Nov. 2, 1926. 1,605,843

L. A. JONES

PLANE ILLUMINATOR

Filed March 10, 1923

FIG. 1.

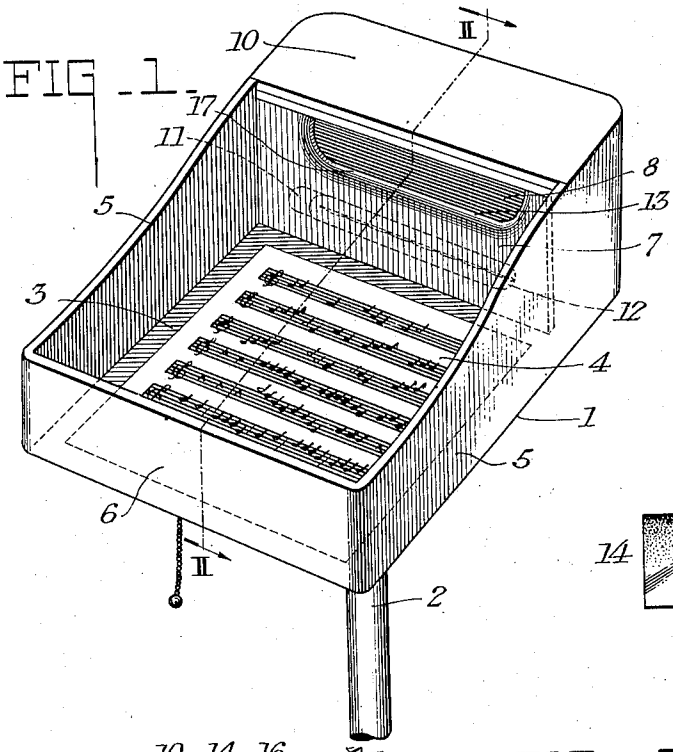


FIG. 4.

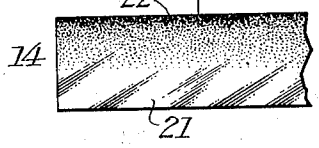


FIG. 2.

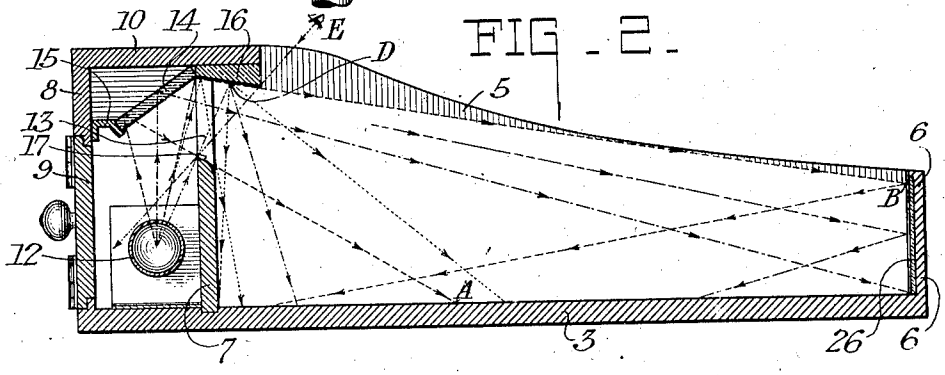
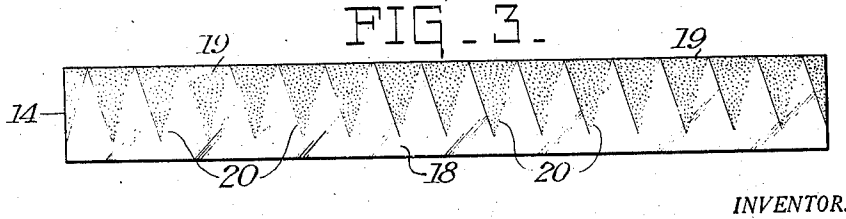


FIG. 3.



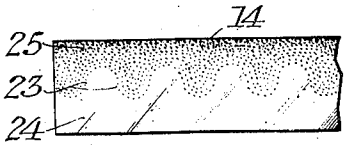


FIG. 5.

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UNITED STATES PATENT OFFICE.

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PLANE ILLUMINATOR.

Application filed March 10, 1923. Serial No. 624,237.

This invention relates to a plane illuminator and more particularly to means for holding and illuminating such material as sheet music or lecture notes.

In rooms that are darkened for the projection of stereopticon or motion pictures, it is usually necessary to provide illuminated stands for music or lecture notes. It is desirable of such stands that they shall throw as little direct light as possible into the hall, and that the paper sheets shall not be so brilliantly illuminated as to constitute glare spots either to the audience or to the lecturer or musicians. Such stands are of many designs but usually comprise a supporting surface with a lamp house at one edge to throw light upon this surface. It is necessary to illuminate the entire surface to such an extent that notes at the least illuminated portions shall be easily legible. If, as is usual, the light is not well distributed, this necessitates the illumination of parts of the sheet far more than is necessary or desirable. It is obvious that if the light rays are more evenly distributed over the whole surface, not only will the total amount of light used be smaller, but the amount of light necessary for the least illuminated portion is less, since the eye tends to accommodate itself to the brightest light, and when the whole illumination is low and even the eye will be adjusted for much less light.

The main objects of my invention are to meet the requirements stated above, and to make an apparatus that is simple in structure, inexpensive to manufacture and free from parts liable to become out of order. These and other objects are attained by the apparatus hereinafter described and illustrated in the accompanying drawings, in which the same reference characters are used throughout to designate the same parts and in which—

Fig. 1 is a perspective view of a music stand embodying my invention;

Fig. 2 is a section on line II—II of Fig. 1;

Fig. 3 is a plan of a mirror used in my apparatus;

Figs. 4 and 5 are fragmentary plans of other embodiments of the mirror.

The preferred embodiment of my invention comprises a sheet holder and illuminator 1 on a suitable support or post 2. It is in the form of an open tray having a bottom 3, on which the sheet 4 to be illuminated may be placed, with side walls 5, a lower end wall 6 and an upper end wall or partition 7. The side walls 5 and bottom 3 extend beyond the partition 7 and are joined by a rear wall 8 with a hinged door 9. A top wall 10 overhangs the partition 7. These and the walls behind the partition constitute a lamp housing within which is a socket 11 for a lamp 12 which is preferably of a long filament type positioned horizontally near the bottom of the housing. The wall or partition 7 has a horizontally extended opening 13, the bottom 17 of which is above the lamp 12 so that no direct rays therefrom can reach the bottom surface 3 of the open tray. A reflector 14 to be more fully described later is mounted at an angle above the lamp and held at its lower edge by support 15. Its upper edge abuts a reflector 16 secured to that part of the top 10 that overhangs the wall 7.

If the partition 7 were absent and the bottom surface illuminated directly by the lamp with or without an ordinary specularly reflecting mirror, the illumination would fall off rapidly, being intense near the light and much less in the far corners of the surface. While the shape and location of a specularly reflecting mirror would affect the distribution of light, there is at best with such an arrangement a contrast that is objectionable to the musician or lecturer, and, if the stand faces the audience, a glare that is annoying.

The reflected rays are, however, capable of control by modifying the character of the reflecting surface. All specularly reflected rays leave the surface at an angle equal to the angle of incidence. If the surface has perfectly diffuse reflecting properties, light falling upon it will be reflected equally in all directions. Every point becomes a source of evenly distributed illumination. If, then, the rays that would be reflected to the more distant portions of the surface fall on a specularly reflecting surface they will reach their destination as before; while if the rays that would be specularly reflected to the nearer and brighter portions fall instead on a diffusely reflecting surface, they will be so distributed that part will reach the more distant portion increasing its illumination while only a part will reach the nearer portion so that its illumination will be less and the surface as a whole will be more uniformly lighted. Such an expedient I apply

to the reflecting means used in my improved illuminator.

If the partition were somewhat lower and the mirror 14 specularly reflecting, rays therefrom would be reflected upon the entire surface in the objectionable manner above described. The partition 7 is, however, at its ends, of the full height of the housing but is cut away at its center to furnish the horizontal aperture 13, the lower edge 17 of which is at such a height as to cut off from the nearest portions of surface 3 all specularly reflected rays from the reflector 14. I furthermore render portions of the reflector 14 matte, for instance, with a sand blast. A convenient design is shown in Fig. 3. One marginal portion 18 of the mirror is left polished and specularly reflective. The other marginal portion 19 is almost entirely matte and diffusely reflective. The matte and polished portions are caused to blend one into the other. As shown in this form there is a zig-zag boundary line 20 between the portions, the part on one side of the line being evenly matte. Another method is shown in Fig. 4 where one marginal portion 21 is polished, and another portion 22 is very matte, the roughness being lessened by degrees to an indistinguishable border between the two portions. In Fig. 5 there is a wavy line of demarcation 23 between the polished portion 24 and matte portion 25, the degree of roughness of the latter also lessening toward that line.

Such a mirror is placed at 14 with the polished portion uppermost. The limits of specularly reflected rays are indicated by those falling at A and B, the first limit being imposed by the edge 17 and the second by the surface of reflector 16. The farther portions of surface 3 receive rays from the polished portion 18 as does the specularly reflective mirror 26 on the inner surface of wall 6, from which rays are reflected back principally on the portions farthest from the lamp housing. The points near A will receive but few specularly reflected rays from the mirror 14 and mirror 26, and those to the left of A will receive only a few, if any, specularly reflected rays from 26. The diffusely reflected light from the lower part of mirror 14 will also be largely cut off by the wall 7 from the regions to the left of A, though a few rays from the lesser diffuse portions will reach it. The diffusely reflected rays will fall in part on the rear of partition 7 and be lost and in large part on the region to the right of A.

The reflector 16 has a surface that is entirely diffusing. This reflector extends out to such a distance as to intercept all possible rays from the lamp through the aperture 13. The path of the limiting visible ray is indicated by a line from the eye E. Every point of reflector 16 may be considered as a source of evenly distributed illumination. From any point such as D, light will fall on the entire surface 3, a few rays being indicated. Of course, the portions nearer to the lamp house will be more brilliantly illuminated from this source. It is apparent that the distribution of light may be varied by changes in the position and form of each of the reflectors, the degree of diffusion, the position and shape of the lamp filament, the height of edge 17 and other constants of the instrument and that for a box of any particular size and shape changes in proportions and dimensions of these optical elements will be necessary. I have pointed out, however, the sources of light falling on the different portions of the surface to be illuminated; and the modification of these to suit particular dimensions is a matter of design. It is possible thus to control the illumination in such a way that it is remarkably even over the whole surface.

It is to be understood that the above structure is to be considered as an example of my invention and that I consider as within the scope thereof, all such modifications and equivalents as fall within the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An illuminator comprising a support with a surface open for inspection, a lamp for illuminating said surface and a reflector along one edge of the support for directing rays from the lamp to the open surface of the support, a portion of the reflector having high specularly reflecting properties and directing specularly reflected light principally to the portions of the surface farthest therefrom, and another portion of the reflector having high diffusely reflecting properties.

2. An illuminator comprising a surface to be illuminated, a housing at one side of said surface, a lamp within the housing and a reflector for directing rays from the lamp to the surface, one portion of the reflector having high diffusely reflecting properties, and another portion having high specularly reflecting properties, the reflecting properties of the reflector changing gradually from one portion to the other, the second portion being positioned to reflect light principally upon the portions of the surface farthest from the light.

3. An illuminator comprising a surface to be illuminated, a housing at one side of the surface and including a partition, a socket for a lamp within the housing and separated by the partition from the surface so that no direct rays from a lamp in the socket can fall on the surface, said housing having a top overhanging the partition by a

slight distance only, and means in the housing and under said top for reflecting rays from a lamp in the socket to the surface, a portion of said means being diffusely reflective and a portion being specularly reflective.

4. An illuminator comprising a surface to be illuminated, a housing at one side of the surface and including a partition, a socket for a lamp within the housing and separated by the partition from the surface so that no direct rays from a lamp in the socket can fall on the surface and means for reflecting rays from a lamp in the socket to the surface, a portion of said means being specularly reflective and directing light rays particularly to the portions of the surface farther from the housing, and a portion of said means being diffusely reflective.

5. An illuminator comprising a surface to be illuminated, a housing at one side of the surface and including a partition, a socket for a lamp within the housing and separated by the partition from the surface so that no direct rays from a lamp in the socket can fall on the surface and means for reflecting rays from a lamp in the socket to the surface, a portion of said means being diffusely reflective and a portion being specularly reflective, the reflective properties of the reflector changing gradually from one portion to the other the specularly reflective portion being positioned to reflect light principally upon the portions of the surface farthest from the housing.

6. An illuminator comprising a tray with a bottom and with walls at its edges, a housing including one of said walls and overhanging said wall, a lamp within the housing and behind said wall, reflecting means for directing light rays from said lamp to the bottom of the tray, the elements being so arranged that no direct rays from the lamp either fall on the bottom or are visible from any point outside of the illuminator.

7. An illuminator comprising a tray with a bottom and with walls at its edges, a housing including one of said walls and overhanging said wall, a lamp within the housing and behind said wall, specularly reflecting means for directing light rays from said lamp to the bottom of the tray, the elements being so arranged that no direct or specularly reflected rays are visible from any point outside of the illuminator.

8. An illuminator comprising a tray with a bottom and with walls at its edges, a housing including one of said walls and overhanging said wall, a lamp within the housing and behind said wall, specularly reflecting means for directing light rays from said lamp to the bottom of the tray, the elements being arranged so that no direct rays from said lamp either fall on the bottom or are visible from any point outside the illuminator and so that no specularly reflected rays are visible from any point outside the illuminator.

9. An illuminator comprising a tray with a bottom and with walls at its edges, a housing including one of said walls and overhanging said wall, a lamp within the housing and behind said wall, reflecting means for directing rays from said lamp to the bottom of the tray, the walls reflecting means and housing entirely surrounding said lamp, whereby a ray of light proceeding from said lamp in any direction will fall upon one of said elements.

10. An illuminator comprising a tray with a bottom and with walls at its edges, a housing including one of said walls and overhanging said wall, a lamp within the housing and behind said wall, specularly reflecting means for directing rays from said lamp only upon the bottom of the tray and upon the interior of the walls and housing, the walls, reflecting means and housing entirely surrounding said lamp, whereby a ray of light proceeding from said lamp in any direction will fall upon one of said elements.

11. A plane illuminator comprising an open tray with a plane bottom to be illuminated, a housing at one side of the tray, a lamp within the housing, one wall of the housing separating the lamp from the tray and having an opening above the lamp, and a reflector in the housing in a position to reflect rays from the lamp through the opening upon the plane, portions of the reflector being capable of high specular reflection and portions being capable of highly diffuse reflection.

12. An illuminator comprising an open tray with a bottom surface to be illuminated, a housing at one side of the tray and including a partition, a lamp within the housing and separated by the partition from the surface so that no direct rays from the lamp can fall on the surface, a reflector angularly positioned above the partition and adapted to reflect rays from the lamp to the surface, a portion of the reflector being specularly reflective and directing light rays particularly to the portions of the surface farther from the housing and the rest of the reflector being diffusely reflective.

13. An illuminator comprising an open tray with side walls and a bottom to be illuminated, a lamp house including one of said walls, a reflector in said lamp house and adapted to direct light rays across said tray, a portion of said reflector having high diffusely reflecting properties and a portion having high specularly reflecting properties, and a reflector on the inner surface of one of the other side walls.

14. An illuminator comprising an open

tray with side walls and a bottom to be illuminated, a lamp house including one of said walls, a reflector in said lamp house and adapted to direct light rays across said tray, a portion of said reflector having high diffusely reflecting properties and a portion having high specularly reflecting properties, the side wall opposite the lamp house having its inner surface with high specularly reflecting properties.

Signed at Rochester, New York, this 7th day of March 1923.

LOYD A. JONES.