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E. D. TILLYER

2,279,084

HEAT SCREEN FOR PROJECTION APPARATUS

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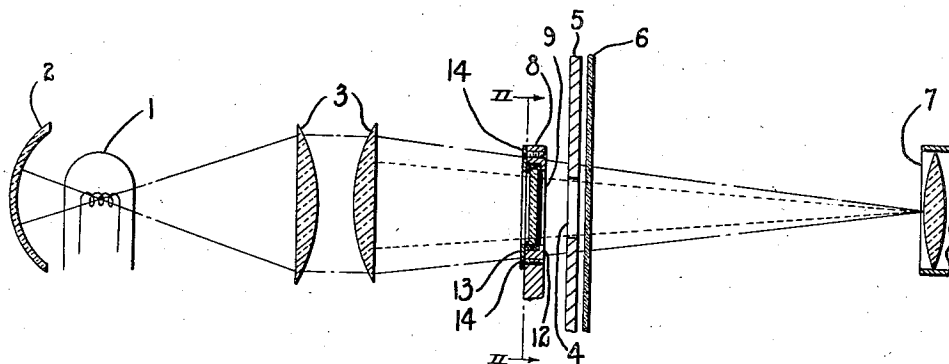


Fig. I

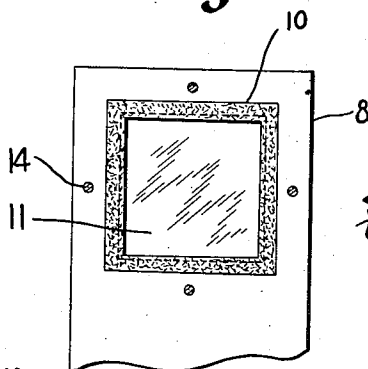


Fig. II

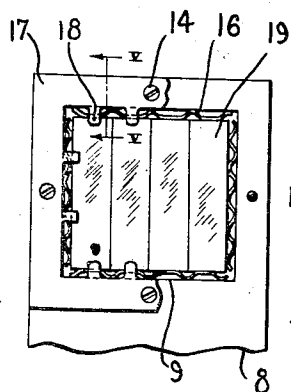


Fig. III

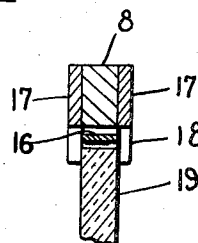


Fig. IV

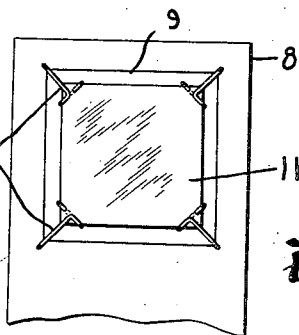


Fig. V

INVENTOR.

EDGAR D. TILLYER

BY

Harry H. Styll.

ATTORNEY.

UNITED STATES PATENT OFFICE

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HEAT SCREEN FOR PROJECTION
APPARATUS

Edgar D. Tillyer, Southbridge, Mass., assignor to
American Optical Company, Southbridge,
Mass., a voluntary association of Massachu-
setts

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2 Claims. (Cl. 88—24)

This invention relates to improvements in projection apparatus and has particular reference to improved means and methods of forming and supporting a heat screen for the protection of the film or slide used with such apparatus.

One of the principal objects of the invention is to provide a substantially colorless vitreous infra-red absorbing heat screen having high transmission of the visible rays and method of supporting the same so as to make it resistant to heat, shock and strain.

Another object of the invention is to provide improved means and methods of forming and supporting a heat screen so as to make it resistant to shock and strain by controlling its composition, mounting it in a resilient support and by heat insulating it from its holder.

Another object of the invention is to provide improved means and methods of forming and supporting a heat screen of vitreous material in such a manner as to make it possible to distribute the absorbed heat evenly throughout the area of said heat screen.

Another object of the invention is to provide a heat screen which is flexibly supported in its holder with said flexible support tending to retard the passage of heat from the heat screen to the holder.

Another object of the invention is to provide improved means and methods of forming and supporting a heat screen of vitreous material which will transmit a high percentage of the visible rays and reduce or eliminate the transmission of the invisible or infra-red heat rays, and which is resiliently supported on and substantially heat insulated from its holder.

Another object is to provide improved means and methods of forming and supporting a heat screen of the above character, which is substantially colorless and which is so supported as to substantially obviate the risk of cracking or breaking when acted upon by heat.

Another object is to provide means for supporting a heat retarding screen of vitreous material in such a manner that it will be relieved from the shock of heat or impact.

Another object is to provide a heat screen of the above character, which comprises a plurality of separate panels, or sections of vitreous material, which are adapted to move under the action of resilient means upon the application of heat or cold thereto.

Other objects and advantages of the invention should become apparent from the following

description, taken in connection with the accompanying drawing, and it will be apparent that many modifications and departures may be made from the specific features and methods disclosed herein without departing from the spirit of the invention, as expressed in the accompanying claims. I, therefore, do not wish to be limited to the specific details of construction, arrangement of parts, and methods shown and described as the preferred forms only have been given by way of illustration.

Referring to the drawing:

Fig. I is a diagrammatic, longitudinal cross sectional view through a projection apparatus, showing one arrangement and location of the device embodying the invention;

Fig. II is an enlarged view of the heat screen and support of applicant's invention, taken on lines II—II of Fig. I;

Fig. III is a view similar to that of Fig. II, showing an alternate supporting construction;

Fig. IV is a view similar to those of Fig. II and Fig. III in which the heat screen is made up of separate panels, which are so supported that they may move under the action of resilient means upon the application of heat or cold; and

Fig. V is a partial section of Fig. IV, taken on line V—V.

In the past, many types of heat screen devices have been devised for use with projection machines to obviate the danger of the action of the intense heat created by projectors upon the relatively combustible means, such as the film or slide, or the like used with such projectors. It was found that the best possible material for use in such a heat screen is a vitreous material which balances the desirable elements of greatest light transmission, greatest freedom from color, and greatest heat retardation properties.

Upon using this desirable material, however, it was found that the material was subjected to strain and breakage when heat was applied thereto. Such a disadvantage could easily prove very dangerous and expensive, due to replacement of broken heat screen and damaged film or slide, due to the heat acting thereon past the broken heat screen.

The present invention deals with means and methods of supporting the above-mentioned desirable heat screen material in a projector in such a manner as to obviate the dangerous possibilities of strain and breakage. Thus, applicant makes possible the safe and practical use of the most desirable heat screen material.

Referring more particularly to the drawing

wherein like characters of reference designate like parts throughout the several views, the device embodying the invention, as illustrated diagrammatically in Fig. 1, comprises a source of illumination 1, with a reflector 2 positioned so as to direct the light from the source of illumination 1, through the projector, as is common in the art. The beam of light from the lamp 1 and the reflector 2 passes through the condenser lenses 3 which direct it through an aperture 4 in a film guide 5, passes through the film 6 and enters the projection lens system 7.

The heat screen embodying applicant's invention is, in this particular instance, and for purposes of illustration, placed in the light beam between the film guide 5 and the condenser lenses 3. Its purpose is to allow the visible light to pass through and act on the film to produce the desired picture, and also to retard the heat generated by such strong illumination as is used in projectors of this sort, so that it will not have the opportunity to harmfully act upon the film 6, which is of a material which is readily destroyed by excessive heat.

Referring to Fig. II, of which a cross section is shown on the line II—II in Fig. I, applicant's invention, as illustrated for this particular instance, comprises a holder 8, which has an opening 9 therein, and a heat retarding lining material in said opening which is flexible and may be resilient, if so desired. This lining 10 has a very definite use, in that it tends to keep the heat which is built up in the heat retarding material 11 by the action of the beam of light thereon, from leaking off or being carried off by contact between the material 11 and the holder 8, through the support 10, so as to cause variations in temperature throughout the area of said heat retarding material 11, which may be considerable due to the fact that the edge portions of the heat retarding material 11, if in direct contact with the holder 8, would have means of direct conduction of its heat, which the central portions of the heat retarding material 11 would not have. With the heat retarding lining 10, which is flexible, inserted between the holder 8 and the heat retarding material 11, it will be seen that the heat built up in said heat retarding material 11 is substantially completely kept therein as far as conduction through the holder 8 is concerned. This means that the heat built up in the heat retarding material 11 is carried off by air currents, and by radiation through air, substantially uniformly throughout its area and on both sides. With this arrangement it will be seen that there will be no portions of the area of said heat retarding material 11 which are at a substantial variation in temperature with other portions of said material.

This is a very important point, due to the fact that the most desirable heat retarding material for use at 11 in projectors of this type has been found to be one which is balanced between the material providing the greatest transmission of the visible rays, the one which transmits all the colors substantially without color absorption, and the one which retards the greatest percentage of heat per unit area. Such a material, however, has been found to be subject to strain and breakage if the temperature is at any considerable variance at various portions of its area. It will, therefore, be seen that in order to use this desirable heat retarding material, some means must be provided for keeping the temperature of said material constant

throughout its area. Applicant's invention is directed to this purpose and is broadly accomplished by the insertion between the heat retarding material 11 and the holder 8, of a heat retarding flexible material 10, such as asbestos. It will be noted that the asbestos lining 10 lies within the opening 9 of the support 8 against a shoulder 12, and that the heat retarding material 11 is supported by said asbestos liner 10 within or overlying the opening 9, and that a cover plate 13 overlies the heat retarding member 11 and the asbestos liner 10, and is attached to the holder 3 by means of screws 14, or other suitable attaching means.

The heat retarding material 11 is preferably formed, in order to have the infra-red or heat absorbing properties and also the heat shock resisting properties which will render said screen or condensing lens resistant to cracking or breaking under the action of heat, of a vitreous composition whose analysis may be expressed as P_2O_5 —52 to 77%; material from the group consisting of CaO , BaO , SrO —0.1 to 12%; material from the group consisting of K_2O , Na_2O , Li_2O —0.1 to 10%; and material from the group consisting of Al_2O_3 , BeO and mixtures of Al_2O_3 and BeO —5 to 20%; $Fe_3(PO_4)_2 \cdot 8H_2O$ —1 to 10%, or by the use of a glass whose chemical analysis may be expressed as:

	Per cent
P_2O_5	73.40
Al_2O_3	10.89
FeO	2.04
MgO	4.74
BaO	3.42
B_2O_3	4.34
SiO_2	0.33
Na_2O	0.38

The material or glass resulting from the above compositions is reduced to a desired size and thickness and to the contour shape desired. This may be accomplished by surfacing the opposite sides of the material with a suitable abrasive such as emery, rouge, etc., for producing the surface texture desired. The heat screen may be reduced to the desired size by cutting and edging the said glass material by means and methods employed in the art of forming ophthalmic lenses. The screen thus formed may then be hardened to place the outer surfaces in compression and the interior in tension to render the glass material of said screen resistant to heat shock.

This may be accomplished by heating the glass material to a point just about at the softening point and for a predetermined time, depending upon its dimension, and then chilling it rapidly by an air jet, vapor jet, or by dropping the said heated material into a bath of oil, fused salts, or the like.

The amount of heat and time is so controlled as to avoid softening the screen to a point whereby its finished surfaces will flow and become distorted or the screen change its shape. This is of particular importance when one of the condensing lenses 2 is used as the screen, and is formed of the material having the infra-red absorbing characteristics, as the surface curvatures of said lens must be controlled and maintained in order to have the proper optical function.

After the hardening process has been completed, the opposed surfaces of the screen or condensing lens, as the case may be, may be

refinished slightly to insure against distortions or blemishes. This lens will have its outer surfaces in compression and its interior in tension, and will thereby be rendered resistant to heat shock.

It is particularly desirable that the glasses used in forming said heat screens be substantially free from silica and that they contain at least 60% of phosphorus, expressed as P_2O_5 , and that they contain an infra-red absorbing ingredient, such as iron in the ferrous condition. This produces a glass which will be relatively clear and transparent and which possesses the desirable infra-red absorbing characteristics.

The screen or lens formed of material whose analysis may be expressed as: P_2O_5 ; material from the group consisting of CaO , BaO , SrO ; material from the group consisting of K_2O , Na_2O , Li_2O ; material from the group consisting of Al_2O_3 , BeO , and mixtures of Al_2O_3 and BeO ; and $Fe_3(PO_4) \cdot 2.8H_2O$, will be substantially colorless and will have the desired infra-red absorbing characteristics. The lens or screen, therefore, while absorbing the infra-red or heat rays, will have an exceptionally high transmission of the visible rays. Most prior art heat screens of this character had from 40% to 50% transmission, while the screen embodying the invention, as formed of the glass described above, will have from 85% to 90% transmission. It is apparent, therefore, that the change in intensity of the light, as brought about by the heat screen embodying the invention, will be much less than that of the prior art heat screens mentioned above and will be substantially unnoticeable to the human eye.

The glass whose chemical analysis is expressed as P_2O_5 , Al_2O_3 , Fe_2O_3 , MgO , BaO , B_2O_3 , SiO_2 , and Na_2O , will have some color, but will transmit much more of the visible rays than most prior art heat screens.

The glasses disclosed herein are resistant to weathering, acids, and to discoloring, particularly when acted upon by radiation.

The gist of the invention, as herein described, is to provide a colorless heat screen which may be permanently mounted in the path of the projected light, between the light source and the film or slide, and which will have the desirable infra-red or heat absorbing characteristics with a high transmission of the visible rays, and which will be resistant to cracking or breaking when acted upon by heat, due to the fact that it is insulated from its holder by a flexible heat resistant material, such as asbestos. The colorless heat screen set forth above renders it possible to use such heat screens with a projection apparatus, utilizing commercially known Kodachrome slides, which embody a film having different colored pigments.

It is possible with applicant's colorless heat screen to permanently position the screen between the source of light and the colored film, as it does not materially change the intensity or color of said light. It, therefore, will have little, if any, effect on the projected colors as produced by the color film slide. This is a big advance over known prior art heat screens of this character, as most prior art screens so reduced the intensity of the light that it was not practical to permanently mount the said screens in the path of the projected light. Such prior art screens also greatly altered the color of the light.

It is to be understood that the coefficient of

expansion of applicant's glasses may be controlled to render the said glasses more resistant to heat. This may be accomplished by altering the percentages of the Al_2O_3 , BeO , etc., to obtain the results desired.

An alternate construction of applicant's invention is illustrated in Fig. III, in which the heat retarding material 11 is supported by its corners within or overlying the opening 9 of the holder 8. The heat screen 11 is supported by braces 15 each having one end embedded in the holder 8, and the other end formed to grasp a corner of the heat screen. These braces so support the heat screen in the holder 8 as to leave a space of air between the heat screen 11 and the holder 8 throughout the periphery of said heat screen. The braces 15 may be of wire or other suitable material and is preferably made slightly resilient, so as to take up any shock or strain which might cause the heat screen 11 to vibrate or expand or contract. In this alternate structure, it will be noted that there is ample air space between the heat screen and the support, so that direct conduction of heat from the heat screen to that support would be substantially negligible.

Another alternate construction embodying applicant's invention is shown in Fig. IV. In this construction the heat screen 11 is made up of a plurality of separate panels 19 of the desired heat screen material, with the panels arranged parallel to each other and being substantially rectangular, as shown. In the recess of the holder 8 is positioned a plurality of springs 16, which bear on the edges of the heat screen panels which are adjacent the edges of the opening 9 in the holder 8. It is to be noted that the contacts made by these springs on the heat screen and on the holder cover a relatively small portion of the edges of said panels and that there are air spaces between the panels and the holder 8 formed by the curvatures of the springs 16. It will be seen that any shock or strain caused by a blow, or expansion, or contraction which acts on the heat screen, as shown in this structure, will cause the panels to move under the action of said springs, so as to take up such shock or strain without breakage. This alternate construction is provided with a cover plate 17 which is designed to hold the heat screen panels and the springs 16 in position by means of tongues 18. This construction may have cover plates on both sides of the heat screen, as shown in Fig. V. This type of cover plate allows free circulation of air between the heat screen panels 19 and their holder 8, thus providing heat insulation between them.

Both of the alternate structures shown in Figs. III and IV are well heat insulated from their holders, due to the fact that they are surrounded by air spaces and come in contact with said supporting members only through the contact members or supporting members which contact a relatively small part of the area of said heat screen, thereby tending to keep the retarded heat of projection from being conducted to the holder 8, and in this manner, keeping the temperature of the heat screen uniform throughout its area, and thus preventing strain or breakage, due to sudden variations in the temperature of different portions of the heat screen.

It is to be understood that the cover plate 13 may be made so as to contact the heat screen, holder and other parts of the unit only at spaced points of an amount and positional distribution to properly retain the various parts of the unit

in desired position in order that a sufficient circulation of air may be obtained between the heat screen and holder and throughout the area of said heat screen. A section of such a cover plate is shown in Fig. V.

One of the important features of the invention is the provision of resilient or flexible supporting means for supporting the heat screen member in spaced, heat insulated relation with the holding member. It will be noted that such an arrangement provides means whereby the heat screen member may expand or contract without the danger of strain or breakage which would be present if the heat screen were held in a rigid support.

It is found desirable to have the projected beam cover the entire heat screen so that the screen will receive the heat from the beam uniformly over its entire area; thus helping to eliminate temperature differences at different parts of the screen and the resultant strain. This is illustrated in Fig. I where the path of the light beam is outlined by dot and dash lines and the path of that part of the beam which covers the heat screen is outlined by dash lines. It should be understood that the dot and dash lines on the film side of the heat screen (Fig. 1) merely illustrate the path of the light beam if no heat screen were present. This beam is, by the insertion of the heat screen reduced to the path outlined by the dash lines.

From the foregoing description it will be seen that simple, efficient, and economical means and methods have been provided for accomplishing all of the objects and advantages of the invention, particularly that of providing a heat screen of vitreous material having the desirable infra-red or heat absorbing characteristics, exceptionally high transmission of the visible rays, being colorless, and being resiliently supported in and heat insulated from its holder whereby it will be more resistant to cracking or breaking when acted upon by heat.

Having described my invention, I claim:

1. A heat retarding unit for use with a light projection system comprising a support having an opening therein through which light may be projected, the portion of the support having the opening therein having substantial thickness producing a wall surrounding said opening, said support having a lip surrounding said opening on one side of the wall thereof, a heat screen of a contour shape to fit within the opening in the

support and of a dimension permitting said contour edges thereof to be spaced relative to the wall of the opening throughout said contour edge, heat retarding means between the edge contour of the heat screen and the wall of the opening having a yielding nature for resiliently engaging and supporting the heat screen and means secured on the side opposite the lip having a portion overlying the adjacent side surface of the heat screen adjacent the contour edge thereof for securing said heat screen and holding said heat retarding means in position and allowing the heat screen to expand or contract while held against displacement against said support.

2. A heat retarding unit for use with a projector embodying means for producing a beam of light and a member for supporting means to be projected having an aperture through which said beam of light is directed, said heat retarding unit comprising a support having an opening therein adapted to be positioned in said beam of light between the means for producing said beam and said member, said opening being larger than the aperture in the member for supporting the means to be projected, the portion of the support having the opening therein having substantial thickness producing a wall surrounding said opening, a heat screen of a contour shape to fit within the opening and of a dimension permitting the contour edges thereof to be spaced relative to the wall of the opening throughout said contour edge, means between the edge contour of the heat screen and the wall of the opening of a material having such characteristics and so associated with the heat screen as to have substantially negligible heat conduction and having a yielding nature for yieldingly engaging the heat screen and means carried by the support for retaining said heat screen in the opening in said support and for holding said means having the yielding nature in position and allowing the heat screen to expand or contract while held against displacement from said support, said heat screen, said beam of light and said aperture in the member for supporting the means to be projected being controlled as to related sizes so that said heat screen lies entirely within said beam of light and completely intercepts the light passing through said aperture whereby the entire area of the screen is subjected to heat of substantially even intensity during use.

EDGAR D. TILLYER.