United States Patent [19]

Constable

[11] **3,739,110**

[45] **June 12, 1973**

[54] **MULTIPLE SWITCH CONTROL ASSEMBLY WITH MULTIPLE PUSHBUTTON INTERLOCK LATCH BAR AND SAFETY SWITCH**

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[22] Filed: **Dec. 15, 1971**

[21] Appl. No.: **208,208**

[30] **Foreign Application Priority Data**

Dec. 22, 1970 Great Britain 60826/70

[52] **U.S. Cl.** .... **200/5 R,** 200/5 B

[51] **Int. Cl.** **H01h 9/26**

[58] **Field of Search** .... 200/5 EB, 5

[56] **References Cited**

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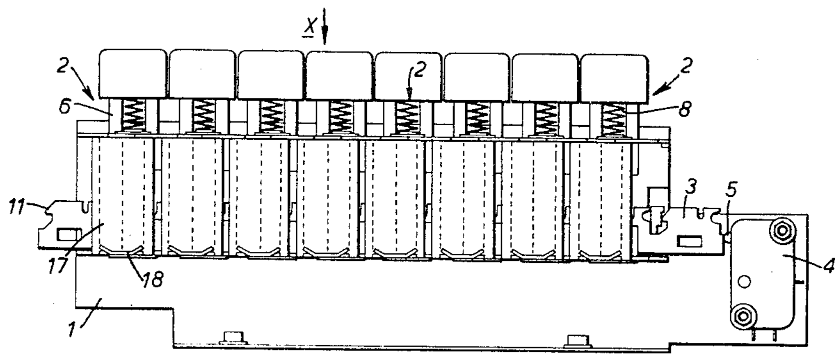
[57] **ABSTRACT**

A multiple push button assembly with abutment members on each pushbutton are securely held in undercut portions of a single latch bar in the respective pushbutton switch operative positions. More than one pushbutton assembly may be simultaneously actuated and interlocked in the operative position.

8 Claims, 8 Drawing Figures



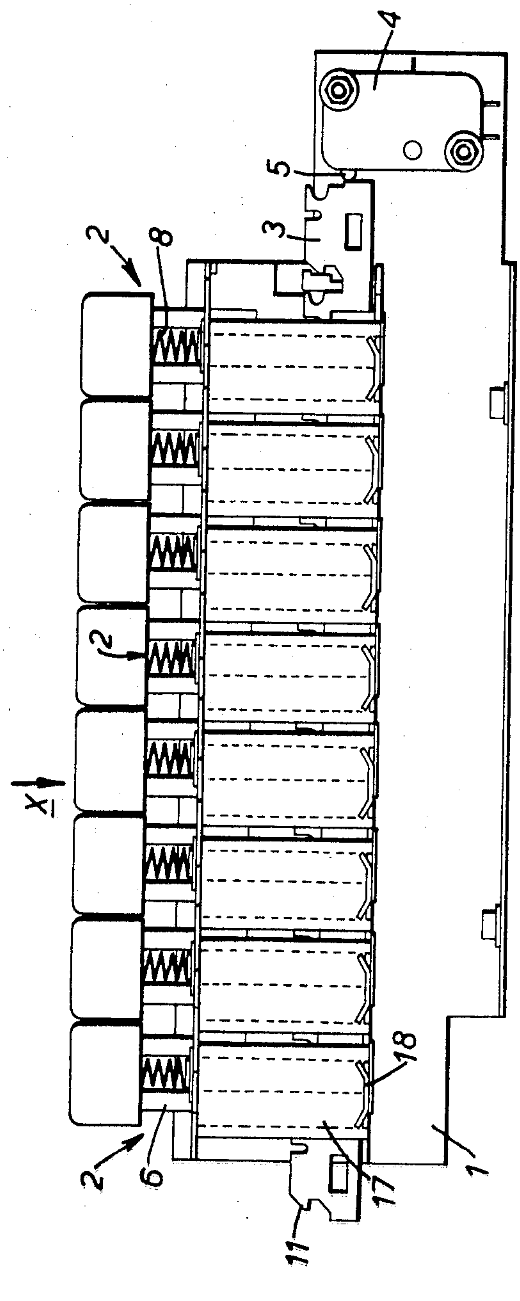


FIG. 1.

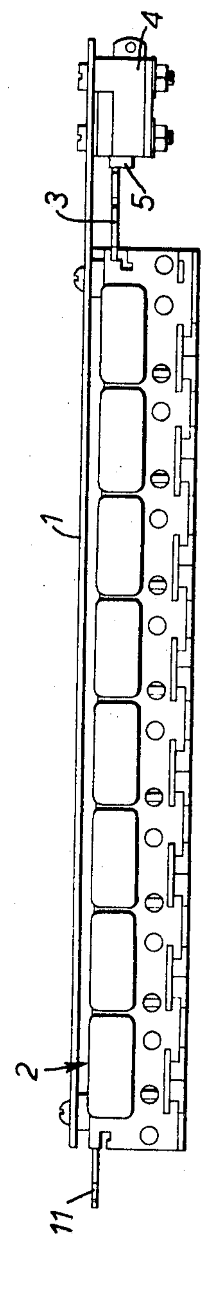


FIG. 2.

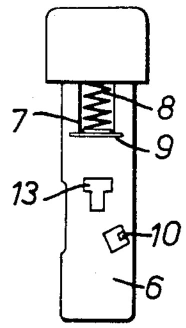


FIG. 3.

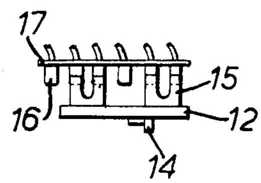


FIG. 6.

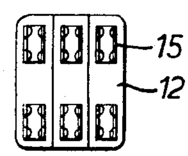


FIG. 5.

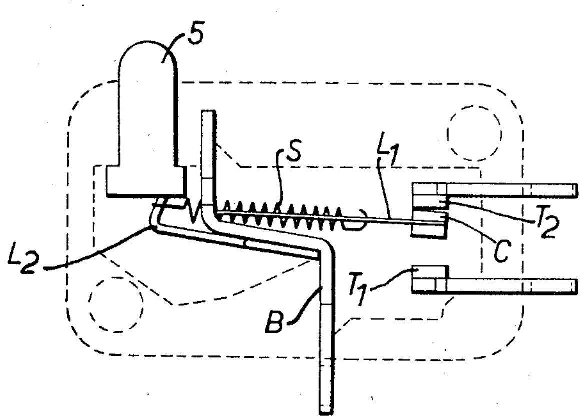


FIG. 8.

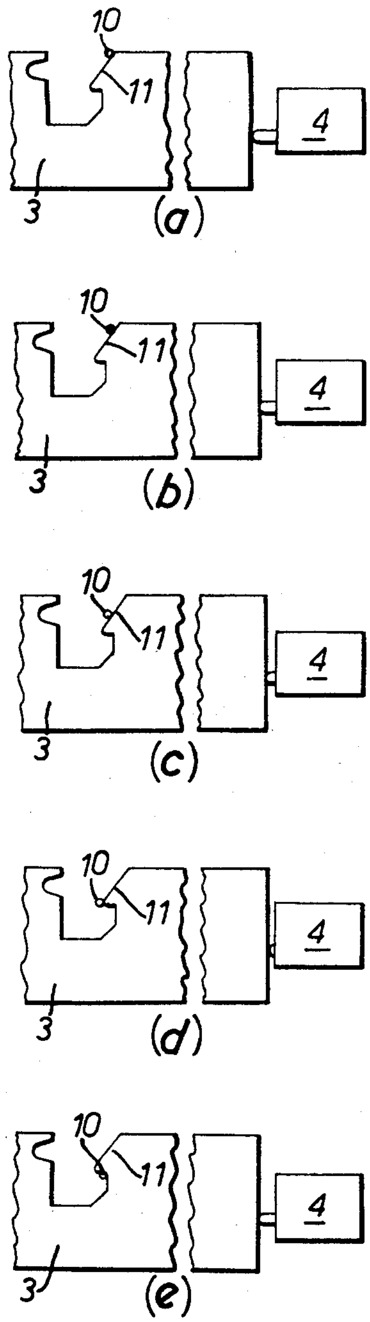


FIG.4.

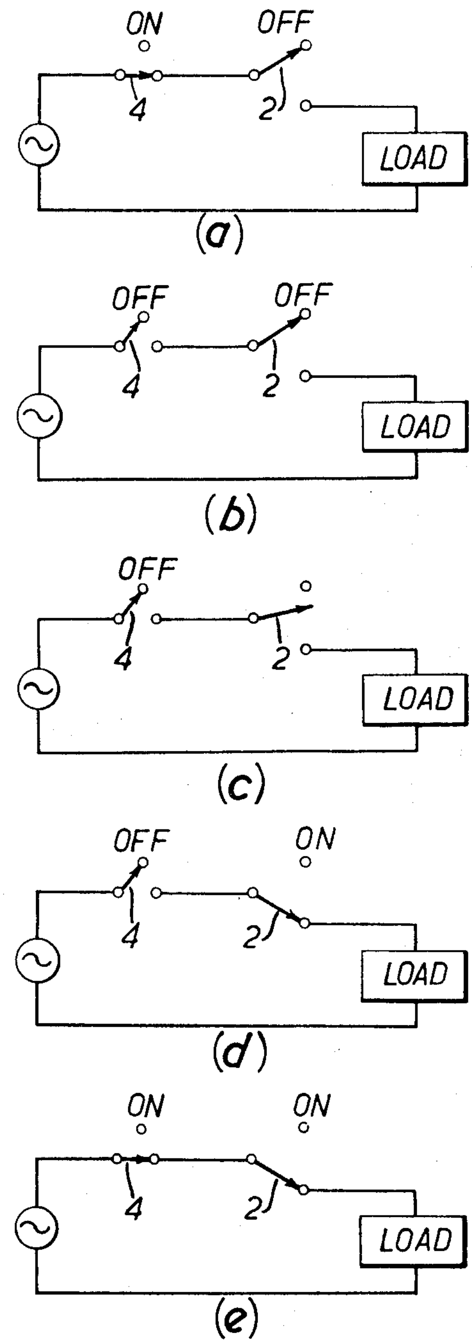


FIG.7.

MULTIPLE SWITCH CONTROL ASSEMBLY WITH MULTIPLE PUSHBUTTON INTERLOCK LATCH BAR AND SAFETY SWITCH

This invention relates to an electrical switch device for controlling a central heating system.

It is becoming increasingly important in domestic heating control to provide a programming switch which is capable of selecting complex combinations of hot water and central heating functions. Thus, sophisticated switching is envisaged whereby, for example, time periods for the two functions and predetermined levels of control for the central heating can be selected. If such control is to be achieved, switches will have to be incorporated in the programmer which can supply current to perhaps two circulating pumps at say 0.7 amperes each (inductive), and in the case of a large domestic oil-fired boiler to a fan/oil pump motor at say 3 amperes (inductive). In addition, low currents will have to be applied to control circuits to achieve the current conditions of heating and, as said previously, the motors and circuits will have to be supplied in many variations and combinations. Such complex selection inevitably requires a number of switches, the current carrying capacity of which would have to be in the order of 5 amperes. Unfortunately, however, as explained below, the problem does not end here because the current switching capacity of the switches will also have to be of the order of 5 amperes. Furthermore, there are two critical positions in which a switch is liable to be damaged. Firstly, when connection is made, the "in rush" current may be many times larger than the final steady current. Secondly, when connection is broken, a destructive arc can be drawn between the contacts if the load is inductive. The latter is generally the more troublesome. In fact, current switching capacity is always less than the current carrying capacity and if the current cannot be guaranteed to be less than the switching capacity of the switch at the instant of switching, then the carrying capacity must, in order to prevent damage, be restricted to that of the switching capacity. Switches used for central heating control must meet this requirement since switching of relatively high current inductive loads is necessary.

Although complex selection can be achieved using a number of relatively heavy duty switches each of which has a current carrying and switching capacity of the order of 5 amps, clearly such an arrangement would be space consuming and uneconomic. As a compromise, therefore, it has been common practice to have less sophisticated selection using these higher rated switches. An alternative to this is to carry out the program switching at low currents and use these to switch the heavier currents with relays. This too is unwieldy and expensive.

According to the present invention there is provided an electrical switch device including a number of selector switches and a safety switch which are connectible, in use, in a current supply circuit for a load to be controlled by the device; and mechanical means which, in use, actuate the safety switch to isolate a given selector switch from the current supply circuit while it is in the process of switching and to connect it in the circuit when switching is completed; the safety switch having a current switching capacity higher than that of the selector switch so that during switching of the latter contact, arcing is prevented.

Preferably, the safety switch isolates all the selector switches from the current supply circuit whilst a given selector switch is in the process of switching. Then, whilst program switching is carried out by the selector switches the safety switch switches off the supply. Consequently, each selector switch can have a relatively low switching capacity, for example, 0.2 amperes, it only being necessary to provide the safety switch with a high switching capacity of, for example, the order of 5 amperes.

The mechanical means may be such that if one or more selector switches are in the "on" position, it or they can be returned to the "off" position by moving another selector switch from the "off" to the "on" position.

The mechanical means may include a longitudinally movable latch bar. Each selector switch may be in the form of a spring-loaded push button having a longitudinally movable lever adapted to engage the latch bar to cause longitudinal movement thereof. The latch bar may be provided with a number of cam surfaces and each lever may be provided with an abutment member, each member being adapted to engage a corresponding one of the surfaces to cause longitudinal movement of the latch bar. Each cam surface may be provided with an undercut portion so that after a predetermined movement of the latch bar in one direction, the abutment member disengages the cam surface and latches in the undercut portion. The latch bar may be spring biased in a direction opposite to the one direction, so that when the abutment member leaves the cam surface, the latch bar is moved in the opposite direction and the abutment member latches in the undercut portion. The safety switch may be of the snap-action type and is provided with a spring biased plunger against which one end of the latch bar engages. Each lever may support one or more electrical contacts which are adapted to engage or disengage one or more stationary electrical contacts during movement of the lever. Movement of each lever may be at right angles to the movement of the latch bar.

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic plan view of a push button switch assembly for a central heating system;

FIG. 2 is a view as seen in the direction of arrow X in FIG. 1;

FIG. 3 shows in more detail an individual push button assembly and its associated actuating lever;

FIGS. 4 (*a*), (*b*), (*c*), (*d*) and (*e*) all show a detail of a latch bar of the switch assembly shown in FIG. 1, and each illustrate a particular operational position thereof;

FIG. 5 shows in detail a plan view of a movable contact carrier of the assembly shown in FIG. 1;

FIG. 6 shows an end elevation of the carrier shown in FIG. 4 in an operative position relative to a stator terminal member of the assembly shown in FIG. 1;

FIGS. 7 (*a*), (*b*), (*c*), (*d*) and (*e*) all diagrammatically illustrate how the switch assembly of FIG. 1 is connected in circuit, and each show a particular operational condition; and

FIG. 8 is a diagrammatic illustration of a microswitch.

Referring to the drawings, FIG. 1 shows a push button switch assembly including a base plate member 1 on which is mounted a bank of eight selector or push button switches indicated generally at **2**. Each of the selector switches **2** is spring-loaded and when depressed causes movement of a latch bar **3** to the right as shown in FIG. **1** to actuate a safety switch in the form of a snap-action microswitch **4**.

The microswitch illustrated diagrammatically in FIG. **8** is of conventional form and is such that depression of the plunger **5** causes a movable contact C to move with a snap-action out of contact with a first terminal T_1, into contact with a second terminal T_2, and then, when the plunger is released back into contact with the first terminal T_1. This movement of the contact is provided by a simple lever mechanism L_1, L_2 and spring, S, mounted on a fixed bracket B.

It will be understood, of course, that switch constructions different from that just described can be used provided the switch has a higher current switching capacity than that of each selector switch.

FIG. **3** shows in more detail the construction of an individual push button assembly. Extending from each push button itself is an actuating lever **6**, one end of which is provided with a slot **7** for receiving a spring **8** and an associated backing plate **9**. An upturned tag **10** formed on each lever is arranged to engage a corresponding cam surface **11** formed on the latch bar **3** as indicated in detail in FIGS. **4** (*a*), (*b*), (*c*), (*d*) and (*e*). Each lever supports a contact carrier **12** as shown in FIGS. **5** and **6**, a T-shaped cut-out **13** in the lever being arranged to receive a complementary projection (see FIG. **6**) formed on the underside of the carrier. The contact carrier is shown in plan view in FIG. **5** and has, for example, six contact clips **15** which are arranged to engage the terminals **16** of a corresponding stator **17** carried by a bracket **18** secured to the base plate **1**. FIG. **6** illustrates how each stator is assembled to its corresponding contact carrier and shows the clips **15** in the "not-operated" position.

In the fully retracted position of the actuating lever, the tag and the cam surface on the latch are in the positions shown in FIG. **4**(*a*) and the contact deployment as in FIG. 7(*a*).

Initial depression of the push button as shown in FIG. **4**(*b*) is not sufficient significantly to disturb the push button switch contacts which remain "off", but is sufficient to cause the tag **10** to move along the cam surface **11** resulting in movement to the right of the latch bar and breaking of the microswitch contacts. Further depression of the push button causes further movement of the latch bar (see FIG. **4**(*c*)), maintaining the microswitch operated and "off" and breaking the push button switch contacts as shown in FIG. **7**(*c*). Continued depression of the push button causes continued movement of the latch bar (FIG. **4***d*) which causes the microswitch to remain in the operated condition and the push button switch contacts to make as shown in FIG. 7(*d*). Depression of the push button beyond the position shown in FIG. **4**(*d*) causes the latch bar to be returned to the left by the spring biased microswitch plunger until the tag positively engages the latch as shown in FIG. **4**(*e*) so that the microswitch contacts remake as shown in FIG. **7**(*e*).

For convenience, FIGS. **7**(*a*) to (*e*) illustrate single pole switches **2**. Such switches are not excluded from the ambit of the invention, but it will be appreciated from FIGS. **1**, **5** and **6** that in the particular example presently being described these switches are of the multi-pole type having, for example, a six-pole changeover configuration so that complex switching off and between several loads is possible. Again, in FIGS. **7**(*a*) to (*e*), the safety switch **4** is connected between the supply and the selector switches **2**. However, it will be understood that the switch **4** may be connected anywhere in the supply circuit for the load to be controlled, for example, between the switches **2** and the load or between the supply and the load.

It will be appreciated from the foregoing description that while a particular push button switch is moved from "off" to "on", current supply to it is cut off by virtue of the microswitch being opened. However, the mechanical relationship between the actuating levers, latch bar and microswitch plunger is such that movement of the switch button is completely interdependent whereby if one switch is in its "on" position, it can be returned to its "off" position by moving another switch from "off" to "on". Consequently, current supply to the switches will be cut off by the microswitch not only while a push button switch is moved from "off" to "on" but also when retracted from "on" to "off".

As an alternative to the push button switch assembly described above, a rotary switch could be employed. The rotary switch would be of the "push in order to turn" type, the pushing action serving to actuate the safety or microswitch. The sequence would then be "push" thereby cutting off the supply by opening the safety switch, turn to select or change a particular program and then release to reestablish the supply by closing the safety switch.

The main feature of the switch assemblies described above is that while a particular selector switch is in the process of switching, it is isolated from the supply by the safety switch. Consequently, if the assembly is required to switch high current loads, each selector switch can have a comparatively low switching capacity it only being necessary to provide the microswitch with a relatively high switching capacity to meet the switching load requirements. Consequently, the switch assemblies described have application wherever switching off high power loads is required, for example, in the control of central heating systems.

I claim:

1. An electrical switch means comprising in combination a plurality of selector switches each having operative and inoperative conditions, a safety switch, mechanical actuating means movable to operate said selector switches and operatively connected to said safety switch, and electrical connections interconnecting said safety switch with each said selector switch, said safety switch controlling current supply to said selector switches and having a first position in which current can be supplied to said selector switches and a second position in which current cannot be so supplied, said actuating means having first, second, third, and fourth positions and being movable consecutively from said first position in which each of said selector switches is in one of its conditions and said safety switch is in its said first position, to said second position in which each of said selector switches is, and has remained, in said one condition and said safety switch is in its said second position, to said third position in which at least one said selector switch is in its said other condition and said safety switch is, and has remained, in its said second position, and into said fourth position in which the said at least one selector switch is, and has remained, in its said other condition and said safety switch is in its said first position, said safety switch having a current switching capacity higher than that of each said selector switch and sufficient to meet predetermined switching load requirements.

2. An electrical switch means as claimed in claim **1,** in which said actuating means comprises a longitudinally movable latch bar operatively connected to said safety switch and a plurality of spring-loaded push buttons each for actuating a respective one of said selector switches, each said push button having a longitudinally movable lever connected to said latch bar to effect longitudinal movement thereof.

3. An electrical switch means as claimed in claim **2,** in which said latch bar is provided with a plurality of cam surfaces and each said lever is provided with an abutment member, each of said abutment members being engageable with a corresponding one of said surfaces to effect longitudinal movement of said latch bar.

4. An electrical switch means as claimed in claim **3,** in which each of said cam surfaces is provided with an undercut portion so that after a predetermined movement of said latch bar in one direction, said abutment member disengages said cam surface and latches in said undercut portion.

5. An electrical switch means as claimed in claim **4,** in which said latch bar is spring biased in a direction opposite to said one direction so that when at least one of said abutment members leaves its corresponding cam surface, said latch bar is moved in said opposite direction and at least one of said abutment members latches in said undercut portion.

6. An electrical switch as claimed in claim **2,** in which each of said selector switches comprises two sets of electrical contacts, one set being supported on a corresponding one of said levers and said other set being mounted on a stationary support.

7. An electrical switch as claimed in claim **2,** in which movement of each of said levers is at right-angles to said movement of said latch bar.

8. An electrical switch as claimed in claim **2,** in which said safety switch is of the snap-action type and is provided with a spring biased plunger against which one end of said latch bar engages.

* * * * *