

May 14, 1940.

P. J. RUNKEL
SWITCHBOARD CIRCUITS

2,200,682

Filed Jan. 23, 1939

Fig. 1.

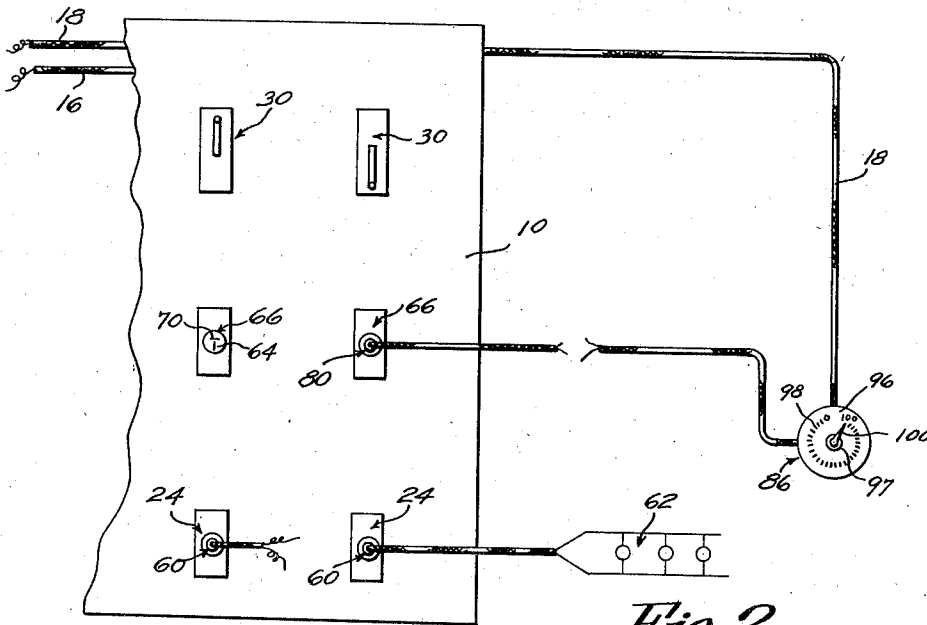
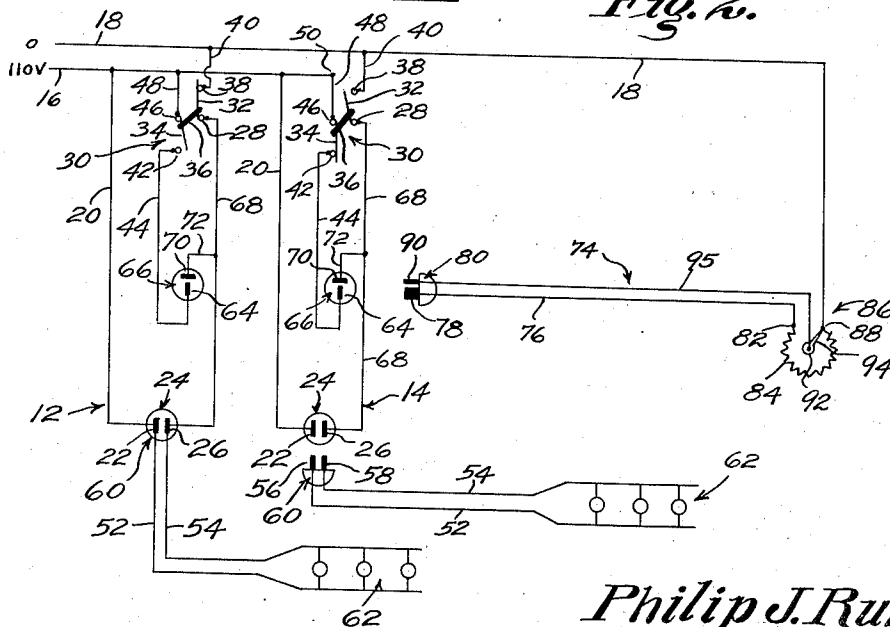


Fig. 2.



Philip J. Runkel
INVENTOR

BY *Victor J. Evans & Co.*

ATTORNEYS

UNITED STATES PATENT OFFICE

2,200,682

SWITCHBOARD CIRCUITS

Philip J. Runkel, Stevens Point, Wis.

Application January 23, 1939, Serial No. 252,449

1 Claim. (Cl. 175—312)

My invention relates to electric circuits, and has among its objects and advantages the provision of an improved dimmer circuit particularly adapted to systems for controlling the current in theatre lighting circuits, flood lighting and the like.

In connection with switchboards, particularly in theatre lighting circuits and the like, it is common practice to permanently connect a voltage control apparatus with each circuit in the switchboard. The cost of each such control apparatus far exceeds the cost of each circuit, and it is rarely that the voltage control apparatus of more than a minority of the circuits is being operated at a given time. Only a comparatively few of the load circuits, after the dimming process, are left with their voltages at anything other than zero or normally full voltage.

It will thus be seen that any switchboard wherein each circuit is connected permanently to a dimmer which will affect that circuit and none other, the ratio of the number of hours any one dimmer is used to the number of hours the switchboard is used constitutes a small fraction of the total time involved. Therefore, the dimmer facilities, which constitute a most expensive part of the switchboard structure, lie idle a great majority of the time.

Accordingly, an object of my invention is to provide a system wherein one dimmer may be transferred to any one of a number of load circuits when the voltage in that circuit is zero or full.

It is important that the dimmer facilities be so devised as to be insertable in or removable from a load circuit without affecting the lamps connected with that circuit. If the lamps in the circuit are "full on," it must be possible to insert a dimmer into the circuit preparatory to "dimming down" without causing the lamps to blink—that is, to go off, or change intensity for even the smallest instant. Similarly, if the lamps in the load circuit are "full off," it must be possible to plug in the dimmer without causing blinking. This also holds true in connection with removal of the dimmers from the circuits. My circuit is so designed as to fulfill these requirements.

More specifically, I make use of an auto-transformer dimmer circuit which may be plugged into any one of the load circuits incorporated in the switchboard. The auto-transformer dimmer is rated at a maximum load capacity, and any load which is of a wattage not over the rated capacity may be used with it. In connection with resistance dimmers, such dimmers are rated for a cer-

tain wattage load. If the resistance dimmer is used with any lesser or greater load, the result is that either the dimmer burns out, or the load does not dim completely or satisfactorily. For instance, if the resistance dimmer is rated at 2,000 watts, only a load of 2,000 watts may be fully controlled by it. The steps of voltage change in the auto-transformer dimmer are practically nil, so that when the dimmer is used to control incandescent lamps, each of the steps composing any individual voltage change resulting from adjustment of the dimmer is indiscernible to the eye as a step. This is not true of a resistance dimmer wherein the step is undesirably discernible.

A further object is to provide a system of the type described in which the circuit facilities are exceedingly simple in their construction, arrangement and operation.

In the accompanying drawing:

Figure 1 is a fragmentary view of a switchboard illustrating my invention applied thereto; and

Figure 2 is a diagrammatic view of two of the switchboard circuits and the dimmer circuit tapped into one of the circuits.

In the embodiment selected to illustrate my invention, I make use of a switchboard 10 which may be wired to provide a plurality of identical circuits 12 and 14. Circuits 12 and 14 are identical in construction and operation so that the description of one will apply to both. Line wire 16 comprises the "hot" wire, while line wire 18 comprises the "neutral wire." For the sake of convenience, the description will be directed largely to circuit 14.

A wire 20 connects the wire 16 with the terminal 22 of a load receptacle 24. The other terminal 26 of the load receptacle is connected with the terminal 28 of a double-throw switch 30. Switch 30 comprises blades 32 and 34 interconnected by an insulated link 36. Blade 32 is electrically connected with the terminal 28 and is arranged to be moved into conducting relation with the terminal 38 of the switch 30, which terminal is connected with the wire 18 through the medium of a wire 40. Blade 34 may be moved into conducting relation with a terminal 42 associated with a wire 44, and the blade is electrically related to a terminal 46 connected with a wire 48 connected to the wire 16, as at 50.

Load wires 52 and 54 terminate in prongs 56 and 58 carried by a plug 60. Prongs 56 and 58 are adapted to be moved into conducting relation with the terminals 22 and 26, respectively.

Thus the circuit may be closed through the load 62 by moving the blade 32 into conducting relation with the terminal 38.

Wire 44 is connected with the terminal 64 of a dimmer receptacle 66. The wire 68 connects the terminal 28 of the switch 30 with the terminal 26 of the load receptacle 24. Terminal 70 of the dimmer receptacle 66 is connected with the wire 68 through the medium of a wire 72. According to Fig. 2, my dimmer circuit 74 comprises a wire 76 connected with the prong 78 of the plug 80, which prong is arranged to be moved into electrical relation with the terminal 64 of the dimmer receptacle 66. The opposite end of the wire 76 is connected at 82 with a coil 84 of an auto-transformer dimmer 86. Wire 18 is connected with the coil 84 at 88, while the prong 90 associated with the dimmer plug 80 is electrically connected at 92 with a sliding tap 94 through the medium of a wire 95. Rotation of the sliding tap may be made through the medium of a knob 97.

Coil 84 comprises wire wound in the form of a helix so as to set up, when current passes through it, an electromagnetic impedance to that current, such that the voltage potential from "full," at the point 82, gradually drops to zero, at the point 88. The sliding tap 94 is so arranged as to make contact with the coil 84 at any of a large number of closely spaced points. Thus the potential at any point in the coil may be tapped through the medium of the sliding tap.

Switch 30, when positioned as illustrated in circuit 14, may be said to be in the dimmer position, while switch 30, as illustrated in the circuit 12, may be said to be in the load position. With the switch 30 adjusted according to the circuit 12, there is a full potential of 110 volts across the load 62, but when positioned according to the circuit 14, there is a potential of zero across the load. The auto-transformer dimmer 86 includes a dial 96 having graduations 98 reading from zero to one hundred. Knob 97 carries a pointer 100 which determines the position of the slider 94 on the coil 84.

With the switch 30 in its dimmer position and the plug 80 connected with the receptacle 66, assuming that the slider 94 is in its zero position, the circuit through the load is broken. In other words, we may trace the incomplete circuit as follows: from wire 16 to wire 20, terminal 22, prong 56, wire 52, load 62, wire 54, prong 58, terminal 26, wire 68, terminal 70, wire 95, slider 94, zero connection 82, wire 76, prong 78, wire 44, terminal 42, blade 34, terminal 46 and wire 48 connected with the wire 16. It will thus be seen that the load is fully off. In turning the slider 94 to the other end of the coil 84, the circuit is traced as follows: from wire 16 to wire 20, terminal 22, prong 56, wire 52, load 62, wire 54, prong 58, terminal 26, wire 68, terminal 70, prong 90, wire 95, slider 94 and back to the wire 18. Thus the circuit through the load will be closed.

Neutral wire 18 is connected with one end of the coil 84, while the opposite end of the coil is connected with the hot wire 16 as follows: wire 48, terminal 46, blade 34, terminal 42, wire 44, terminal 64, prong 78 and wire 76 leading to the connection 82 with the coil. Tracing the circuit from connection 82 through wire 76, prong 78, terminal 64, wire 44, terminal 42, blade 34, terminal 46, wire 48, wire 20, terminal 22, prong 56 to wire 52, we find that one end of the coil is connected with one side of the load. Tracing from connection 92 through wire 95, prong 90, terminal

70, wire 72, wire 68, terminal 26, prong 58 and to wire 54, we find that the other end of the load is connected with the slider 94. Thus the four connections necessary to the proper operation of the auto-transformer dimmer are established. Therefore, as the slider 94 is turned from its zero position to its full on position, the load will be gradually "dimmed up" from full off to full on.

Similarly, we may turn the slider from its full on position to its zero position for gradually "dimming out" the load. Slider 94 may be adjusted to any one of many positions for "dimming up" or "dimming out" the load circuit in variable degrees. Switch 30 may be adjusted to its load position, during which adjustment there is a moment when both terminals 38 and 42 are completely disconnected from their respective blades 32 and 34. For the sake of illustration, let us assume that the slider 94 is in its full on position. With both terminals 38 and 42 momentarily disconnected from their respective switch blades, the circuit may be traced as follows: from wire 16 through wire 20, terminal 22, prong 56, wire 52, load 62, wire 54, prong 58, terminal 26, wire 68 wire 72, terminal 70, prong 90, wire 95, slider 94 and back through 18. Thus the circuit will remain closed notwithstanding the open position of the switch 30. With the blade 32 contacting the terminal 38 the terminal 42 is disconnected from the circuit. Thus the dimmer plug 80 may be removed and the circuit through the load will be complete. The dimmer plug 80 may be disconnected with no consequent blinking in the load circuit. The same may be said of my circuit when disconnecting the dimmer plug 80 with the slider 94 in its zero position. If it is desired to leave the load either full on or full off upon inserting or removing the dimmer plug, the slider must be adjusted to its proper on or off position. With the switch 30 in the dimmer position and the plug 80 connected with the receptacle 66, the load will correspond to whatever point is indicated by the graduations 98 which determine the location of the slider.

Briefly stated, the general operation may be stated as follows: to turn the load full on, the switch 30 is thrown to its load position. In turning the load fully off, the switch is thrown to the dimmer position, i. e., the position illustrated in circuit 14. In dimming the load up gradually to full on, the plug 80 is connected with the receptacle 66 with the switch 30 in its dimmer position. The slider 94 is then turned to its full on position. To leave the load fully on and disconnect the dimmer for other purposes, the switch 30 is thrown to its load position and the plug 80 removed. In dimming the load down gradually to full off, the plug 80 is connected with the receptacle 66, the switch 30 moved to its dimmer position and the slider 94 turned to its zero position. Thus the load may be left fully off at this time by merely removing the plug 80. To dim the load gradually up to seventy-five per cent, as an example, the plug 80 is connected with the receptacle 66 with the switch 30 in its dimmer position and the slider 94 adjusted to the graduation indicating seventy-five per cent delivery.

Receptacle 66 is of the two-pole polarized type, while the plug 80 is also polarized. The plug 80 can be connected with the receptacle 66 in one way only. With the plug 80 disconnected, the prongs of the plug cannot lead anywhere but to the neutral wire 18. When the circuit is installed in a switchboard, the only exposed carriers of cur-

rent are these, which are dead at all times at which they are exposed. Thus the dimmer circuit may be manipulated with complete safety.

Without further elaboration, the foregoing will
5 so fully illustrate my invention that others may, by applying current knowledge, readily adapt the same for use under various conditions of service.

I claim:

10 In a lighting control system, first and second line wires, a plurality of load circuits each having a third wire connected with said first line wire and a fourth wire connected with said second
15 line wire, a switch in each of said fourth wires for electrically connecting and disconnecting that load circuit with respect to said line wires, first and second terminals associated with each of said
load circuits, the first terminals being electrically connected with their respective fourth wires, fifth

wires connecting said second terminals with said first line wire, a switch in each of said fifth wires for opening and closing that wire with respect to said first line wire, each switch in said fourth
5 wires being operatively connected with the switch in said fifth wire of that load circuit in such manner as to break the fourth wire when said fifth wire is closed and vice versa, a dimmer circuit including an auto-transformer having a wired
10 connection with said second wire, third and fourth terminals, a wire connecting the third terminal with the wiper element of said auto-transformer, a wire connecting the auto-transformer with said
fourth terminal, and said third and fourth terminals being adapted for selective connection with
15 said first and second terminals of each load circuit for controlling the light intensity thereof.

PHILIP J. RUNKEL.