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[54] **HEAT SHIELD DEVICE FOR A REPRODUCING APPARATUS**

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[52] **U.S. Cl.**.....**355/71,** 355/121

[51] **Int. Cl.**.....**G03b 27/76**

[58] **Field of Search**.....355/71, 8, 66, 84, 121

[56] **References Cited**

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Primary Examiner—John M. Horan

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[57] **ABSTRACT**

A heat shield device for a reproducing apparatus wherein a heat shield plate is mounted for motion between an original document table and a light source lamp, the plate is positioned between the table and the lamp for a time period during which the luminous intensity of the lamp reaches a certain point, and the plate is removed from between the table and the lamp when the luminous intensity of the lamp reaches a certain point, whereby the lamp is prevented from heating the table partially.

6 Claims, 8 Drawing Figures

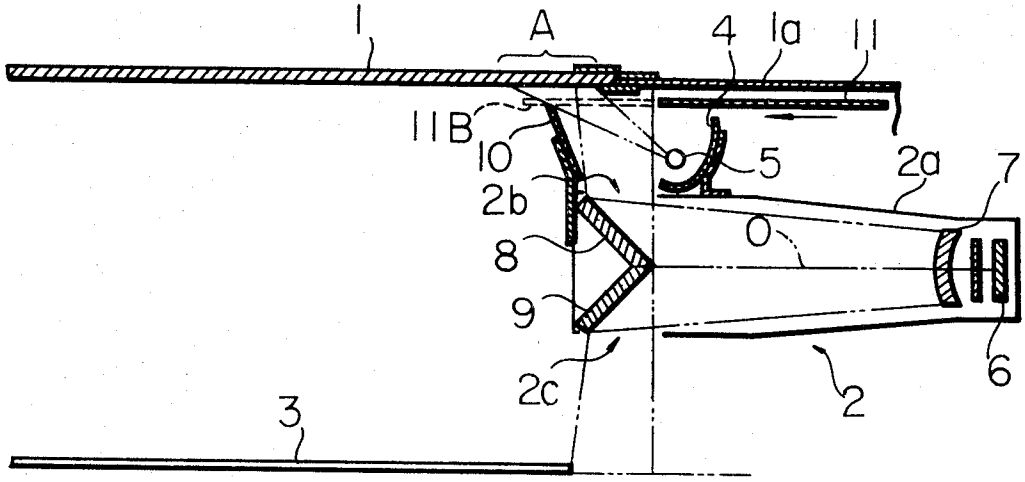


Fig. 1

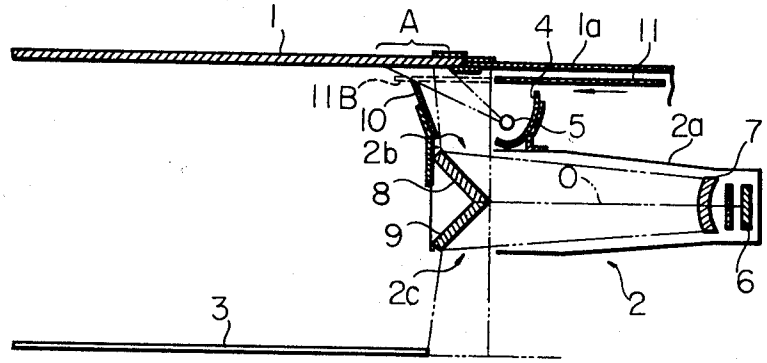


Fig. 2

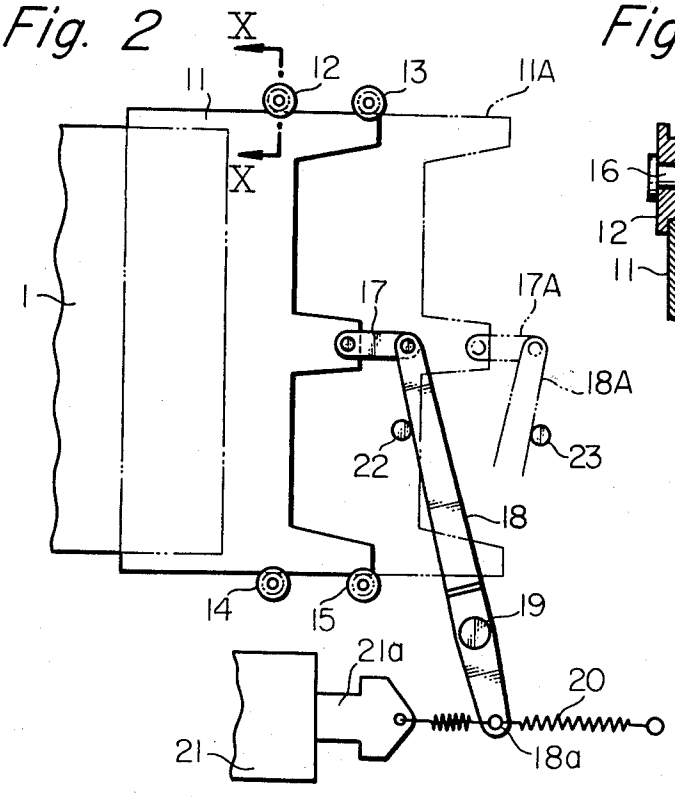
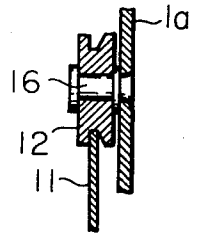


Fig. 3



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Fig. 4

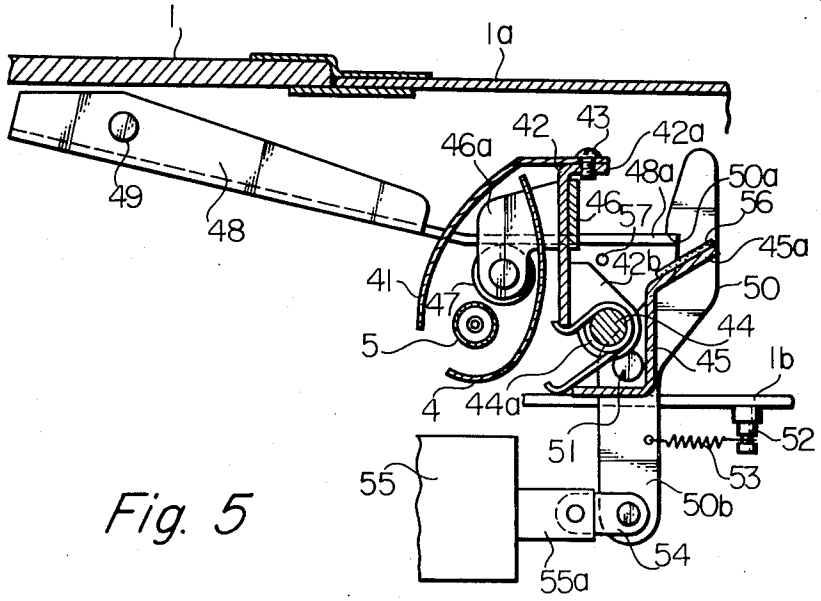
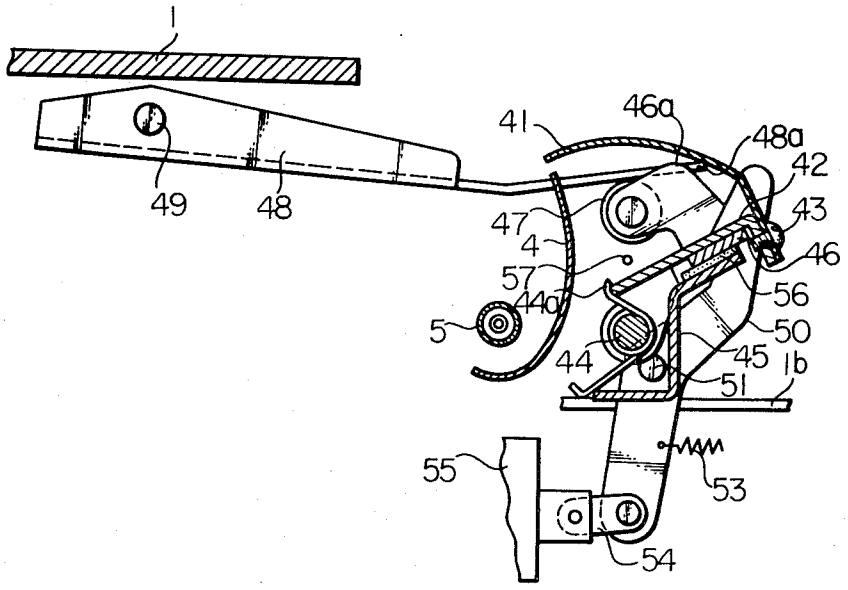


Fig. 5



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Fig. 6

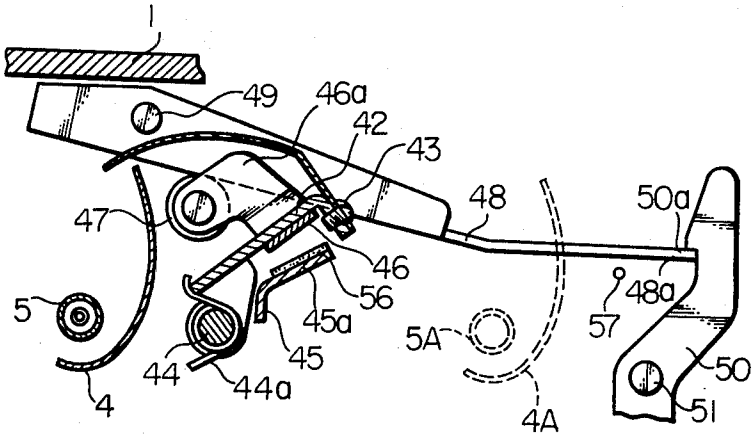
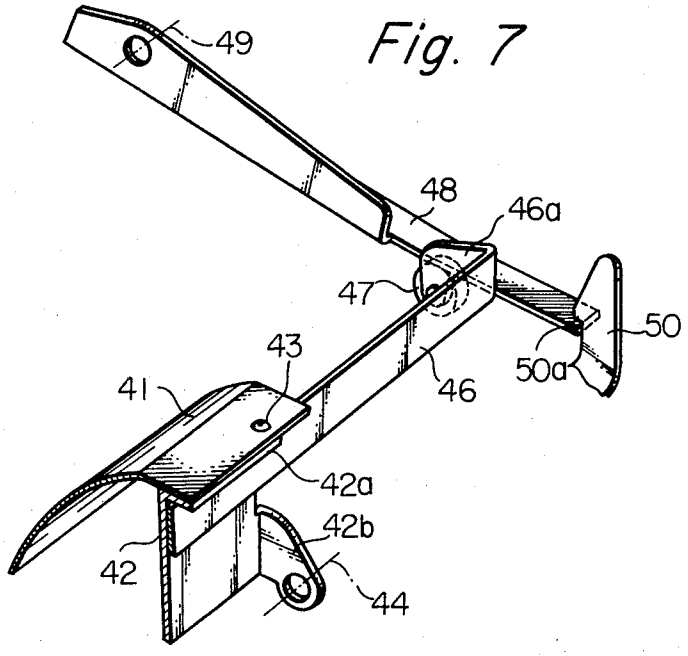


Fig. 7

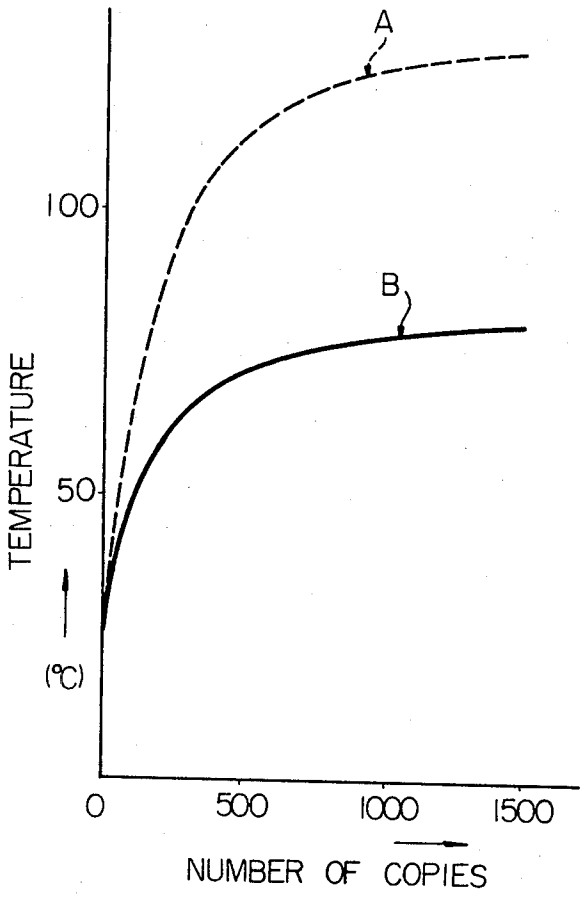


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Fig. 8



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HEAT SHIELD DEVICE FOR A REPRODUCING APPARATUS

The invention relates to a heat shield device for a reproducing apparatus for preventing a partial temperature rise of an original document table.

In order to obtain a sufficient exposure in a reproducing apparatus, especially, in a reflection type reproducing apparatus, it is necessary to use a light source lamp having an intense illumination. Such a light source emits a large quantity of heat proportional to the illumination. However, assuming that the light source lamp has a predetermined illumination, the illumination quantity is inversely proportional to the square of the distance. Therefore, the light source lamp is usually positioned near the original document table as far as it is possible.

On the other hand, as the light source lamp cannot reach the normal lighting condition until a predetermined time, that is, the so-called rise time of the lamp has passed, the light source lamp before the lapse of the predetermined time is deficient in its lighting and cannot effect exposure.

There are proposed many exposure means for a reproducing apparatus. In one of them, a light source lamp and an optical system for exposure are caused to travel relative to a fixed original document and a photosensitive paper. In another of them, an original document and a photosensitive paper are caused to travel synchronously with each other relative to a fixed light source lamp and an optical system for exposure. Anyhow, before the lapse of the rise time of the light source lamp, the light source lamp is in its starting position and faces a portion of the original document table and illuminates a predetermined portion of the table and gives a large quantity of heat only to that predetermined portion. Recently, the exposure process in exposure portion is made very rapid to increase the reproduction efficiency. When the exposure process is repeated in high speed and the light source lamp is extinguished every time a scan is finished, heat is imparted to the original document table in every beginning of an exposure process and the heat is accumulated upon the same portion of the original document table and results in raising the temperature of the portion very high.

As an original document table, transparent materials such as heat resisting glass are usually used. As mentioned above, when the original document table is heated partially, a strain will be induced between heated portions and non-heated portions, which may damage the table and bad effects upon the original cannot be neglected.

Therefore, it is an object of the present invention is to provide a heat shield means for a reproducing apparatus wherein a partial temperature rise of an original document table by a light source lamp is prevented by providing a heat shield plate, the heat shield plate being freely moved in and out between the light source lamp and the original document table.

It is another object of the present invention to apply a heat shield means to such an exposure embodiment, the present invention is applied to such an exposure means wherein a light source lamp and an exposure optical system are moved relative to a fixed original and photosensitive paper in order to effect scanning. However, it is of course that the present invention may be applied to any other type of exposure means.

With these and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIG. 1 is a partial sectional view of an embodiment of a reproducing apparatus embodying the present invention;

FIG. 2 is a bottom plan view of a heat shield device embodying the present invention;

FIG. 3 is an enlarged sectional view taken along lines X—X of FIG. 2;

FIG. 4 denotes a cross-sectional view of a heat shield device showing another embodiment of the present invention;

FIGS. 5 and 6 are cross-sectional views showing the operation modes of the above-mentioned device;

FIG. 7 is a perspective view showing the construction parts of the above-mentioned device; and

FIG. 8 is a diagram showing the condition of the temperature rise of an original document table.

In FIG. 1, an original document table is shown which is made of a transparent material such as glass and is supported by a top plate 1*a* of the reproducing apparatus. An exposure means 2 is illustrated as well as a photosensitive paper 3 facing a fixed original (not shown in the drawings) placed on the original document table 1, respectively. Upon the upper surface of the housing 2*a* of the exposure means 2 is provided a light source lamp 5 having a reflection mirror 4 at the rear side thereof. In the housing 2*a*, there is fixed a projection lens 7 having an integral reflection mirror 6 at the rear side and a pair of reflection mirrors 8 and 9 are fixed on the optical axis 0 in front of the projection lens 7, the reflection mirrors 8 and 9 have an edge line vertical to the optical axis 0 and are inclined to each other. There are provided openings 2*b* and 2*c* in the upper and lower surfaces of the housing 2*a* at the position corresponding to the reflection mirror 8 and 9. The light source lamp 5 is positioned immediately back of the opening 2*b* and an inclined light shield plate 10 is provided at the front upper portion of the opening 2*b* of the housing 2*a*.

When the light source lamp 5 is lighted by pushing a print button (not shown in the drawings), the exposure means 2 begins to move forward between the original document table 1 and the photosensitive paper 3, that is, leftward in FIG. 1, after the lapse of the rise time required by the light source lamp 5, it scans the original illuminated by the light source lamp 5. The scanned original image is successively projected onto the photosensitive paper 3 through an optical exposure system comprising the reflection mirror 8, the projection lens 7 and the reflection mirror 9. When the original has been scanned, the light source lamp 5 is lighted and the exposure means 2 then moves back to its original position.

When the exposure means 2 is at its starting position, there is provided a heat shield plate 11 (seen in FIG. 2) between the light source lamp 5 and the end portion of the original document table 1. Both sides of the heat shield plate 11 are slidably supported by guide rollers 12, 13, 14 and 15 as seen in FIG. 2 and the leading end portion of said heat shield plate 11 has a width sufficient to shield completely over the heat receiving portion of the original document table 1 during the rise time of the light source lamp 5. The above-mentioned

guide roller 12, as shown in FIG. 3, is freely supported by a shaft 16 secured to the top plate 1*a*, whereas the heat shield plate 11 is supported by loosely engaging the side thereof with the flange portion. The other guide rollers 13, 14 and 15 are journalled in the same way as the roller 12 and the guide rollers support the heat shield plate 11 in the way as mentioned above.

At the back central portion of the heat shield plate 11, one end of a connecting rod 17 is mounted for oscillation, and the other end of the rod 17 is loosely connected to one end of a lever 18. The lever 18 is mounted for rotation to a shaft 19 secured to the top plate 1*a*. On the other end of lever 18*a*, a spring 20 hangs thereon and the lever 18 is rotatable around the shaft 19 in the counterclockwise direction as shown in FIG. 2. Further, at the end 18*a* of the lever 18 there is connected an actuating plunger 21a of a solenoid 21 which actuates in the direction opposite to the spring 20 and the lever 18 is made to rotate in the clockwise direction against the spring 20 when the solenoid 21 is energized.

When the exposure means 2 is in the starting position and the solenoid 21 is actuated, the lever 18 is under the action of the spring 20 whereby it contacts with a stopper 22 and pushes forward the heat shield plate 11 between the light source lamp 5 and the original document table 1 through the connecting rod 17. Upon pushing the print button (not shown), the light source lamp 5 is firstly lighted. After the light source lamp 5 is lighted and the rise time thereof is passed, the solenoid 21 is caused to work through a control cam and the like, whereby the lever 18 is rotated in the clockwise direction until it comes to a position shown by chain line 18A and contacts a stopper 23. When the lever 18 comes to this position, the connecting rod 17 displaces to the position shown by chain line 17A and the heat shield plate 11 is advanced to a position shown by chain line 11A. This condition is shown by solid line in FIG. 1, and when the heat shield plate 11 comes to this condition, the original document table 1 is separated from the light source lamp 5 and the exposure means 2 simultaneously begins to move forward in order to scan the original. When the exposure means 2 has finished its advance stroke, the solenoid 21 is stopped from operating and the heat shield plate 11 returns to its original position, that is, to the position shown by chain line 11B in FIG. 1. According to the present apparatus, a portion of the original document table 1 illuminated by the light source lamp 5 during its rise time, for example, a region A shown in FIG. 1, is completely protected from heat lighting by the heat shield plate 11 and the above-mentioned operation is repeated along with the repetition of the exposure performance. Therefore, no heat accumulation will be occurred.

In the above-mentioned embodiment, there is shown a case in which the heat shield plate is provided to a fixed member of a reproducing apparatus. It is possible to mount the heat shield plate on the side of the light source lamp, that is, to the exposure means. An embodiment in which a heat shield plate is provided on the side of the light source lamp will be explained of hereunder with reference to FIGS. 1 to 6. The reference numbers used in FIG. 2 are used in the following drawings to denote the same or equivalent members.

In FIG. 4, there is provided a heat shield plate 41 in front of the light source lamp 5 and the reflector 4 so as to shield them, and the base 41*a* of the heat shield plate 41 is secured to an upper bent portion 42*a* of a supporting plate 42 by a screw 43. As shown in FIG. 7, the supporting plate 42 has a bended leg portion 42*b* which is loosely fitted with a shaft 44 secured to the upper surface of the exposure means 2 (seen in FIG. 1). Under the shaft 44 and over the upper surface of the exposure means 2, there is secured a stopper 45 (seen in FIG. 4) and to the stopper 45 and the lower edge of the supporting plate 42 there is hung a torsion spring 44*a* fitted with the shaft 44, whereby the supporting plate 42 is given a rotational bias around the shaft 44 in the clockwise direction seen in FIG. 4. To the supporting plate 42 is secured an arm member 46 (seen in FIG. 7), and a projection end 46*a* of the arm member 46 is formed after being bent and a roller 47 is mounted for rotation in this portion. Near the lower end portion of the original document table 1 at the side wall of the reproducing apparatus, there is supported a control arm 48 (seen in FIG. 7) for oscillation by a shaft 49 and the roller 47 is pressed against the control arm 48 from the lower side through the oscillatory habit of the supporting plate 42. A hook 50*a* engages an end portion 48*a* of the control arm 48, the hook 50*a* being provided in one arm of an engaging lever 50. This lever 50 is supported for oscillation by a shaft 51 fixed to the side wall of the reproducing apparatus. To the other arm 50*b* of the lever 50 there hung is hanged one end of a spring 53 and the other end of the spring 53 is secured to the horizontal edge 1*b*, whereby a rotational bias is given to the lever 50 around the shaft 51 in the counterclockwise direction seen in FIG. 4. A connecting rod 54 is connected for oscillation to the arm 50*b* of the engaging lever 50 and an actuator 55*a* of the solenoid 55 is mounted for rotation to the connecting rod 54.

As mentioned above, the supporting plate 42 has rotational bias in the clockwise direction in FIG. 4 around the shaft 44. Therefore, the heat shield plate 41 has a tendency to move to a position remote from the light source lamp 5 and the reflector 4. However, as the roller 47 provided in the arm member 46 which is integral with the supporting plate 42 is pressed against the control arm 48 engaged by the engaging lever 50 from the lower side, the light source lamp 5 and the reflector 4 are perfectly covered in the condition seen in FIG. 4, that is, the condition when the solenoid 55 is not actuated.

Now, pushing down the print button (not shown in the drawings), the light source lamp 5 is firstly lighted and the solenoid 55 is energized after the lapse of the rise time of the light source lamp 5. When the solenoid 55 is actuated, the engaging lever 50 is attracted against the spring 53 to rotate around the shaft 51 in the clockwise direction and remove the engagement with the control lever 48 as shown in FIG. 5. When the control arm 48 is relieved from the engaging lever 50, the supporting plate 42 rotates around the shaft 44 in the clockwise direction in accordance with its rotational bias and simultaneously lifts the control arm 48 by the roller 47, whereby the heat shield plate 41 is removed to a position remote from the light source lamp 5 and the reflector 4. Further, in this case, the arm member 46 which is integral with the supporting

plate 42 contacts with a buffer member 56 such as a sponge or the like provided in an inclined portion 45*a* of the above-mentioned stopper 45, and therefore the rotation of the supporting plate 42 is gradually stopped by the stopper 45.

When the heat shield plate 41 assumes the position shown in FIG. 5, a forward stroke signal is sent to the exposure means 2 (seen in FIG. 1) and the scan of the original and the exposure of photosensitive paper are commenced. When the exposure means 2 begins forward travel, the roller 47 simultaneously moves leftward seen in FIG. 5 until it disengaged from the control arm 48. When the roller 47 is disengaged from the control arm 48, the control arm 48 falls by gravity and contacts a stopper 57 provided in the side wall of the reproducing apparatus, whereas the solenoid 55 remains in an energized condition at this time and, the engaging lever 50 is maintained in the condition apart from the arm end of the control lever 48.

When the scanning of the original is completed, the forward travel of the exposure means 2 is finished, the light source lamp 5 is extinguished and the solenoid 55 is de-energized. Then, the exposure means 2 begins to move back to its original position and simultaneously the roller 47 begins to lift the arm 48 by sliding along the under surface of the arm 48. The end 48*a* of the lifted arm 48 engages with the hook 50*a* of the lever 50 which has travelled back by the de-energization of the solenoid 55. Even after the control arm 48 has collided with the engaging lever 50, the roller 47 continues to move rightward in FIG. 6 according to the returning exposure means 2, and gradually goes down along the control arm 48. When the roller 47 has gone down, the supporting plate 42 rotates around the shaft 44 counter-clockwise against its own rotational habit and the heat shield plate 41 is permitted to move again above the light source lamp 5 and the reflector 4. When the exposure means 2 has returned to the original position as shown by chain line 5A and 4A in FIG. 6, the heat shield plate 41 completely covers the light source lamp 5 and the reflector 4 as shown in FIG. 4. Further, the cross section of the heat shield plate 41 is a circular arc form around the central shaft 44 in this embodiment so as to move smoothly. However, the heat shield plate 41 may take any other shape.

As mentioned above, the heat shield device of the present invention can completely shield the original document table from the light source lamp during the rise time thereof and can keep the partial temperature rise of the original document table very low as shown by solid line B in FIG. 8. On the contrary, in the event the heat shield plate is not provided, the temperature rise of the original document table by the accumulated heat is very high as shown by dotted line A in FIG. 8. In fact, the temperature rise when the repetition number reaches 1,500 sheets is in the order of 129° C without a heat shield plate. However, according to the present invention, the temperature rise may be supressed in the order of 80° C in the same condition as mentioned above.

Further, in the embodiment as mentioned above, a suitable cam or the like which is rotated by pushing a print button is used as the means which causes the solenoid to actuate when a light source lamp is extinguished. The desired object of the present invention may be achieved by operatively connecting the heat shield plate to the cam itself through a linkage or the like, in this case the solenoid may be omitted particularly.

What is claimed is:

1. A heat shield device for a reproducing apparatus, comprising

a heat shield plate which is provided so as to move in or out from between an original document table and a light source lamp,

means for driving said light shield plate to remove said heat shield plate from between the original document table and the light source lamp when the light source lamp is lighted and reaches its normal lighting condition,

said drive means further for positioning said light shield plate between the original document table and the light source lamp prior to the light source lamp reaching said normal lighting condition, after the light source lamp is lighted,

a plurality of guide means on which said light shield plate is slidably mounted adjacent said original document table,

said drive means comprises,

a two armed pivoted lever operatively connected at one arm to said heat shield plate,

a spring connected to the other arm of said lever and biasing said lever to cause said heat shield plate to a position between said original document table and said light source, and

an actuating means connected operatively to said other arm for moving said lever in a direction opposite to the direction of biasing of said spring when said lamp reaches said normal lighting condition.

2. The apparatus, as set forth in claim 1, wherein

said guide means are secured to said original document table.

3. The apparatus, as set forth in claim 2, wherein

said heat shield plate is disposed slidably parallel and adjacent to said original document table.

4. The apparatus, as set forth in claim 3, further comprising

an exposure means having a housing on the upper side of which said lamp is disposed and facing said original document table,

said exposure means includes a mirror system for imaging a document image onto a photosensitive paper,

said exposure system being movable along said original document table from an initial position, when said lamp reaches said normal lighting condition, and

said heat shield plate covering a front portion of said original document table, from said lamp.

5. A heat shield device for a reproducing apparatus, comprising

a heat shield plate which is provided so as to move in or out from between an original document table and a light source lamp,

means for driving said light shield plate to remove said heat shield plate from between the original document table and the light source lamp when the light source lamp is lighted and reaches its normal lighting condition,

said drive means further for positioning said light shield plate between the original document table and the light source lamp prior to the light source lamp reaching said normal lighting condition, after the light source lamp is lighted,

a movable exposure means for movably scanning said original document table and including said lamp,

said heat shield plate has the shape of an arc of a cylinder,

said drive means comprises,

a supporting means pivotably mounted on said exposure means and biased in a direction away from a position between said lamp and said original document table.

6. The apparatus, as set forth in claim 5, wherein,

said portion of said supporting means removably abutting said control arm is a roller.

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