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Ege

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[54] **SAFETY DISCONNECT SWITCH**

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[52] **U.S. Cl.** ..... **200/4,** 200/11 EA, 200/63, 200/153 LB

[51] **Int. Cl.** **H01h 19/58**

[58] **Field of Search** ..... 200/4, 67 PK, 153 LB, 200/63–64, 65, 11 EA

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Primary Examiner—David Smith, Jr.
Attorney—Joseph P. O'Halloran

[57] **ABSTRACT**

A safety override disconnect switch particularly adapted for emergency use in the main electrical power supply of heavy equipment. The switch features an operator controlled axially fixed rotor having cam means for axially driving an axially movable contact-carrying element to close the switch, and heavy biasing means for strongly biasing the contacts away from the circuit connectors.

In a preferred embodiment a backup cam system becomes operational should the contact-carrying axially movable element remain stuck to circuit connectors during reverse rotation of the operator controlled rotor.

10 Claims, 8 Drawing Figures

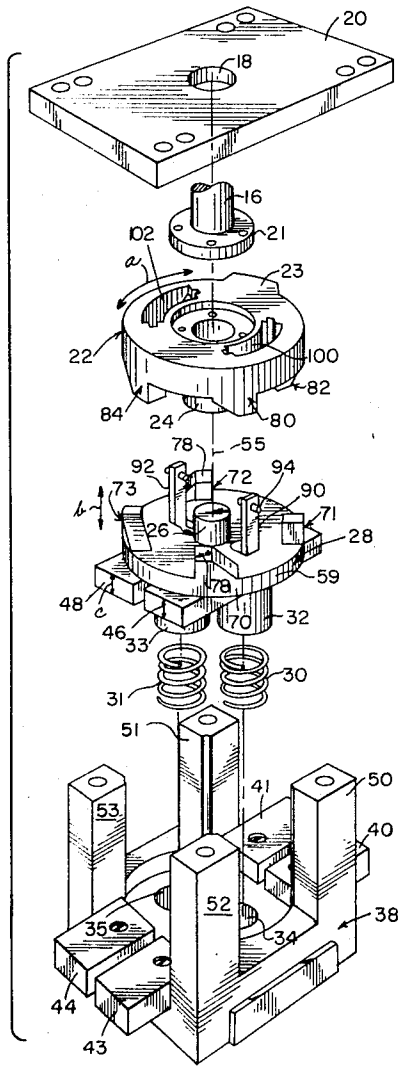
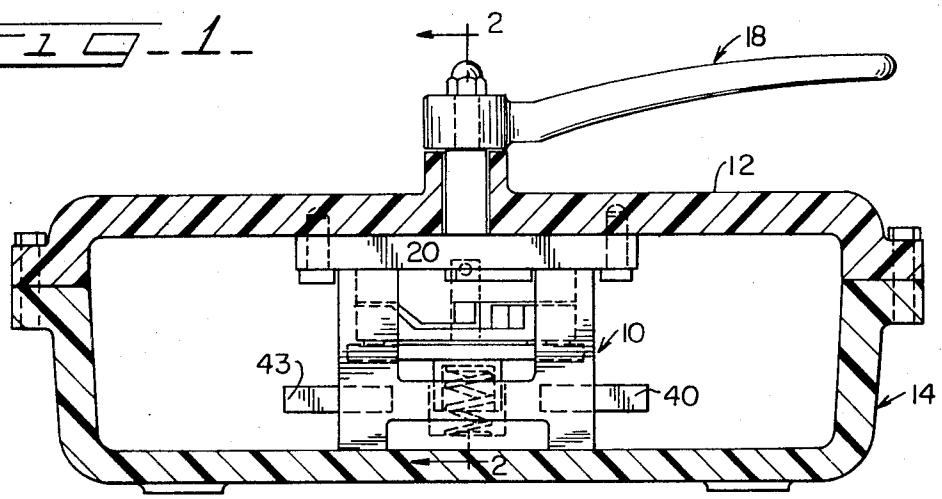


Fig. 1


2
18
12
20
10
43
40
14
2

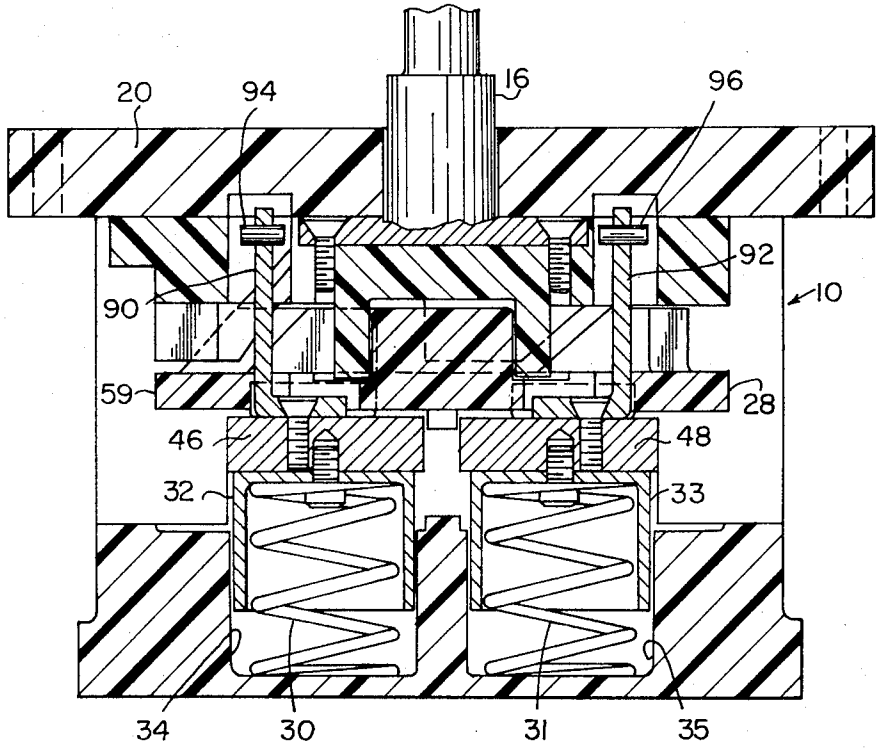

20
94
16
96
92
10
90
59
28
46
48
32
33
34
30
31
35

Fig. 2

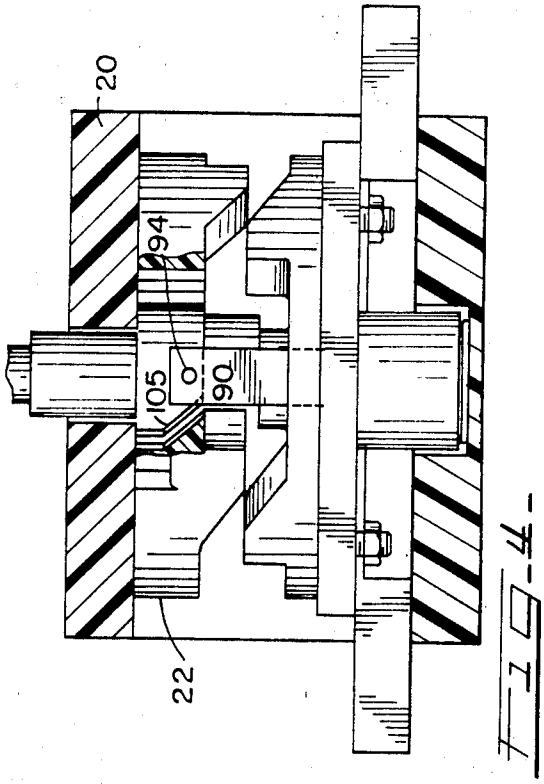


FIG-4

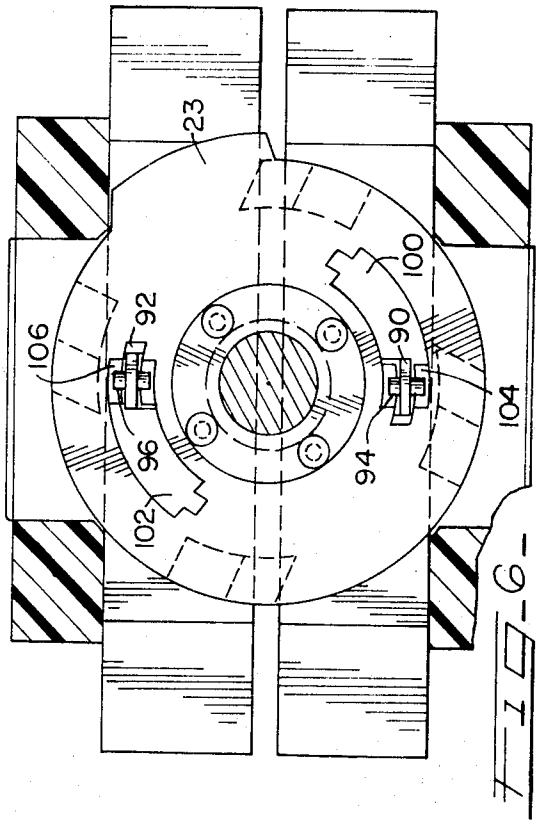


FIG-6

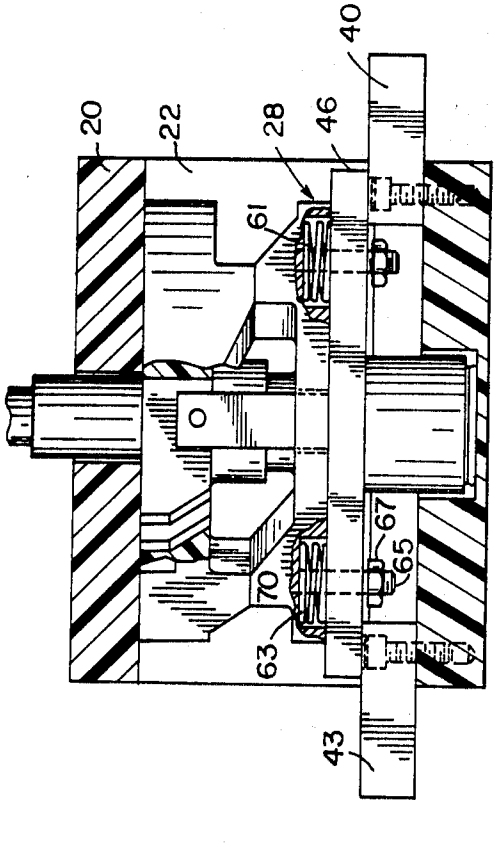


FIG-3

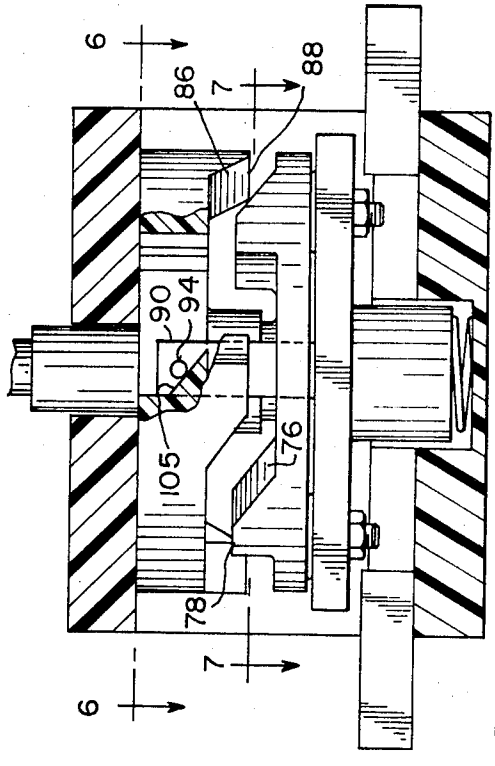
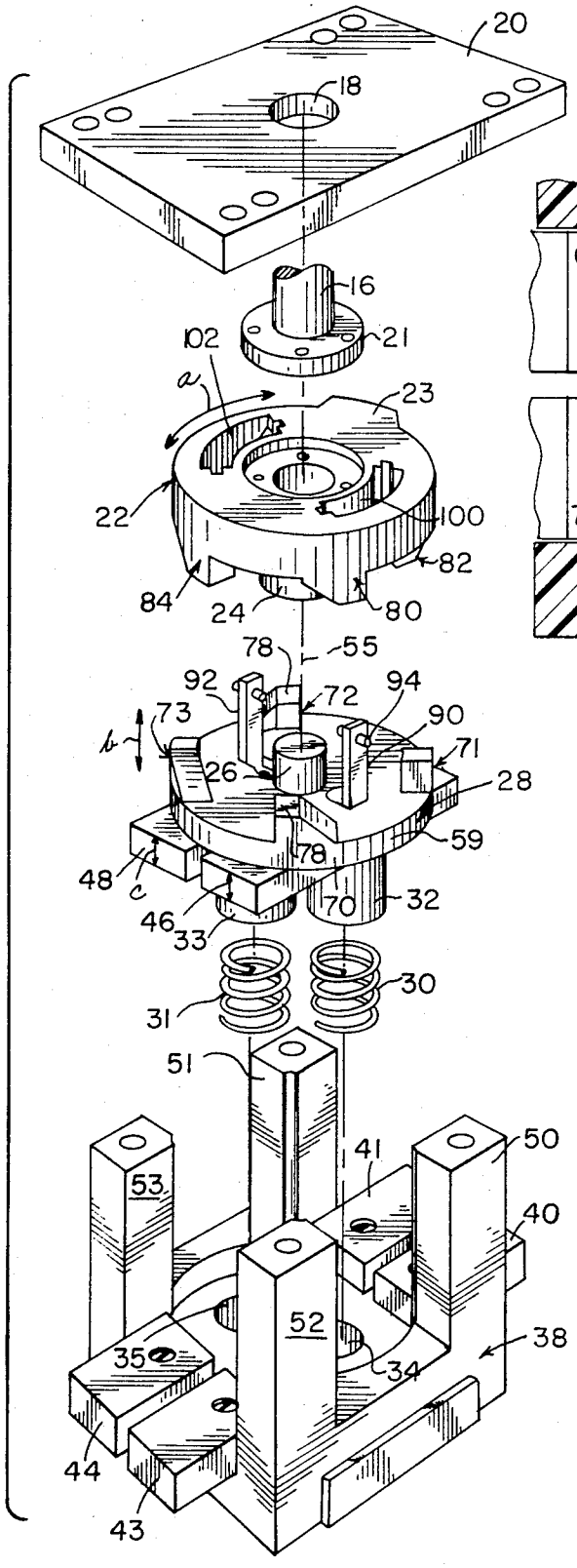


FIG-5

FIG-8-


20
18
16
21
102
a
23
22
100
82
84
24
80
78
55
92
72
94
73
b
90
71
26
28
59
48
c
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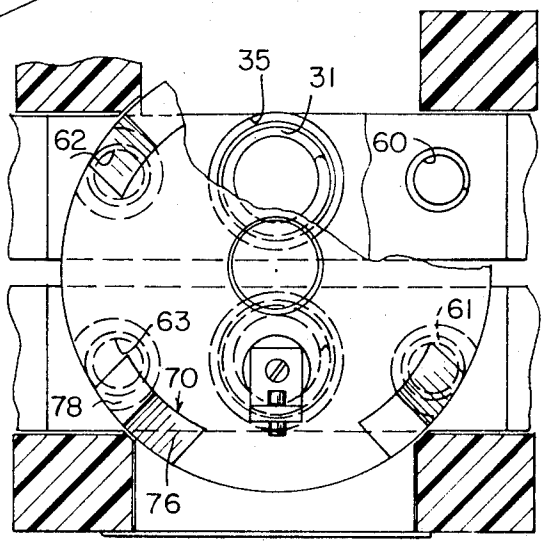

35
31
62
60
63
61
70
78
76

FIG-7-

SAFETY DISCONNECT SWITCH

This invention relates to a safety override disconnect switch which is particularly adapted for use in the main electrical power supply of heavy equipment such as mining machinery and vehicles and the like. These switches are designed for carrying high amperage, for example 400 amps. A preferred embodiment also provides a positive safety disconnecting action in the event the switch contacts stick together, and normal operation of the switch fails, for any reason.

It has been reported that there have been numerous accidents, some resulting in human fatality, which have resulted from the failure of disconnect switches, such as foot switches and other on-off switches presently existing for example, in mining equipment and the like. Because of the high amperage service in which these switches are normally used, there is at least a tendency for abutting contacts to stick to each other, in which event, normal operation of some switches would fail. That is, the electrical contacts would remain adhering to each other, thwarting the disconnection of the power.

It is an object of the present invention to provide a safety override disconnect switch which is particularly adapted for use as a main electrical power supply switch in a high amperage system for instantly shutting down the system in an emergency.

It is another object of the present invention to provide a safety disconnect switch which is particularly adapted for use in high amperage service, and which provides reliable disconnect operation.

It is another object of the present invention to provide a main power supply safety override disconnect switch which is adaptable for use in conjunction with explosion proof housings.

It is a further object of a preferred embodiment of the present invention to provide a positive disconnect backup operation, to positively disconnect the contacts, should the normal operation of the switch fail, for any reason.

These objects, and other objects which will be apparent hereinafter, are achieved in accordance with the present invention which is described hereinafter and with the aid of the accompanying drawings in which:

FIG. 1 is a side view of a preferred embodiment of the switch of the present invention in an enclosure which is shown in cross section;

FIG. 2 is an enlarged elevational cross-sectional view of the switch portion with the switch in the "open" position and taken along the line 2—2 in FIG. 1;

FIG. 3 is an enlarged side view of the switch with the contacts in the "closed" position;

FIG. 4 is an enlarged side view showing the relative position of the operating elements in the event the electrical contact stick, during normal disconnect operation;

FIG. 5 is an enlarged side view illustrating the positive lifting action which forces the contacts to separate;

FIG. 6 is a top cross-sectional view taken approximately along the line 6—5 1n FIG. 5;

FIG. 7 is a fragmentary cross-sectional view taken approximately along the line 7—7 in FIG. 5; and

FIG. 8 is an exploded perspective view showing the various elements of the switch of the presentinvention.

Referring to FIG. 1 a preferred safety switch of the present invention is generally indicated by the numeral

10. Switch 10 is shown mounted on a face plate 12 of a housing 14. Housing 14 is preferably of the explosion-proof type, and many constructions of explosion-proof housings are presently available commercially. Consequently the details of the expolsion-proof construction features can be conventional and will not be discussed further hereinafter, since they are not part of the present invention.

In order to simplify the further description of the switch of the present invention, various structural relationships will be described using directional terms such as above, below, etc., and these terms are intended to be applicable only when the switch is positioned so that rotor element 22 is above axially movable element 28, and the axis of rotation of rotor 22 is substantially vertical as illustrated in the drawings in FIGS. 1–5 and 8. Thus, as used herein, the terms "above" and "below", "horizontal", "upwardly sloped", and the like are not intended to be restrictive except in this context, and are not to be construed as implying that the switch is operational only when in any particular position. Quite to the contrary, the switch of the present invention is operational in any position.

The switch 10 is operated by means of shaft 16 which is controlled by handle 18.

The overall construction and operation of the switch 10 can be summarized by reference to FIG. 8 which shows only the structural elements actually associated with switch 10. In the following discussion larger and more basic structural elements and relationships will be discussed in sequences progressing from the top of FIG. 8 toward the bottom of FIG. 8, and thereafter the details of the respective elements and relationships will be discussed in sequence progressing from the bottom of FIG. 8, towards the top of FIG. 8. FIGS. 3, 4, 5 and 6 are provided to illustrate the operation of a preferred embodiment. Referring to FIG. 8, control shaft 16 passes through opening 18 in top plate 20 and a flange 21 at the inner end of shaft 16, is secured to a cam-carrying rotor element 22. Flange segment 23 serves as a rotation stop to limit the extent of rotation of rotor 22. A centered, elongated collar 24 which is secured to and extends downwardly from rotor 22, mates over centered post 26 on axially movable contact-carrying and cam follower carrying driven member 28. The arrow, *a*, shown in FIG. 8 adjacent rotor 22 indicates that the operational movement of element 22 during switching pivotally about the central axis, and the arrow, *b*, adjacent contact-carrying element 28 indicates that element moves in an axial direction during switching.

Member 28 is biased axially towards top plate 20 by heavy coil springs 30, 31 which reside in part inside respective collars 32, 33 which, in turn, reside in part in respective recesses 34, 35 in base element generally indicated by the numeral 38. Base element 38 carries a pair of fixed connectors 40, 41 on a power source side of the switch 10, and another pair of fixed connectors 43, 44, respectively, on an equipment side of switch 10. Contact bars 46, 48 are carried by axially movable element 28 and operate to connect and disconnect the power supply circuit. Contact bar 46 is sized to bridge between and butt against respective portions of connectors 40, 43 and second contact 48 is sized to bridge between and butt against respective portions of connectors 41, 44.

In the assembled condition, illustrated in FIGS. 1–7 herein, axially movable element 28 resides between

posts 50, 51, 52, 53 which extend axially upwardly, from base element 38 as seen in FIGS. 1 and 8. Just as connectors 40, 41 reside between posts 50, 51, and connectors 43, 44 reside between posts 52, 53, respectively, contact bars 46, 48 extend between these posts also, and this helps prevent substantial rotation of member 28 about the central axis indicated by the broken line 55 in FIG. 8. Also, as indicated above, sleeves, or cups 32, 33 reside at least partially within and are axially movable within circular recesses 34, 35 and this relationship also aids in preventing substantial rotation of axially movable member 28 around the central axis 55. However, it is to be understood that due to normal manufacturing tolerances, some clearance between these structural elements is necessary, and at least a small amount of pivoting of element 28 around the central axis is possible and, indeed is encountered within the limits of these clearances as a result of any angular forces exerted on axially movable element 28. The greatest apparent movement of element 28 which is normally encountered in the operation of this switch 10 is its axial movement and as indicated above this element is biased away from connectors 40, 41, 43, 44 by primary heavy springs 30, 31.

Bridging contact bars 46, 48 are also biased away from the central support portion 59 of axially movable element 28 by secondary springs 60, 61, 62, 63 which are shown in FIG. 7. Thus bars 46, 48 are fixed with respect to element 28 in regard to movement of these elements about axis 55, but are movable within small limits with respect to element 28 in regard to axial movement, as indicated by the small arrows, *c*, in FIG. 8.

Referring to FIG. 2, support portion 59 of axially movable element 28 in spaced apart from bridging contacts 46, 48 because of the fact that the secondary springs 60, 61, 62, 63 bias these elements apart. During movement of element 28 to the "closed contact position" illustrated in FIG. 3, contact elements 46, 48 come to bear against connectors 40, 43, and 41, 44, respectively, and continued axially downward movement of axially movable member 28 causes further compression of the secondary springs 60, 61, 62, 63 as indicated in FIG. 3 thus assuring continuous and very firm biasing of the bridge contacts 46, 48 against the respective connectors. Each contact 46, 48 is secured to support portion 59 of axially movable member 28 by means of threaded studs 65 and nuts 67. The positioning of nuts 67 on studs 65 will determine the limit of the extent of axial movement which contacts 46, 48 can undergo with respect to support portion 59. In FIG. 3, contact bar 46, is shown tightly compressed against connectors 40 and 43, it is noted that a small gap exists between the top of nuts 67 and the underface of contact 46.

Another advantage of this structural relationship is the fact that axially movable element 28 is already in motion away from base 38 when nuts 67 strike contacts 46–48. This striking of the contacts from below, and the inertia of moving element 28 helps to dislodge contacts 46–48 from contact with their respective connectors in normal operation.

Thus each pair of studs 65 and nuts 67 which is associated with the respective contact bars 46, 48 permit limited axial movement of bars 46, 48, respectively, but prevent rotation of these bars with respect to support portion 59 of axially movable element 28.

The upper surface of axially movable member 28 includes a plurality of elevated cam follower structures, 70, 71, 72, 73 each of which includes an inclined surface portion 76 and a horizontal surface portion 78.

Extending downwardly from rotor 22 are a plurality of cam structures generally indicated by the numerals 80, 81, 82, 83, respectively, each of which have an inclined portion 86 and a horizontally disposed bottom portion 88 (See FIG. 5). Cam structures 80, 83 are located on rotor 22 to reside between respective cam follower structures 70–73, when the switch is in the "open" position (See FIG. 1), and respective top portions 76 of cam follower structures 70–73 and respective bottom portions 88 of cam structures 80–83 are positioned so that these horizontal surface portions are axially aligned and butting when the switch is in the locked "closed" configuration (See FIG. 3).

Structures 70–73 and 80–83 are referred to herein as the primary cam system, and this primary cam system operates, upon rotation of rotor 22 about axis 55, to drive the axially movable cam follower element 28 in an axial direction, either away from rotor 22 to close the switch under the driving force provided by rotation of handle 18, in which case primary springs 30, 31 are compressed, or upon rotation of handle 18 in an opposite direction, in which case the driving force causing axial movement of element 28 towards rotor 22 is provided by springs 30, 31 in normal operation.

In a preferred embodiment of the present invention a second cam system is utilized as a backup system to positively separate contact bars 46, 48 from respective connectors in the event contact sticking occurs, and the bias of springs 30, 31 is insufficient to cause separation.

Axially extending arms 90, 92 are directly secured to contact bars 46, 48, respectively (See FIG. 2). Adjacent the axially upward extreme of arms 90, 92 are cam follower pins 94, 96, respectively. Arms 90, 92 are of sufficient length and are so located as to extend upwardly through rotor 22 and reside within arcuate slots 100, 102, respectively. Slots 100, 102 include upwardly inclined cam surfaces 104, 106, respectively. Slots 100, 102 include upwardly inclined cam surfaces 104, 106, respectively which are located at that end of the slots 100, 102 which are the trailing ends as rotor 22 rotates about axis 55 when rotor 22 is being rotated in the switch opening direction.

Arms 90, 92, pins 94, 96 and cam surfaces 105 provide what is referred to herein as a secondary cam system. Structural relationships and operation of the secondary cam system are further illustrated with the aid of FIGS. 3–6.

FIG. 3 shows the switch in normal "closed" configuration, and it is noted that the primary cam system is in the configuration in which respective horizontal surface 78, and 88 are butting. In the configuration shown in FIG. 3 the rotor 22 thus locks the axially movable element 28 in the switch closed configuration preventing the contact bars 46, 48 from moving axially away from the respective connectors. Moreover, in this configuration, the secondary spring system comprising springs 60, 61, 62, 63 continually urges the contact bars against respective connector elements, against and overcoming the biasing action of the respective primary springs 30, 31.

As the rotor element 22 is rotated in the direction indicated by arrow D in FIG. 4 inclined surface 76 of cam followers 70–73 would be normally urged axially against inclined portion 86 of cam structures 80–83.

FIG. 4 is provided for the purpose of illustrating the relative configuration in that unlikely, but dangerous circumstance in which conductors **46, 48** stick to the respective connectors **40, 43,** and **41, 44,** respectively even though rotor **22** has been moved to the unlock configuration. Without the backup system referred to above, rotor **22** would have no further control over the separation of the contacts **46, 48** from their respective connectors. It is under these circumstances that the secondary cam surfaces **104** approach and engage cam follower pins **94, 96** as illustrated in FIGS. **4, 5** and **6.** As the rotation of cam rotor **22** in the direction indicated by the arrow D in FIG. **4** leads to the configuration shown in FIG. **5** in which cam surfaces **105** bear against pins **94** causing arm **90** to be urged axially, and lifting the contact bars **96–98** as illustrated in FIG. **5.** This action is further illustrated in FIG. **6** in which it is more clearly shown that secondary cam surfaces **104–106** are slotted to permit arms **90, 92** to rotate spring cam follower pins **94, 96** against secondary cam surfaces **104, 106.** It is essential that means be provided to maintain rotor **28** in a fixed axial position, and in the illustrated embodiment (as shown in FIG. **1**) this is accomplished by securing rotor **22** close to plate **20** by securing handle **18** to shaft **16** close to housing **12** where rotor **22** is so positioned. This assures cooperative alignment of pins **94, 96** and secondary cam surfaces **104, 106,** when axially movable element **28** is in "stuck" position.

It is to be emphasized that the secondary cam system serves as a backup safety system, and that normally the biasing of contacts **46, 48** away from their respective connectors by springs **30, 31** is more than adequate to force separation and opening, to keep portions of the adjacent faces of the rotor **22** and cam-follower element **28** engaged. Biasing by secondary springs **60, 61, 62, 63** must be strong enough to overpower the bias of springs **30, 31,** when the switch is in closed position.

Another operational advantage flows from the particular switch structure of the present invention. This results in combined angular-axial vectors for separating stuck contacts. During normal closing of the switch, axially movable cam follower element **28** will initially be urged to rotate about central axis **55** because of the pressure of cam surfaces **86** against cam follower surfaces **76.** As indicated above, very little rotational movement of element **28** is permitted, but due to normal manufacturing clearance tolerances, some definite amount of angular rotation of element **28** around axis **55** is in fact possible, and is encountered. Thus contacts **46, 48** will tend to be rotated, against the urging of springs **30, 31,** in the clockwise direction, when viewed from the top, when rotor **22** is rotated in a clockwise direction. When contacts **46, 48** are initially seated against connectors **40, 43** and **41, 44,** respectively, the cam surfaces **86** and cam follower surfaces **76** will still be engaged, and cooperating thus causing continued forcing of the contacts **46, 48** against the respective conductors, along with compression of secondary springs **60, 61, 62, 63** until the horizontal surfaces **88, 78** slide across one another to the position shown in FIG. **3.** It is noted that the contacts **46, 48** will be at the extreme limit of the rotational movement permitted them in the clockwise direction when seating or switch closing contact occurs. In normal switch opening operation, contacts **46–48** will merely move axially from their seated position. In the event sticking occurs, however, and the rotor **22** is turned to the configuration shown in FIG. **4** so that secondary cam surfaces **104, 106** engage pins **94, 96,** respectively, several vectors are applied at ends **94, 96.** One vector urges arms **90, 92** to rotate about the central axis, and this in turn causes contacts **46, 48** to be urged to rotate about the central axis **55,** as well. The second vector is the axially directed vector which was referred to above causing straight line separation. It is our belief, based on observation, that this combined rotationally, and simultaneously axially directed urging of the contacts **46, 48** accounts in part for the highly effective and reliable backup separation which is provided by the secondary cam system in accordance with the present invention.

Thus an important feature of one aspect of the present invention involves the cooperation of cam elements on rotor **22** and axially movable elements **28** which constitutes means for positively and directly forcing the bridging contact apart from the fixed conductors, particularly by a cam system which applies both axial and rotational forces at the interface between the contacts and connectors.

Having received this disclosure of the invention, and a particularly preferred embodiment thereof, it will be apparent to those skilled in the art that many modifications and variations thereof can be made without departing from the spirit or scope of the invention. Specific disclosures and drawings are provided herein to illustrate a particular preferred embodiment, and are not to be construed as limiting the scope of the invention, which is defined in the claims appended hereto.

For example, rotor **22** and axially movable element support **28** could be used as shown in FIG. **8** with connectors **40, 41, 43, 44** being positioned above contacts **46, 48** instead of below, and being supported by elements depending from top plate **20** instead of by bottom framing member **38.** In such an embodiment the cams on the adjacent faces of rotor **22** and axially movable support element **28,** which are defined above as the primary cam system, serve as the positive cam means for separating contacts **46, 48** from connectors **40, 43** and **41, 44,** respectively, and a secondary backup cam system is unnecessary. In such an alternative configuration the cams on the adjacent faces serve the same function as the secondary cam system described and defined hereinbefore.

I claim:

1. A safety switch for opening and closing high amperage circuits comprising a frame; a rotor; means for rotating said rotor through a limited arc around its axis; means for securing said rotor against substantial axial movement; an axially movable support element adjacent said rotor; said rotor and said support element having mating alignment means for maintaining the alignment of said support element with said rotor, during the axial movement of said support element and rotation of said rotor, said alignment means comprising an annular element which is concentric with the axis of rotation of said rotor, and a mating element extending axially and closely fitting said annular element, cooperating cam means on adjacent faces of said rotor and said support element for moving said support element axially in a first direction in response to rotation of said rotor in a first rotational direction through said predetermined arc; movable switch contact means for completing said circuit carried on said support element; circuit connector means fixed with respect to said frame

and positioned for contacting said contact means at the limit of the axial motion of the switch contact means in said first axial direction, primary biasing means for biasing said switch contact means away from said connector means, and secondary biasing means for biasing said contact means toward said connector means.

2. A safety switch for opening and closing high amperage electrical circuits comprising a frame; a rotor; means for rotating said rotor through a limited arc around its axis; means for securing said rotor against substantial axial movement; an axially movable support element adjacent said rotor said rotor and said support element having mating alignment means for maintaining the alignment of said support element with said rotor, during the axial movement of said support element and rotation of said rotor, said alignment means comprising an annular element which is concentric with the axis of rotation of said rotor, and a mating element extending,axially and closely fitting said annular element; cam means on adjacent surfaces of said rotor and said support element for moving said support element axially in the direction away from said rotor as said rotor is rotated through a predetermined arc about said axis in a first direction; movable switch contact means for completing said circuit carried on said support element; circuit connector means fixed with respect to said frame and positioned for contacting said contact means as said support element is moved axially in the direction away from said rotor; primary biasing means for biasing said contact means away from said connectors, and secondary biasing means for biasing said contact means away from said support element and towards said connector means; said cam means including means for compressing said secondary biasing means after said contact means electrically connects with said connectors; and locking means for axially immobilizing said support element in the position in which said secondary biasing means is under compression, and said contact means is electrically connected with said conductors; and means for moving the electrically connected contact means away from said connectors when said rotor is rotated through a predetermined arc in a direction opposite said first direction.

3. The switch of claim 2 which includes secondary cam means for positively disengaging said contact means from said connector means comprising a first cam element fixed with respect to said contact, and extending axially in the direction toward said rotor, said first cam element including cam follower means, and in which said secondary cam system includes cam surfaces on said rotor which are adapted to engage said cam follower means as the rotor is rotated about said axis in a switch-opening direction.

4. A safety switch for opening and closing high amperage circuits comprising: an insulating rectangular base element, said base element having pairs of electrical connectors fixed at each side thereof, said base element including posts extending upwardly from each corner of said base element, said base element including a pair of recesses extending into said base element from the top thereof, each of said recesses being aligned with respective pairs of said connecting elements; coil spring biasing means residing in said recesses; an axially movable switch contact-carrying support element to which is secured a pair of cups adapted to mate over said coil spring biasing means, and mate within said recesses, said support element comprising a pair of contact means for bridging across and electrically connecting pairs of said respective connector means, said contact means extending between and being positioned closely adjacent to said posts, whereby rotation of said support elements around the rotors axis of rotation is substantially prevented; means for biasing said contact bars away from said support element; a rotor member, said support element and said rotor having alignment means for maintaining these elements in operating alignment with respect to each other; said alignment means comprising an annular element which is concentric with the axis of rotation of said rotor, and a mating element extending axially and closely fitting said annular element; said rotor and said support element having at the adjacent faces thereof cam means for driving said element in an axial direction away from said rotor, as the rotor is moved through a predetermined arc around its central axis, handle means for rotating said rotor, plate means adapted to be secured against the top of said posts maintaining compression of the respective biasing spring means.

5. The switch of claim 4 includes axially extending secondary cam follower means carried by said support element and substantially fixed with respect to said contact means, and secondary cam means on said rotor for engaging said secondary cam follower means as said rotor is rotated about its axis in a switch opening direction, said secondary cam follower means being positioned to engage said secondary cam surfaces in the event that said contacts stick to said connectors as said rotor is rotated in the switch opening direction to a position at which the contact carrier element would normally begin to move axially away from said connectors under the bias of said biasing means.

6. The switch of claim 4 wherein said secondary biasing means comprises a pair of coil springs situated to bear against each of said contacts on each side of each primary biasing means, and wherein said secondary cam means includes a plurality of arm means which extend axially away from said contact carrier element through slots in said rotor, and wherein said secondary cam follower means comprises cam follower members extending from either side of said arm means radially, and wherein secondary cam surface comprises an inclined plane situated at the walls of said slots which are trailing said slots as the rotor is moved in the switch opening direction, said inclined plane being sloped in the direction in which said cam follower means is urged in the direction away from said connectors.

7. A safety switch for opening and closing high amperage circuits comprising a frame; a rotor; means for rotating said rotor through a limited arc around its axis; means for securing said rotor against substantial axial movement; an axially movable support element adjacent said rotor; said rotor and said support element having mating alignment means for maintaining the alignment of said support element with said rotor, during the axial movement of said support element and rotation of said rotor, said aligment means comprising an annular element which is concentric with the axis of rotation of said rotor, and a mating element extending axially and closely fitting said annular element, cooperating cam means on said rotor and said support element for moving said support element axially in a first direction in response to rotation of said rotor through said predetermined arc; movable switch contact means for

completing said circuit carried on said support element; circuit connector means fixed with respect to said frame and positioned for contacting said contact means at the limit of the motion of said switch contact means in an axial direction opposite said first direction, and means for moving said contact means in said first direction to abutt said connector means.

8. A safety switch for opening and closing high amperage electrical circuits comprising a frame; a rotor; means for rotating said rotor through a limited arc around its axis; means for securing said rotor against substantial axial movement; an axially movable support element adjacent said rotor; cam means on adjacent surfaces of said rotor and said support element for moving said support element axially in the direction away from said rotor as said rotor is rotated through a predetermined arc about said axis in a first direction; movable switch contact means for completing said circuit responsive to the movement of said support element; circuit connector means fixed with respect to said frame and positioned for contacting said contact means as said support element is moved axially in the direction away from said rotor; primary biasing means for biasing said contact means away from said connectors, and secondary biasing means for biasing said contact means away from said support element and towards said connector means; said cam means including means for compressing said secondary biasing means after said contact means electrically connects with said connectors; and locking means for axially immobilizing said support element in the position in which said secondary biasing means is under compression, and said contact means is electrically connected with said conductors; means for moving the electrically connected contact means away from said connectors when said rotor is rotated through a predetermined arc in a direction opposite said first direction; secondary cam means for positively disengaging said contact means from said connector means comprising a first cam element fixed with respect to said contact, and extending axially in the direction toward said rotor, said first cam element including cam follower means, and in which said secondary cam system includes cam surfaces on said rotor which are adapted to engage said cam follower means as the rotor is rotated about said axis in a switch-opening direction.

9. A safety switch for opening and closing high amperage circuits comprising: an insulating rectangular base element, said base element having pairs of electrical connectors fixed at each side thereof, said base element including posts extending upwardly from each corner of said base element, said base element including a pair of recesses extending into said base element from the top thereof, each of said recesses being aligned with respective pairs of said connecting elements; coil spring biasing means residing in said recesses; an axially movable switch contact carrying support element to which is secured a pair of cups adapted to mate over said coil spring biasing means, and mate within said recesses, said support element comprising a pair of contact means for bridging across and electrically connecting pairs of said respective connector means; means for biasing said contact bars away from said support element; a rotor member, said support element and said rotor having means for maintaining these elements in operating alignment with respect to each other, said rotor and said support element having at the adjacent faces thereof cam means for driving said element in an axial direction away from said rotor, as the rotor is moved through a predetermined arc around its central axis, handle means for rotating said rotor, plate means adapted to be secured against the top of said posts maintaining compression of the respective biasing spring means; axially extending secondary cam follower means carried by said support element and substantially fixed with respect to said contact means, and a secondary cam means on said rotor for engaging said secondary cam follower means as said rotor is rotated about its axis in a switch opening direction, said secondary cam follower means being positioned to engage said secondary cam surfaces in the event that said contacts stick to said connectors as said rotor is rotated in the switch opening direction to a position at which the contact carrier element would normally begin to move axially away from said connectors under the bias of said biasing means.

10. A safety switch for opening and closing high amperage circuits comprising: an insulating rectangular base element, said base element having pairs of electrical connectors fixed at each side thereof, said base element including posts extending upwardly from each corner of said base element, said base element including a pair of recesses extending into said base element from the top thereof, each of said recesses being aligned with respective pairs of said connecting elements; coil spring biasing means residing in said recesses; an axially movable switch contact-carrying support element to which is secured a pair of cups adapted to mate over said coil spring biasing means, and mate within said recesses, said support element comprising a pair of contact means for bridging across and electrically connecting pairs of said respective connector means; means for biasing said contact bars away from said support element; a rotor member, said support element and said rotor having means for maintaining these elements in operating alignment with respect to each other, said rotor and said support element having at the adjacent faces thereof cam means for driving said element in an axial direction away from said rotor, as the rotor is moved through a predetermined arc around its central axis, handle means for rotating said rotor, plate means adapted to be secured against the top of said posts maintaining compression of the respective biasing spring means; secondary biasing means comprises a pair of coil springs situated to bear against each of said contacts on each side of each primary biasing means, and wherein said secondary cam means includes a plurality of arm means which extend axially away from said contact carrier element through slots in said rotor, and wherein said secondary cam follower means comprises cam follower members extending from either side of said arm means radially, and wherein secondary cam surface comprises an inclined plane situated at the walls of said slots which are trialing said slots as the rotor is moved in the switch opening direction, said inclined plane being sloped in the direction in which said cam follower means is urged in the direction away from said connectors.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,739,109 Dated June 12, 1973

Inventor(s) Hans Ege

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

Column 1, line 61, "6-5 ln" should read as --6-6 in--

Column 8, Claim 5, first line, after "4" insert --which--

Column 10, line 59, the word "trialing" should be changed to --trailing--

Signed and sealed this 12th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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