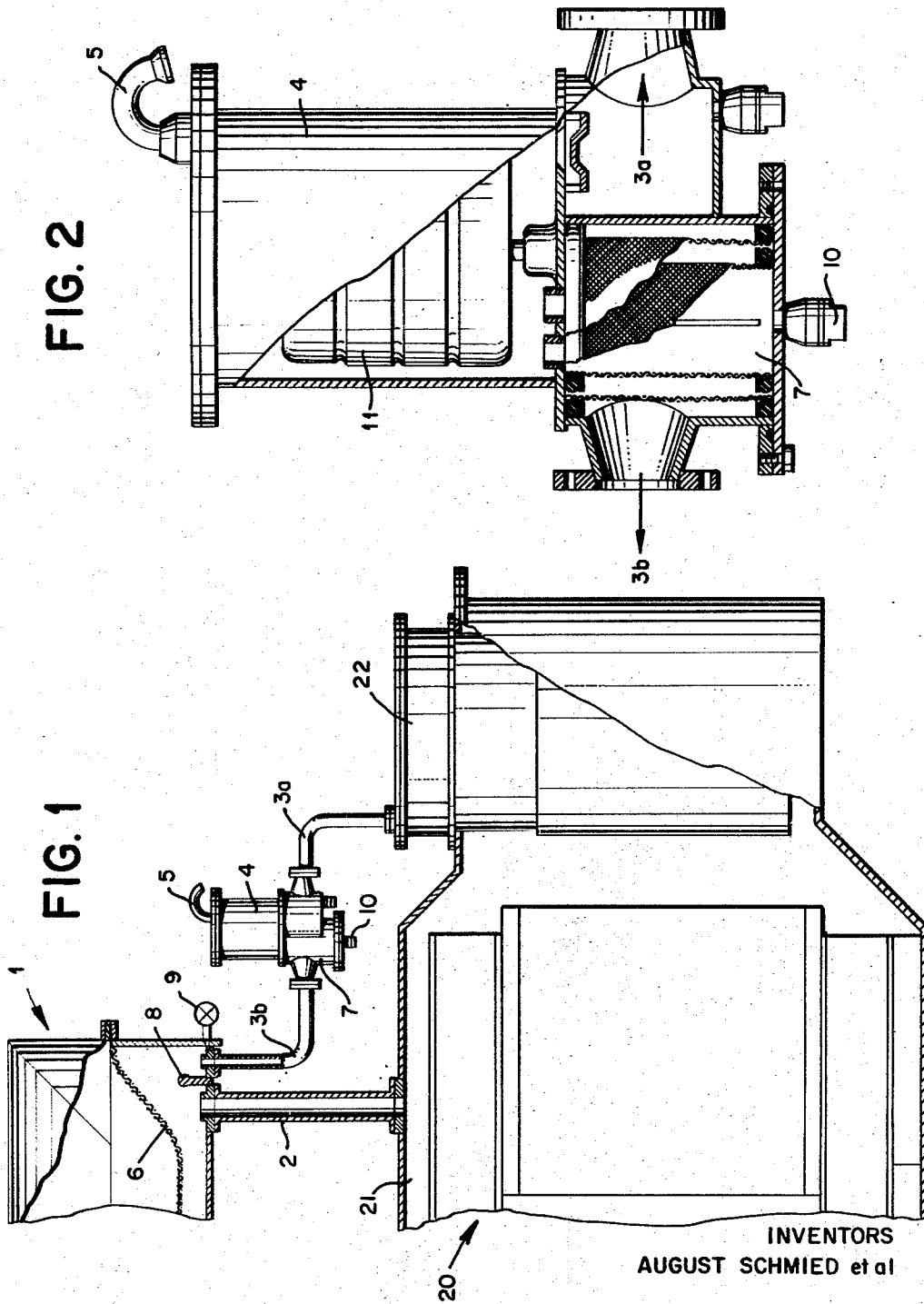


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REGULATING TRANSFORMER
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REGULATING TRANSFORMER

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5 Claims. (Cl. 336—58)

In regulating transformers, it is a general practice to have the tap changing equipment submerged in the transformer tank. A special problem in such regulating transformers is to separate the oil volume of the transfer switch casing, contaminated as a result of switching operations, from the remaining transformer oil.

For this purpose, it is known to subdivide the conservator or oil expansion tank and to allot its smaller part or section to the oil filling of the tap changer or transfer switch casing, for receiving the volume variations of said oil filling. The volume of the on-load tap changer oil being thus separated from the remaining, actual transformer oil is sometimes filtered by a circulation process.

In accordance with a recent proposal according to German Patent application 1,101,607, to Licentia G.m.b.H., laid open to public inspection on March 9, 1961, the circulation of the tap changer oil through a filtering apparatus is automatically initiated, depending on the degree of the oil contamination. In order to enable the gases, resulting from arcing under oil, to be released into the atmosphere, the expansion tank part allotted to the on-load tap changer oil generally communicates with the outside air.

The oil level of the expansion tank part which receives the fluctuations of the transformer tank oil volume, however, is in many cases protected against contact with the outside air by an inert gas shield or by covering the same with an elastic diaphragm. In doing so, however, the disadvantage results that the oil volume of the on-load tap changer comes into contact with the atmosphere and, therefore, absorbs oxygen and hydrogen. It should be noted that working conditions may occur under which a higher oil level results in the section of the expansion tank which is allotted to the on-load tap changer than in the remaining section of the conservator. Also, the sealing off of the tap changer casing or container against the surrounding tank oil can be judged as being only drip-proof, at least for a prolonged time. Under such conditions, the differences of oil levels between the expansion tank sections will allow the oil of the on-load tap changer casing to leak off into the transformer tank, contaminating the latter.

A static pressure head with reversed direction may also cause tank oil to enter the tap casing, which casing is undesirable with regard to regular operation. A pressure head in said direction results mostly if the tank oil level is shielded or covered by an inert gas layer or cushion, and/or the tank oil has a much higher temperature than the oil of the on-load tap changer container.

Furthermore, it is known to provide an inert gas shielding for both oil levels of the expansion tank in order to protect also the tap changer oil against absorption of oxygen and hydrogen and to prevent the occurrence of a reversed pressure head. In doing so, however, measures must be taken to drain off switching gases ascending from the on-load tap changer before they enter the expansion tank as otherwise they would mix with the inert gas shielding.

A known expedient to this end is to provide an exhaust valve, inserted into the oil pipe leading from the transfer switch casing to the expansion tank, by which the gas

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bubbles ascending in this pipe are gathered and discharged into the atmosphere (see U.S. Patent No. 2,960,672, to Kowatschitsch et al., entitled "Transformer"). Even in doing so it is not possible entirely to eliminate pressure differences as under certain operating conditions level differences can still result between the tank oil and the transfer switch oil, and therewith a pressure head may build up in the one or the other direction owing to the different volumes of the tank oil and the transfer switch oil, and also owing to the different temperatures. It is, therefore, possible that the transfer switch oil, no longer contaminated by the absorption of oxygen or hydrogen but by residues of the switching process (the contact burning off), passes into the transformer tank, and conversely, the tank oil seeps into the transfer switch casing. Even if no other disadvantages result under changed operating conditions, the pressure head between the transfer switch casing and the transformer tank will necessarily increase.

It is the object of this invention to avoid the disadvantages indicated above. This invention relates to a regulating transformer, the on-load tap changer of which is submerged into the transformer tank, the casing of its transfer switch being only drip-proof with respect to the surrounding tank oil, and an exhaust valve being inserted into the oil pipe leading from the transfer switch casing to the expansion tank.

In accordance with this invention there is provided a non-subdivided expansion tank common to both the tank oil and the transfer switch oil, the oil level in said expansion tank being shielded against the outside air by an inert gas cushion or by an elastic diaphragm, and an oil filter being inserted into the oil pipe leading from the transfer switch casing to the expansion tank.

According to a preferred embodiment, it is best to combine the oil filter with the exhaust valve provided for the existing gas bubbles resulting from the switching operations.

This invention will be explained in more detail with reference to the sole figure of the accompanying drawing.

In the drawing, 1 indicates an expansion tank of a transformer, generally identified by numeral 20, while 2, 3a and 3b are oil pipes leading from said expansion tank 1 to a transformer tank 21 and to a transfer switch casing 22, respectively. In a conventional manner, the casing 22 lodges a selector switch and/or an on-load tap changer, both being known per se for regulating transformers of the described type. As it is known from the above-mentioned U.S. Patent No. 2,960,672 an exhaust valve 4 is inserted between the pipe sections 3a and 3b. This is usually a float valve in the upper part of which gas bubbles may gather until gas pressure exceeds the buoyancy of a float 11, and a disk valve is opened by means of a lever arrangement 12, thus allowing the gathered bubbles to escape through a pipe 5 to the outside air. At 7 an oil filter is provided in accordance with this invention, which is constructionally combined with the exhaust valve 4.

In the schematically illustrated exemplary embodiment, the oil level within the expansion tank 1 is covered by a diaphragm 6. In order to establish an oil sump where oil contaminations, possibly reaching the expansion tank in spite of filter 7 may deposit, the expansion tank is only subdivided by a low partition wall 8 arranged far below the minimum oil level. An oil drain 9 makes it possible to rinse this part of the expansion tank 1 from time to time, and another oil drain 10 to rinse the filter 7 and the casing of the exhaust valve 4.

As the same pressure (that of an inert gas or of a diaphragm) bears upon the entire oil level in the expansion tank 1, there are no pressure differences caused by external influences which would tend to equalize through leaks of the transfer switch casing 22. Oil escaping from the

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transfer switch casing having passed the filter 7 may flow without disturbance to the common expansion tank 1. On the other hand, an oil volume deficiency in the transfer switch casing 22 may immediately be refilled from the oil volume of the expansion tank 1. In doing so, oil level differences resulting from different oil temperatures, and unavoidable with hitherto known arrangements, as well as a pressure head resulting from said level differences, are also avoided.

In accordance with the invention, a perfect oil shield is achieved, that is to say an oil shield which also includes the oil of the transfer switch casing, without being compelled to satisfy too high requirements as to the tightness of the casing which seals the transfer switch 22 against the oil in tank 21. The only requirement is that the flow resistance of the filter 7 provided in accordance with the present invention, is smaller than that through possible leaks of the transfer switch casing 22. No doubt, this requirement is easy to be fulfilled and to be guaranteed, also in the long run.

What we claim is:

1. In combination, a regulating transformer having its on-load tap changer submerged in the transformer tank, the transfer switch of said tap changer being enclosed in a separate casing sealing off the oil in said transfer switch against the oil in the surrounding transformer tank in a drip-proof manner, an oil pipe leading from said transfer-switch casing to an expansion tank at a level higher than that of said transformer tank, said expansion tank serving for said transfer-switch oil as well as for said transformer-tank oil in its unitary inner space devoid of dividing means that would separate the said two kinds of oils, means for eliminating both gaseous and solid contaminations from said transfer-switch oil, resulting from switching operations within said transfer-switch casing, said eliminating means being inserted in said oil pipe, and including an exhaust valve and an oil filter, the latter being structurally combined with said exhaust valve and disposed at a level lower than that of said exhaust valve, the latter serving to exhaust gas bubbles resulting from said switching operations while said oil filter serves to eliminate solid contaminations resulting from said switch-

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ing operations, and means to shield the oil level in said expansion tank against the atmosphere.

2. The regulating transformer as defined in claim 1, wherein said shielding means is constituted by a layer of inert gas resting above said oil level in said expansion tank, and including both said transfer-switch oil and said transformer-tank oil.

3. The regulating transformer as defined in claim 1, wherein said shielding means is constituted by an elastic diaphragm resting above said oil level in said expansion tank, and including both said transfer-switch oil and said transformer-tank oil.

4. The regulating transformer as defined in claim 1, further comprising a second oil pipe leading from said transformer tank to said expansion tank, and wall means in said expansion tank, intermediate the ends of said first-named and said second oil pipes, said wall means extending only to a height substantially below the minimum oil level in said expansion tank, and including both said transfer-switch oil and said transformer-tank oil.

5. The regulating transformer as defined in claim 1, further comprising at least one drain means in said eliminating means and said expansion tank for discharging residues originating from said transfer-switch oil.

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