Jan. 3, 1956 E. W. SEEGER 2,729,752

ILLUMINATION CONTROL

Filed Aug. 1, 1952

Fig. 1

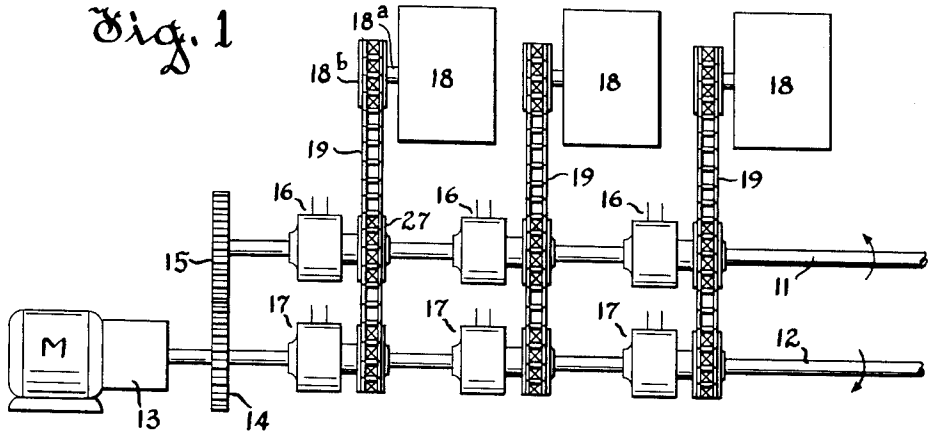


Fig. 2

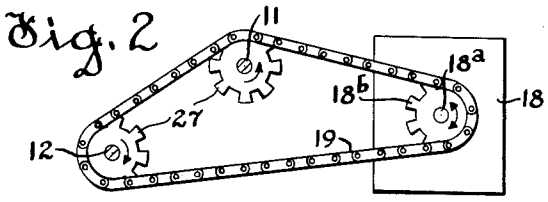


Fig. 3

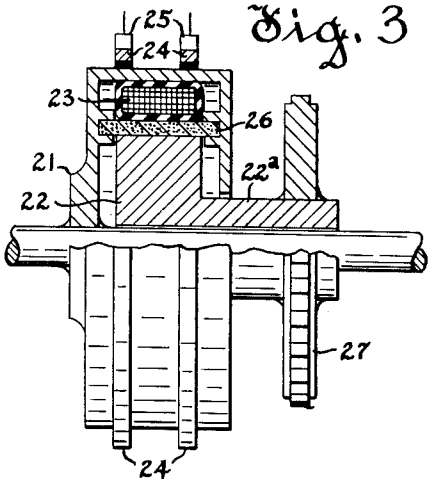


Fig. 4

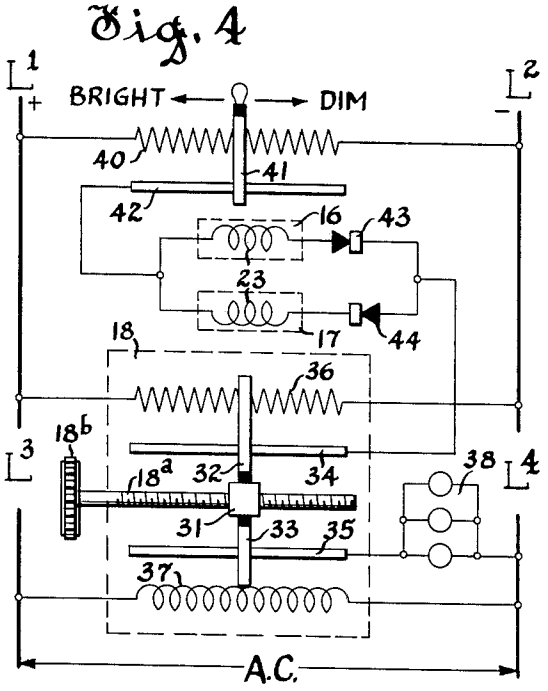
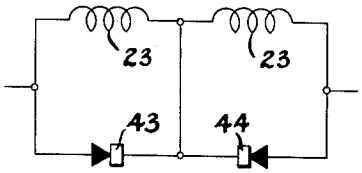


Fig. 5



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ILLUMINATION CONTROL

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8 Claims. (Cl. 307—31)

This invention relates to illumination control used in theaters and the like, and more particularly to an improved positioning drive system for use with the dimmers or other similar devices.

In theaters the illumination control panel is frequently situated at a considerable distance from the banks of floodlights and sidelights which it controls. It thus becomes desirable to mount the variable dimmers as close to the banks of lights as possible in order to avoid the expense of running full load wiring from the panel to the lights. In the same and other installations it is also desirable to electrically control dimmers or groups of dimmers which are mounted in or near the control console. To accomplish the above purposes it has long been the practice in the art to operate the dimmers by means of individual reversible electric motors which are remotely controlled from the console for either single or group operation. However, systems of this latter type have not been entirely satisfactory. In addition to the larger number of motors required, the associated relays and contactors involve a large initial expense, are noisy in operation and relatively expensive to maintain because of arcing at the contacts. Furthermore, systems in which the drive motors are directly connected to the dimmers have been found to have a tendency to overshoot.

Accordingly, it is an object of this invention to provide an improved illumination control system which overcomes the above-mentioned difficulties and disadvantages.

Another object of this invention is to provide an improved dimmer positioning drive for illumination control systems and by means of which a single electric motor is used to drive a multiplicity of individual dimmers.

Another object is to provide a dimmer drive in which the remote torque controlling means is included directly in the control circuit and does not require a separate power circuit.

A further object is to provide a dimmer positioning drive of improved design which is economical to manufacture, easy to maintain, quiet in operation and reliable by reason of its relatively small number of parts.

Other objects and advantages will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention in a theater dimming system for controlling the intensity of illumination of a lamp circuit or circuits, it being understood that the invention is susceptible of embodiment in other forms without departing from the spirit of the invention or the scope thereof as defined by the appended claims.

In the drawing,

Figure 1 is a schematic view of a bank of three dimmers together with their associated drive mechanism.

Fig. 2 is a side view of the drive shown in Fig. 1 and shows the relative position of certain of its parts.

Fig. 3 is a partial sectional view of a so-called magnetic particle clutch which is particularly suitable for use with my invention.

Fig. 4 illustrates schematically and diagrammatically a simplified control system for use with my invention, and

Fig. 5 shows a variation of the circuit diagram shown in Fig. 4.

Referring to Fig. 1, the motor M is connected for driving the oppositely rotating shafts **11** and **12** by means of the reduction gear box **13** and gears **14** and **15**. The clutches **16** and **17** are mounted in pairs on the shafts **11** and **12** respectively, and are connected to the individual dimmers **18** for rotation of the control shaft thereof by means of the chain **19**. (See Fig. 2.) Thus it will be seen that by energizing one or the other of said clutches the dimmers **18** can be driven in one or the other direction, increasing or decreasing the light intensity as required. The motor M may be constantly running or separately controlled for starting just prior to clutch energization and should have a torque sufficient to carry the combined load of all the dimmers in case all of them should require resetting simultaneously. Although only three dimmers are shown as connected for driving by the oppositely rotating shafts **11** and **12**, it is of course to be understood that the number of dimmers capable of being driven by the pair of oppositely rotating shafts is limited only by the effective torque of the motor M and the specified operating characteristics of the controller. It is also contemplated that the motor M could be provided with variable speed control for effecting operation of the dimmers **18** at different speeds. Although this latter feature is not shown in the drawing it is to be understood that it could be provided in various manners well known to those skilled in the art.

In Fig. 3 of the drawing there is shown an enlarged partially sectioned view of one of the clutches shown in Fig. 1, which are of like construction. Such clutches are preferably of the magnetic particle type shown in the Findley Patent No. 2,519,449 and in the Rabinow Patent No. 2,575,360. More particularly such clutch comprises a driving member **21** which is welded or otherwise secured to the shaft **11** or **12** and a driven member **22** which is centrally apertured to receive and is freely rotatable about said shaft. The member **21** has a winding **23** extending around the inner face thereof. The terminals of said winding are connected to the insulated slip rings **24** which may be energized by means of stationary brushes **25**. An annular opening **26** of rectangular cross-section is formed by the opposing faces of the members **21** and **22** and the winding **23**. Within this opening there is contained a paramagnetic substance such as powdered iron suspended in a light oil or graphite. Energization of the winding **23** causes the paramagnetic mixture to effect an adhesive bond between the driving member **21** and the driven member **22** and thus cause the driven member to rotate in the same direction as said shaft. A gear wheel **27** is fixedly mounted on the hub portion 22^a of member **22** for driving engagement with the chain **19** whereby the gear wheel 18^b on the dimmer **18** is rotated whenever said clutch is energized.

In Fig. 4 there is shown a system for controlling the energization of the clutches **16** and **17** and consequently the dimmers **18**. Enclosed within the dotted lines which represent a dimmer **18** are the dimmer control shaft 18^a on which is threadedly mounted a crosshead **31** having insulated sliding contact arms **32** and **33** which engage bus bars **34** and **35** respectively. Contact arm **32** also engages the resistance element of a potentiometer rheostat **36** which is connected across a direct current source comprising lines L^1 and L^2. Contact arm **33** also engages an autotransformer winding **37** which is connected across an alternating current source comprising lines L^3 and L^4. A bank of lamps **38** are energized in parallel by a circuit which extends from the line L^3 through a portion of the autotransformer winding **37** thence through the contact **33**, lamps **38** and bus bar **35** to line L^4, the intensity of illumination afforded by said lamps being determined by

the point at which the contact arm 33 engages the winding 37.

The resistance element of a second potentiometer rheostat 40 is also connected across the lines L^1, L^2 and is engaged by a manually movable sliding contact member 41 which also engages a stationary bus bar 42. Half-wave rectifiers 43 and 44 are connected in inverse parallel with each other, each being connected in series with one of the windings 23 of clutches 16 and 17 and the windings 23 being connected in parallel between the bus bars 34 and 42, whereby a direct current potential placed on said circuit will cause a current to flow in only one of said windings. The direction of current flow will of course determine which of said windings will be energized.

The sender rheostat arm 41 and the follower rheostat arm 32 are shown in balanced position, that is, they are so positioned on their respective rheostats that there is zero current flow between them. However, on movement of the contact arm 41 to the left, a current will flow from said arm through the winding 23 of clutch 16, energizing said clutch and causing the dimmer control shaft 18a to rotate in a counterclockwise direction until the contact arm 32 on the crosshead 31 reaches a point on the rheostat 36 which is substantially equal in potential to the newly selected point on the rheostat 40. Current flow between the two contact arms will then stop with consequent deenergization of the clutch 16 and stopping of the dimmer control shaft 18a. Movement of the contact arm to the right will repeat the above cycle except for the fact that clutch 17 will be energized and shaft 18a will move clockwise to move the crosshead 31 to the right. Any tendency on the part of the mechanism to hunt is overcome by the fact that as the potential difference between the two sliding potentiometer contact arm approaches zero there will be a reduction of the current flow through the clutch winding 23 and a consequent decrease in the torque exerted by said clutch. At the point said torque becomes zero the dimmer will have reached a position which closely corresponds to the setting by the remote potentiometer controller. The simplicity, reliability and other advantages of this system are believed to be readily apparent.

A variation of the system shown in Fig. 4 is shown in Fig. 5 in which the separate clutch windings 23 are connected in series with each other and in parallel with two opposed serially connected rectifiers 43, 44.

While the use of magnetic particle clutches is preferred in the system hereinbefore described, it is to be understood that the invention is not limited to their use. Any electrically controllable clutch wherein the coupling or torque transmitted between driving and driven elements can be varied by variation in the value of control current may be used.

I claim:

1. A dimmer positioning drive system comprising, in combination, a dimmer, a motor, a pair of shafts connected for simultaneous drive by said motor in opposite directions respectively, a pair of electrically controllable clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, and driving connections between said dimmer and the selectively driven elements of said clutches for effecting drive of said dimmer in one direction or the other in response to the selective energization of said clutches.

2. A dimmer positioning drive system comprising, in combination, a dimmer, a motor, a pair of shafts connected for simultaneous drive by said motor in opposite directions respectively, a pair of clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, said clutches each being of a type having an electrical energizing winding serving in accordance with the degree of electrical energization thereof to vary the degree of coupling between its driving and driven elements,

and driving connections between said dimmer and the selectively driven elements of said clutches for effecting drive of said dimmer in one direction or the other in response to the selective energization of the windings of said clutches.

3. A dimmer positioning drive system comprising, in combination, a dimmer, a motor, a pair of shafts connected for simultaneous drive by said motor in opposite directions respectively, a pair of magnetic particle clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, said clutches each having an electromagnetic energizing winding serving in accordance with its degree of energization to vary the degree of adhesive coupling between its driving and driven elements, and driving connections between said dimmer and the driven elements of said clutches for effecting drive of said dimmer in accordance with the degree of energization of the windings of said clutches selectively.

4. A dimmer positioning drive system comprising, in combination, a plurality of dimmers, a motor, a pair of shafts connected for simultaneous drive by said motor in opposite directions respectively, a plurality of magnetic particle clutches comprising pairs associated with each dimmer and individualized to each of said shafts for drive of their driving elements thereby, said clutches each having an electromagnetic energizing winding serving in accordance with its degree of energization to vary the degree of adhesive coupling between its driving and driven elements, and driving connections between each dimmer and its associated pair of clutches for effecting drive of each dimmer in a direction and at a rate corresponding with the degree of energization selectively of the windings of its associated clutches.

5. The combination with a dimmer having a reversibly rotatable control member, of a motor, a pair of shafts connected for simultaneous rotation thereof in opposite directions respectively by said motor, a pair of electrically controlled clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, driving connections between the dimmer control member and the driven elements of said clutches, and means including a selectively positionable control device and a control device positionable by said dimmer in electric circuit with said clutches for controlling the energization of the latter selectively in accordance with the difference in adjustment between said control devices.

6. The combination with a dimmer having a reversibly rotatable control member, of a motor, a pair of shafts connected for simultaneous rotation thereof in reverse directions respectively by said motor, a pair of clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, said clutches each being of a type having an electrical energizing winding serving in accordance with the degree of energization thereof to vary the degree of coupling between its driving and driven elements, driving connections between the dimmer control member and the driven elements of said clutches, and means comprising a potentiometer rheostat having a selectively positionable contact element, a second potentiometer rheostat having its contact element positionable by said dimmer control member, and means connecting the contact elements of said rheostats in circuit with the windings of said clutches to afford energization of the same in accordance with the potential difference between said contact elements.

7. The combination with a dimmer having a reversibly rotatable control member, of a motor, a pair of shafts connected for simultaneous rotation thereof in reverse directions respectively by said motor, a pair of clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, said clutches each being of a type

having an electrical energizing winding serving in accordance with the degree of energization thereof to vary the degree of coupling between its driving and driven elements, driving connections between the dimmer control member and the selectively driven elements of said clutches, and means for selectively controlling the energization of the clutch windings comprising a potentiometer rheostat having a selectively positionable contact element, a second potentiometer rheostat having its contact element positioned by said dimmer control member and a pair of unidirectional conducting devices, each of which is connected in series with an associated clutch winding between the contact elements of said rheostats in opposed current conducting relation to the other unidirectional conducting device.

8. The combination with a dimmer having a reversibly rotatable control member, of a motor, a pair of shafts connected for simultaneous rotation thereof in opposite directions respectively by said motor, a pair of magnetic particle clutches individualized to each of said shafts for simultaneous drive of their driving elements thereby in opposite directions respectively, said clutches each

having an electromagnetic energizing winding serving in accordance with its degree of energization to vary the adhesive coupling between its driving and driven elements, driving connections between the dimmer control member and the selectively driven elements of said clutches, and means for selectively controlling the energization of the clutch windings comprising a potentiometer rheostat having a selectively positionable contact element, a second potentiometer rheostat having its contact element positioned by said dimmer control member and a pair of half-wave rectifiers, each of which is connected in series with an associated one of said clutch windings between the contact elements of the rheostats in opposed current conducting relation to the other.

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