Aug. 13, 1929. C. I. VERMILYE 1,724,119

SWITCH CONTROL GEAR

Filed Nov. 29, 1926 2 Sheets-Sheet 1

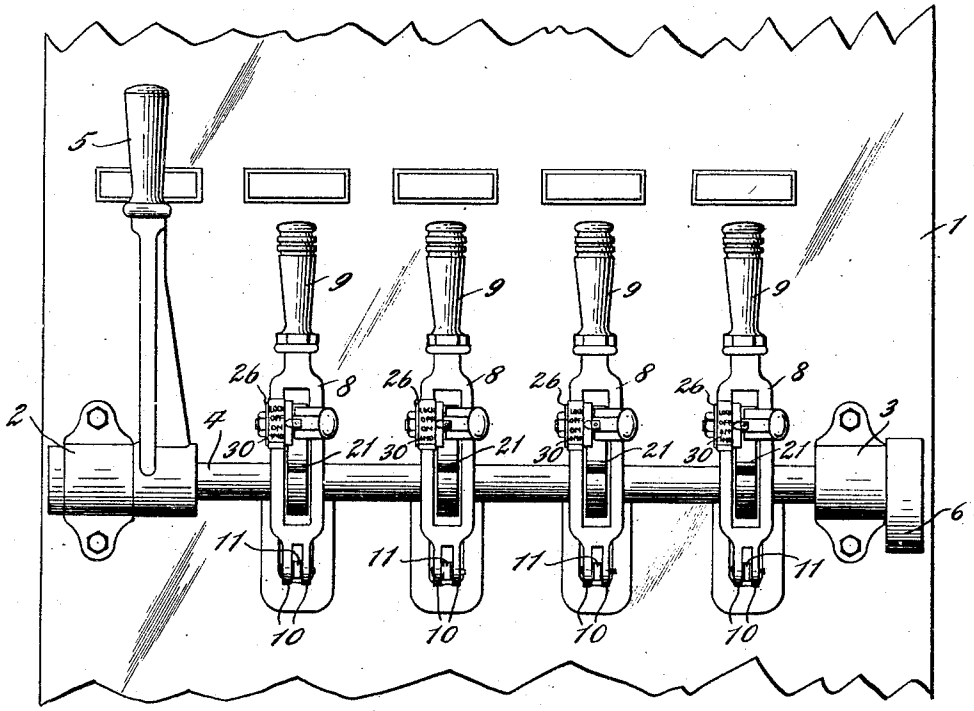


Fig. 1.

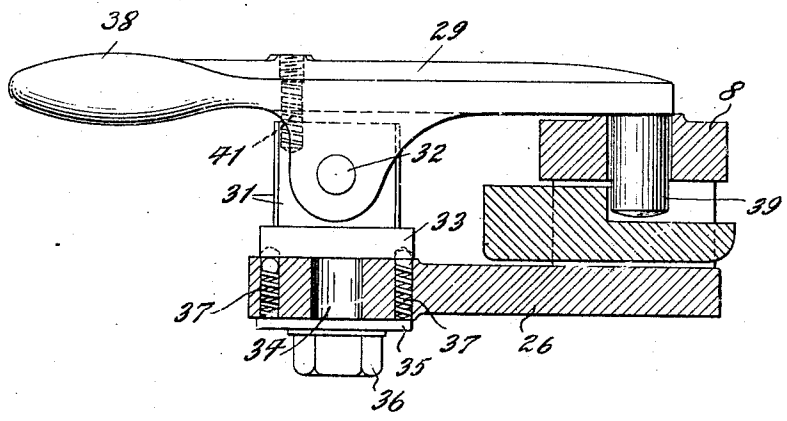


Fig. 7.

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SWITCH CONTROL GEAR

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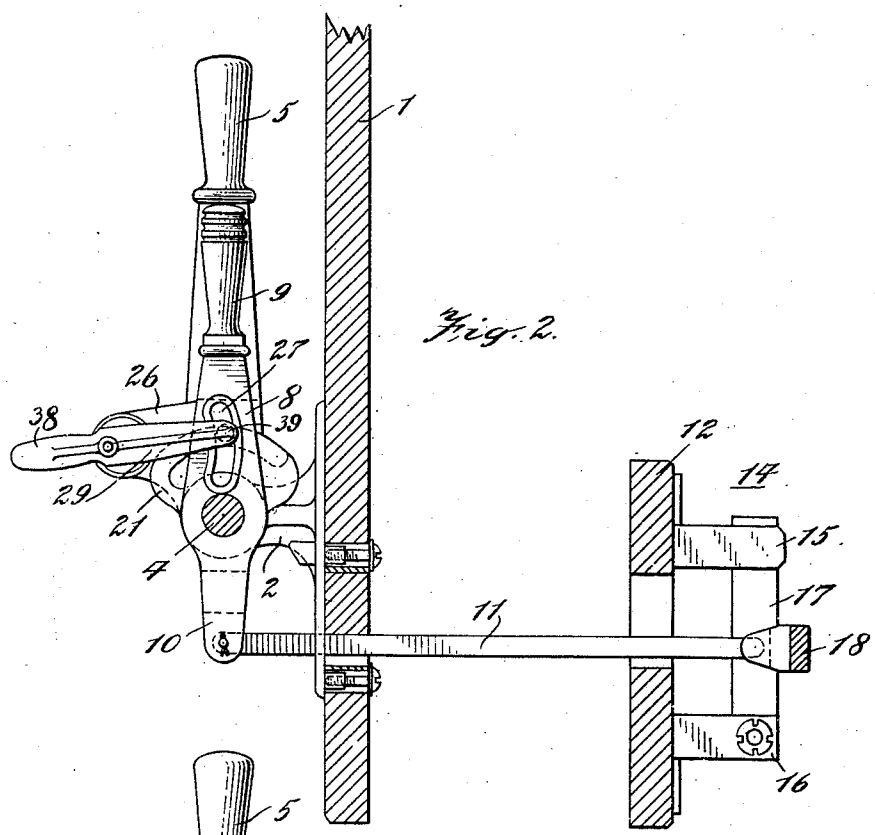


Fig. 2.

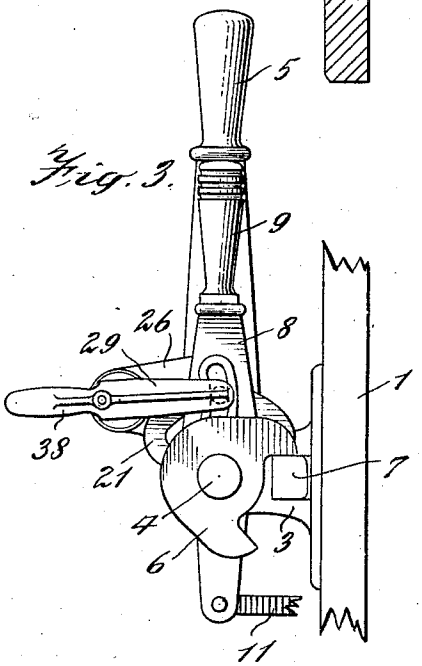


Fig. 3.

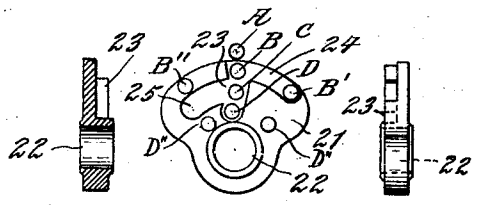


Fig. 5. Fig. 4. Fig. 6.

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UNITED STATES PATENT OFFICE.

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SWITCH-CONTROL GEAR.

Application filed November 29, 1926. Serial No. 151,346.

The controlling of groups of electric lights by means of switches is as old as the art of lighting by electricity, but, with the elaborate development of electric lighting, particularly in theatres and similar public places, necessity has arisen for more convenient means for control of the switches in the light circuits, in order that rapid, accurate, switching operations may be performed for the production of elaborate lighting effects on the stage or auditorium in which the lights are located. In many cases, lights of various colors are used in groups at various points, as on a stage, and it is necessary that these groups of lights, or in some cases even single lights, be turned on and off in succession as the performance, which they illuminate, progresses and that they be turned on and off in successive diversified combinations in order to produce various light effects. At first this was done by manipulation of the independent switches by a group of operators, which was for a time adequate. As the number of lights and circuits increased, however, and with them the complexity of the requirements, such hand switching was found unsatisfactory, and attempts were made to construct switching gear which could be manipulated entirely by a single operator. Difficulty has however been experienced in designing gear to meet the requirements in a satisfactory manner.

The device of my invention provides switches and a switch gear adapted to control them by the manipulation of a master handle, through the agency of adjustable interlocks between the master handle and the switch levers, so that any desired combination or sequence of combinations of closing or opening may be produced. My invention further provides means whereby the switch gear may be set for a certain switch combination, to produce a given light effect, positioning some of the switches closed, and if desired, others opened, and additional means whereby the next switch combination may be preset upon an interlocking device, such that movements of the master handle will open desired switches, close other desired switches, and leave still others either open or closed, as desired.

My invention further provides means for adjusting the sequence of opening and closing, or of closing and opening, under the movements of the master handle so that it is possible to open certain switches and then close others by the master handle or to close some and thereafter open others.

My invention further provides means whereby under certain conditions several successive combinations may be set up, in such way that successive movements of the master handle will provide several successive preset combinations.

My invention further provides a simple, rugged, durable, inexpensive switch interlock system, which is especially well adapted for stage light control, and is likewise adapted to many other purposes where adjustably preset switching combinations are desirable, and where it is desired that no interference shall occur with the normal manual operation of the switches by the usual levers.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawings, wherein

Fig. 1 is a front view of an embodiment of my invention;

Fig. 2 is a side view, partly in section and partly diagrammatic of the same embodiment;

Fig. 3 is an end view of the same embodiment of my invention;

Fig. 4 is a face view of the cam forming a part of my invention;

Fig. 5 is a view in vertical section of the same cam;

Fig. 6 is a side view of the same cam, and

Fig. 7 is a view in horizontal section of the latch pin member of my invention.

Referring to Figs. 1 and 2, I provide a mounting panel 1 which may be of slate, wood, marble, or other suitable material, or which alternatively may be replaced by any convenient supporting member, such as an angle iron frame, since it supports no current carrying parts but provides only mechanical support, and appearance. Upon the front of the panel 1, I provide a pair

of journal bearings 2 and 3, which support a shaft 4. Upon the shaft 4 is positioned a master handle 5, which is attached to the shaft 4 and adapted to cause rotation thereof upon actuation by an operator. Upon the shaft 4 is also fastened a limit cam 6, which cooperates with a stop 7 upon the journal member 3, as shown in Fig. 3. This limit cam serves to restrain the motion of the handle 5 and shaft 4 to a suitable angular amount.

Upon the shaft 4 are further positioned a plurality of switch lever members 8. These switch lever members are journaled freely upon the shaft 4 so that they may revolve easily thereon. They are provided at their upper ends with handles 9 and at their lower ends with connecting members 10 for the attachment of pull rods 11.

Behind the main panel 1, I provide a sub-panel 12, preferably formed of an insulating material, such as slate or marble, upon which are mounted a plurality of typical electric switches 14 each having jaws 15, pivot members 16, knife bar members 17, and a cross-bar member 18, to which the pull rod members 11 are pivotally attached. These similar switches are mounted upon the sub-panel in corresponding positions with respect to the various switch levers 8, and the switches are electrically connected between electric supply mains and the desired groups of lights. The switches are thus mechanically controlled by the switch lever members 8 and 9 and move in accordance therewith, to light or extinguish the connected groups of lamps.

The switch lever members 8 are each provided with a slot extending at right angles to the axis of the shaft 4 and dividing the bearings therein which cooperate with the shaft 4. In each slot is positioned a cam member 21, which is attached to the shaft 4. This cam is shown in detail in Figs. 4, 5 and 6. It has in general a fan-shape as indicated, with a shaft hole 22 at the bottom, which is adapted to cooperate with the shaft 4 and to permit of firm attachment of the cam thereto by a set screw, pin, or other convenient means.

The cam has a series of connected arc-shaped channels formed in one of its faces. This channel may be considered as being formed by the intersection and cooperation of three separate channels, one, 23, being formed in an arc-shape substantially in a radial direction with respect to the shaft 4. Another channel 24 may be considered as formed concentrically with the axis of the shaft 4 at the outer edge of the cam, and the third 25 may be considered as formed concentrically with the shaft at a position nearer the axis of the shaft 4.

The switch lever member 8 further has, integral therewith, an arm member 26, best shown in Figs. 2 and 3, extending forward therefrom. This arm is desirably upon the left side of the slot in the member 8. The right side of the member 8 is provided with a further slot 27, having an arcuate form in a position to cooperate with the face of the cam 21.

Upon the arm 26 is positioned a secondary lever 29, most advantageously shown in Figs. 2, 3 and 7. The lever 29 is pivotally mounted upon a stud bearing 31 by means of a pin 32 as shown in Fig. 7. The stud member 31 is provided with a collar portion 33 and a pivot pin 34 by means of which it is also pivotally mounted in a bearing near the end of the arm 26. A washer 35 and nut 36 are provided for holding the stud member 31 in place. Spring actuated detent members 37 are provided for indexing the position of the stud member 31 so that it will tend to remain at a given position, and will tend to stop at successive index points.

Upon the front edge of the arm 26 is mounted a dial plate 30 marked with words indicating the various positions of the lever 29; the words, Lock, Off, On, and Ind. for independent, being used. A pointer member is attached to the lever 29 and is adapted to move over the plate 30 according to the movements of the lever, thereby indicating the position of the lever 29 and the action which will be obtained from the associated switch lever upon actuation of the master handle.

The forward end of the lever 29 is provided with a convenient handle 38 for actuation by an operator. The rear end is provided with a latch pin 39 which is adapted to enter through the arcuate slot 27 and cooperate with the face of the cam 21. The lever will swing around the pivot 34, and the pin 39 will accordingly travel in the slot 27. The slot 27 is positioned in the handle frame 8 in such a way that with the pin 39 at the extreme top it will clear the cam 21. The lever 29 may then be held in this position A by the indexing means 37. When so positioned the master handle 5, the shaft 4, and cam 21 are disconnected and free from the switch lever 8. The individual levers 8 may then be actuated by the handles 9 as desired without interference from other portions of the switch gear and the desired groups of lamps lighted or extinguished.

The lever 29 may be adjusted in three other positions. Moving the handle member 38 upward and the pin 39 downward by one step of the indexing detents, brings the pin 39 into engagement with the cam 21. If the switch handle and master handle are in corresponding positions, the pin 39 assumes the position B as shown in Fig. 4, and the master lever may then be moved to the off position without interference with the switch member, the cam 21 moving rela-

tively to the pin 39 to bring the rear end of the upper slot adjacent the pin 39 as shown at B′. If the switch is off and the master handle on, the lever 29 cannot be moved directly into its second position because of the fact that it strikes the edge of a land of the cam 21. It can, however, be swung around the pivot 32 and the pin 39 withdrawn from the engagement with the face of the cam 21, after which the lever may be moved to the second position and the pin 39 will engage with the land of the cam in the position B″. In this position the lever 8 is still capable of free movement with respect to the master lever 5. If the switch is closed by movement of the lever 8, the pin 39 will be carried along the face of the cam and allowed to enter the channel in the position B. If the master lever is moved to the off position the face of the cam will be carried under the pin 39 until the relative position changes from that indicated by B″ to that indicated by B. The lever 29 is then returned to its original position by the pressure of spring 41 and the latch pin 39 engages with the slot 24 in the cam 21. The pin 39 in position B is then engaged by the land of the cam 21 and upon return of the master lever 5 to the on position, the pin 39, and with it the whole switch structure including the lever 8 is carried to the on position, and the switch 14 thereby closed. The master lever may thereafter be pulled to the off position without disturbance of the closed switch, the cam then moving under the latch pin 39, to bring it to position B′.

If desired, the lever 29 may be moved to a third position engaging with the second slot in the cam 21. The process is similar to that previously described but of a reverse sequence. If the switch lever and the master lever are in corresponding positions, (both on or both off), the lever 29 and the pin 30 are freely movable from the second to the third position, indicated as C. If both are in the open position, the switch may thereafter be freely closed without movement of the master lever 5 and shaft 4. If both are in the closed position, movement of the master lever 5 will bring the land of the cam against the pin 39 and carry it and its supporting mechanism to the open position, thereby opening the switch. If the switch is in the open position and the master lever in the on position, direct movement of the pin 39 from the first to the third position is prevented by the land of the cam. As before, however, the pin 39 may be swung outward, pivoting upon the pin 32, to disengage it from the face of the cam, and the pin will then pass radially from the first to the third position or from the second to the third position (since in the second position it may be supported by the land). In the third position the switch lever 8 will be carried from the on position to the off position by movement of the master lever but will not be closed by it, this being the reverse of the sequence of operations in the second position.

A fourth position is also provided in which the lever 8 is locked to the master lever through the cam and shaft, so that it follows all movements of the master lever. As before, if the master handle and the switch handle are in corresponding positions, the lever 29 and the attached pin 39 is radially moved from any of the previous positions to the fourth position, indicated at D, thereby locking the lever 8 to the master handle 5. As before, if the switch lever 8 and the master handle 5 are not in the same position, the lever 29 may be swung to withdraw the pin 39 from the cam slots, after which it may be swung to position 4 at D′ or D″, with the pin 39 engaging with the land of the cam. Upon movement of the master handle to a position corresponding to that of the switch handle 8, the pin 39 will then drop into place in the cam slots, and thereby lock the switch lever to the master lever.

In the operation of my device it may be convenient to set all of the switch handles to the off position. With the master lever likewise in the off position, the locking levers on the switches, which it is desired shall be closed for the first light combination, may be moved to position two, that is, the on position. Upon movement of the master handle to the on position, these switches will be carried to the closed position and the first of the desired light combinations thereby obtained.

The locking levers may therefore be adjusted for the second combination, those which are to be turned off for the second combination being moved to the third position, those which are off in the first position and are desired on in the second position may be set by the movement of the locking levers to position two with the pins 39 resting on the lands of the cams. Movement of the master lever from the on to the off position will then open the desired switches and allow the locking levers and pins to drop into the cam slots and thereafter be carried to the closed position by movement of the master lever to the on position. The third combination may then be set by suitable movements of the locking levers.

In some instances, it is possible to set more than one successive combination at the beginning. If the second combination involves only the removal of lights, while the third combination involves only the addition of lights, the combinations may be set up as before, the second combination obtained by the off movement of the master

lever and the third combination obtained by the on movement. If some of the lights are desired on for the first combination, off for the second combination, and on for a third combination, the locking levers of the switches controlling these lights may be placed in the fourth position, whereby they are caused to follow all movements of the master lever.

It is obvious that many modifications of the settings are possible and that several combinations may be set up in advance of the actual operation, according to the complexity of the requirements of the successive combinations.

It is to be noted also that the device of my invention is particularly advantageous for rapid determination of the conditions, both of the switches and of the locking levers. A quick glance by the operator will show which switches are on and which are off, by the position of the respective switch levers. Likewise, a quick glance will show by the position of the handles 38 of the locking levers, what, if any, movements will be obtained on the respective switches by movement of the master handle, and the combinations are accordingly very conveniently and easily prepared and show conveniently whether they are or are not properly prepared.

By my invention I have produced a rugged, durable, simple, convenient and flexible switch control for the preset production of given switch combinations. It is particularly designed and adapted for the control of theatre stage lights but it is likewise very well adapted to many other purposes which will be obvious to those skilled in the art.

While I have shown but a single embodiment of my invention in the accompanying drawings and description, it is capable of various modifications therefrom without departing from the spirit thereof and I desire therefore that only such limitations shall be imposed thereon as are required by the prior art or indicated by the appended claims.

I claim as my invention:

1. A switch gear comprising a master handle, a plurality of switch levers, a shaft therebetween, switches attached thereto and a slotted cam having four position-sectors thereon, a swinging lever mounted upon said switch lever, and having a pin on an end thereof adapted to cooperate with said switch lever and said cam for engagement with one of the sectors thereon.

2. A switch gear comprising a master handle, a plurality of switch levers, a shaft therebetween, switches attached thereto and a slotted cam having four position-sectors thereon, a swinging lever mounted upon said switch lever, and having a pin on an end thereof adapted to cooperate with said switch lever and said cam for engagement with one of the sectors thereon, and means comprising a pivotal connection between said swinging lever and said switch lever whereby said pin may be withdrawn from engagement with said cam.

3. A switch control gear comprising a master handle, a shaft attached thereto, journal bearings therefor, a supporting means for said journals, a plurality of switch levers freely mounted upon said shaft, a plurality of sector cams attached to said shaft and cooperating with said levers, a plurality of latch means attached to said levers and co-operating with said cam sectors, and a shaft stop means for restraining the movement of said cams from an extent beyond the limit of the sectors thereof, comprising an angle member attached to said shaft, and a bar member attached to one of said journal bearings.

4. A switch control gear comprising a master handle, a plurality of switch levers, means comprising face cams and swinging latch levers for operating said switch levers in a predetermined fashion by the movements of said master lever and indicating means showing the position of said latch means and thereby indicating the character of movement obtainable in response to a movement of the master handle.

5. A switch control gear comprising a master handle, a shaft attached thereto, a plurality of switch levers independently positioned thereon, and having slots therein, a plurality of face cams attached to said shaft and positioned in the slots in said handles whereby movement along the length of said shaft is prevented, and means comprising pivoted latch levers cooperating between said switch levers and said cams.

6. A switch gear comprising a master handle, secondary switch handles, a shaft therebetween, switches attached thereto and a slotted cam having four position-sectors thereon, a swinging lever mounted upon said switch lever, and having a pin on an end thereof adapted to cooperate with said switch lever and said cam for engagement with one of the sectors thereon and detent means cooperating between said switch lever and said swinging lever for indexing the positions of said swinging lever and said pin with respect to said cam.

7. A switch control gear comprising a shaft, a cam mounted thereon, said cam having limiting means disposed on a lateral face thereof, a switch frame rotatable on said shaft, a hand lever pivoted on said switch frame, and means carried by said lever and movable thereby into and out of engagement with said limiting means.

8. A switch control gear comprising a shaft, a cam mounted thereon, said cam having limiting means disposed on a lateral face thereof, a switch frame rotatable on said

shaft, a hand lever pivoted on said switch frame, and means carried by said lever and movable thereby in a direction transverse to the plane of the cam face into and out of engagement with said limiting means.

9. A switch control gear comprising a shaft, a cam mounted thereon, said cam having limiting means disposed on a lateral face thereof, a switch frame rotatable on said shaft, a hand lever pivoted on said switch frame, and means carried by said lever and movable thereby in a direction substantially radial to said cam, into and out of engagement with said limiting means.

10. A switch control gear comprising a shaft, a cam mounted thereon, said cam having limiting means disposed on a lateral face thereof, a switch frame rotatable on said shaft, a hand lever pivoted on said switch frame, and means carried by said lever and movable thereby in a direction transverse to the plane of the cam face and in a direction substantially radial to said cam.

11. A switch control gear comprising a shaft, a cam carried thereby and having at least three abutments extending in a substantially radial direction, a switch frame rotatable on said shaft, and means carried by said frame and movable into and out of engagement with each of said abutments.

12. A switch control gear comprising a shaft and a plurality of switch frames rotatable thereon, a separate switch connected to each of said frames and operable thereby, means for operating said shaft, means for locking and unlocking each of said switch frames to and from said shaft and means interchangeable with said locking and unlocking means whereby the operation of said shaft in one direction causes any one or more of the switch frames to open its switch and the operation of said shaft in the opposite direction does not move the switch frame.

13. A switch control gear comprising a shaft and a plurality of switch frames rotatable thereon, a separate switch connected to each of said frames and operable thereby, means for operating said shaft, means for locking and unlocking each of said switch frames to and from said shaft and means interchangeable with said locking and unlocking means whereby the operation of said shaft in one direction causes any one or more of the switch frames to close its switch and the operation of said shaft in the opposite direction does not move the switch frame.

In witness whereof, I hereunto subscribe my signature.

CLAUDE I. VERMILYE.