United States Patent

Witkor

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[45] **Oct. 10, 1972**

[54] **BYPASS AND ISOLATION SWITCH**

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[73] Assignee: **Automatic Switch Company**

[22] Filed: **Dec. 20, 1971**

[21] Appl. No.: **209,514**

[52] **U.S. Cl.** ..... **200/48 R**

[51] **Int. Cl.** **H01h 31/00**

[58] **Field of Search**.....200/48 R, 48 RP, 48 SB, 148, 200/146; 307/138, 139, 112, 113

[56] **References Cited**

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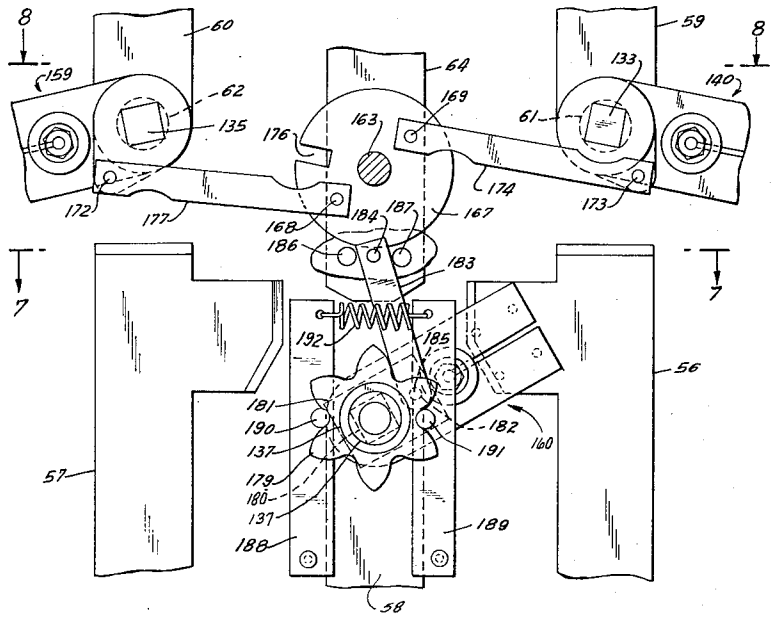
Primary Examiner—Herman J. Hohauser

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[57] **ABSTRACT**

A switch including three conductors for connection, respectively, to a normal power source, an emergency power source, and a load, as well as three conductors for connection to an automatic transfer switch. An isolating switch contact is located between each power source conductor and one of the transfer switch conductors, and a bypass contact is located between the load conductor and the third transfer switch conductor. Manually operable control means are provided for opening and closing the isolating switch contacts, and for positioning the bypass contact so that it engages either its respective transfer switch conductor or one of the power source conductors. An interlock forming part of the control means prevents opening of the isolating switch contacts unless the bypass contact is engaging one of the power source conductors. The interlock also prevents disengagement of the bypass contact from either power source conductor unless the isolating contacts are closed. The control means also includes means defining only a limited number of stable positions of the bypass contact.

11 Claims, 10 Drawing Figures



PRIOR ART

FIG. 1

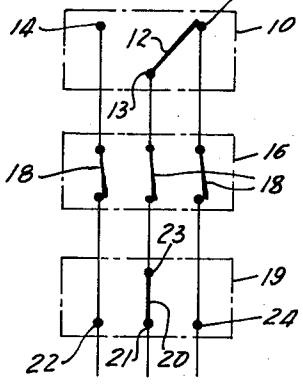


FIG. 2

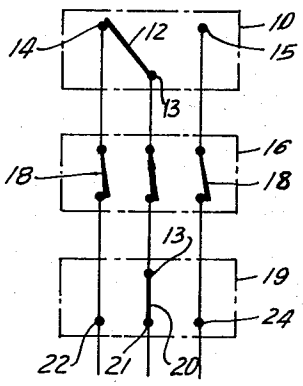
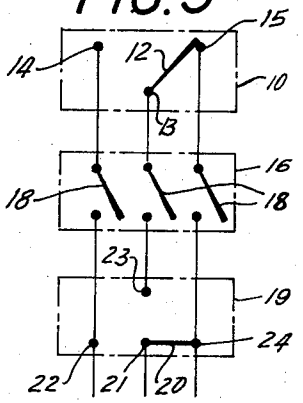


FIG. 3



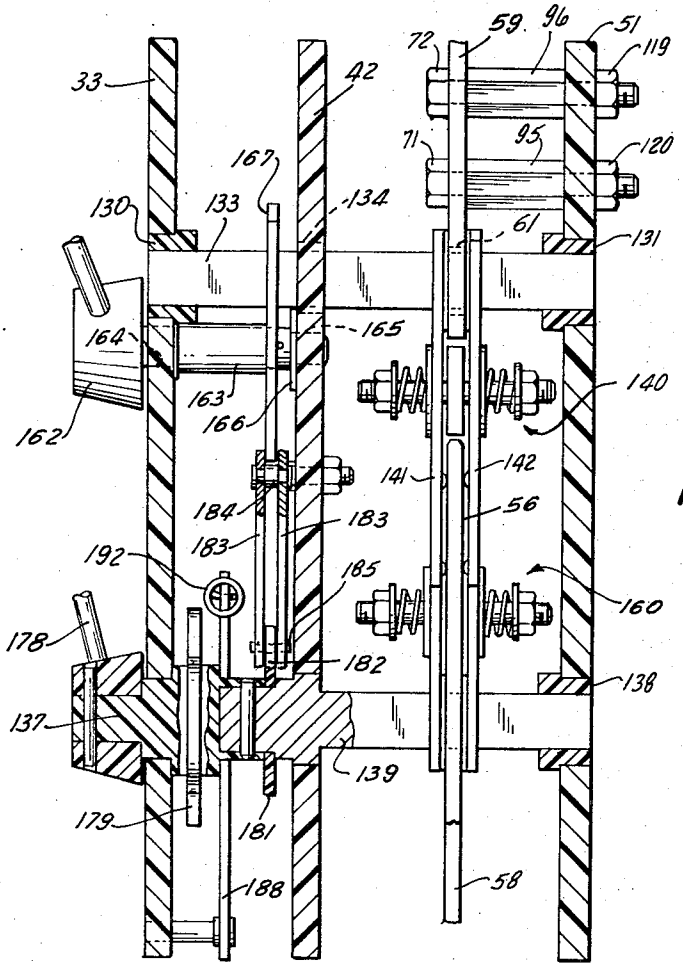


FIG. 4

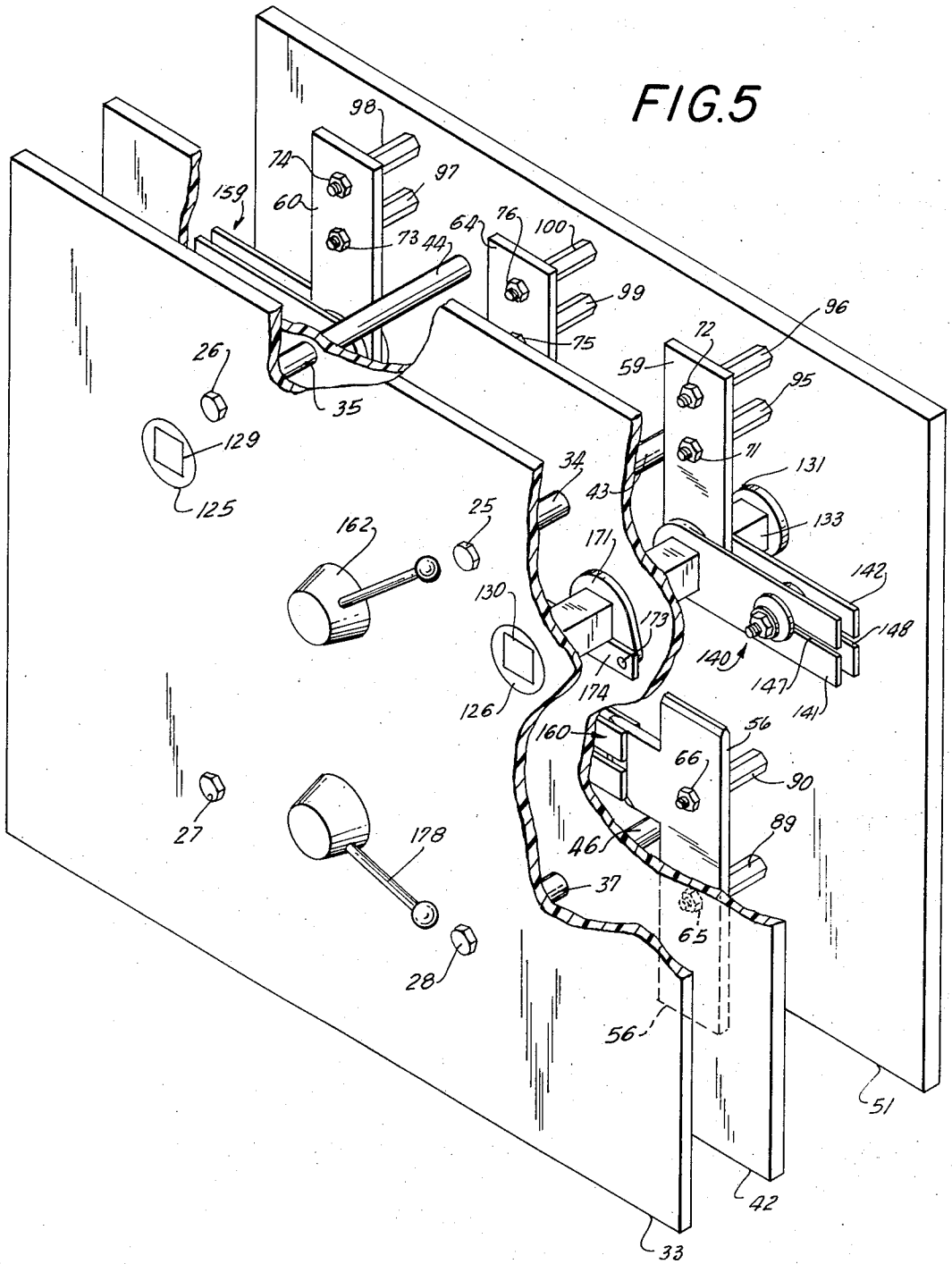
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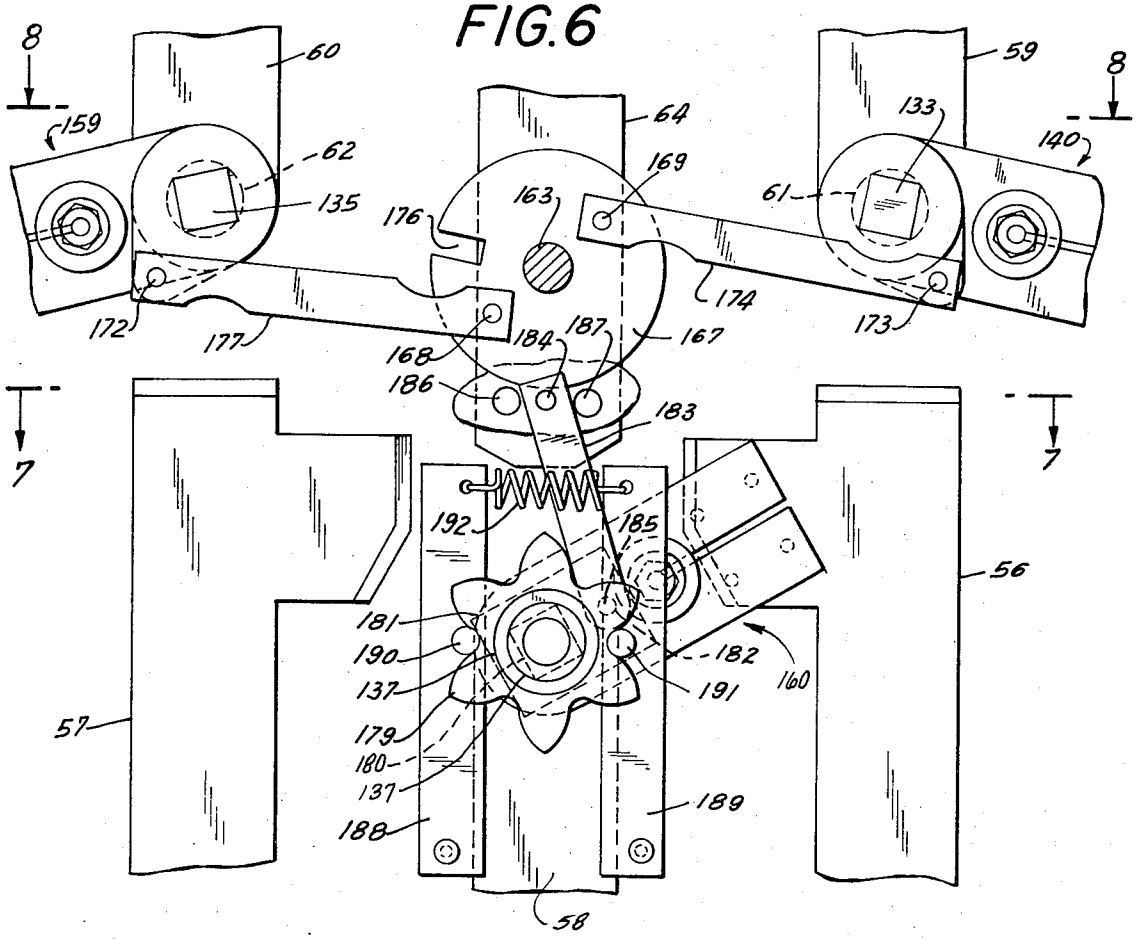
FIG.5



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FIG.6



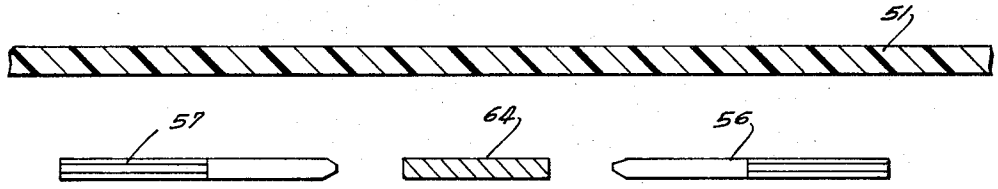
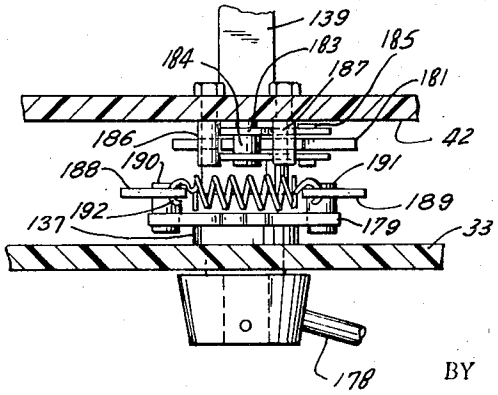


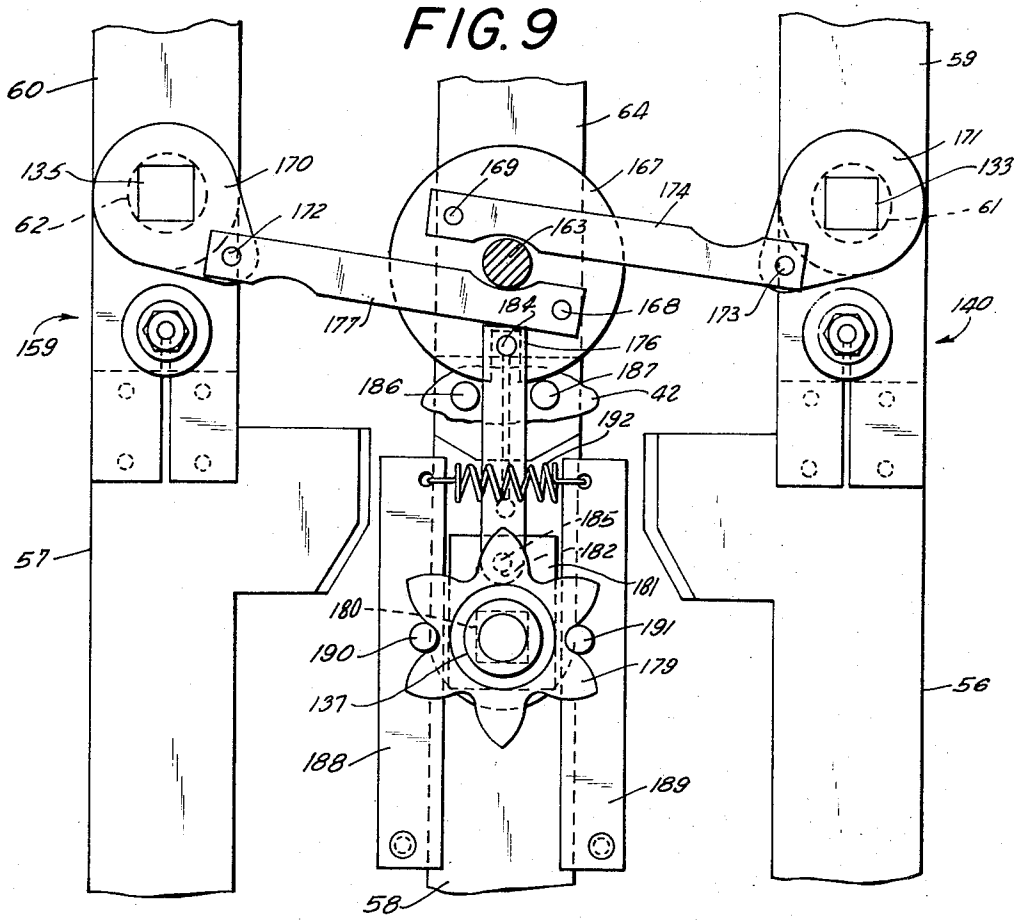
FIG.7



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FIG. 9



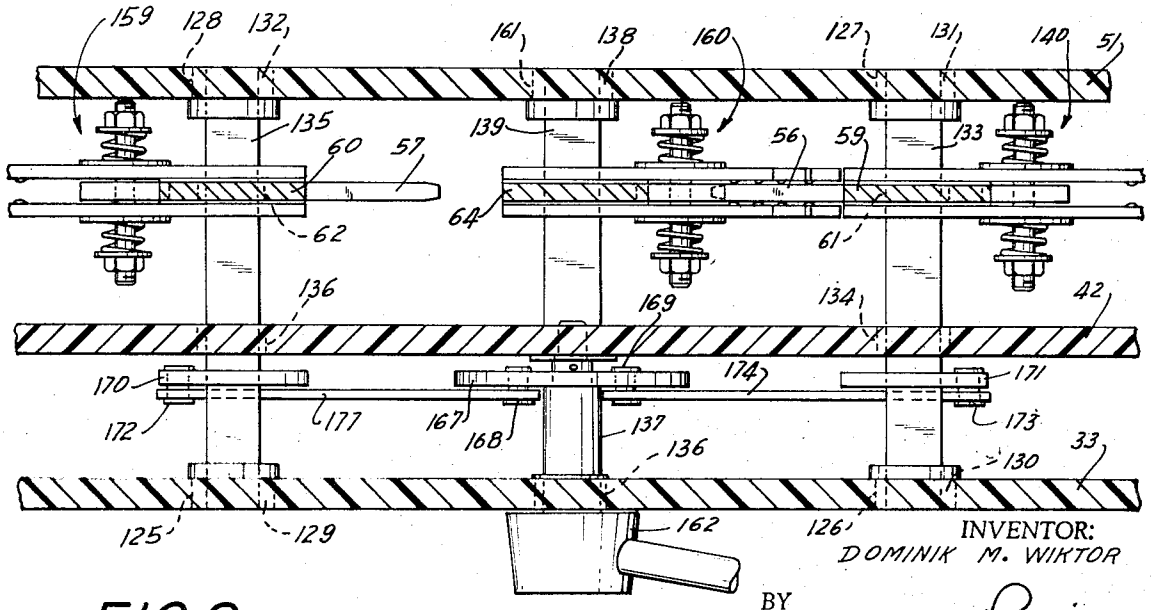


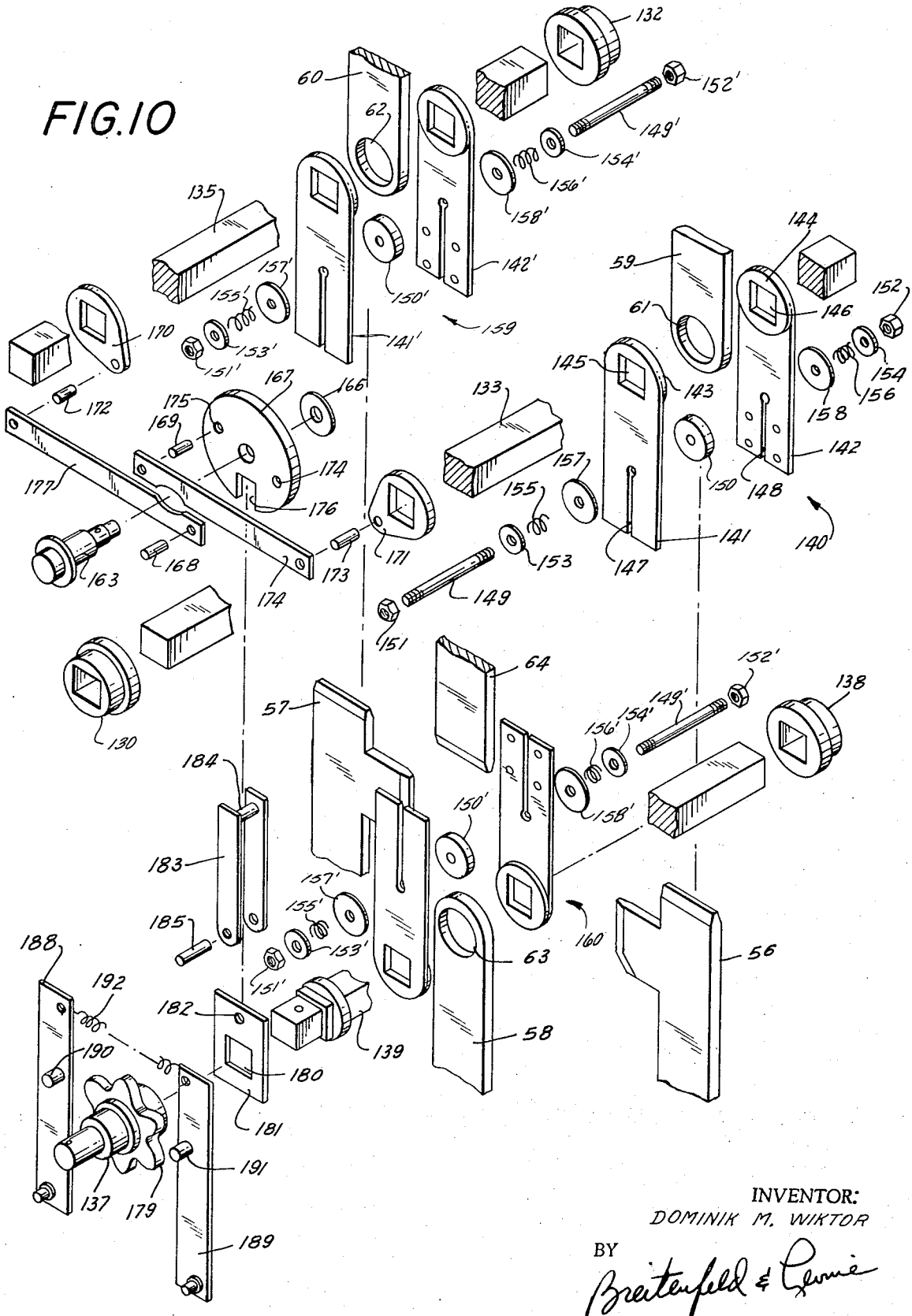
FIG. 8

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FIG.10



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BYPASS AND ISOLATION SWITCH

Modern electrical systems embody transfer switches which are used to connect a primary source or an emergency source of power to a load. Maintainance work must be done on transfer switches from time-to-time, and occasionally they must be repaired or even replaced. Heretofore, to repair or replace transfer switches without interrupting the delivery of power to a load, it has been customary to use an isolation switch and a separate bypass switch in conjunction with each transfer switch.

Such an arrangement often necessitates long cable runs between the bypass switch and the isolating switches, as well as intricate electro-mechanical interlocking schemes to insure that the transfer switch is not isolated before being bypassed.

It is an object of the invention to overcome these problems by providing a unitary bypass and isolation switch, thereby eliminating the need for interconnecting cables and complex mechanical interconnections between the bypass and isolation switch.

It is another object of the invention to provide an interlocked bypass and isolation switch to obviate inadvertent power loss to system loads.

It is a further object of the invention to provide a combined bypass and isolation switch which is compact, and includes a minimum of parts for ease of manufacture and maintainance.

It is still another object of the invention to provide a bypass and isolation switch which performs with complete safety to the system and operating personnel.

The above-mentioned and other objects of this invention will become apparent by reference to the following description, in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic view of a switching arrangement, according to the prior art, wherein a load is connected to a primary source via a transfer switch and separate isolation and bypass switches;

FIG. 2 is a similar view wherein a load is connected to an emergency source of power via a transfer switch and separate isolation and bypass switches;

FIG. 3 is a similar view showing an isolated and bypassed transfer switch;

FIG. 4 is a vertical cross sectional view of an isolation and bypass switch in the bypass condition according to the invention;

FIG. 5 is a perspective view of an isolation and bypass switch according to the invention;

FIG. 6 shows a front view of an isolation and bypass switch, the supporting plates having been omitted for clarity, and the switch being in a condition wherein it bypasses and isolates the transfer switch;

FIG. 7 is a horizontal cross sectional view of the isolation and bypass switch, taken along line 7—7 of FIG. 6;

FIG. 8 is a horizontal cross sectional view of an isolation and bypass switch taken along line 8—8 of FIG. 6;

FIG. 9 is a view similar to FIG. 6, but the switch being in a condition wherein the load is connected to a power source via the transfer switch; and

FIG. 10 is a fragmentary, exploded, perspective of an isolation and bypass switch according to the invention.

A typical conventional switching arrangement is shown in FIG. 1 wherein a transfer switch 10 includes

an arm 12 connected to terminal 13, and a pair of terminals 14 and 15. An isolation switch 16 includes a three pole, single throw switch, having arms 18, and a bypass switch 19 includes an arm 20 connected to a terminal 21 and three terminals 22, 23, and 24. Normally, the isolation switch 16 is closed, arm 12 of transfer switch 10 is in contact with terminal 15, arm 20 is in contact with terminal 23, terminal 24 is connected in series with terminal 15, and terminal 13 is connected in series to terminal 21 via arm 20 so that power can flow from a primary source (not shown) connected to terminal 24 to a load (not shown) connected to terminal 21.

Referring to FIG. 2, if the primary source is deficient the arm 12 of transfer switch 10 automatically disengages terminal 15 and engages terminal 14. Power is thereafter delivered to the load from an auxiliary source of power which is connected to terminal 22 and voltage is supplied to terminal 14 via switch 18.

Referring to FIG. 3, when it becomes necessary to repair the transfer switch 10, the arm 20 of the bypass switch 19 is engaged with terminal 24, if power is being supplied by the primary source, or terminal 22, if power is being supplied by the auxiliary source, and the isolation switch 16 is opened thereby decoupling the transfer switch 10 from power sources while still supplying power to the load.

In the conventional arrangement described above, the transfer switch 10, isolation switch 16, and bypass switch 19 are connected by cables. Moreover, a serviceman can inadvertently open the isolation switch 17 before arm 20 of the bypass switch 19 has been shifted into engagement with terminal 22 or 24, thereby disconnecting power from the load.

The bypass and isolation switch chosen to illustrate the present invention overcomes this problem, and for convenience, is illustrated and described below in connection with single phase operation. The switch includes a framework comprising three spaced apart, parallel plates 33, 42, and 51. The plates are held together by four elongated bolts 25, 26, 27, and 28 passing, respectively, through holes (not shown) in front plate 33, holes (not shown) in intermediate plate 42, and holes (not shown) in back plate 51. The bolts are held in place by nuts (not shown). Tubular spacers 34, 35, 36, and 37 surround the bolts in the region between front plate 33 and intermediate plate 42, and spacers 43, 44, 45, and 46 surround the bolts in the region between intermediate plate 42 and back plate 51.

As shown in FIGS. 4–10, in the space between the intermediate plate 42 and the back plate 51, there are located two stationary bus conductors 56 and 57 each having a beveled end and a perpendicular extension with a beveled end, the perpendicular extensions pointing towards each other. A stationary bus conductor 58 is located between bus conductors 56 and 57 and has a hole 63 (FIG. 10). Two bus conductors 59 and 60 are arranged above and aligned with conductors 56 and 57, respectively, these conductors having holes 61 and 62, respectively. A bus conductor 64 is located between bus conductors 59 and 60 in alignment with conductor 58. The bus conductors 56, 57, 58, 59, 60 and 64 all lie in a plane substantially parallel to the back plate 51 and are fastened thereto by screws 65 to 76 which pass through mounting holes in the conductors and through

holes in the back plate 51. Tubular spacers 89 to 100 surround bolts 65–76, respectively, and the bolts are held in place by nuts 113 to 124, respectively.

The front plate 33 has two holes 125 and 126, and the back plate 51 has two holes 127 and 128 which, respectively, accommodate top hat bearings 129, 130, 131, and 132. Bushings 130 and 131 are rigidly fastened to a square rod 133 which passes perpendicularly through a hole 134 in intermediate plate 42 and hole 61 in bus conductor 59. The bearings 129 and 132 are rigidly fastened to a square rod 135 which passes perpendicularly through a hole 136 in intermediate plate 43 and hole 62 in bus conductor 60. As a result, the square rods 133 and 135 are rotatable. In addition, the front plate 33 includes a hole 136 for supporting a bushing 137 having a drive shaft at one end and a square hole at the other. The square hole and a top hat bearing 138 which is retained by a hole 161 in back plate 51 rotatably support a square rod 139 which passes rotatably through hole 140 in the intermediary plate 42 and hole 63 in bus conductor 58.

Referring to FIGS. 4, 5, 6, 8, 9, and 10, square rod 133 supports a movable contact assembly 140. The contact assembly includes two contacts 141 and 142, each having a boss 143, and 144, and a square hole 145 and 146, on one end, and a slot 147 and 148 at the other end. Contact 141 is supported by the square rod 133 on one side of bus conductor 59 and contact 142 is supported by the square rod on the other side of the bus conductor 59. Further, a pin 149 supported in circular openings at the inner ends of slots 147, 148 supports a washer 150 between the contacts 141 and 142. Adjacent each of its ends, pin 149 carries a nut 151 and 152, a washer 153 and 154, a coil spring 155 and 156, and a washer 157 and 158 combination which urges the conductors 141 and 142 towards each other. The engagement between the square rod 133 and holes 145 and 146 of contacts 141 and 142 allows the contact assembly to be rotated with rod 133, and the coil springs 155 and 156 insure that a good electrical contact is maintained between the contact assembly and bus conductors 59 and 56. Contact assemblies 159 and 160, similar to the last described and shown in FIG. 10 with primed references, are respectively supported in electrical contact with bus conductors 60 and 58 by square rods 125 and 139. When appropriately rotated, contact assembly 140 may be used to electrically connect bus conductor 59 to bus conductor 56; contact assembly 159 may be used to electrically connect bus conductors 60 and 57; and a contact assembly 160 may be used to electrically connect bus conductor 58 to any of bus conductor 56, bus conductor 57, or bus conductor 54.

Referring to FIGS. 4, 6, 8, 9 and 10, a control handle 162 is coupled to a shaft 163 tapered rearwardly in stepwise fashion. Shaft 163 is supported by holes 164 and 165 in the front and intermediate plates 33 and 42, respectively, and is axially retained therein by a washer 166 located between intermediate plate 42 and a step on the shaft. Fixed to shaft 163 is a circular disk 167 having a radial slot 176 extending from its periphery, and two diametrically opposite holes 174 and 175 which, respectively, support pins 168 and 169. Between the front plate 33 and intermediate plate 42 square rods 133 and 135 carry eccentric discs 170 and 171, respectively. Each disc 170 and 171 supports a pin 172 and 173. A link 174 pivotally connects pin 173 to pin 169 and a link 177 pivotally connects pin 172 to pin 168, so that a rotation of control handle 162 rotates shaft 163, circular disc 167, and square rods 133 and 135 via discs 170 and 171, respectively, in opposite directions with respect to each other. As a result, contact assemblies 140 and 159 simultaneously engage bus conductors 56 and 57, respectively, as shown in FIG. 9, or are disengaged from bus conductors 56 and 57, as shown in FIG. 6.

Referring to FIGS. 4, 5, 6, 7, 9, and 10, a control handle 178 is connected to the shaft of bushing 137 as shown in FIG. 4. Bushing 137 carries a starwheel 179. In addition, the square rod 139, which engages the bushing 137, engages square hole 180 of a rectangular plate 181. The rectangular plate includes a hole 182 accommodating a pin 185. A pair of links 183 which are secured in parallel relation by a rod 184 are pivotally connected to plate 181 by pin 185.

As the shaft 139 is rotated, by rotation of handle 178, the motion of the pair of links 183 is guided by a pair of pins 186 and 187 which are secured to the intermediate plate 42 below circular disc 167. If the slot 176 of the circular disc 167 is facing the space between the pair of pins 186 and 187, and the parts are as shown in FIG. 6, rotation of shaft 139 in a counterclockwise direction causes the rod 184 to be guided into the slot (see FIG. 9). At this point, rotation of circular disc 167 is restrained until the rod 184 is moved out of the slot 176 by a further rotation of shaft 139. If the slot 176 of the circular disc does not face the space between the pair of pins 186 and 187 (see FIG. 6), the rod 184 contacts the perimeter of the circular disc 167 and prevents rotation of the square rod 139.

When the slot 176 faces the space between pins 186 and 187, contact assemblies 140 and 159 engage bus conductors 56 and 57, respectively, and the rod 184 may enter the slot 176 thereby permitting contact assembly 160 to engage bus conductor 64 (as shown in FIG. 9). The parts are therefore in a position corresponding to that shown in FIGS. 1 and 2, and the transfer switch may connect the load to either the normal power source or an emergency power source. The engagement between contact assemblies 140 and 159 and bus conductors 56 and 57 is locked by the restraining action of rod 184 in slot 176 and the pins 186 and 187 on the links 183 and rod 184.

The paragraph immediately above describes the normal position for a bypass and isolation switch, according to the invention, wherein the isolation contacts, i.e., contact assemblies 140 and 159, are locked in place until a bypass connection has been made to insure continuity of power to a load. To achieve the bypass function, contact assembly 160 is rotated to engage conductor 56 (as shown in FIG. 6) or 57, thereby withdrawing the rod 184 from the slot 176 and enabling the circular disc 167 to rotate contact assemblies 140 and 159 out of engagement with bus conductors 56 and 57. As shown in FIG. 6, the parts are now in a position corresponding to that shown in FIG. 3, and the transfer switch is isolated from the load and the power sources, so that it can safely be repaired or replaced. The load is now connected directly to the normal source via bus conductor 58, contact assembly 160, and bus conductor 56. If contact assembly 160 has been swung into en-

gagement with bus conductor **57**, the load would be connected to the emergency source, The rotation of circular disc **167** to the position of FIG. **6** prevents rotation of contact assembly **160**, due to engagement of rod **184** with the periphery of the disc. Hence, contact assembly **160** cannot be moved out of engagement with bus conductor **56** (or **57**) until contact assemblies **140** and **159** have been brought back into engagement with bus conductors **56** and **57**, respectively. Consequently, continuity of power to the load is assured.

Referring to FIGS. **4**, **6**, **7**, **9**, and **10**, to prevent accidental rotation of shaft **139** and to insure full engagement of contact assembly **160** with the bus conductors, there is pivotally mounted on the back of the front plate **33**, on each side of the starwheel **179**, members **188** and **189** having, respectively, pins **190** and **191**. A coil spring **192** connected at each end to one of the members **188** and **189** urges the pins **190** and **191** into contact with the periphery of the starwheel **179**. Thus, to turn the control handle **178**, and consequently, the starwheel **179** and square rod **139**, a force sufficient to stretch the coil spring **192** is required. If, when the control handle is released, the pins are on either side of a crest on the starwheel **179**, the tension in the coil spring **192** will urge the pins **190** and **191** toward each other thereby causing the starwheel **179** to rotate until the pins **190** and **191** rest in the valleys of the starwheel. As a result, the square rod **139** and contact assembly **160** will be stable in positions determined by the valleys of the starwheel **179**. The proper alignment of the starwheel **179** with the square rod **139** will insure that stability is achieved when the contact assembly **160** is in full engagement with either bus conductors **56**, **57**, or **64**.

The preferred embodiment described above is intended for use with a single phase transfer switch. However, a multiphase bypass and isolation switch may be provided, according to the invention, for a multi-phase transfer switch. To provide such a switch, it is only necessary to serially couple plates to back plate **51**; extend square rods **133**, **139**, **135** to the last plate in the series; and connect to the square rods **133**, **139**, **135** and the additional plates conductors such as described herein with regard to the space between intermediate plate **42** and back plate **51**.

It is to be understood that the description herein of a preferred embodiment according to the invention is set forth as an example thereof and is not to be construed or interpreted as a limitation of the claims which follow and define the invention.

What is claimed is:

1. A bypass and isolation switch, comprising:

a. a stationary conductor for connection to a source of power,

b. a stationary conductor for connection to a load,

c. two stationary conductors for connection to a transfer switch,

d. movable contact means for connecting or disconnecting said conductor (a) and one of said conductors (c), whereby the transfer switch may be connected to or isolated from the power source, and

e. movable contact means for alternatively connecting said conductor (b) to said conductor (a), so as to bypass the transfer switch, or for connecting said conductor (b) to the other of said conductors (c), so as to complete a circuit from the transfer switch to the load.

2. A bypass and isolation switch, as defined in claim **1**, including means for preventing movement of said contact means (e) which will cause disconnection of said conductors (a) and (b), unless said contact means (d) is positioned to connect said conductor (a) to one of said conductors (c).

3. A bypass and isolation switch, as defined in claim **1**, including means for preventing movement of said contact means (d) for disconnecting said conductor (a) and its respective conductor (c) thereby causing isolation of the transfer switch, unless said contact means (e) is connecting said conductors (a) and (b).

4. A bypass and isolation switch, as defined in claim **3**, wherein said means for preventing movement of said contact means (d) includes a disc having a slot; a first link coupling the disk to contact means (d); and means for engaging the slot to prevent rotation of the disc when contact means (e) is connecting conductors (b) and the other of said conductors (c).

5. A bypass and isolation switch, as defined in claim **4**, wherein said means for engaging the slot include: a second link; means for guiding the second link into the slot; and means for driving the second link, coupled to said contact means (e).

6. A bypass and isolation switch as defined in claim **5** including means for preventing movement of said contact means (e) which will cause disconnection of said conductors (a) and (b), unless said contact means (d) is positioned to connect said conductor (a) to one of said conductors (c).

7. A bypass and isolation switch, as defined in claim **6** wherein said means for preventing movement of said contact means (e) includes the disc used for preventing movement of said contact means (d).

8. A bypass and isolation switch, as defined in claim **6**, including a starwheel coupled to contact means (e); and means for driving the starwheel into predetermined positions, thereby causing contact means (e) to engage stationary conductor (a) or the other of said conductor (c).

9. A bypass and isolation switch, comprising:

a. a stationary conductor for connection to a source of power,

b. a stationary conductor for connection to an auxiliary source of power,

c. a stationary conductor for connection to a load

d. first and second stationary conductors for connection to a transfer switch,

e. a third stationary conductor for connection to a transfer switch,

f. movable contact means for connecting or disconnecting conductors (a) and (b) respectively with first and second conductors (d), whereby the transfer switch may be connected to or isolated from the main and auxiliary power sources, and

g. movable contact means for connecting said conductor (c) to either said conductor (a) or said conductor (b), so as to bypass the transfer switch, or for connecting said conductor (c) to conductor (e), so as to complete a circuit from the transfer switch to the load.

10. A bypass and isolation switch, as defined in claim **9**, including means for preventing movement of said

contact means (f) for disconnecting conductors (a) and (b) respectively from the first and second conductors thereby causing isolation of the transfer switch, unless said contact means (g) is connecting conductor (c) to either said conductor (a) or said conductor (b).

11. A bypass and isolation switch, as defined in claim 10, including means for preventing movement of said contact means (g) which will cause disconnection of conductor (c) from either said conductor (a) or said conductor (b) unless said contact means (f) is positioned to connect conductors (a) and (b) respectively to said first and second conductors (d).

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,697,709 Dated November 28, 1972

Inventor(s) Dominik M. Wiktor

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

First page, left column, line 2, change "Witkor" to ---Wiktor---.

Signed and sealed this 1st day of May 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334