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Miyajima et al.

[11] **3,781,625**

[45] **Dec. 25, 1973**

[54] **PLURAL MOTOR, PLURAL CONTROL STATION PLANETARIUM**

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[73] Assignee: **Minolta Camera Kabushiki Kaisha**, Osaka, Japan

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **318/547**, 318/17, 35/42.5

[51] **Int. Cl.** **H02p 7/20**

[58] **Field of Search** 318/17, 51, 54, 547, 318/548, 625; 35/42.5

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Primary Examiner—T. E. Lynch
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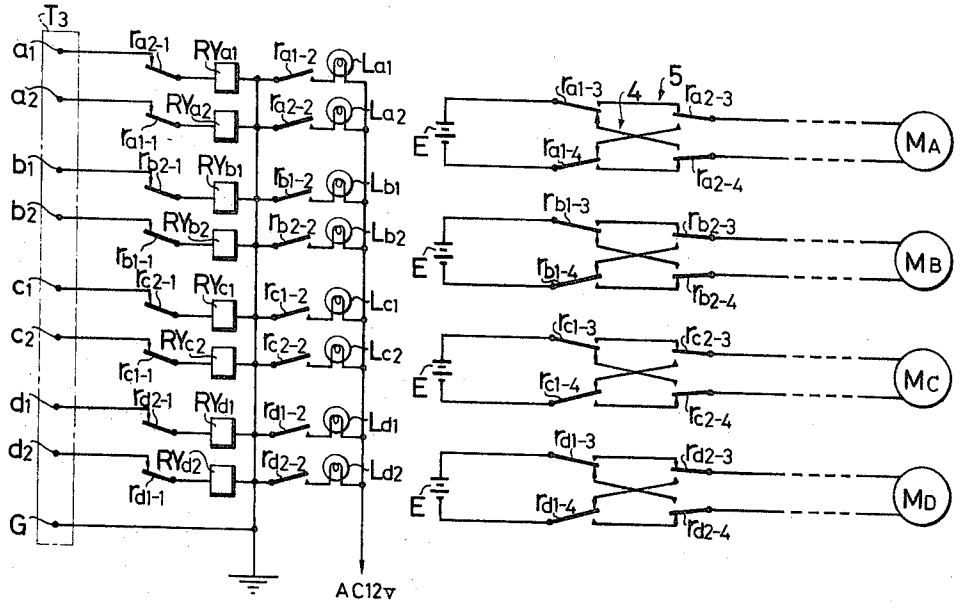
[57] **ABSTRACT**

A planetarium includes a parent unit and distal units. The parent unit comprises a control console mounted on a operation unit for controlling motion mechanisms generally incorporated in the planetarium. The distal units are disposed on some of the seats for the spectators or students and enable them to control the motions of the planetarium through the parent unit. The controlling operations of the distal units are coordinated by electric circuits so as to eliminate interference therebetween. The control operations on the distal units are indicated on the parent unit.

8 Claims, 5 Drawing Figures



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SHEET 1 OF 4

FIG. 1

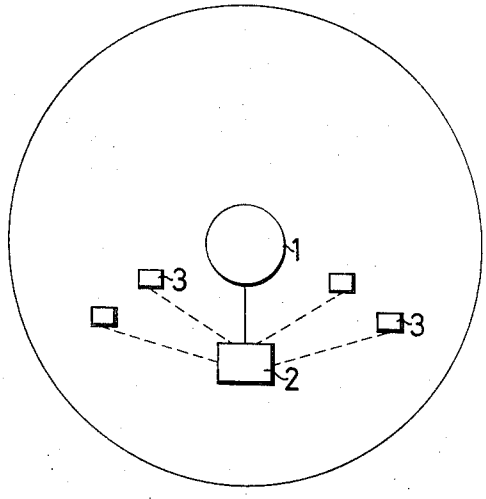

FIG. 2

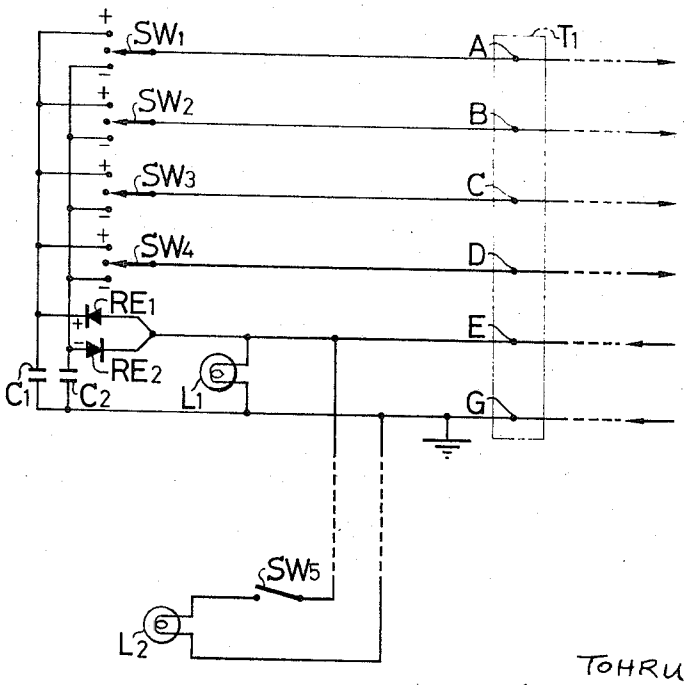

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FIG. 3

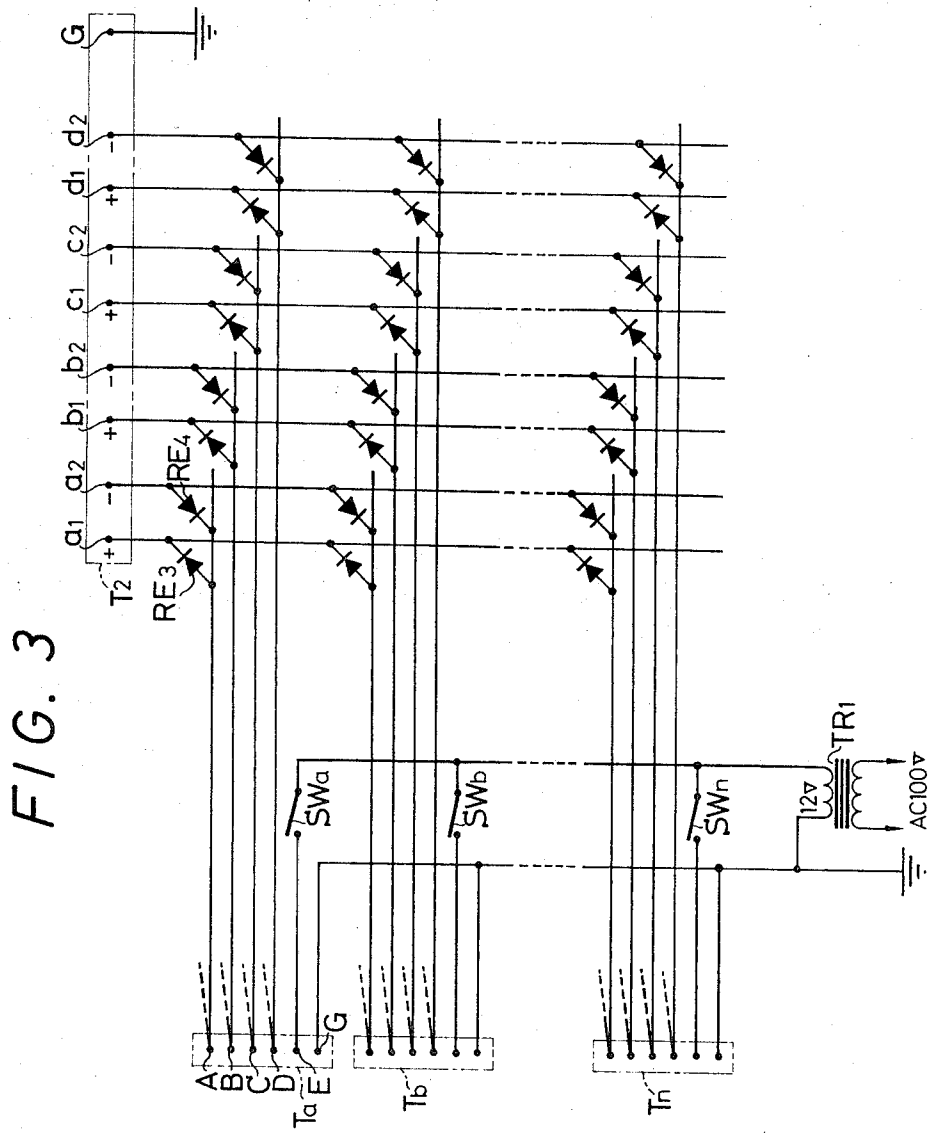

G
d2
d1
c2
c1
b2
b1
a2
a1
T2
RE3
RE4
SWa
SWb
SWn
TR1
12V
AC100V
A
B
C
D
E
G
Ta
Tb
Tn

FIG. 4

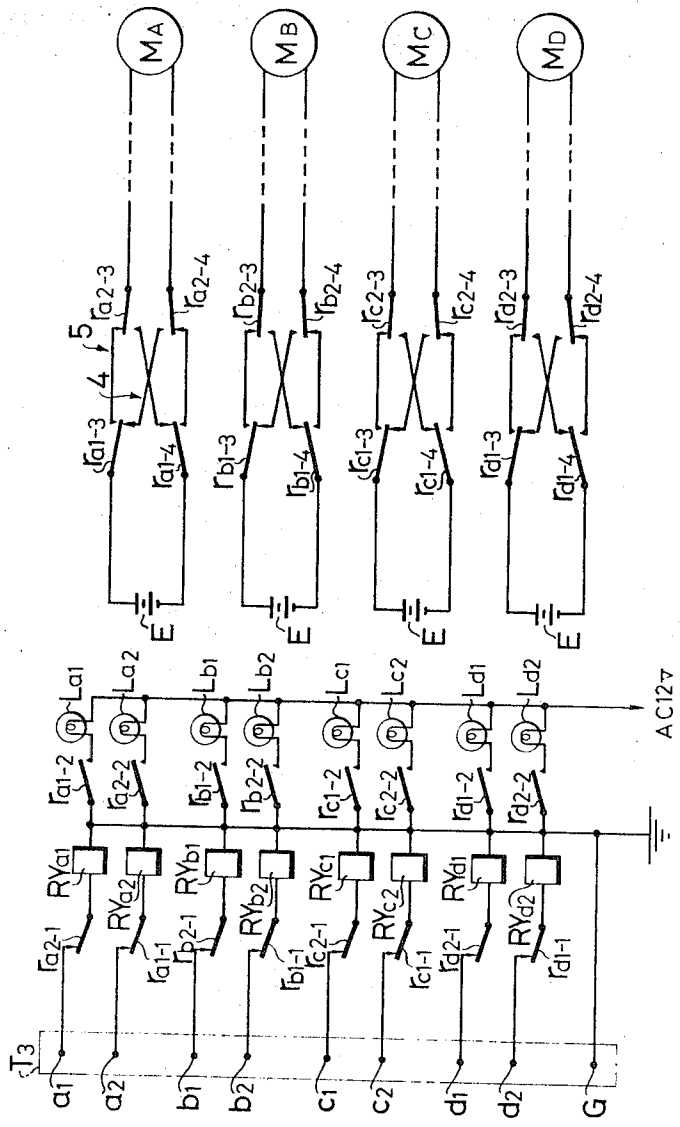
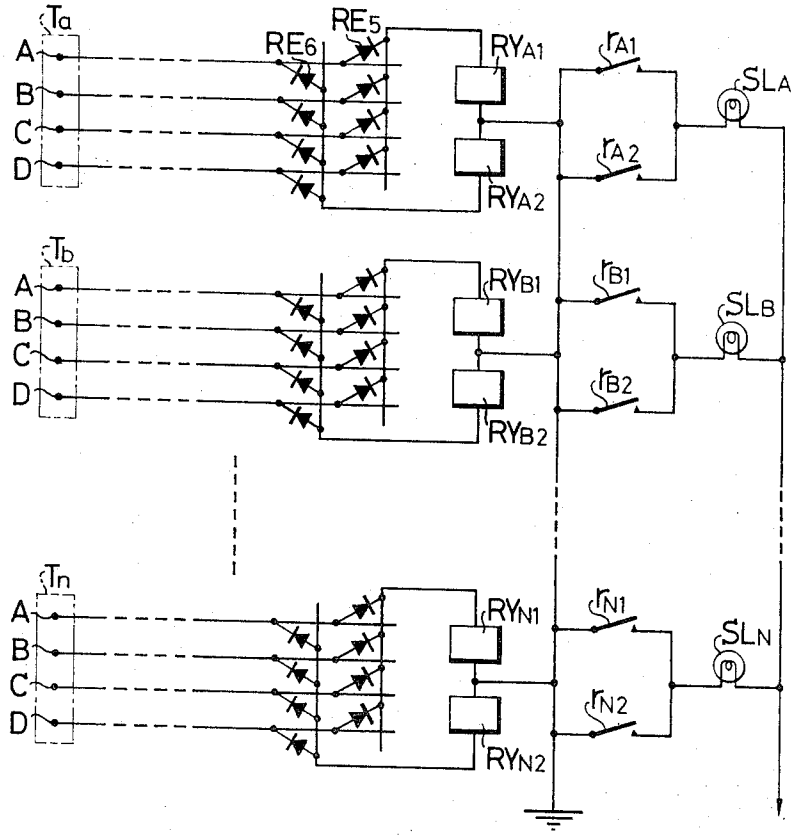


FIG. 5



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PLURAL MOTOR, PLURAL CONTROL STATION PLANETARIUM

BACKGROUND OF THE INVENTION

For the study of astronomy with the aid of a planetarium, much better educational results will be achieved if the students themselves can control the operation of the planetarium. However, a conventional planetarium equipped with only one control unit is inconvenient in that a great number of students can not individually control the apparatus as desired. Since such education is provided only for a limited period of time, the time limit is apt to disturb the study if the apparatus is operated by the students, with the result that efficient study would be deteriorated. Moreover, it will be difficult to afford every student an equal opportunity to control the apparatus.

SUMMARY OF THE INVENTION

The present invention relates to a planetarium to be used for the study of astronomy which is particularly useful for a great number of students because of its peculiar advantages.

A primary object of this invention is give every student an equal opportunity to operate a planetarium as he desires without disturbance when one planetarium is utilized for the education of many students so as to achieve educational results efficiently.

Another object of this invention to readily enable the students to operate a planetarium under a centrally coordinated system and guidance without troubles to be caused by individual and concurrent control operations conducted by the students.

The planetarium of this invention comprises a planetarium main body, a control parent unit to be used by the instructor for controlling the overall operation of the planetarium and a plurality of distal units to be operated by a great number of students so that they can control part or all of the operations only through the parent unit, the parent unit being provided with coordinating means for controlling the operations by the distal units and means for indicating the control operations performed by the distal units.

Accordingly, the present invention enables a great number of students to control one planetarium through a number of the distal units with equal opportunity and without troubles due to the individual control operations, the invention thus insuring effective and efficient group education of astronomy.

In accordance with this invention, the functions of a planetarium can be controlled only through one parent unit, so that the elements on the parent unit can be utilized as the essential elements required for control on the individual distal units, with the result that the distal control units to be provided in a great number can be made simple in construction. In the case where a great number of control units are operated individually or the same system in the planetarium is simultaneously operated by way of many control units for positive or reverse rotation, there arises a possibility of troubles and therefore a need to coordinate the individual control operations. Such coordination can be readily provided by the parent unit. The present apparatus has a further advantage that means are readily incorporated therein for giving operation instructions to the distal units and for indicating the operations individually performed by the distal units.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram showing an embodiment of this invention;

FIG. 2 is a circuit diagram showing an embodiment of a distal unit for the students; and

FIGS. 3 to 5 are circuit diagrams showing an embodiment of a parent unit for the instructor: FIG. 3 being a diagram showing an input circuit for receiving signals from distal units, FIG. 4 being control circuit for motors for operating the planetarium, FIG. 5 being a signal lamp circuit for indicating the control operations on the distal units.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawings show a principal embodiment of this invention comprising a planetarium main body 1, a parent unit 2 which is specifically a switch board to be operated by an instructor and distal units 3, which are switch boards to be operated by students. Generally, the elements to be operated on the planetarium main body are motors M_A, M_B, M_C, M_D ... (see FIG. 4) for controlling motions such as annual motion, precession motion, daily motion, latitude motion, switches for lamps serving as light sources for projectors and other attachments. If it is possible for students to control the above-mentioned four motions as desired, education on astronomy will then be carried out almost satisfactorily. Accordingly, description will be given below with reference to an embodiment wherein the motors M_A to M_D for effecting the four motions can be controlled by each of the distal units 3.

The parent unit 2 is capable of controlling all of the devices generally incorporated in the main body 1 of the planetarium, while the distal unit 3 is so adapted as to control the respective motors M_A, M_B, M_C and M_D mounted on the parent unit 2 through electric control circuits for the motors. The parent unit 2 is further provided with functions to selectively permitting the distal unit 3 to perform the above controlling operations and with indicator means for inspecting such operations conducted by the distal unit 3.

FIG. 2 illustrates an electric circuit incorporated in the distal unit 3 and adapted to control each of the four motors M_A, M_B, M_C and M_D. Indicated at SW_1, SW_2, SW_3 and SW_4 are switches for initiating each of the motors into positive or reverse rotation and for stopping the rotation. For example, the switch SW_1 controls the motor M_A for daily motion. When the switch SW_1 is switched to a positive side, a positive voltage is obtained at a terminal member A on terminal T_1, while when it is switched to a negative side, a negative voltage is obtained. Terminal members B, C and D, connected to the switches SW_2, SW_3 and SW_4 respectively, give positive or negative voltage in the same manner as above by operating the respective switches. Terminal members E and G on the terminal T_1 are connected to an AC current source on the parent unit 2, and the terminal member G is grounded. Diodes RE_1 and RE_2 are rectifiers for producing positive and negative voltages for signal. RE_1 produces a positive voltage, while RE_2 produces a negative voltage. Capacitors C_1 and C_2 serve to smooth each of the above voltages. A lamp L_1 illuminates the rear faces of indicator plates and also serves to indicate the passage of current into the electric circuit on the distal unit. The lamp L_1 thus makes

it possible to operate the unit in the dark. A lamp L_2 is used for explanation of a constellation or the like. For instance, it is provided for a projector cylinder to be used by the student for projecting an arrow mark. A button switch SW_5 turns on and off the lamp L_2.

The present apparatus includes a number of the distal units 3 provided with the electric circuit described above. The terminals T_1 of the distal units 3 are connected by cables to input terminals T*a*, T*b*,...., T*n* on the parent unit 2 illustrated in FIG. 3.

Referring to FIG. 3, a transformer Tr_1 provides the AC current source for operating the circuits on the distal units 3. For instance, the transformer produces a changed voltage of 12V. Switches SW*a*, SW*b*,...., SW*n* are inserted in the electric circuits connected to the distal units 3. Through the switching operation thereby effected, each of the distal units 3 is permitted to operate or prevented from operation. Accordingly, it is possible to operate some of the switches SW*a*, SW*b*,...., SW*n* by the parent unit 2 to thereby permit the operation of only particular distal units 3. Pairs of terminal members a_1, a_2; b_1, b_2; c_1, c_2; d_1, d_2 and a terminal member g on terminal T_2 serve as junctions of lines connected to the motor driving circuits shown in FIG. 4. Suppose the daily motion switch SW_1 on the distal unit 3 in FIG. 2 is turned on for positive rotation, a positive voltage will be obtained at the terminal member a_1, while, on the contrary, if it is switched reversely, a negative voltage will be obtained at the terminal member a_2. Thus, by turning on the switch SW_1 on any distal unit 3, a positive voltage is obtained at the terminal member a_1 or a negative voltage at the terminal member a_2 by way of any one of the terminals T*a*, T*b*,...., T*n*, the voltage corresponding to the operation of the switch SW_1 being obtained selectively.

Depending upon whether a positive or negative voltage is supplied to the terminal member A on the input terminal, for example, on terminal T*a*, rectifying elements RE_3 and RE_4 shown in FIG. 3 perform selection to introduce a corresponding positive voltage to the terminal member a_1 or a negative voltage to the terminal member a_2. Rectifying elements are also provided for switches SW_2, SW_3 and SW_4 other than for daily motion so that signals can be obtained selectively at the respective pairs of the terminal members b_1, b_2; c_1, c_2; and d_1, d_2 connected to the circuits in which the pertinent switches are incorporated.

Relays RY_{a1}, RY_{a2}; RY_{b1}, RY_{b2}; ....; RY_{d1}, RY_{d2} in FIG. 4 have contacts r_{a1-1}, r_{a1-2}, r_{a1-3}, r_{a1-4}; r_{a2-1} .... r_{a2-4}; r_{b1-1} .... r_{b1-4}; r_{b2-1} .... r_{b2-4}; r_{c1-1} ....; r_{c2-1} ....; r_{d1-1} ....; r_{d2-1} ....; r_{d2-4} .... , each relay having four interlocked contacts. Each pair of the relays RY_{a1}, RY_{a2}; ....; RY_{d1}, RY_{d2} and the respective contacts thereof are constructed as follows. Relay RY_{a1} is connected to the input terminal member a_1 on the terminal T_3 through the closing contact r_{a2-1} interlocked with the relay RY_{a2}. The relay RY_{a2} is connected to the input terminal member a_2 on the terminal T_3 by the closing contact r_{a1-1} interlocked with the relay RY_{a1}. The terminal T_3 is connected to the terminal T_2, and positive or negative signals introduced by the respective switches SW_1, ..., SW_4 are applied to the input terminals on the terminal T_3. When a positive voltage is applied to the input terminal member a_1, the relay RY_{a1} is energized and the contact r_{a1-1} is opened at the same time, so that the other relay RY_{a2} is freed from the input terminal member a_2. As a result, even if the switch SW_1 on some other distal unit 3 is switched for reverse rotation, the relay RY_{a2} will not be energized.

The interlocked contacts r_{a1-2} and r_{a2-2} of the relays RY_{a1} and RY_{a2} will now be described. The closing contacts r_{a1-2} and r_{a2-2} are inserted between the relays RY_{a1}, RY_{a2} and the lamps L_{a1}, L_{a2}. Contacts r_{a1-3}, r_{a1-4} and r_{a2-3}, r_{a2-4} are disposed between the motor M_A and a power source E therefor in combination. More specifically, the contacts r_{a1-3} and r_{a1-4} for closing operation are disposed at one end of a circuit 4 for reverse rotation, and the contacts K_{a2-3}, K_{a2-4} are disposed at the other end of a circuit 5 for positive rotation. When the relay RY_{a1} is energized, the contact r_{a1-2} is closed to turn on the lamp L_{a1}, while the contacts r_{a1-3}, r_{a1-4} close one end of the circuit 5 for positive rotation so as to energize the circuit 5 in cooperation with the contacts r_{a2-3} and r_{a2-4} which are disposed at the other end of the circuit 5 in closed state. Accordingly, the motor M_A for daily motion is driven in the positive direction. On the other hand, when the relay RY_{a2} is energized, the contact r_{a2-2} is closed to turn on the lamp L_{a2} and the contacts r_{a2-3}, r_{a2-4} close the other end of the circuit 4 for reverse rotation so as to energize the circuit 4 for reverse rotation in cooperation with the r_{a1-3} and r_{a1-4} in closed state at one end of the circuit 4. Thus, the motor M_A is driven in the reverse direction.

Each pair of the other relays RY_{b1}, RY_{b2}; RY_{c1}, RY_{c2}; and RY_{d1}, RY_{d2} and the contacts interlocked therewith in each combination are so adapted as to bring the corresponding motor M_B, M_C or M_D into positive or reverse rotation in the same manner as above, the arrangement being shown in FIG. 4. Lamps Lb_1, Lb_2, ..., Ld_1, Ld_2 are pirot lamps disposed in each circuit.

FIG. 5 shows a signal lamp circuit included in the parent unit 2 for the inspection of operation. Indicated at T*a*, T*b*, ..., T*n* in the drawing are terminals branching out respectively from the input terminals in FIG. 3 and at SL_A, SL_B, ..., SL_N signal lamps. Each pair of relays RY_{A1}, RY_{A2}; RY_{B1}, RY_{B2}; ....; RY_{N1}, RY_{N2} is connected to each terminal of each terminal of the distal unit 3. Rectifying elements RE_5 and RE_6 are provided as shown so that, when a positive or negative signal is applied to any one of the terminal members A, B, C, D of each terminal, current passes through the relay RY_{A1} or RY_{A2}. More particularly, when the signal is positive, current passes through the relay RY_{A1} of each pair, while if it is negative, current passes through the other relay RY_{A2}. Each relay RY_{A1}, RY_{A2}, RY_{B1}, ... is provided with one of the interlocked contacts r_{A1}, r_{A2}, r_{B1}, r_{B2}, ..., r_{N1}, r_{N2}. Each pair of the contacts r_{A1}, r_{A2}; r_{B1}, r_{B2}; .... is connected in parallel with one of the lamps SL_A, SL_B, ..., SL_N. Thus, when desired one of the switches SW_1, ... on any distal unit 3 is switched to the positive or negative side, a positive or negative signal is introduced through the input terminal member corresponding to the switch which terminal member is included in the terminal supplied with the signal from the distal unit 3. As a result one of a pair of the above relays is energized to close the corresponding contact and turn on the signal lamp corresponding to the distal unit 3 whose switch is operated. In this manner, the parent unit provided with the signal lamp circuit indicates that some operation has been made on the distal unit 3. The turning on of the lamp L_{a1}, L_{a2}, ..., L_{d1}, L_{d2} also indicates what operation has been made.

For the control of the light source lamp for each projector of the planetarium, the lamp can be turned on or

off with much greater ease than in the control of the direction in which the motor is driven. Accordingly, the description will not be given with respect to an embodiment wherein switching of the lamp and control of other devices attached to the planetarium can be effected on the distal units. It is to be understood that various modification of the invention can of course be made without departing the spirit thereof. The planetarium of this invention can further be put to use for audience in general in addition to educational use.

We claim:

1. A planetarium system comprising a planetarium projector including a plurality of controllable operating parameters, a parent control means for controlling each of said operating parameters, a plurality of mutually spaced distal control means remote from said parent control means for controlling at least one of said operating parameters, means response to the actuation of one of said distal control means to control one of said operating parameters for disabling the other distal control means from controlling said respective operating parameter, means at said parent control means for indicating which of said operating parameters is actuated by said distal control means, a source of current, means for selectively connecting each of said distal control means to said current source to enable the respective distal control means, and a pilot lamp located at each of said distal control means and connected to said current source through said connecting means.

2. A planetarium system comprising a planetarium projector including a plurality of controllable operating parameters, a parent control means for controlling each of said operating parameters, a plurality of mutually spaced distal control means remote from said parent control means for controlling at least one of said operating parameters, means response to the actuation of one of said distal control means to control one of said operating parameters for disabling the other distal control means from controlling said respective operating parameter, means at said parent control means for indicating which of said operating parameters is actuated by said distal control means, a source of current, an indication projector including a lamp disposed at each of said distal control means, and means for selectively connecting said lamps to said source of current.

3. A planetarium system comprising a planetarium projector having a plurality of controllable operating parameters, including the independent angular adjustments of said planetarium projector about different axes, a parent control means for controlling each of said operating parameters, a plurality of mutually spaced distal control means remote from said parent control means for controlling at least one of said operating parameters, means response to the actuation of one of said distal control means to control one of said operating parameters for disabling the other distal control means from controlling said respective operating parameter, and means at said parent control means for indicating which of said operating parameters is actuated by said distal control means.

4. The system of claim 3 wherein said planetarium projector comprises means including an electric motor for effecting each of said angular adjustments, said parent control means comprising a source of current and switches for selectively connecting said motors to said source of current.

5. The system of claim 4 wherein said parent control means comprises means for selectively enabling said distal control means including a switch connected between said source of current and each of said distal control means.

6. The system of claim 4 wherein each of said switches is defined by the solenoid actuated contacts of a relay and said relays are controlled by each of said distal control means.

7. The system of claim 3 wherein said planetarium projector comprises means including a reversible DC motor for effecting each of said angular adjustments, said parent control means comprising a source of DC current, a pair of relays associa ted with each of said motors and including contacts disposed between a respective motor and said DC current source and solenoids, such that deenergization of said solenoids disconnects said motor from said DC current source, energization of one of said solenoids actuates the contacts to connect said motor to said DC current source in a first sense and energization of the other of said solenoids actuates the contacts to connect said motor to said DC current source in an opposite sense and each of said distal control means includes switches for alternatively connecting selected solenoids to a source of current.

8. The system of claim 7 wherein said disabling means comprises a normally closed contact pair connecting each solenoid of each of said pairs of solenoids to said distal control means, the energization of one of said solenoids opening the contact pair of the other solenoid of the respective pair of solenoids.

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