Dec. 17, 1957 H. S. AKERS 2,817,020

X-RAY CASSETTE

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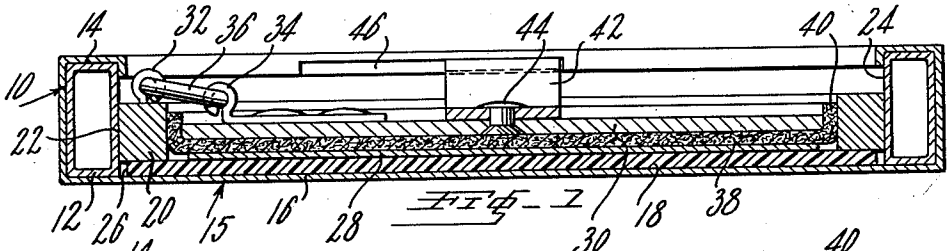


FIG. 1

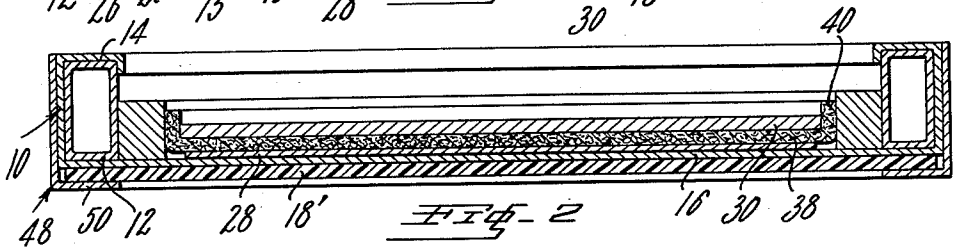


FIG. 2

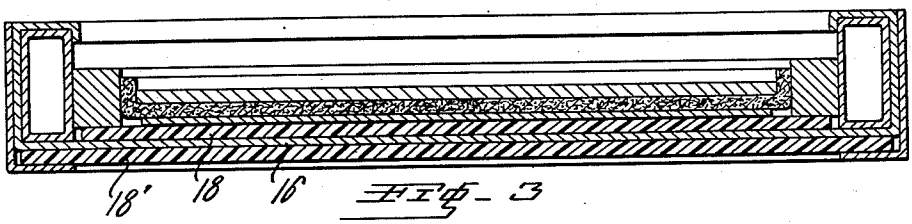


FIG. 3

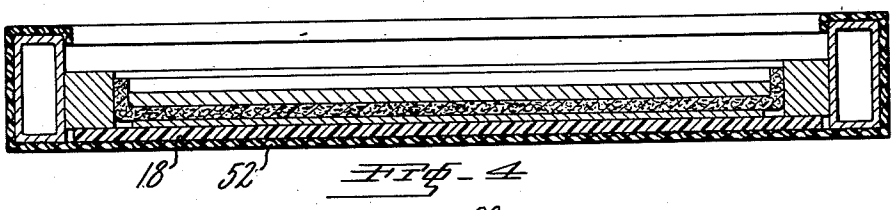


FIG. 4

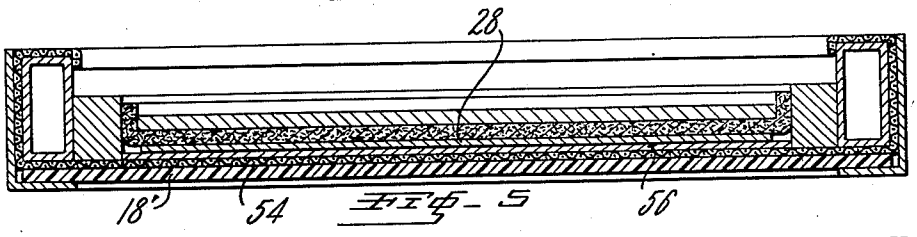


FIG. 5

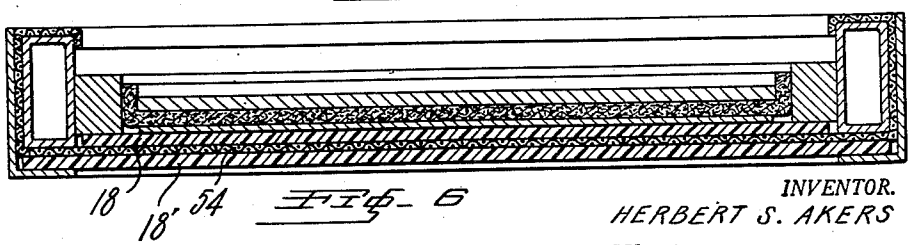


FIG. 6

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X-RAY CASSETTE

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17 Claims. (Cl. 250—68)

The present invention relates to holders for light-sensitive films and more particularly to an X-ray cassette for the production of radiographs.

Various types of holders have been employed for supporting photographic plates in a light-tight manner for subsequent exposure to X-rays. A number of these known constructions embody a front or tube-side plate of a readily deformable, X-ray pervious material superposed over the light-sensitive film. Under the normal loads encountered during handling and processing of radiographs, the tube-side plate often bows or sags, especially when a relatively heavy object is supported on the cassette. This bowing or sagging becomes still more pronounced when the size of the cassette is increased to accommodate larger objects, as for example, a major portion of the body of a patient.

As a result of this deformation, the contact pressure over the photographic plate is caused to vary with consequent uneven exposure of the radiograph. The risk of erratic variations in contact pressure is further increased with holders fabricated of material which may be permanently deformed, dented or warped. One such material is aluminum which is dented when impacted, and another material commonly used is Bakelite which has a tendency to warp with changes in ambient temperature and pressure. Accordingly, as an incident to normal handling and processing of photographic plates with known cassettes, the resultant radiographs often lack detail, yield images having a blurred or diffused appearance, and include regions of increased or decreased densities.

Accordingly, it is an object of the present invention to provide a novel holder for photographic plates which obviates some or all of the foregoing difficulties.

It is another object of the present invention to provide an X-ray cassette which will not be temporarily or permanently deformed under impacts and loads encountered during exposure and processing of photographic plates.

It is a further object of the present invention to provide an X-ray cassette capable of minimizing variations in contact pressure with the photographic plate, yet of a construction compatible with the requirements of lightness, compactness, and perviousness to X-rays.

The foregoing and other objects will become apparent from the following brief description of an illustrative embodiment particularly advantageous for producing uniformly exposed radiographs having good definition. Certain objects are attained according to this embodiment by the provision of a novel front or tube-side member for a film holder pervious to X-rays and constructed to withstand impacting and loading without appreciable deformation. The front member includes a relatively thin reinforcing member drawn taut and arranged substantially in a single plane, and one or more face plates substantially coextensive with the reinforcing member and supported in contact therewith.

In accordance with a further aspect of the present invention, an appreciable reduction in scattered radiation is

brought about in a manner consistent with the requirements of rigidity and compactness. This is accomplished by utilizing a foraminous reinforcing member capable of absorbing scattered or secondary radiation and of permitting the passage of a relatively great amount of direct primary radiation.

The above objects and brief description will be best understood by reference to the following detailed description when taken in conjunction with the drawing, wherein:

Fig. 1 is a transverse sectional view showing a cassette constructed in accordance with the principles of the present invention and including an interiorly disposed face plate;

Fig. 2 is a transverse sectional view showing a modified cassette including an exteriorly disposed face plate;

Fig. 3 is a transverse sectional view showing a further modified cassette including interiorly and exteriorly disposed face plates;

Fig. 4 is a transverse sectional view showing a still further cassette constructed in accordance with the principles of the present invention and particularly advantageous for reducing secondary radiation;

Fig. 5 is a transverse sectional view showing a modified cassette somewhat similar to the illustrative construction of Fig. 4 and embodying an exteriorly disposed face plate; and,

Fig. 6 is a transverse sectional view showing a further modified cassette including interiorly and exteriorly disposed face plates.

Referring now more particularly to the drawings, there is shown in Figs. 1 to 3 several illustrative forms of the exceptionally rigid and compact cassettes contemplated by the present invention. Each of these constructions embodies a tube-side plate or front member which is a composite of a taut reinforcing member fabricated of aluminum or a suitable alloy such as duraluminum and a protective face plate arranged in abutment with the reinforcing member and preferably fabricated of a phenolic material, such as Bakelite. This composite formation of the tube-side or front member of the cassette provides for the requisite rigidity, perviousness to X-rays, and strength to withstand relatively large loads and impacts.

Specific reference will now be made to Fig. 1 wherein there is shown a cassette embodying a composite tube-side member **15** constructed in accordance with principles of the present invention. Certain details of the cassette have been eliminated for the sake of clarity and simplicity. The cassette includes a substantially rectangular main frame **10** having end flanges **12**, **14** arranged in two spaced apart planes. Extending across the end flange **12** is a reinforcing member **16** which is drawn taut against end flange **12** and clinched about the frame **10** in accordance with principles and practices well understood, per se.

The reinforcing member **16** comprises a thin sheet of commercial aluminum, or of any light metal alloy having the requisite strength and ductility, such as duraluminum. The sheet may be readily supported with a major portion thereof in a single plane to form a suitable X-ray pervious rest for the object.

Arranged immediately behind and substantially coextensive with the reinforcing member **16** is a protective face plate **18**, preferably fabricated of Bakelite.

The face plate **18** is supported in abutment with the taut reinforcing member **16** by means of a rectangular locking bar **20** having an outer periphery 22 substantially complementary to the inner periphery 24 of the main frame **10**. The lock bar or rim may be secured in place by screws or the like, not shown, and serves to maintain the face plate **18** in direct contact with the reinforcing member **16**.

As clearly illustrated, the outer margin 26 of the face plate 18 terminates short of the inner periphery 24 of the main frame 10 whereby the face plate 18 is free to expand and contract due to variations in ambient temperature and pressure. It is to be noted, however, that the lock bar 20 bears against the face plate 18 of the tube-side member 15 with sufficient force to maintain the plate 18 in position.

Any suitable structure may be employed for maintaining the photographic plate or film 28 to be exposed in uniform contact with the composite tube-side member 15. Although the photographic plate 28 is illustrated directly in abutment with the face plate 18 of the tube-side member 15, it is apparent that one or more intensifying screens may be interposed therebetween.

The illustrative structure for maintaining the light-sensitive film 28 in place has been shown as a backing or table-side plate 30 which is pivoted on the lock bar 22 by means of the eyes 32, 34 and the interconnecting linkage 36. Secured on the inner face of the backing plate 30 is a light seal 38 having its marginal edges 40 turned upwardly and interposed between the lock bar 22 and the backing plate 30. The light seal may take the form of felt padding or sponge rubber and serves to support the film 28 in a light-tight manner and in contact with the tube-side member 15.

In order to removably clamp the backing plate 30 in its superposed position relative to the film 28, one or more resilient clamping fingers 42 are pivoted by studs 44 on the backing plate 30. The opposite extremities of the clamping fingers 44 are extensible into suitable finger-receiving slots 46 formed on the main frame 10 upon pivotal movement of the clamping fingers to a longitudinally extending position. The slots 46 are of a length sufficient to permit the opposite extremities of the clamping fingers 42 to be pivoted free from the main frame 10 to permit the backing plate 30 to be swung about its pivotal connection for insertion and removal of the photographic plates.

In Fig. 2 there is shown a modification of the cassette of Fig. 1 wherein a face plate 18' is supported exteriorly of the taut reinforcing member 16. In order to effect this rearrangement of the superposed components forming the composite tube-side front member 15, it is necessary to employ an auxiliary frame 48 which is substantially complementary to the frame 10 and is secured thereabout and provides additional support for the clinched marginal portions of the reinforcing member 16. The auxiliary frame 48 includes an inturned flange 50 spaced forwardly of the reinforcing member 16 and cooperating therewith to define a channelway for the face plate 18'. The face plate 18' is supported to permit contraction and expansion with temperature variations and is rigidly mounted by the bearing contact with the flange 50 and the underlying reinforcing member 16.

In Fig. 3 there is shown a further modified cassette in which the reinforcing member 16 is sandwiched between the inner and outer face plates 18, 18', respectively, supported as shown in Figs. 1 and 2.

Still further variations of the relatively thin composite tube-side members illustrated in Figs. 1 to 3 may be necessary to obtain the requisite strength and rigidity without resorting to bulky and cumbersome structures.

In each of the illustrative forms, the various superposed components are comparatively thin and their overall thickness does not result in too great a depth of material for easy penetration by the X-rays. However, in each of the forms it is possible to incorporate the desired resistance to impact and loading advantageous in producing exceptionally good radiographs.

Referring now to Figs. 4 to 6, there are shown cassettes incorporating the load and impact resistant construction of Figs. 1 to 3 and further constructed to substantially reduce back scatter or secondary radiation. This is accomplished by replacing the thin, continuous reinforcing sheet 16 with a foraminous member 52 of a material capable of absorbing a portion of the scattered or secondary radiation.

Among the materials highly suitable for this purpose are copper, bronze or alloy screening capable of absorbing secondary or scattered radiation. The mesh of the foraminous member 52 is selected to assure the requisite penetration of the direct or primary rays and to further avoid the production of an image of the screen proper on the exposed radiograph.

In Fig. 4, there is shown a screen 52 which has replaced the reinforcing member 16 of Fig. 1 and serves the dual purpose of imparting rigidity to the composite front member 15 of the cassette and reducing the deleterious effect of back scatter. Since the remaining components of the cassette have not been altered and are designated by corresponding reference numerals in Figs. 1 to 3, further description is dispensed with as superfluous. Preferably, and in order to provide a smooth and uninterrupted surface upon which to rest the object being radiographed, the screen 52 is imbedded in any suitable X-ray pervious plastic.

In Fig. 5, there is shown a modification of the cassette of Fig. 4 which is somewhat analogous to the structure of Fig. 2 in that the face plate 18' is arranged exteriorly of the cassette and in position to serve as the object rest, the reinforcing member 16 being replaced by a screen 54 drawn taut and clinched over the main frame 10. In this embodiment one or more intensifying screens 56 maintain the screen 54 out of direct contact with the photographic plate 28.

Referring now to Fig. 6, there is shown a still further modification of the cassette of Fig. 4, this arrangement being somewhat similar to the structure of Fig. 3. Specifically, the foraminous member or screen 54 is clinched over the frame in the manner previously described and sandwiched between an inner face plate 18 and an outer face plate 18'. Once again both face plates 18, 18' are supported in a manner permitting expansion and contraction to avoid warping and distorting as temperature and pressure vary.

From the foregoing it can be seen that cassettes constructed in accordance with the principles of the present invention are exceptionally rigid and capable of withstanding large loads or sharp impacts. Even when the size of the cassette is increased to accommodate larger objects, the problem of eliminating bothersome bulging or sagging and the consequent blurring and diffusion of the radiographs is not made insurmountable, since a composite front or tube-side member may be provided embodying an exceptionally taut reinforcing member or members with superposed face plates. Accordingly, it is possible to obtain exceptionally good radiographs having well defined images without being limited in respect to the size of the radiographs. Further, all of the aforementioned advantages may be arrived at by structures additionally capable of eliminating a portion of the secondary or back scatter radiation. This may be accomplished in the embodiments illustrated in Figs. 4 to 6 by the dual function foraminous member 54 and in the embodiments illustrated in Figs. 1 to 3 by placing a screen capable of absorbing secondary radiation between the superposed components.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

What I claim is:

1. In an X-ray cassette, the combination with a film holder, of a front member for said film holder pervious

to X-rays and constructed to withstand impacting and loading, said front member comprising a relatively thin reinforcing member on said film holder, and a face plate substantially coextensive with said reinforcing member and fixed in abutting relation therewith.

2. In an X-ray cassette, the combination with a film holder having a supporting frame, of a light-impervious front member for said film holder readily penetrable by X-rays and capable of withstanding impacting and loading, said front member including a relatively thin reinforcing member drawn taut on said supporting frame and fixedly secured thereon, and a face plate substantially coextensive with said reinforcing member and secured on said supporting frame in abutting relation with said reinforcing member.

3. In an X-ray cassette, a front member readily penetrable by X-rays and capable of withstanding loading and impacting without appreciable deformation, said front member comprising a reinforcing member supported with a major part thereof rendered taut and arranged in a plane, and a face plate arranged substantially coextensive with said reinforcing member and secured in confronting and abutting relation with said reinforcing member.

4. In an X-ray cassette, the improvement consisting of a tube-side member pervious to X-rays and constructed to withstand impacting and loading, said tube side member comprising a relatively thin reinforcing member of ductile material rendered taut and arranged in a plane, and a face plate substantially coextensive with said reinforcing member and secured in abutment therewith.

5. In an X-ray cassette, the improvement consisting of a tube-side member pervious to X-rays and including a relatively thin sheet of aluminum rendered taut, and a face plate of phenolic material coextensive with and laterally constrained in abutment against said relatively thin sheet.

6. In a cassette for exposing a light sensitive film to an X-ray source, the improvement consisting of a tube-side member pervious to X-rays and including a screen of X-ray absorbing material, said screen being of a mesh sufficient to pass a major portion of direct radiation from said X-ray source, and a face plate of X-ray pervious material substantially coextensive with said screen and supported in abutment therewith.

7. In an X-ray cassette adapted to be exposed to a source of X-rays, the improvement consisting of a tube-side member including a foraminous member rendered taut and arranged in a single plane, and a face plate pervious to radiation from said source arranged substantially coextensive with said foraminous member and supported in abutment therewith.

8. An X-ray cassette including a main frame, a tube-side member pervious to X-rays and constructed to withstanding loading, said tube-side member comprising a relatively thin reinforcing member rendered taut on said main frame and a face plate substantially coextensive with and abutting against said reinforcing member, and means operatively connected to said main frame and bearing against said face plate for preventing the latter from being laterally displaced from abutment with said reinforcing member and permitting said face plate to expand and contact with variations of ambient temperature.

9. An X-ray cassette according to claim 8, wherein said reinforcing member is fabricated of a relatively ductile sheet of a light metal alloy pervious to X-rays.

10. An X-ray cassette according to claim 8, wherein

said reinforcing member is a relatively ductile screen of a mesh selected to pass a major portion of direct radiation emanating from an X-ray source, said screen being fabricated from a material capable of absorbing secondary radiation.

11. An X-ray cassette according to claim 10, wherein said face plate is fabricated of a phenolic material having a uniform thickness.

12. In a cassette adapted to be exposed to radiation from an X-ray source, a tube-side member including a screen of a material capable of absorbing secondary radiation, and a face plate of a material pervious to radiation from said X-ray source and substantially coextensive with said screen.

13. In a cassette adapted to be exposed to radiation from an X-ray source, a tube-side member including a screen of a material capable of absorbing secondary radiation, a face plate of a material pervious to radiation from said X-ray source and substantially coextensive with said screen, and means operative to render said screen taut and supporting said screen in a single plane.

14. In an X-ray cassette, a tube-side member pervious to X-rays and capable of withstanding impact and loading, said tube-side member comprising a taut reinforcing member of ductile material, a face plate substantially coextensive with and abutting said reinforcing member, and marginal supporting means for said face plate constraining said face plate against lateral displacement from abutment with said reinforcing member.

15. In an X-ray cassette, a tube-side member pervious to X-rays and capable of withstanding impact and loading, said tube-side member comprising a taut reinforcing member of ductile material, a face plate substantially coextensive with and abutting said reinforcing member, and marginal supporting means for said face plate constraining said face plate against lateral displacement from abutment with said reinforcing member, said marginal supporting means being arranged to define a clearance space around said face plate permitting said face plate to expand and contract with variations in ambient temperature.

16. For use with an X-ray cassette, a tube-side member pervious to X-rays including a relatively thin reinforcing member rendered taut and in a single plane, and a face plate of phenolic material coextensive with and laterally constrained in abutment with said reinforcing member.

17. For use with an X-ray cassette, a tube-side member pervious to X-rays including a screen of X-ray absorbing material rendered taut and arranged in a single plane, and a face plate pervious to X-ray radiation arranged substantially coextensive with and in abutment against said screen.

References Cited in the file of this patent

UNITED STATES PATENTS

1,213,208	Kelley	Jan. 23, 1917
1,550,499	Buck	Aug. 18, 1925
1,662,860	Leslie	Mar. 20, 1928
1,909,312	Page	May 16, 1933
1,950,035	Morrison	Mar. 6, 1934
2,003,254	Drexel	May 28, 1935
2,247,451	Rawls	July 1, 1941
2,384,500	Stoll	Sept. 11, 1945
2,403,077	Hershberger	July 2, 1946
2,666,855	Gacki	Jan. 19, 1954