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CASSETTE FOR HIGH SPEED HALIDE X-RAY INTENSIFYING SCREENS

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FIG. 1

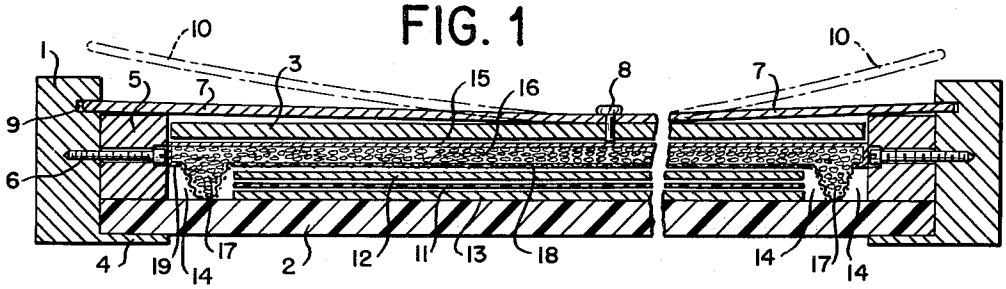


FIG. 2

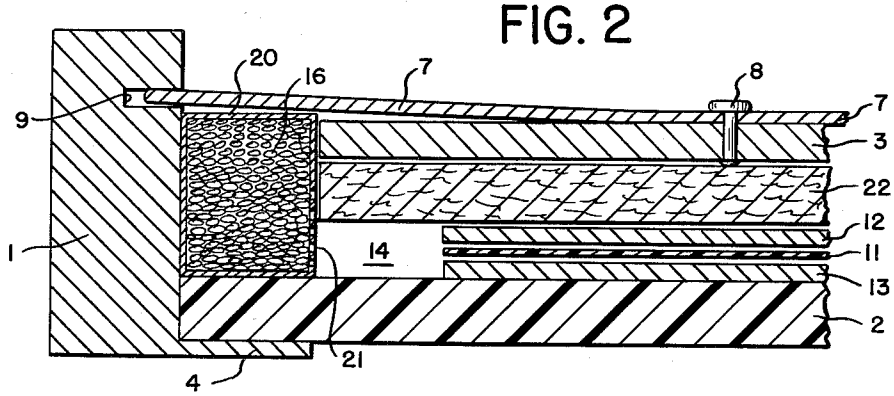


FIG. 3

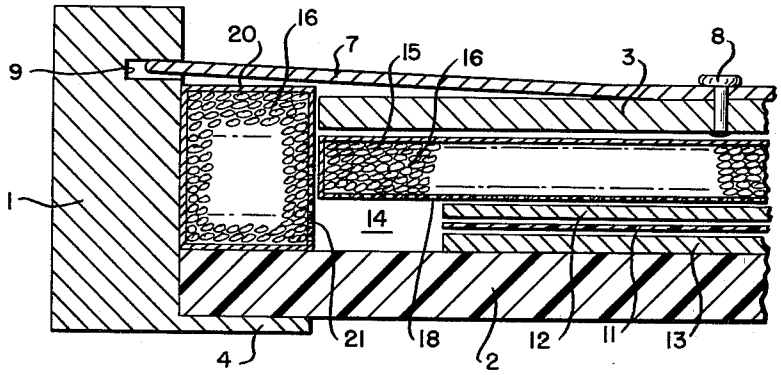
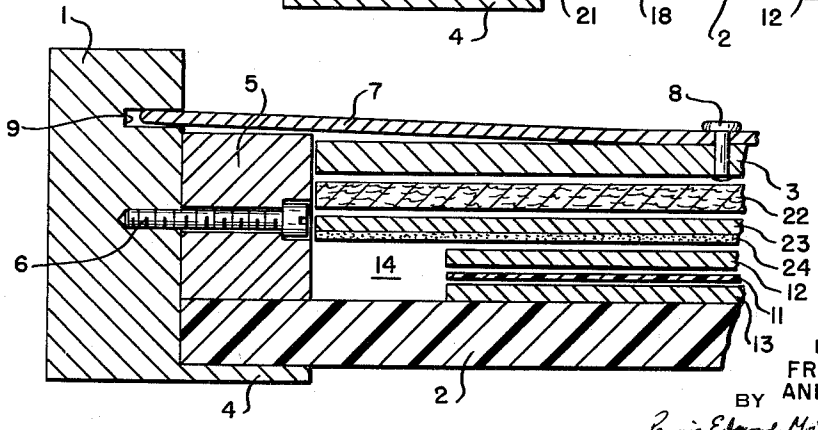


FIG. 4



INVENTORS
FRANK J. MASI
ANDREW F. MILLETT
BY
Pennie, Edmonds, Morton, Taylor & Adams
ATTORNEYS

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CASSETTE FOR HIGH SPEED HALIDE X-RAY INTENSIFYING SCREENS

Frank J. Masi and Andrew F. Millett, Morristown, N.J., assignors to United States Radium Corporation, Morristown, N.J., a corporation of Delaware

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10 Claims. (Cl. 250—68)

This invention relates to improvements in X-ray photography and to a device suitable for extending the useful life of high speed halide X-ray intensifying screens. More particularly, the present invention relates to a cassette of specific construction for holding the high speed halide X-ray intensifying screens and X-ray sensitive photographic film used in X-ray photography in such a manner whereby the screens are protected against the ambient humidity and the life of the screens is thereby extended.

The halide phosphors used in the preparation of these very high speed X-ray intensifying screens are extremely hygroscopic and consequently they are sensitive to atmospheric moisture. Exposure of the halide X-ray intensifying screen to relative humidities above 35% at 90° F., for example, causes rapid deterioration of the screen. Under these conditions water vapor gradually penetrates the relatively thin plastic protective coating of the screen and is adsorbed by the halide. When sufficient water has passed therethrough, the halide begins to dissolve and exert local pressure upon the protective coat until small blisters or large irregularly shaped swollen areas are formed. This penetration of water vapor cannot be retarded by increasing the thickness of the protective coating because the thickness is restricted preferably to the order of 0.001 in. or less to avoid interference with the radiographic detail of the screens. Moreover, materials in this thickness range, having exceedingly low moisture vapor transmission rates and possessing in addition other chemical and physical properties such as flexibility, abrasion resistance, low light absorption in the region of spectral emission of the phosphors, solvent resistance and stain resistance to X-ray developer solution, all of which properties are necessary for the efficient performance of halide X-ray intensifying screens, are unknown.

When in use, X-ray intensifying screens are customarily positioned on both sides of an X-ray sensitive photographic film and the resulting assembly is inserted into a box-like structure called a cassette. The cassette serves a double purpose of preventing stray light from fogging the photographic film and of ensuring good contact between the intensifying screens and the fillm. With ordinary X-ray intensifying screens which do not contain hygroscopic phosphors, it is not necessary that the cassette be completely airtight.

With high speed halide intensifying screens having extraordinary hygroscopicity, a new and further condition of limiting the humidity in the space surrounding the intensifying screens is imposed upon the system in order to prolong the benefits to be derived from the use of such intensifying screens.

Presently, high speed halide intensifying screens when placed within conventional cassettes have a very short useful life. For example, under conditions where the relative humidity is in the neighborhood of 90% and the temperature is approximately 90° F., these screens become deteriorated after one day. The life of these screens can be extended somewhat by air conditioning the environment in which they are to be used; however, such air conditioning is an effective control of the temperature

only and is not an effective control of the humidity. One effective way of controlling the humidity in the space surrounding the intensifying screens is by rigid control of humidity throughout the environment in which the normal cassette containing the halide intensifying screens is used; however, very few users of these screens have the facilities to control the environmental humidity to the degree necessary for obtaining optimum results from the halide intensifying screens since creating such environmental conditions as, for example, a 35% relative humidity over a temperature range up to and including 90° F. and maintaining these conditions requires the use of some relatively expensive equipment.

A second way of effectively controlling the humidity in the space surrounding the high speed halide intensifying screens so as to prolong the life of these screens is by internal dehumidification of the cassette; and it is to this second method that the present invention is directed.

According to the teachings of the present invention, a cassette is constructed and a suitable desiccant is placed therein in a particular manner whereby the humidity in the immediate vicinity of the intensifying screens may be controlled and limited.

Generally, the desiccant is placed within the cassette around the edges of the high-speed halide screens. Upon closing the cassette, any air that might be left between the screens and X-ray film is forced through this desiccant by pressure exerted on the screen-film assembly. Furthermore, any air that might tend to leak into the closed cassette is directed through the desiccant so that it will be dehumidified before reaching the screen-film assembly.

A fuller understanding of the invention will be obtained by a reading of the following detailed description with reference being made to the drawings of which:

FIG. 1 is a side elevation of the cassette of the present invention in cross-section;

FIG. 2 is a partial side elevation of a modified form of the invention in cross-section;

FIG. 3 is a view similar to that of FIG. 2 of another modified form of the invention; and

FIG. 4 is a view similar to that of FIG. 2 of still another modified form of the invention.

The cassette of the present invention is generally rectangular in shape and as shown in FIG. 1 of the drawings, it comprises an outer frame **1**, a front plate **2**, and enclosing back plate **3**. The frame **1**, which may be made of metal or the like, is provided with a lip portion **4** extending completely around the frame and extending in a direction toward the center of the cassette. This lip portion provides a support upon which the front plate **2** is positioned, and in order that the front plate will not interfere with the photographing operation, it is made of Bakelite or the like. Disposed within the outer frame on all sides thereof is a subframe **5**. This subframe holds the front plate **2** in place and may be secured to the outer frame as by means of screws **6**. The back plate of the cassette may be provided with a plurality of locking arms, one of which is shown at **7** rotatably secured thereon as at **8**. Cooperating with these locking arms are slots **9** formed on opposite inner faces of the frame **1**. The arms may be of suitable spring metal so that in their unrestrained state they will be disposed in the position as shown by the dotted lines **10**. In order to lock the back plate within the framework, the arms are pressed down to the position shown at **7** and rotated about the point **8** until the ends become engaged within the slots **9**. In constructing the cassette, the closure plate **3** is made to fit as accurately within the subframe **5** as possible; however, in order to

provide for easy removal of the plate 3, slight air spaces may result between it and the subframe.

To prepare the cassette for use, an X-ray sensitive photographic film 11 is positioned between a pair of high speed halide intensifying screens 12 and 13 and the composite screen-film assembly is centered against the front 2 of the cassette with the edges thereof facing the inner periphery of the subframe 5. As shown in FIG. 1, the photographic film and intensifying screens are spaced from the subframe 5 so as to provide an open area 14 completely encircling the screen-film assembly.

According to the teachings of the present invention, dehumidifying means are provided within the cassette for producing a moisture exchange zone along the edges of the intensifying screens whereby the atmosphere in the vicinity of the edges of these screens is dehumidified by exchanging the air originally between the film and intensifying screens with dry air within the dehumidifying means. Furthermore, any air from the ambient atmosphere leaking into the cassette through the air spaces between the back closure plate 3 and subframe 5 will have to pass through the dehumidifying means so as to become dehydrated before reaching the edges of the screen.

As shown in FIG. 1, this dehumidifying means comprises a shallow box-like container 15 having the same length and width dimensions as the closure plate 3. Within the box-like container is disposed a suitable desiccant 16 such as, for example, silica gell, calcium sulfate, alumina or calcium chloride. The desiccant is formed with a ridge portion 17 which extends completely around its borders. In order to hold the desiccant within the container, a perforated flexible material or screen 18 is placed over the desiccant and secured to the container along the open edges as at 19. The container 15 may be fitted with an opening and removable seal so that desiccant which has become spent may be removed and replaced by fresh desiccant.

In assembling the cassette, the desiccant box is placed on top of the back X-ray intensifying screen 12 with its perforated surface facing into the cassette and with the ridge portion 17 in contact with the front plate 2 so as to completely encircle the screen-film assembly. Next, the closure plate 3 is locked into position. Although for clarity, the parts of the cassette are shown as spaced apart in the drawings, it is to be understood that in each modification, the various parts are all in pressure contact with each other. This pressure contact forces any air out from between the intensifying screens and film and into the space 14 and since the desiccant in the construction shown in FIG. 1 drapes itself over the edges of the screen-film assembly, an effective path for exchange of moist air inside the cassette with dry air inside the desiccant box is created whereby the atmosphere in the vicinity of the edges of the screens is dehumidified.

As previously stated, it is also possible for room air to exchange with the air in the space 14 in the closed cassette and to carry moisture with it when the ambient humidity is high because there are normally small air spaces between the closure plate 3 and the subframe 5. Any air entering in this manner, however, will have to pass through the desiccant which is in pressure contact with the front plate and will consequently become dehydrated before reaching the edges of the screens.

With reference to FIG. 2 of the drawings in which a modified form of the invention is shown, the subframe 5 shown in FIG. 1 is replaced by a hollow desiccant container 20 having a perforated side portion 21 facing the edges of the screen-film assembly 11, 12, 13. In this form of the invention, the entire container 20 is filled with desiccant and the desiccant container 15 is replaced by a felt liner 22 which becomes part of the back closure means and may therefore be trimmed to fit the back plate 3. When the intensifying screens are assembled and the screen-film assembly centered upon the front plate of the cassette in a manner as described with respect to the construction shown in FIG. 1 and the back closure means including the felt liner is locked into place, a space 14 completely surrounding the screen-film assembly is created and any air squeezed out from between the screen and film assembly as well as any air that enters from the room around the edges of the closure means between the back plate 3 and container 20 will be dehydrated by exchanging with the dry air contained within the desiccant. The container 20 shown in FIG. 2 may be removably positioned in the outer frame 1 so that the spent desiccant may be replaced when necessary.

Furthermore, since the space 14 is not taken up by the desiccant, screen-film assemblies extending to the inner periphery of container 20 may be used. In this case when the back of the cassette is closed, practically all the air will be driven out of the cassette and any air seeping into the casette through the spaces between the closure means and the container 20 will be in very close proximity to the perforated portion 21. During the exchange of moist air within the cassette with dry air within the desiccant container, moisture will be adsorbed by the desiccant and the interior of the cassette will be dehumidified.

The structure shown in FIG. 3 of the drawings includes a combination of the teachings shown in FIGS. 1 and 2 and brings together in a single cassette the removable hollow container 20 filled with desiccant 16 and having a perforated inner surface 21 and the shallow box-like structure 15 filled with desiccant having one surface covered by a mesh 18. In this manner, the desiccant may be disposed both under and around the edges of the screen-film assembly whereby the action of the desiccant may be enhanced. The desiccant containers are removable for regeneration or replenishment in order to maintain constant dehumidification in the space around the edges of the screens and film. The felt liner 22 of FIG. 2 is not necessary with this modification since the shallow desiccant box between the back intensifying screen 12 and the back plate 3 of the cassette serves to take up the space occupied by the felt liner.

It will be noted that with this modification as with that of FIG. 2, there is no desiccant disposed within the space 14 and thus, use of larger sized screen-film assemblies that may extend to the inner periphery of the hollow frame 20 is permitted.

The modification shown in FIG. 4 of the drawings is similar to that shown in FIG. 1 except that here the desiccant container has been replaced by a sheet of metal or other substrate 23 coated on one side with a suitable desiccant 24. The sheet of metal has a length and width such as to fit snugly into the cassette and is positioned with the coated surface 24 in contact with the rear screen 12. Between the sheet of metal and the back plate 3 is positioned a felt liner 22 similar to that shown in FIG. 2 which acts as part of the closure means for taking up the slack between the plate 3 and metal sheet 23 so that pressure will be exerted on the screen-film assembly when the back plate 3 is locked into position.

As with the forms of the invention previously described, a space 14 will be created and any mositure present in the air within this space, whether coming from between the screens during the closing of the cassette or from exchange with room air, will be adsorbed into the desiccant coating with consequent dehumidification of the air in that space. Finally it should be noted that the desiccant coated sheets 23 may be replaced with freshly regenerated coatings to keep the air within the cassette constantly dehumidified.

The above description sets forth various modifications of the present invention; however, it is to be understood that other changes in the particular construction of the cassette may be made without departing from the scope of the invention as set forth in the following claims.

We claim:

1. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) a frame for encompassing the edges of said screen-film assembly and having an open front and back,
(b) a plate secured to said frame across said front opening for holding said screen-film assembly within said frame,
(c) closure means removably secured to said frame across said back opening for enclosing said screen-film assembly in fixed position within said frame and in pressure contact with said plate and closure means, and
(d) a desiccant positioned within said frame forming a moisture exchange zone along the edges of said screen-film assembly whereby air disposed between the screens and film of the screen-film assembly and air leaking into said cassette from the ambient atmosphere will be exchanged with dry air contained within said desiccant.

2. A cassette as set forth in claim 1 wherein said desiccant is disposed between the edges of said screen-film assembly and the opposed inner periphery of said frame.

3. A cassette as set forth in claim 1 wherein said desiccant is disposed between said screen-film assembly and said closure means in pressure contact with one side of said screen-film assembly.

4. A cassette as set forth in claim 1 wherein said desiccant is disposed between the edges of said screen-film assembly and said frame and in pressure contact with the side of said assembly facing said closure means.

5. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) a frame for encompassing the edges of said screen-film assembly and having an open front and back,
(b) a first plate secured to said frame across said front opening for holding said screen-film assembly within said frame with the edges spaced therefrom,
(c) a desiccant container positioned within said frame and having a perforated side facing said screen-film assembly,
(d) a desiccant disposed within said container and having a ridge portion extending away from the open side of said container and surrounding the edges of said screen-film assembly, and
(e) a second plate secured to said frame across said back opening for pressing the desiccant into pressure contact with said screen-film assembly and the ridge portion thereof into pressure contact with said first plate.

6. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) an open frame having a front and back,
(b) a desiccant container positioned along the inner periphery of said frame and having a perforated side portion facing the center of said frame,
(c) a desiccant disposed within said container,
(d) a plate secured across said opening on the front of said frame and adapted to receive said screen-film assembly within said frame with the edges thereof facing the perforated portion of said desiccant container, and
(e) closure means removably secured at the back of said frame and extending across said opening for holding said screen-film assembly in pressure engagement within said frame.

7. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) an open frame having a front and back;
(b) a desiccant container positioned along the inner periphery of said frame and having a perforated side portion facing the center of said frame;
(c) a desiccant disposed within said container;
(d) a plate secured across said opening on the front of said frame and adapted to receive said screen-film assembly within said frame with the edges thereof facing the perforated portion of said desiccant container; and
(e) closure means removably secured at the back of said frame and extending across said opening for holding said screen-film assembly in pressure engagement within said frame, said closure member comprising:
(1) a plate removably secured to the back of said frame, and
(2) a felt liner positioned within said frame in superimposed relationship with respect to said screen-film assembly and extending across said opening.

8. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) an open frame having a front and back,
(b) a first desiccant container positioned along the inner periphery of said frame and having a perforated side portion facing the center of said frame,
(c) a second desiccant container positioned within said frame and having a perforated side facing into the opening of said frame from the back thereof,
(d) a desiccant disposed within each of said containers,
(e) a first plate secured across said opening on the front of said frame and adapted to receive said screen-film assembly within said frame with the edges thereof facing the perforated portion of said first desiccant container and one side thereof facing the perforated side of said second desiccant container, and
(f) a second plate removably secured to the back of said frame and extending across said opening for holding the desiccant in said second container in pressure engagement with said screen-film assembly.

9. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) an open frame having a front and back,
(b) a plate secured across said opening on the front of said frame receiving said screen-film assembly within said frame with the edges thereof facing the inner periphery of said frame,
(c) a metal sheet positioned within said frame in superimposed relationship with respect to said screen-film assembly and extending across said opening,
(d) a desiccant coating on said sheet facing said screen-film assembly, and
(e) closure means removably secured at the back of said frame and extending across said opening for holding said screen-film assembly in pressure engagement within said frame.

10. A cassette for extending the useful life of high speed halide X-ray intensifying screens of an X-ray screen-film assembly comprising:
(a) an open frame having a front and back;
(b) a plate secured across said opening on the front of said frame receiving said screen-film assembly within said frame with the edges thereof facing the inner periphery of said frame;
(c) a metal sheet positioned within said frame in superimposed relationship with respect to said screen-film assembly and extending across said opening;
(d) a desiccant coating on said sheet facing said screen-film assembly; and
(e) closure means removably secured at the back of said frame and extending across said opening for holding said screen-film assembly in pressure engage-

ment within said frame, said closure means comprising:

(1) a plate removably secured to the back of said frame, and

(2) a felt liner positioned within said frame between said removable plate and said metal sheet and extending across said opening.

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RALPH G. NILSON, *Primary Examiner.*