

[54] **AUTOMATIC LIGHT EXPOSURE DEVICE
FOR THE GRAPHIC ARTS**

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[58] Field of Search 355/87, 91, 113, 115, 119

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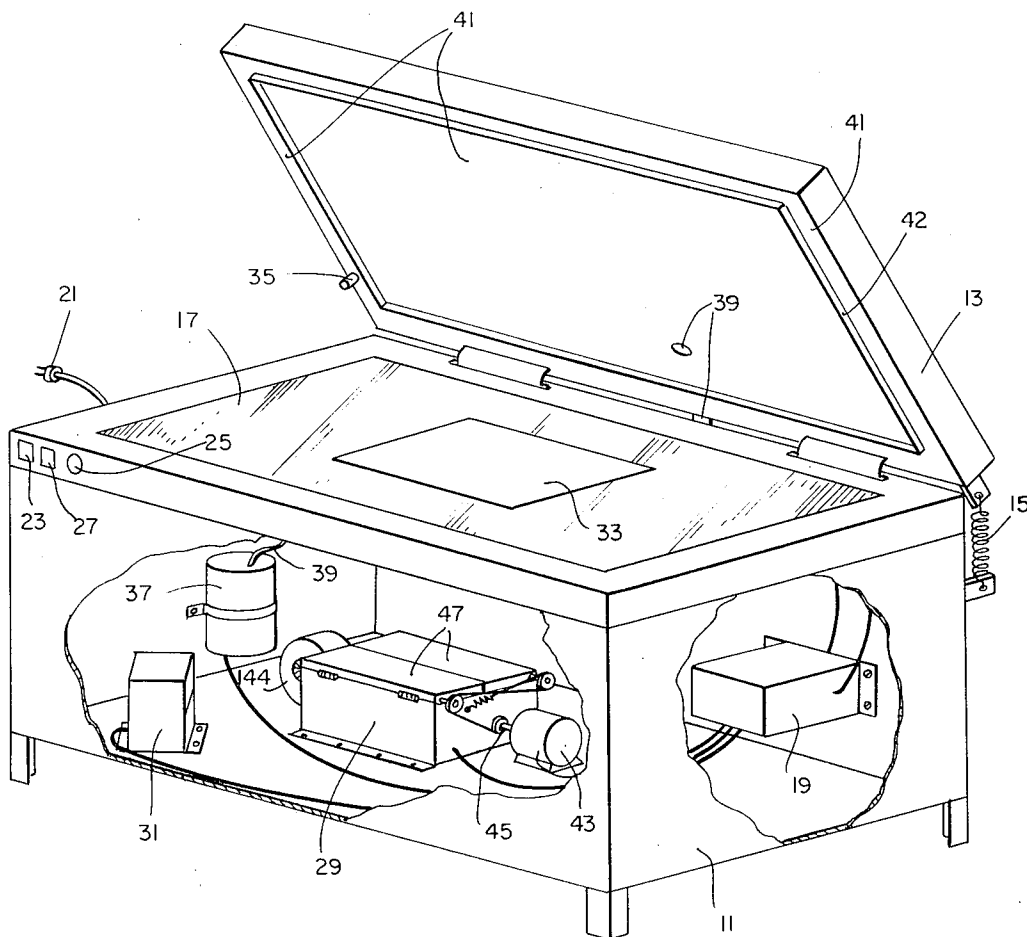
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[57]

ABSTRACT

The present device provides a means to automatically force photosensitive materials into close contact with either a negative or a positive depending upon what type of print is to be produced. In addition, the present device employs a mercury lamp as its light source because of its wealth of ultraviolet light. The present arrangement acts to keep the mercury lamp on at all times and to automatically expose the photosensitive materials to the mercury lamp for the proper amount of time only after the photosensitive materials have been forced into close contact with the negative (or positive). The negative and the positive will hereinafter be referred to as the transfer image means. Thereafter the lamp is automatically turned off and the member forcing said close contact between the photosensitive material and the transfer image means is released.

5 Claims, 2 Drawing Figures



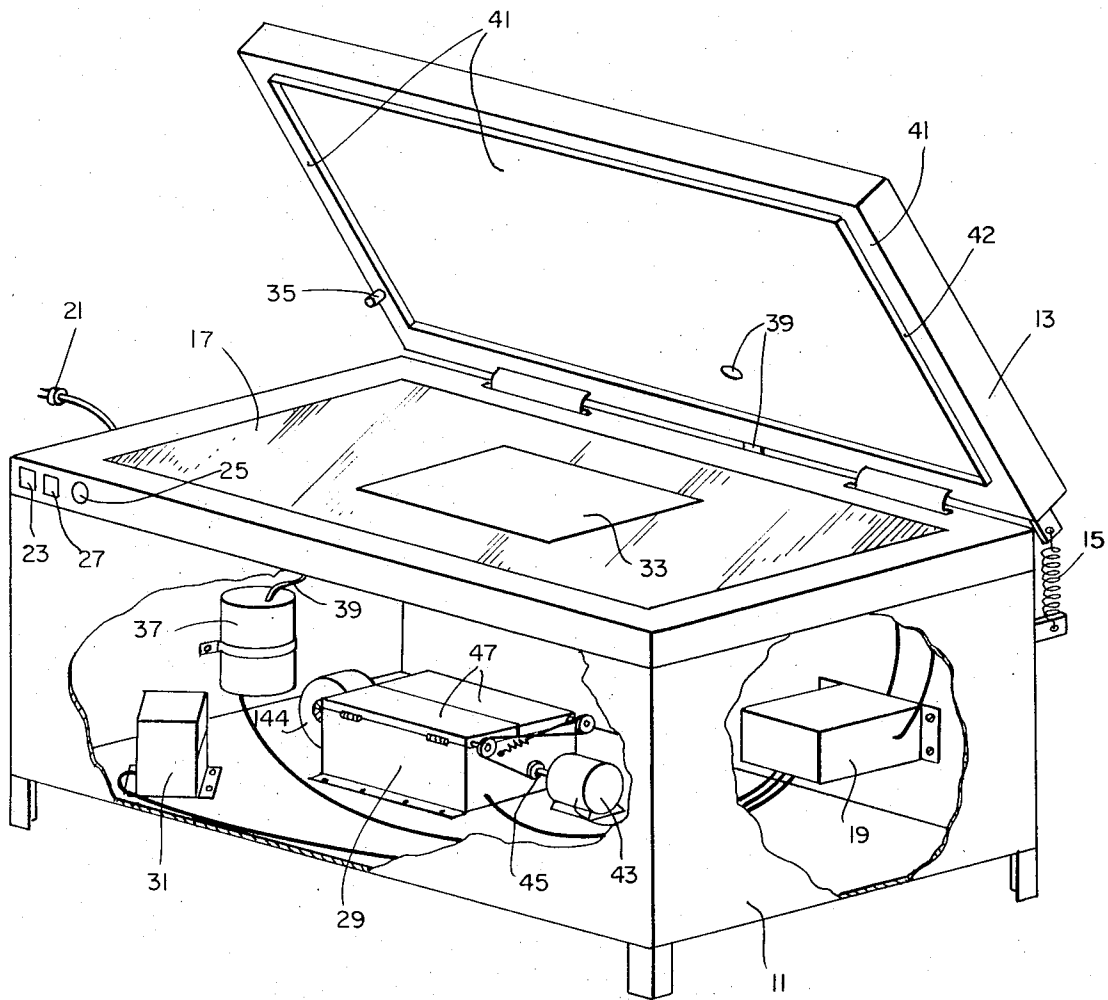
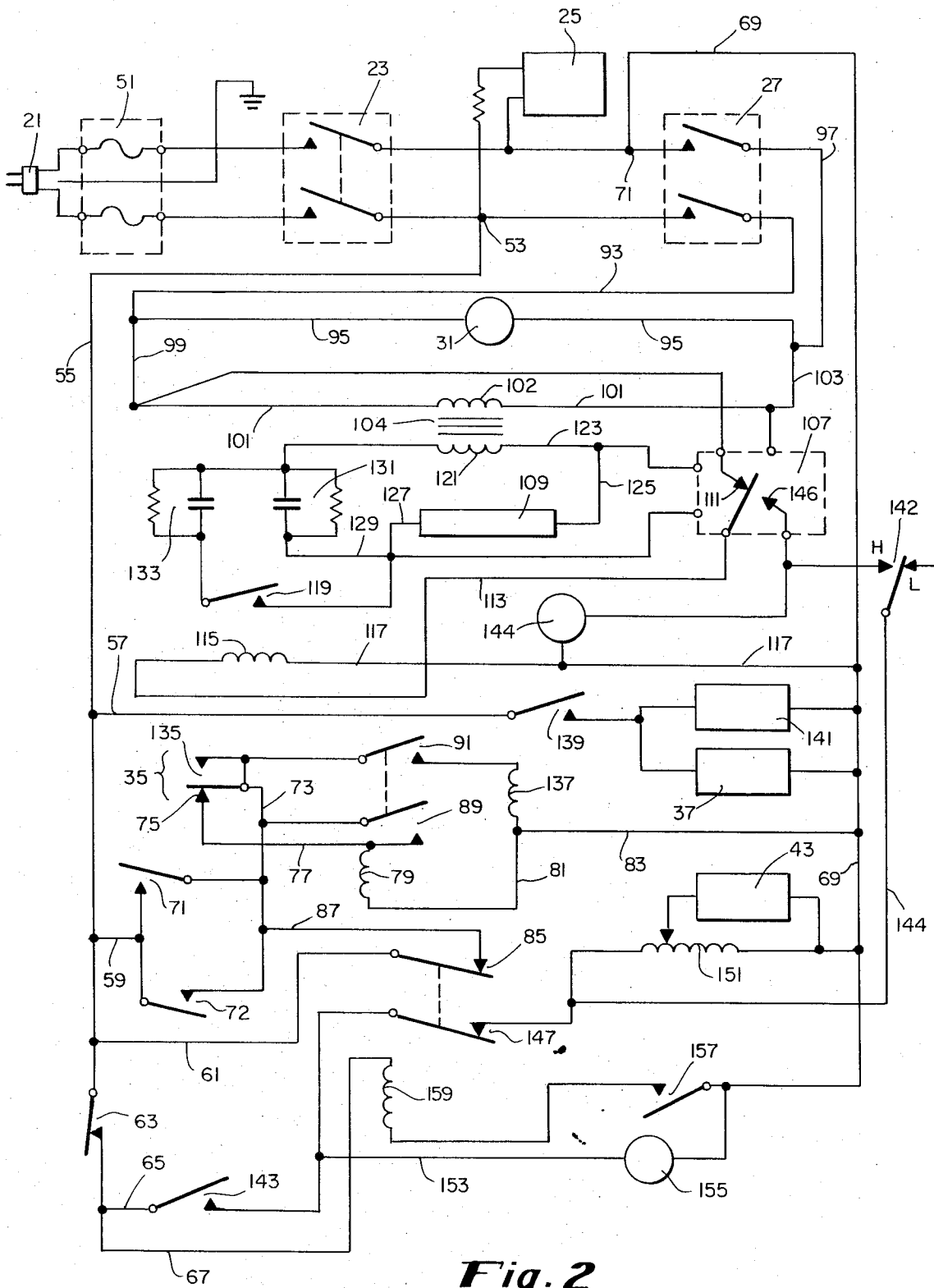


Fig. 1



AUTOMATIC LIGHT EXPOSURE DEVICE FOR THE GRAPHIC ARTS

BACKGROUND

In the graphic arts it has been understood for a long time that Diazo paper is very responsive to ultraviolet light. It is also well known that a mercury lamp provides a wealth of ultraviolet light and therefore it is the practice, if possible, to use a mercury lamp as the source of light to which to expose Diazo paper and a transfer image means. It has been found that rapid response of the lamp and uniformity of ultraviolet light require that the mercury lamp remain illuminated, rather than having it switched off and on with each exposure. In the prior art, it has been the practice to, first, place the photosensitive materials over the transfer image means which is located on a transparent table top and thereafter an edge sealed flexible blanket is clamped over the photosensitive layer and said transfer image means. After the materials, which are going to be exposed to the light, are clamped the space under the flexible blanket is exhausted to a low pressure so that the blanket is forced downward toward the transparent table top causing the photosensitive material and the transfer image means to be in very close contact.

Further in the prior art, subsequent to the foregoing two steps, a shutter over the mercury lamp is opened and held open for the proper period of exposure time. Finally the lamp shutter is closed in response to the operator throwing a switch or by time actuation, the vacuum pump is stopped in response to an operator throwing a second switch and the operator unclamps and lifts the lid to remove the exposed photosensitive material. For the next exposure the procedure is repeated and of course such a procedure requires constant attendance. The present system provides an automatic arrangement with additional advantages.

SUMMARY

In the present system the operation is automatic. The lid has an edge sealed flexible blanket center which is supported around its periphery and in the back by a rigid section. The blanket can be fabricated from rubber or some other suitable flexible, sturdy material. Means are provided to exhaust any air lying under the blanket within the seal and the transparent glass or plastic table top with which it comes in contact in response to the lid being simply closed, so that the air pressure on the upper side of the blanket and the underside of the glass forces the blanket within the seal against the photosensitive paper, transfer image means and glass. When the lid is closed against the transparent table top a switch turns on a vacuum pump and exhausts the exposure chamber (the space between the edge sealed flexible blanket and the transparent top) so that the blanket is automatically under pressure. Thereafter, automatically, the shutter over the lamp is opened for the desired exposure time after which it is automatically closed. When the light has been automatically turned off the vacuum pump is turned off and the lid is automatically lifted. A minimum amount of attendance is necessary.

The objects and features of the present invention will be better understood in view of the description hereinafter taken in conjunction with the drawings in which:

FIG. 1 is a pictorial view of the present invention;

FIG. 2 is a schematic wiring diagram of the control circuit.

Consider FIG. 1 wherein there is shown a pictorial of the light exposure device. In FIG. 1 there is shown a housing means 11 which is "cut away" in the front and on the side to show some of the necessary members of the system. Hinged to the housing 11 there is shown a lid 13 which is spring-loaded by spring 15 to the housing so that if the lid 13 is not held against the transparent table top 17, it will be returned to its released position as shown in FIG. 1.

When the system is in the "ready for operation stage" the power plug 21 is connected into an electrical power source. Accordingly, there is electrical power supplied to the switch 23. When the light exposure device is to be used, the switch 23 is turned on which turns on indicator light 25 and which supplies power to the switch 27. Next the operator turns on switch 27 which supplies power to the control box 19, which in turn supplies some electrical power to the mercury lamp held in shutter box 29. Prior to the actual exposure step, the lamp is illuminated under partial power so that it can readily be turned on when necessary, without experiencing a start-up delay, and in addition which state does not consume full energy when the system is idling. When the system is first turned on the mercury lamp will receive full power but shortly thereafter, it will be subject to partial power; i.e., during the idling period as will be more fully explained hereinafter. At the same time, in addition to turning on the lamp to partial illumination, the fan 31 is turned on to keep the housing cool and this eliminates damage from overheating.

Let us now assume that there is to be an exposure of Diazo paper (or some other photoresist coated or photosensitive paper, offset plate, silk screen, or a circuit to be etched) with a transfer image means. In such circumstances the photosensitive material with its sensitive side down, would be placed on top of the transfer image means to form the exposure package 33 shown in FIG. 1 lying on the transparent table top 17. Thereafter the lid 13 will be closed against the transparent table top 17 causing the lid switch 35 to close. It should be noted that the underside of the lid is made up of a blanket 41 to which there is attached a seal 42. When the lid switch 35 closes the vacuum pump 37 is turned on and the air is exhausted from the exposure chamber; i.e., the air lying under the blanket 41 within the seal 42 and the transparent table top through the tube 39 whose opening can be seen in the flexible blanket section 41.

When the vacuum pump has exhausted the exposure chamber, the section of the blanket 41 within the seal 42 will be forced down to insure a close contact between the elements of the exposure package 33 and thereafter the shutter motor 43 is turned on. The shutter motor 43 is a stall-type motor such as a fractional horsepower geared motor manufactured and sold by Brevel Corporation. The motor 43 has its shaft 45 turn thereby lifting the shutters 47 of the shutter box 29. Accordingly, the mercury lamp housed in the shutter box 29 transmits light to the exposure package 33. The lamp may be providing maximum illumination if desired by the operator as will be explained in the discussion of FIG. 2.

When the vacuum pump has effected the proper vacuum in the exposure chamber, two additional automatic steps take place. First a timing device is turned

on to provide a control signal at the end of the exposure time so that the shutters 47 will be closed at the end of the selected time and secondly the mercury lamp is subjected to full electrical power to thus provide maximum intensity light. The timer and the means for providing the full power to the lamp are held in the control box 19 and will be discussed in conjunction with the discussion of FIG. 2.

When the timer has reached its full time, the shutter motor 43 (which will be in a stalled mode) will be turned off and the shutters 47, which are spring-loaded as shown, will be returned to their closed position (shown in FIG. 1). After closure of the shutters and only after such closure, the vacuum pump will be turned off, which in conjunction with a normally open solenoid valve, opening to the atmosphere in T connection with the vacuum tube, will cause the force which kept the lid closed to be removed and the lid will be returned to its released position under the urging of spring 15.

It becomes apparent that the exposure package 33 can be quickly removed, another put in its place and the lid closed to start the process over again. Once the lid 13 is closed the process is automatic and involves no operators in attendance or throwing switches or opening and closing of clamps, etc.

Consider FIG. 2 which is a schematic wiring diagram of the circuitry found in control box 19. In FIG. 2 there is shown the power plug 21 which provides electrical power from a source, through the fuse box 51 to the switch 23 which we discussed earlier. When the switch 23 is closed it causes the indicator lamp 25 to be illuminated as discussed earlier and provides power to switch 27. In addition one side of the power line starting at terminal 53 is connected by line 55 to lines 57, 59 and 61, and through switch points 63 to lines 65 and 67.

If the circuits connected to the lines 57, 59, 65 and 67 are traced out it will be found that these circuits are not completed, at this time, to line 69 which returns to the other side of the power line at terminal 71. However, there is a completed circuit connected to line 61. Electrical current passes from terminal 53, along line 55, along line 61, through the normally closed points 85, along the line 89 to line 73, through the normally closed points 75, along line 77 to energize relay 79 and along lines 81 and 83 to line 69, thus completing the circuit. Accordingly, relay 79 is energized when switch 23 is closed.

It should be noted that when relay 79 is energized it closes the normally open points 89 and 91. Relay points 89 are holding relay points and serve to keep relay 79 energized even if the normally closed points 75 of the frame switch are opened (and provided that points 85 remain closed). The system now awaits the closing of the switch 27 as mentioned above.

When the operator is going to actually use the machine he turns on switch 27. With switch 27 closed electrical current will flow along line 93, along line 95 to energize the fan 31, along line 97 to the other side of switch 27. Current also passes along line 93, along line 99, along line 101 to energize the primary winding 102 of transformer 104, along line 103 to the other side of the switch through line 97.

In addition electrical current passes along lines 93, 99 and 105 to the starting module 107. The starting module 107 can be a voltage sensitive relay, or a difference amplifier connected to a relay or any one of the

many circuits which will energize a relay when a threshold voltage has been reached. The starting module 107 has a pair of normally closed terminals therein and a voltage sensitive element. When the voltage across the exposure (mercury) lamp 109 reaches a certain threshold, then the normally closed points 111 of the starting module will open and the function should be apparent immediately hereinafter.

While the normally closed points 111 are closed there will be electrical current along line 113 to energize relay 115 and return to the other side of the line (line 69 via line 117). The energization of relay 115 closes the normally open points 119 and their role will be explained hereinafter.

Going back for a moment it will be recalled that the primary winding 102 was energized and this in turn induced a voltage on the secondary 121. The voltage induced in the secondary 121 acts as a source voltage to supply current along lines 123 and 125, through mercury lamp 109, along lines 127 and 129, through the impedance network 131 to the other side of the secondary winding 121. The impedance network 131 is comprised of a resistor and a capacitor. The capacitor limits the power to lamp 109 and the resistor provides a discharge patch. The capacitive impedance of impedance network 131 is sufficiently high to subject the lamp to about one-half power. When the points 119 are closed the capacitor of impedance network 133 is added in parallel with the capacitor of impedance network 131 to reduce the overall impedance and thus subject the lamp to full power and obtain maximum illumination. This procedure also permits the lamp to warm up to operation temperatures rapidly. After the full power is applied to the lamp and the voltage drop there across equals the threshold value of the voltage sensing element of the starting module 107, the normally closed points 111 will be opened and the relay 115 will be de-energized. When relay 115 becomes de-energized the points 111 drop out thereby cutting out the parallel impedance 133 and thus reducing the power applied to lamp 109.

Thus far switches 23 and 27 have been turned on with the result that the lamp 109 is illuminated under half power, the fan 31 is operating and relay 79 is energized. The system is involved in no other steps until the lid 13 (FIG. 1) is closed.

When the lid 13 is closed, the lid switch 35 (FIGS. 2 and 1) is closed and (FIG. 2) we find the normally open points 135 will be closed. The closing of points 135 provides current from line 73, through points 135, through points 91 to energize relay 137, and thereafter to line 69 via line 83. When relay 137 is energized the normally open points 139 are closed which provides current along line 57, through points 139 to energize pump 37 and close the solenoid valve 141. It is necessary to close valve 141 when pump 37 starts pumping because this valve opens the vacuum tube 39 to the atmosphere through a T connection when the valve is not energized and hence if it were not closed the vacuum pump would not effectively exhaust the air from the exposure chamber. Thus when the valve 141 and pump 37 are energized, the exposure chamber under the closed lid will have the air exhausted therefrom. Now the vacuum pump 37 and tube 39 have a pneumatically-operated vacuum switch 143 associated therewith and when a sufficient degree of vacuum has been obtained in the exposure chamber, the switch 143 will

close. The switch 143 is physically located connected to tube 39 and can be a Bourdon tube actuated switch manufactured by the Mercoid Company. When the switch 143 closes, electrical current will pass along line 65, through switch 143, along line 145, through the normally closed points 147 of the shutter relay 159 to the transformer 151. The transformer 151 is a step down transformer and as can be seen in the schematic (FIG. 2), the power to the shutter motor 43 is from a tapped position on the transformer.

Accordingly the shutter motor 43, which operates with a reduced applied voltage, is energized. As explained earlier, the shutter motor 43 is a stall motor which operates to open the shutters covering the lamp 109 and will stall and keep the shutters open for as long as energy is applied to the motor. When the shutters 47 are opened they operate to close the points 71. Accordingly the relay 79 is held energized through points 85 and 71.

It should be recalled that during the idling period the lamp 109 has less than full illumination. If the operator is desirous of only low illumination he moves the manual switch 142 to the L (low) position as shown in FIG. 2. On the other hand, if the operator wants the lamp 109 to be operated at maximum intensity he will move the switch 142 to the H (high) position. It should be noted that when the switch 142 is in the high position and the vacuum switch 143 closes, electrical current will pass along line 145, through points 147, along line 144, through the H point of switch 142, through the normally open points 146 of the starting module 107 to energize relay 115. When relay 115 is energized the operation is as described earlier; i.e., points 119 will close to connect the impedance network 133 in parallel with impedance network 131 thereby applying full power to the lamp 109 and causing high illumination thereof. When the lamp 109 is providing maximum illumination, additional cooling is required. This is accomplished by providing electrical current through the H points of switch 142, through the lamp cooling blower 144 to line 117 and back to line 69.

Further and simultaneously with the energization of the shutter motor 43, and full illumination of lamp 109, current is passed along line 153 to energize the timer motor 155.

The timer mechanism is a standard automatic reset timing mechanism such as one manufactured and sold by Precision Timer Company. When the timer has completed its time cycle, the points 157 will be closed which will enable current to pass along line 67, through relay winding 159 through points 157 to the other side of the line (line 69). It follows that when relay 159 is energized the points 85 and 147 open thereby cutting off the electrical current to the shutter motor 43 and the high intensity relay 115. It will be recalled that with the shutters open; i.e., shutters 47 (FIG. 1) lifted, the points 71 will be closed.

Thus it becomes apparent that relay 79 will be de-energized only after the shutters 47 are closed. This arrangement insures that the lid 13 will not be released until the shutters are completely closed. In other words, even though the timer has caused relay 159 to be de-energized, the pump 37 and solenoid valve 141 will remain energized (thus keeping the lid closed) until the shutters 47 close. This is a safety measure for the operator; i.e., the lid will not "pop up" while the mercury lamp is in a position to send light through the transpar-

ent table top and injure the operator's eyes. This arrangement also avoids partial exposure of the exposure package under "no vacuum" conditions.

When the shutters 47 return to their closed position, the points 71 open and relay 79 drops out, thereby opening the points 89 and 91. In turn, relay 137 becomes de-energized causing points 139 to open. When points 139 open, the electrical current to the vacuum pump 37 and valve 141 is interrupted and thus the vacuum pump ceases to exhaust the exposure chamber while open valve 141 opens the exposure chamber to atmosphere. Accordingly the lid 13 is no longer forced down but is released and moves upward under the urging of the spring 15.

The functions of switch 63 and switch 72 are to circumvent the automatic features of the unit when desired. When switch 63 is opened manually the exposure is delayed because the timer is taken out of the system. If switch 72 is manually closed the vacuum can be maintained even though the exposure time is finished.

I claim:

1. An automatic light exposure device comprising in combination: housing means; transparent means disposed to form the top of said housing means; lid means movably secured to said housing means and formed and disposed to fit over and come in contact with said transparent means; flexible means disposed to form a substantial portion of the side of said lid means which comes in contact with said transparent means; vacuum effecting means connected to said flexible means to effect a substantial vacuum between said transparent means and said flexible means in response to said lid means coming in contact with said transparent means thereby providing a force against said flexible means toward said transparent means; lamp means; shutter means disposed to cover said lamp means when closed and to expose said lamp means when open; shutter moving means connected to said shutter means to cause said shutter means to open and close; timing means; switch means disposed on said lid means to be switched when said lid means comes in contact with said transparent means; vacuum detecting means connected to said vacuum effecting means to detect said substantial vacuum and in response thereto to provide a signal for activating said shutter moving means; and control circuitry means connected between said switch means, said vacuum detecting means, said shutter moving means, said timing means, and said vacuum effecting means whereby when said switch means is switched said vacuum effecting means effects said substantial vacuum so that said force causes said flexible means to come in close contact with said transparent means and whereby said vacuum detecting means provides a signal to cause said shutter moving means to move said shutter means to expose said lamp means for a predetermined time, as determined by said timing means, and whereby at the end of said predetermined time said shutter moving means closes said shutter means and whereby said vacuum effecting means terminates effecting a vacuum to remove said force from said flexible means.

2. An automatic light exposure device according to claim 1 wherein said control circuitry includes a lamp power circuit which causes said lamp to be illuminated to less than maximum intensity when said shutters are closed and alternatively illuminated to maximum intensity when said shutters are open.

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3. An automatic exposure device according to claim 2 wherein said lamp is a mercury arc lamp.

4. An automatic exposure device according to claim 1 wherein said vacuum effecting means comprises a vacuum pump with a tube connected thereto and a solenoid valve connected between said tube end atmosphere and wherein said control circuitry means is connected to said solenoid valve to close said valve to the

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atmosphere when said vacuum pump is operating and to open said valve to the atmosphere when said vacuum pump is not operating.

5. An automatic light exposure device according to claim 1 wherein there is further included means to lift said lid whereby when said force is terminated said lid automatically lifts.

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