Jan. 25, 1966 R. O. MAJOR 3,231,784

STAGE LIGHTING SYSTEM

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Fig. 1.

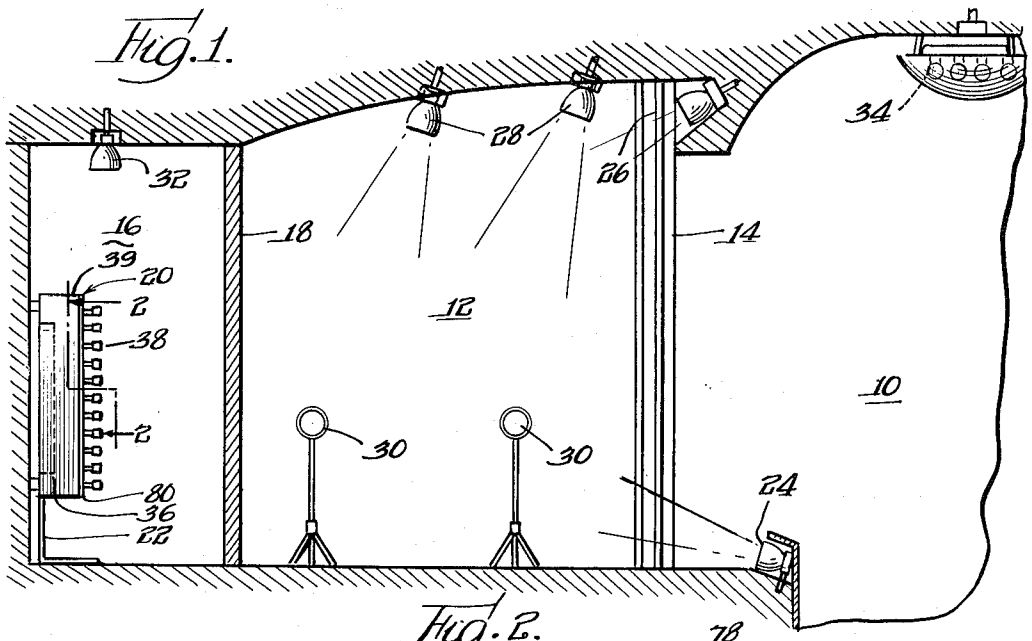
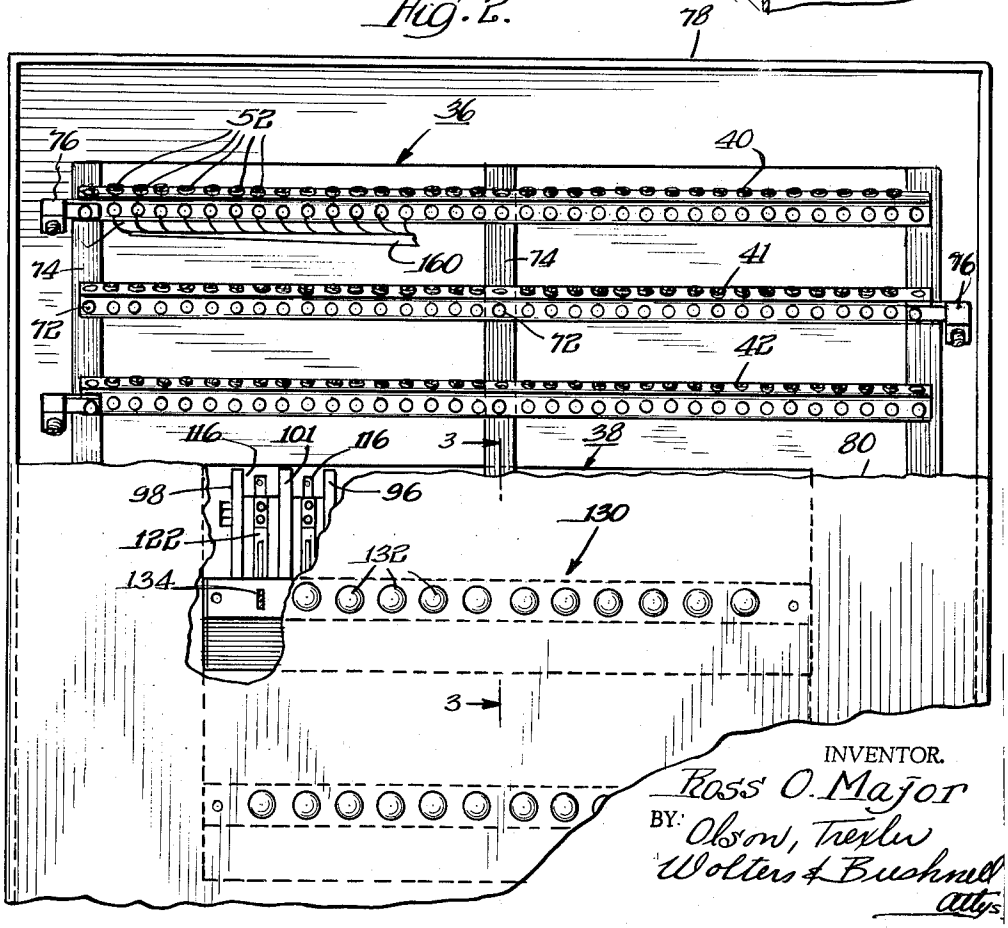


Fig. 2.



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Fig. 3.

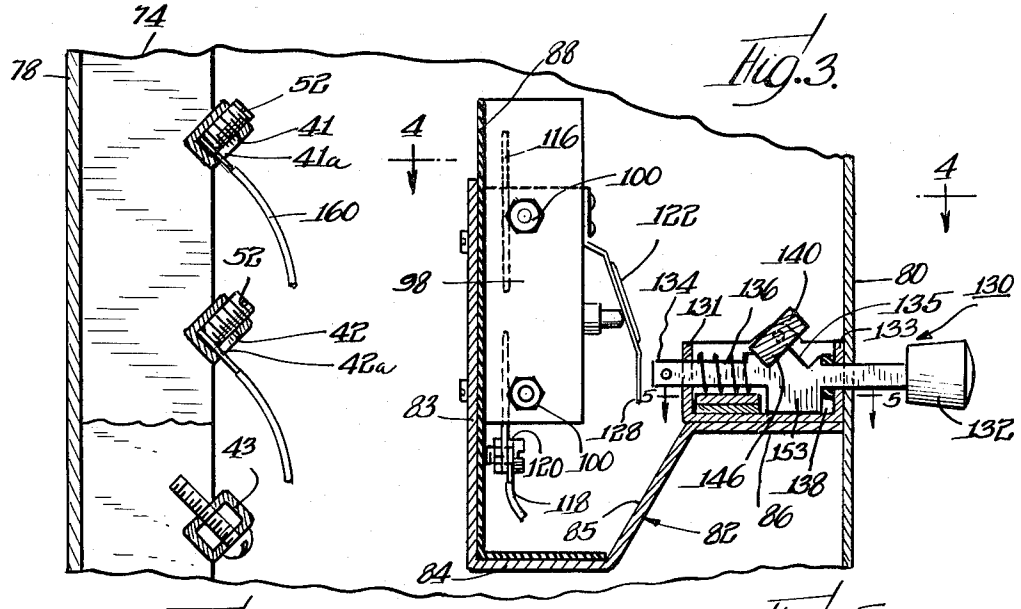


Fig. 4.

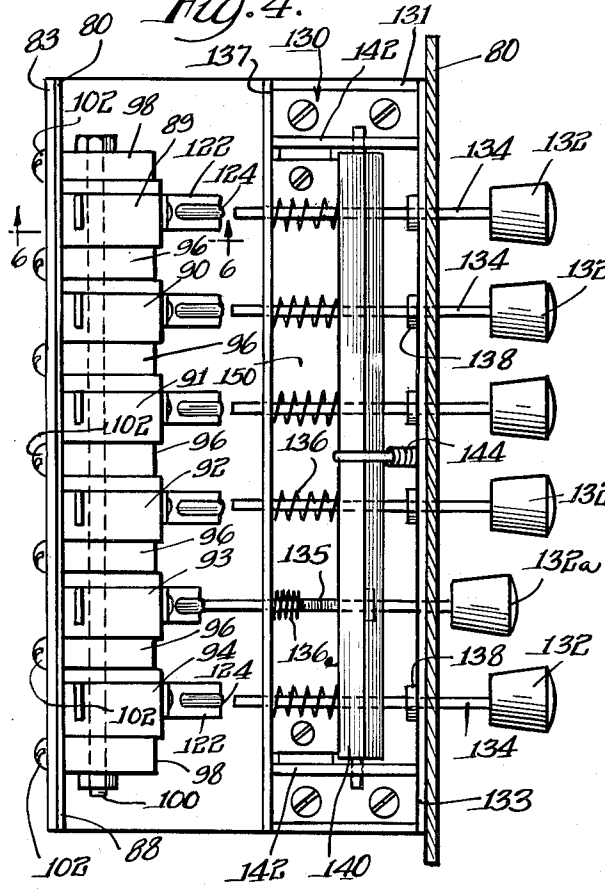


Fig. 5.

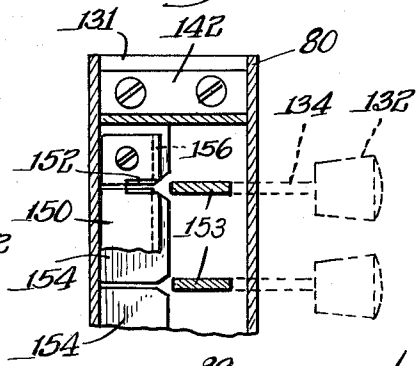
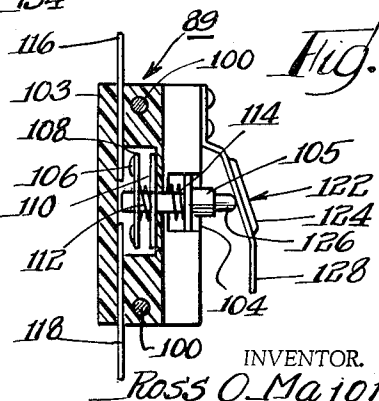


Fig. 6.



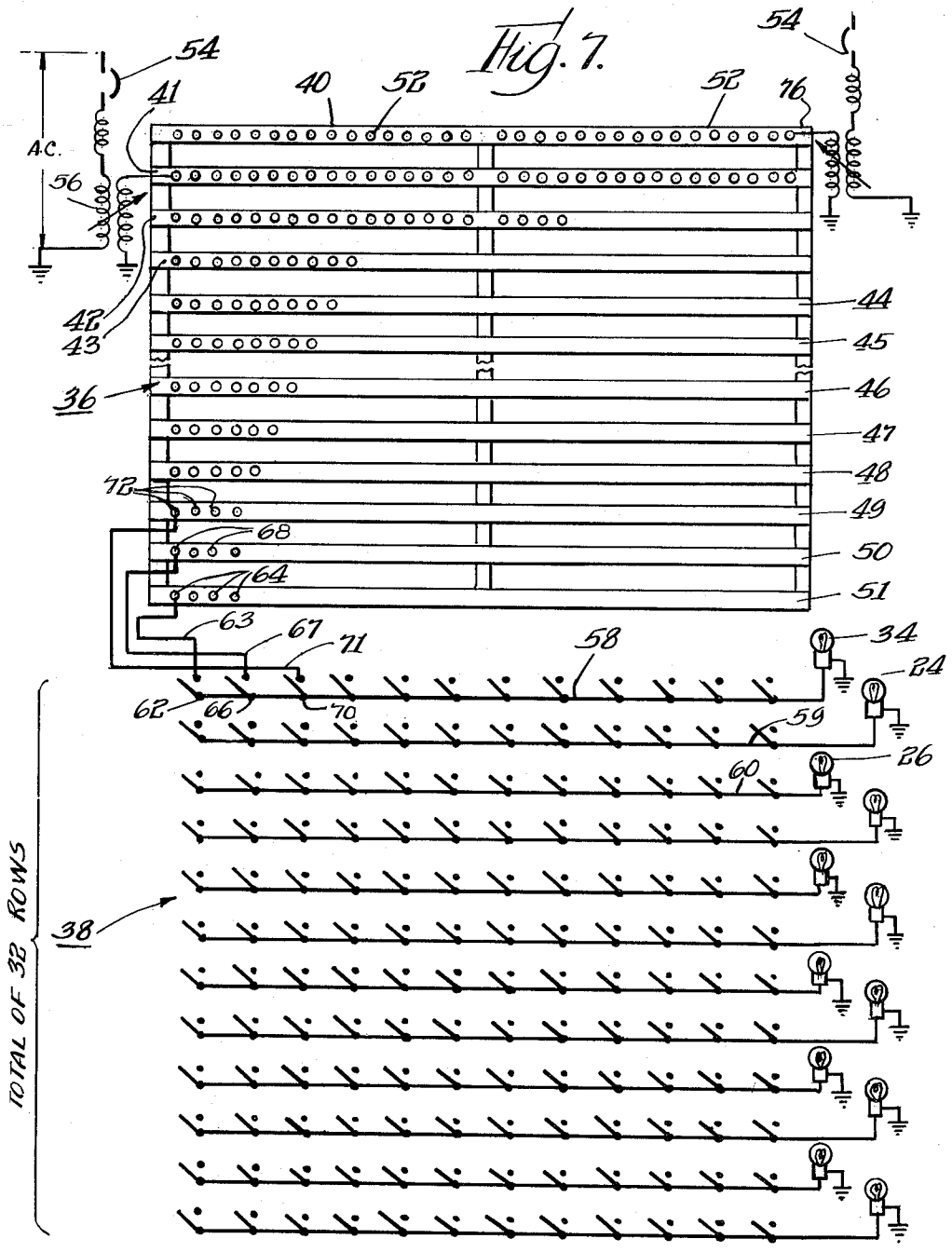
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Fig. 7.



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Fig. 8.

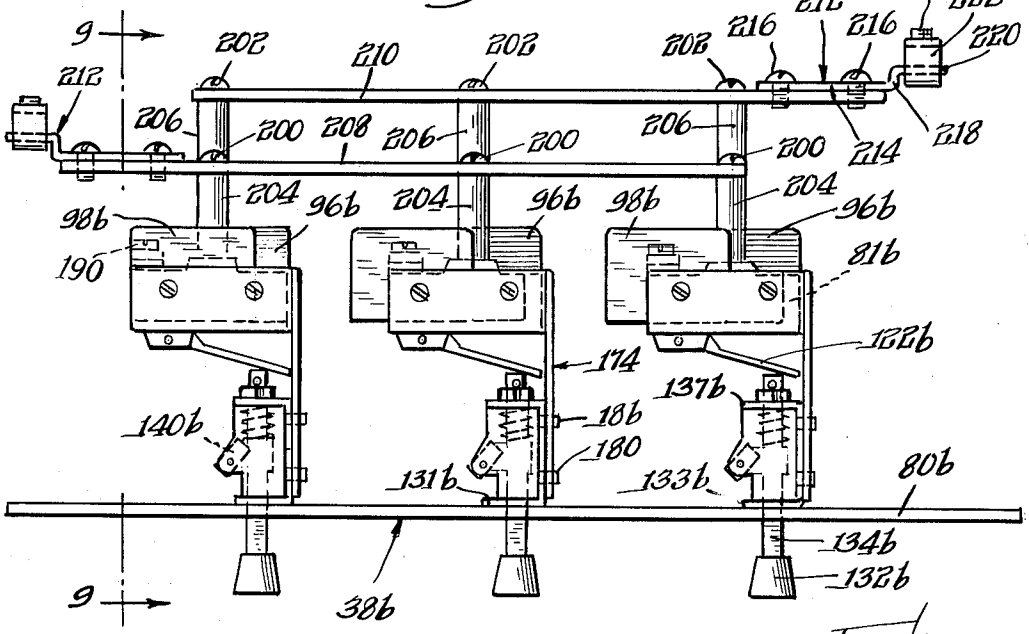


Fig. 9.

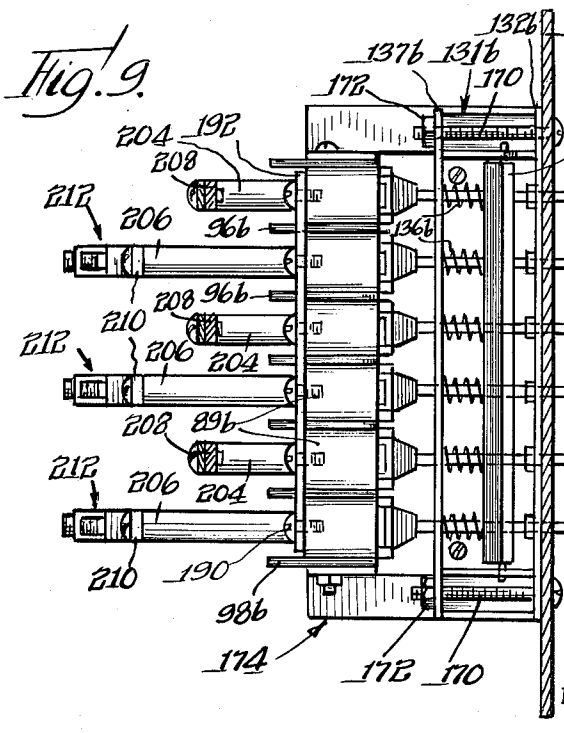
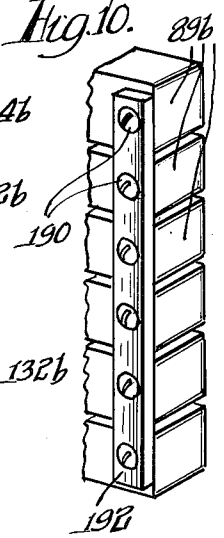


Fig. 10.

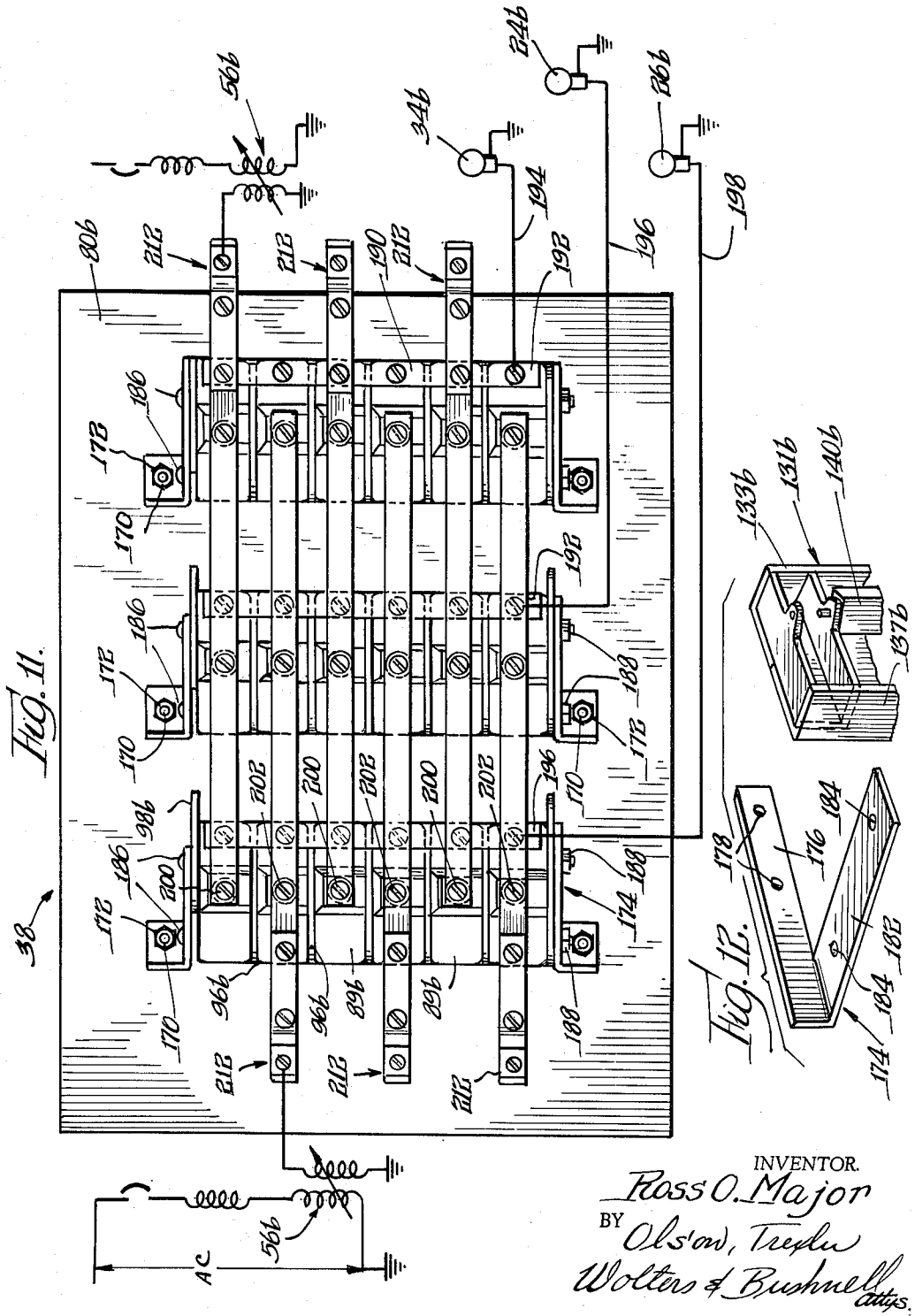


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3,231,784

STAGE LIGHTING SYSTEM

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Filed June 13, 1963, Ser. No. 288,858
14 Claims. (Cl. 315—312)

This is a continuation-in-part of application Serial No. 159,333 filed December 14, 1961, now abandoned.

This invention pertains generally to lighting systems for auditoriums, theaters, or the like, and particularly relates to improved means for selectively applying varying potentials to separate theater lighting circuits.

A well equipped auditorium for presenting dramatic and musical productions may have from twenty-five to over fifty lighting circuits or even more. Certain of these circuits may supply the auditorium or house lights, stage foot lights, side lights, overhead lights, proscenium lights, and the spot light mounted at the rear of the "house." Further, certain arrays of lights disposed in one location in the auditorium, for example the overhead spot lights, may be arranged in two or more circuits. This arrangement affords great flexibility in devising creation lighting effects for dramatic productions.

Enhancing the flexibility afforded by the numerous lighting circuits, banks of "dimmers," usually variable transformers or reactors, may be brought into the lighting circuits by means of a patch board. The dimmers are usually several in number whereby to supply a range of potentials to any one of the various lighting circuits. For example, in an auditorium lighting system supplied from a 120 volt A.C. source the dimmers may supply potentials ranging from zero volts to full line voltage in sixty-four or more degree increments, a total of sixty-four or more different potentials.

It is known that lighting circuits used in the theater, the lights being usually gas filled lamps, although carbon arc spots are frequently used, are highly inductive and cause large initial surges of current. It has been found that the switching means for selectively applying the potentials to the lighting circuits must be adapted to accommodate inductive loads in the range from 20 to about 25 amps.

Prior switching means or patch boards include arrangements similar to a telephone switchboard whereby plugs and jacks connect a selected lighting circuit to a selected dimmer. This type of patch board is simple and remarkably cheap, but is electrically dangerous. Another prior art switching device comprises a sliding plug which is slid along a bar and is depressed to engage a transverse bar, large number of such crossed bars is required. Rotary switch selectors have served switching functions on prior patch boards, but this structure, as well as the two foregoing, did not afford ease of manipulation for selecting circuits, and required a degree of expertise to obtain a precisely controlled series of lighting effects.

Therefore, an important object of this invention is to provide an improved lighting system for an auditorium, theater, or the like, which facilitates a rapid and positive switching a varying A.C. potentials to highly inductive lighting circuits.

Another object of the invention is to provide an improved patch board construction which is arranged for easy wiring into an existing theater lighting system for economical assembly as either an original equipment item or as a replacement.

Still another object is to provide an improved switching arrangement for highly inductive lighting systems and the like whereby push button actuated switches of high inductive capacity are employed.

Yet another object of the invention is to provide an improved feeder panel means associated with a patchboard having an array of push button actuated switches of high inductive capacity.

A further object of the invention is to provide an improved patch board construction which is highly practical in use, which is economical to manufacture, and which is flexibly adapted to afford rapid and positive switching of inductive loads between varying A.C. potentials.

Other objects an advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings wherein like reference numerals designate like parts throughout, in which:

FIGURE 1 is a fragmentary side view partially in section of an auditorium and stage showing groups of lights arranged in different sectors of the auditorium and stage and further showing an electrical control panel backstage incorporating the principles of the instant invention;

FIG. 2 is an enlarged fragmentary sectional view of the control panel shown in FIG. 1, taken generally in the direction of the arrows along the line **2—2** therein;

FIG. 3 is a further enlarged fragmentary sectional view taken generally in the direction of the arrows along the line **3—3** in FIG. 2;

FIG. 4 is a horizontal sectional view, taken generally in the direction of the arrows along the line **4—4** in FIG. 3;

FIG. 5 is a horizontal sectional view, partially broken away, taken in the direction of the arrows along the line **5—5** in FIG. 3;

FIG. 6 is a vertical sectional view of a plunger actuated switch employed in the present invention;

FIG. 7 is a schematic view of the transfer board shown in association with the circuit diagram of the present invention;

FIG. 8 is a top view of a modification of the invention, and generally similar to FIG. 3;

FIG. 9 is a vertical sectional view taken along the line **9—9** of FIG. 8;

FIG. 10 is a perspective view showing a detail of the modified form of the invention;

FIG. 11 is a rear plan view of the modification, with certain schematic additions thereto illustrating electrical connections; and

FIG. 12 is a fragmentary exploded perspective view showing one of the mounting brackets for the switch structure.

There is shown in FIG. 1 of the drawings a forward portion of an auditorium including the auditorium proper designated generally **10**, and the stage **12** which is separated from the auditorium **10** by a curtain **14**. The stage area **12** is divided from a back stage area **16** by a back drop **18**. It is well known that the back drop **18** and curtain **14** are each movable whereby to separate the stage area from the back stage area and to partition the auditorium area **10** from the stage area **12**.

Mounted in the backstage area **16** is a lighting control cabinet generally designated **20** which incorporates light control means made in accordance with and embodying the principles of the present invention. As shown in FIG. 1, the control cabinet **20** is mounted against the wall and may be supported further by a standard **22** which engages the floor of the backstage area **16**.

The switching means enclosed by the cabinet **20** will be described in detail presently, but to fully appreciate the significance of that apparatus a description of the various lighting circuits will now be set forth. It is apparent that in any well equipped theater a multiplicity of

lighting circuits are required to obtain a degree of flexibility for creating various lighting effects. Various of these lighting circuits may include several circuits controlling a bank of foot lights **24** and several more circuits for controlling an arrangement of proscenium lights **26**. Other circuits supply several groups of overhead lights **28** and wing lights **30** arranged on each side of the stage area **12**. Backstage **16**, an independent circuit for backstage overhead or work lights **32** affords illumination to the working area. An array of spotlights now shown may be positioned in the auditorium area **10** for directing controlled illumination with respect to various parts of the stage area **12**. House lights **34** may also be provided in the auditorium.

Thus it is to be recognized that the stage lighting circuits may vary in number from a minimum of say 25 upwards to 50 to 75 or more for an elaborately equipped stage lighting system. Further, dimmers are provided for varying the potential supply to each of the numerous circuits. The dimmers (not shown in FIG. 1) are usually arranged backstage closely adjacent to the lighting control cabinet **20** whereby a range of different A.C. potentials may be preset and then applied selectively to any one of the various lighting circuits.

To facilitate switching the highly inductive lighting loads between the various electrical potentials, the light control cabinet **20** includes a feeder bus panel or transfer panel **36** positioned adjacent the back wall of the cabinet **20** and a push button patch board **38** arranged on a winged door **39** of the cabinet **20**. Referring now to the circuit diagram shown in FIG. 7, the feeder bus panel **36** includes twelve bus bars consecutively numbered **40** through **51**, each bar being provided with a plurality of terminal portions **52** equal in number to the number of lighting circuits. In this case, thirty-two circuits are shown as one exemplification. A.C. potential is applied to each bus bar **40–51** through a circuit breaker **54** and a variable transformer **56**, the power being supplied to the circuit breakers **54** and variable transformers **56** from a common A.C. source. It is seen that in this exemplification twelve different potentials may be applied to the feeder bus panel **36**.

The push button patch board **38** includes a row of twelve switches for each of the thirty-two lighting circuits shown in the illustrative embodiment. A row of switches **58** may, for example, be electrically connected to the spotlights **34**; the next row of switches **59** may operate the foot lights **24**; and the row of switches **60** may afford selective dimming to the overhead lights **26**, etc. Taking now the row of switches **58** as an exemplification, the first switch **62** in row **58** is connected by a wire **63** to a terminal means **64** on the bus bar **51** having a predetermined selected potential thereon. The second switch **66** in row **58** is connected by a wire **67** to a terminal means **68** on the bus bar **50** having a second potential thereon. A third switch **70** in row **58** is in turn electrically connected by a lead **71** to a terminal **72** on the bus bar **49** having a third and different potential thereon. Each succeeding switch in row **58** is in turn connected to one of the bus bars **40** through **48** of the transfer panel **36**. In a similar fashion, the switches in row **59**, **60** etc. are respectively connected to the feeder panel **36**. When its is desired to apply to the spotlights **34** a pre-selected potential from the bus bar **49**, the switch **70** is actuated; from the bus bar **50**, the switch **66** is actuated; and from the bus bar **51**, the switch **62** is actuated.

Referring now to FIG. 2, each of the bus bars **40–51** is fastened by screws **72** to three equally spaced insulating frame members **74**. One end of each bus bar **40–51** is provided with a lug **76** for receiving the line from the variable transformer **56**. The frame **74** and bus bar assembly may be mounted on a panel wall **78** (FIG. 3) which may form the back of the light control cabinet **20**. A forward face **80** of the hinged door **39** of the cabinet **20** is the principal supporting member for the patch board

arrangement **38** which includes, for purposes of illustration, 32 rows of identical push button actuated switches, one for each circuit.

In FIG. 4 there is shown a typical arrangement of six switches of high inductive capacity in association with a push button mechanism. This mechanism and switch arrangement is typical of that employed to operate one-half of the row of twelve switches shown in the illustrative embodiment. Shown in elevational section in FIG. 3, the switch array and push button mechanisms both supported upon a frame **82** comprising a vertically extending base panel **83** joined to a horizontally disposed wall **84** which is joined to an upwardly inclined panel **85** which, in turn, is integrally connected to a second base portion **86** disposed at a right angle with respect to the base portion **83**. A sheet of insulation **88** is interposed between the confronting surfaces of the base portion **83** and the array of switches mounted thereon, the insulation extending over the frame wall **84**.

For purposes of identification the six switches shown in FIG. 4 have been numbered consecutively **89** through **94**. The six switches **89–94** are generally flat and box-like in form and are laterally spaced apart on predetermined centers along the base **83** and maintained in such position by intervening insulating spacer members **96**. A pair of end spacer members **98** completes the switch and spacer sandwich which is adapted to receive a pair of through-bolts **100** with co-operating fasteners for securing the members **89–94**, **96** and **98** together as a unit. The switch array is in turn secured to the base member **83** over the insulating board **88** by a plurality of fasteners **102** which are received into the insulating spacers **96** and **98**.

Referring to FIG. 2, a pocket **101** shrouding a switch terminal **116** is defined by the spacers **96**, **98** extending beyond the proximate end of the switch **89**. In a like fashion, a pocket **101** is provided for each of the switches on the patch board **38** to afford physical isolation of the somewhat exposed switch terminal **116**. This arrangement obviates wrapping the terminal **116** and its associated electrical conduit (not shown) with tape or other insulating material.

Referring now to FIG. 6 wherein a typical switch **89** is shown, it is seen that the construction of the switch **89** is of the plunger actuated two-point make variety. The rectangular casing **103** is provided with a cavity **104** which receives a spring biased plunger member **105**. The innermost end of the plunger **105** carries a pair of contacts **106** spaced on opposite sides of the plunger **105** and rigidly mounted on a rectangular bar **108**. Inwardly of the contact carrying bar **108** there is fixedly mounted on the plunger **105** a fiber spacer bar **110** positioned apart from the contact bar **108** by a first coil spring **112**, the spacer **110** being shaped complementary to the bar **108**. The bars **108** and **110** both being mounted on the plunger **105** cooperate with the spring **112** to provide an over travel limiting means. More specifically, when the plunger **105** is depressed against the bias of a spring **114** within the cavity **104**, the contacts **106** are urged into engagement with the spaced end portions of a pair of flat, outwardly extending terminal plates **116** and **118**. If inward travel of the plunger **105** is thereafter continued, the innermost end of the plunger **105** slides through the contact bar **108** against the bias of spring **112** until the coils of spring **112** are fully compressed against each other and against the spacer **110** fixedly secured to the plunger **105**. This arrangement precludes over stressing and eliminates bending of the plate **108** whereby to ensure positive engagement of the contacts **106** with the spaced ends of the terminals **116** and **118**.

The terminals **116** and **118** each extend outwardly of the casing **103** a distance to conveniently receive an electrical conductor (not shown). As arranged on the frame **82** the switches **89–94** have their respective terminals **116** extending outwardly of the frame **82** into a pocket **101**

(see FIG. 2). The terminals **118** of the switches **89–94** are joined to a common bus bar **120** arranged in the pocket-like inner portion of the frame **82** defined by the panels **83** and **84**.

A lever arm **122** is shown in FIG. 6 cantilevering from one end of the switch casing **103** over the outermost portion of the plunger **105**. The central portion of the lever arm **122** is provided with an outwardly protruding channel-like portion **124** extending longitudinally of the arm **122** for receiving a tip **126** of the plunger **105**. A free end portion **128** of the lever arm **122** extends away from the plunger **105** whereby as the end **128** is depressed towards the terminal **118**, the plunger **105** is urged into the body of the switch to complete a circuit between the terminals **116, 118**. When the depressing frame is removed from the end **128**, the spring **114** urges the plunger **105** upwardly carrying the contact bar **108** away from the terminals **116, 118** to open the circuit.

Push button means for selectively actuating each of the switches **89–94** by depressing the lever arm **122** is secured to the second base panel **86** of the frame **82**, shown clearly in FIG. 3.

The push button mechanism, generally designated **130** and shown in FIGS. 3 and 4, is typical of that which may be used for actuating six of the twelve switches in any one of the thirty-two rows of switches on the push button panel **38**. A channel shaped member **131** attached to the second base panel **86** supports the push button mechanism **130** on the frame **82**, and connects the frame **82** to the door panel **80**, a first flange **133** of the member **131** being fixedly secured to the inner side of the door panel **80** a second flange **137** being spaced inwardly therefrom.

The mechanism **130** comprises a row of six push buttons **132** spaced on centers complementary to the spacings of the switches **89–94**, each button or knob **132** being fixedly secured to a flat push rod **134**. Each rod **134** extends through complementary apertures provided in the panel **80** and in the upstanding flanges **133, 137** of the channel member **131**. One end of the rod **134** projects inwardly from the second flange **137** towards the free end **128** of the lever arm **122**, shown best in FIG. 3.

Each of the rods **134** has a double notched central portion **135**, one end of which forms an abutment for one end of a coil spring **136**, the opposite end of the coil spring engaging the second flange **137**. On the opposite end of the notched central portion **135** a rubber stop member **138** is positioned so as to arrest outward movement of the push rod **134** by engaging the first flange **133**.

Referring now to FIG. 4 to maintain a selected push button, such as push button **132*a***, in a depressed position, a rocking bail **140** is provided on the mechanism **130**. As it will presently appear, the bail **140** also functions to release the depressed button **132*a*** when any other button in the mechanism **130** is pressed.

The rocking bail **140** extends at a right angle across the central portions **135** of the six rods **134**, the bail being rotatably mounted at its ends in spaced L-shaped clips **142** secured to the channel **131**. The medial portion of the bail is biased by a tension coil spring **144** to urge a corner **146** of the bail **140** into one of two notches **135** in each rod **134**, shown best in FIG. 3. Thus, as the button **132*a*** is depressed the projection intermediate the notches **135** pushes or "rocks" the corner **146** from the first notch as shown in FIG. 3 to the second notch as shown in FIG. 4.

Subsequently, when a button **132** other than button **132*a*** is pressed, the corner **146** of the bail **140** is rocked from the second notch of the depressed button **132*a***. The previously compressed spring **136** then urges the button **132*a*** to the extended or original position, the extending motion being arrested by the elastomeric snubber element **138**.

Means for preventing two or more push buttons **132** from being depressed simultaneously is provided in the mechanism **130**. Referring now to FIG. 5 more particularly, an elongated plate **150** is secured to the web of the member **131** and is provided with six spaced apart slots **152** each for receiving a tab **153** integral with the rod **134**. On opposite sides of each slot **152** there is provided a pair of spacers **154** slidably mounted beneath the plate **150** and retained therein by a flange member **156** integral with a long edge of the plate **150**. Between the two spaced clips **142** the cams **154** provide only sufficient free space for one of the tabs **153** to be interposed. Hence, when any one tab **153** is inserted within any one of the slots **152**, the cams **157** on either side of the interposed tab **153** are pushed together completely filling the remaining slots **152** thereby precluding a second push button in the row from being depressed.

It is to be noted that the push rods **134** are arranged to have a predetermined distance of free travel before operatively engaging the lever arm **122**, clearly shown in FIGS. 3 and 4. Further, the operative travel of the rod **134** between the two locking notches **135** is matched to the deflection of the free end **128** of the lever **122**, such deflection being in turn matched to the operative travel of the plunger **105** requisite to close the switch.

The push rods **134** are mounted for easy movement between the "in" and "out" positions. To achieve this condition in the mechanism **130** a measure of overtravel of the rod **134** beyond the depressed position shown in FIG. 4, is inherent. This is easily understood from the arrangement of the coil spring **136*a*** in relation to the spring abutments **137** and **135**, it not being desirable to completely compress the spring **136*a*** in depressing the push button **132**. The overtravel of the push rods **134** is determined by the measure of residual compressibility of the coil spring **136*a*** beyond that of the "in" position. It has been found that the life of the switches **89–94** employed in the patch board **38** is greatly increased by matching the overtravel of the rods **134** to that of the contact carrying plunger **105**. The matching of the comparative overtravel capabilities is in addition to matching the operative travel of the rods **134** with that of the lever arm **122** and plunger **105**.

Prior to securing a group of six switches to the frame **82**, the inwardly extending terminals **118** are each fastened to the common bus bar **120** which, in turn, may receive the conductor leading to the lighting circuit. This arrangement permits wiring the switches to the feeder bus panel **36** after the attachment of the switch array to the push button frame means **82**.

Referring to FIG. 3, the bus bars are provided with wire receiving apertures **41*a***, **42*a***, arranged in the wall of the hollow bus bar at a right angle to the lug screw **52**. A typical conductor **160** may have one end secured in the aperture **41*a*** and have the opposite end in electrical contact with the lug **116**, leaving sufficient slack in the lead **160** to permit opening of the cabinet door **39** of the lighting control cabinet **20**.

When closed, the cabinet door **39** presents a pushbutton patch board having 32 rows of 12 pushbuttons each. The stage electrician may rapidly switch potentials between the twelve dimmers **56** and the thirty-two lighting circuits, each circuit of which may be loaded to twenty to twenty-five amps inductively. Being that the load resulting from the use of gas filled lamps is highly inductive, it is requisite that the plunger actuated switches have contacts and terminal members of ample size to safely accommodate such loads. For this reason the terminals **116** and **118** are broad adjacent the contacting area within the body of the switch. Being that the circuit is broken within the switch **89** simultaneously at two spaced points a minimum of arcing occurs upon opening the switch.

Turning now to the embodiment of FIGS. 8–12, it will be understood that the feeder bus panel has been combined with the pushbutton patch board. For simplicity of illustration, a rather small pushbutton patch board is shown, comprising three vertical columns, each consisting of six pushbuttons, a total of eighteen pushbuttons,

as contrasted with the larger number heretofore discussed. Many of the parts in FIGS. 8–12 correspond directly with those heretofore shown and described, and for simplicity of disclosure, these parts are identified by like numerals with the addition of the suffix *b*.

Thus, the pushbutton patch board **38***b* includes a panel **80***b* having a plurality of pushbuttons **132***b* mounted on members **134***b*. A channel-shaped member **131***b* comprises a pair of angle members mounted edge to edge, and, providing parallel flanges **137***b* and **133***b*, the latter of which is adjacent the panel **80***b*, and the former of which is spaced therefrom. Through-bolts **170** and nuts **172** thereon secure the two halves of the channel together and to the panel **80***b*.

As previously has been described, particularly in connection with FIGS. 3 and 4, a rocking bail **140***b* is provided for each row of pushbuttons, and cooperates with appropriate shoulders on the members **134***b* for holding any depressed button down, while insuring against spring return of a prior depressed button by means of the corresponding spring **136***b* whenever a subsequent button is depressed. The inner end of each member or flattened push rod **134***b* is engageable with the pivoted operating lever **122***b* of a corresponding pushbutton switch **89***b*. The switches may be similar to those heretofore described in detail, or may be improved.

The switches are mounted by means of brackets **174** seen in FIGS. 8, 9, 11 and particularly 12. Each such bracket comprises a flat strap-like portion **176** having a pair of apertures **178** therein for receipt of the ends of screws **180** (FIG. 8) extending through the two-part channels **131***b* at either end thereof. The apertures are tapped to receive the threads of the screws.

There are two brackets provided for each channel, respectively at the opposite ends thereof. In addition to the strap-like portion **176**, each bracket includes at its outer end an elongated, right-angularly disposed flange **182** having a pair of apertures **184** therein, relatively adjacent the opposite ends. Through-bolts **186** extend through the apertures **184** in corresponding brackets, and also through the intermediate switches **89***b* to support the switches. End spacer plates of insulating material **98***b* and intermediate spacer plates **96***b* of insulating material also are secured by the through-bolts **186**. Nuts **188** are threaded on the ends of the through-bolts, as will be understood.

All of the switches are herein designated as **89***b*. It will be observed that near one end of each switch near the back side thereof, there is provided a screw **190**. A common bus bar **192** (see particularly FIG. 10) is secured under the heads of all of the screws **190** for any given vertical row of switches. The intermediate insulating spacers **96***b* are suitably notched to accommodate each common bus bar **192**. As may be seen in FIG. 11, each of the common bus bars **192** is secured to one of the lighting circuits, such as **34***b*, **24***b* and **26***b*, for example, respectively by means of a wire **194**, **196** and **198** secured beneath the head of a screw on a corresponding common bus bar, preferably by means of an approved eyelet type of connector.

As has now been observed, the screws **190** and common bus bars **192** are disposed relatively toward one end of each switch. Relatively adjacent the center of each switch, there is also disclosed a connecting screw **200**, or **202**. As will be observed, the screws **202** are substantially longer than the screws **200**.

Tubular insulating members **204** and **206** of different length, corresponding to the length of the screws **200** and **202**, respectively encircle the screws **200** and **202**. Feeding bus bars **208** and **210** are respectively secured beneath the heads of the screws **200** and **202** against the ends of the insulators **204** and **206**. In the illustrative example, each feeding bus bar is connected to three switches, and it will be understood that in general, a feeding bus bar is connected to all corresponding or parallel switches in whatever number of vertical rows of switches may be provided. The feeding bus bars are alternately spaced at different distances from the rear ends of the switches to provide a requisite spacing for electrical safety purposes.

Electrical connectors are provided at the ends of the feeding bus bars **208** and **210**, all of the connectors being similar. The connectors to the feeding bus bars **208** are at one corresponding end thereof, while the connectors on the feeding bus bars **210** are at the opposite end thereof. The connectors are all of the same construction, including a strap-like body **214** secured to the end of the corresponding feeding bus bar **208** or **210** by means of screws **216** passing through the strap-like body **214** and threaded into tapped apertures in the corresponding feeding bus bar. Each connector is further provided with an offset **218**, and a continuing parallel tip **220**. A conductive stirrup **222** encircles each extending end **220**, and has a set screw **224** threaded therethrough and confronting the extending end **220**. As will be understood, a wire is inserted into the stirrup **222** and the set screw **224** is turned down against the wire to clamp the wire against the extending end **220** to make the connection.

Insofar as the actual connections are concerned, they are made to the feeding bus bars from transformers or other dimmers **56***b*, as previously indicated in connection with FIG. 7.

As will now be apparent, the patch board and feeder bus panel or transfer panel have now been unitized, thereby providing a simpler and more rugged construction. The various electrical components are mounted in simplified fashion, in accordance with the embodiment of FIGS. 8–12.

While reference has been made to pushing different buttons to apply different potentials to a given lighting circuit, it will be understood that this is principally by way of illustration. Primarily the patch board herein will be used to connect various combinations of lights to any given dimmer, whereby selective actuation of any of the various dimmers will effect concurrent changes in lighting intensity in desired combinations of lights, as set up by punching the appropriate buttons.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appendant claims all such modifications in the true spirit and scope of the invention.

What is claimed is as follows:

1. In a lighting system for a theater auditorium and stage having a plurality of highly inductive lighting circuits supplied from source means, the combination comprising: a plurality of variable transformers connected to said source means for setting a range of different potentials to be applied to the lighting circuits; a feeder panel including a plurality of bus bars, each electrically connected to one of said variable transformers, each bus bar having terminals at least equal in number to said lighting circuits; and a push button actuated patch board having a gang of switches of high inductive capacity for each of the lighting circuits, a switch in each gang being electrically associated with one of said bus bars of said transfer panel, and means co-operating with said gang of switches for preventing closing of more than one switch at a time, each of said switches being a discrete switch having an operator extending therefrom and further comprising a push button having a plunger thereon engageable with said operator.

2. The combination as set forth in claim **1** wherein each switch has a first terminal and a second terminal, said switches being arranged in horizontal rows and vertical columns, wherein said bus bars comprise a pair of physically parallel bus bars each connected to the first terminals of a corresponding group of said switches, and further in-

cluding an additional plurality of buses physically parallel to one another and disposed at right angles to said bus bars and connected to a second terminal of a group of corresponding switches.

3. The combination as set forth in claim 1 wherein each switch is aligned with a respective push button.

4. The combination as set forth in claim 3 and further including a front panel which is imperforate except for a plurality of relatively small apertures therein arranged in a plurality of vertical columns and a plurality of horizontal rows, said apertures and said push buttons being equal in number and each push button having a rearward projection extending through and substantially filling a respective aperture.

5. In a system for switching variable electrical potentials one at a time to a plurality of highly inductive lighting circuits, the combination comprising: a feeder panel board having a plurality of bus bars mounted thereon, each bus bar providing connection means for one source of A.C. potential; and a patch board for selective switching of ones of the variable potentials to respective ones of the lighting circuits, said patch board including frame means having a plurality of ganged push buttons mounted thereon for one-at-a-time actuation, and a plunger-actuated spring-biased two point make switch having a lever arm thereon coacting with one of said push buttons to open and close said switch for breaking and making a circuit between one of said bus bars and an associated lighting circuit.

6. In a system for switching variable electrical potentials one at a time to a plurality of highly inductive lighting circuits, the combination comprising: a feeder panel board having a plurality of bus bars mounted thereon, each bus bar providing connection means for one source of A.C. potential; and a patch board independent of said feeder panel for selective switching of ones of the varying potentials to respective ones of the lighting circuits, said patch board including frame means having mounted thereon a plurality of gangs of push buttons, and a plurality of complementary gangs of plunger actuated switches, each gang of switches having one switch electrically connected to each one of said bus bars, each push button including an axially advanceable rod having a first range of lost axial motion, said switch plunger having a second and smaller range of lost motion, and means coacting with said rod and switch plunger to accommodate the travel of said rod to the travel for closure of said switch plunger.

7. In a push button patch board for switching a variety of different inductive loads to variable electric devices for dimming theater lights, the combination comprising: a frame, an array of push button mechanisms on said frame arranged in rows, the push button mechanism of each row having first means for limiting overtravel of said push buttons; and a plurality of discrete plunger actuated switches on said frame grouped in rows and respectively aligned with said push button mechanisms, each row coacting with a respectively corresponding row of push buttons, each switch having second means complementary to said first means for limiting overtravel of the contact actuating plunger to prevent bending of the contacts, the switches in each row being arranged side-by-side and maintained in a spaced apart relationship by insulating members sandwiched between adjacent switches, each row of switches having a bus bar electrically connected to one terminal on each switch in said row and adapted for connection to an inductive lighting circuit load, each of the other terminals on the switches in each row being adapted for connection to separate ones of the variable electric devices.

8. In a push button patch board for switching a variety of different inductive loads to variable electric devices for dimming theater lights, the combination comprising: an array of push button mechanisms on said frame arranged in rows, the mechanism of each row including a plurality of push buttons spaced on predetermined centers, said push buttons including axially movable rod members coacting with means for releasing a depressed button when any other button in said row is depressed, and a plurality of discrete plunger actuated switches on said frame grouped in rows, each row coacting with a respectively corresponding row of push buttons, the switches in each row being maintained on said predetermined centers by insulating spacer means secured to said frame, the plungers of said switches being offset from the respective rod members, and means on each of said switches engaging the plungers thereof and coacting with the respective one of said rod members for depressing said plunger to close said switch.

9. In a push button patch board for switching a variety of different inductive loads to variable electric devices for dimming theater lights, the combination comprising: a frame; an array of push button mechanisms on said frame arranged in rows, the mechanism of each row including a plurality of push buttons spaced on predetermined centers, said push buttons including axially movable rod members coacting with means for releasing a depressed button when any other button in said row is depressed; each rod member having first overtravel limiting means associated therewith; and a plurality of discrete plunger actuated switches on said frame grouped in rows, each row being in substantial alignment with and coacting with a respectively corresponding row of push buttons, the switches in each row being arranged side by side and maintained in a spaced apart relationship by insulating members sandwiched between adjacent switches, the plunger of each of said switches having second overtravel limiting means associated therewith, and means on each of said switches engaging the plunger thereof and coacting with the respective one of said rod members for depressing said plunger to close said switch, said first limiting means being compatible with said second limiting means to permit overtravel of said plunger without bending of the switch contacts.

10. In a system for selectively connecting a plurality of electric sources of potential to a plurality of electric utilization circuits, a patch board comprising frame means, a plurality of discrete switches each having first and second terminals and means for inter-connecting said terminals arranged in mutually perpendicular rows and carried from said frame means, a like plurality of pushbuttons carried from said frame means, means operatively connecting each pushbutton with a respective switch for selectively inter-connecting the first and second terminals of a switch, a plurality of parallel bus bars each connected directly to the first terminals of each switch in a corresponding row and to a source of potential, and a plurality of parallel feeder buses disposed at right angles to said bus bars and directly connected to a second terminal of each switch in a row perpendicular to the last mentioned row of switches, each of said feeder buses being connected to a utilization circuit.

11. The combination as set forth in claim 10 wherein the feeder buses are spaced from the switches by means including insulating spacers.

12. The combination according to claim 11 wherein the spacers are of two different lengths, alternate feeder buses being spaced different distances from said switches, feeder buses spaced apart by one feeder bus being spaced the same distance from said switches.

13. The combination as set forth in claim 10 wherein said switches are supported from said frame means respectively in alignment with said push buttons.

14. The combination as set forth in claim 13 and further including a front panel which is imperforate except for a plurality of relatively small apertures therein, said apertures being arranged in a plurality of vertical columns and a plurality of horizontal rows, said apertures and said

push buttons being equal in number and said push buttons having rearward projections extending through and substantially filling said apertures respectively.

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