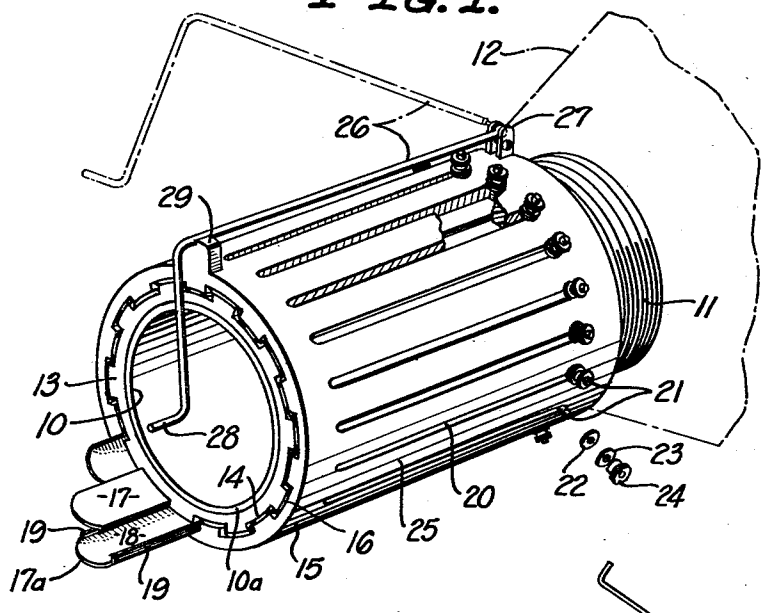
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PROTECTIVE NOZZLE FOR X-RAY MACHINE

Filed Nov. 15, 1960

FIG. 1.



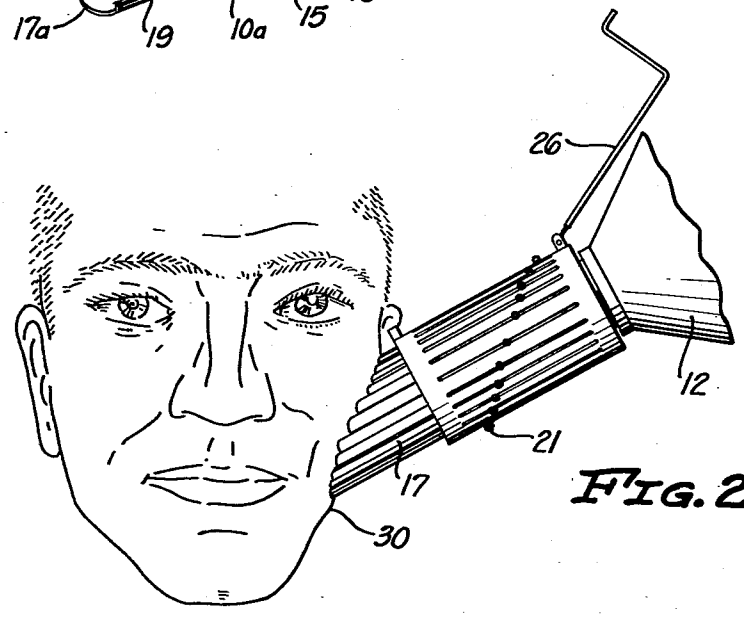




FIG. 2.

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# PROTECTIVE NOZZLE FOR X-RAY MACHINE

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The present invention relates in general to X-ray equipment and, more particularly, to a protective device for attachment to X-ray equipment for confining the random emanation of radiation from the X-ray machine.

The use of X-rays has gained very wide acceptance in recent years and is increasing at an accelerating rate from day to day. As is now well known, radiation from X-ray machines can have harmful effects to both operator, patient and surrounding personnel if the amount of radiation to which a person is subjected is not kept within certain limits.

As an example only, it is convenient to consider the X-ray equipment which is commonly used for diagnostic purposes in dentistry. Such X-ray equipment commonly comprises a machine which includes a head, housing an X-ray tube from which X-rays are directed onto that area of the patient's anatomy which it is desired to photograph. In most cases the head of the X-ray machine is provided with a tubular or conical member which may conveniently be referred to as an "outlet cone" and this outlet cone is placed in contact with the patient's body (in the case of dentistry, with that area of the patient's jaw which it is desired to photograph) and an exposure of film is made in a manner well known in the art.

The end of such outlet cone normally lies in a plane which is at right angles to the longitudinal axis of the direction of X-ray emanation. Accordingly, when for various reasons, it is necessary to have the axis of X-ray radiation at an angle to the surface of the patient's face, there is a gap between the end of the cone and the patient's face through which random emanation of radiation may take place. This random emanation of radiation may cause a patient to be subjected to X-ray radiation over a greater portion of his body than is necessary or desirable for the purposes of the diagnosis and, further, unless elaborate precautions are taken, the operator of the X-ray device and surrounding personnel may be exposed to radiation from this source.

Many attempts have been made to protect the operator from this random radiation. The operator is the person who, due to the frequency of exposure, is most likely to suffer from an overdose of radiation and in order to protect him proposals such as that made by J. W. Wilson in United States Patent No. 2,436,279 which issued on February 17, 1948 have been put forward. This specific proposal, although an improvement over a permanently fixed outlet cone is not entirely satisfactory since it does not eliminate the gap which will exist between the end of the outlet nozzle and the patient's face when the axis of radiation emanation is not normal to the local surface which is being X-rayed. Other attempts have been made such as that described in United States Patent No. 2,794,128 of May 28, 1957 which issued to F. J. Shasky and which involves the use of screens or shields of a flexible nature which can be draped over the patient to confine the radiation to the desired area.

Further attempts have been made along the lines suggested by the present applicant in an article published by him and entitled "X-rays, Hazards, Injuries and Control" in the Journal of the Ontario Dental Association in July 1959. This article discloses the use of an enclosing cubicle within which the operator stands during the X-ray operation, the cubicle being lined with lead so as to



protect the operator from whatever random radiation may be present.

The solution proposed in the Shasky patent and in the applicant's article suffer from the disadvantage that they are relatively cumbersome and involve bulky equipment which requires storage and which complicates the act of X-ray diagnosis.

Accordingly, it is an object of the present invention to provide a protective device for confining the random emanation of radiation from X-ray equipment which is small, compact, simple to operate, economical to manufacture and which may be fitted to X-ray machines as a component part thereof or which may be attached to existing machines as an accessory.

A preferred embodiment of the invention is disclosed in the accompanying drawings by way of example in which like reference numerals denote like parts in the various views and in which:

FIGURE 1 is a perspective view, partly cut away and partly exploded showing a preferred embodiment of the invention, and

FIGURE 2 is a view showing the manner in which the device of FIGURE 1 may be employed in practice.

Turning now to the drawings and, in particular, to FIGURE 1, the protective device may be seen to comprise a first tube 10 which, in the embodiment illustrated, is cylindrical, but of course, may be of other cross-sectional configuration as well. This tube 10 comprises a rigid continuous cylindrical wall which is substantially opaque to X-rays and it is provided, adjacent one end, with an attaching means 11 whereby it may be fitted to the head of an X-ray machine indicated by the dotted line 12. The method of attachment of the device to the X-ray machine forms no part of the present invention and any means which are found suitable for the purpose may be employed. In the embodiment illustrated the attaching means 11 are shown as comprising a threaded collar which may be threaded into a suitably threaded fitting on the head 12 of the X-ray device. In order to provide for universal application to X-ray machines suitable adapters may be employed to fit the device onto X-ray machines which are not provided with threaded fittings. Similarly, the composition of material from which the tube 10 is made forms no part of the present invention, it being merely essential that the material employed and the thickness of that material used is sufficient to substantially eliminate the passage of X-rays therethrough.

Completely surrounding and secured to the first tube 10 is a second tube 13 which extends the full length of the tube 10 from the attaching means 11 to the free end 10*a* of the tube 10. This second tube 13 may be formed from plastic, metal or any other suitable material and over its external surface it is provided with a plurality of spaced, parallel grooves 14 which grooves lie parallel to the longitudinal axis of the tube 10.

Surrounding the second tube 13 is a third tube 15 which is also provided with a plurality of spaced, parallel grooves 16 which grooves 16 are in staggered relationship with respect to the grooves 14 as seen in FIGURE 1. The third tube 15 is secured to the second tube 13 at the end of the second tube 13 adjacent the attaching means 11.

Surrounding the second tube and inside the third tube there are provided a plurality of elongated slat members 17 which, as seen in FIGURE 1, are of shallow U-shaped cross-section having surfaces 18 and upstanding side flanges 19. Every other elongated slat member 17 lies in one of the grooves 14 of the second tube 13 and is slidable therein. The alternate slats 17 lie, one in each groove 16 in the third tube 15 and are slidable therein. Adjacent slats are oppositely oriented and the width of each surface 18 is such that the upstanding flange 19 of one slat 17

will lie inside the upstanding flange 19 of an adjacent slat 17 and thereby will interlock adjacent slats together in the manner shown in FIGURE 1. The end 17*a* of each slat 17 is rounded to prevent injury to the patient by sharp corners which might otherwise be present.

The outer tube 15 is provided with a plurality of slots 20 which are spaced apart and parallel to one another and to the longitudinal axis of the tubes, the number of slots being equal to the number of slats 17. Each slat 17 is provided with control means in the form of a threaded stud 21 which extends radially outwardly of the tubular assembly, one stud 21 extending through each slot 20. By grasping the stud 21 manually, an operator may slide an individual slat 17 longitudinally of the device to cause it to extend from the end of the device remote from the attaching means 11 in the manner shown in FIGURE 1. A smooth plain washer 22 or other anti-friction means may be placed over the end of the threaded shank or stud 21 and a spring washer 23 placed on top. Finally, a nut 24 may be threaded on the stud 21 to provide for a convenient operating knob. The nut 24 may be tightened down on the spring washer 23 to an extent sufficient to cause a frictional engagement between the washer 22 and the outer surface 25 of the third tube 15. This frictional engagement should be relatively light but sufficient to ensure that each slat 17 will remain stationary in any location.

The slat members 17 are made from a material similar to that from which the tube 10 is formed but once again the composition of material forms no part of the present invention. It is essential only that the material be such and used in a thickness such that it is substantially opaque to X-rays.

A pointer 26 may conveniently be provided and mounted by means of a ball and socket joint 27 at that end of the device adjacent the attaching means 11. The pointer is formed so that its free end 28, when in the position shown in solid lines in FIGURE 1, lies on the axis of the tubular member 10, and is supported in that position by a brace member 29. This pointer will assist in aiming the X-ray machine at the area which it is desired to photograph and, when the machine has been properly located and locked in position, the pointer 26 may be swung to the position shown in dotted lines in FIGURE 1 and solid lines in FIGURE 2.

Turning now to FIGURE 2, the device may be seen in a position suitable for taking an X-ray photograph of a portion of a patient's jaw. It will be seen that the surface 30 of the patient's face is not normal to the axis of X-ray emanation and it may also be seen that the slats 17 have been extended by moving the individual control members 21 to slide the slat members 17 longitudinally of the tubes to constitute a tubular member opaque to X-rays over its entire length and presenting an end, the configuration of which has been adjusted to conform to the surface irregularities of the patient's face. Obviously, an infinite variation within the limits of travel of the slats 17 is attainable and the opacity of the composite tubular member effectively confines the X-ray radiation to the area which it is desired to photograph. Random emanation of X-rays through a gap between the device and the patient is effectively prevented and, in addition to avoiding exposure of the operator and surrounding personnel to X-rays, it is possible to obtain a better contrast of film, to reduce film fogging and to reduce the exposure time which is necessary to produce a satisfactory photograph.

It is believed that the present invention will effectively prevent the random emanation of radiation from X-ray devices of the type which are now conventionally used and, of course, the invention may be constructed in various sizes and shaped to accommodate various requirements.

It is further contemplated by the invention that a recess may be provided within the tube 10 adjacent the attaching means 11 to receive filters and other analogous devices which are commonly employed by X-ray technicians. In this respect the present device does not differ significantly from the fixed stationary outlet cones which are commonly available for X-ray machines.



Although exemplary embodiments of the invention have been disclosed herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiments without departing from the spirit of the invention as defined by the claims which follow:

1. A protective device for confining the random emanation of radiation from X-ray equipment comprising a first inner tube consisting of a continuous cylindrical wall of a material substantially opaque to X-rays, the tube having, at one end, attaching means to secure it to an X-ray device, a second tube surrounding and secured to the first tube, a plurality of elongated slat members of a material substantially opaque to X-rays longitudinally aligned with and slidable relative to the longitudinal axis of the tubes and arranged about the outer surface of the second tube with the longitudinal edges of each slat member contacting the adjacent edges of both adjacent slat members, a third tube surrounding the first and second tubes and the slat members and secured to the second tube at the end adjacent the attaching means on the first tube, guide means on the outer surface of the second tube and on the inner surface of the third tube and associated with the slat members to maintain the slat members in their edge contacting relationship, a number of parallel slots in the third tube equal to the number of slat members and parallel to the longitudinal axis of the tubes and extending along a major portion of the length of the third tube, control means on each slat member extending through the slots in the third tube whereby the individual slat members may be moved longitudinally relative to the tubes along the guide means to extend from the end of the device remote from the attaching means to constitute a tubular member opaque to X-rays over its entire length and presenting an end, the configuration of which may be adjusted to conform to the surface irregularities of an object being X-rayed.

2. A protective device as claimed in claim 1 in which the slat members each overlap the adjacent edges of each adjacent slat member.

3. A protective device as claimed in claim 1 in which each slat member is of a shallow U-shape in cross-section and adjacent slat members are oppositely oriented so that the flange of each side of one slat member engages and interlocks with the flange on the adjacent side of each adjacent slat member.

4. A protective device as claimed in claim 1 in which the guide means on the second and third tube comprises spaced, parallel grooves, every other slat member riding in a groove in one of the second and third tubes and intermediate slat members each riding in a groove in the other of the second and third tubes.

5. A protective device as claimed in claim 1 including a pointer pivotally mounted by one end on the third tube adjacent the attaching means and movable from a first position with its free end co-axial with the tubes to a second position angularly displaced from the first position about its pivotal mount.

6. In a protective device for confining the random emanation of radiation from an X-ray device, the combination of: a continuous cylindrical wall defining a tube comprised of material substantially opaque to X-rays, said tube having at one end a means for attaching same to said X-ray device; an outer tube surrounding said inner tube and spaced a relatively small radial distance therefrom, said outer tube being secured to said inner tube at the end adjacent said X-ray device; a plurality of elongated slat members of a material substantially opaque to X-rays, longitudinally aligned with and slidable relative to the longitudinal axis of the tubes and positioned between said inner tube and said outer tube;

guide means located between said tubes to maintain the slat members in their proper relationship; and control means secured to each slat member whereby said slat members may be individually moved longitudinally relative to the tubes along the guide means to extend from the end of the device remote from said attaching means to constitute a tubular configuration and whereby each slat member may be fixed relative to said tubes in its desired extended position.

7. A device as defined in claim 6 in which the edges of each slat member overlap the edges of its neighboring slat members and in which said control means includes means for sliding each slat member independently of movement of its neighboring slat members.

8. A device as defined in claim 6 in which each slat member provides longitudinal edges contacting the adjacent edges of both adjacent slat members.

9. A device as defined in claim 6 in which the slat members overlap and in which each slat member is of a shallow U-shape in cross-section including a bottom surface and upstanding side flanges and in which adjacent slat members are oppositely oriented with their flanges extending respectively inwardly and outwardly in overlapping and interlocking relationship so that the flange on each side of one slat member engages and interlocks with the flange on the adjacent side of each adjacent slat member.

10. A device as defined in claim 6 in which said guide means includes alternate parallel grooves and ridges located on the outer surface of the inner tube and on the inner surface of the outer tube with the ridges of one tube extending into the grooves of the other to provide individual slat-receiving slots therebetween.

11. In a protective device for confining the random emanation of radiation from an X-ray device, the combination of: a continuous cylindrical wall defining a rigid tube comprised of material substantially opaque



to X-rays, said tube having at one end a means for attaching same to said X-ray device; an outer tube surrounding said inner tube and spaced a relatively small radial distance therefrom, said outer tube being secured to said inner tube at the end adjacent said X-ray device and said outer tube having a plurality of parallel longitudinal slots therein extending along a major portion of the length thereof; a plurality of elongated slat members, equal in number to the slots in said outer tube, of a material substantially opaque to X-rays, longitudinally aligned with and slidable relative to the longitudinal axis of the tubes, and positioned between said inner tube and said outer tube in a cylindrical pattern with the longitudinal edges of each slat member contacting the adjacent edges of both adjacent slat members; guide means located between said tubes to maintain the slat members in their proper relationship; and control means including a stud secured to each of said slat members and extending radially outwardly relative to the tubular assembly and through the corresponding slot in said outer tube and a lock nut located at the outer extremity of each of said studs for releasably securing each slidable slat member to said outer tube.

12. A protective device as defined in claim 11 including a pointer pivotally mounted at one end on the outer tube adjacent the attaching means and movable from a first position with its free end coaxial with the tubes to a second position angularly displaced from the first position about its pivotal mount.

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