United States Patent

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[54] **COMBINED VACUUM CIRCUIT BREAKER AND CURRENT TRANSFORMER DEVICE**
2 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **200/144,** 317/15, 336/174
[51] **Int. Cl.** **H01h 9/56**
[50] **Field of Search** 200/144.2, 148; 317/15, 58; 336/174, 175; 174/C.T.Digest

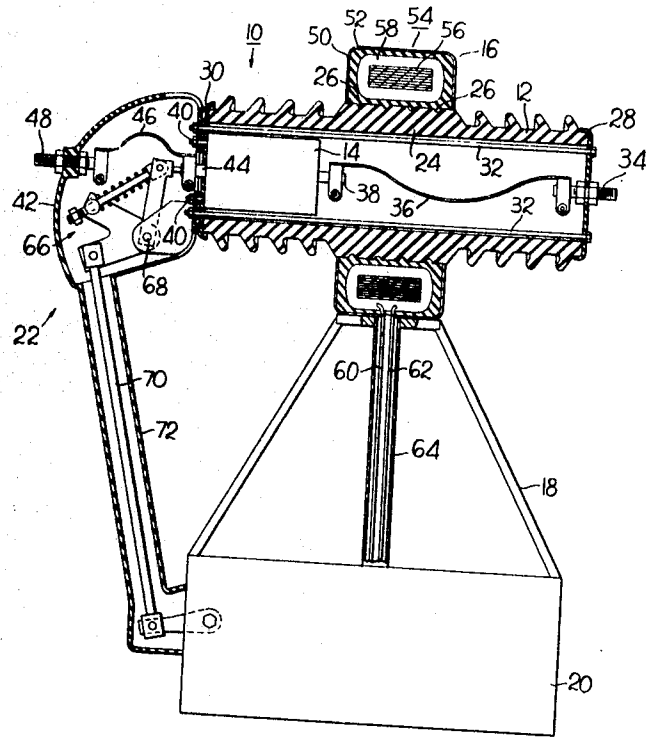
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ABSTRACT: One or more vacuum circuit breakers are mounted inside a horizontally disposed hollow skirted porcelain insulator tube having sealed ends. The insulator tube extends through and is supported by current transformer means which have the shape of an annular torus. The current transformer means is supported on a framework which is grounded to the current transformer means. Circuit breaker operating means, including an electrically insulating rod, extend between the circuit breaker or breakers and the lower portion of the framework.



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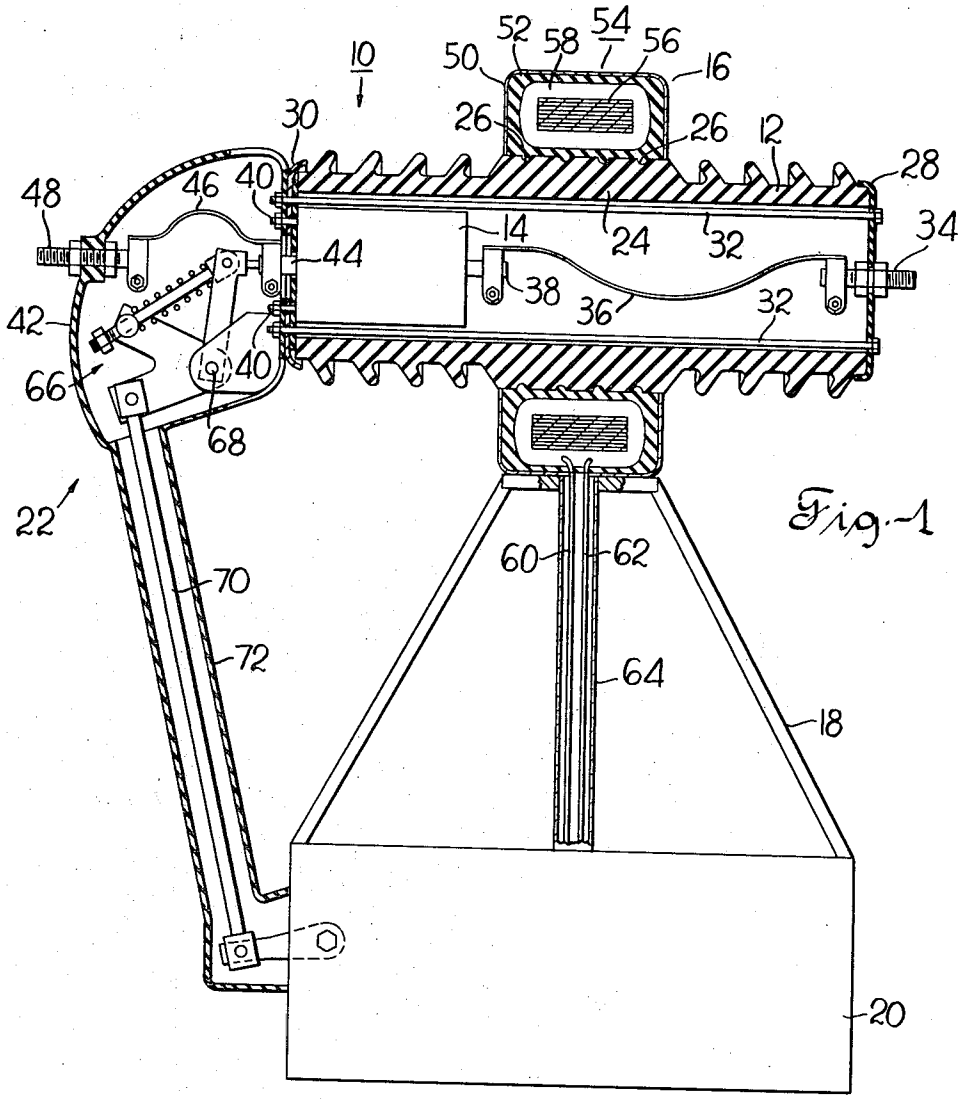


Fig.-1

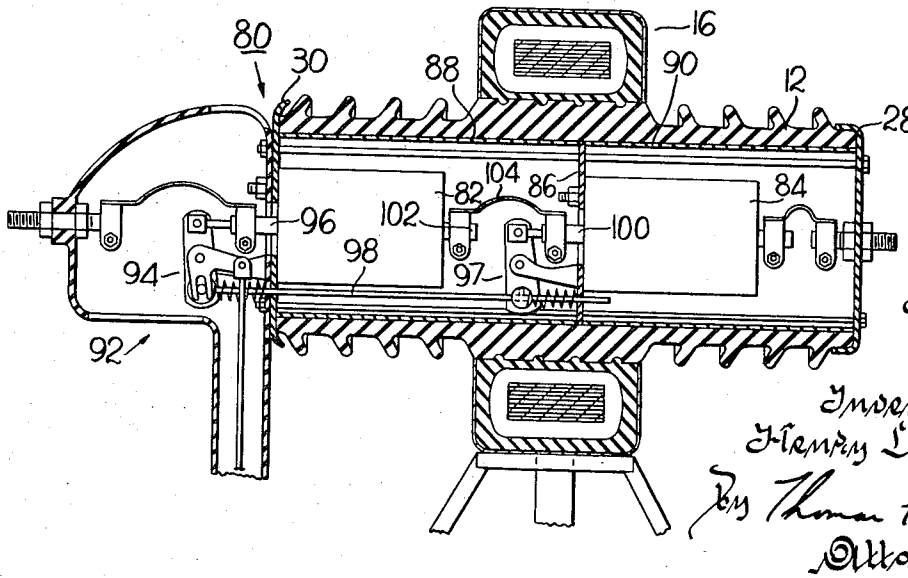


Fig.2

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COMBINED VACUUM CIRCUIT BREAKER AND CURRENT TRANSFORMER DEVICE

SUMMARY OF THE INVENTION

This invention relates generally to combined vacuum circuit breaker and current transformer devices. More particularly, it relates to a high voltage electric circuit breaker mounted in an insulator tube which is surrounded and supported by a grounded current transformer.

One type of high voltage outdoor vacuum circuit interrupted device comprises a metal cabinet into which a pair of insulator bushings extend and a vacuum circuit breaker is mounted between the ends of the bushings within the cabinet. Operating mechanism for the circuit breaker is mounted within the cabinet. Necessary current transformers are connected to the line outside of the cabinet as a separate installation. Vacuum circuit interrupter devices of the foregoing type are relatively bulky and, because of the requirement to provide a separate current transformer, are also costly.

OBJECT OF THE INVENTION

It is an object of this invention to provide a combined vacuum circuit breaker and current transformer device which is more compact and less costly than equivalent prior art apparatus.

Another object is to provide a device of the aforesaid character wherein one or more circuit breakers are mounted inside a hollow insulator tube, wherein the tube is surrounded and supported by current transformer means and wherein the current transformer means are mounted on a support which has an operating means connected to the breakers.

Other objects and advantages of the invention will hereinafter appear.

DESCRIPTION OF THE DRAWING

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

In the drawing:

FIG. 1 is a cross-sectional view of a combined vacuum circuit breaker and current transformer device in accordance with the invention; and

FIG. 2 is a view similar to FIG. 1 showing a device incorporating two series connected vacuum circuit breakers.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 the numeral **10** designates one embodiment of a combined vacuum circuit and current transformer device in accordance with the present invention. It is to be understood that device **10** is to be used in one of the phase lines of a high voltage multiphase electrical power transmission system and that similar devices would be used in the other phase lines.

Device **10** comprises a horizontally disposed hollow skirted insulator tube **12** in which a vacuum circuit breaker **14** is mounted. Tube **12** is supported by current transformer means **16** which are shaped like an annular torus and which are supported by a framework or support **18** having a base **20**. Operating means **22** for circuit breaker **14** are connected between the circuit breaker and base **20**.

Insulator tube **12** is preferably made of porcelain or other insulating material and has a configuration which enables it to withstand voltages on the order of 34,000 volts and higher. Insulator tube **12** is provided with a relatively heavy unskirted center section **24** for extra strength and this section is provided with a plurality of grooves **26** which aid in securely mounting current transformer means **16** thereon. Insulator tube **12** is provided with end caps **28** and **30** which seal off the end of the tube and are held in place by a plurality of tie rods **32** which extend through the tube and are made of suitable insulating material.

End cap **28** on tube **12** supports an electrical connector **34** which is electrically connected by a conductor **36** to a stationary contact rod **38** on vacuum circuit breaker **14**.

End cap **30** on tube **12** rigidly supports vacuum circuit breaker **14**, as by means of volts **40**, within tube **12** and also supports an insulated housing **42** for operating means **22**. A movable contact rod **44** on vacuum circuit breaker **14** is electrically connected by a conductor **46** to an electrical connector **48** on housing **42**.

Current transformer means **16** comprises an exterior protective cover or shell **50**, preferably metallic, which is rigidly mounted on support **18** and filled with a solidified electrically insulating potting compound **52**. Potting compound **52** fills the grooves **26** in insulator tube **12** thereby preventing axial slippage of the current transformer means **16** on the tube. A current transformer **54** comprising a laminated magnetizable core **56** and a secondary winding **58** is embedded in the potting compound **52**. Secondary winding **58** of current transformer **54** is provided with wire connection leads **60** and **62** which extend downwardly to base **20**, preferably through a conduit **64** which is part of support **18**. Secondary winding **58** of current transformer **54** surrounds conductor **36** and is therefore responsive to current flow through the latter to produce an output signal through the leads **60** and **62** which, as will be understood, is usable to effect operation of operating means **22** in any customary manner.

Operating means **22** comprise a linkage **66** which is connected to reciprocably movable contact rod **44** and is pivotable to open and closed positions about a pivot point **68** by reciprocably movable operating rod **70** made of insulating material. If preferred, rod **70** may be housed in a tube **72** connected between base **20** and housing **42**.

As will be apparent in the foregoing construction, the current transformer which is at ground potential is fully insulated from the high potential being carried by the vacuum circuit breaker **14** and other associated components. Similarly, the components of operating means **22** which are at high potential (i.e., those associated with movable contact **44** of vacuum circuit breaker **14**) are insulated from base **20** by insulated rod **70**, insulated housing **42** and insulated tube **72**.

Referring to FIG. 2, the numeral **80** designates a combined device incorporating another embodiment of the invention wherein insulator tube **12** contains within it two series connected vacuum circuit breakers **82** and **84** which are understood to be similar to breaker **14**, hereinbefore described. Breaker **82** is supported by end cap **30** and breaker **84** is supported by means of a flange or ring **86** which is entrapped between the adjacent ends of a pair of insulating tubular spacers or liners **88** and **90** which fit within insulator tube **12**. The spacers **88** and **90** are compressed between the end caps **28** and **30** of insulator tube **12**. Operating means **92** are provided to effect simultaneous opening and closing of both vacuum circuit breakers **82** and **84** and comprises a linkage **94** for association with a movable contact rod **96** on circuit breaker **82** and a linkage **97**, comprising an insulating rod **98**, for association with a movable contact rod **100** on a circuit breaker **84**. Movable contact rod **100** of circuit breaker **84** is electrically connected to a stationary contact rod **102** on circuit breaker **82** by a conductor **104**. Current transformer assembly **16** of combined circuit breaker and current transformer device **80** surrounds a portion of conductor **104** and movable contact rod **100** to monitor current flow and device **80** is suitably connected in an energized circuit.

I claim:

1. An electrical device comprising:
   - an insulator tube;
   - first and second end caps on said tube for closing the ends thereof;
   - at least one insulating tie rod for securing said end caps in place and extending through said tube;
   - at least one vacuum-type circuit breaker disposed within said tube in a high potential region and supported by said first end cap;

said circuit breaker having contact rods extending therefrom and at least one of said rods being movable to effect circuit breaker operation;

an insulated housing mounted on said first end cap;

a first linkage for said movable contact rod located within said housing in said high potential region;

a first electrical connector mounted on said housing;

a first electrical conductor connected between said first connector and said one contact rod;

a second electrical connector mounted on said second end cap;

a second electrical conductor connected between said second connector and the other of said contact rods of said first circuit breaker;

current transformer means comprising a core and coil potted in electrical insulating material which maintains them at ground potential;

said current transformer means surrounding and supporting said insulator tube;

supporting means including a base at ground potential for supporting said current transformer means;

wire leads connected between said current transformer coil and said base; and

a movable electrically insulating rod connected between said operating linkage and said base.

2. An electrical device according to claim 1 comprising a second vacuum-type circuit breaker disposed within said tube in said high potential region and having contact rods extending therefrom, at least one of which rods being movable, to effect operation of said second circuit breaker;

a pair of spacers of insulating material in said tube compressed between said end caps;

a supporting ring of insulating material entrapped between said spacers for supporting said second circuit breaker;

a second linkage disposed within said tube for operating said movable contact rod of said second circuit breaker;

a movable insulating rod connected between said first and second linkages;

wherein said second electrical conductor is connected between said second connector and the other of said contact rods of said second circuit breaker; and

further comprising a third electrical conductor connected between said other contact rod of said one circuit breaker and said one contact rod of said second circuit breaker.