Aug. 8, 1967 L. A. WARNER 3,335,319

CONTROL CIRCUIT

Filed Feb. 19, 1965 2 Sheets-Sheet 1

Fig. 1

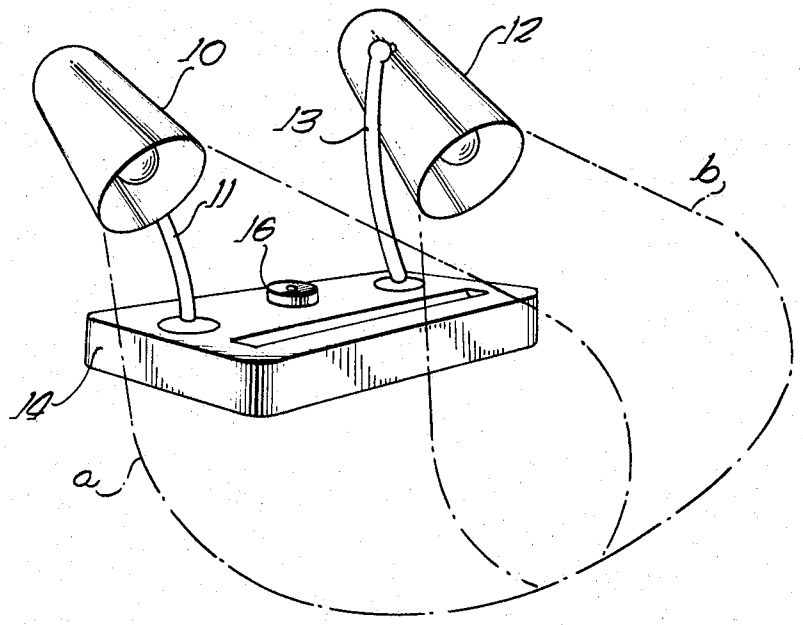


Fig. 2

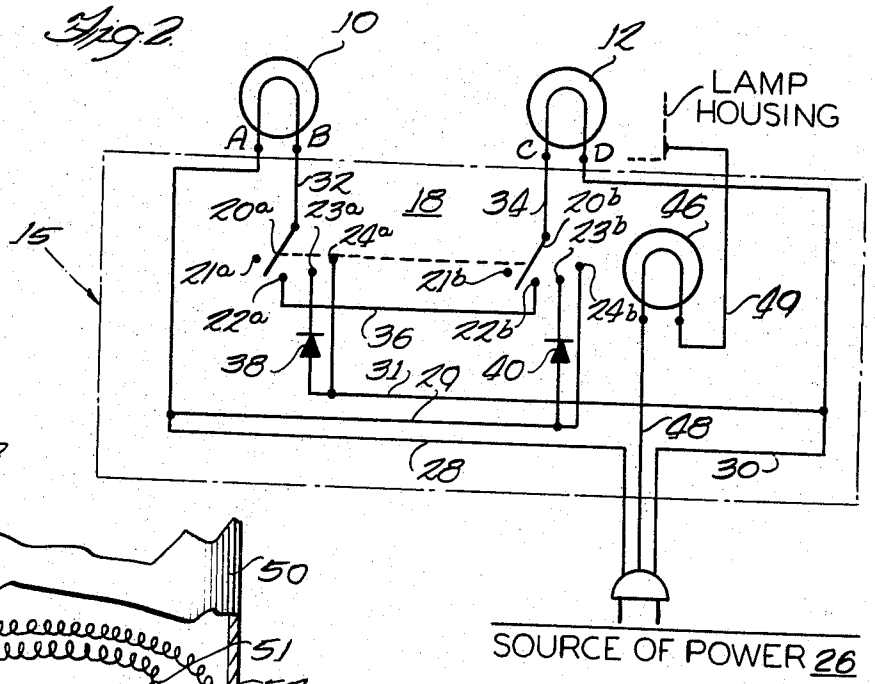
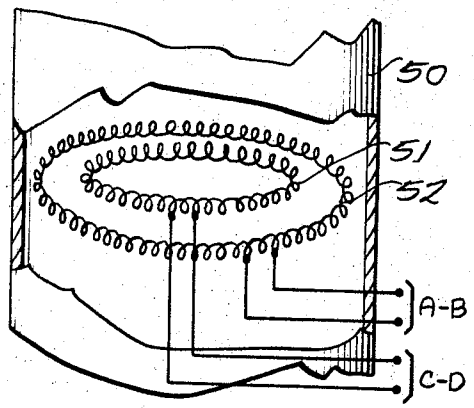


Fig. 3



Inventor
Louis A. Warner
Dominik & Stein
Attorneys

Aug. 8, 1967 L. A. WARNER 3,335,319

CONTROL CIRCUIT

Filed Feb. 19, 1965 2 Sheets-Sheet 2

Fig. 4

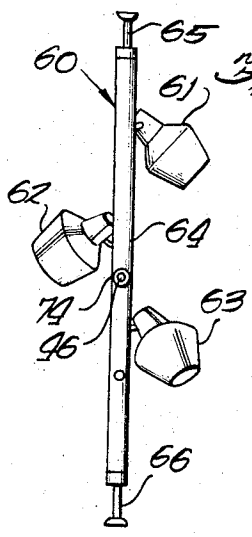


Fig. 5

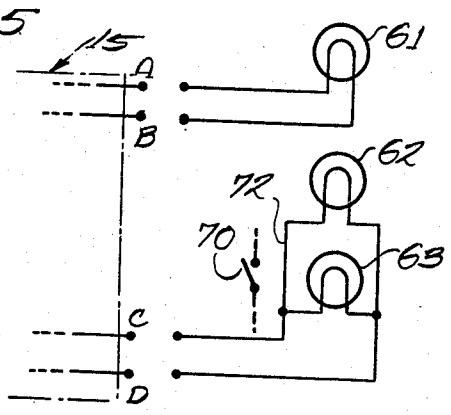


Fig. 6

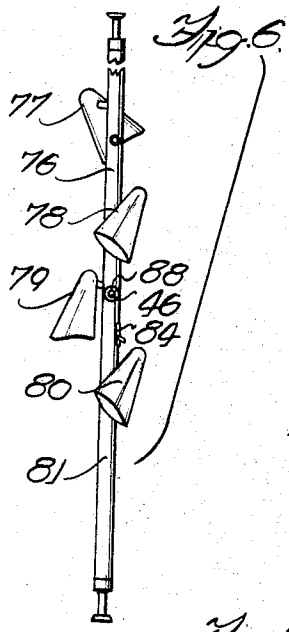


Fig. 7

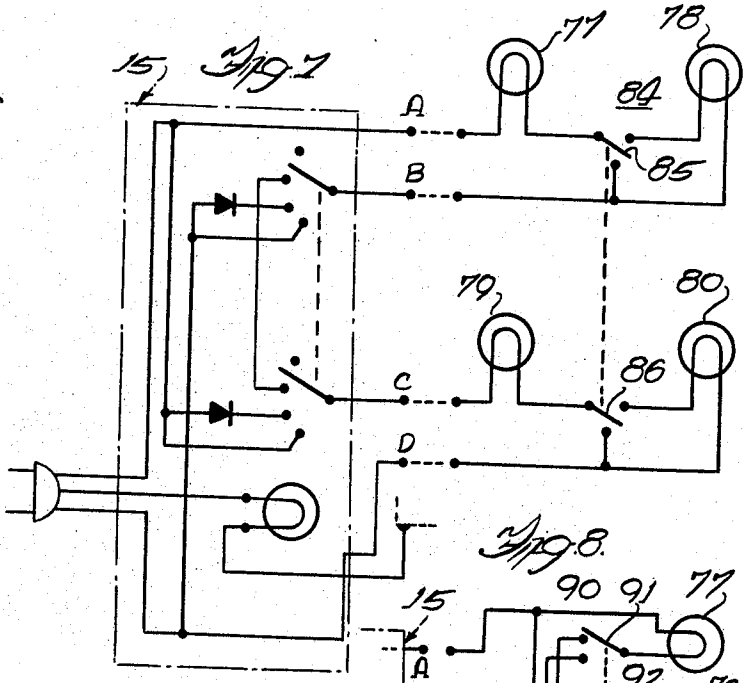


Fig. 8

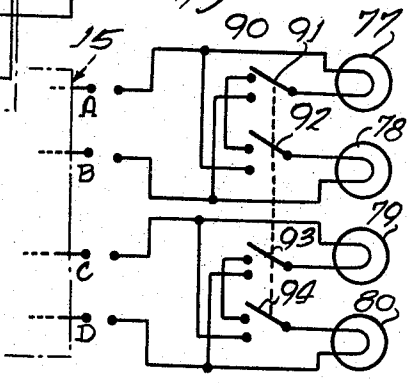
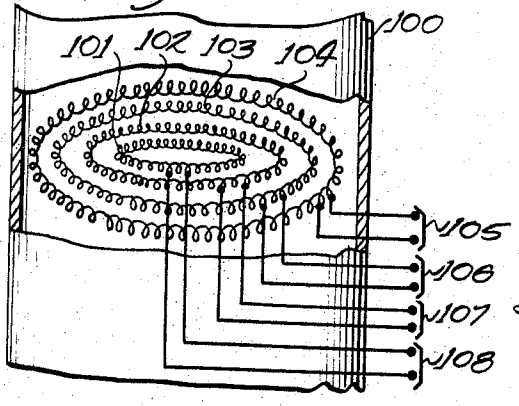


Fig. 9



Inventor
Louis A. Warner
Dominik & Stein
Attorneys

United States Patent Office 3,335,319
Patented Aug. 8, 1967

3,335,319

CONTROL CIRCUIT

Louis A. Warner, 5223 N. Natoma Ave.,
Chicago, Ill. 60656

Filed Feb. 19, 1965, Ser. No. 433,954
5 Claims. (Cl. 315—201)

ABSTRACT OF THE DISCLOSURE

A control circuit which is particularly applicable in a light dimming arrangement to provide a balanced, variable degree of illumination.

This invention relates to a control circuit and more particularly it relates to a light dimming arrangement for providing progressive degrees of illumination.

In the past, numerous light dimming arrangements have been devised for providing progressive degrees of illumination, however, they all have been generally unsatisfactory, for one reason or another. For example, arrangements having two or more lamps and a switch for simultaneously lighting one or more of the lamps to provide different degrees of illumination have been devised. Arrangements of this type are generally unsatisfactory, however, since the individual lamps are spaced from one another so that in switching only one or the other of the lamps on, an unbalanced lighting, or illumination, effect results. In other cases, a lamp having a number of filaments is used, but lamps of this type are relatively expensive and are therefore economically undesirable. Arrangements have also been devised using resistors to limit the current flow through a lamp or lamps, autotransformers to step-down the line voltage and complex circuits for providing an infinite degree of illumination. These latter arrangements have also been generally unsatisfactory for the reason that power is wasted, or they are relatively expensive and/or they are adapted to a particular application or environment.

The present invention is particularly applicable for providing different degrees of illumination, however, it will be apparent from the description which follows that it is equally applicable to control the degree of energization of electrical apparatus other than lamps.

It is therefore an object of this invention to provide a control arrangement for controlling the degree of energization of electrical apparatus.

It is another object of this invention to provide a control arrangement for controlling the degree of energization of electrical apparatus wherein control is effected with no waste of power.

It is still another object of this invention to provide a control arrangement for providing different degrees of energization of electrical apparatus which may be easily expanded to provide an infinite number of different degrees of energization.

It is a further object to provide a control arrangement for providing different degrees of illumination, which is relatively inexpensive to manufacture and which is easily adaptable to various applications. In this respect, it is also contemplated that the illumination provided be balanced.

It is a further object to provide a control arrangement for controlling the degree of energization of electrical apparatus having incorporated therein provision for indicating when a short circuit occurs, rendering the apparatus potentially dangerous.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The control arrangement according to the principal embodiment of invention comprises two pairs of output terminals, a two gang-four position switch and a pair of rectifiers. These elements are connected in a fashion such that:

(1) in a first switch position, both output terminals are deenergized;

(2) in a second switch position, the apparatus connected to each of the output terminals to connected in series with one another so as to operate at 25% full power;

(3) in a third switch position, the apparatus connected to each of the output terminals is connected in series with an associated rectifier and in parallel across the source of power so that the apparatus connected to each of the output terminals is supplied current on only one alternation of the source of power and therefore operate at 50% full power; and

(4) in a fourth switch position, the apparatus connected to each of the output terminals is connected directly across the source of power so that they operate at 100% full power.

In the hereinafter described application of the invention, a lamp is connected to each of the output terminals, to provide different degrees of illumination, and it may be noted that the lighting effect provided is always balanced, regardless of the degree of illumination, since both lamps are lighted in all cases. It may be further noted that no power waste results, since no current limiting impedances or line voltage step-down devices are used. In other applications of the control arrangement, electrical apparatus having, for example, a pair of heating coils may have one of the heating coils connected to each of the output terminals so that different degrees of heat can be provided.

A safety feature in the form of a warning light is incorporated in the control arrangement and is energized should a short circuit result from the housing of the electrical apparatus to the source of power.

The control arrangement of the principal embodiment of the invention is easily modified to provide still additional degrees of energization by merely expanding the apparatus, or circuitry, secured to the two pairs of output terminals. For example, according to a second embodiment of the invention, a third lamp is secured in parallel with the lamp connected to one of the two output terminals and a switch is provided to connect this third lamp in and out of parallel circuit relationship to provide still another degree of illumination. In a third embodiment, each of the output terminals has two series connected lamps coupled to it, the latter of the two series connected lamps being coupled through a switch which may be operated to include, or disconnect, the lamp from the series circuit to provide still more degrees of illumination. In a fourth embodiment, four lamps are used and two of them are connected to each of the two pairs of output terminals. A switch is included in the coupling between the output terminals and the lamps which is adapted to switch the lamps from a series to a parallel circuit arrangement. With this latter arrangement, an almost infinite number of different degrees of illumination can be provided. The arrangements disclosed in the latter embodiments can be advantageously used in pole lamps of the type having three or four lamps, as well as in conjunction with other electrical apparatus where, for example, different degrees of heat are desired.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following

detailed description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a desk lamp or the like which has two lamps and which is illustrated to explain the present invention;

FIGURE 2 is a wiring diagram of a control circuit exemplary of the present invention, as it is incorporated in the desk lamp of FIG. 1 to provide progressive degrees of illumination;

FIGURE 3 is a partial sectional view of a hot water heater which has two heating coils and which is illustrated to explain the adaptability of the present invention to other electrical apparatus than lamps;

FIGURE 4 is a side plan view of a pole lamp having three lamps;

FIGURE 5 is a wiring diagram of one manner in which the control circuit of the present invention can be connected to light the three lamps of the pole lamp of FIG. 4, to provide several degrees of illumination;

FIGURE 6 is a plan view of a pole lamp having four lamps;

FIGURES 7 and 8 are wiring diagrams illustrating how the control circuit of the present invention can be connected to light the four lamps of the pole lamp of FIG. 6, to provide different degrees of illumination; and

FIGURE 9 is a partial sectional view of a hot water heater which has four heating coils and which is illustrated to explain the adaptability of the present invention to other electrical apparatus, to provide different degrees of energization.

Referring now the drawing, in FIG. 1 there is shown a pair of lamps **10** and **12** which are supported on a base **14**. The base **14** in addition to supporting the lamps **10** and **12** includes the hereinafter described circuitry and switch for controlling the degree of illumination of these lamps. A knob **16** mounted on the base **14** is connected to the aforesaid switch for operating it.

The lamps **10** and **12** may be adjusted by bending the flexible supports **11** and **13** to any practical spaced relation and, for the purpose of emphasizing one of the advantages of the present invention, are shown to be spaced a considerable distance apart. With the apparatus of the prior art, lamps **10** and **12** are generally either both lighted simultaneously to illuminate the areas A and B or are individually lighted to light the areas A or B, respectively. It may be noted that when only one or the other of the lamps **10** and **12** is lighted, an unbalanced degree of illumination is provided since the area normally illuminated by the other one of the lamps is dark. With the apparatus of the present invention, different degrees of illumination are provided, however, lamps **10** and **12** are always both lighted, hence the illumination is always balanced. Furthermore, as explained in detail below, the lamps **10** and **12** are lighted to provide different degrees of illumination, without waste of power.

Referring now to FIG. 2 which shows the circuitry for lighting the lamps **10** and **12**, a two gang-four position switch **18** having wipers **20***a* and **20***b* associated with contacts **21***a*–**24***a* and **21***b*–**24***b*, respectively, is connected between the lamps **10** and **12** and the source of power **26** which may be the 110-volt, 60 cycle source normally found in the home or office. One side of the source of power **26** is connected by means of a conductor **28** to terminal A of lamp **10** and the other side of the source of power is connected by means of a conductor **30** to terminal D of the lamp **12**. Terminals B and C of the lamps **10** and **12**, respectively, are connected by means of conductors **32** and **34** to the wipers **20***a* and **20***b*, respectively, of the switch **18**. Contacts **21***a* and **21***b* of switch **18** are both open positions; contacts **22***a* and **22***b* are connected to one another by means of a conductor **36**; contact **23***a* is connected to one terminal of a rectifier **38** which has its other terminal connected to conductor **30** by means of a conductor **31**; contact **23***b* is connected to one terminal of a rectifier **40** which has its other terminal connected to conductor **28** by means of a conductor **29**; and contacts **24***a* and **24***b* are directly connected to **31** and **29** (and hence conductor **30** and **28**), respectively, bypassing the rectifiers **38** and **40**. The rectifiers **38** and **40** may be of any type capable of handling the current flow in the above circuits.

With the above described arrangement, when wipers **20***a* and **20***b* of switch **18** are engaged with contacts **21***a* and **21***b*, it is apparent that both lamps **10** and **12** are deenergized. When wipers **20***a* and **20***b* are engaged with contacts **22***a* and **22***b*, current will flow from the source of power **26** through conductor **28**, through lamp **10**, through conductor **32** to wiper **20***a* and contact **22***a*, through conductor **36** to contact **22***b* and wiper **20***b*, through conductor **34** and lamp **12** and back to the other side of the source of power **26** through conductor **30**. Lamps **10** and **12** are therefore both connected in series across the source of power and hence will operate at only 25% full power, to thereby provide one degree of illumination.

A second degree of illumination is provided when switch **18** is operated to engage wipers **20***a* and **20***b* with the contacts **23***a* and **23***b*, respectively. In this switch position, during one-half cycle of the source of power **26**, current flows through conductors **30** and **31**, rectifier **38**, contact **23***a* and wiper **20***a*, conductor **32**, lamp **10** and conductor **28** to the opposite side of the source of power. During the other one-half cycle of the source of power **26**, the current flows through conductors **28** and **29**, rectifier **40**, contact **23***b* and wiper **20***b*, conductor **34**, lamp **12** and conductor **30** to the other side of the source of power. It may be noted that the rectifiers **38** and **40** alternately block current flow to the lamps **10** and **12** during opposite alternations of each cycle of the source of power, hence the lamps **10** and **12** each operate at only 50% full power, thereby providing the second degree of illumination.

In operating the switch **18** to engage wipers **20***a* and **20***b* with contacts **24***a* and **24***b*, respectively, lamps **10** and **12** are each connected directly across the source of power. In this case, both lamps are operating at 100% full power, hence a third degree of illumination is provided.

It may be noted that in each position of the switch **18**, except the "off" position, both of the lamps **10** and **12** are lighted, even though the intensity or degree of illumination is different in each case. The illumination is therefore always balanced, that is, you never have a condition where only the area A or B is illuminated. It may be further noted that these different degrees of illumination are achieved without the use of power wasting impedances, step-down transformers or the like so that greater efficiency is provided.

One aspect of the invention which is not particularly apparent, but which is a very desirable feature, is the fact that a fixture of the type shown in FIG. 1 can be used as both a reading lamp and as a night light in a bedroom. Normally, as previously indicated, in switching on a lamp or fixture of this type, the lamp **10**, for example, is illuminated with full intensity. If it is switched on in a room which is totally dark, the intensity of the illumination affects and has a painful effect on the eyes. With the arrangement of the present invention, using, for example, 40 watt light bulbs, both of the lamps **10** and **12** can be switched on simultaneously and the intensity of the illumination is such that the eyes can adjust almost instantaneously to the degree of illumination. This is primarily due to the fact that lamps **10** and **12** are connected in a series circuit with the source of power in the first switch position and they, therefore, are only at 25% full power. If the switch is operated to the fourth position, the lamps **10** and **12** are each connected directly across the source of power, giving 100% full power and sufficient illumination for lighting the room or for reading.

A low wattage warning lamp **46** can be advantageously connected by means of conductor **48** to ground and by means of conductor **49** to the housing of the electrical apparatus to provide a safety feature. With the lamp **46** so connected, a short circuit from the conductor **28** or **30** to the housing will cause current to flow through the lamp **46** when conductor **28** or **30** is positive with respect to the conductors **48** and **50** and the lamp **46** will light to give a visual warning that a short circuit which makes the lamp potentially dangerous has occurred. The lamp **46** can be incorporated into the knob **16**, as shown in FIG. 1, so that the entire knob will light up when a short circuit develops. A separate warning lamp can, of course, be provided and incorporated into the unit in a manner which will not detract from its appearance.

In FIG. 3 there is shown a partial sectional view of a hot water heater or the like **50** having two heating coils **51** and **52**, for the purpose of illustrating the utility of the control circuit **15** of the present invention to provide different degrees of energization of electrical apparatus other than lamps. In the past, three-phase wiring normally is provided and the heating coils were connected in delta and Y circuits to provide different degrees of heating. With the present invention, the terminals of a pair of heating coils can be connected to the A–B and C–D terminals of the control circuit of FIG. 2, respectively, and by operating the switch **18**, they can be energized to different degrees to provide different degrees of heating. Other electrical apparatus can be connected in a similar fashion.

In FIG. 4 there is shown a pole lamp of the well known type having lamps **61–63** secured to a pole **64** which has expandable supports **65** and **66** on its ends for supporting the pole lamp **60** in an upright position, in the well known manner. The control circuit **15** of the present invention is easily adapted to the pole lamp **60** to provide an unusual lighting, or illuminating, effect. Normally, lamps **61–63** are either independently energized or are progressively energized so that one or more are energized simultaneously to provide the different degrees of illumination. In FIG. 5 there is shown one manner in which the 3 lamps **61–63** of the pole lamp of FIG. 4 may be energized, using the control circuit **15** of the present invention. The lamp **61** is connected directly to the terminals A–B of the control circuit **15** and the lamps **62** and **63** are each connected in parallel with its terminal C–D. With this arrangement, when the switch **18** is operated in the above described manner, the lamps **61–63** are energized simultaneously and different degrees of illumination are provided. A still greater number of degrees of illumination can be easily provided by including a switch **70** in the circuit connection **72** so that the lamp **62** can be disconnected from the circuit so that only lamps **61** and **63** are energized. The warning light **46** can also be incorporated in a switch control knob **74** secured to the pole lamp **60** as in the case of the knob **16** of FIG. 1, to give a visual indication that a short circuit has occurred.

In FIG. 6 there is shown a pole lamp **76** which may be of the same type as the pole lamp **60** of FIG. 4, with the exception that the pole lamp **76** has 4 lamps **77–80** secured to a pole **81**. In FIGS. 7 and 8 there are illustrated two ways in which the lamps **77–80** can be connected to the control circuit **15** of the present invention to provide different degrees of illumination. In FIG. 7, the lamps **77** and **78** are connected in series across the terminals A–B of the control circuit **15** and the lamps **79** and **80** are connected in series across its terminals C–D. With this arrangement, the operation is the same as in the case of the lamps **10** and **12** of FIG. 1, except for the fact that when switch **18** is operated terminals A–B and C–D of the control circuit **15** are energized to light all of the lamps **77–80** simultaneously, and the three degrees of illumination previously described are likewise provided. Additional degrees of illumination and an entirely different lighting effect can be provided by incorporating a

switch **84** having wipers **85** and **86** which are operated simultaneously to short out two of the lamps **78** and **80** so that only lamps **77** and **79** are energized. It is also apparent that the individual lamps **77–80** could each have a switch for individually disconnecting them from circuit relationship so that four more different degrees of illumination, or a total of 8 different degrees of illumination could be provided with the circuitry of FIG. 7.

As in each of the previously described examples, a warning lamp **46** can be incorporated into a switch control knob **88** secured to the pole **81** to give a visual indication that a short circuit has occurred. The switch **84** can be advantageously provided in the form of a toggle switch, as shown in FIG. 6, so that the two switches **18** and **84** would not be confused.

In FIG. 8 there is shown still another arrangement for energizing the lamps **77–80**. With the arrangement of FIG. 8, a four gang-two position switch **90** is provided having wipers **91–94**. The wipers **91** and **92** are connected to the lamps **77** and **78** in a fashion such that when operated, they function to connect the lamps **77** and **78** in either a series or a parallel circuit relationship with the terminals A–B of the control circuit **15**. The wipers **93** and **94** are likewise connected in circuit relationship with the lamps **79** and **80** in a fashion such that when operated they function to connect the lamps **79** and **80** in either a series or a parallel circuit relationship with the terminals C–D of the control circuit **15**. With the switch **90** operated to connect the lamps **77** and **78** and the lamps **79** and **80** in series, a circuit substantially the same as the circuit of FIG. 7 results so that in the first switch position of switch **18** lamps **77–80** are all connected in a series circuit and are all energized simultaneously. With the switch **90** in the same position, the switch **18** can be operated to connect the output terminals A–B and C–D in the circuit relations described above to energize the series combination of lamps **77** and **78** and lamps **79** and **80** to provide three different degrees of illumination, as described above. By operating the switch **90** to connect the lamps **77** and **78** in parallel and the lamps **79** and **80** in parallel, three more different degrees of illumination are provided when the switch **18** is operated. The arrangement of FIG. 8 therefore provides at least six different degrees of illumination. Still additional degrees of illumination can be provided merely by providing a switch to control the circuit connections of the two lamps connected to each of the output terminals A–B and C–D, respectively so that, for example, lamps **77** and **78** can be connected in series circuit relationship and lamps **79** and **80** can be connected in a parallel circuit relationship, or vice-versa. In addition, each of the lamps **77–80** could be individually controlled by a switch. From the above description, it is apparent that the control circuit **15** of the present invention can be easily expanded and modified to provide an infinite number of different degrees of illumination, or energization, in a manner which is relatively simple and inexpensive. The control circuitry and the various modifications or expansions thereof makes it particularly adaptable for controlling the degree of energization of the lamps of a pole lamp.

In FIG. 9, there is shown a section of a hot water heater **100** or the like having 4 heating coils **101–104**. The output terminals **105–108** of the heating coils **101–104** can be connected in the above described circuits shown in FIGS. 7 and 8, in place of the lamps **77–80**, and energized in the manner described in connection with the lamps **77–80** to provide a number of different degrees of energization so that different degrees of heat can be provided. For example, when the heating coils **101–104** are connected to the circuit shown in FIG. 8 in place of the lamps **77–80**, by operating the switches **18–90** in the appropriate manner at least six different degrees of heating can be provided. It is apparent that other electrical apparatus can be connected to the control circuit of the present invention in the manner shown in any one of the

FIGS. 2, 5, 7 and 8 and energized in the manner described, to provide different degrees of energization of the apparatus.

It will thus be seen that the objects set forth above, among those made apparent from the preecding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. A control circuit for providing a balanced, variable output to electrical apparatus connected respectively as a load to a first and second pair of output terminals comprising: a pair of rectifier means; a source of alternating power; switch means coupled between said source of power and said first and second pair of output terminals, said switch means being operative in a first position to connect said first and second pair of output terminals and said source of power in a series circuit, operative in a second position to connect said first and second pair of output terminals, respectively, in a parallel circuit with said source of power and operative in a third position to connect respective ones of said pair of rectifier means in a series circuit with said first and second pair of output terminals and said first and second pair of output terminals and its associated rectifier means in parallel with said source of power.

2. A control circuit, as claimed in claim 1, wherein said pair of rectifier means are connected so as to be conductive on opposite one-half cycles of said source of alternating power.

3. A control circuit, as claimed in claim 1, further including a grounding conductor coupled between the housing of said electrical apparatus and said source of power; and visual indicating means included in said coupling which is energized when a short circuit has developed to give a visual indication that such a condition has occurred.

4. A light dimming arrangement for controlling the degree of energization of lamp means coupled respectively to a first and second pair of output terminals to provide a balanced, variable degree of illumination comprising, in combination: a pair of rectifier means; a source of alternating power; switch means coupled between said source of power and said first and second pair of output terminals, said switch means being operative in a first position to connect said first and second pair of output terminals and said source of power in a series circuit, operative in a second position to connect said first and second pair of output terminals, respectively, in a parallel circuit with said source of power and operative in a third position to connect respective ones of said rectifier means in a series circuit with said first and second pair of output terminals and said first and second pair of output terminals and its associate rectifier means in parallel with said source of power.

5. A light dimming arrangement as claimed in claim 4, wherein said rectifier means are connected in said series circuits with said lamp means to limit current flow through each one of said lamp means to opposite one-half cycles of said source of power.

References Cited

UNITED STATES PATENTS

769,638	9/1904	Sargent	307—37
1,300,546	4/1919	Armstrong	340—255
3,180,999	4/1965	Kuykendall	315—201

JOHN W. HUCKERT, *Primary Examiner.*

D. O. KRAFT, R. SANDLER, *Assistant Examiners.*