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PHOTOELECTRIC AMBIENT LIGHT SIGN CONTROL APPARATUS

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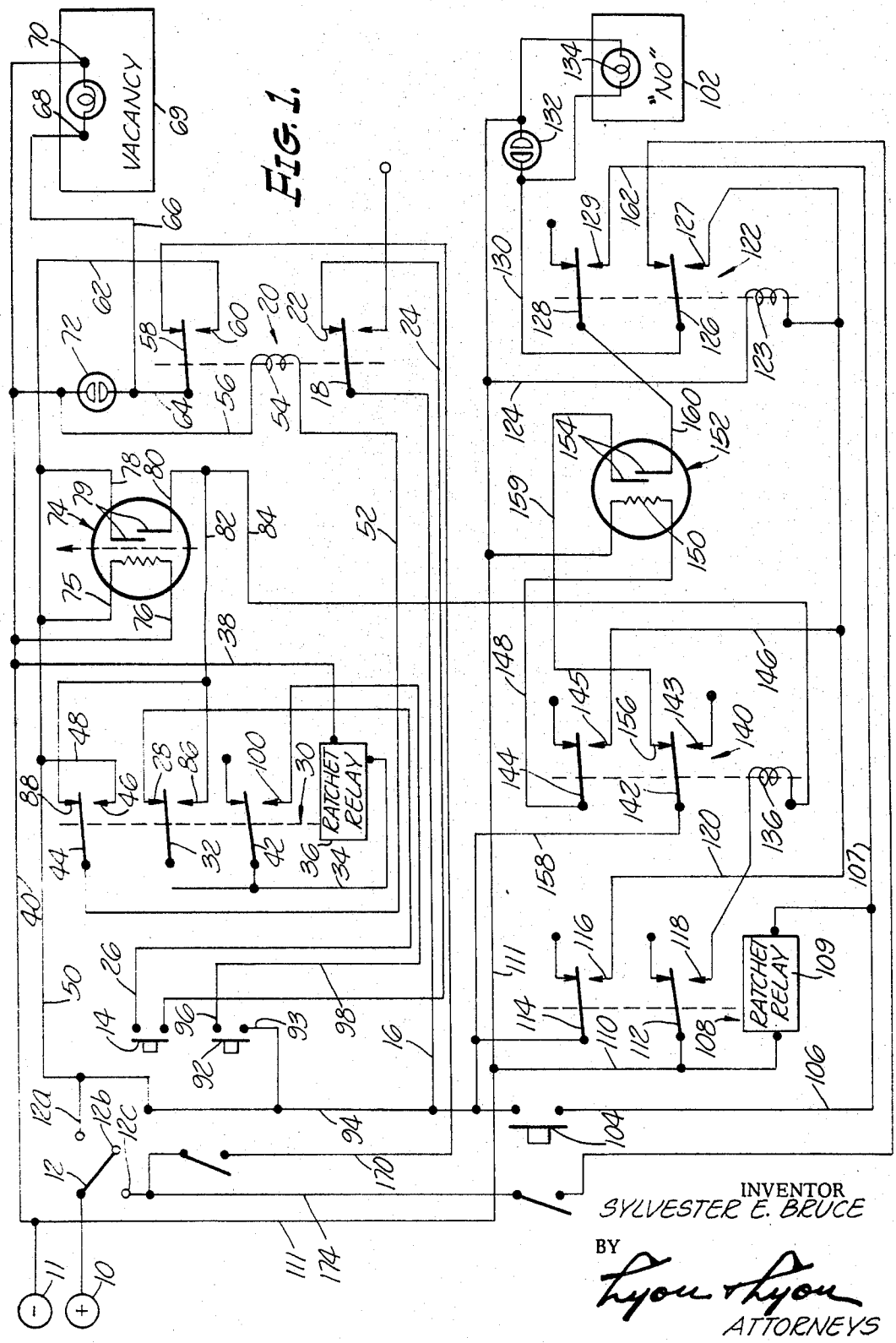


Fig. 1.

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PHOTOELECTRIC AMBIENT LIGHT SIGN CONTROL APPARATUS

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ABSTRACT OF THE DISCLOSURE

A circuit for automatically controlling the operation of an electric sign having two or more portions, the circuit including a light responsive cell exposed to ambient sunlight to turn the sign on or off and further including circuit means for turning off one portion of the sign but requiring said portion to be turned on manually.

The present invention relates generally to circuit means for automatically controlling the operation of an electric sign. More specifically, the present invention relates to circuitry particularly adaptable for use in controlling the electric signs of hotels and motels which indicate whether or not a vacancy is available.

It has been for some time an established practice of motels and some hotels to provide a lighted sign to indicate to passers-by whether or not the establishment has a vacancy. Usually such a sign will accompany or be made a part of the sign which announces the name of the establishment and the facilities available there. The word "VACANCY" will usually remain lighted and thus may be included on the same circuit as the rest of the sign but the word "NO" is placed upon an independent circuit so that it may be turned on and off depending on whether vacancies are available. Thus, the operator of the establishment must actuate two separate controls from his office, one to turn the sign on as dusk approaches and the other to turn on the word "NO" after all the vacancies have been taken for the night.

One of the difficulties with such a system is that the operator of the establishment, being involved with other duties, may forget to turn the sign on early enough in the evening to alert passers-by that vacancies are available and therefore some trade may be lost. To avoid such a loss of trade, the operator may turn the sign on early in the day or just leave it on all day, which of course uses unnecessary electric power. Even more important, the operator may forget to turn off the "NO" portion of the sign the next day and a whole day's business may be lost without the operator realizing the reason therefor. Although it is known that light-responsive devices have been employed for some time for turning on and off a light, such systems have not included sufficient circuitry to properly control the "NO" portion of the sign.

The present invention obviates the aforementioned difficulties by providing a circuit which automatically turns on the sign including the "VACANCY" portion thereof when the sunlight outside drops to a predetermined level but does not actuate the "NO" portion of the sign at that time unless the independent control therefor has already been actuated. Whenever the operator of the establishment rents all the vacancies, he throws the "NO" switch, whether the rest of the sign is yet lighted or not. The following morning when the sunlight again reaches a predetermined level, the control apparatus turns off the sign including the "NO" portion and the "NO" portion will not be relighted until the manual control is again actuated. The present invention also includes circuitry for preventing the alteration of

established conditions within the circuit should there be a power failure.

It is an object, therefore, of the present invention to provide a circuitry for automatically controlling an electric sign.

More specifically, it is an object of the present invention to provide means for automatically controlling a "NO VACANCY" sign for motels and the like.

It is also an object of the invention to provide means for automatically controlling a "NO VACANCY" sign so that the "NO" portion thereof is not inadvertently lighted.

It is also an object of the present invention to provide an automatic sign control circuit whereby the operation thereof will not be altered in the event of a power failure.

Further objects and advantages of the present invention will be readily apparent upon reading the following description in conjunction with the drawing in which:

FIGURE 1 is a schematic circuit diagram of a sign control apparatus made in accordance with the present invention.

The layout of the circuit diagram can be most readily understood by an explanation of the sequence of operation thereof. Terminals **10** and **11** are connected to an external source of AC power, terminal **10** being connected to the positive terminal and terminal **11** to the negative. Any single phase of three phase system, of any of the conventional voltage values may be accommodated in a customary manner. Switch **12** is a key operated selector switch which determines whether the circuit will operate automatically or manually. For turning off the entire unit switch **12** is left in contact with terminal **12**(*b*) as shown. The manual operation will be explained subsequently. For automatic operation switch **12** is moved to terminal **12**(*a*). The vacancy portion of the sign may then be turned on by depressing pushbutton **14**. Line **16** is connected to the positive terminal **10** through line **94** and switch **12** and to the contact **18** of relay **20**. Terminal **22** of relay **20** is connected through line **24** to one terminal of pushbutton **14**. When button **14** is depressed, the two contacts thereof are connected together and current will be conducted along line **26** to terminal **28** of ratchet relay **30**. In the initial, non-energized state contact **32** of ratchet relay **30** will be in conducting contact with terminal **28** thereof and therefore current will flow in line **34** to the coil **36** of relay **30**. The other terminal of coil **36** is connected through line **38** to the negative bus **40** coupled to terminal **11**. Thus, depression of pushbutton **14** causes current to flow in coil **36** of relay **30** causing immediate change in the position of contact **32** as well as contacts **42** and **44**. Relay **30** is a bi-stable switching device, or in other words it is the nature of relay **30** that a change in the contact positions caused by an initial flow of current through the coil will change the state of the contact and will permit the contacts to remain in that position until a flow of current is again experienced through the coil whereupon the contacts will change their state once more.

The contact **44** will thus be moved into conducting contact with terminal **46** which is coupled through line **48** to line **50** which in turn is coupled to the positive terminal **10**. Thus, current will flow through line **48**, past contacts **46** and **44** and through line **52** to the coil **54** of relay **20**, the other side of which is connected through line **56** to the negative bus **40**. Relay **20** is a monostable switching device wherein continuous current through the coil is necessary to maintain it in its unstable state. The stable state of relay **20** is as shown in FIGURE 1. Current will flow through the coil **54** changing the state of contacts **18** and **58**. Contact **58** will thus be moved into

conducting contact with terminal 60 which is connected through line 62 to line 50 and current will flow through line 50, line 62 past terminal 60 and contact 58 to line 64, thence to line 66 which is connected to terminal 68 of the "VACANCY" sign. Terminal 70 of the sign 69 is in turn coupled to the negative bus 40 and current through the sign 69 will light the same. An indicator light 72 is coupled between line 64 and the bus line 40 so that when current flows through line 64 to light the sign 69, current will likewise flow through the indicator light 72 lighting the same. The indicator light 72 will be placed upon the control board thereby indicating to the operator that the sign is in operation.

A photocell 74 which may be a cadmium sulfide light-sensitive switch has its sensitive surface exposed to the exterior ambient sunlight. The resistance terminals thereof 75 and 76 are coupled to the positive line 50 and the negative bus 40 respectively. Contact terminal 78 of cell 74 is likewise coupled to positive line 50 and the second contact terminal 80 is coupled to lines 82 and 84. As the ambient light intensity increases, the contacts 79 of switch 74 close permitting current to flow therethrough from positive line 50 through line 82, which is coupled to terminals 86 and 88 of relay 30. Where the button 14 has previously been depressed, as described above, contact 32 will be in contact with terminal 86 and therefore current will flow through contact 32, line 34 and through coil 36 of relay 30. This will cause a change in state of the contacts 32, 42 and 44 breaking the contact between 32 and 86 but re-establishing contact between contacts 44 and 88 whereupon current will continue to flow through line 82 past contacts 88, 44 and through line 52 to the coil 54 of relay 20 thereby maintaining the unstable state of those relay contacts so that current continues to flow to light the sign 69. At this point, after dusk, control of current to energize the sign has now been taken over by the photocell 74.

When the sun rises the next morning, contacts 79 will open thereby interrupting the flow of current through line 82 the result of which is to stop the flow of current through relay coil 54 thereby breaking contact between 58 and 60 to shut off the flow of current to the sign 69. In this manner, the operator may turn on the sign 69 before dusk but the photocell takes over at dusk and automatically turns the sign off as soon as the exterior ambient sunlight reaches a value sufficient to actuate the contacts of photocell 74. In a similar manner it will be obvious that should the operator not turn on the sign 69 prior to dusk, the photcell 74 will turn the sign on automatically as soon as the sunlight drops below a level sufficient to let the contacts 79 thereof close. In such an instance, current will commence initially to flow through line 82, contacts 88 and 44, line 52 and through relay coil 54 thereby closing contact between 58 and 60 to permit current to flow from line 50 through line 64 and 66 to terminal 68 of the sign. It will be noted that when the sunlight increases to the extent that photocell 74 breaks the flow of current to de-energize the sign circuit, the ratchet relay 30 remains in its initial state having been returned to that state when the photocell took over, so that if at any time the operator desires to relight the sign he may do so merely by depressing button 14 again. On the other hand, it is one of the advantages of the circuit that once the sign has been lit, a second depression of pushbutton 14 will not have any effect since the change of state accomplished in relay 20 opened contacts 18 and 22 so that there is no further positive potential available through line 24 to pushbutton 14. An extra terminal 90 is available for an auxiliary circuit if desired.

A second pushbutton 92 is provided, one terminal 93 of which is connected to line 94 which in turn is coupled to the positive terminal 10 through switch 12 and the second terminal 96 of which is connected by line 98 to terminal 100 of relay 30. The purpose of button 92 is to extinguish the sign 69 at any time before photocell 74 has taken over. This would be a time during which there would be electrical contact between contact 42 and terminal 100 whereupon the depression of button 92 would cause current to flow in line 98, through terminal 100 and contact 42, thence through line 34 to coil 36 of relay 30 causing a change in state of the contacts 42, 32 and 44 thereby breaking the contact between 44 and 46 extinguishing the flow of current through coil 54 necessary to maintain contact between 58 and 60, thereby interrupting the flow of current to the sign 69. It will be noted, however, that if the photocell has taken over such that contact is broken between 42 and 100, depression of button 92 will have no effect.

The lower or second half of the circuit shown in FIGURE 1 controls the activation of the "NO" sign 102. When the "NO" is de-energized, pushbutton 104 will turn it on if switch 12 is still in contact with 12(*a*). When the contacts of pushbutton 104 are closed, current will flow through the line 94 which is coupled to the positive potential source 10 through switch 12 and thence through line 106 to the ratchet relay 108. Relay 108 is similar in type to relay 30, being bi-stable in operation. Line 106 is connected to one terminal of coil 109 in relay 108 the other terminal of which is connected to line 110 which is in turn connected to negative bus line 111 which connects to the negative terminal 11. Thus, when button 104 is depressed current flows through the relay coil 109 changing the state of contacts 112 and 114. As previously described with respect to ratchet relay 30, an impulse of current through the relay coil 109 changes the state of the contacts until a second impulse of current flows through the coil 109. Thus, contact will be made between contact 114 and the terminal 116 as well as between contact 112 and terminal 118. Contact between 114 and 116 will permit current to flow therethrough and through line 120 which is coupled to coil 123 of relay 122. Relay 122 is similar in type to relay 20, being monostable in operation requiring current through the coil to maintain its unstable state. The other terminal of coil 123 is coupled to line 124 to the negative bus 111. Current flowing through line 120 and therefore through 123 will change the state of relay 122 contacts 126 and 128. Since terminal 127 is likewise coupled to line 120, as soon as contact is made between 126 and 127, current will flow through these contacts and through line 130, which is connected to an indicator lamp 132 and the filaments 134 of the "NO" sign 102. The other terminals of indicator lamp 132 and filaments 134 are connected to the negative bus line 111. Thus, the depression of button 104 immediately lights the "NO" sign 102.

As previously mentioned, when ratchet relay 108 was activated upon the depression of button 104, contact was made between contacts 112 and 118. Thus, one terminal of relay coil 136 was coupled through line 110 to the negative bus 111. The other terminal of relay coil 136 is connected to line 84 which in turn is connected to terminal 80 of photocell 74. When the ambient light impinging upon photocell 74 falls below a certain value, contacts 79 will close, as previously stated, thereby coupling line 84 to line 50 which is connected to the positive potential source. Thus, current will flow in line 84 and through relay coil 136 of relay 140 thereby causing a change in state of contacts 142 and 144. So that 142 makes contact with terminal 143 and 144 makes contact with terminal 145. Relay 140 is also of the monostable type requiring current in coil 136 to maintain its unstable state. Terminal 145 is connected through line 146 to line 120 at which there is a positive potential when contacts 114 and 116 remain closed as previously described. Current will thus flow through line 146 and past contacts 144 and 145 to line 148 which is coupled to one terminal of resistance element 150 of thermo-delay switch 152. The other terminal of the resistance element 150 is connected to the negative bus 111, so that current through the resistance element 150 will create heat therein which in turn causes contacts 154 to close. No current will flow through con-

tacts **154** since at this point contacts **142** and **156** are open. It will be noted that the "NO" sign **102** has been manually turned on by depression of button **104** and that the sign **102** can be turned off by a second depression of button **104** which would again change the state of relay contacts **112** and **114** interrupting the flow of current in line **120**. The sign **102** can also be turned off automatically when impinging daylight on photocell **74** is sufficient to interrupt the flow of current once more in line **84**.

When the photocell **74** receives enough impinging light, contacts **79** will open, interrupting the flow of current in line **84** which will interrupt the flow of current through coil **136** of relay **140** causing relay contacts **142** and **144** to return to their original state whereby relay contact **142** makes contact with terminal **156**. Relay terminal **142** is connected through line **158** to line **94** which is coupled to the positive potential terminal **10** through switch **12** so that current passes contact **142** and terminal **156** and through line **159** to one terminal of the contacts **154** of thermo delay switch **152**. The change of state in relay **140** breaks the contact between contacts **144** and **145** thereby interrupting the flow of current in resistance element **150**, but contacts **154** will remain closed for approximately three to five seconds while the resistance element cools thereby permitting current to continue to flow momentarily through line **160** to relay contact **128** which still remains in a position whereby it makes contact with terminal **129** whereupon current will flow through line **162** to line **107** coupled to coil **109** of ratchet relay **108** which thereby causes a change in state of relay contacts **112** and **114**. When contacts **114** and **116** are opened in this manner, current ceases to flow in line **120** and therefore in relay coil **123** which causes contacts **126** and **127** to open thereby interrupting the flow of current in filament **134** of sign **102**. After the three to five seconds of operation during which the delay switch **152** cools, contacts **154** open so that the entire "NO" vacancy circuit has been recycled to its initial state and is in the off position ready to be recycled once more.

The present circuit contains preventive measures against a change in the state of the signs should there be a power failure. If both of the signs **69** and **102** have been energized, and there is then a power failure, it is important that both of the signs be properly relighted after the power failure has ceased and to assure that this happens, there must be no current impulses which would cause a change of state in either of the ratchet relays **30** or **108**. In the event of a power failure, current will cease to flow through line **50**, and therefore through line **82**, past contacts **44** and **88**, through line **52** and through the relay coil **54** thereby causing contacts **58** and **60** to open so that no current would flow through line **64**, or line **66** to terminal **68** of sign **69**. When power is restored to the system, current will then flow through contacts **79**, line **82** and through line **52** to again close contacts **58** and **60** permitting current to flow through line **62** to sign **69**. No change of state of relay **30** will be experienced.

In the lower half of the circuit, in the event of power failure, current will cease to flow through line **84** and therefore there will be no current through coil **136** therefore closing contacts **142** and **156** but no current will flow in that line and even though there may be some residual current flowing to the contacts **154** and thence through line **160** to contact **128**, the lack of current in line **120** will cause relay **122** to change state, opening contact between **128** and **129** so that no current flows through line **162** and back to relay **108**. When contact is broken between **126** and **127**, current will cease to flow to filament **134** of sign **102**.

When power is restored to the circuit, current will flow again in coil **136** thereby re-establishing contact between **144** and **145** causing current to flow in the heater filament **150**. Current flow through coil **123** will also resume re-establishing contact between **126** and **127** thereby energizing sign **102**.

The circuit of the present invention also includes means for manual operation should there be a failure in some portion of the automatic circuit or for use in such instances where it is desired to leave both of the signs on for extended periods of time. Switch **12** in the **12**(a) position permits automatic operation as previously described. When switch **12** is moved to contact **12**(c), it couples the positive potential source **10** to switches **166** and **168**. When switch **166** is closed, current will flow through line **170** to relay terminal **172** of relay **20**. Since relay **20** is de-energized, contact is maintained between terminal **172** and contact **58** so that current flows through lines **64** and **66** to sign **69**. Similarly, when the switch **168** is closed, current will flow through line **174**, line **176** to relay terminal **178** of relay **122**. Since relay **122** is de-energized, contact is maintained between terminal **178** and contact **126** thereby permitting current to flow through line **130** and through the filaments **134** of sign **102**. In order to prevent the possibility of simultaneous use of portions of each of the two separate circuits, it may be desired to make switches **12**, **166** and **168** key switches so that they can not be inadvertently actuated.

Although the circuit diagram of FIGURE 1 shows one embodiment of the circuit, it will be obvious to persons skilled in electronics that various changes and modifications in the circuit may be made yet accomplishing the same functions. It will be equally obvious that several of the circuit elements may have equivalents which may be substituted and which will achieve the same results even though they may be more or less efficient or more or less costly than those elements shown herein. For example, it will be obvious that other types of switching circuits such as multivibrators might be substituted for the relays and that other types of light-responsive cells and time delay devices may be used. It is the aim of the appended claims to cover all such changes, modifications and substitutions as fall within the true scope and spirit of this invention.

I claim:

1. A light-responsive control apparatus for signs and the like wherein the sign includes first and second portions, comprising:

first and second means for controlling said first and second sign portions, said first control means comprising first switching means coupled to a source of electrical potential and to said first sign portion for energizing said sign portion, means coupled to said switching means for manually actuating the same, and light-responsive means coupled to said switching means for actuating said switching means in response to ambient light intensity levels;

said second control means comprising second switching means coupled to said source of electrical potential and to said second sign portion, means for manually actuating said second switching means, said light-responsive means being coupled to said second switching means to de-energize said second sign portion in response to ambient light intensity levels, said second switching means including time delay means.

2. Apparatus of the type described in claim **1** further including means coupled to said first and second control means for maintaining the state of each of said switching means in the event of an interruption of external power.

3. Apparatus of the type described in claim **1** wherein said first switching means comprises:

a bi-stable switch and a monostable switch; said bi-stable switch being coupled to said potential source, said monostable switch and said light-responsive means; said bi-stable switch having first and second states, in said first state said switch being coupled for current conduction through said light-responsive means, through said monostable switch and through said first sign portion; in said second state said switch being coupled for current conduction through said bi-stable switch to actuate said monostable switch to connect said potential source to said first sign por-

tion; said manual means coupled to said bi-stable switch to actuate said bi-stable switch to said second state, and said light-responsive means operative to actuate said bi-stable switch to said first state.

4. Apparatus of the type described in claim 3 wherein said second switching means comprises:

a bi-stable switch and a monostable switch, said bi-stable switch having first and second states, said bi-stable switch being coupled to said potential source, to said monostable switch and to said light-responsive means; in said first state said switch being coupled to conduct no current, in said second state said switch being coupled for current conduction through said bi-stable switch and through said monostable switch to said second sign portion; said light-responsive means being coupled to said bi-stable switch to interrupt the flow of current to said second sign portion; and said manual means coupled to said bi-stable switch operative to change said bi-stable switch from said first to said second state.

5. Apparatus of the type described in claim 4 wherein

said second switching means further includes a time delay means and a third switch means, said third switch means coupled to said light-responsive means, said delay means coupled between said third switch means and said monostable switch whereby interruption of current flow from said light-responsive means, indicative of an increase in ambient light intensity, causes current to flow through said monostable switch to said bi-stable switch to change the bi-stable switch from the second to the first state.

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