July 10, 1962 F. REISINGER 3,043,900

TRANSFORMER

Filed June 30, 1959

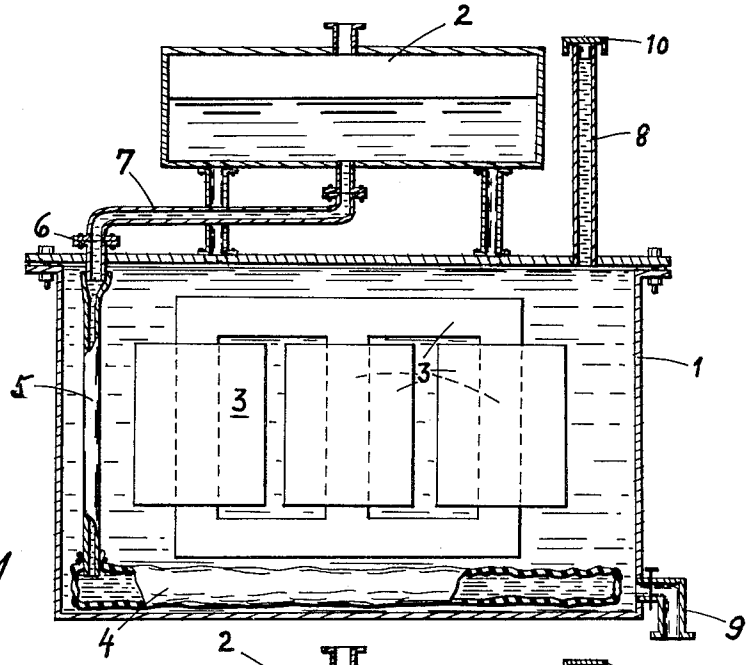


Fig. 1

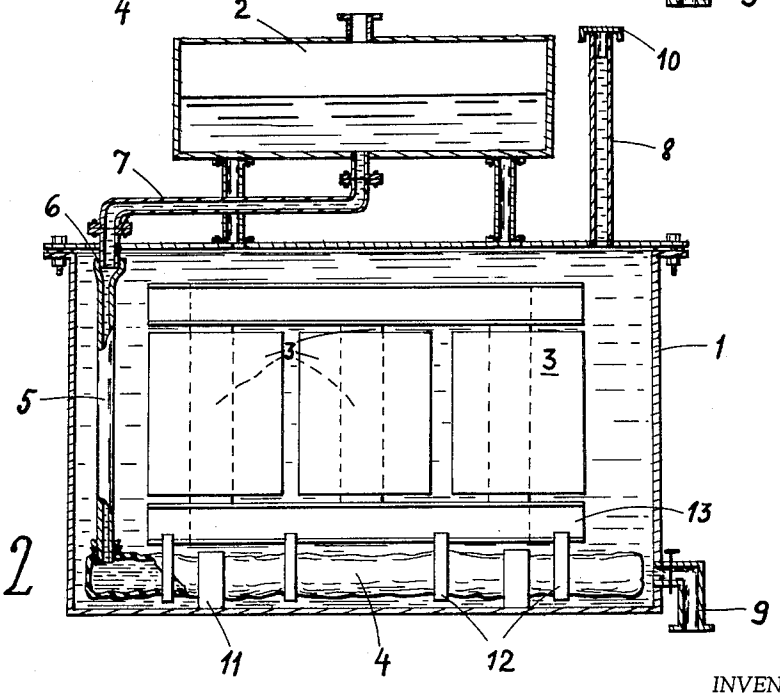


Fig. 2

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TRANSFORMER

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In transformers it is well known to use an expansion tank arranged at the height of the bushings, which serves to compensate for the differences of the oil volumes according to the different operating temperatures during action.

Air-drying apparatus well known in transformers for great capacity are not suitable for distributing transformers, necessitating permanent service and surveillance. Therefore in distributing transformers the oil level of the expansion tank has an immediate contact with the outside air and the oil having a rather high temperature in the expansion tank absorbs greedily the humidity of the outer air deteriorating its electrical-insulation value. The atmospheric oxygen absorbed by the transformer oil adds to the aging of the oil. Frequent oil-changing is necessary for these transformers to prevent heavy damage resulting from deteriorated oil. According to the fluctuation of the oil volume and thus of the oil level, the inner walls of the expansion tank become attacked alternately by the transformer oil and by the atmospheric oxygen, causing condensation resulting in heavy corrosion. In these distributing transformers particles of the corrosive incrustations loosened from the walls arrive into the oil tank and to the windings often causing heavy damage. The loosening of the particles is advanced by the frequent change in location as it is usual with distributing transformers.

It is also known to avoid the disadvantage resulting from breathing of the transformer, apart from the use of the above mentioned drying means, as for instance silicagel, by providing a cushion of nitrogen above the oil level or to seal off the oil volume by a rubber membrane, said membrane curving down or up from a mid-position, according to the oil temperature and thus of the oil level. The attachment of the membrane is subject to a special (two-part) structure of the expansion tank. The inventive arrangement avoids the above described disadvantages which involve expensive air-drying apparatus requiring permanent service and surveillance and removing only the injuirous influence of the atmospheric moisture. The harmful influence of the atmospheric oxygen is not taken into account by these air-drying apparatus.

The invention also does not need a special structure of the expansion tank.

The chief object of the invention is to seal off in electrical apparatus, especially transformers and choke coils, the oil volume differing according to the oil temperature. The oil volume is sealed off with respect to the atmosphere by providing an oil-filled sack-like expansion body arranged in dead spaces of the transformer housing, especially near the bottom of the housing between the structural members supporting the active parts of the electrical transformer. The expansion body is made of a well extensible and foldable, oil-resistant material which is impermeable to gas and which is connected by means of a hose line to an open expansion tank of the well known type arranged above the housing. The housing has a filling pipe reaching up to the height of the upper edge of the expansion tank. The advantages of the inventive arrangement will become apparent from the following description and the accompanying drawing. The novel features which characterize the invention will be pointed out in the claims annexed to this specification.

In the drawing, FIG. 1 shows one embodiment of the

electrical transformer system in elevation and partly in section, and FIG. 2 is a similar view of a modified arrangement according to the invention.

In FIG. 1, the expansion tank **2** is arranged above the transformer housing **1**. Within the housing there are the windings and core **3** arranged in a manner which is not described in detail. In the illustrated embodiment, the expansion body **4** is arranged between the housing bottom and the lower core yoke. The body **4** therefore occupies a space generally not important for the cooling or the insulating of the transformer. The hose line **5** joins the body **4** to the lead-in **6** and the usual pipe line **7** is connected to the expansion tank **2**. Moreover the filling pipe **8** serving to fill with oil the whole transformer housing is arranged on the cover of the housing. Pipe **8** is hermetically closed by a cap **10**. On the pipe, there can be provided a high-pressure relief valve or a breaking diaphragm in a well known manner, not illustrated in the drawing. The volume of the expansion body **4** is equal to or greater than the maximum difference of oil volume of the acting oil.

In the following, the oil filling process will be described. By means of pipe **8** the transformer housing becomes filled with oil while the expansion tank is empty. When the housing is completely filled the expansion body **4** is entirely pressed down and its air-volume has escaped by way or the hose line **5**, the pipe **7** and the expansion tank **2**. Then, the opening of pipe **8** is closed by the cap **10** and the expansion tank **2** is being completely filled with oil. When later some oil is being drained by the oil-drain valve **9** at the bottom of the housing, exactly the same oil volume will escape from the expansion tank **2** into the expansion body **4** thereby preserving in every case the complete filling of the transformer housing **1**. At the oil gauge (not illustrated) there are arranged several marks according to the oil levels at various oil temperatures. Knowing the filling temperature of the oil there is defined thereby the amount of oil volume to escape from the expansion tank **2** so as to fill (by opening the oil-drain valve **9** of the transformer housing) the expansion body **4** with exactly the oil volume which is necessary to reach the oil level, that is the special mark, corresponding with the filling temperature and which has to be pressed back to the expansion tank **2** when the oil has reached its highest temperature.

In a favorable embodiment of the device according to the invention, means are provided for connecting the bag **4** with the active transformer part **3**, so that these parts form a unit with the bag, which as a whole can be taken out of the housing **1** when inspection or repair becomes necessary.

This embodiment of the invention is shown in FIG. 2 wherein similar elements are designated by like numerals. In this embodiment a supporting structure **13**, e.g. a plate made of fiber board, is provided for the transformer core **3** which is mounted on wooden blocks **11**. The bag **4** is carried by a number of U-shaped bands **12** anchored in the plate **13**. This arrangement makes it possible to remove the core and bag as a unit.

The advantages of the inventive arrangement are described in the following. The walls of the expansion body consist of a material having a neoprene base. There is no danger for the oil in the transformer housing to become soiled by the oxygen or the atmospheric humidity by way of diffusion through the walls of the expansion body. In the latter the oil is enriched with these impurities as oxygen, atmospheric humidity, or solid particles, but this oil is not in contact with the active oil in the transformer housing. A further advantage by using the inventive arrangement is obtained by eliminating the difficulties arising by the corrosive action on the walls of the expansion tank. The inner walls of the expansion tank have to be treated with a suitable protective agent

against corrosion. It is not necessary to take care of the chemical influences of this protective agent on the oil in the expansion tank, because the oil of the expansion tank never serves to insulate but only for the filling of the expansion body. The insulating quality of this oil is therefore not important.

The invention and its advantages will be understood from the foregoing description. It is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention, the form hereinbefore described and illustrated in the drawing being merely a preferred embodiment thereof and several other forms of application to electrical oil-filled transformers are feasible.

What is claimed is:

1. An electrical transformer system having a housing with a cover and an oil-drain valve at the bottom; pipe means for filling the housing to capacity with oil and including a high-pressure relief valve, said system comprising a core and coil assembly submerged in the oil, said oil being completely enclosed in said housing and sealed off from the outer air, an expansion tank arranged above the housing, said expansion tank being filled with oil and having communication with the surrounding atmosphere, a bag-like expansion body arranged in the interior of said housing at a dead space between structural members supporting the active transformer parts and consisting of extensible, and pliable, oil-resistant and gas-impermeable material, the interior of said bag being completely shut off from contact with the oil in said casing, and means being provided for connecting said bag-like body with said expansion tank for at least partly filling the bag with oil from the expansion tank for equalizing the differences of oil volume at different operating temperatures, said connecting means including a hose line made of similar material to that of the expansion body, a lead-in pipe connected to said hose line, and pipe means for connecting said lead-in pipe to said expansion tank.

2. An electrical transformer system according to claim 1, wherein means are provided for attaching said bag-like expansion body to said transformer within the housing, so as to form a unit, said unit being suitable for lifting out of the housing as a whole.

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