July 21, 1970 E. SLAGLE 3,521,061

X-RAY SPOT FILMER WHEREIN THE GRID IS CARRIED BY THE CASSETTE TRAY

Filed Oct. 9, 1967 2 Sheets-Sheet 1

FIG. 1

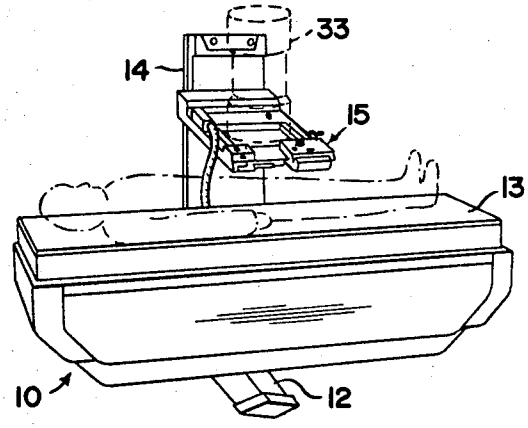
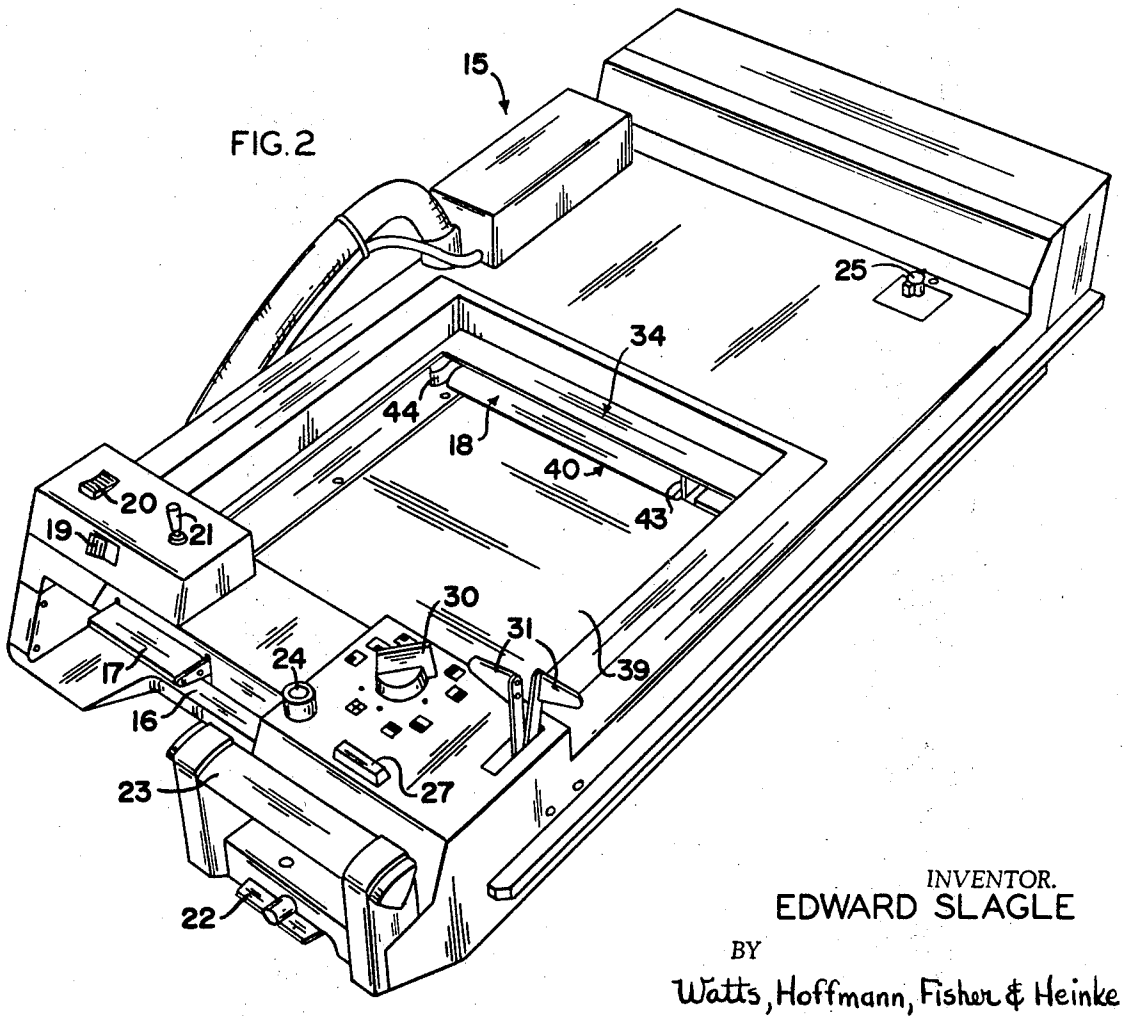


FIG. 2



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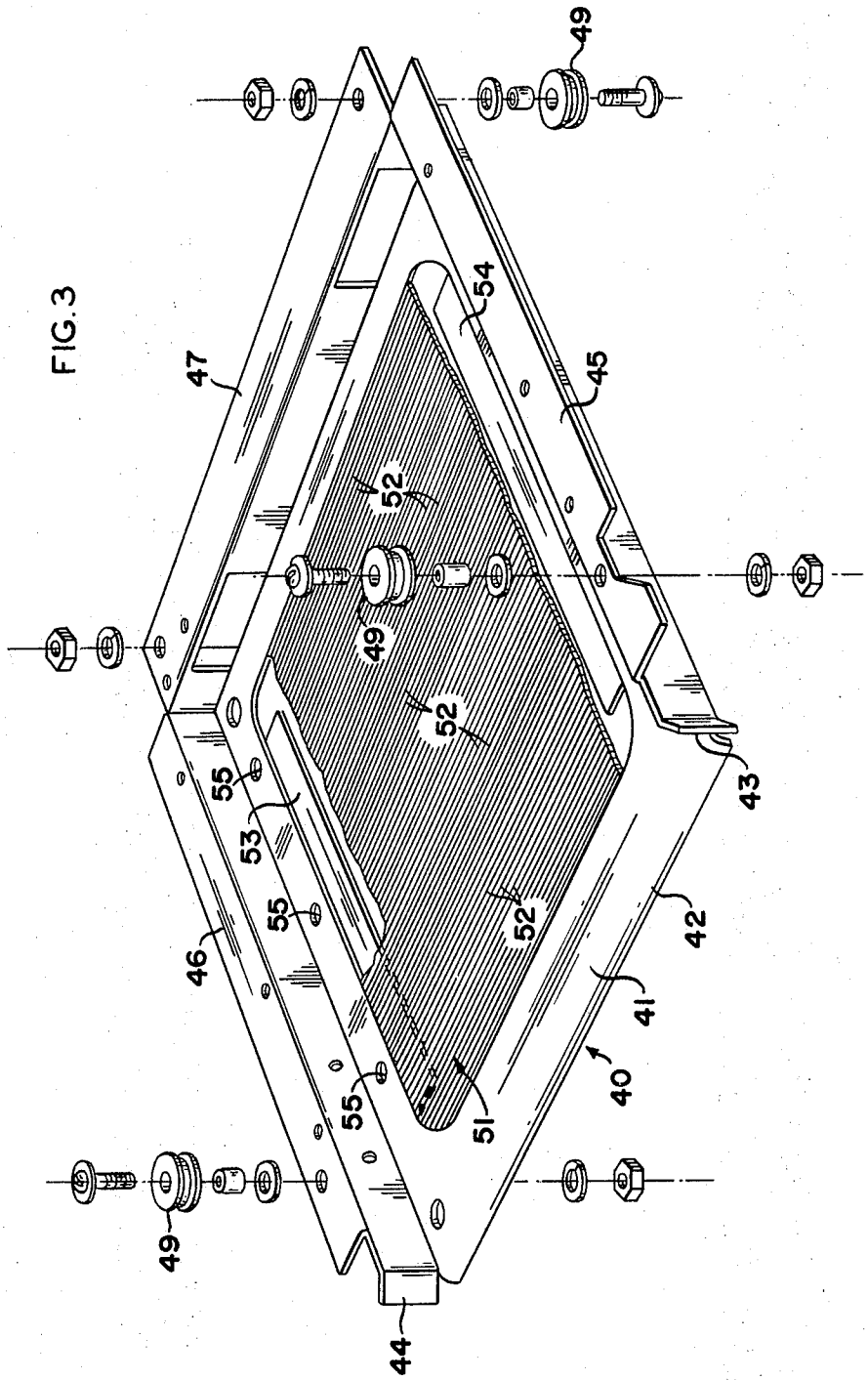
BY
Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

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FIG. 3



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3,521,061

X-RAY SPOT FILMER WHEREIN THE GRID IS CARRIED BY THE CASSETTE TRAY

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U.S. Cl. 250—66 5 Claims

ABSTRACT OF THE DISCLOSURE

X-ray spot filmer for taking medical radiographs which minimizes patient-to-film distance with an X-ray absorbing grid which is carried by a cassette tray so it is fixed during the radiographing operation and is shifted into position automatically with the X-ray film.

CROSS-REFERENCED PATENTS

(1) Pat. 2,872,584, issued Feb. 3, 1959, to R. C. Schiring et al., entitled, "X-Ray Apparatus";
(2) Pat. 3,173,008, issued Mar. 9, 1965, to D. M. Barrett et al. entitled, "Spot Filmer."

BACKGROUND OF THE INVENTION

Field of the invention

Medical X-ray tables are frequently equipped with a device known as a spot filmer. One such spot filmer is that described and claimed in the Pat. 3,173,008 to D. M. Barrett et al. entitled, "Spot Filmer." These spot film devices are carried on the tower of an X-ray table such as that described and claimed in R. C. Schiring et al. Pat. 2,872,584 entitled "X-Ray Apparatus."

With an X-ray table equipped with a spot filmer, an X-ray tube is carried by the tower and positioned within the body of the X-ray table. The spot filmer is mounted in the path of an X-ray beam emitted by the tube and is movable toward and away from the table body. A cassette carrying X-ray film is carried by the spot filmer and is selectively positionable in the path of the X-ray beam for taking X-ray radiographs.

In many modern X-ray mechanisms, an image intensification tube is carried by the spot filmer and used for conducting what is sometimes referred to as "bright fluoroscopy." That is, the patient is fluoroscoped by use of an image intensification tube and the output of the image intensification tube may be (1) viewed optically; (2) reproduced on a closed-circuit television monitor for viewing; and, (3) photographed by a cine camera.

The quality of an X-ray radiograph and the quality of the fluoroscopic image produced by an image intensifier and associated apparatus, is dependent upon a number of factors. One of the more important factors is the distance between the film or the image intensifier and the patient or other subject being X-rayed. The closer the film is to the patient, for example, the sharper will be the radiograph. An interrelated factor is the distance between the X-ray tube and the film or image intensification tube. The energy required to produce a suitable radiograph varies with the square of the distance between the X-ray source and the radiographic film. Thus, not only is the quality of the radiograph a function of the distance between the X-ray tube and the film but the amount of exposure of X-ray to which the patient is subjected is proportional to that distance.

Another factor in making a limited patient-to-film distance important is the amount of information which can be obtained on any given film size. The X-ray beam is essentially pyramidal in shape emanating from a point source on the anode of the X-ray tube and collimated by

diaphragms to a rectangular field. For any given field size, the closer the film is to the patient the larger the X-ray field size which can be accommodated and therefore the more information which can be presented on the film.

As the X-ray arts have advanced and accessories have been added to spot filmers the tube-to-film distance and the patient-to-film distance has usually suffered adversely as a consequence. For example, the addition to spot filmers of such accessories as phototiming attachments and grids, both oscillating and stationary, for inhibiting the fogging of the film due to scatter radiation have increased the patient-to-film distance and therefore the patient-to-X-ray-tube distance.

PRIOR ART

It is customary to position a grid between the patient and the radiographic film. The grid is a framework equipped with a series of usually-parallel bars of lead or other material which is impervious to penetration by X-rays. This has the effect of filtering out so-called scatter radiation deflected by the patient and approaching the film at an angle. Thus, the radiographic exposure is made essentially by primary, substantially parallel radiation passing directly through the patient to the grid.

Two types of grids have been employed in the past. One is a so-called stationary grid which is in a fixed position during radiographing and which results in parallel lines or bars being visible on the radiograph. For many purposes these bars are not objectionable and do not interfere with the diagnosing of a patient. At other times, an oscillating grid is used. The oscillating grid is caused to reciprocate back and forth during the X-ray exposure producing the filtering effect insofar as scatter radiation is concerned, but obviating the appearance of grid bars on the finished radiograph.

With prior art spot filmers, it has been customary to provide radiographic grids as accessories. Grids added to spot filmers in the past have resulted in increased patient-to-film distance.

Moreover, where both fixed and oscillating grids are provided, it is essential that both be movable from a storage to a use position and return so that one may selectively and one at a time use either the fixed grid or the oscillating grid, or neither. Thus, they are not in the same plane and add to the patient-to-film distance.

The use of fixed grids with image intensification tubes creates another problem. Until very recently and to a large degree to this day, the amount of intensification available with image intensification systems has prohibited the use of heavy grids during times when so-called bright fluoroscopy studies are conducted. High-quality radiographs, however, require a relatively heavy grid. Accordingly, a compromise to a relatively light grid to get a good quality bright fluoroscopy work has resulted in a poorer quality of radiograph.

In the past, where the grid was positioned selectively in the path of the X-ray beam, it was necessary for the operator of the mechanism to position the grid before taking a radiograph or, in the alternative, to provide a mechanism for automatically positioning the grid. If the grid is positioned automatically, obviously the spot filmer mechanism is made more complex. If it is necessary to position it manually, there is the added problem of potential human error and resultant failure to obtain the radiographs desired.

SUMMARY OF THE INVENTION

The present invention has overcome all of the above disadvantages and provided additional advantages as well. With the present invention, a film tray which supports the cassette is equipped with an aperture in the central portion of the lower part of the tray. A so-called stationary

grid is mounted in that aperture so that it moves with the film from a storage position to the exposure position. Inherently, when the film is in an exposure position, the grid is also in that position.

In addition to the advantage of the grid automatically being positioned without any addition of any automatic positioning mechanism, this construction has other advantages. Since the grid is positioned in a recess at the base of the film tray, the presence of the grid has no effect on the film-to-patient distance.

There are many who believe that one factor which contributes to good-quality radiographs is the distance between a grid and a radiograph. These persons assert that if the grid is as close as possible to the film better quality radiographs are produced. With the present mechanism, the grid is juxtaposed against the film cassette and is therefore as close as possible to the grid.

The explanation advanced by those who assert that the grid should be as close as possible to the film, for their claim of improved radiographs, is that this minimizes to the greatest possible extent the obtuseness of an angle of incident radiation exposing the radiographic film. In other words, it limits the X-rays which reach the film to those more clearly approaching parallel than if the grid were spaced further from the grid.

As indicated above, the construction for the fixed grid of this invention adds no space at all. All other accessories are selectively added wtih the purchaser again having the ability to determine whether or not the adverse effect on the radiograph justifies the addition of the accessory.

Accordingly, the object of this invention is to provide a novel and improved X-ray spot filmer equipped with a stationary grid positioned for radiography in a novel and improved manner.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective somewhat diagrammatic view of an X-ray table equipped with a spot filmer embodying this invention;

FIG. 2 is an enlarged perspective view of the spot filmer with the image intensification tube removed for clarity of illustration and the spot filmer tray partially through the aperture where the image tube is customarily mounted; and,

FIG. 3 is an exploded view of the spot filmer cassette tray and the improved stationary grid construction of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, an X-ray table is shown generally at **10**. The table **10** includes a body **11** mounted on a pedestal **12**. The body **11** has a top **13** which is shown as horizontal in FIG. 1. The table body **11** is movable from the position shown to a position wherein the top **13** is vertical. With a so-called 90—90 table, the body is tiltable in either direction until the top **13** is in a vertical position.

The table **10** includes the usual tower or mast assembly **14** which is movable longitudinally and transversely with respect to the table top **13** to various positions along the table. The tower **14** carries a spot filmer shown generally at **15**. The spot filmer **15** is movable reciprocally in the usual manner toward and away from the table top **13**.

Referring now to FIG. 2, the spot filmer **15** is of the front loading type, having a front load opening shown generally at **16**. The filmer is equipped with a cassette eject bar **17** which ejects a cassette from the spot filmer whenever the cassette tray **18** is in a load position. Other parts of the spot filmer shown include a cassette park and load switch **19**, a lock switch **20** for a Bucky tray carried in the table, a toggle switch **21** for a power top on the table and a table tilt switch **22**. A power assist handle **23** is provided as is a button **24** for energizing compression locks. A density control switch **25** is provided at the rearward part of the spot filmer for controlling the density of a phototimed radiographic exposure. The film advance button **27** is provided for causing the cassette tray to advance to an exposure position. The usual program selector **30** is provided as are diaphragm controls **31** for adjusting the field size of the X-ray beam. All of the structure thus far defined is known in the art and may be made in accordance with the teachings of the above-referenced Pat. 3,173,008, entitled "Spot Filmer."

The spot filmer as shown in FIG. 1 is equipped with an image intensification tube **33**. For clarity of illustration, the image intensification tube **33** has been omitted from all figures other than FIG. 1. The image tube is mounted in a well or recess shown generally at **34** so as to be positioned as near the patient as possible.

A cassette tray is shown generally at **40** in FIG. 2. Referring to FIG. 3, the cassette tray includes tray body **41**. The tray body **41** includes a downwardly bent sloping portion at **42** for guiding a cassette into the tray on rectilinear insertion of it. Side flanges **43**, **44** are also provided for camming the cassette into the tray. A pair of side mounting flanges **45**, **46** project outwardly from and form a part of the tray **41**.

The tray **41** also has a rearwardly extending mounting flange **47** in the same plane as the side mounting flanges **45**, **46**. The mounting flanges **45**, **47** carry suitable rollers **49** for carrying the cassette in its forward and rearward movement and for carrying it in its transverse movement through the usual radiographic sequences.

Other structure carried by the tray has been omitted for clarity of illustration since it forms no part of this invention. The other structure includes such things as the latching mechanism for holding a cassette in the tray, the eject mechanism for ejecting the cassette from the tray and lead shielding carried by the tray for radiation absorption.

The tray body **41** includes a base structure defining a generally rectangular aperture **50** at the bottom. The aperture **50** is of a perimetrical size equal to the size of the fixed grid **51** which is secured in the tray. The grid **51** has the usual parallel bars **52** which absorb scatter radiation emanating from a patient and permit the direct radiation to pass through to form a sharp and clear radiograph. The grid **51** is also of a thickness equal to the bottom portion of the tray body **41**. Typically, the tray may be formed from a panel of ⅛ inch thickness and the grid **51** will also be of ⅛ inch thickness.

A pair of tray mounting plates **53**, **54** are provided at opposite sides of the aperture **50**. The mounting plates **53**, **54** are secured in place as by fasteners **55**. In assembly, the grid **51** is lowered into the aperture **50** and supported on the plates **53**, **54**. A suitable bonding agent such as an epoxy resin is then poured at the joints between the grid **51** and the walls of the aperture **50** and above the plates **53**, **54** respectively. This bonding agent secures the grid in place by bonding it to the supporting plates **53**, **54** and to the tray body **41**. Thus, the grid is bonded in place to become a portion of the base structure of the tray.

Although a preferred embodiment of the invention has been shown and described, it is apparent that many changes and modifications may be made by one skilled in the art without departing from the true spirit and scope of the invention.

What is claimed is:

1. In an X-ray spot filmer including a housing, a cassette tray movable in the housing from load position to a selected exposure position, and structure within the housing for moving the tray, the improved tray construction comprising:

(a) tray structure defining the perimeter of a cassette space;

(b) said structure defining an aperture beneath the space;

(c) a grid in the aperture, said grid having a plurality of spaced, X-ray absorbing bars; and,

(d) said structure including means securing the grid in the aperture.

2. The device of claim 1 wherein said means securing the grid in the aperture comprises a pair of mounting plates secured to the tray structure and means bonding the grid to the plates.

3. The device of claim 2 wherein the means bonding the grid and plates comprises an epoxy resin.

4. In an X-ray spot filmer including a structure for shifting an X-ray cassette supporting tray from storage to exposure positions and return, the improved tray construction comprising:

(a) a base structure defining the base of a cassette receiving space;

(b) said base structure including a grid portion disposed centrally and forming the major portion of said base structure, said grid portion including a plurality of spaced, X-ray absorbing bars; and,

(c) marginal members projecting upwardly from said base structure and defining a plurality of sides of the cassette receiving space whereby to provide marginal members for locating and maintaining the cassette within the tray.

5. In an X-ray spot filmer including structure for shifting an X-ray cassette supporting tray from storage to exposure positions and return, the improved tray construction comprising:

(a) a base member defining the base of a cassette receiving space; said base member having an enlarged aperture therein such that said base member comprises relatively narrow marginal portions defining the perimeter of the aperture;

(b) a grid disposed within and substantially filling said aperture, said grid having a thickness substantially equal to that of the base member, said grid also having a plurality of spaced, X-ray absorbing bars;

(c) means secured to the base member and to the grid and maintaining the grid in the aperture; and,

(d) marginal flange members projecting upwardly from said base member and defining at least three sides of the cassette receiving space whereby to provide a front opening for insertion of a cassette into said tray and marginal members for locating and maintaining the cassette within the tray.

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WILLIAM F. LINDQUIST, Primary Examiner

U.S. Cl. X.R.

250—62