Sept. 2, 1930. M. BUCHHOLZ 1,774,961

OPTICAL PROTECTION OF ELECTRICAL APPARATUS

Filed Nov. 30, 1927

Fig.1.

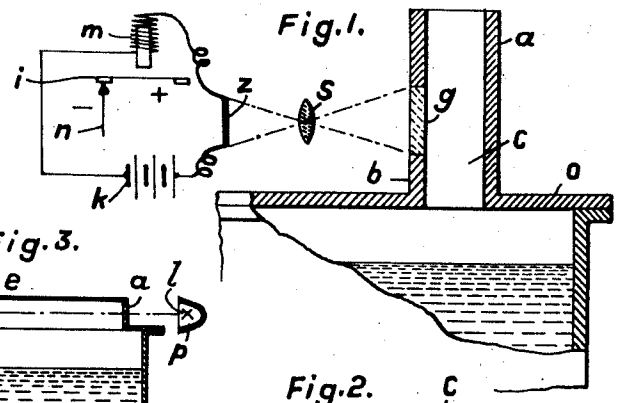


Fig.3.

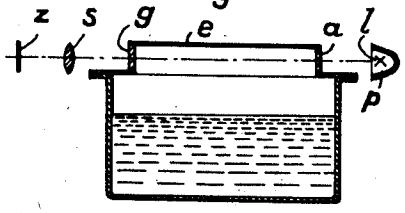


Fig.2.

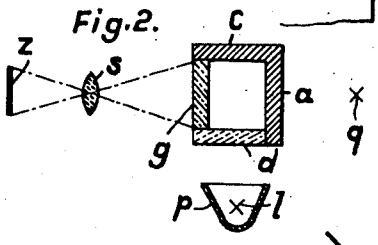


Fig.4.

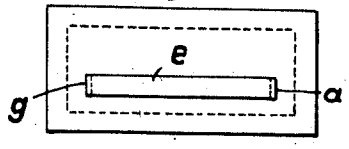


Fig.5.

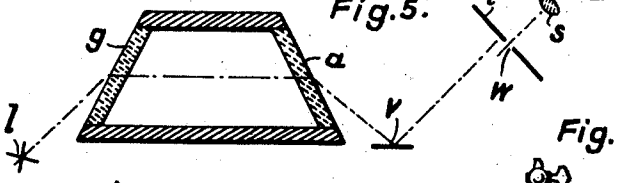


Fig.7.

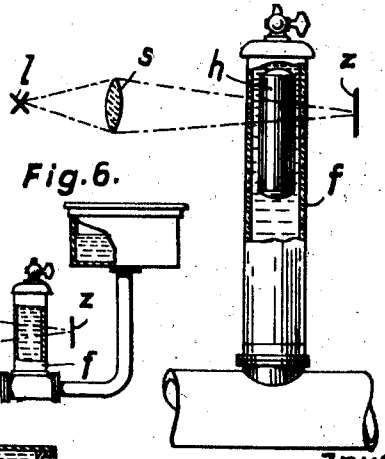


Fig.8.

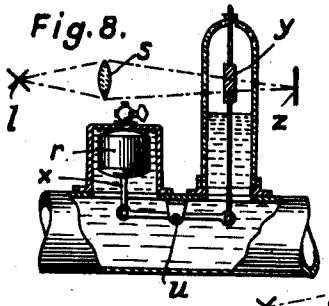
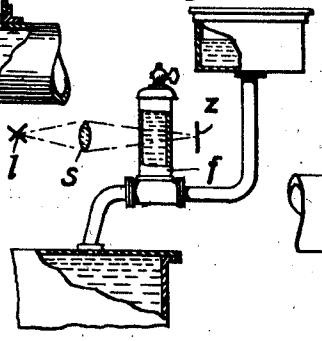


Fig.6.



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UNITED STATES PATENT OFFICE

MAX BUCHHOLZ, OF KASSEL, GERMANY

OPTICAL PROTECTION OF ELECTRICAL APPARATUS

Application filed November 30, 1927, Serial No. 236,743, and in Germany December 15, 1926.

My invention refers to insulated electrical apparatus and more especially to means whereby such apparatus can be protected from injury caused by abnormal working conditions and subsequent development of combustible or explosive gases or vapours in the insulation.

In a patent of the United States No. 1,642,397 and other patents relating to the same subject matter I have shown that the gaseous or vaporous products of decomposition formed in the solid or in the liquid insulating means, surrounding transformers, switches, motors, generators or other electrical apparatus, when operating under abnormal conditions, can be utilized for actuating an optical or acoustic signal or alarm for throwing out the apparatus to be protected etc.

The present invention refers to improvements of the protective means above referred to and more particularly to arrangements comprising bodies sensitive to light, such as a selenium cell or photo cell inserted in an electrical circuit, a variation of the resistance of the cell and the current generated or the interruption or oscillation of current brought about in the circuit being utilized for operating the protective means.

In the drawings affixed to this specification and forming part thereof several such arrangements are illustrated diagrammatically by way of example.

In the drawings,

Figs. 1 and 2 are a vertical section and a cross section, respectively, illustrating a transformer vessel or the like having an ascending pipe or chimney mounted on its cover, the walls of this pipe being partly transparent and an optical system including a selenium cell or the like being associated with the transparent parts of the walls to be influenced by decomposition gases rising in the pipe, whereby an electrical protective circuit is closed or opened.

Figs. 3 and 4 are a vertical section and plan view, respectively, of a transformer vessel or the like having an optical and electrical protective device associated with the transparent parts of the cover.

Fig. 5 illustrates a modified form of ascending tube or pipe as shown in Figs. 1 and 2, the tube being shown in cross section.

Figs. 6, 7 and 8 are elevations, partly in vertical section of three further modifications.

Referring first to Figs. 1 and 2, *o* is the cover of a transformer vessel or the like filled with a liquid insulating means such as oil. On the cover *o* is mounted an ascending tube or chimney having walls *a*, *b*, *c*, *d*. The walls *a* and *c* are assumed to be impervious to light, while wall *d* is transparent and *b* has an aperture closed by a glass pane *g*. A system of lenses *s* is mounted in front of the pane *g* so as to project an image of the pane onto the sensitive cell *z*, which is inserted in a circuit comprising a source of current *k*, electromagnet *m* and contact device *n*, *i*. A source of light *l* provided with a reflector *p* projects light rays into the tube across the transparent wall *d*, without, however, lighting the inner surface of wall *a* which is preferably painted black. The lens system *s* therefore projects onto the cell *z* a deep-black image, thereby weakening or interrupting the circuit of the magnet *m*. As soon, however, as gases or vapours of decomposition are developed in the vessel, they will rise and escape through the chimney. On their way therethrough they are illuminated by the light rays emanating from *l* and the lens system *s* will then project a light image onto the cell *z*, which now allows current to flow in the protective circuit. The magnet *m* will be energized and will cause opening of the contact device *n*, *i*, whereby the operative conditions of the signalling or switching device enclosed in the contact circuit can be changed.

Instead of providing a soure of light *l*, I may also provide one behind the wall *a*, for instance at *q*, this wall being in that case transparent also. If no vapours rise in the chimney, the light projected by this source of light traverses the walls *a* and *q* and causes the selenium or other cell *z* to allow the passage of current. However, as soon as vapours fill the chimney, the light rays will be weakened or screened altogether and the op-

erative condition of the cell z will be changed accordingly.

I can attain the same result, if the inner surface of the impervious wall a is lighted in some suitable manner, or if a source of light is provided on the inner surface of this wall.

In the modification illustrated in Figs. 3 and 4 the cover e of the transformer vessel or the like is provided with transparent walls a and g which allow light rays projected by the reflector p surrounding the source of light l to be thrown by the lens s onto the cell z, the electrical effect being the same as described with reference to Figs. 1 and 2.

In the modification illustrated in Fig. 5 the chimney has two transparent walls a, g disposed at a pointed angle to one another, so as to form the inclined sides of a parallelogram. The source of light l will project light rays onto the wall g which will travel as shown by the dot and dash line and after having passed the walls g and a, will be reflected by a mirror v so as to meet the screen t. Whenever gases or vapours rise in the chimney, the light rays passing across the chimney will be deflected by refraction so as to meet and pass across the slit w in the screen t and to be thrown by the lens s onto the selenium cell z. Preferably the gases or vapours before entering the chimney are deprived of their chemical constituents by means of a filter inserted in the chimney in order that the light rays be weakened as little as possible.

In the modification illustrated in Fig. 6, the source of light l sends its rays across a lens s into a glass tube f filled with oil. Behind the tube is arranged a selenium cell z or the like, which as long as the glass tube is filled with oil, will receive no or very little light, so that the contact device connected with the cell is not actuated. Whenever gases or vapours of decomposition rise in the oil, they will collect in the glass tube f and will displace the oil therein, thereby affording free passage for the light rays across the glass tube, whereby the cell z is influenced. In order to prevent any light from being thrown onto the cell z, when the apparatus is inoperative, a float h may be arranged in the transparent tube f, as shown in Fig. 7. Obviously, when gases or vapours of decomposition collect in the tube, the float will descend together with the oil and allow the light rays to pass freely across the tube.

The arrangement illustrated in Fig. 7 still involves the disadvantage, that the gases or vapours collecting in the tube, being more or less impervious to light, offer an obstacle to the passage of the light rays. This can be remedied by the arrangement illustrated in Fig. 8, where r is a float immersed in the oil and acting on a double-armed lever pivoted at u and operating a screen y provided in the glass tube. When gas bubbles rise in the oil and collect around the float r, the float will descend and will cause the screen y to be lifted so as to allow light rays to pass across the tube and to meet the cell z. The screen y being constantly surrounded by air will either prevent altogether or else admit the passage of light.

The selenium or photo cell can be lighted by means of any suitable source of light which may also be constituted by a non-luminous Bunsen flame, which will emit light when in contact with the gases or vapours of decomposition.

The variations of current in the circuit enclosing the selenium or other cell can also be utilized for actuating means, whereby carbon dioxide gas or other inert gases are admitted from separate containers into the apparatus or rooms to be protected, in order to prevent conflagration or to stifle same. It is, however, also possible to throw out the endangered transformer and to throw in another one or to stop the excitation of the generator and so on.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

I claim:

1. Electrical protective system for insulated electrical apparatus comprising a protective circuit, a selenium cell inserted in said circuit, a lens system and a source of light in front of said cell and partly transparent means for directing gases of decomposition developed in the insulation in consequence of abnormal conditions of working of said apparatus between said lens system and said source of light including a float.

2. Electrical protective system for insulated electrical apparatus comprising a protective circuit, a selenium cell inserted in said circuit, a lens system and a source of light in front of said cell and partly transparent means for directing gases of decomposition developed in the insulation in consequence of abnormal conditions of working of said apparatus between said lens system and said source of light including a float and a screen influenced by said float.

3. The combination with an insulated electric apparatus, of a protective system comprising an electric circuit, a light responsive means in said circuit, a source of light in front of said means, and a chamber associated with said apparatus to receive the accumulation of gases of decomposition of the insulation developed in consequence of abnormal working conditions of said apparatus, said accumulated gases being operative to effect a variation of light transmitted to said light responsive means to thereby render the protective circuit operative.

4. The combination with an insulated elec-

tric apparatus, of a protective system comprising an electric circuit, a light responsive means in said circuit, a source of light in front of said means, and a chamber associated with said apparatus, means interposed between the light and the light responsive means normally screening the latter from the light, and gas collecting means associated with said apparatus, the presence of gas in which acts to render said screening means inoperative upon accumulation of gases of decomposition of the insulation developed in consequence of abnormal working conditions of said apparatus.

5. A protective system for liquid insulated electric apparatus comprising a receptacle containing liquid surrounding the apparatus, an electrical protective circuit, a light responsive means in said circuit, a lens system and a source of light in front of said means, a float member controlling the transmission of light to the light responsive means, and a supplemental chamber above the level of liquid in the receptacle and in which gases of decomposition developed in consequence of the abnormal working conditions of said apparatus may collect, said float member being operable incident to collection of the gases in the chamber to render said light responsive means operative in relation to the protective circuit.

6. A protective system for liquid insulated electric apparatus comprising a receptable containing liquid surrounding the apparatus, an electrical protective circuit, a light responsive means in said circuit, a lens system and a source of light in front of said means, a screening member interposed between the light and the light responsive means normally screening the latter from the light, a float member operatively connected to said screening means, and a supplemental chamber communicating with the receptacle and arranged above the level of liquid therein in which gases of decomposition developed in consequence of the abnormal working conditions of the apparatus may collect to effect a displacement of the float member with a corresponding displacement of the screening member to render said light responsive means operative in relation to the protective circuit.

In testimony whereof I affix my signature.

MAX BUCHHOLZ.