

Transformer with a bobbin made of synthetic material.

The invention relates to a transformer comprising a plastics coil former on the hollow winding tube of which windings with different potentials are wound one onto the other between coil flanges which are provided with spacing means to keep the windings axially spaced from the flanges, an insulating layer which extends from flange to flange being provided between the windings.

Particularly in the case of a large potential difference between the primary and the secondary winding, it is essential that the insulation of transformers complies with the safety requirements. Suitable and known steps to achieve this are to separate the windings from one another by means of insulating foils and, in addition, to dimension the air gaps or creepage paths between the primary and secondary windings in conformity with the safety requirements.

The construction should guarantee that the positions of the windings, which dictate the safety clearances, are maintained throughout the manufacturing process and the service life of the product. In prior-art constructions this is effected by inserting insulating parts, such as corrugated spacer rings, in the clearances to be maintained between the windings. Particularly in the case of small transformers the production and mounting of these insulating parts represent a substantial cost factor.

It is an object of the invention to provide a transformer of the kind set forth in which the spacing means are parts of the coil former with winding tube and flanges, so that these parts need not be manufactured and delivered separately.

According to the invention this object is achieved in that the winding nearer the coil-former axis is spaced from the flanges by means of lateral steps provided on the winding tube, and the winding wound on the insulating layer is spaced from the flanges by means of spacing blocks which are connected to the flange areas of the coil former by means of integral hinges and which are swung down onto the insulating layer after said layer has been provided.

The steps provided at the area of the lower winding, in fact being portions of enlarged diameter of the winding tube of the coil former, do not interfere with the

winding process for the lower winding, for example the primary winding. When the lower winding is being wound and when the insulating layer is applied the spacing blocks are pivoted out of the winding space. After the insulating layer has been applied the spacing blocks are pivoted into the winding space. If the upper winding is then
5 arranged in the winding space thus formed for this winding the position of this winding will be secured. The spacing blocks can be folded onto the insulating layer by hand or in an automated fashion.

In a further embodiment of the invention the spacing blocks on one flange are 90° offset relative to those on the other flange. This facilitates the mould
10 construction.

In a further embodiment of the invention the spacing blocks are provided with tongues which point towards the respective opposite flange when the spacing blocks are in the swung down position. The tongues are enveloped at the beginning of the winding process and keep the spacing blocks in their final positions as winding
15 proceeds. Since they adapt themselves to the contour of the winding profile, the flexible tongues prevent the winding from sliding down the spacing blocks, which would reduce the length of the creepage path and thereby impair safety.

In a further embodiment of the invention the tongues comprise a plurality of parallel arms. As a result of the division into parallel arms the tongues are more
20 flexible in the circumferential direction and can better adapt themselves to the curvature of the winding profile.

In a further embodiment of the invention during the provision of the lower winding the spacing blocks are immobilised in the swung-up position by means of breakable limbs, and in a modified embodiment of the invention the limbs have
25 preformed thinner portions in which the limbs are susceptible to break when the spacing blocks are swung down. This ensures that the spacing blocks cannot inadvertently enter the winding space while the lower winding is being wound.

The invention will be described in more detail with reference to the drawing. Therein:

30 Fig. 1 is a sectional view of a coil former of a transformer, which coil former has fixed steps for a lower winding and spacing blocks for an upper winding, which blocks can be pivoted into the winding space, and

Fig. 2 is a plan view of the coil former.

The coil former 1 shown in Fig. 1 has an axis 2 and comprises flanges 3 and 5 (for the sake of clarity the flange 5 is not shown in Fig. 1) interconnected by a hollow winding tube 7. The winding space 9 thus defined between the flanges 3 and 5 is provided with a lower winding 11 and an upper winding 13. Near the flanges 3 and 5 the winding tube 7 has portions 3a and 5a of enlarged diameter, resulting in shoulders 3b and 5b forming steps which define axial boundaries 11a of the lower winding 11. The height of the winding 11 corresponds to the height 15 of the shoulders 3b and 5b. The lower winding 11 wound between the steps 17 and 19 thus fills the winding space 9a.

10 A multiple insulating layer 21 is then wrapped around the lower winding 11 and, in contrast with the lower winding 11, it extends from the flange 3 to the flange 5. Thus, the insulating layer 21 extends beyond the lower winding 11.

The spacing blocks 23 are outside the winding space 9 during the winding of the lower winding 11 and the insulating layer 21. At the flange areas 24 the plastics 15 coil former 1 comprises moulded-on spacing blocks 23, which are connected to the coil former by integral hinges 25. The free front surfaces 27 of the spacing blocks 23 comprise moulded-on tongues 29 which taper towards their distal ends 31 and are divided into parallel arms 34 by the provision of slits 33 (Fig. 2).

After the lower winding 11 and the insulating layer 21 have been wound, 20 the spacing blocks 23 are swung onto the insulating layer 21 in the direction of the arrows 35. This results in a winding space 9b being defined between the insulating layer 21 and the front surfaces 27 which function as shoulders. The swung-down positions of the spacing blocks 23 are denoted by dashed lines in Figs. 1 and 2. The tongues 29 are disposed underneath the lowermost layer of the upper winding 13. This lowermost layer 25 thus retains the spacing blocks 23 in their swung-down positions. The front surfaces 27 define the axial dimension 13a of the upper winding 13.

In this way the safety clearances between the primary winding and the secondary winding in the finished transformer are defined; the spacing blocks 23 need not be manufactured and handled as separate parts, but are present on the coil former 30 and are swung down after the lower winding 11 and the insulating layer 21 have been wound. This can be effected by means of an automated process.

Fig. 2 shows that the spacing blocks 23 on the flange 3 and those on the flange 5 are offset by 90° relative to each other. Wedge-shaped portions 37 moulded-on

at opposite sides of the spacers 23 enable the spacing blocks 23 to be latched in the swung-down positions.

In order to ensure that during the rotation while the lower winding is being formed the spacing blocks cannot perform any uncontrolled movements about their integral hinges, they are initially connected to the respective flanges by means of thin limbs 39. When the spacing blocks are swung into the winding space these limbs are severed, for example by breaking. It is possible to facilitate breaking by means of a preformed thinner portion 41 in the material.

The other elements of the coil former are of conventional construction.

10 Fig. 2 shows, for example connector pins 43 which can be connected to the power supply of the apparatus.

**CLAIMS:**

1. A transformer comprising a plastics coil former on the hollow winding tube (7) of which windings (11, 13) with different potentials are wound one onto the other between coil flanges (3, 5) which are provided with spacing means (17, 19, 23) to keep the windings (11a, 13a) axially spaced from the flanges (3, 5), an insulating layer
5 (21) which extends from flange to flange being provided between the windings (11, 13), characterized in that the winding (11) nearer the coil-former axis is spaced from the flanges (3, 5) by means of fixed spacers (17, 19) provided on the winding tube (7), and the winding (13) wound on the insulating layer (21) is spaced from the flanges (3, 5) by means of spacing blocks (23) which are connected to the flange areas (24) of the coil
10 former by means of integral hinges (25) and which are swung down onto the insulating layer (21) after said layer has been provided.
2. A transformer as claimed in Claim 1, characterized in that the spacing blocks (23) on one flange (3) are 90° offset relative to those on the other flange (5).
3. A transformer as claimed in Claim 1 or 2, characterized in that the
15 spacing blocks (23) are provided with tongues (29) which point towards the respective opposite flange (3, 5) when the spacing blocks (23) are in the swung down position.
4. A transformer as claimed in Claim 3, characterized in that the tongues (29) comprise a plurality of parallel arms.
5. A transformer as claimed in any one of the Claims 1 to 4, characterized
20 in that during the provision of the lower winding the spacing blocks (23) are immobilised in the swung-up position by means of breakable limbs (39).
6. A transformer as claimed in Claim 5, characterized in that the limbs (39) have preformed thinner portions (41) in which the limbs (39) are susceptible to break when the spacing blocks (23) are swung down.