

- [54] METHOD AND APPARATUS FOR CHECKING THE SUPERIMPOSITION OF AN X-RAY FIELD AND A LIGHTFIELD
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- [58] Field of Search 250/476, 511, 512, 513, 250/491, 252

- [56] References Cited
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- [57] ABSTRACT
A method and apparatus is disclosed for checking the

alignment of various interfaced components in a conventional x-ray system. The disclosed method functions to verify the coincidence of the x-ray field, emanating from the x-ray apparatus, with the target lightfield, projecting from the x-ray collimator. If these two fields are coincident within an allowable tolerance, the x-ray apparatus, collimator and film cassette carrier are properly aligned for that particular source-to-image distance. The apparatus includes a plurality of target plates having a width equal to the allowable tolerance for the particular source-to-image distance. The method includes the steps of projecting the lightfield over the target area, and centrally positioning the plurality of target plates on the peripheral edges of the lightfield. An x-ray beam is then projected onto the film located in the target area. The exposed x-ray film is then examined to determine whether a portion of each of the target plates is located on the x-ray field. If one or more of the target plates is not located on the exposed x-ray film, the x-ray field is not superimposed on the lightfield within the allowable tolerance. The x-ray apparatus is then realigned with the collimator and the test procedure is repeated until a portion of all four target plates is located on the exposed x-ray film to denote proper alignment.

9 Claims, 3 Drawing Figures

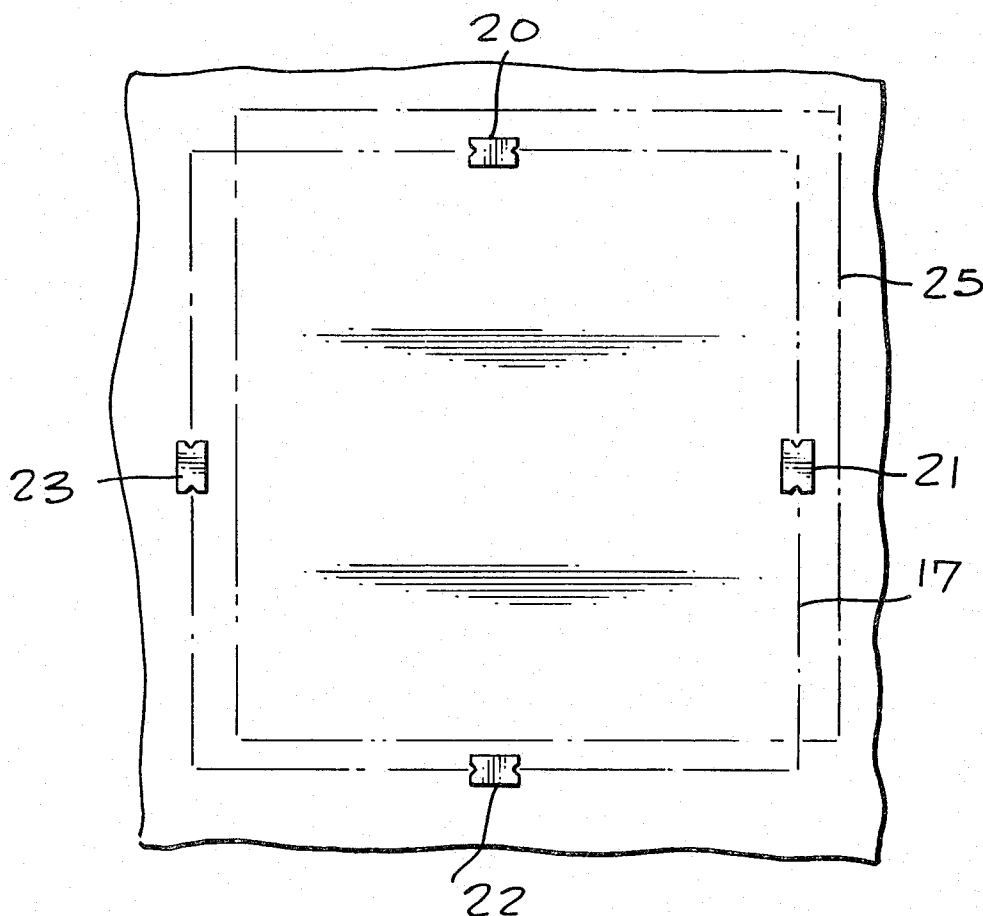


Fig. 1

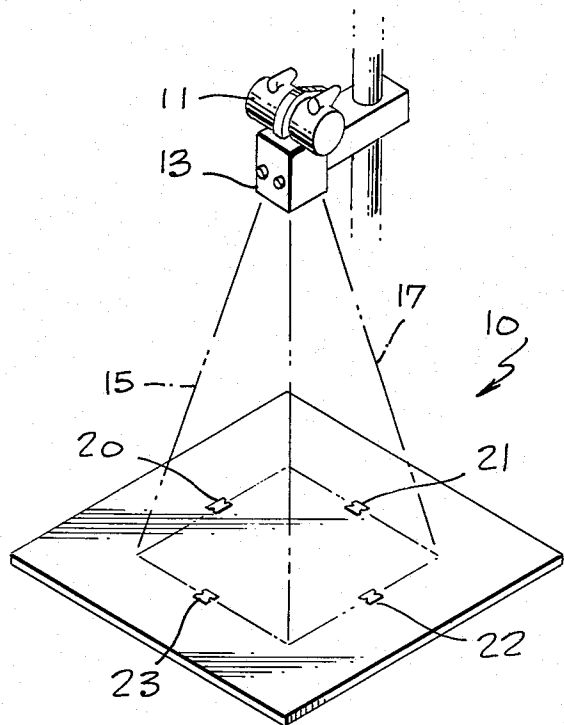


Fig. 2

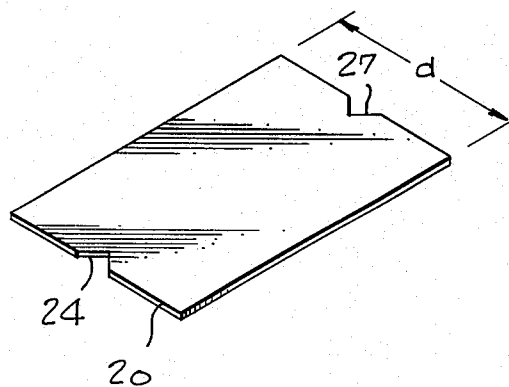
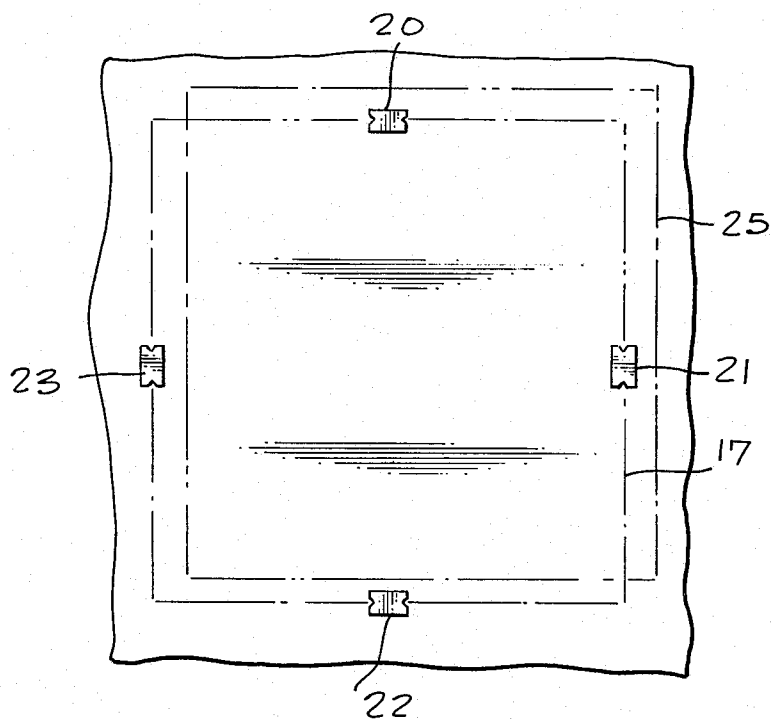


Fig. 3



METHOD AND APPARATUS FOR CHECKING THE SUPERIMPOSITION OF AN X-RAY FIELD AND A LIGHTFIELD

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and apparatus for checking the alignment of various components in a conventional medical x-ray system and more particularly to a method and apparatus for verifying the coincidence of the x-ray field with the target lightfield.

2. Description of the Prior Art

Under the new Bureau of Radiological Health (hereinafter called BRH) standards, which have been in effect since Aug. 1, 1974, the x-ray field, established by the x-rays emanating from an x-ray apparatus onto a target area, must be coincident with the target lightfield, projecting from the x-ray collimator, within a certain tolerance. It has been established that this tolerance (the distance the peripheral edge of the x-ray field can deviate from the mating peripheral edge of the target lightfield) must be two percent or less of the x-ray source-to-image distance (hereinafter called SID). For example, for an SID of 40 inches, the tolerance would be 0.8 inches.

Although one of the reasons for having the lightfield and x-ray field coincident is to properly align the x-ray apparatus with the collimator, the main reason for the coincidence is to ensure that the patients are not unduly exposed to a broader dosage of x-rays than is necessary to cover the x-ray film used in the exposure. Therefore, the crux of the new BRH standards is patient safety.

Heretofore, a complex procedure has been utilized for aligning the x-ray apparatus with the x-ray collimator. This aligning procedure consisted of mounting a piece of ready pack film over the target area and projecting the collimator lightfield onto the ready pack film envelope. A plurality of pinholes are then inserted through the film envelope at the periphery of the light beam to designate the lightfield when film is developed. An x-ray exposure is then taken. Upon examining the exposure, the edges of the x-ray field are determined (the area denoting 25 percent maximum density) and the distance between the pinholes, denoting the lightfield edges, and the edges of the x-ray field are then physically measured. It is then necessary to calculate whether this distance is greater or less than 2 percent of the given SID (the allowable tolerance). The shortcoming with this system is that physical measurements must be taken and mental calculations must be made, which, of course, are susceptible to errors.

SUMMARY OF THE INVENTION

The present invention obviates the above-mentioned shortcomings by providing an x-ray components alignment method and apparatus that eliminates the need for physical measurements and mental calculations.

In its broadest aspect, the method includes the steps of locking the x-ray apparatus and collimator in position over the target area at a specific SID. The square or rectangular lightfield from the collimator is then projected on the target area. A special target piece is then centrally positioned on each of the peripheral edges forming the outline of the lightfield. Each target piece forming the test apparatus is a plate having a pair

of indices equal to the allowable tolerance of the x-ray field with respect to the lightfield at the specific SID. After the target pieces are centrally placed on the edges of the lightfield, an exposure is made on the x-ray film. Upon developing the film, the film is examined to determine if portions of all four target pieces appear on the film. If this is accomplished, then the x-ray and lightfields are coincident, and no alignment readjustment between the x-ray apparatus and collimator is necessary. If one or two of the target pieces do not appear on the exposed film, this would signify that the distances between the lightfield edges and the x-ray field edges were greater than the allowable tolerance for that particular SID. When this occurs, adjustments between the x-ray apparatus and the collimator have to be made and the entire test procedure repeated.

The primary advantage of the present invention is that the entire test method can be accomplished expeditiously and accurately.

The features of the present invention, which are believed to be novel, are set forth with particularity in the appended Claims. The present invention, both as to its organization and manner of operation, together with the further advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of an x-ray system utilizing the apparatus of the present invention;

FIG. 2 is an isometric view of one of the target plates utilized in the present invention;

FIG. 3 is a plan view of the target area of the x-ray system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, FIG. 1 illustrates a typical medical x-ray system, generally indicated by arrow 10 consisting of an x-ray apparatus 11, a collimator 13 and a target area 15. These components can be of any conventional design, and the apparatus of the present invention can be utilized on any x-ray equipment ensemble.

As with all conventional x-ray systems, the x-ray apparatus 11 functions to emit a quantity of x-rays onto the target area with the collimator 13 functioning to constrain the x-ray beam to a given size. The collimator 13 also includes a light emitter (not shown) for projecting a field of light 17 onto the target area 15. The purpose of the lightfield is to indicate to the operator where the x-ray field will be located during the desired exposure. The target area usually includes a bucky movably supporting a film cassette for one or more exposures. The patient to be x-rayed would be located between the target area and the x-ray apparatus.

As stated previously, the purpose of the present invention is to insure that for each SID, the x-ray field is coincident with the lightfield 17 within the BRH tolerance.

In accordance with the present invention, a plurality of target plates 20, 21, 22 and 23 are provided to be positioned on the peripheral edges of the lightfield 17. As shown more clearly in FIG. 2, each target plate is rectangular in shape and includes a pair of centering notches 24 which function as a guide for centering the

target plate onto a respective peripheral edge of the lightfield 17.

The width of the target plate is denoted by the letter d and is equal to the amount of tolerance of the x-ray field with respect to the lightfield for a particular SID. As in the previous example, if the SID were 40 inches, the amount of allowable tolerance or width of the target plate would be 0.8 inches.

As shown in FIG. 3, the set of four target plates 20, 21, 22 and 23 is utilized, with one target plate being positioned on each peripheral edge of the lightfield 17. It would be noted that the lightfield and superimposed x-ray field can be either square or rectangular in shape depending on the type of x-ray taken.

OPERATION

In operation, the x-ray apparatus 11 is fixed with respect to the collimator 13. During the test period, it is preferable to position a sheet of paper over the target area 15 in order that the lightfield can be more easily seen. After the paper is inserted on the target area 15, the collimator light is turned on to project the lightfield 17 onto the paper of target area 15. The desired set of target plates 20, 21, 22 and 23 for that particular SID are centrally positioned on the peripheral edges of the lightfield 17. Afterwards, the x-ray beam from the x-ray apparatus 11 is projected onto the target area 15. For illustrative purposes, the outline of the exposed x-ray field is shown by the numeral 25. The next step of the procedure is to develop the exposed x-ray film and examine it to determine the outline of the x-ray field. In practice, the x-ray field outline is determined by the lines equal to 25 percent of the maximum density of the x-ray. The x-ray is then further examined to determine whether a portion of each of the target plates 20, 21, 22 and 23 is located on the peripheral edges of the x-ray field 25. In the example shown, only the target plates 20 and 21 appear on the x-ray film, while the target plates 22 and 23 are completely absent therefrom. This would mean that the x-ray field is not sufficiently coincident with the lightfield 17 within the allowable BRH tolerance. The x-ray apparatus 11 would then have to be adjusted with respect to the collimator 13, and the test procedure would have to be repeated until a film exposure is taken in which all four target plates 20, 21, 22 and 23 appear on the peripheral edges of the x-ray field 25. Once this is accomplished, the x-ray field will be properly positioned with respect to the lightfield 17 within the allowable BRH standards. This procedure would then be repeated for the other SIDs with different sets of target plates being used for the different SIDs. As can be seen, no physical measurements or mental calculations are required for this test procedure, and the entire operation can be handled more easily and quickly than prior systems.

It should be noted that various modifications can be made to the assembly while still remaining within the purview of the following claims. For example, a plural-

ity of pairs of indices can be utilized on each target plate, with each pair of indices representing the allowable tolerance for a respective SID.

What is claimed is:

1. In an x-ray system which includes a target area having a film cassette mounted thereon, an x-ray apparatus having a source of x-rays, located a specific distance from said target area, for emitting a beam of x-rays onto said target area, and a collimator having a light emitter for projecting a light beam onto said target area, a method for checking the superimposition of the x-ray field and the lightfield on said target area comprising the steps of:
 - projecting a lightfield on said target area;
 - positioning a plurality of target pieces on the outline of said lightfield, said target pieces each having a pair of indices equal to the allowable tolerance of the x-ray field position with respect to the lightfield position at the specific source-to-target area distance;
 - projecting an x-ray field onto said target area; and
 - developing and examining said exposed film located on said target area to determine whether a portion of each target piece is located on the outline of the x-ray field.
2. The method of claim 1 wherein each target piece is centrally positioned on the lines forming the outline of said lightfield.
3. The method of claim 1 wherein said lightfield is square or rectangular and one target piece is positioned on each of the four lines forming the outline of said lightfield.
4. The method of claim 1 further including the step of mounting a piece of paper over said target area to enable the lightfield to be more visible.
5. In an x-ray system which includes a target area having a film cassette mounted thereon, an x-ray apparatus having a source of x-rays, located a specific distance from said target area, for emitting a beam of x-rays onto said target area, and a collimator having a light emitter for projecting a light beam onto said target area, an apparatus for checking the superimposition of the x-ray field and the lightfield on said target area comprising:
 - a plurality of target pieces, said target pieces each having a pair of indices equal to the allowable tolerance of the x-ray field position with respect to the lightfield position at the specific source-to-target area distance.
 6. The combination of claim 5 wherein each target piece has a width equal to said allowable tolerance.
 7. The combination of claim 5 wherein each target piece is a rectangular plate.
 8. The combination of claim 5 wherein each target piece includes a pair of centering notches bisecting the width of each piece.
 9. The combination of claim 5 wherein the plurality of target pieces number four.

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