My invention relates broadly to electric control systems and more particularly to a constant current regulating system for lighting and the like.

One of the objects of my invention is to provide an electric control system in which the values of the currents supplied to the load circuit may be varied at will.

Another object of my invention is to provide an electric regulating system in which current variations may be produced with the system under load.

Still another object of my invention is to provide an electric control system where changes can be made in output current without visual blackening of the lights in the load circuit.

A still further object of my invention is to provide an electric control system for changing the value of the current to a load circuit while at the same time preventing more than one relay of the control system to close its contacts at any one time.

These and other objects and advantages of the invention will be more readily apparent from the specification hereinafter following by reference to the accompanying drawings in which:

Fig. 1 shows a schematic circuit arrangement for an electric control system embodying my invention;

Fig. 2 shows a modified form of circuit employing my invention.

Referring to Fig. 1 of the drawings, the control system shown is adapted to duty Electric Company, Milwaukee, Wis., a corporation of Wisconsin

Application January 11, 1950, Serial No. 137,970

8 Claims. (Cl. 315—355)

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from 5' to, for example, 4'. When this change is made contactor B₃ is de-energized and drops back into place closing all the contacts of the four interlocks. As soon as the interlock contacts are closed, it is possible for current to flow through the holding coil of contactor B₃ thus moving it into a closed position and opening the interlocks connected in the circuits to the other contactors. Inasmuch as the tap connected with contactor B₃ produces a lower voltage to the monophasic square, a corresponding reduction in current will flow to the load circuit 1ₖ, making a corresponding reduction in the brilliance of the lamps.

From this system it can be seen that only one contactor may be closed at one time because of the interlock contacts involved. Successive taps may be changed in the same manner.

Because of the quick change feature of snap switch 4 and the relatively short drop out time between the opening of one contactor and closing of the second contactor very little time has elapsed and is of such short duration that the filaments of the lamps 1ₚ have not had a chance to glow any visibly bright. As a result of this it is to provide non-interrupted illumination during switching periods.

When an open circuit occurs in load circuit 1ₖ, it is reflected in an increase in current to the primary of a monophasic square. The secondary of transformer 1 is in series with the coil of current relay 8 which has normally open contacts. As the current rises in the primary of transformer 7 thus causing a similar rise in the secondary, the relay 8 closes its contacts. As these contacts close, they actuate the holding coil of relay 9 which has one normally open and one normally closed contact. As the normally closed contact of a relay opens, the circuit to primary switch 3 is opened thus de-energizing the equipment. At approximately the same time but with a slight lag, the normally open contacts of relay 9 close, thus scaling the current to the holding coil of relay 9 and keeping it in that position until such time as it is reset by the opening of "on-off" switch 5. Thus the circuit is de-energized in case of an open in the load circuit 1ₖ and cannot be energized until "on-off" switch 5 is opened and reclosed.

The alternate means of switch 1ₕ, shown in Fig. 2, operates in substantially the same manner except that the switch is of the shorting type thus necessitating use of a mechanical interlock and a relay 1ₖ with normally open contacts. In operation the contact of switch 1ₕ is moved for example from 5' to 6'. Because of the interlocks on contactors 6 and 1ₖ, only one contactor can be energized at one time. Thus when the shorting type contact leaves contact 5', contactor B₅ drops out and contactor B₆ is energized as soon as the interlocks on contactor B₅ are closed.

The manual interlock on switch 1ₕ is a safety precaution in case switch 1ₕ may be left in position between two contacts when the circuit is de-energized. Thus when the current is turned on, the manual interlock is open when the switch bridges two points of contact and no damage can occur when two contactors are close simultaneously. As it is desirable to have the circuit to the primary switch holding coil opened during normal switching when the equipment is energized, a relay 1ₖ with normally open contacts is placed in the circuit and this relay is closed during normal operation of the equipment.

Wherever in the specification and/or claims I have referred to "incandescent lamp" I desire that it be understood that any form of luminous device is intended and that the term "incandescent lamp" has been used as embracive of mercury vapor, sodium vapor, fluorescent lights and electronic devices.

I have also specifically referred to a monophasic square constant current regulator in the specification and claims and I desire that it be understood that this term is intended to include a multiple circuit system of any type to perform an equivalent function of the monophasic square constant current regulator.

While one embodiment of the invention and a modification of same has been shown and described in detail herein, I desire that it be understood that I do not intend my invention to be limited to the exact circuits shown and that the circuits described are to be considered as illustrative only and not as a description of the scope of the invention, reference being had for that purpose to the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is as follows:

1. A control system for incandescent lighting circuits which comprises a series circuit including a multiplicity of incandescent lamps, an alternating current power supply source, means for applying alternating current from said alternating current power supply source to said series circuit in step by step increments of differing current amplitudes, a control switch movable to successive contact positions through a drop out time of relatively short duration, each of said positions corresponding to a predetermined current amplitude condition in said series circuit, and interlock circuit interposed between said alternating current power supply source and the aforementioned means for maintaining the application of energy to said incandescent lamps at the individual current amplitude steps and effecting the cessation of one current amplitude step prior to the application of a succeeding current amplitude step and at a rate for maintaining the visible illumination of said incandescent lamps without appreciable blackening of visibility of the change in position of said control switch and application of differing current amplitudes to said series circuit.

2. A system for brightness switching for an incandescent light system comprising a load circuit including a multiplicity of incandescent lamps, a power source of alternating current, a pair of transformer systems, each of said transformer systems including primary and secondary windings, with the primary winding of one of said transformer systems connected with said power source of alternating current, a monophasic square having input and output circuits, the output circuit of said monophasic square being connected with the primary winding of said other transformer system, the secondary winding of said first mentioned transformer system being connected with said load circuit, means interconnecting the secondary windings of said first mentioned transformer system with the input circuit of said monophasic square including a multiplicity of circuits for changing the current amplitude supplied to said load circuit in steps, and a control switch movable by increments to successive contact positions corresponding to the number of said circuits for changing the current amplitude supplied to said load circuit through drop out times of relatively short
duration for controlling the rate of change of said steps whereby illuminosity of said incandescent lamps may be continuously maintained and without any visible blackening of the incandescent lamps during the said changes the drop out time of said control switch and during the changes in current amplitude in said load circuit.

3. A system for brightness switching for an incandescent light system comprising a load circuit including a multiplicity of incandescent lamps, a power source of alternating current, a pair of transformer systems, each of said transformer systems including primary and secondary windings with the primary winding of one of said transformer systems connected with said power source of alternating current, a circuit for converting substantially constant potential into substantially constant current, said circuit including an input system and an output system, connections between the output system of said circuit and the primary winding of said second mentioned transformer system, connections between the secondary winding of said last mentioned transformer system and said load circuit, means interposed between the secondary winding of said first mentioned transformer system and said input system for successively applying voltage of differing amplitudes to said input system for correspondingly controlling the operation of said load circuit at differing current amplitudes, and a control switch movable to successive contact positions spaced from one another through drop out times of relatively short duration where said contact positions are electrically connected with spaced taps in the secondary winding of said first mentioned transformer system for controlling the rate of operation of said last mentioned means for maintaining said load circuit substantially continuously energized and without appreciable visible blackening of the incandescent lamps during the periods of change in position of said control switch and in the change in current amplitude applied to said load circuit.

4. A system for brightness switching for an incandescent light system as set forth in claim 3 in which said first mentioned means comprises an interlock circuit for effecting the application of current to said input system at a selected current amplitude while blocking the application of current to said input system at other current amplitudes while the selected current amplitude is being applied to said input system.

5. A system for brightness switching for an incandescent light system as set forth in claim 3 in which said first mentioned means is constituted by a multiplicity of coacting interlock circuits for applying current of a selected amplitude to said input system selectively, while preventing the concurrent application of current of differing amplitude thereto, and in which the control switch renders effective individual interlock circuits for selectively controlling the application of current of predetermined amplitudes to said load circuit through time intervals too short to effect visual blackening of said incandescent light system.

6. A system for brightness switching for an incandescent light system as set forth in claim 3 in which said first mentioned means is constituted by a multiplicity of electrical interlock circuits for controlling the energization of said input system at an individual selected current amplitude and in which said control switch includes a manually controllable member and in which said contacts are individual to the aforementioned multiplicity of electrical interlocks, and an interlock on said switch for restricting the position thereof with respect to said contacts.

7. A system for brightness switching for an incandescent light system as set forth in claim 3 in which said control switch is connected with a multiplicity of individual controllable interlock switches for individually controlling the application of differing current amplitudes to said input system, and a reset circuit for restoring said interlock switches subsequent to each operation thereof.

8. A system for brightness switching for an incandescent light system as set forth in claim 3 in which said first mentioned means is constituted by a multiplicity of individual interlock switches for controlling the application of voltage at differing amplitude to said input system and in which said control switch includes a manually operable switch controller and where said contacts are individual to each of said interlock switches, a manual interlock associated with said last mentioned manually operable switch, and an overcurrent relay for interrupting the circuit between said power source of alternating current and the primary winding of said first mentioned transformer systems at a predetermined current amplitude.

ALOYSIUS J. HAUCK.

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