

Sept. 7, 1943.

K. M. HAMMELL

2,328,801

INTERLOCKING MECHANISM FOR ELECTRIC SWITCHES

Filed Dec. 2, 1940

3 Sheets-Sheet 1

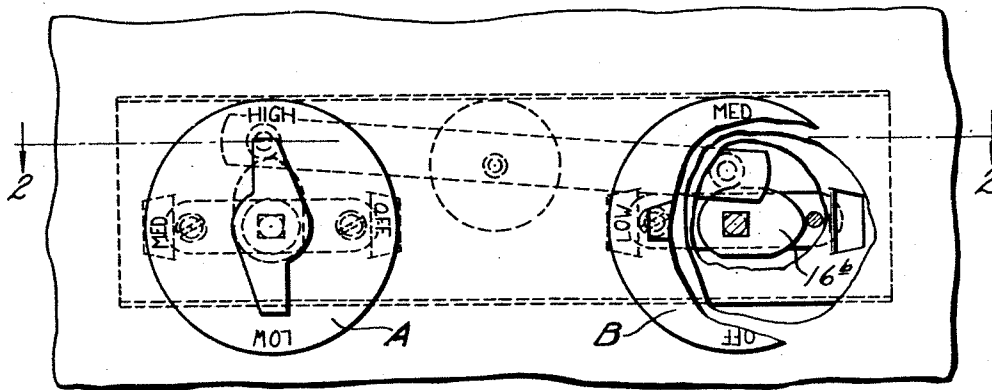


FIG. 1.

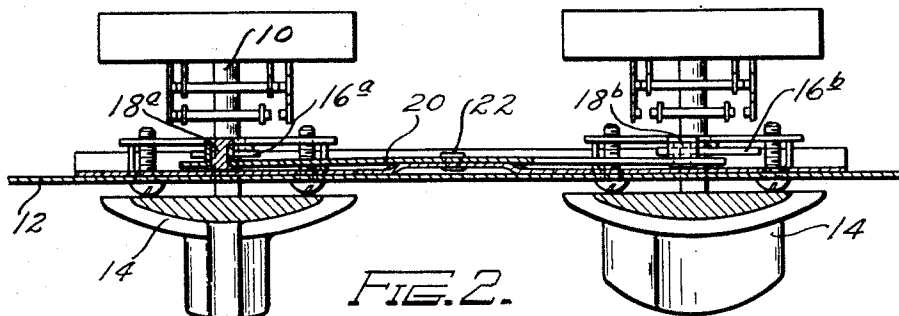


FIG. 2.

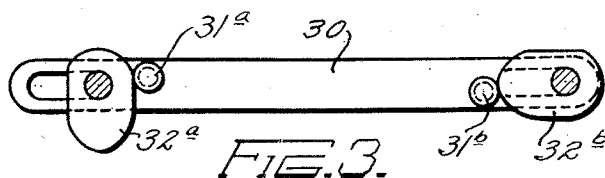


FIG. 3.

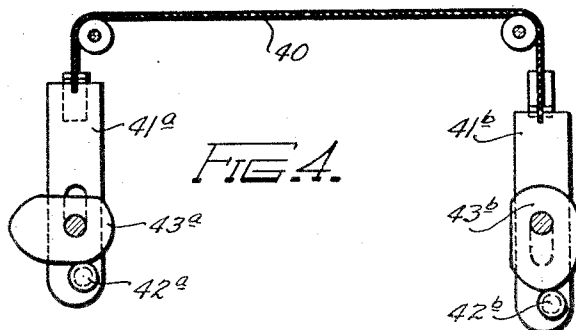


FIG. 4.

Inventor
Kemper M. Hammell

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Ben & Ben

Attorney's

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3 Sheets-Sheet 2

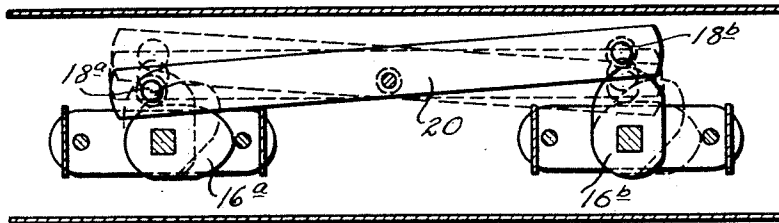


FIG. 5.

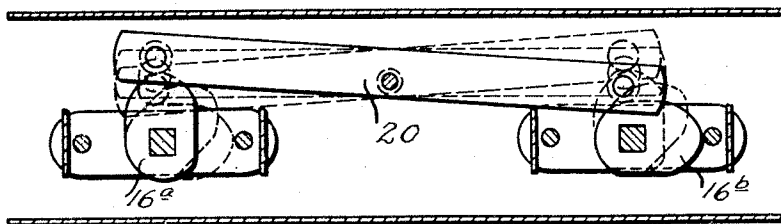


FIG. 6.

Inventor
Kemp M. Hammell

By Owen & Owen

Attorneys

Sept. 7, 1943.

K. M. HAMMELL

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3 Sheets-Sheet 3

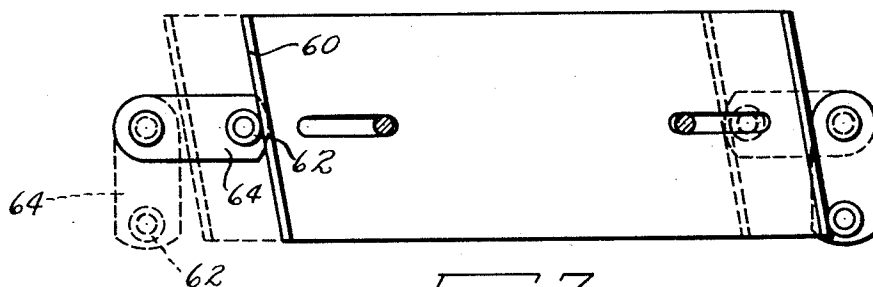


FIG. 7.

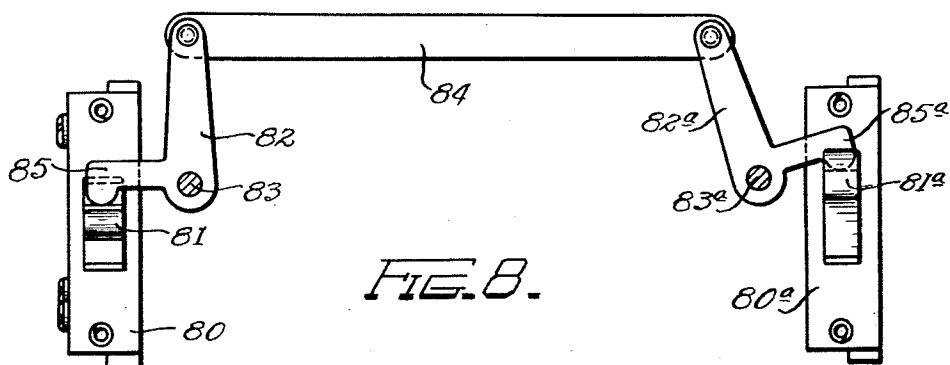


FIG. 8.

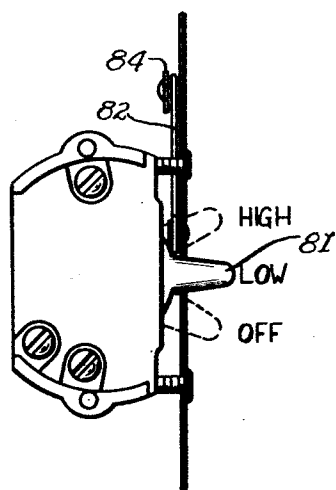


FIG. 9.

Inventor
Kemp M. Hammell

By Owen & Owen

Attorneys

UNITED STATES PATENT OFFICE

2,328,801

INTERLOCKING MECHANISM FOR
ELECTRIC SWITCHES

Kemper M. Hammell, Toledo, Ohio, assignor to
The Swartzbaugh Manufacturing Company,
Toledo, Ohio, a corporation of Ohio

Application December 2, 1940, Serial No. 368,170

9 Claims. (Cl. 200—50)

This invention relates to mechanically interlocked switches for electric circuits and is particularly applicable to switches for use in hot-plates and the like where it is necessary to limit the power consumption of the appliance to a predetermined maximum.

Safety considerations dictate the restriction of the power consumption of domestic appliances installed without special wiring to a relatively low maximum, for example, 1600 w. The common hot-plate has a total capacity in excess of the allowable maximum if all of the units are turned to the "high" position, so that it is the usual practice to provide some means to prevent the user from turning the switches which energize the several units to such a position that the allowable maximum will be exceeded. Taking, for example, the common two-element hot-plate, each element may have a heating capacity of 1000 w. on "high" and 600 w. on "medium." It is obvious that one element may be used on "high" and the other on "medium" simultaneously, but that if both elements are turned to "high" the 1600 w. maximum will be exceeded.

The common practice has been to interlock the switches electrically or, in most instances, to provide some means whereby the act of turning one of the switches to "high" will open the circuit of the other unit. Another frequent proposal has been to arrange the switches in such relation that the act of turning one unit to "high" interposed a dog or latch in the path of the other switch in the "off" position preventing its movement. Prior devices have therefore been characterized by the disadvantage that when one switch was standing in or turned to the "high" position, the other switch was either turned off or locked against movement to any of its heating positions.

The primary object of the present invention is the provision of an efficient and simple means to interlock two or more switches of an electric appliance in such a manner that, if one of the switches is standing in the "high" position, the act of turning another switch to its "high" position will result in a movement of the first switch to a position in which its element consumes less power as, for example, the "medium" position.

Another object of the invention is the provision of a simple and efficient interlocking mechanism for two switches, whereby movement of one to a predetermined position causes a corresponding reverse movement of the other from a predetermined position, each of the switches being free to move to any position at any time.

Other objects and advantages of the invention will become apparent as the description proceeds, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation, with parts broken away, of a switch interlocking mechanism incorporating the present invention; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is a fragmentary diagrammatic representation of a modification; Fig. 4 is a fragmentary diagrammatic elevational view of a further modification; Figs. 5 and 6 are motion diagrams for the form of the invention shown in Figs. 1 and 2, showing the parts in various positions; Fig. 7 is a diagrammatic view illustrating a variation in the motion transmitting apparatus; Fig. 8 is a diagrammatic front view of the invention applied to a toggle type switch, and Fig. 9 is a side view of the parts shown in Fig. 8.

Referring to the drawings, and particularly to the form shown in Figs. 1, 2, 5 and 6, the invention is shown as applied to two four position switches A and B which may be used for any electrical appliance in which the four positions are useful. The switches shown are of the snap acting type commonly used with hot-plates and ranges. The switch elements are shown only diagrammatically since the present invention relates entirely to the operators therefor.

Each switch has, of course, a rotatable shaft 10 carrying certain of the switch parts and extending through the front plate or panel 12 to carry a dial 14 on which are imprinted the usual legends, "Off," "Low," "Medium," "High" to indicate the heat at which the associated element is operating.

Fixed rigidly to the respective shafts 10 are similar cams 16^a and 16^b, each of which has a base circular portion and an extending lobe. Driver members 18^a, 18^b are associated with the cams and preferably comprise pivoted rollers to reduce the friction between the parts. In the form under consideration the drivers 18^a, 18^b are carried at opposite ends of a lever 20 pivoted at its center on a fulcrum 22. The lever 20 is so arranged that one driver stands against the base circular portion of one cam when the other driver is in engagement with the lobe of its cam. The length of the lever arms, that is, the distance between the centers of the drivers 18^a and the fulcrum of lever 20, is fixed so that when a cam is standing with its lobe under a driver, the center of the driver is offset with respect to the cam, and the offset is, in the form shown, opposite to the direction of intended movement. In Fig. 1 it

will be seen that the driver associated with switch A is standing on the lobe of its cam, but that its center is slightly to the left of the extreme top of the cam. Therefore, if the lever 20 were to be moved to force the driver 18^a downwardly, the driver could move only if the cam under it turned in a clockwise direction.

The operation of the interlock is apparent. As shown in Fig. 5, with cam 16^a turned to a position such that its driver rests on the circular portion and cam 16^b standing with its lobe under the driver 18^b, switch A is on "medium" and switch B is on "high." If the user wishes to turn switch A to "high," cam 16^a moves its lobe upwardly, forces driver 18^a up, lever 20 pivots about its fulcrum and driver 18^b must move down. The only way driver 18^b can move down is to force its cam 16^b to turn. The center of the driver being offset with relation to the center of the cam 16^b the driver presses the cam around its center. The turning movement of the cam 16^b causes switch B to go from "high" to "medium."

Obviously, the converse is true, as shown in Fig. 6. Here switch A is shown standing on "high" and switch B on "medium." Movement of cam 16^b to the dotted line position, toward "high," causes a movement of cam 16^a toward "medium."

The form of the invention so far described utilizes a leverage transmitted force to interlock the switches. The force may also be transmitted by a member in compression or by a member in tension. Fig. 3 shows a compression bar 30 carrying drivers 31^a and 31^b adapted to move and be moved by cams 32^a, 32^b. The centers of the drivers are offset with relation to the centers of their associated cams so that as the bar 30 is moved in a direction against a cam lobe, the cam (and switch) will turn in response to lateral movement of the bar.

Fig. 4 shows a tension member 40 connected at its ends to slide members 41^a and 41^b. Each slide member carries a respective driver 42^a, 42^b and each is slotted to receive the shaft of the associated switch on which cams 43^a and 43^b are mounted. Taking the parts in the position shown, movement of cam 43^a to a position wherein its lobe would abut driver 42^a causes slide 41^a to pull down on the tension member which transmits the force to driver 42^b and hence moves cam 43^b out of its "high" position.

The description has been confined entirely to those situations in which one or the other of the switch carried cams would stand in "high" position. It will be apparent that so long as neither switch cam attains this position each moves entirely independently of the other and the switches are not interlocked.

In the forms so far described the movement of the switch being turned down has been produced by the interaction of cams and drivers contacting each other at a point offset with relation to the center of the shaft to be turned. Obviously, the point of contact might be shifted so long as the resultant of the force between the driving and driven members remained eccentric. For example, as shown in Fig. 7, an inclined member 60 may cooperate with a roller 62 carried at the end of a crank arm 64 which is, in turn, fixed to the switch shaft. The wedging action produced by moving the inclined member 60 at right angles to the shaft axis will cause the shaft to turn. The operation of this form

is the same as the operation of the form shown in Fig. 3.

In the case of a multi-position toggle switch, the invention may take the form shown in Figs. 8 and 9. As indicated in Fig. 9, the switches 80 and 80^a may have three positions designated "Off," "Low" and "High" corresponding to the heat of an associated electric unit. Each switch is provided with an extending operating finger 81, 81^a, so that it may be moved to its various positions. The interlocking mechanism for the switches includes a pair of bell crank levers 82, 82^a, pivoted at 83, 83^a, and having their ends tied together by a bar 84. Each bell crank lever has an extending arm 85, 85^a, which engages the operating finger of the respective associated switch. The length of the tie bar and the disposition of the bell crank levers are such that when the switch finger 81^a is moved to "high" position, as shown in Fig. 8, the arm 85 of bell crank lever 82 must stand in the position corresponding to the reduced heat of switch 80. It will be seen that in the event the operator moves switch finger 81 to "high" position, the system of bell crank levers and connecting bar 84 will move switch finger 81^a back from its "high" position to the next lower heat.

It will be understood that in every instance the interlocking mechanism described is capable of acting on and moving the operator or operating element of each of a plurality of switches from "high" position to a position in which the associated units give off a lower heat when a companion switch is moved to a predetermined high position, but in no instance is the interlocking mechanism capable of moving any switch to the "off" position or blocking a switch to prevent its movement to "high" position. These are the two characteristics which have been so disadvantageous in devices with which I am familiar.

While the invention has been described in a specific environment and with a particular form and disposition of the parts, it will be appreciated that it is capable of diverse uses and modifications without departing from the scope and spirit of the appended claims.

What I claim as original and desire to secure by United States Letters Patent is:

1. In combination with a plurality of switches for electric heating units or the like, each of which switches has a high position, a lower position, and an off position, corresponding to the several degrees of energization of the associated heating unit, an interlocking mechanism including a cam carried by and movable with each switch, and means to move one cam by movement of another including a pivoted lever and drivers carried on each end of the lever and engageable by said cams, the fulcrum of said lever and the length of the lever arms being such that movement of one cam to high position will cause movement of a cam standing in high position to the lower position.

2. In combination with a plurality of rotatable switches for electric heating units or the like, each of which switches has a high position, a lower position, and an off position, corresponding to the several degrees of energization of the associated heating unit, an interlocking mechanism including a cam carried by each switch, a driver associated with each cam and, when said cam is turned to present its lobe to the driver, standing offset with respect to the center of rotation of the cam, and means connecting the drivers

whereby movement of one cam causes a force to be transmitted through its driver to the other driver and other cam and switch whereby movement of one switch to high position causes movement of another switch already standing in high position to the lower position. 5

3. Mechanism in accordance with claim 2 in which said connecting means comprises a pivoted lever.

4. Mechanism in accordance with claim 2 in which said connecting means comprises a member in compression. 10

5. Mechanism in accordance with claim 2 in which said connecting means comprises a member in tension.

6. In combination with a plurality of rotatable switches for electric heating units or the like, each of which switches has a high position, a lower position, and an off position, corresponding to the several degrees of energization of the associated heating unit, an interlocking mechanism including a rotary operator carried by each switch and means disposed between said rotary operators whereby either switch is caused to move in a predetermined direction from its high position to a lower position when the other switch is rotated in either direction into its high position. 20 25

7. In combination with a plurality of rotatable switches for electric heating units or the like, each of which switches has a high position, a lower position, and an off position, corresponding to the several degrees of energization of the asso- 30

ciated heating unit, an interlocking mechanism including a rotary cam carried by each switch motion transfer means disposed between said cams so disposed that either switch is automatically moved in a predetermined direction from its high position to a lower position when the other switch is turned in either direction to its high position.

8. Interlocking mechanism for switches for electric heating units or the like, each of which switches has a relatively high position, a lower position, and an off position, corresponding to the several degrees of energization of the associated heating unit, said interlocking mechanism including an operator carried by each switch, and means interconnecting the operators and operated by movement of one switch to high position to move another switch previously in high position to a lower position, between high and off.

9. Interlocking mechanism for switches for electric heating units or the like, each of which switches has a relatively high position, a lower position, and an off position, corresponding to the several degrees of energization of the associated heating unit, said interlocking mechanism including a cam carried by and movable with each switch, and means operated by one cam when its associated switch is moved to high position, to move a cam and associated switch previously in high position to a lower position.

KEMPER M. HAMMELL.