Jan. 1, 1929. 1,697,141

C. J. RODMAN ET AL

ELECTRICAL APPARATUS

Filed March 18, 1925

Fig. 1.

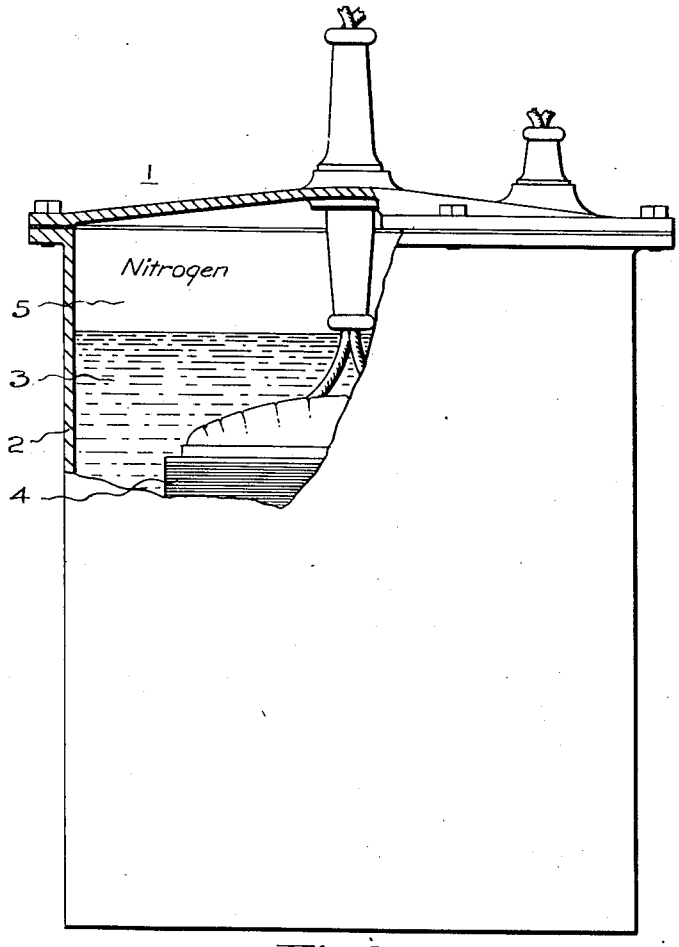
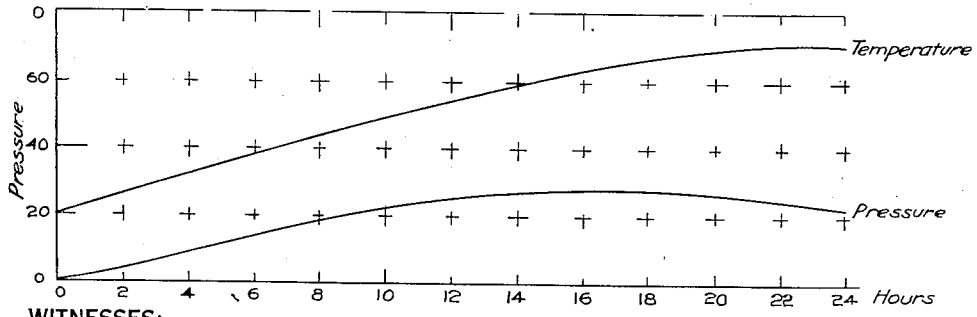


Fig. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CLARENCE J. RODMAN AND AYLMER H. MAUDE, OF WILKINSBURG, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

ELECTRICAL APPARATUS.

Application filed March 18, 1925. Serial No. 16,337.

Our invention relates to electrical apparatus and particularly to oil-filled transformers.

One object of our invention is to provide an electrical device that shall have an air-tight enclosure within which the pressure is maintained within predetermined ranges.

Another object of our invention is to provide an electrical device that is air-tight and partially filled with an inert gas and in which the pressure is maintained within predetermined limits during increases in temperature thereof by reason of the absorption of a quantity of gas by the insulating oil.

It is also an object of our invention to provide a method for maintaining the pressure within air-tight transformers and the like within predetermined limits by partially filling the transformer with insulating oil and then sealing within the transformer a body of gas, the coefficient of solubility of which increases with increases of temperature of the oil.

We have found that it is possible to permanently seal an electrical translating device, such as a transformer, with predetermined quantities of insulating oil and gas therein, the relative volumes of which are dependent upon the characteristic heating curve of the electrical translating devices. The rate of absorption of the gas by the insulating oil is dependent upon the increases in pressure of the oil and gas by reason of the increased temperature thereof whereby an equilibrium is obtained. We have found that nitrogen is suitable for the purposes of this invention.

In the accompanying drawings,

Figure 1 is a view, partially in elevation and partially in section, of a transformer embodying our invention.

Fig. 2 is a curve showing the relation between the temperature of the device and the pressure therein.

Our invention comprises, in general, an electrical translating device 1, such a transformer, comprising a tank 2 that is partially filled with an insulating oil 3 surrounding and covering electrical windings 4, while above the surface of the oil 2 there is confined an inert gas 5, the solubility of which increases with increases of temperature of the insulating oil 3. The gas 5 is preferably nitrogen.

At 25° C. ordinary insulating oil absorbs .0925 volumes of nitrogen gas, while at 80° C. the same oil absorbs .1185 volumes of nitrogen. The volume of the inert gas 5 should be at least 10% of the volume of the tank 2.

Referring to Fig. 2, it will be seen that as the temperature of the oil uniformly increases the gaseous pressure within the tank increases at a gradually diminishing rate. This shows that the absorption of the nitrogen by the oil is taking place at an increased rate. When the temperature has nearly reached its maximum it will be seen that the pressure commences to fall owing to the continued absorption of the gas more than counterbalancing the thermal expansion of the gas and oil.

In large power transformers, the time necessary for the windings 4 to reach their maximum temperature, under normal loads, is approximately twenty hours. However, this time is subject to variations by reason of the fluctuating character of the loads imposed upon such devices.

It will thus be seen that we have provided an air-tight casing for an apparatus in which the pressure is maintained within predetermined limits, without the provision of auxiliary apparatus, by filling such casing with oil and a gas, the absorption of which by the oil increases with increasing temperature.

We do not wish to be restricted to the specific arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of our invention. We desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

We claim as our invention:

1. In combination, an air-tight container, a body of oil partially filling the container, a heat-generating device immersed in the oil and a body of gas whose coefficient of solubility in the oil increases with increases of temperature in communication with the oil in the container.

2. In combination, a valveless air-tight container, a body of oil partially filling the container, an electrical translating device immersed in the oil, and a body of gas whose coefficient of solubility in the oil increases with increases of temperature confined above the oil in the container.

3. In combination, a hermetically sealed container, a body of oil partially filling the

container, an electrical translating device immersed in the oil, and a body of gas whose coefficient of solubility in the oil increases with increases of temperature confined above the oil in the container, the normal volume of gas being dependent upon the thermal characteristic curve of the translating device.

4. In combination, a hermetically sealed container, a body of oil partially filling the container, an electrical translating device immersed in the oil, and a body of nitrogen gas confined above the oil in the container, the normal volume of the nitrogen gas being dependent upon the thermal characteristic curve of the translating device.

5. The method of controlling the pressure in an air-tight casing containing a heat-generating device and partially filled with oil, which consists in confining in the casing a gas whose coefficient of solubility in the oil increases with the increases of temperature thereof.

6. The method of controlling the pressure in an air-tight casing containing a heat-generating device and partially filled with oil, which consists in confining in said casing a gas whose coefficient of solubility in the oil increases with the increase of the temperature thereof and in a volume that is dependent upon the thermal cycle of the oil.

In testimony whereof, we have hereunto subscribed our names this 28th day of February, 1925.

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