

May 26, 1970

A. F. NAYLOR
SPOT FILMER FOR X-RAY RADIOGRAPHING WHICH MINIMIZES
PATIENT-TO-FILM DISTANCE

3,514,596

Filed Oct. 17, 1967

3 Sheets-Sheet 1

FIG. 1

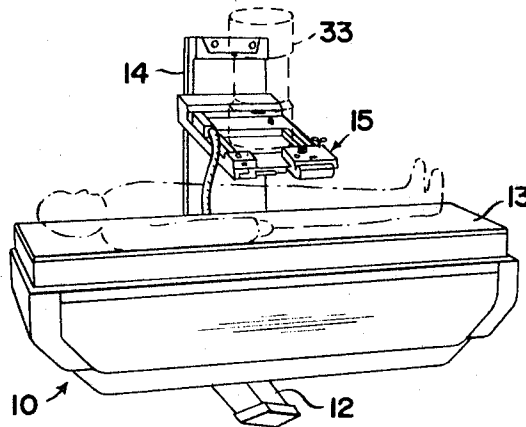
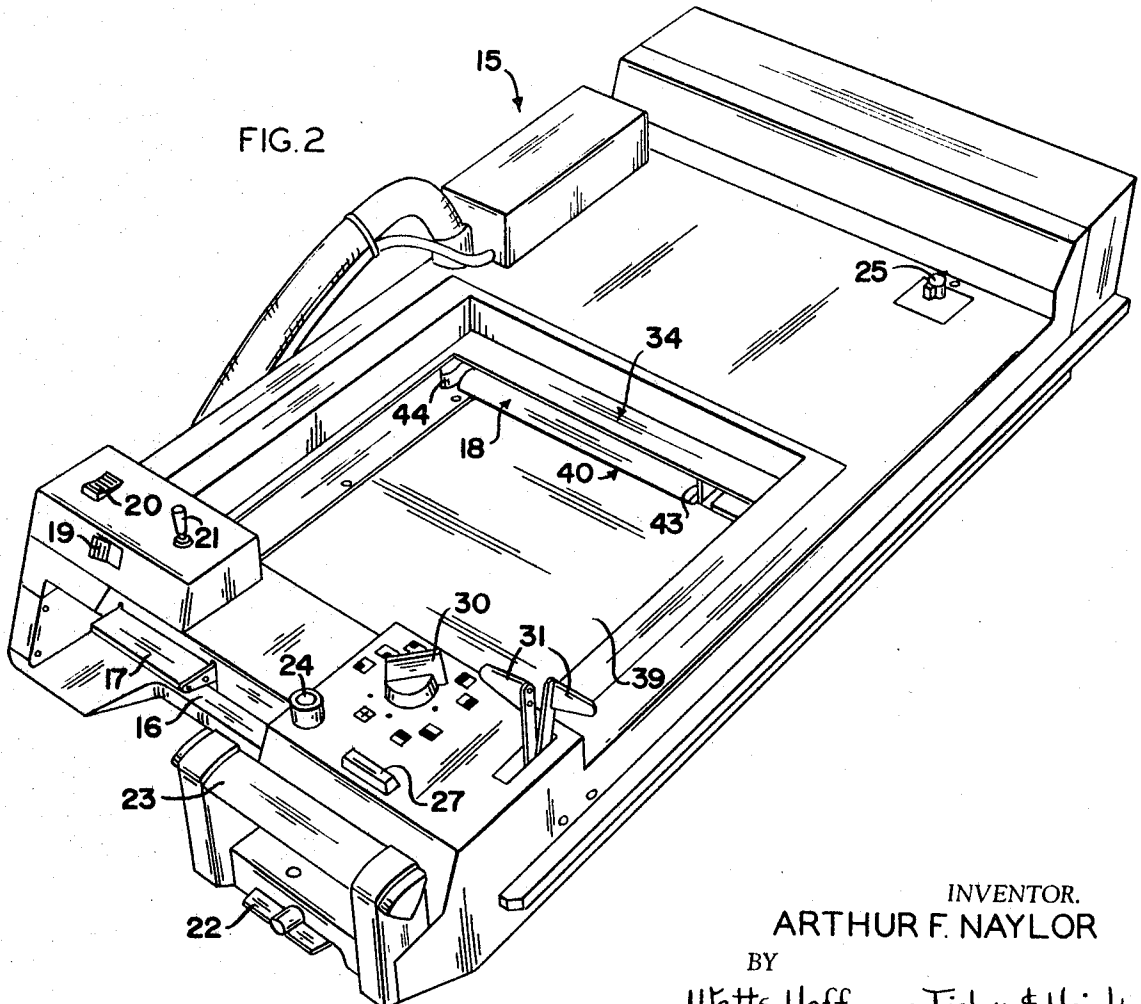


FIG. 2



INVENTOR.
ARTHUR F. NAYLOR
BY
Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

May 26, 1970

A. F. NAYLOR

3,514,596

SPOT FILMER FOR X-RAY RADIOGRAPHING WHICH MINIMIZES
PATIENT-TO-FILM DISTANCE

Filed Oct. 17, 1967

3 Sheets-Sheet 2

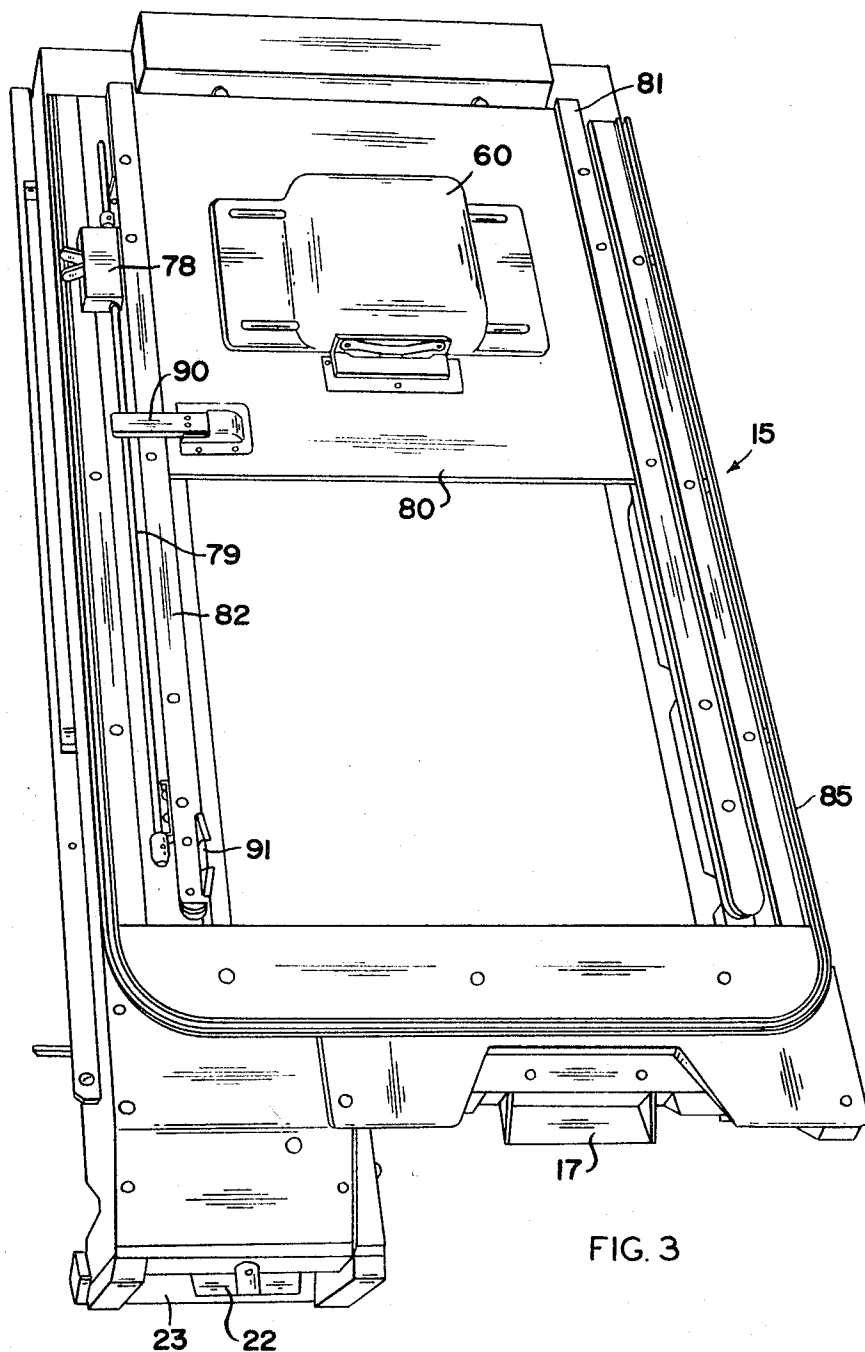


FIG. 3

INVENTOR.
ARTHUR F. NAYLOR

BY
Watts, Hoffmann, Fisher & Heinke
ATTORNEYS.

May 26, 1970

A. F. NAYLOR

3,514,596

SPOT FILMER FOR X-RAY RADIOGRAPHING WHICH MINIMIZES
PATIENT-TO-FILM DISTANCE

Filed Oct. 17, 1967

3 Sheets-Sheet 3

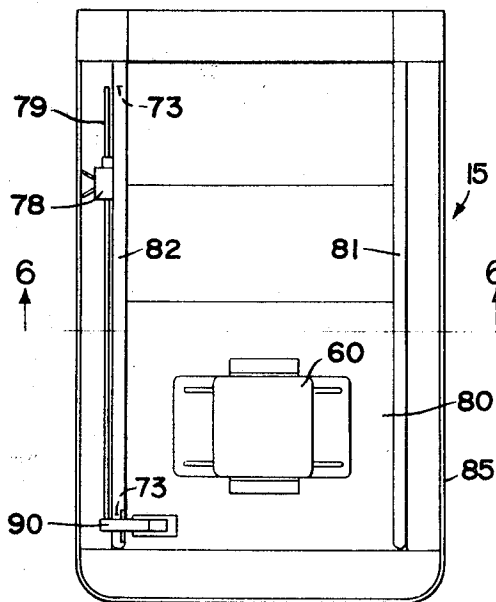


FIG. 4

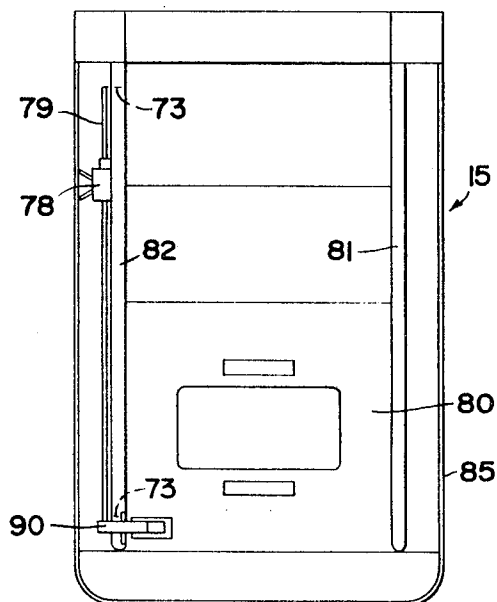


FIG. 5

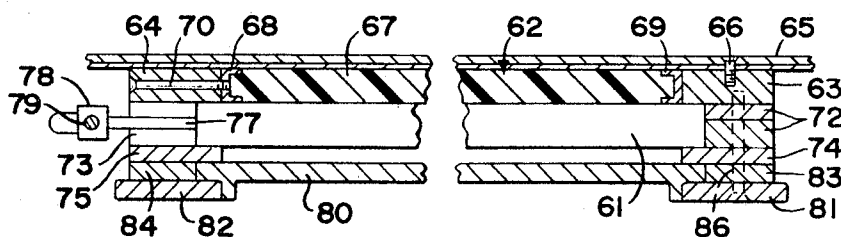


FIG. 6

INVENTOR.
ARTHUR F. NAYLOR

BY

Watts, Hoffmann, Fisher & Heinke

ATTORNEYS.

1

3,514,596

SPOT FILMER FOR X-RAY RADIOGRAPH- ING WHICH MINIMIZES PATIENT-TO-FILM DISTANCE

Arthur F. Naylor, East Cleveland, Ohio, assignor, by
mesne assignments, to Picker Corporation, White Plains,
N.Y., a corporation of New York

Filed Oct. 17, 1967, Ser. No. 675,822

Int. Cl. G03b 41/16

U.S. Cl. 250—62

5 Claims

ABSTRACT OF THE DISCLOSURE

X-ray spot filmer for taking medical radiographs which minimizes patient-to-film distance with (1) a lead apron support which is spaced from the patient and mounted at the perimeter of the spot filmer and (2) has members external of the housing for mounting accessories.

CROSS-REFERENCED PATENTS

Pat. 2,872,584, issued Feb. 3, 1959, to R. C. Schiring et al., entitled "X-ray Apparatus";

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 the 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 the 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

2

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 film due to scatter radiation, have increased the patient-to-film distance and therefore the patient-to-X-ray-tube distance.

PRIOR ART

In the manufacture of spot filmers, it is customary to provide what might be referred to as a "standard" filmer with such things as fixed and oscillating grids, phototimers, compression cones and the like being optional accessories which a given physician may add to his spot filmer. In the past, the entire industry has designed its equipment such that the space for these accessories exists between the patient and the film irrespective of whether or not the accessory is provided. Typically, the housing has been of such thickness and size that available accessories may be positioned within the housing. In that situation where no accessories were desired, the space for the accessories was nonetheless present and resultant radiographic quality was something short of optimum quality.

There have been proposals for mounting certain of the accessories external of the spot filmer housing. In those proposals, however, there has been a failing to provide a construction wherein the spacing between the patient and the film is determined only by those accessories actually included in a given spot filmer. Rather, in these proposals the spacing has been determined by a track which is provided to support a protective lead rubber apron.

SUMMARY OF THE INVENTION

The present invention has overcome all of the above disadvantages and provided additional advantages as well. With the present invention, the lead rubber apron track is positioned perimetally of the spot filmer. If there are no accessories attached to a given spot filmer, its housing will abut the patient without the lead rubber apron or its track in any way being a controlling factor in the spacing of the spot filmer and the patient. In addition, all accessories, such as phototimer, spot filmer paddle, and the like, are positioned externally of the housing and attached by appropriate spacers and fasteners so that the purchaser of the spot filmer has a choice of what accessories he wishes to add, balancing an adverse effect on the quality of radiograph against the advantage of a given accessory.

Accordingly, the object of this invention is to provide a novel and improved X-ray spot filmer equipped with accessories external of the housing and in which patient-to-film distance is minimized.

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; FIG. 3 is a lower perspective view on an enlarged scale with respect to FIG. 2 of the spot filmer of this invention;

FIGS. 4 and 5 are bottom plan views of the spot filmer one with and one without the compression cone attachment; and

FIG. 6 is an enlarged fragmentary sectional view showing attachments added to the bottom of the spot filmer.

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 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 forward portion of a cassette tray is visible at 40 in FIG. 2. It will be seen that the tray is adjacent bottom 39 of the spot filmer and there is no room for, nor are there, accessories between the tray 40 and the bottom 39. The tray 40 is mounted for the usual forward, rearward, and lateral movement through the usual radiographic sequences.

Referring now to FIGS. 3-6, the accessories which may selectively be added externally of and below the housing in the spot filmer 15 are shown. These accessories are a compression cone 60, an oscillating grid 61 and a phototiming exposure control including a phototimer paddle 62.

When one or more of these accessories is to be added to the spot filmer, a spaced pair of tap bars 63, 64 are secured to lower wall 65 of the spot filmer housing, FIG. 6. The tap bars 63, 64 are secured by a plurality of screws which extend through the lower wall 65 and thread into the tap bars. One of these screws is shown threaded into the tap bar 63 at 66.

The spot filmer paddle assembly 62 has a central light transmitting paddle 67 which may be of Lucite® plastic or other similar material. Lucite® plastic is a product sold by E. I. du Pont de Nemours & Co. which serves as a "light pipe" to conduct light from a small fluorescent screen to a phototube, not shown, within the spot filmer

15. The paddle 67 is carried by a pair of mounting strips 68, 69 which are secured to the tap strips 63, 64 as by screws projecting laterally through the tap strips. One of the screws is shown at 70. The thickness of the tap strip 63 is substantially equal to that of the paddle 67 so that the paddle assembly 62 nests between the tap strips.

Two pairs of grid spacers 72, 73 are provided. The grid spacers 72, 73 are mounted immediately below the tap strips 63, 64 respectively. A pair of grid retainers 74, 75 are immediately below the grid spacers 72, 73 to retain the grid 61 in the space between the retainers 74, 75 and the tap bars 63, 64 provided by the spacers 62, 63. Thus, the retainers 74, 75 and the tap bars 63, 64 serve with spacers 72, 73 to provide guide tracks for the reciprocating grid 61.

The spacers 73 at the left side of the spot filmer as seen in FIG. 6, are pairs of spaced forward and rearward spacer sets, the rearward set being visible in FIG. 6. This provides an opening between the tap bar 64 and the retainer 75. A grid positioning rod 77 extends through this opening connecting the grid 61 to a grid positioning assembly 78. The assembly 78 is selectively movable along a grid reciprocating bar 79 which causes the grid to reciprocate during exposures. The construction of the grid positioning bar, the mechanism for selectively reciprocating it and the like are disclosed in greater detail in the above-referenced Barrett et al. patent.

The compression cone 60 is carried by a cone supporting plate 80. The compression cone plate 80 is reciprocally mounted beneath the bucky grid. A track for the cone plate 80 is provided by the grid retainers 74, 75, a pair of compression plate retainers 81, 82 and a pair of compression plate spacers 83, 84 positioned respectively between the retainers 74, 81 and 75, 82. The various spacers and retainers are secured to the tap bars 63, 64 by suitable screws. One such screw is shown in dotted lines at 86 in FIG. 6.

One of the outstanding features of the invention is the flexibility in attaching these accessories beneath the housing so that the patient-to-film distance is controlled only by the accessories attached. To accomplish this, any appropriate combination of the tap bar and the spacers and the retainers may be used for the selected accessories. Normally, if any accessories at all are required, a phototimer will be included. Accordingly, the typical arrangement will include the tap bars 63, 64. If no oscillating grid is employed but a compression cone is used, the spacers 83, 84 and retainers 81, 82 will be secured directly to the tap bar. If a combination of a grid and phototiming is desired, obviously the compression cone spacers and retainers may be omitted. If only a compression cone is required the tap bars, the compression cone spacers and retainers may be employed. In that event, thinner tap bars may be employed, and in fact shim-like devices are used with the retainers 81, 82 being secured by screws corresponding to 66 through the lower wall 65 of the spot filmer 15. Similarly, the grid alone may be used. In that event, the standard tap bars 63, 64 are preferably used because of the positioning of the reciprocating rod 79 and actuating mechanism. Since a reciprocating grid would seldom if ever be used without accompanying phototiming, because both are accessories which contribute to good radiographs, it is not necessary to provide for adjustable positioning of the reciprocating bar 79 although obviously this can simply be accomplished by appropriate shimming of the reciprocating mechanism and the like.

Accordingly, for the first time a structure is provided in which the patient-to-film distance is wholly within the province of the purchaser of the spot filmer. A contributing factor to this achievement is the positioning of a lead apron track 85 perimetally of the spot filmer housing so that the track when combined with the described retainer and spacer construction is not a limiting factor on patient-to-film distance even when no accessories are attached to the spot filmer housing.

5

The compression cone plate 80 is reciprocally movable in the track defined by the spacers 83, 84 and retainers 81, 82 from a rearward storage position shown in FIG. 3 to a forward operating position shown in FIGS. 4 and 5. A spring-biased arm 90 is carried by the plate 80. The arm 90 serves as a handle by which the operator may pull the compression cone forward or push it rearwardly of the spot filmer. When the compression cone is in its operating position, the position of FIG. 4, the arm 90 snaps into an arm-retaining notch 91, FIG. 3, thus latching the cone plate 80 in its operating position.

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, the improved construction comprising:

- (a) a housing structure including a lower wall;
- (b) a cassette tray within the housing and movable to selected exposure positions therein;
- (c) spot filmer accessory structures secured to the spot filmer on the side of the lower wall opposite said cassette tray, said accessory structures including spacer and guide members secured to the lower wall to define a track for one such accessory;
- (d) a lead rubber apron track secured to and forming a part of said spot filmer perimetally of said acces-

6

sory tracks and positioned with its lower surfaces substantially flush with the lower wall of the spot filmer housing whereby said accessory structures determine the space between an object being X-rayed and said tray and said apron track is between said tray and a plane located by surfaces of said spacer and guide members furthest from said spot filmer lower wall.

2. The spot filmer of claim 1 wherein the accessory structures include a phototimer paddle.

3. The spot filmer of claim 2 wherein the accessory structures include a compression cone.

4. The spot filmer of claim 2 wherein the accessory structures include a reciprocable grid.

5. The spot filmer of claim 1 wherein said tray includes a grid forming a portion of the base thereof.

References Cited

UNITED STATES PATENTS

2,749,445	6/1956	Stava et al.	250—66
3,207,899	9/1965	Leishman	250—65 X
3,248,542	4/1966	Nixon.	

RALPH G. NILSON, Primary Examiner

A. L. BIRCH, Assistant Examiner

U.S. Cl. X.R.

250—65, 66, 105, 108