

April 21, 1931.

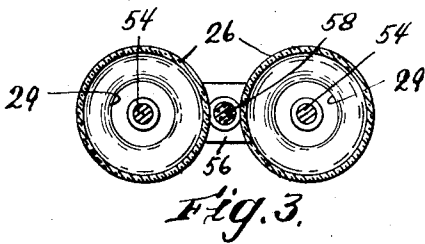
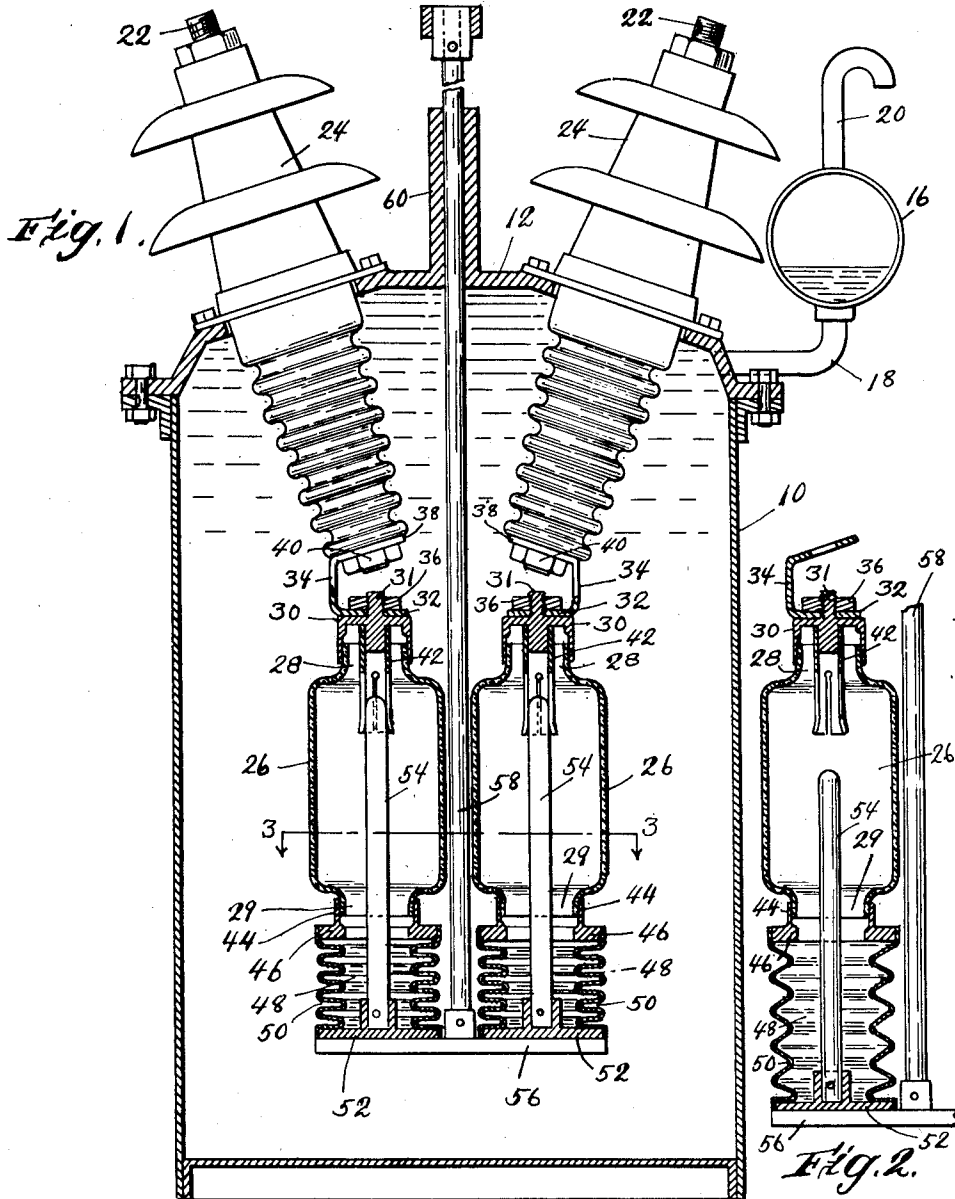
T. T. GREENWOOD

1,801,736

OIL IMMERSED VACUUM TYPE SWITCH

Filed Oct. 30, 1926

2 Sheets-Sheet 1



Inventor.

T. T. Greenwood

April 21, 1931.

T. T. GREENWOOD

1,801,736

OIL IMMERSED VACUUM TYPE SWITCH

Filed Oct. 30, 1926

2 Sheets-Sheet 2

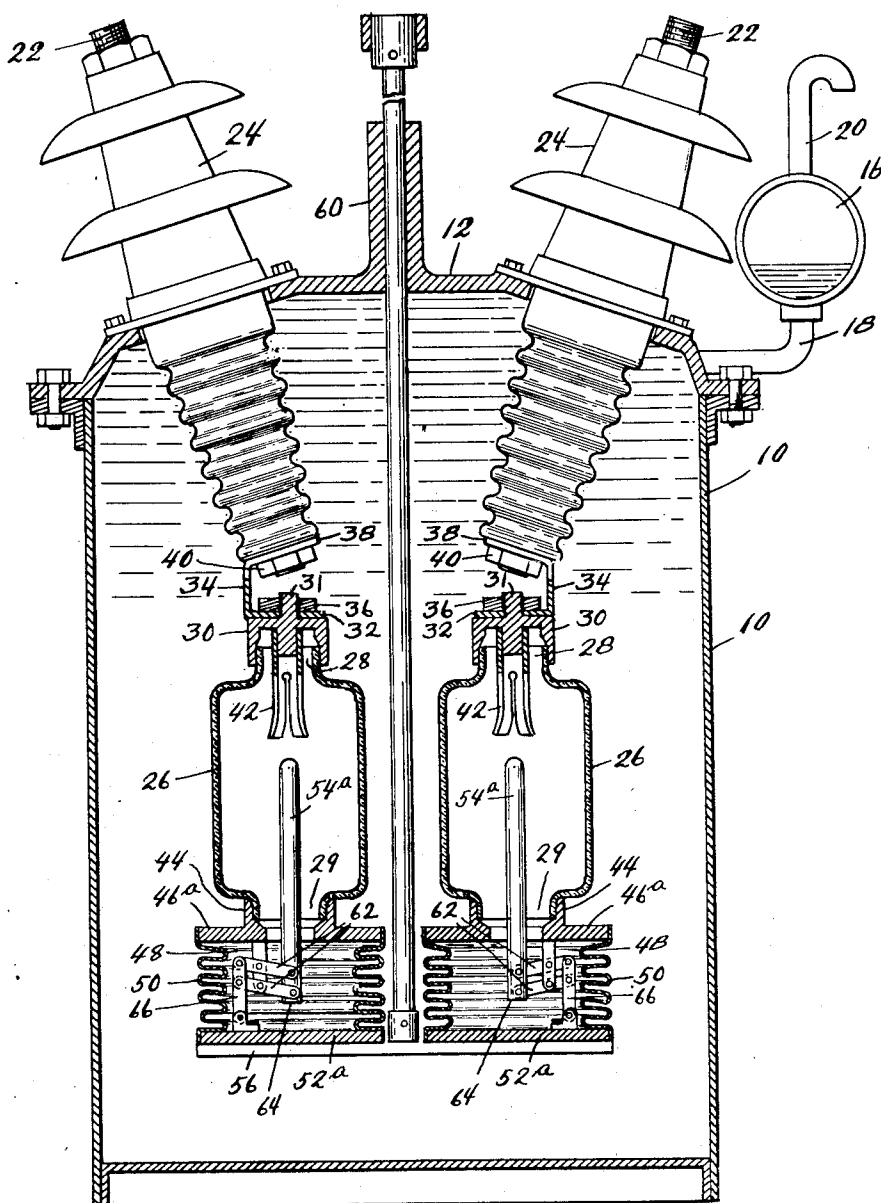


Fig. 4.

Inventor.

T. T. Greenwood

UNITED STATES PATENT OFFICE

TALMA T. GREENWOOD, OF EAST TEMPLETON, MASSACHUSETTS, ASSIGNOR TO CONDIT ELECTRICAL MANUFACTURING CORPORATION, OF SOUTH BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

OIL-IMMERSED VACUUM-TYPE SWITCH

Application filed October 30, 1926. Serial No. 145,326.

This invention relates to circuit interrupters of the type wherein the circuit interrupting arc is drawn in a high vacuum and preferably between separable contact members from which the occluded gases have been removed.

The vacuum type switch comprises an evacuated container composed usually of some insulating material as glass. Stationary and movable contact members are disposed within the container and the stationary contact members are led out of the container through suitable seals.

Due to the fact that it is imperative that a high vacuum be maintained within the container, the movable contact member can not be brought out through the wall of the container for connection with externally-disposed switch operating mechanism since air will leak into the container through any common form of packing that may be utilized between the container wall and the movable switch member. It has consequently been necessary to enclose the movable switch member entirely within the container and provide it with a magnetizable member and to operate it by electro-magnetic means disposed externally of the container. Such an arrangement is undesirable since it places the electro-magnetic operating means relatively near the high tension circuit leads and invites a flash-over therebetween and also because it limits the switch to electro-magnetic operation which is not desirable for many purposes.

An object of this invention therefor is the provision of a vacuum type switch wherein the container is permanently sealed against air leakage thereinto and is provided with means whereby the movable switch member can be operated mechanically by movable means disposed externally of the container.

A further object of the invention is the provision of a vacuum type switch with a permanently sealed container having a flexible wall to one side of which wall, the movable switch member is operatively connected and to the other side of which wall the operating mechanism is operatively connected, the

switch being operated by the flexing of the flexible wall.

A further object of the invention is the provision of a vacuum type switch having a flexible wall operatively connected with the movable switch member and biased to urge the movable switch member constantly in one direction by means of atmospheric or other pressure acting on the outer face of said flexible wall.

A further object is generally to improve the construction and operation of circuit interrupters.

Fig. 1 is a vertical sectional elevation through the circuit interrupter embodying the invention.

Fig. 2 is a sectional detail showing one of the vacuum switches of Fig. 1 in open circuit position.

Fig. 3 is a section along line 3—3 of Fig. 1.

Fig. 4 is a sectional view similar to Fig. 2 but showing a modified arrangement wherein external pressure acting on the flexible wall serves to bias the switch for opening movement.

The circuit interrupter here shown as embodying the invention comprises an enclosing casing including the receptacle 10 and the detachable cover 12. Said cover and receptacle are adapted to be secured removably together in a fluid tight manner. The entire casing is preferably, although not necessarily, completely filled with an insulating fluid as oil whereby to exclude the atmosphere from direct contact with the body of oil in the casing and thereby to prevent auto-oxidation and deterioration of the oil. A slight head or pressure of oil may be maintained in the casing by the provision of the oil storage tank 16 which is adapted to contain a supply of oil therein to some level that is above the top of the casing. The body of oil within said tank is in communication with the body of oil in the casing by means of the pipe 18. The tank 16 may be vented to the atmosphere by means of the breather pipe 20. The body of oil within the casing may thus expand into the tank 16 upon a rise of temperature of the oil.

The circuit interrupter is provided with a

pair of terminals 22 which are extended through insulators 24 rigidly carried by the cover 12 and extended therethrough into the interior of the casing. The lower ends of said terminals are connected electrically with the vacuum switch comprising a part of this invention and also serve as the mechanical support for the casings of said switch.

The vacuum switch forming part of this invention comprises essentially two separate switches electrically connected in series and adapted conjointly to control the circuit through the interrupter. The vacuum switches are or may be identical in construction. Each switch comprises a generally cylindrical container 26 composed preferably although not necessarily of some suitable insulating material as glass. The container is formed with reduced open necks 28 and 29 at its upper and lower ends respectively. A metal cap 30 is welded on the upper end 28, thereby sealing said neck. Said cap is provided with an externally-disposed screw-threaded stud 31 which is passed through the leg 32 of a conducting supporting member 34. A nut 36 is screw-threaded on said stud and serves to connect said connector 34 electrically and rigidly mechanically with said cap. Said connector 34 is provided with an upper leg 38 which is attached rigidly to the lower end of one of the terminals 22 by a nut 40, and said terminal thereby serves as a supporting means for said container 26. The cap 30 is provided with a fixed contact member which is here shown as the slotted tube 42 disposed within said container 26.

A cap 44 is sealed or welded to the lower neck 29. Said cap is provided with an outstanding annular flange 46 to which is welded or otherwise secured in vacuum tight manner one end of a flexible wall member 48. Said wall member is of general tubular form and has its side wall corrugated as indicated at 50. The side wall is of relatively thin and flexible metal and the corrugations therein are relatively deep and so arranged that the member may be elongated in an axial direction as indicated in Fig. 2, and it may also be compressed into the position illustrated in Fig. 1.

The bottom end of said flexible wall member is sealed or welded to a bottom plate 52. The movable switch member comprises a rod 54 which as here shown is fixed rigidly to the inner face of said bottom plate 52 and extends within the container 26 in the line of said stationary contact member 42 and is adapted to be moved into and out of said contact member upon the flexing of said wall member 48. The flexible wall member is adapted to be expanded and contracted by externally-disposed means acting thereon. The flexible wall member thereby provides means whereby by motion may be transferred to the interior

of said evacuated container 26 from externally-disposed actuating mechanism while maintaining the seal of said container.

The bottom plates 52 of both containers are attached to a rigid conducting bar 56 which serves electrically to connect the movable contact members of the two containers and also to actuate both switches conjointly. An insulating switch operating rod 58 is attached to said bar 56 and is extended upwardly in the space between the two containers and through the neck 60 of the cover 12 for attachment to suitable operating mechanism disposed externally of said casing. The upper end of said neck 60 is terminated above the level of the oil in the tank 16 to prevent escape of oil from the casing. It is apparent that as said rod 58 is moved downwardly, the flexible walls 48 will be elongated into some position as illustrated in Fig. 2, thereby separating the stationary and movable contact members and interrupting the circuit through the interrupter.

Atmospheric pressure operating on the flexible walls 48 through the medium of the body of oil contained in the interrupter casing tends to collapse or compress said flexible walls when the restraint on the switch rod 58 is removed, thereby to effect the closing of the interrupter.

For some purposes, it may be desirable to have the interrupter biased for switch opening movement. Such a construction is illustrated in Fig. 4 wherein the movable contact member 54 *a* is pivoted to and carried by parallel levers 62. Said levers are pivoted to an ear 64 carried by the flange 46*a*. A link 66 is pivotally connected with the free ends of said levers and with the bottom plate 52*a*. As thus arranged, the upward movement of the bottom plate, due either to the operation of the switch rod 58 or to atmospheric pressure exerted thereon, effects the opening of the switch.

The containers 26 are adapted to be evacuated to as high a degree as practicable. The parts in communication with the interior of said containers, and especially the separable contact members, are adapted to have the occluded gases removed therefrom. A relatively large amount of energy can thus be interrupted with a small circuit interrupting arc and the circuit interrupting arc will be rapidly extinguished.

The construction may be otherwise modified without departing from the spirit of the invention.

The broad idea of a vacuum switch having a flexible wall through which motion of the external switch operating mechanism is transferred to the internal separable contact members is disclosed and claimed in my concurrently filed application Serial No. 145,328.

I claim:

1. A circuit interrupter having a rigidly-

supported insulated terminal, an evacuated container carried by said insulated terminal, said container having a lower flexible metal wall, stationary and movable contact members disposed within said container, said stationary contact member having an electrical connection with said terminal, said movable contact member having an operative connection with said flexible metal wall, and a switch operating rod disposed externally of said container and having an operative connection with said flexible wall.

2. A circuit interrupter comprising a pair of rigidly supported insulated terminals, an evacuated container carried by the lower end of each terminal, each container having an upper wall composed of insulating material and a flexible lower wall which is sealed to said insulating upper wall in a vacuum-tight manner, stationary and movable contact members contained within said containers, said stationary contact members having electrical connections with said terminals, said movable contact members having electrical and operative mechanical connections with said flexible walls, a bar connecting said flexible walls, and operating mechanism connected with said bar.

3. A circuit interrupter comprising a pair of rigidly supported insulated terminals, an evacuated container carried by the lower end of each terminal, each container having an upper wall composed of insulating material and a flexible lower wall which is welded to said insulating upper wall in a vacuum-tight manner, stationary and movable contact members contained within said containers, said stationary contact members having electrical connections with said terminals, said movable contact members having electrical and operative mechanical connections with said flexible walls, an operating bar connecting said flexible walls, and means to contain an insulating fluid body in which the afore-said elements are immersed.

4. A circuit interrupter comprising an evacuated container having a flexible wall, stationary and movable contact members disposed within the container, and direction changing mechanism operatively connecting said movable contact member with said flexible wall whereby movement of said flexible wall in one direction effects the movement of said movable contact member in the opposite direction.

5. A circuit interrupter comprising an evacuated container having a flexible wall exposed to the vacuum of said container and also to the atmosphere and biased for movement inwardly of said container by atmospheric pressure, an operating member connected externally with said wall, and engageable and disengageable contact members in said container operated by said flexible wall and having means whereby movement of said

flexible wall inwardly of said container effects the disengagement of said contact members.

6. A circuit interrupter comprising an evacuated container exposed to the vacuum of said container and also to the atmosphere and biased for movement inwardly of said container by atmospheric pressure having a movable operating element provided with a vacuum-tight connection with said container, an operating member located externally of said container for operating said operating element, and engageable and disengageable contact members in said container operated by said operating element and having means whereby movement of said operating element inwardly of said container effects the disengagement of said contact members.

7. A circuit interrupter comprising an evacuated receptacle having an interrupter-operating member which is exposed to the vacuum of said receptacle and also to the atmosphere and is biased for movement into said receptacle by atmospheric pressure, and engageable and disengageable contact members in said receptacle operated by said operating member and having means whereby inward movement of said operating member effects the disengagement of said contact members.

In testimony whereof, I have signed my name to this specification.

TALMA T. GREENWOOD.