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TRANSFORMER WITH A BELL-SHAPED COVER AND AN ON-LOAD-TAP-CHANGING DEVICE

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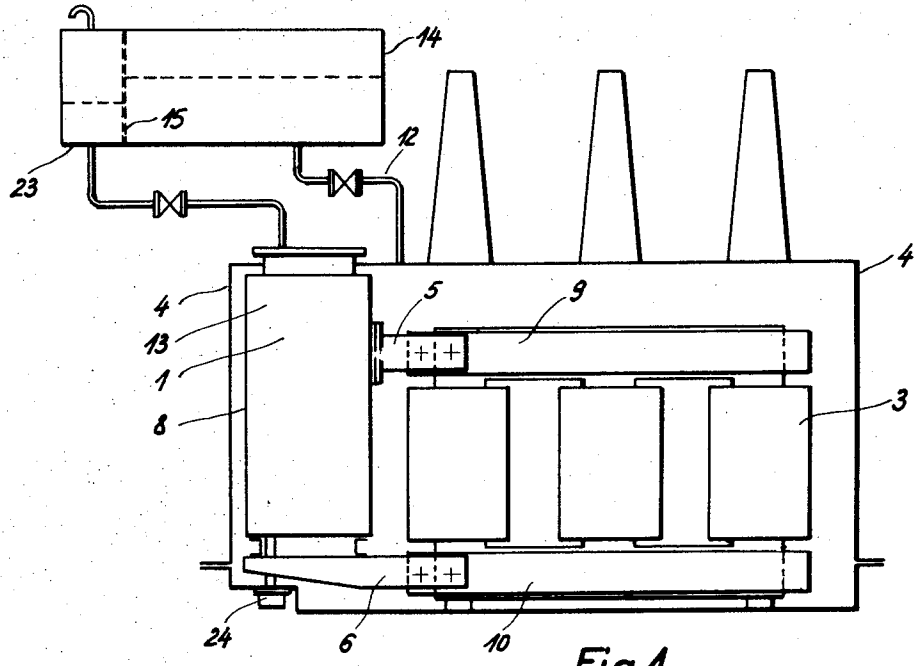


Fig. 1

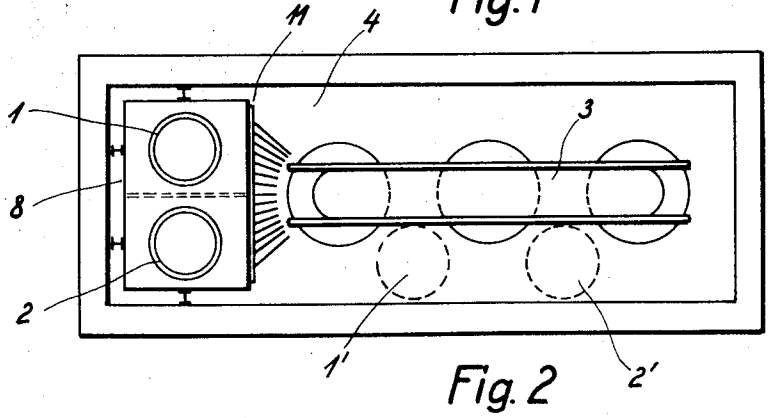


Fig. 2

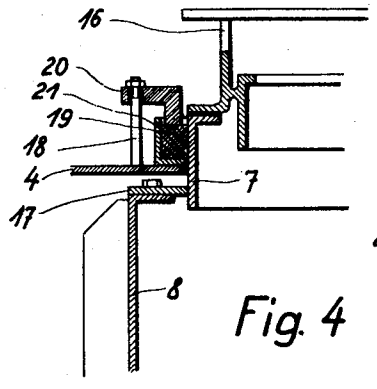


Fig. 4

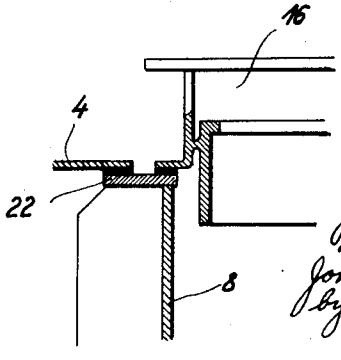


Fig. 3

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TRANSFORMER WITH A BELL-SHAPED COVER AND AN ON-LOAD-TAP-CHANGING DEVICE

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1 Claim. (Cl. 336—10)

The invention relates to transformers with a bell-shaped tank. For raising liquid insulated transformers out of the tank heavy crane facilities are necessary. Where such cranes are not available, there are used bell-shaped covers instead of a tank built as usually. These bell-shaped covers are connected in a fluid-tight manner e.g. by welding with the lower case section. After removing the liquid and disengaging this fluid-tight connection the bell-shaped cover easily may be lifted. In this manner the transformer may be erected, inspected or repaired without the aid of heavy crane facilities.

In particular the invention relates to transformers in a bell-shaped tank, which are electrically connected with an on-load-tap-changing device. Objects of the invention are, to diminish the cost for such an arrangement, to increase its reliability and at the same time to make accessible at least parts of the tap changing device for inspecting, repairing or replacing purposes without lifting the bell-shaped cover. Heretofore on-load-tap-changing devices have been placed above or beside the bell-shaped cover. According to the invention the on-load-tap-changing device is arranged with the transformer under the same bell-shaped cover so, that the electrical connections are not to be carried out of this cover, and there is provided in this cover an opening, allowing of moving in and out at least parts of said on-load-tap-changer without lifting the cover. The tap-changing device or its parts are easily lifted with light crane facilities, whilst instead of lifting the transformer itself, is lifted only the bell-shaped cover.

The on-load-tap-changing device may be placed in known manner in one or more chambers, which preferably are at least partly filled with its own insulating liquid and if necessary are sealed against the surrounding insulating liquid of the transformer. There may be provided separate expansion chambers for the transformer and the tap-changing device and the expansion chamber of the transformer may be sealed off from the outside air and filled with an inert gas, such as nitrogen, instead of air. These and further developments of the invention are described with reference to the embodiments shown by way of example in the annexed drawing.

Fig. 1 is a vertical transverse sectional view of regulating transformer according to this invention with only one tap-changing unit.

Fig. 2 is a plan view of a regulating transformer according to this invention with two tap-changing units.

Figs. 3 and 4 are forms of constructions for sealing the tap-changer against the bell-shaped-transformer tank.

According to Fig. 1 of the drawings, the tap-changer **1** is placed in a sheet metal case **8**, which may be round, oval or angular and which is, if necessary, at least partly sealed against the insulating fluid of the transformer. The tap-changer **1** and its housing **8** is supported by suitable bracket members **5** and **6**, which are mounted upon the end frames (pressure plates) of the yokes **9** and **10** of the three-phase-transformer **3**.

Sometimes it may be advantageous to set up the housing

containing the tap-changer on the bottom of the lower case section or/and to strut the housing against the walls of the transformer tank, as it is shown in Fig. 2. Attachments of similar manner for tap-changers are known and described in the Austrian patent specification No. 162,526 and the German patent specification No. 676,208.

According to this invention, transformer and tap-changer in question are both enveloped by a common bell-shaped tank **4**, which has an opening at the place of the tap-changer. In such manner it is allowed to get at the tap-changer without lifting the bell-shaped case section after breaking the sealing between it and the lower case section.

Fig. 1 shows an arrangement with only one on-load-tap-changing unit for a three-phase transformer. This unit must be therefore a three-phase on-load-tap changer, arranged in the neutral point (zero point) of a star-connected transformer winding, e.g. a tap-changer with a transfer switch according to German patent specification No. 707,188. As to the transformer shown in Fig. 2 it is assumed that the winding to be regulated is delta-connected. In this case there are generally used three single-pole on-load-tap-changer units, each having a different potential. According to the invention in order to facilitate the installation of the tap-changing device there are used only two units **1**, **2** instead of three. This is accomplished by arranging two of the three single-pole tap-changing devices for the three phases of the transformer winding in the same angle, i.e. on the same potential of the delta-connection, so that they may be joined to one unit regulating two phases, whilst the tap-changer for the third phase, representing the second unit, is placed in one of the two other angles of the delta-connection. These two units **1**, **2** just as the unit **1** in Fig. 1 may be three-phase-zero-point-on-load-tap-changing devices constructed in the ordinary manner, only two or one of the three phases being used, the others eventually remaining as spares. The two units **1**, **2** may be arranged side by side or eventually in a common casing on the small side of the transformer tank, as shown in Fig. 2. Alternatively they may be placed, as indicated in Fig. 2 by the dotted circles **1'** and **2'**, laterally in the spaces between the first and second and between the second and third leg of the transformer, thus diminishing the over-all length of the transformer tank and the length of the electrical connections between the winding and the tap-changing devices.

An expansion or conservator tank **14** is provided which communicates with the main tank by way of a pipe **12**. In the pipe **12** a Buchholtz-relay may be installed.

In the exemplified embodiment it is assumed, that the expansion tank **14** is only partially filled with oil and the interior of the expansion tank above the oil level is filled with an inert gas, usually nitrogen, as is known to those skilled in this art, to avoid the destructive influence of the atmosphere on the quality of the insulating fluid. On the contrary the expansion device (**23** or an expansion device, which is common to both the tap-changing devices **1** and **2**, which are sealed for oneself alone), must be in communication with the atmosphere, as shown, in order to allow the escape of the gases originated by switching under load through the liquid in the expansion device. Both the expansion devices **14** and **23** may also be united to a single container with a barrier **15**, which is hermetically installed. The housings **8**, containing the tap-changing devices **1**, **2** are also hermetically sealed against the insulating liquid of the transformer. The connections between tap-changer and transformer winding are led through insulating walls **11**

of the containers 8, which are turned towards the transformer.

The sealing of the tap-changer device against the bell-shaped tank may be attained according to Fig. 3 by tightening the top armature 16 of the tap changer on the broad flange 22 of the housing 8 with a washer and by connecting this housing by means of said flange 22 and a washer with the bell-shaped tank 4, which may be lifted if this connection is loosened.

In case the tap-changer container is supported on its lower part in a manner described in the foregoing, the container may be sealed against the bell-shaped tank by means of a stuffing box packing allowing of a relative moving against the bell-shaped tank, caused e.g. by thermal expansions, at least in vertical direction, as is shown in Fig. 4. According to Fig. 4 the top armature 16 of the tap changer, which usually extends out of the bell-shaped tank, is screwed on a collar-shaped member 7, a washer being interposed, and said member 7 is screwed on the container 8 of the tap-changer. On the bell-shaped tank 4 a washer 19 is placed between two pressure rings 20 and 21, which is pressed to the collar-shaped member 7 by tightening the nuts of bolts 18, which are welded on the bell-shaped tank 4, thus effecting the sealing.

By placing the tap-changing device in one or two hermetically sealed containers 8 there is not only avoided to deteriorate the insulating liquid by switching operations but also to squeeze out the oil of the tap-changer along the operating shaft by excessive pressure in the transformer case.

Furthermore, said operating shaft may be brought out through a tight and pressure resistant gland in the transformer casing or container for the tap changer.

A drain valve 24 makes it possible, to remove the contaminated insulating fluid (oil) out of the transfer switch or the whole on-load-tap-changing device.

We claim:

A three phase transformer, with a delta-connected winding to be regulated, a tap-changing unit for regulating two phases of the delta connected winding in the same angle of the delta-connection, a second tap-changing unit for regulating the third phase of the delta-connected winding, said transformer resting upon the bottom part of its tank and a bell-shaped cover surrounding the transformer and the two on-load-tap-changing units and at least one opening in said bell-shaped cover allowing of moving in and out at least parts of said on-load-tap-changing units without lifting said bell-shaped cover.

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