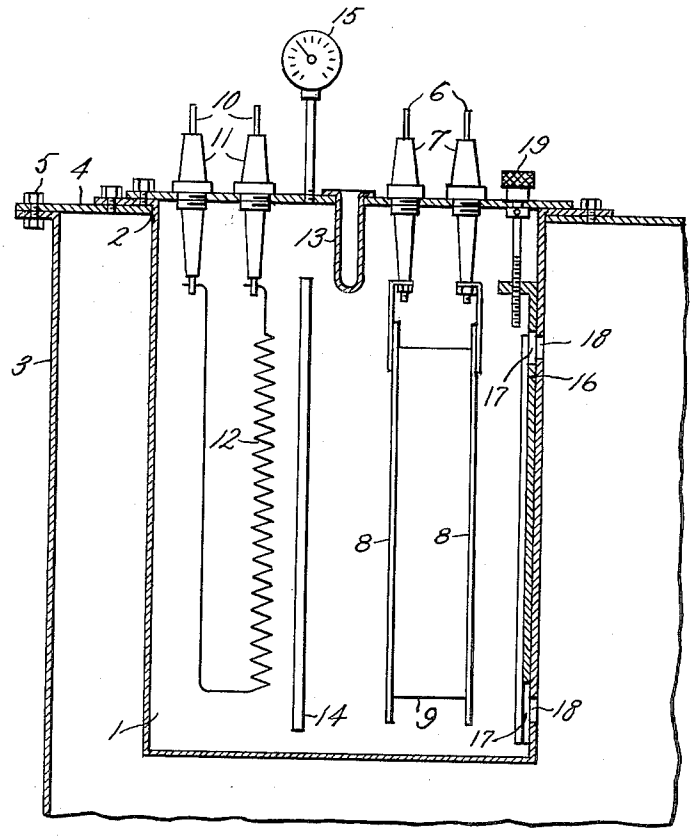
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MEASUREMENT OF MOISTURE IN ELECTRIC TRANSFORMERS

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MEASUREMENT OF MOISTURE IN ELECTRIC TRANSFORMERS

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3 Claims. (Cl. 73—73)

1

This invention relates to electric transformers and more particularly to devices for facilitating the accurate determination of the dryness of large transformers particularly on arrival on site or after a prolonged storage.

It is essential to ensure that large power transformers for high-voltage transmission are thoroughly dry before being put into service. Increased unit ratings coupled with weight restrictions tend to prohibit the practice of transporting the transformers in an oil-filled condition. Consequently, in the manufacturers' Works, the transformers are thoroughly dried out, filled with dry air or inert gas and sealed. On arrival at site, even although the gas seal is apparently intact, it is essential to ensure that there has been no ingress of moisture during transport or storage.

It has been found that power factor measurements on transformer insulation at ambient temperatures do not give a positive indication of dryness since factors other than moisture content enter into a determination of power factor. To obtain such an indication, it is essential to take measurements at elevated temperatures. In some cases the difference between the power factor measured at ambient temperature and at an elevated temperature determines the moisture content. This process, particularly at uncompleted sites, is complex, costly, and tedious.

An object of this invention broadly is to provide a power transformer with a device, known as a "dryness image device" which after transport or prolonged storage can be used to detect the dryness of the transformer in a simple and convenient manner.

More particularly the object of the invention is to avoid having to make such measurements on the actual transformer, on site, by providing a small, simplified winding dryness image device. This device is fitted into, and dried out with the transformer when manufacture is completed. Power factor curves are taken both on the transformer proper and on the image device. These act as a reference datum. During transport, the image device is open to the gas atmosphere within the transformer. On arrival at site, either before, and/or after oil-filling, the device is sealed, removed from the transformer and taken to the nearest laboratory for power factor test, or if facilities are available the device may be left on the transformer for these tests. A heating coil is fitted into the device so that measurement of power factor over the desired range of temperatures may be taken. The meaning of the results can then be deduced from corresponding data obtained in the manufacturers' Works.

2

The dryness image device consists of an insulation "image" encompassed wholly or partly by appropriately shaped electrodes. The image and electrodes may take various forms dependent upon the insulation design of the transformer to which it is fitted.

The accompanying drawing shows a simple diagrammatic arrangement. In essence the device comprises a container 1 which can be mounted in an opening 2 in a wall of a power transformer tank 3 by means of ears 4 and bolts 5. This container is fitted with terminals 6 connected through sealed insulating bushings 7 to electrodes 8 of the device between which is a quantity of any suitable moisture-sensitive solid insulation 9. Terminals 10 are connected through sealed insulating bushings 11 to a resistance heater coil 12 mounted within the device. The arrangement may have provision for temperature measurement by sealed thermometer pockets as at 13, by calibration against heater current or by other known forms. Arrangements may be made for suitable baffle and draught control as by member 14 and for measuring the pressure within the container as by pressure gauge 15 since the vaporization of volatile matter by the application of heat can increase the internal pressure. The casing can be opened or sealed from a point exteriorly thereof by means of a valve plate 16 having ports 17 for cooperation with openings 18 in the casing. A screw assembly 19 permits raising and lowering plate 16 so as selectively to cover and uncover openings 18.

The power factor can be determined by applying a fixed potential, e. g. 3000 volts, across the terminals 6 and determining the ohmic losses across the insulation 9 by means of a conventional bridge circuit. High losses indicate a high power factor.

While I have shown particularly embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical insulation dryness image device for indirect testing of the dryness of the insulation of a large high voltage power transformer comprising, in combination, a casing provided with means for removably fastening it in

an aperture in a power transformer tank, means accessible from outside said casing when it is installed in such a tank for selectively opening said casing for communication with the interior of said tank and sealing said casing, a pair of electrodes in said casing separated by solid insulation of the type used in power transformers, a resistance heater in said casing, and insulated conductor leads connected respectively to said electrodes and heater and extending in a sealed manner through a wall of said casing.

2. An electrical insulation dryness image device as defined in claim 1 in which there is a thermal barrier between the solid insulation and the resistance heater.

3. An electrical insulation dryness image device as defined in claim 1 provided with means accessible from outside the casing for indicating the pressure within the casing.

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