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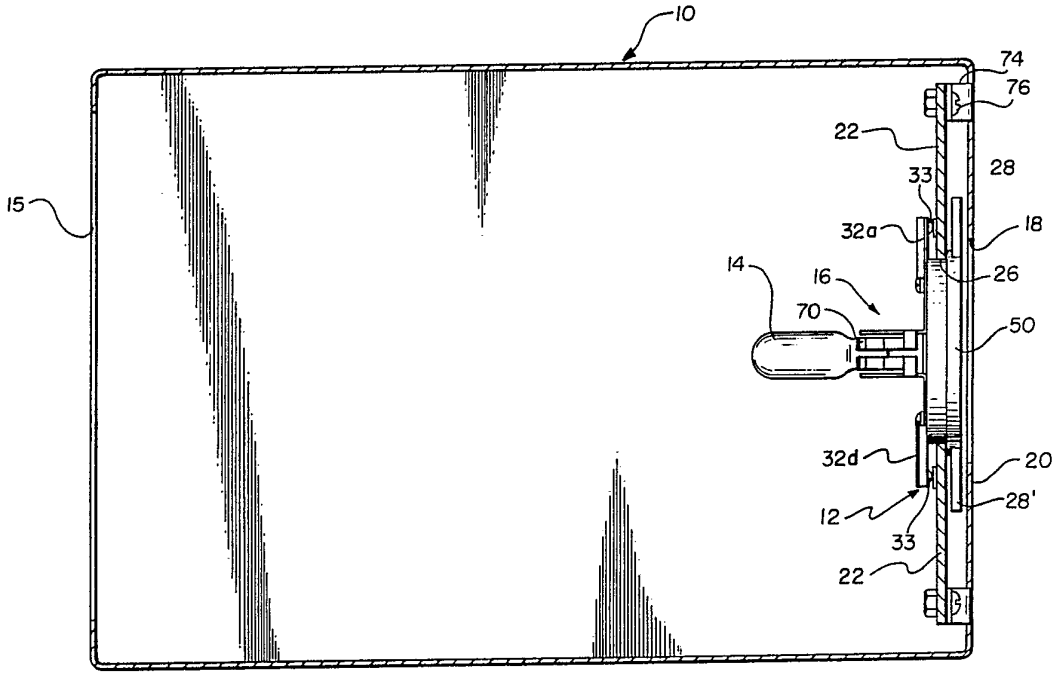

(57) Abstract

A mounting assembly for a light bulb includes a soft start-up circuit as well as a DC-to-AC converter in order to prolong bulb life. In addition, the mounting assembly includes a removable socket to facilitate changing the bulb. When the socket is rotated from an "engaged" position for removal, an interlock causes power to be interrupted at a remote location from the mounting assembly. In addition, conducting portions of the mounting assembly are remotely located to reduce the possibility of accidental contact during socket installation and removal.

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LIGHT SOCKET SOFT START AND POWER INTERRUPT ASSEMBLY

TECHNICAL FIELD

The present invention pertains to a light bulb mounting assmbly having soft start and power interrupt capabilities; and more particularly to a light bulb mounting assembly having a removable socket which interrupts power to the assembly when the socket is removed for replacement of the bulb.

BACKGROUND OF THE INVENTION

In photographic equipment such as film projectors, one or more light bulbs are used to illuminate an image for display. Occasionally, however, the bulb will burn out and require changing. It is common practice when changing the bulb to terminate power to the equipment in order to prevent accidental shock.

Furthermore, it is desirable to maximize the operating life of the bulb. It is known that a significant reduction in bulb life occurs during start-up when power is first applied to the bulb. This is because significant shock to the bulb filament occurs due to the initial surge of current reaching the filament when the light bulb is turned on.

A number of conventional apparatus for reducing an initial surge of current to a downstream load have been disclosed. For example, soft start circuits are described in U.S. Patent No. 4,580,088 by Bloomer; as well as in U.S. 4,621,313 by Kiteley; and U.S. 3,243,689 by Perrins. Furthermore, variable duty cycle circuits have been described in U.S. 4,163,923 by Herbers et al; and in U.S. 4,439,820 by Kuhn et al.

In addition, a number of conventional light bulb socket assemblies have been disclosed. For example, various light bulb socket assemblies used in conjunction with printed circuit boards have been described in U.S. Patent No. 4,152,622 by Fitzgerald; as well as in U.S. 4,076,358 by Taormina et al; in U.S. 3,555,341 by Curtis; and in U.S. 3,544,950 by Lopez et al.

SUMMARY OF THE INVENTION

The present invention pertains to a light bulb mounting assembly which has a soft start capability as well as a DC-to-AC conversion capability to increase bulb life, and which utilizes an interlock feature to interrupt power to the mounting assembly when the bulb is being replaced.

In an exemplary embodiment there is provided apparatus which is comprised of a mounting assembly for a light bulb, including socket means for supporting the light bulb, as well as means for holding the socket means to permit movement of the socket means between an engaged position where an electrical circuit is completed between the holding means and the socket means, and a disengaged position where the electrical circuit is not completed.

There is also provided means for interrupting a signal, as well as means for generating a signal. The signal generating means includes first signal means for supplying a first drive signal via the signal interrupt means to the holding means for activating the light bulb through the completed circuit when the socket means is in the engaged position. In addition, second signal means are provided for supplying a second signal to the signal interrupt means when the socket means is

in the disengaged position in order to interrupt the drive signal at the signal interrupt means and to prevent it from reaching the mounting assembly.

It is therefore an object of the present invention to provide for a light bulb mounting assembly and circuit in which power to the mounting assembly is interrupted when the socket is disengaged.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will become more readily apparent upon reading the following detailed description in conjunction with the attached drawings in which:

FIG. 1 is a side sectional view of a light box containing a light bulb socket and holder of the present invention;

FIG. 2 is an exploded isometric view of the light bulb socket and holder of the present invention;

FIG. 3A is an exploded isometric view of the light bulb socket of the present invention, and FIG. 3B is an elevated sectional view taken through the light bulb and engaging electrical contacts;

FIG. 4 is a diagram of the circuit used in conjunction with the light bulb socket and holder for achieving a soft start as well as a power interrupt capability;

FIG. 5 is a diagram showing various signals generated internally and externally by a conventional pulse width modulator to achieve soft start operation; and

FIG. 6 is a simplified diagram of the conventional pulse width modulator circuit which is utilized in an exemplary embodiment of the present

invention.

DETAILED DESCRIPTION OF THE INVENTION

By means of an introduction and by referring first to FIG. 1 there is shown a light box indicated at 10 containing a light bulb mounting assembly indicated at 12 which in turn supports a conventional wedge base light bulb 14. In an exemplary embodiment the light bulb 14 illuminates an image contained on a film carrier (not shown) through an opening in a left end 15 of the box.

As shown more clearly in FIG. 2, the mounting assembly includes a socket 16 which is inserted through an opening 18 in a right wall 20 of the light box. Located at a slightly spaced apart location from the inside surface of the right wall 20 is a printed circuit board 22 which contains four electrical contact pads 24a through d on its left surface and which are located about an opening 26 in the circuit board. When the socket 16 is inserted through the right wall opening 18, it is rotated in a counterclockwise direction (when viewing FIG. 2) so that radially extending wings 28 of the socket 16 are located in a gap 29 between the right side of the board 22 and light box right wall 20. This prevents the socket from being pulled out of the box in an axial direction. In addition, there are raised electrical contact prongs 32a through d, attached to the socket 16 and having dimples 33, which are caused to rotate into engagement with the contact pads 24a through d to complete an electrical circuit to the light bulb. More specifically, as shown in FIG. 1 the contact prongs 32 are retained above the wings 28 by a distance approximately equal to the thickness of the board 22 so that the dimples 33 on prongs 32 are brought into resilient

engagement with the contact pads 24 when the socket is rotated into an "engaged" position.

Soft starting of the bulb 14 is achieved by means of the circuit shown in FIG. 4. Briefly, when the socket 16 (shown schematically at the right side of FIG. 4) is rotated in a counterclockwise direction from a "disengaged" position shown in dashed lines, to an "engaged" position shown in solid lines, dimples 33 on socket prongs 32a, 32b engage contact pads 24a, 24b, thereby completing an electrical path between pads 24a and 24b; while at the same time dimples 33 on prongs 32c, 32d engage pads 24c, 24d completing an electrical path between pads 24c and 24d. It should be apparent therefore that a slight clockwise rotation of the socket 16 from the "engaged" position interrupts the electrical connection between pads 24a and 24b as well as between pads 24c and 24d, thereby providing the power interrupt feature of the present invention in a manner to be described in greater detail later. In addition when the socket assembly is in the "engaged" position, electrical contact is established between contact pads 24a and 24c, as well as between pads 24b and 24d. These connections provide current for lighting the bulb in a manner also to be described in greater detail later.

With regard to soft start, the rotation of the socket into the "engaged" position allows current to flow from an input line 36 (FIG. 4) through transistor switches 38a through d to the bulb 14 via the prongs 32 and mounting assembly. The switches 38 are controlled by a pulse width modulator circuit 40 which controls the operation of the switches 38 so as to slowly increase the "on" time of the bulb 14 as power is initially applied to

the bulb. More specifically, in an exemplary embodiment, pulse width modulator 40 generates an internal sawtooth waveform identified by the number 42 in FIG. 5. Rotation of the socket 16 to the "engaged" position and completion of the electrical circuit allows a capacitor 44 (FIG. 4) which is connected to the modulator 40 to charge up. This in turn generates a ramping waveform 46 shown in FIG. 5, and which is compared with the sawtooth waveform by the modulator 40 to generate a modulated output identified by the number 48 in FIG. 5. It is apparent from FIG. 5 that as the capacitor 44 charges up, the duty cycle of output pulses 48 increase, thereby increasing the "on" time of the bulb and providing its soft start capability. Rotation of the socket 16 from the "engaged" position causes the electrical connection to be broken between pad 24a and 24b as well as between pads 24c and 24d, resulting in the discharge of capacitor 44. This in turn interrupts power to the mounting assembly.

It is a further feature of the present invention that the capacitor 44 (FIG. 4) is not allowed to charge up until the socket 16 is in the "engaged" position. In this mode the switches 38 are not closed, and current does not reach the mounting assembly. Furthermore, the conducting portions (left sides) of the printed circuit board 22 (FIG. 1) and mounting assembly face away from the light box opening 18 as well as from the grasping surfaces of the socket so as to minimize human contact with the conducting portions when removing and reinstalling the socket 16.

Having provided a brief introduction to the present invention, a more detailed description will

now be provided. Referring first to the mounting assembly 16 shown in FIG. 3A, the socket is formed by a round base 50 to which there is integrally connected at opposing sides of the base 50 the aforementioned wings 28, 28' which are characterized by their rectangular shapes. Integral with and located atop the base 50 is a round platform 52 which has a slightly smaller radius than the base 50 so that an outlying portion of the base 50 forms a lip 54. The platform 52 includes raised locating bosses 60, 60' as well as upstanding pins 61, 61' at its opposing ends for engaging electrical contacts 62, 62'. The contacts 62, 62' each include i) a horizontal portion 66, which is positioned relative to the platform 52 by the respective locating boss 60 as well as by the respective upstanding pin 68, and which is retained thereon by a retainer 67 and by a screw-type fastener 69, and ii) a pair of upstanding fingers 70 (FIG. 3B) which are formed in a manner to engage notches 71 and a conductive terminal 73 of the light bulb 14 in a compressive manner thereby providing support for the bulb as well as a current path to light the bulb, and iii) bulb support tabs 75 which project upwardly from the upper surface of the horizontal portion 66 and provide lateral support to the light bulb 14. Also projecting horizontally from the opposite end of the horizontal portion 66 is the aforementioned pair of electrical prongs 32. That is, the prongs 32a, 32b extend over and above the upper surface of the wing 28 in a parallel manner, while the prongs 32c, 32d extend over and above the upper surface of the wing 28'. Located between each pair of prongs is a retention tab 77 for holding the socket in place in a manner to be described later.

In order to hold the socket 16, the light box 10 (FIG. 1) includes a number of leftward extending mounts 74 which are integrally connected to the inside surface of the right wall 20. The printed circuit board 22 is connected in a vertical manner to these mounts by fasteners 76 which extend through holes in the circuit board. To facilitate insertion of the socket 16, the openings 18, 26 in the wall 20 and board 22 all have shapes which are complementary in shape to, but slightly larger than, socket 16. That is, each opening has a round portion with rectangular wing portions at opposite ends. Furthermore, the openings 18, 26 are aligned with each other so that upon insertion of the socket through the opening 18 (FIG. 2) into the space 33 between the wall 20 and board 22, the prongs 32 extend through the circuit board opening 26 and engage the left side of the board 22. More precisely, the board opening 26 has a slightly smaller radius than the wall opening 18 so that during the insertion of the socket, the lip 54 of the socket base engages the right side of the board 22 to prevent further insertion; while the prongs 32, fingers 70, support tabs 75, and light bulb 14 extend through the board opening 26 into the light box 10. In addition, after clockwise rotation of the socket, dimpled portions of the retention tabs 75 drop into a pair of slots 79 which are located about the perimeter of the opening 26 on the circuit board 22. The retention tabs also provide tactile feedback to the user by indicating that the socket is in the correct position for use and that it need not be rotated further into position. However, should rotation of the socket continue, it is limited by a first tab 84 which extends (when

viewing FIG. 2) from the left surface of the wall 20 at a location adjacent a lower edge of the right wing opening, and a second tab 86 which extends from the left surface of the wall 20 at a location above the round portion of the opening 18. In this manner the tab 84 prevents unwanted counterclockwise rotation of the socket assembly during insertion, and the tab 86 limits the maximum clockwise rotation during insertion so that the prongs 32 properly align with the contact pads 24 in the "engaged" position. In order to achieve this alignment, contact pads 24a and 24b (FIG. 2) are located side-by-side next to the upper edge of the opening 26, and the contact pads 24c and 24d are located side-by-side next to the lower edge of the opening. In this manner, when viewing FIG. 2 pad 24a occupies a two o'clock position, pad 24b a one o'clock position, pad 24c an eight o'clock position, and pad 24d a seven o'clock position. When socket 16 is inserted and rotated into the "engaged" position, dimples 33 on prongs 32b and 32d(FIG. 4) wipe across pads 24a and 24c respectively; however not until after i) pads 24a and 24b make electrical contact and ii) pads 24c and 24d make electrical contact, is any substantial current permitted to reach the socket. It should be appreciated that insertion of the socket may be conveniently accomplished by grasping the socket 16 by the base portion 50 (FIG. 1) and then by inserting the socket through the opening 18 and rotating it clockwise when viewed axially from a point to the right of the right wall 20 in FIG. 1. Removal of the socket may be accomplished by simply reversing this procedure, with the first tab 84 limiting overroation of the socket 16 in the counterclockwise direction.

Turning our attention now to the details of the circuit shown in FIG. 4, transistors 38a through d are provided to not only accomplish the soft starting operation, but also in an exemplary embodiment, they are provided to convert a direct current (DC) signal, fed along the input line 36 from a conventional upstream power source (not shown), to an alternating (AC) signal. This DC-to-AC conversion is accomplished by first turning on transistors 38a and 38d, while turning off transistors 38b and 38c. In this manner a current path is provided through the bulb 14 in the direction of an arrow identified by the number 90. On the other hand, the AC cycle is completed by turning transistors 38a and 38d off, and turning transistors 38b and 38c on, so that a current path (identified by an arrow with the number 92) is generated through the bulb 14. Thus by cycling transistor pairs 38a, 38d, and 38b, 38c, on and off, a DC-to-AC conversion is accomplished which will prolong bulb life.

As mentioned briefly before, control of the transistors 38 (FIG. 4) is accomplished by the modulator circuit 40 which in an exemplary embodiment is a pulse width modulator chip referred to as an SMPS Control Circuit SG3524 manufactured by Signetics, and which is described beginning at page 7-52 of the Signetics data manual dated 1985. More specifically, the modulator chip includes emitter pins 98, 100, as well as collector pins 102, 104. In order to better understand the present invention, reference is made to FIG. 6, which is a simplified diagram of the modulator chip, as well as to the timing diagram of FIG. 5. In order to achieve a soft start capability, the external charging

capacitor 44 is tied to an input 111a of an internal comparator 112 for receiving the ramping signal 46. The modulator includes an oscillator 114 which has an input 116a tied to an external resistor 118, with its other input 116b being tied to an external capacitor 120. The oscillator uses the resistor 118 to establish a constant charging current into the capacitor 120. This charging current provides a linear ramp voltage on the capacitor which forms the sawtooth waveform 42 (FIG. 5) to provide a reference signal to the input 111b of the comparator 112. A second output from the oscillator is a narrow clock pulse 122 which occurs each time capacitor 120 is charged. This output 122 toggles a downstream edge triggered flip flop 124, generating an output signal 126 which is fed to an AND gate 128 which in turn gates the output signal 48 from the comparator 112 in order to generate an output signal 130 for cycling the downstream transistor 108. The output signal 126 from flip flop 124 also is inverted and fed to an AND gate 132 to gate the output signal 48 from the comparator 112 in order to generate a signal 134 for cycling the transistor 110 on and off. In this manner, on and off cycling of the transistors 108, 110 is achieved as explained more fully in the Application Notes for the SG1524 from the 1980 Data Book by Silicon General Co. This generates a signal 135 (FIG. 5) for driving the lamp in a manner to be described below. Furthermore, as the capacitor 44 ramps up, the duty cycle of the signal 48 increases. This signal gates the inputs to AND gates 128, 132 to increase the on times of the transistors 108, 110, and thereby progressively increase the current to the bulb.

In the present embodiment, overcurrent

protection is provided by a transistor 136 (FIG. 6) having its collector tied to input 111a, its emitter tied to ground, and its base tied to the output of a differential amplifier 138 having inputs 140a, 140b, which are connected across a current sensing resistor 142. In the event of an overcurrent condition, the transistor 136 is turned on so that the capacitor 44 is discharged.

In operation, when transistor 108 (FIG. 4) is turned "on", a base terminal 143b of the transistor 38b goes low, turning transistor 38b on. Transistor 38b is biased by an upper resistor 144b and a lower resistor 146b which are connected at a node 148b which in turn is connected through a current limiting resistor 150b (and a parallel speed up capacitor 152b) to the base terminal 143b. In this configuration, an upper end of the upper resistor 144b is connected to the power input line 36 and the lower end of the lower resistor 146b is connected to the modulator collector terminal 102. Furthermore, the collector of transistor 38b is tied through a node 154 to the contact pad 24a of the socket assembly. In addition, a bypass resistor 156b is tied between the emitter and collector of the transistor 38b for reasons to be discussed later.

Meanwhile, with modulator transistor 108 still "on", the emitter current from modulator terminal 98 to the base terminal of transistor 38c causes it to turn on. In this configuration the emitter of common emitter transistor 38c tied to a return line 158 to the power supply, and the collector of transistor 38c is tied through a node 160 to contact pad 24c of the socket assembly. Transistor 38c is biased by a resistor 162c which has one end tied through a node 164c to modulator

terminal 98 and its other end tied to the return line 158. The node 164c is tied through the current limiting resistor 150c to the base terminal.

At the same time that modulator transistor 108 is on, modulator transistor 110 is off. Therefore the voltage level at the base to transistor 38a is high (since there is no current through collector terminal 104), and transistor 38a is also off. As shown in FIG. 4, the base of transistor 38a is connected through resistors 150a, 146a to the modulator collector terminal 104, while the collector of transistor 38a is tied to contact pad 24c of the socket assembly via the node 160. In addition, with modulator transistor 110 off, there is a low voltage at the base to transistor 38d, causing it to be in an off state. Transistor 38d is configured so that its emitter is tied to the grounded power return line 158, while its collector is connected through the node 154 to contact pad 24a.

In the other mode of operation where modulator transistor 110 is on and modulator transistor 108 is off, the above described situation is reversed so that transistors 38a and 38d are turned on, and transistors 38b and 38c are turned off. In this manner current is fed through the bulb in an opposite direction indicated by the arrow 90.

In an exemplary embodiment where the present invention is part of a video system, resistor 118 (FIG. 6) and capacitor 120 (to the oscillator) are bypassed and the oscillator is clocked by an external signal via an external clock line 170 so that the switching of modulator transistors 108, 110 occurs at a video rate (approximately 15.75 kHz NTSC). This decreases the

presence of circuit noise when the image is displayed as part of a video system.

Turning now to the remaining operation of the modulator chip (FIG. 4), the aforementioned charging capacitor 44 has one end tied to the return line 158 and its other end tied through a node 172 to the comparator input 111a (FIG. 6) of the modulator.

In order to discharge the capacitor 44 when the socket 16 is rotated from the "engaged" position, the node 172 is tied to the collector of a discharge transistor 174 which has its emitter tied to ground and its base tied to the collector of an upstream switching transistor 176. Discharge transistor 176 has its base biased via a line 177 which is tied to a voltage reference output 179 of the modulator through a resistor 181. The operation of the switching transistor 176 is controlled by rotation of the socket assembly between the "engaged" and "disengaged" positions. More specifically, the emitter of the switching transistor 176 is tied to ground, with a biasing resistor 178 tied between its base and emitter. Also tied to the base of transistor 176 is the downstream end of a current limiting resistor 180 which has its upstream end tied to an upper end of a charging capacitor 182. The other end of the charging capacitor 182 is tied to ground. In operation, as capacitor 182 charges up (as a consequence of the rotation of the socket 16 to the "engaged" position), it turns on switching transistor 176 which in turn shuts off discharge transistor 174 to allow capacitor 44 to charge up. On the other hand, when capacitor 182 is discharged due to movement of the socket from the "engaged"

position, discharge transistor 174 is turned on, thereby discharging capacitor 44 and preventing it from charging up so that there is only a small potential between the contact pads 24 of the socket. Furthermore, the voltage at capacitor 44 is clamped by a diode 184 to a level set by a potentiometer indicated at 186 in order to limit the voltage across the light bulb 14.

Charging of capacitor 182 is accomplished only when the socket 16 is in the "engaged" position. More specifically, before start-up the capacitor 44 is in a discharged state and the transistor pairs 38a,38d and 38b,38c are "off". In this manner there is very little current which reaches the contact pads 24 when the socket is disengaged. Furthermore, the switches 38 and the portion of the circuit upstream of switches 38 are located away from the hole 26 in the circuit board 22 (FIG. 1) to prevent accidental contact during removal of the socket.

When the pads 24a and 24b are placed in mutual electrical contact by dimples 33 on prongs 32a and 32b, as well as the pads 24c and 24d placed in mutual electrical contact by dimples 33 on prongs 32c and 32d, a very small amount of current is fed around the transistors 38a, 38b via the bypass resistors 156a, 156b and nodes 154, 160, and on to contact pads 24a and 24c of the socket assembly. This current is then fed across to the pads 24b and 24d by the dimples 33 on socket prongs 32 and is discharged along interlock lines 190, 192 and through downstream blocking diodes 194, 196 and a downstream resistor 198 to charge up the capacitor 182. In the manner discussed previously, this shuts off discharge transistor 174 to allow the charging of capacitor 44.

It should be appreciated that as soon as the socket is rotated from the "engaged" position, the current through interlock lines 190, 192 is interrupted, allowing capacitor 182 to discharge to ground through resistors 180 and 178, and thereby turning on discharge transistor 174 to discharge capacitor 44. In the manner discussed previously, this interrupts power at the transistors 38 to the socket assembly.

CLAIMS:

1. Apparatus comprising:

a. a mounting assembly for a light, and having a portion which is movable between an engaged position and a disengaged position;

b. means for interrupting a signal; and

c. means for supplying a signal, including

1) first signal means for supplying a first signal by way of the signal interrupt means to the mounting assembly for activating the light when the light supporting means is in the engaged position, and

2) second signal means for supplying a second signal to the signal interrupt means when the light supporting means is in the disengaged position in order to interrupt the first signal at the signal interrupt means and thereby prevent the first signal from reaching the mounting assembly.

2. The apparatus as set forth in Claim 1 wherein the mounting assembly includes:

1) means for supporting the light; and

2) means for holding the light supporting means to permit movement of the light supporting means between the engaged position where an electrical circuit is completed between the holding means and the light supporting means in order to activate the light, and the disengaged position where the electrical circuit is not completed.

3. The apparatus as set forth in Claim 2 wherein:

a. the second signal means includes 1)

means for supplying the second signal to a first input, and ii) means for feeding the second signal from a first output to the signal interrupt means; and

b. the mounting assembly further includes means for electrically connecting the first input with the first output when the light supporting means is in the disengaged position in order to feed the second signal to the signal interrupt means.

4. The apparatus as set forth in Claim 2 wherein the signal interrupt means is a switch which is operable in response to the second signal, between a first position for conducting the first signal to the mounting assembly and a second position for not conducting the first signal to the mounting assembly.

5. The apparatus as set forth in Claim 4 wherein:

a. the holding means includes a first input for receiving the first signal from the signal interrupt means, a first output which is connected to the light supporting means, a second input for receiving the second signal from the second signal means, and a second output which is connected to the signal interrupt means;

b. the light supporting means includes first means for electrically connecting the second input with the second output when the light holding means is in the engaged position so as to feed the second signal to the signal interrupt means;

c. the interrupt means includes means, responsive to the second signal, for feeding the first signal to the holding means; and

d. the light supporting means further

includes second means for electrically connecting the first input with the first output when the light supporting means is in the engaged position in order to feed the first signal from the holding means to the light.

6. The apparatus as set forth in Claim 5 wherein

a. the holding means includes i) a first wall having first and second opposing surfaces with the first surface containing the first and second inputs as well as the first and second outputs, and ii) a second wall having third and fourth opposing surfaces and a first opening in communication with the third and fourth surfaces, ;

b. the light supporting means includes i) a base portion which extends through the opening when the light supporting means is in the engaged position, ii) an extended portion which is engaged between the second and third surfaces when the light supporting means is in the engaged position, and iii) electrical conducting means, which includes the first connecting means and the second connecting means, for engaging the first and second inputs and and first and second outputs on the first surface when the light supporting means is in the engaged position.

7. The apparatus as set forth in Claim 6 wherein:

a. the first wall is a circuit board which contains the first and second inputs and the first and second outputs on the first surface, and which contains a second opening which extends between the first and second surfaces; and

b. the electrical conducting means are spaced apart from the extended portion of the light

supporting means in a manner that when the extended portion is engaged between the second and third surfaces, the electrical conducting means extend through the second opening to engage the first and second inputs as well as the first and second outputs on the first surface.

8. The apparatus as set forth in Claim 7 wherein the first signal means includes means for modulating the first signal in a manner that after the light supporting means is moved to the engaged position, an output intensity of the light increases over time.

9. The apparatus as set forth in Claim 8 wherein the signal generating means includes means for receiving the first signal as a DC signal and converting the DC signal to an AC signal, the signal converting means including:

a. first switch means and second switch means each having an input for receiving the first signal as a DC signal, and an output for feeding the AC signal to the holding means;

b. means for i) switching the first and second switch means into a first mode in which the first switch means is conducting and the second switch means is nonconducting in order to feed the first signal in a first direction to the mounting assembly, and ii) for switching the first and second switch means into a second mode in which the second switch means is conducting and the first switch means is nonconducting in order to feed the first signal to the mounting assembly in a second direction which is opposite to the first direction..

10. The apparatus as set forth in Claim 9 wherein the modulating means includes means for switching the first and second switch means so that

when the light supporting means is moved to the engaged position, an amount of time in which the first and second switch means are conducting increases over time in order to increase the intensity output of the light.

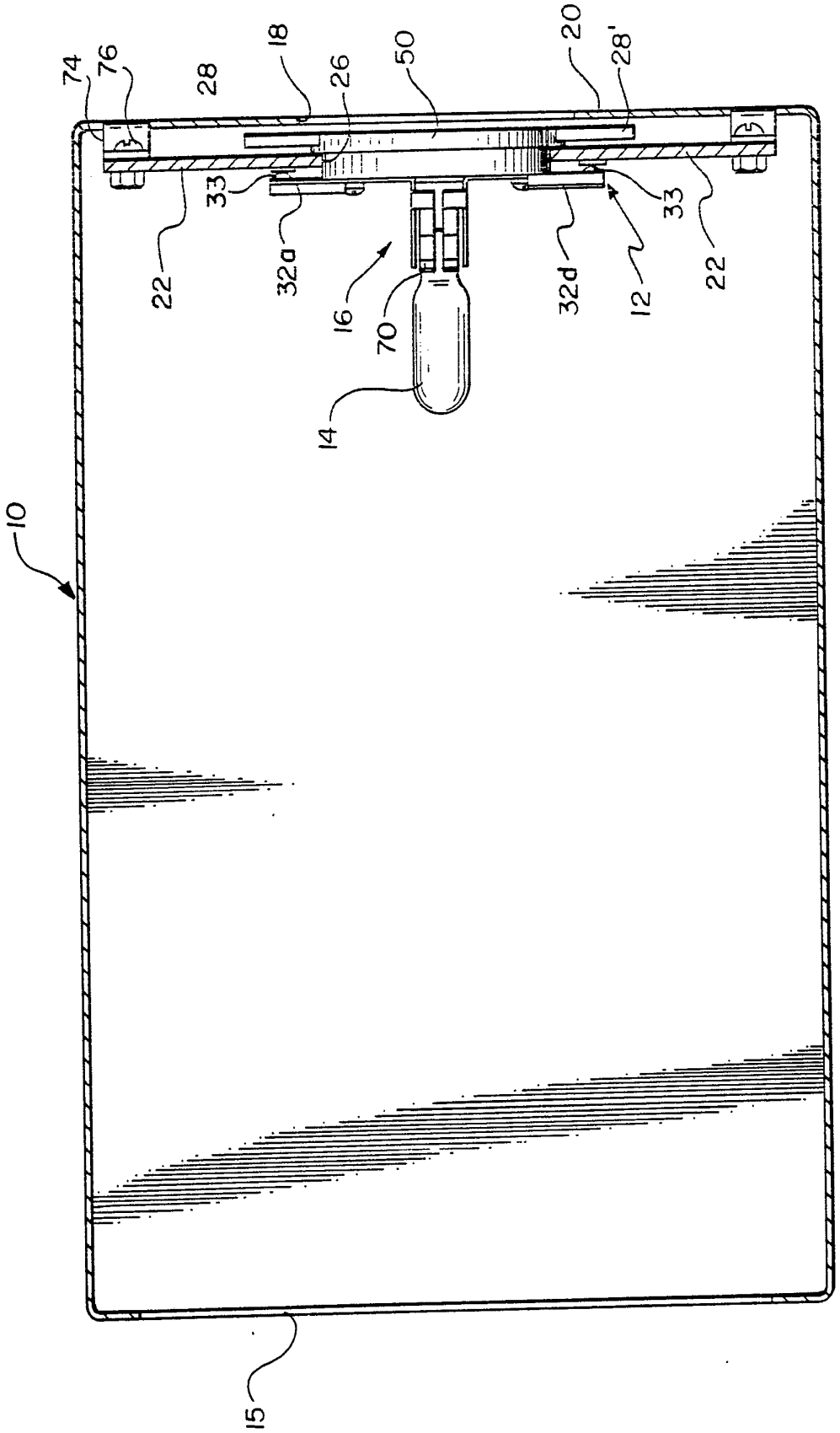

FIG. 1

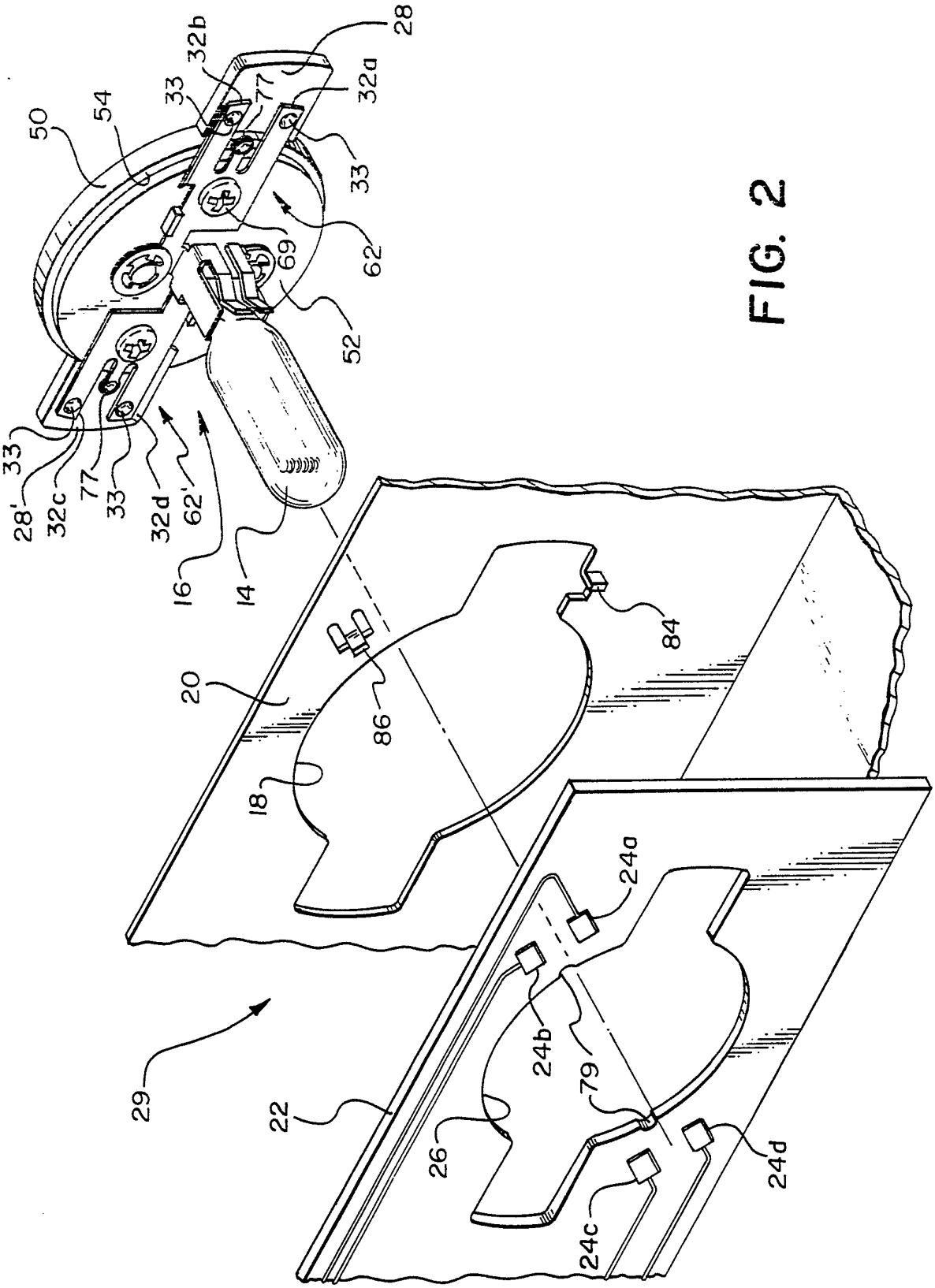
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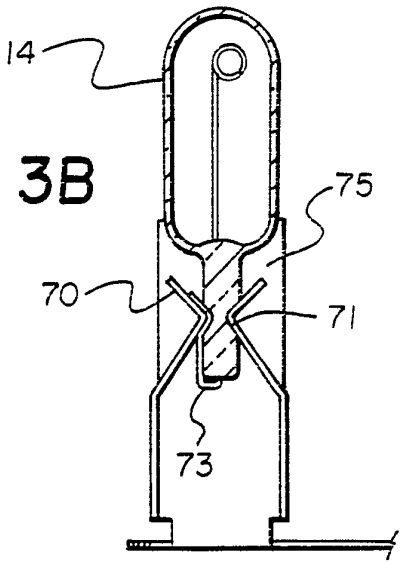
FIG. 2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73

FIG. 3B

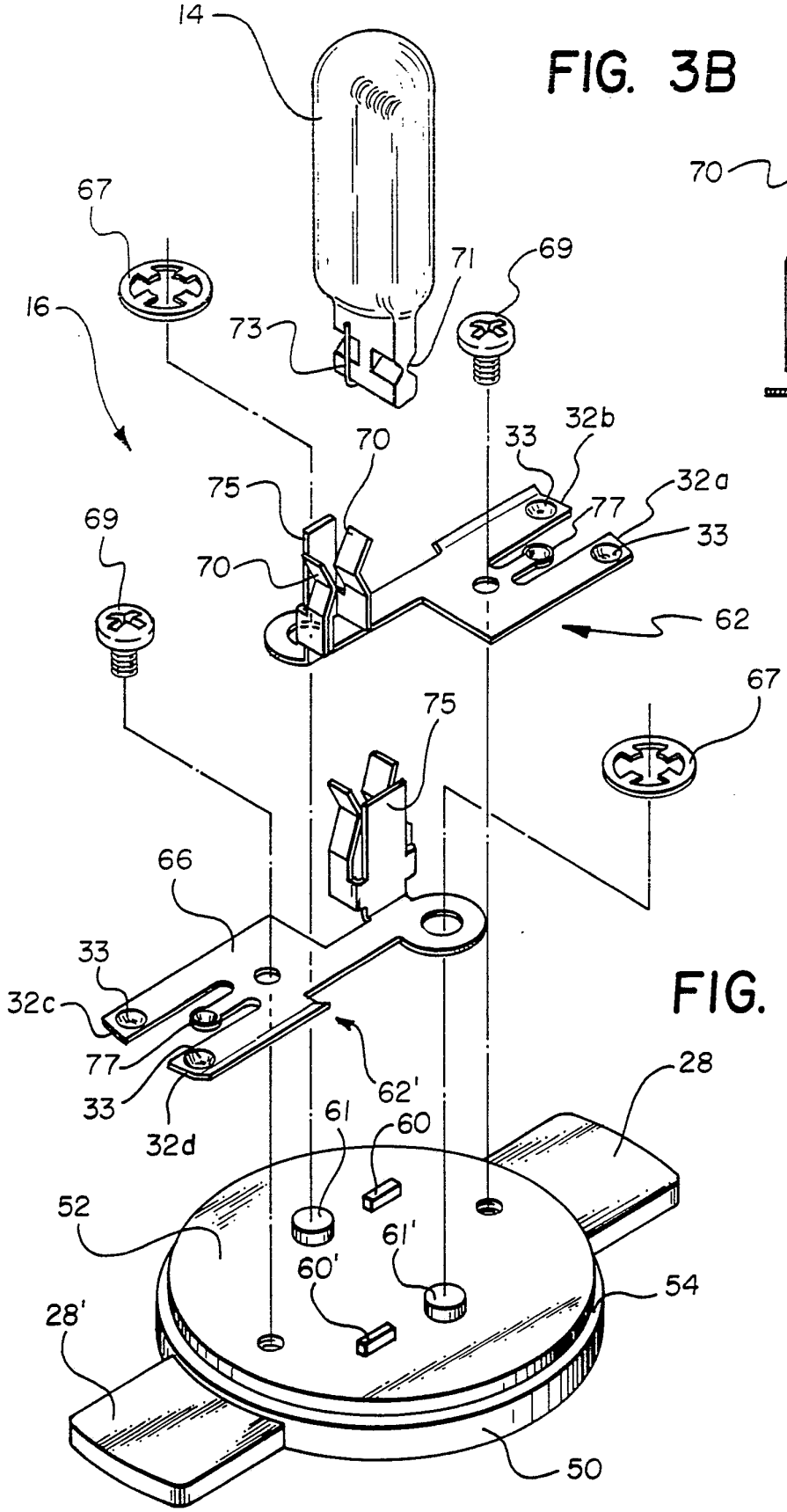

14
67
16
73
71
69
70
33
32b
75
32a
77
33
69
70
62
67
75
66
33
32c
77
33
32d
62'
61
60
28
52
61'
60'
54
28'
50

FIG. 3A

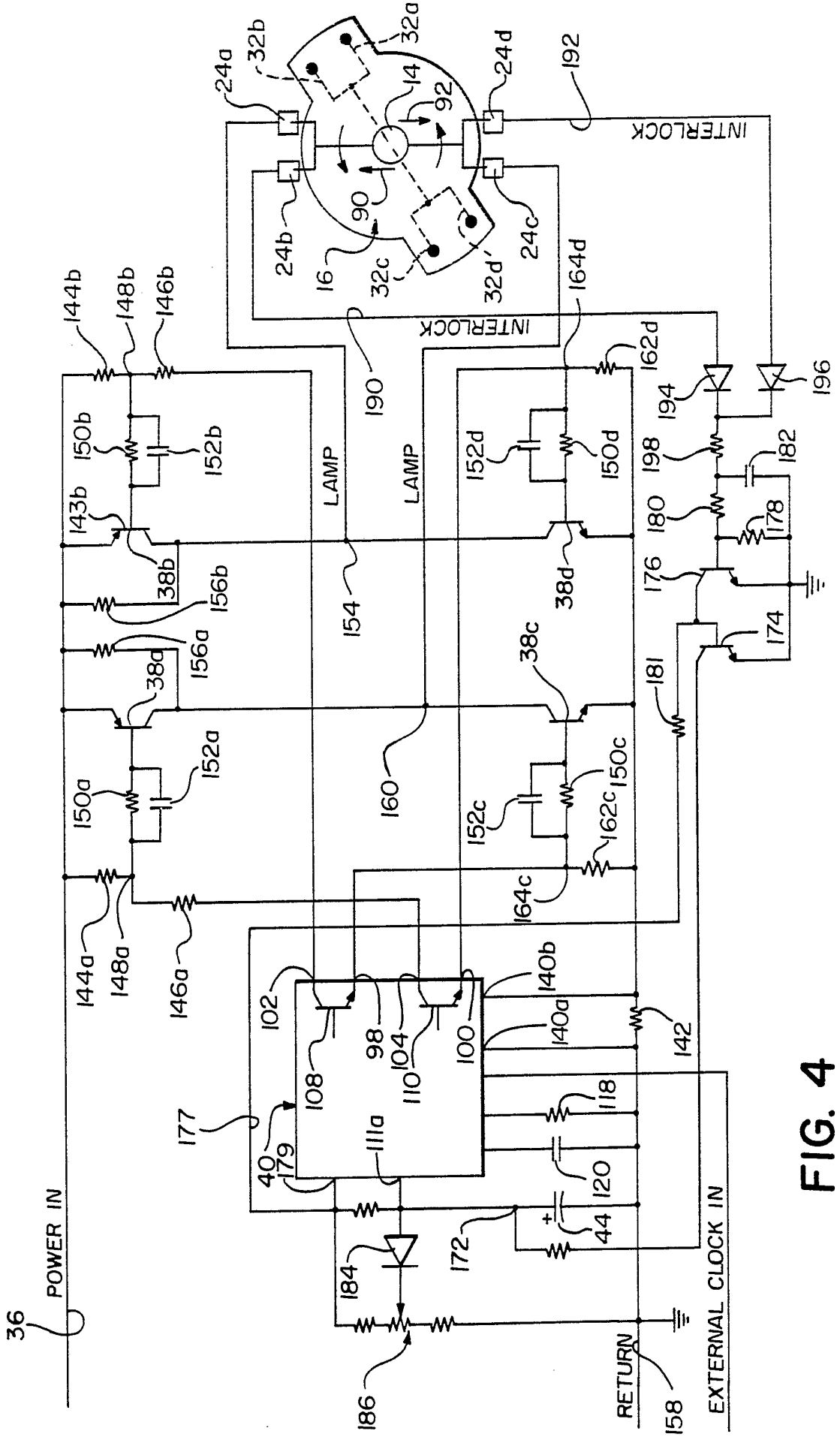
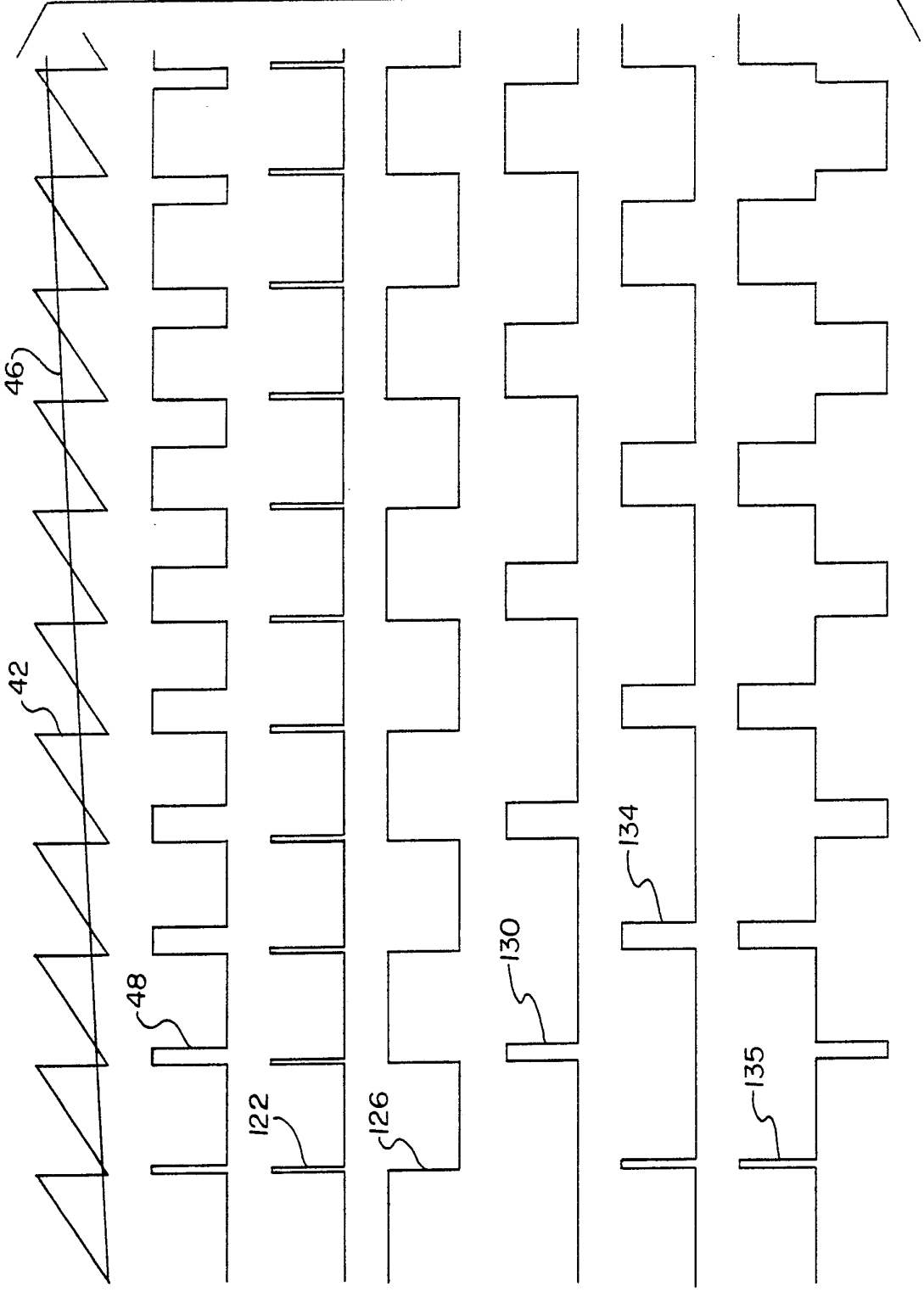

POWER IN
36
EXTERNAL CLOCK IN
RETURN
158
INTERLOCK
INTERLOCK
LAMP
LAMP
24a
24b
24c
24d
32a
32b
32c
32d
14
16
90
92
190
192
194
196
198
182
180
178
176
174
181
144a
144b
146a
146b
148a
148b
150a
150b
150c
150d
152a
152b
152c
152d
154
156a
156b
160
162c
162d
164c
164d
38a
38b
38c
38d
40
44
98
100
102
104
108
110
111a
118
120
140a
140b
142
143b
172
177
179
184
186

FIG. 4

FIG. 5



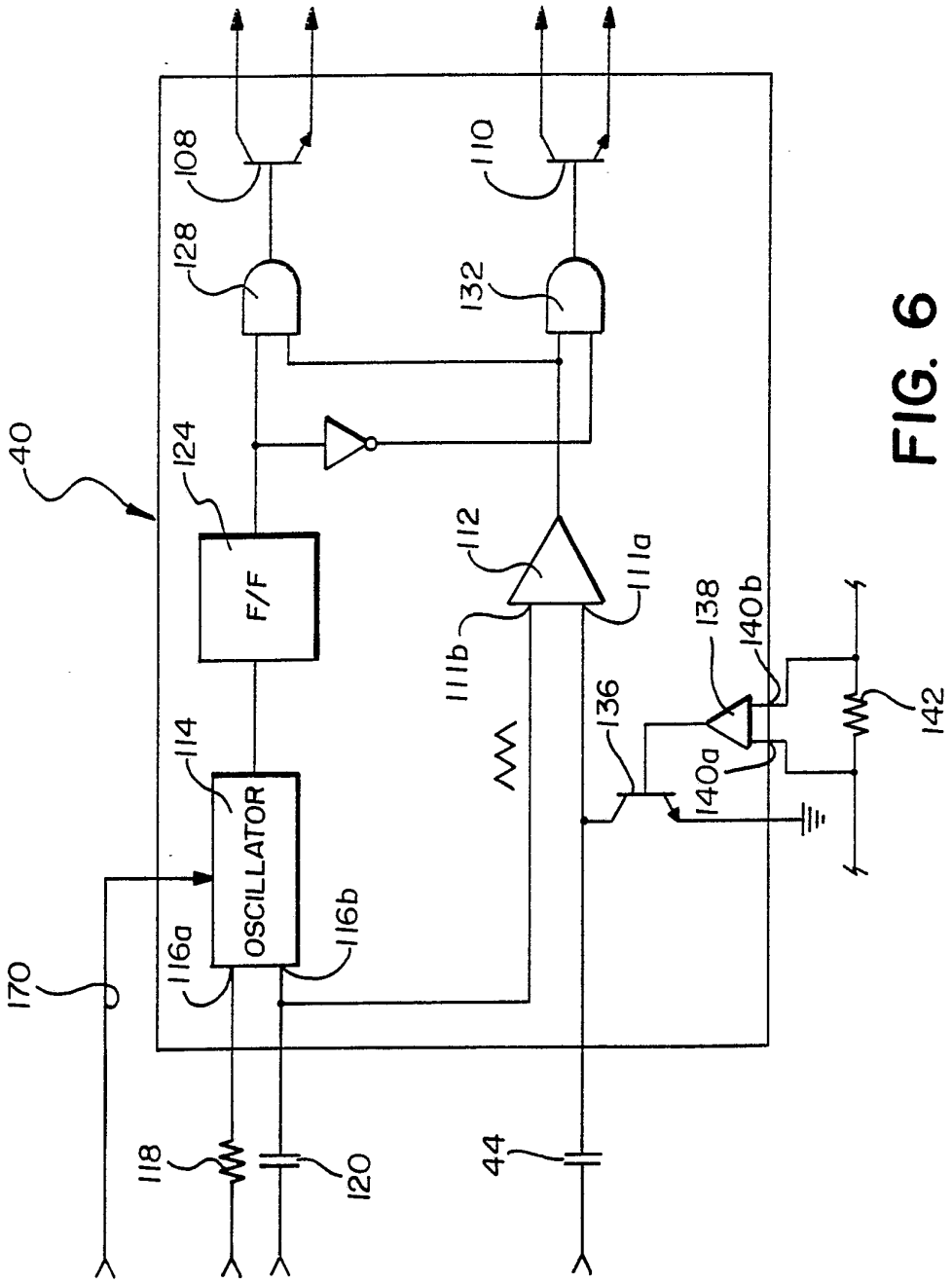

40
108
110
128
132
124
F/F
112
111a
111b
138
140b
136
140a
142
114
OSCILLATOR
116a
116b
170
118
120
44

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/04618

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: H 01 R 33/96; H 01 R 33/09

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	H 01 R, F 21 Q

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	DE, C, 866070 (MIX & GENEST) 5 February 1953, see page 1, line 28 - page 2, line 7; page 2, lines 19-21,100-108; figure 1 --	1,2
A	DE, U, 8406847 (DOLIN) 14 June 1984 see page 1, lines 5-13; page 2, lines 1-25; page 5, lines 15-25; figure 4 --	1-3,6
A	EP, A, 0107856 (OLYMPUS) 9 May 1984 see abstract; page 1, lines 1-23; figure 1	1-3,8,10

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
26th April 1989	30. 05. 89
International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	P.C.G. VAN DER PUTTEN

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 8804618 SA 26591

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 23/05/89
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C- 866070		None	
DE-U- 8406847	14-06-84	None	
EP-A- 0107856	09-05-84	JP-A- 59078495	07-05-84
		US-A- 4568858	04-02-86