United States Patent

[11] **3,567,887**

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[54] **MULTIPHASE ELECTRIC CIRCUIT BREAKER WITH PHASES ARRANGED RADIALLY ABOUT A COMMON HOUSING AND OPERATED BY A COMMON RECIPROCAL CAM**
4 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **200/153,** 200/144, 200/145
[51] **Int. Cl.** **H01h 3/42,** H01h 33/42, H01h 33/66
[50] **Field of Search** 200/144.2, 153.12, 145, 148.6, 153.13

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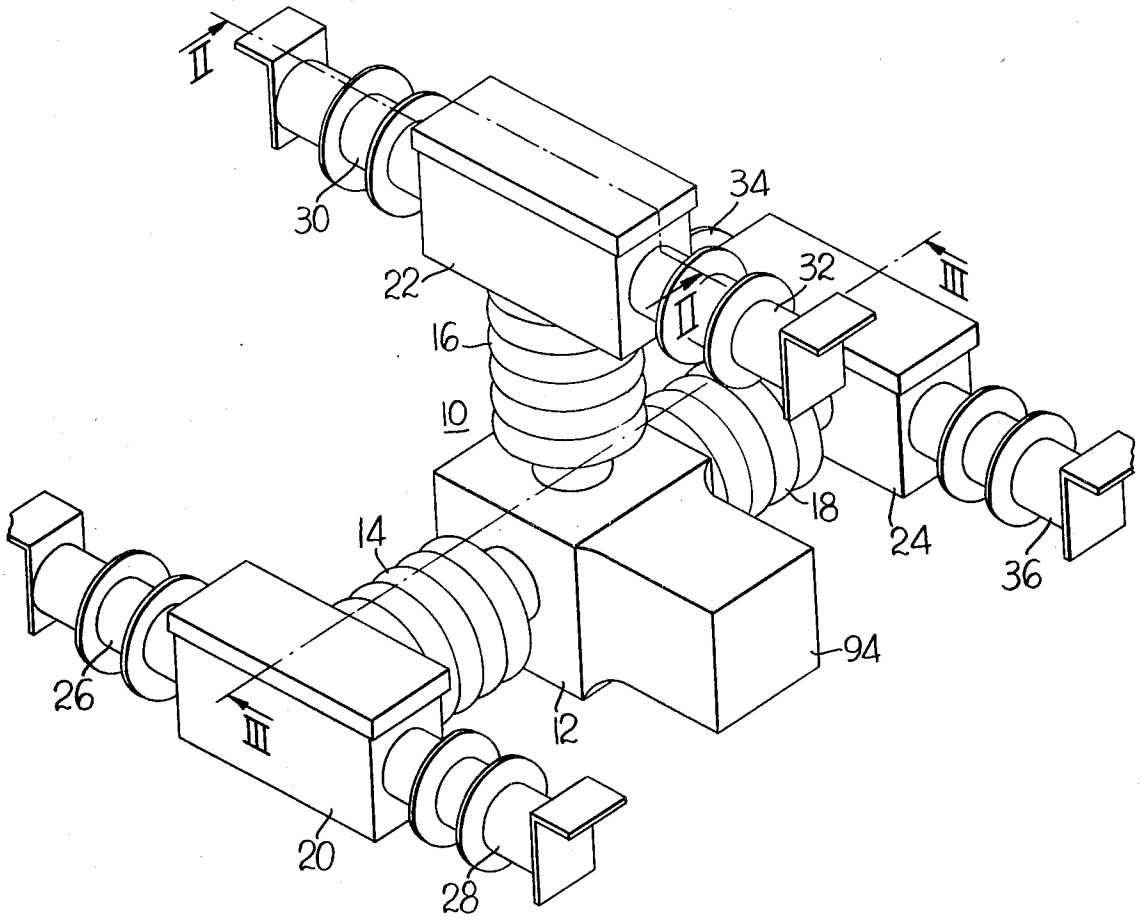
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ABSTRACT: A three phase circuit breaker comprises a supporting housing having three insulating columns mounted on three different sides thereof but in the same plane. Each column has a casing mounted at its end. A pair of series connected vacuum switches are mounted on opposite sides of each casing in axial alignment with each other and transverse to the aforesaid plane. Each vacuum switch has a contact which is axially movable by a cam plate in the associated casing. Each cam plate is moved by a push rod which extends from the associated casing, through the associated insulating column into the housing. All push rods are operated by a single cam in the housing.



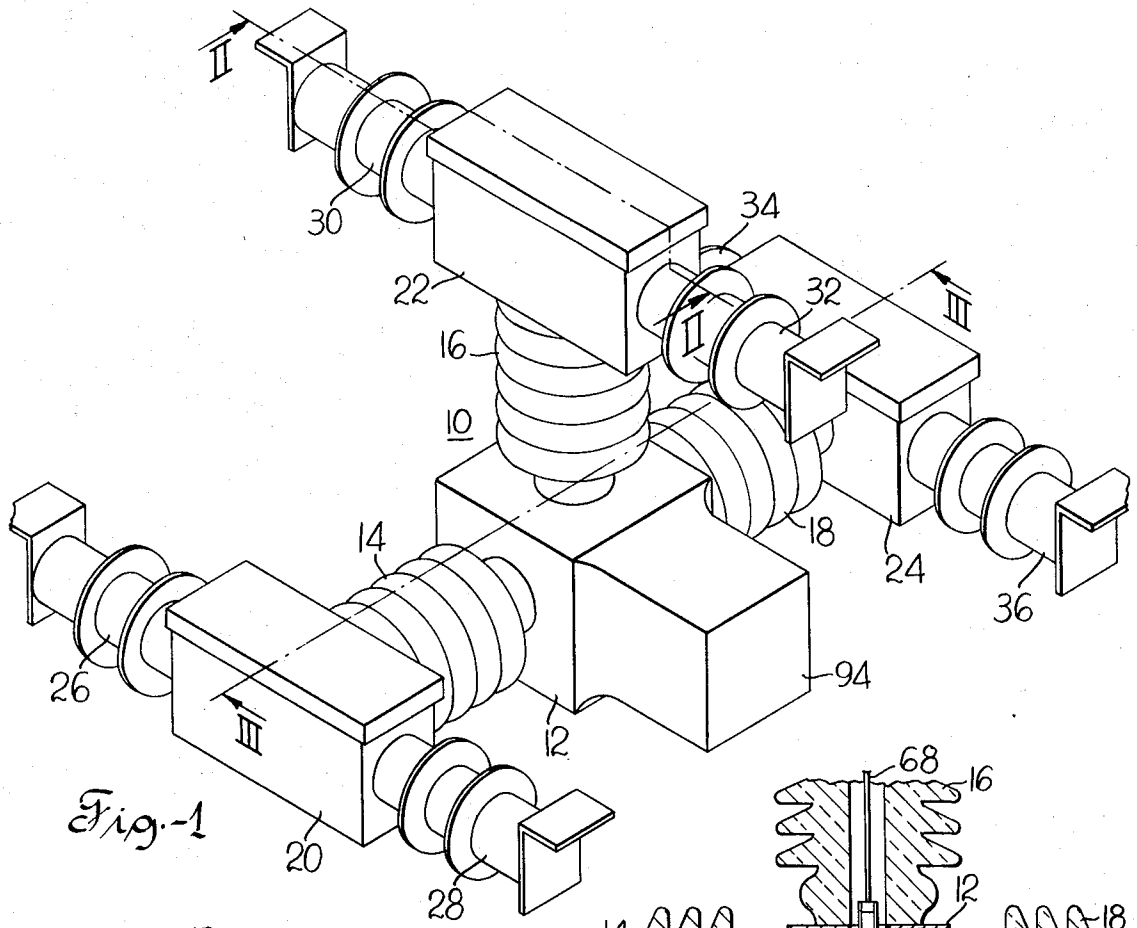


Fig.-1

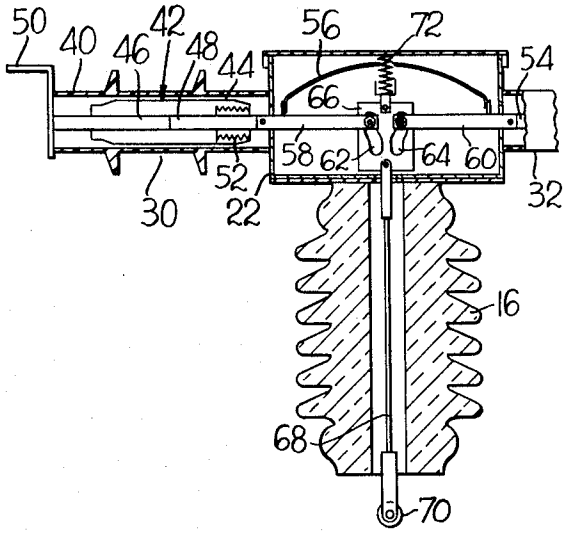


Fig.2

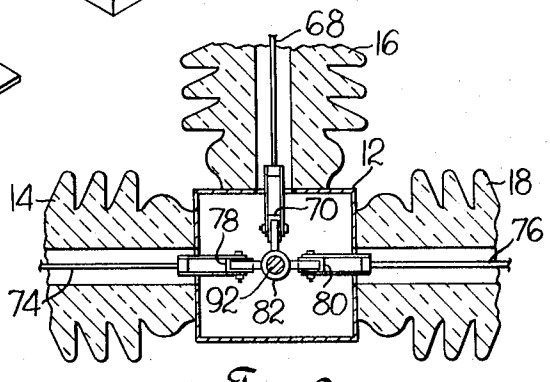


Fig.3

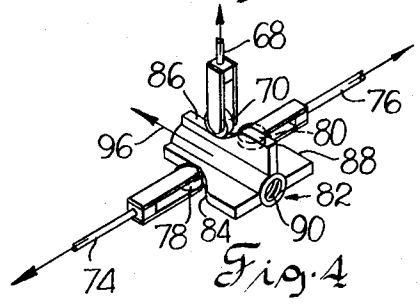


Fig.4

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MULTIPHASE ELECTRIC CIRCUIT BREAKER WITH PHASES ARRANGED RADIALLY ABOUT A COMMON HOUSING AND OPERATED BY A COMMON RECIPROCAL CAM

SUMMARY OF THE INVENTION

This invention relates to multiphase electric circuit breakers employing a plurality of switch modules arranged for actuation by a common operating means.

In some electrical transmission systems, for example, banks of capacitors are switched by circuit breakers which employ vacuum switches. One such circuit breaker comprises a supporting frame on which three insulating bushings, one for each phase, are aligned in a single row. A casing is mounted on each bushing and a pair of axially aligned vacuum switch modules are mounted on opposite sides of each casing. Thus, each pair of modules, associated casing, and insulating column form a T-shaped assembly and each pair of axially aligned modules lie parallel to the other pairs of modules. Each module comprises a vacuum switch having an envelope and a pair of cooperating separable contacts, one of which is axially movable. A reciprocably movable push rod extends from the supporting frame, through each column and into the casing associated therewith to operate the movable contacts of the associated pair of switches. Each push rod is driven by a crank and all cranks are connected by adjustable linkages and simultaneously operable by an operating rod.

While the aforedescribed circuit breaker is satisfactory for its intended purpose, the arrangement is such that the supporting frame is long and large, the in-line arrangement of the interrupter modules occupies an undue amount of space, and the cranks and linkages require adjustment as well as many duplicate parts.

In accordance with the present invention, there is provided an electric circuit breaker comprising a relatively small supporting frame or housing on which a plurality of assemblies, each of which comprises an insulating column, casing and one or more vacuum switch modules, are disposed in a cluster arrangement rather than an in-line arrangement, and wherein all push rods are simultaneously operable by a single reciprocably movable cam in said housing.

OBJECTS

It is an object of the present invention to provide an improved multiphase circuit breaker and one wherein all circuit interrupter devices are operated simultaneously.

Another object is to provide circuit breakers of the aforesaid character wherein the interrupter modules are more physically compact and properly spaced electrically.

Another object is to provide s circuit breakers of the aforesaid character wherein all interrupter devices are operated simultaneously by relatively simple cam means.

Other objects and advantages of the invention will hereinafter appear.

DRAWINGS

The accompanying drawing illustrates a preferred embodiment of the invention, but it is to be understood that the embodiment illustrated is susceptible of modifications with respect to details thereof without departing from the scope of the appended claims.

In the drawing:

FIG. 1 is a isometric view of a multiphase electric circuit breaker in accordance with the present invention;

FIG. 2 is a cross-sectional view of a portion of the circuit breaker taken along line II–II of FIG. 1;

FIG. 3 is a cross-sectional view of a portion of the circuit breaker taken along line III–III of FIG. 1; and

FIG. 4 is an isometric view of the cam means shown in FIG. 3.

DESCRIPTION OF THE INVENTION

Referring to FIG. 1, the numeral 10 designates a multiphase circuit breaker in accordance with the present invention. Breaker 10 comprises a base or supporting frame 12 on which three hollow insulating columns or bushings 14, 16 and 18 are mounted in a cluster arrangement so as to extend therefrom in different radial directions but to lie in substantially the same common plane. Casings 20, 22 and 24 are mounted on the ends of the columns 14, 16 and 18, respectively. Casing 20 supports a pair of vacuum switch modules 26 and 28 which are disposed on opposite sides thereof in substantially axial alignment with each other. The casings 22 and 24 support pairs of vacuum switch modules 30, 32 and 34, 36, respectively. Each pair of modules on a given column lies on an axis which is parallel to the axes on which the other pairs of modules lie. The axis on which each pair of modules lies is also transverse, specifically, perpendicular, to the common plane in which the insulating columns 14, 16 and 18 lie. Each pair of modules and its associated column present an assembly which has generally T-shaped configuration and it is to be understood that normally each assembly serves as one circuit breaker phase or pole.

The vacuum switch modules 26, 28, 30, 32, 34, and 36 are understood to be identical and, therefore, only module 30, shown in cross section in FIG. 2, is hereinafter described in detail. Module 30 comprises a hollow tubular insulating housing 40, preferably of transparent plastic, which is rigidly mounted to casing 22. A circuit-interrupting device such as a vacuum switch 42 is rigidly mounted within housing 40. Switch 42 comprises an insulating envelope 44, preferably transparent within which a pair of cooperable separable contacts such as a stationary contact 46 and a movable contact 48 is disposed. Stationary contact 46 is electrically connected to a terminal 50 mounted on insulating housing 40. Movable contact 48 enters envelope 44 through bellows means 52 which permit the contact to be as axially movable with respect to the envelope. Movable contact 48 is electrically connected to a similar movable contact 54 which is understood to be located in module 32 by conductive means 56 in casing 22. It is to be understood that the two switch modules in each phase are similarly connected in series with each other.

Means are provided in housing 22 to effect axial movement of the movable contacts 48 and 54 of modules 30 and 32, respectively. Such means comprise drive rods 58 and 60, which are mechanically connected at one of their ends to the movable contacts 48 and 54, respectively. The other ends of the rods 58 and 60 cooperate with cam slots 62 and 64, respectively, in a cam plate 66 which is to be understood to be reciprocably movable in response to axial movement of a push rod 68 which is connected to the cam plate. Push rod 68 extends from casing 22, through column 16 into base 12 and is provided at its end with a cam follower 70. It is to be understood that movement of the push rod 68 and cam plate 66 upward (with respect to FIG. 2) effects simultaneous opening movement of the movable contacts 48 and 54 and downward movement of rod 68 and cam plate 66 effects contact closing. Biasing means such as a spring 72 in casing 22 are provided which tend to bias plate 66 and push rod 68 downward and contacts 48 and 54 close.

It is to be understood that the casings 20 and 24 house components similar to those in casing 22 described above and that the other two poles comprise push rods 74 and 76 shown in FIG. 3 which extend through the columns 14 and 18, respectively, into base 12. The rods 74 and 76 are provided with cam followers 78 and 80, respectively.

As FIGS. 3 and 4 show, the cam followers 78, 70 and 80 of the push rods 74, 68 and 76, respectively, cooperatively engage with a cam means, such as a cam member 82. Cam member 82 is reciprocably movable to contact open and closed positions along an axis which is transverse to those axes in which the push rods lie. Cam member 82 comprises three

cam surfaces **84**, **86** and **88** on which the cam followers **78**, **70** and **80**, respectively, are adapted to ride. Each cam surface has a high and low area with a transition area therebetween. Cam member **82** is provided with means such as a threaded opening **90** which adapts it for mechanical connection to a cam operator **92** located in an operating housing **94** which is mounted on or associated with base **12**. It is to be understood that cam operator **92** can be operated electrically, hydraulically, mechanically, manually or by any other suitable means. Movement of cam member **82** in the direction or of arrow **96** in FIG. **4** causes cam followers **78**, **70** and **80** to ride up to the high area of cam surfaces **84**, **86** and **88**, respectively, thereby effecting outward radial movement of the push rods **74**, **68** and **76**, respectively. Such push rod movement effects simultaneous opening movement of the contacts in the vacuum switches in the modules **26**, **28**, **30**, **32**, **34** and **36**. Reverse movement of cam member **82** has the opposite effect.

I claim:

1. A circuit breaker comprising:

a supporting housing;

a plurality of hollow insulating columns radially arranged on said housing;

at least one circuit-interrupting device supported on each column;

each device comprising a pair of cooperating separable contacts at least one of which is movable along an axis of said device;

a pair of terminals for each device located at opposite ends thereof on said axis;

the axis of the plurality of devices being parallel to one another;

an axially movable push rod extending through each column and into said housing for effecting movement of the movable contact of its associated device;

and cam means in said housing for effecting axial movement of all push rods; and

said cam means being movable along an axis which is transverse to the axis of movement of each push rod.

2. A circuit breaker according to claim **1** comprising at least a pair of axially aligned, series-connected interrupting devices supported on each column; wherein said pair of terminals are located at opposite ends of said pair of devices and wherein said cam means effects simultaneous operation of said movable contacts of all devices in said circuit breaker.

3. A circuit breaker according to claim **2** wherein three columns are provided, one for each circuit breaker pole and all of which lie in a common plane, wherein a casing is supported on each column and each casing supports a pair of devices, and wherein said cam means moves along an axis which is parallel to the axes of said devices.

4. A circuit breaker according to claim **3** wherein said cam means comprises a single member which engages a roller on each push rod.