Sept. 23, 1947. A. P. REYNOLDS 2,427,923

APPARATUS FOR PRINTING ON LIGHT SENSITIVE MATERIAL

Filed March 28, 1942 2 Sheets-Sheet 1

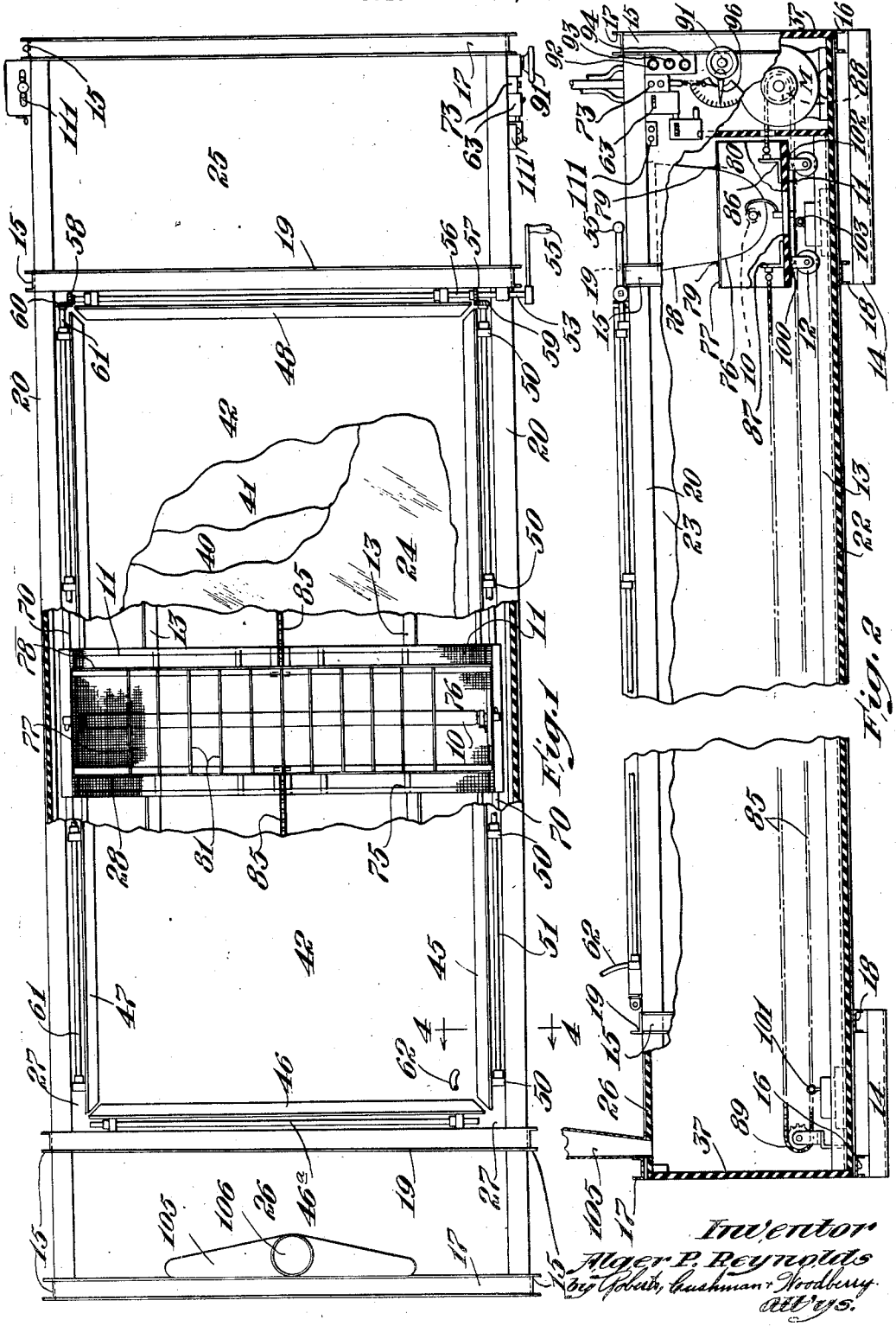


Fig. 1

Fig. 2

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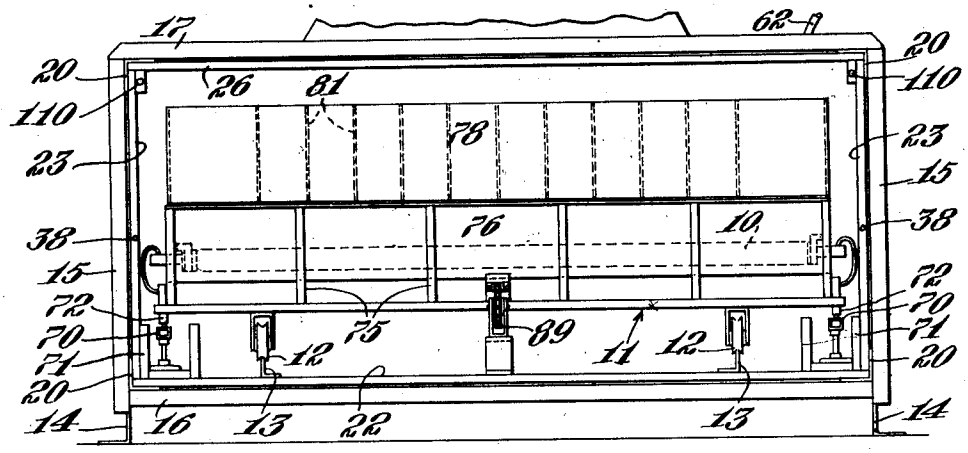


Fig. 3

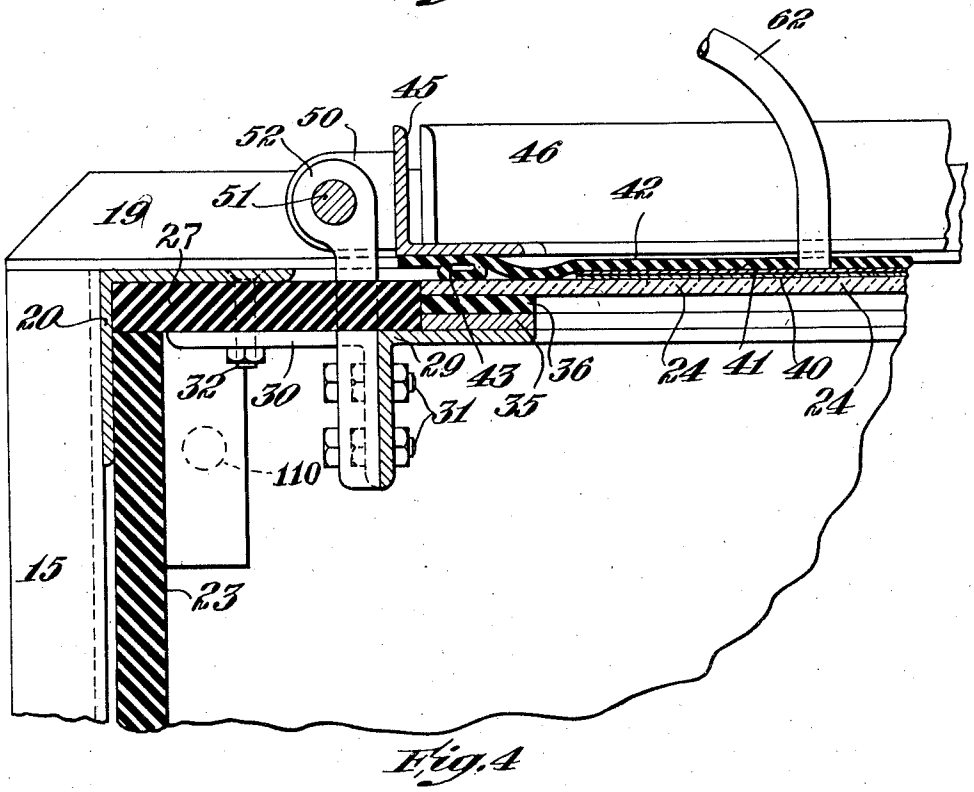


Fig. 4

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APPARATUS FOR PRINTING ON LIGHT-SENSITIVE MATERIAL

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4 Claims. (Cl. 95—73)

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This invention relates to an apparatus for printing upon light-sensitive material an image carried by a translucent material. A few examples of this type of print are blue prints, diazo prints, Van Dyke prints and photolithographic plates.

The invention will be described with respect to blue prints, its application to similar printing processes being obvious to those skilled in the art. In making a blue print an opaque diagram or image carried by transparent or translucent paper, cloth or other material is transposed over the light-sensitive surface of a sheet of blue print paper and the image-bearing material is then exposed to light for the required period of time. The blue print paper is then washed or bathed with the required chemicals to bring out the blue background in the areas which were exposed to light during the printing step. Thereafter the paper is dried leaving a white image upon a blue background in the finished blue print. The present invention deals primarily with the step of exposing the superimposed image-bearing material and light-sensitive material to light, commonly called the printing step.

The principal object of this invention is the provision of apparatus for subjecting the superimposed image-bearing material and light-sensitive sheet to a uniform light exposure throughout its entire area to thereby accurately reproduce all details of the image in the final print.

A further object is the provision of such apparatus which may utilize but a single source of light.

A further object is the provision of such apparatus wherein the translucent image-bearing material and the light-sensitive material are retained absolutely stationary during exposure and wherein the source of light extends from side to side of the image-bearing material and is moved from end to end thereof at a uniform speed, thereby preventing relative movement of the image-bearing material and the light-sensitive material during exposure and providing a uniform exposure throughout the entire area of the light-sensitive material.

A further object is the provision of an apparatus in which the source of light may remain lighted while the previously exposed image-bearing material and light-sensitive material are being removed and the next sheets of image-bearing material and light-sensitive material are being inserted.

Another object is the provision of a longitudinally extending source of light and a series of

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substantially parallel light-impervious members extending between the source of light and the image-bearing material substantially at right angles to the longitudinal axis of the light to prevent undercutting of the opaque lines of the image by preventing light beams from impinging upon the image-bearing material at acute angles to its surface.

Other objects will be apparent from a consideration of the following description and the accompanying drawings which exemplify one embodiment of the invention chosen for the purposes of illustration.

In the drawings

Fig. 1 is a plan view with parts broken away showing an apparatus embodying my invention;

Fig. 2 is a side elevational view of the apparatus of Fig. 1 with parts broken away;

Fig. 3 is an enlarged end elevational view looking from left to right at Fig. 1, with the end panel removed; and

Fig. 4 is an enlarged section on the lines 4—4 of Fig. 1.

The apparatus illustrated comprises a hollow rectangular container in which the source of light 10 is mounted on a carriage 11 which is provided with wheels 12 running along two horizontal tracks 13 so that the source of light may be moved at a uniform speed from end to end of the apparatus in a horizontal path.

The apparatus is supported by four angle irons 14 (Figs. 2 and 3) which rest upon the floor. Each set of the angle irons 14 has four vertically extending channel members 15 secured thereto. Each set of channel members 15 which is adjacent each end of the apparatus has a horizontally extending channel member 16 secured adjacent their lower ends, and a horizontally extending channel member 17 secured adjacent their upper ends. Each set of channel members 15 which is spaced inwardly from the end of the apparatus has a horizontally extending channel member 18 secured adjacent their lower ends and a horizontally extending angle iron 19 secured adjacent their upper ends. Thus the vertical channels 15, the horizontal channels 16, 17 and 18 and the angle irons 19 form four spaced vertically positioned rectangular frames which are rigidly supported by the four angle irons 14.

Four horizontally extending angle irons 20 (Fig. 3) extend from end to end of the apparatus, each of said angle irons being secured to an inside corner of said vertically positioned rectangular frame (see Fig. 3). The bottom 22 of the apparatus consists of sheet insulating mate-

rial which is a non-conductor of electricity and of heat. This bottom 22 is secured to the lower two angle irons 20 by screws (not shown) extending from the outside of the angle irons into the sheet material. The sides of the apparatus consist of two side members 23 which are also made of the same insulating material and are secured in the same manner to the upper and lower angle irons 20. The top of the apparatus consists of a rectangular centrally disposed sheet of glass 24, at the opposite ends of which are located the horizontally disposed sheets of insulating material 25 and 26 and at opposite sides of which are located sheets 27. The top members 25, 26 and 27 are supported by screws (not shown) which pass from the top downwardly through the top angle irons 20.

The sheet of glass 24 is supported by angle irons 29 and 30 (Fig. 4) which are secured in back to back relation by bolts 31 and are supported from the angle irons 20 by bolts 32. Angle irons in the same relationship as the angle irons 29 and 30 are provided to support each edge of the glass 24. The glass 24 is resiliently supported on the angle irons 29 by means of a strip of plywood 35 and a strip of rubber 36 (Fig. 4).

Each end of the device consists of a rectangular sheet of insulating material 37 (Fig. 2) which fits between the corner angle irons 20 (see Fig. 3) and abuts the exposed ends of the side members 23, the bottom member 22 and the top member 26 or 25. These end members 37 are detachably secured by screws which pass into the holes 38 (Fig. 3).

Thus a hollow rectangular container is provided the walls of which are impervious to light except for a sheet of glass disposed centrally of the top.

The translucent image-bearing material 40 is placed flat against the upper surface of the glass 24 and the light-sensitive blue print paper or other sensitive material 41 is placed sensitized side down flat against the upper surface of the image-bearing material. A rubber blanket 42 is then placed flat against the upper surface of the blue print paper. This blanket has a bead 43 (Fig. 4) extending around its edges. The edges of the blanket are pressed firmly against the surface of the glass 24 by angle irons 45, 46, 47 and 48 (Figs. 1 and 4). Each of these angle irons is supported for pivotal movement about a horizontal axis. Referring to Figs. 4 and 1, the angle iron 45 is secured to collars 50 each of which is secured to a horizontal rod 51 which is rotatably supported in bearings 52, the latter being supported by the angle irons 29 and 30. The angle irons 46, 47 and 48 are similarly supported respectively by horizontal rods 46a, 61 and 56 which are rotatable in bearings identical to the bearings 52.

The angle irons 45, 47 and 48 are simultaneously rotated upwardly out of engagement with the rubber blanket 42 by means of the crank 55 (Fig. 1) which is secured to the horizontal rod 56 which forms the axis of rotation for the end angle iron 48. Beveled gears 57 and 58 secured to the rod 56 mesh respectively with the beveled gear 59 secured to the rod 51 and the beveled gear 60 secured to the rod 61. Thus rotation of the crank 55 causes simultaneous rotation of the rods 56, 51 and 61 which causes rotation of the associated angle irons 48, 45 and 47 to either free the edges of the blanket 42 or to clamp them securely against the glass depending upon the direction in which the handle is rotated.

A rubber tube 62 has one end communicating with a vacuum pump (not shown) and the other end communicating with the space between the blanket and the glass 24. The switch 63 (Fig. 2) starts and stops the vacuum pump. When the switch is moved to a position to start the vacuum pump the pump creates negative pressure in the tube 62 thereby causing the blanket 42 to be sucked downwardly toward the glass. The blanket thus presses the light-sensitive paper 41 and the image-bearing material 40 very tightly against the glass 24, and prevents displacement thereof, so long as the vacuum pump is in operation. When the vacuum pump is stopped this negative pressure is released so that the blanket may be readily removed by rotating the crank 55 and rolling the blanket toward the angle iron 46.

The source of light consists of a tube 10 which may be a 25 ampere, 220 volt, 59 inch high pressure mercury vapor burner which requires a minimum of 980 volts for operation. The current for operation of the light is supplied by the two parallel high voltage rails 70 (Fig. 3) which are supported in the trough-like insulation members 71 secured to the bottom member 22 (Fig. 3). The brushes 72 (Fig. 3) are supported by the carriage 11 and each brush is adapted to slide longitudinally along the top of the adjacent rail 70 and to remain in contact therewith at all times so that the light is lighted at all times when the electric rails are energized. The light is turned off and on by the switch 73 (Fig. 2) which controls the supply of current to the rails.

The light carriage consists of a bottom member 11 which is supported for movement from end to end of the apparatus by the wheels 12 which run on the tracks 13 (Figs. 2 and 3). Six uprights 75 are secured to the bottom member 11 and a reflector 76, parabolic in cross section, is supported by these uprights. A sheet of open wire mesh screen 77 is preferably secured across the top of the bottom section of reflector 76 to prevent heavy objects from accidentally falling upon the light 10. The member 78 forms an upward extension of the walls of the reflector and it is detachably secured to the reflector by means of bolts (not shown) which pass through the flanges 79 and 80. A series of parallel partitions 81 are secured to the walls of the reflector member 78. These partitions in combination with the reflector cause the light beams emitted from the light to impinge upon the image-bearing material substantially at right angles to its surface. Without the partitions some of the light beams tend to extend longitudinally of the reflector and to impinge upon the image-bearing material at acute angles to thereby cause undercutting of the image lines so that the lines in the print are narrower than the image lines, and to create blurred areas on the edges of the lines of the print.

One end of the chain 85 is secured to the member 86 which is fixed to the carriage 11 and the other end of this chain is secured to the member 87 which is also fixed to the carriage 11. The chain 85 passes over a driven sprocket 88 at one end of the apparatus and an idler sprocket 89 at the other end.

The sprocket 88 is driven by the motor M through a variable speed drive (not shown). The speed of movement of the carriage 11 is controlled by the rotatable handle 91 (Fig. 2) which is mechanically connected to the variable speed drive whereby the speed of the carriage may be

varied from one to ten feet per minute. The pointer **96** moves with the handle **91** and it indicates the speed of travel of the carriage. The switch **92** operates to start movement of the carriage. When this switch is pressed the sprocket **88** is rotated in a direction which causes movement of the carriage and the light from right to left (looking at Fig. 2). When the switch **93** is pressed it causes the sprocket to rotate in the opposite direction which causes movement of the carriage and light from left to right (looking at Fig. 2). When the switch **94** is maintained in depressed position the carriage may be stopped at the left-hand end of the apparatus (looking at Fig. 2).

When the switch **92** is pressed and nothing further is done with the switches **93** and **94** the carriage is moved from right to left (looking at Fig. 2) and when it arrives at the left-hand end of the apparatus the inclined surface **100** of the carriage bottom member **11** depresses the movable switch member **101** which causes the sprocket **88** to be driven in the opposite direction so that the direction of movement of the carriage is automatically reversed. When it reaches the right-hand end of the apparatus (looking at Fig. 2) the inclined surface **102** of the carriage depresses the movable switch member **103**, which automatically stops the sprocket. To again start the movement of the carriage it is merely necessary to again press the switch member **92**.

It will be observed from Fig. 2 that when the carriage is at rest at the end of the apparatus the beams emitted by the source of light cannot reach the sensitized paper on the plate **24** and that they also cannot pass out into the room to spoil sensitized paper which is apt to be stored near the machine. When the carriage is at the other end of the machine the light beams are likewise prevented from reaching either the glass **24** or the exterior of the room. Thus during reversal of the direction of the light the sensitized paper is not over exposed. The light ordinarily remains lighted while a previously exposed subject is being removed and a new subject is being inserted beneath the blanket.

The hood **105** and pipe **106** afford communication between the interior of the apparatus and a blower (not shown). The opposite end member **37** is provided with a dust filter through which air may pass. When the switch **73** is depressed to energize the rails and the light it also closes a circuit and the blower is started. This creates a cooling air current from the motor end of the apparatus through the hood **105** thereby preventing the light from overheating the interior of the apparatus.

Spring actuated switches **110** (Fig. 3) are provided at each end so that as soon as either end panel **37** is removed for access to the interior of the apparatus all electric current is immediately shut off. The main switch **111** also operates to shut off all electric current communicating with the apparatus, and this switch is normally turned off when the machine is not in use.

The preferred light source which is described emits a large quantity of heat. It is also necessary to turn it on about ten minutes before initial use. In my preferred method the speed of travel of the light is set fast enough so that for the correct exposure the light should travel from one end of the device to the opposite end and back to the original end. This eliminates overheating of the glass panel which is apt to occur if such a light is moved too slowly. Obviously

other sources of light may be used and they may be moved slowly enough to provide sufficient exposure by a single movement from end to end of the subject.

The application of that aspect of this invention which relates to use of a longitudinally extending source of light in combination with substantially parallel light-impervious members extending at right angles to the longitudinal axis of the light source and toward the image-bearing material is not limited to apparatus in which the image-bearing material and light-sensitive material are held stationary during printing nor to apparatus in which the source of light is moved during printing. That phase of this invention may be used in apparatus of well known constructions in which the light is stationary during printing and the light-sensitive and image-bearing materials are moved with respect to the translucent supporting surface during printing, as well as in apparatus in which both said materials and said light are stationary during printing.

Many modifications may be made without departing from the scope of the appended claims.

I claim:

1. In apparatus of the class described having a flat translucent work-receiving plate for receiving the image-bearing material and the light-sensitive material in superimposed relationship, a reflector of parabolic shape in cross section spaced from the surface of said plate and extending from side to side of the image-bearing material and a source of light fixedly mounted on said reflector, the improvement which comprises a support for said plate which extends outwardly from each end thereof a sufficient distance to provide a free space adjacent each end of the plate large enough to receive said reflector in a position wherein the light from said source of light is prevented from reaching said light-sensitive sheet, and means for moving said reflector at a uniform speed substantially parallel to the surface of said plate and throughout the path extending from said free space adjacent one end of said plate into the free space adjacent the opposite end of the plate.

2. Apparatus of the class described comprising a hollow rectangular container, a flat translucent work-receiving plate forming a portion of the top wall of said container and adapted to receive the image-bearing material and the light-sensitive material in superimposed relationship, a movable carriage carrying a reflector of parabolic shape in cross section extending substantially from side to side of said plate, a source of light mounted on said reflector, light-impervious portions of the top wall adjacent each end of said plate, each of said portions being at least as wide as the width of said reflector, and means for moving said carriage at a uniform speed throughout a path which is substantially parallel to the surface of said plate from a position wherein said source of light is beneath said light-impervious portion at one end of said plate to a position wherein said source of light is beneath said light-impervious portion at the other end of said plate.

3. In apparatus of the class described having a flat translucent work-receiving plate for receiving the image-bearing material and the light-sensitive material in superimposed relationship, the improvement which comprises a carriage, a source of light on said carriage adapted to light a portion of the image-bearing material from side to side thereof, a support for said plate which extends outwardly from each end thereof

a sufficient distance to provide a free space adjacent each end of the plate large enough to receive said source of light in a position wherein the light from said source of light is prevented from reaching said light-sensitive sheet, and means for moving said carriage and source of light in a path substantially parallel to the surface of said plate at a uniform rate of speed throughout its path, out from said free space adjacent one end of said plate and into the free space adjacent the opposite end of the plate.

4. Apparatus of the class described comprising a hollow rectangular container, a flat translucent work-receiving plate forming a portion of one wall of said container, a carriage, a source of light on said carriage adapted to light a portion of the image-bearing material from side to side thereof, the wall adjacent each end of said plate having a light-impervious portion, and means for moving said carriage at a uniform speed throughout a path which is substantially parallel to the surface of said plate from a position wherein said source of light is beneath said light-impervious portion at one end of said plate to a position wherein said source of light is beneath said light-impervious portion at the other end of said plate.

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