generated by the anode 14 are emitted in all directions. However, most of the X-radiation is intercepted and contained within the housing 10 so that only a useful cone of radiation, defined by dotted lines 16, is allowed to escape into the atmosphere externally of the housing. To accomplish this, the housing is at least partially lined with ray-proofing material such as liner 17, and the housing and liner are provided with concentric openings in which the port structure 11 is located.

The edge of the housing about the opening therein is provided with an outwardly directed annular flange 18 (FIG. 2), the inner peripheral edge of which is grooved as indicated at 19. Within the groove lies the outwardly directed flange 20 of a reentrant X-ray transparent window 21 which is formed of plastic, glass, or other material which is unaffected by X-radiation or oil within the housing. To prevent leakage of oil around the window 21, the upper edge of flange 20 is grooved to receive a rubber or other resilient O-ring 22 which engages the bottom of groove 19 and when compressed, in the assembly of the parts, provides an efficient seal without the requirement of gaskets or other means for this purpose.

Located against the outer surface of flange 18 and against a portion of the outer surface of flange 20 is a plate 23 of ray-proofing material such as antimony lead or other material which is relatively impervious to X-rays. Plate 23 and flange 18 upon which it rests preferably, but not necessarily, have a substantially square marginal configuration as illustrated best in FIG. 3. Plate 23, however, has a centrally located circular opening 24 (FIG. 3) into which is fitted a disc 25 of ray-proofing material. The disc 25 is of the same thickness as plate 23 and has a substantially square centrally located aperture 26 for the exit of X-rays from within the housing.

Over the port 11 is positioned a flanged escutcheon 27 which fits over the outer surfaces of plate 23 and disc 25, and a collar 28 of ray-proofing material is located about the circumference of housing flange 18. Escutcheon 27 may be secured to plate 23 as by screws or clips (not shown).

In assembling the port structure, the plate 23 is preferably screwed or otherwise connected to housing flange 18 and functions to retain window 21 and O-ring 22 in place. The disc 25 is inserted in opening 24 and is held in place by the escutcheon 27.

Disc 25 is rotatable in the assembly about the axis of aperture 26 whereby the sides of the aperture may be accurately horizontally and vertically aligned so that the emitted cone of X-radiation will superimpose properly

upon a film frame. To properly locate the disc 25, the escutcheon 27 is provided with indexing means such as detents 29 which cooperatively engage recesses in the adjacent surface of disc 25 for this purpose.

In cases where it is desired to provide a filter, such as in deep X-ray therapy where soft X-rays do not penetrate to the depth of the area being treated and might be harmful to the skin of the patient, the unwanted rays may be filtered out by placing an aluminum or other filter in the structure in a position to intercept the cone 16 of radiation. This is easily done by removing escutcheon 27 and disc 25 and placing a disclike filter 30 within a groove provided therefor in the supporting edge of the window 21, whereupon the disc 25 and escutcheon 27 are replaced to hold the filter 30 in place, as shown in FIG. 2.

It will be apparent from the foregoing that the disc 25, plate 23, and collar 28 provide, with housing liner 17, a completely ray-proof structure which will prevent any emission of radiation from the housing except through aperture 26. The port structure described, therefore, is not only more efficient, but is simple to manufacture and assemble, and is adaptable to the use of filters without increase in the length by which the port structure extends from the wall of the housing. The structure, furthermore, is readily adaptable for use with collimators commonly used in X-ray applications.

While the foregoing description and the attached drawings illustrate a preferred embodiment of the invention, various changes and modifications may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims.

I claim:

1. An X-ray device comprising a housing having a port comprising an opening in one wall and an outwardly directed flange encircling the opening, the housing having X-ray impenetrable material lining its inner surface around the opening, an X-ray transparent window in the opening having a marginal portion positioned against the outer surface of the flange, a plate mounted upon the outer surface of the flange and extending over the marginal portion of the window for holding the window in place, the plate having a central opening therethrough, an apertured disc within said opening with its inner marginal surface positioned against the marginal portion of the window, an escutcheon mounted over the plate and extending over a portion of the outer surface of the disc for retaining the disc within the opening in the plate, and a collar closely encompassing the outer circumference of said flange, the plate, disc and collar being impenetrable to X-radiation and in combination with said lining material providing means for preventing escape of X-rays in

the area of the port except through the aperture in the disc.

2. An X-ray device comprising a housing having an opening in one wall encircled by an annular outer surface area, an X-ray transparent window in the opening having its marginal area positioned against said annular surface of the housing, a plate mounted on the annular surface of the housing and extending over a portion of the marginal area of the window for holding the window in place, the plate having a central circular opening therethrough, a disc within said circular opening with its inner marginal surface positioned against the marginal area of the window, the disc having a central aperture therein of predetermined shape and being rotatable within said opening about the axis of the aperture, an escutcheon mounted over the plate and extending over a portion of the outer surface of the disc for retaining the disc within the opening in the plate, and cooperating indexing means in the disc and escutcheon.

3. A device as set forth in claim 2 wherein the aperture in the disc is generally rectangular in shape, and the indexing means are related to the horizontal and vertical sides of the aperture to align them with respect to known horizontal and vertical planes.

4. An X-ray device comprising a housing having an opening in one wall and an outwardly directed grooved flange encircling the opening, a reentrant cup-shaped X-ray transparent window in the opening having a marginal portion positioned in the groove in the flange, a plate mounted upon the outer surface of the flange and extending over the marginal portion of the window for holding the window in place, the plate having a central circular opening therethrough, an apertured disc within said circular opening with its inner marginal surface positioned against the marginal portion of the window, an escutcheon mounted over the plate and extending over a portion of the outer surface of the disc for retaining the disc within the opening in the plate, and a disclike filter removably mounted with its periphery positioned between the inner surface of the disc and the adjacent marginal portion of the window, the filter being of a material which is relatively impenetrable to specific wavelengths of X-radiation.

References Cited in the file of this patent

UNITED STATES PATENTS

2,137,122	Humphreys	Nov. 15, 1938
2,344,543	Findlay	Mar. 21, 1944
2,836,729	Snarr	May 27, 1958
3,018,398	Atlee	Jan. 23, 1962