United States Patent [19]

Koh

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[54] **INDUCTIVE COMPONENTS**

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[52] **U.S. Cl.** **336/160,** 336/212, 336/217, 336/234

[51] **Int. Cl.** **H01f 27/24**

[58] **Field of Search** 336/160, 212, 234, 336/214, 215, 216, 217, 83

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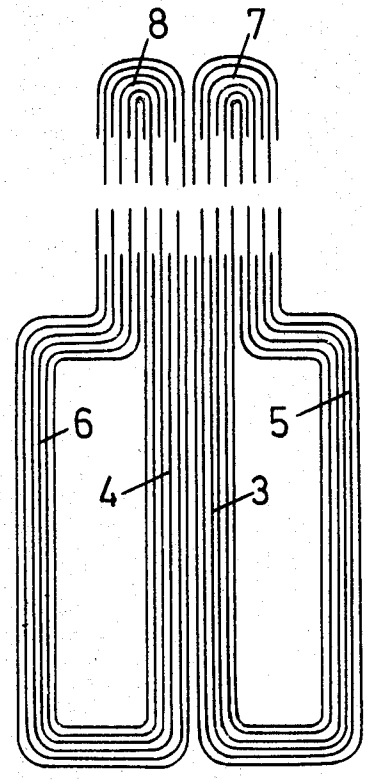
[57] **ABSTRACT**

An inductive component having a central core comprises two stacks of U-shaped laminations disposed side by side so that the adjacent limbs constitute the central core. The outer limbs of the two stacks are bent towards the central core with the laminations at the ends of the outer limbs parallel to those of the central core.

6 Claims, 4 Drawing Figures



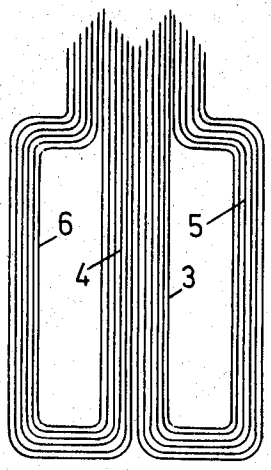


FIG.1

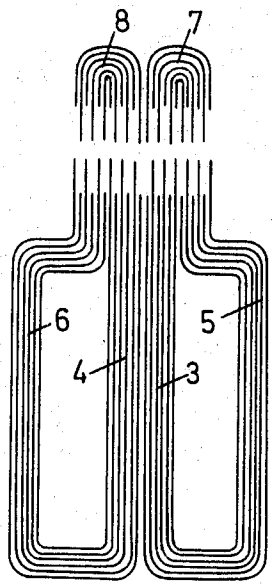


FIG. 2

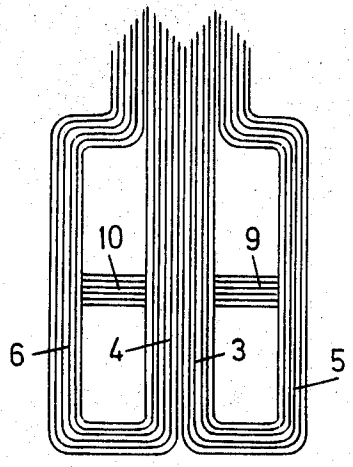


FIG.3

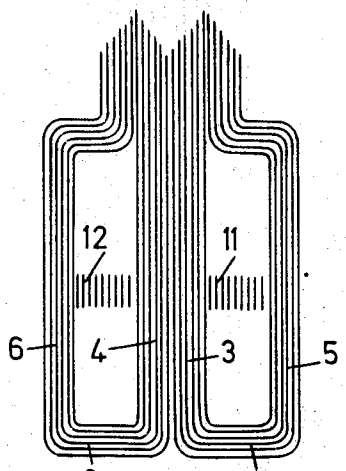


FIG.4

INDUCTIVE COMPONENTS

BACKGROUND OF THE INVENTION

This invention relates to inductive components having cores, such as reactors or chokes, and transformers, such as power transformers or stray-field transformers.

A stray-field transformer is arranged to have a magnetic circuit with substantial leakage. Such transformers are often used for energising discharge lamps and have the advantage that the primary current is limited should the secondary winding be short-circuited. This limitation of the current is due to the high inductive impedance caused by the magnetic leakage. One known type of choke or reactor has two stacks of E-shaped laminations with corresponding limbs of the laminations end to end. A winding is wound around the central core formed by the central limbs of the two stacks of E-shaped laminations. In another known construction, two stacks of U-shaped laminations are placed with their limbs end to end and a winding is fitted around one or both of the limbs of the thereby completed magnetic circuit. These constructions have the disadvantage that they require different blanking tools and dies for cutting laminations for different shapes and sizes of cores. A certain proportion of material has to be wasted in cutting the laminations using the blanking process.

SUMMARY OF THE INVENTION

According to this invention, there is provided an inductive component having a core comprising two stacks of U-shaped laminations disposed side by side so that the adjacent limbs constitute a central core, the outer limbs of the stacks of laminations being bent towards the central core so as to rest against the central core.

In one known core construction for a power or stray-field transformer, there is provided a stack of U-shaped laminations with a central stack of flat laminations resting against the base of the U-shaped laminations. The ends of the U-shaped laminations are bent to engage the outer end of the central stack or are connected thereto by furher laminations. This known construction has the disadvantage that there is a joint in the magnetic circuit in the base of the stack of U-shaped laminations and the central stack where undesirable magnetic losses always occur because it is effectively impossible to produce the base of the U-shaped laminations with a sufficiently flat surface so that the central stack can be placed on it without an air gap. A transformer of any type having a core in accordance with this invention does not suffer from this disadvantage as the central stack is effectively integral with the rest of the magnetic circuit.

A further advantage of a transformer employing a core in accordance with this invention is that it is possible to use laminations of grain-orientated steel which allows magnetic flux to pass more easily in the direction of grain-orientation. In the known construction previously described it is impossible to utilise grain-orientated steel because of the extremely low permeability which would occur at the joint between the base of the stack of U-shaped laminations, and the central stack. However if grain-orientated steel is used for the laminations of a core of a transformer in accordance with this invention, it is necessary to provide "caps" of bent-over laminations to connect magnetically the

outer limbs of the stacks of U-shaped laminations to the central core because of the use of grain-orientated steel there will be low permeability therebetween even if they engage.

Preferably the outer limbs of the stacks of laminations are bent so that the laminations at the ends of the outer limbs are parallel to those of the central core.

It is preferred that the laminations are of grain orientated steel and that the component comprises two further stacks of U-shaped laminations, the ends of the limbs of each further stack being disposed in line with and in engagement with corresponding limbs of an individual one of the first mentioned stacks.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of this invention will now be described, by way of example only, with reference to the accompanying drawings of which each of FIGS. 1 to 4 is a sectional elevation through a core of a transformer in accordance with this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there are provided two adjacent stacks of generally U-shaped laminations 1 and 2 of a suitable magnetic steel, the two limbs 3 and 4 of the stacks 1 and 2 respectively being in contact. The outer limbs 5 and 6 of the stacks of laminations 1 and 2 respectively are bent inwardly in generally Z-formations to rest against the central core formed by the limbs 3 and 4. It will be appreciated that two complete magnetic circuits are formed by the stacks 1 and 2 respectively. The winding is mounted on the central core before the upper ends of the limbs 5 and 6 are bent into Z-formations as shown.

In the embodiment shown in FIG. 2, the stacks 1 and 2 are similar to those shown in FIG. 1 but are of grain-orientated steel so that the magnetic circuits are not completed at the upper ends of the limbs 3, 4, 5 and 6 by the fact that the limbs 3 and 5 and the limbs 4 and 6 respectively are in contact. In order to complete the magnetic circuit two stacks or "caps" 7 and 8 of U-shaped laminations are provided and complete the magnetic circuits of the limbs 3 and 5 and 4 and 6 respectively. As shown in FIG. 2, the ends of the laminations of the limbs 3, 4, 5 and 6 and the stacks 7 and 8 are alternately of different lengths so that the laminations of the stacks or caps 7 and 8 can be fitted into the ends of the laminations of the limbs 3 and 4 and 4 and 6 respectively so as to reduce still further the effective air gap between the stacks or caps 7 and 8 and the stacks 1 and 2 respectively.

The embodiment shown in FIG. 3 is similar to that shown in FIG. 1 with the addition that the limbs 3 and 5 and the limbs 4 and 6 are joined at their mid-points by stacks of laminations 9 and 10 respectively which are transverse to the laminations of the limbs 3 and 5 and 4 and 6 respectively. It will be appreciated that the stacks of laminations 9 and 10 effectively provide leakage and the core shown in FIG. 3 is suitable for a stray-field transformer.

The embodiment shown in FIG. 4 only differs from that shown in FIG. 3 in that the laminations 9 and 10 are replaced by stacks of laminations 11 and 12 which are parallel to the limbs 3 and 5 and 4 and 6 respectively.

I claim:

1. An inductive component having a core comprising:

first and second stacks of U-shaped laminations composed of grain-oriented steel and disposed side by side so that one limb of one of said stacks is placed adjacent one limb of the other one of said stacks to define a central core of said inductive component, the remaining outer limbs of each one of said stacks being bent towards said central core so as to rest thereagainst;

third and fourth stacks of U-shaped laminations of grain-orientated steel having limbs which are disposed in line with corresponding limbs of said first and second stacks respectively, the ends of each of said limbs of said third and fourth stacks being in engagement with the ends of said corresponding limbs of said first and second stacks.

2. An inductive component as claimed in claim 1, wherein said remaining limbs of said stacks of laminations are bent so that the laminations at the ends of said remaining limbs are parallel to those of said central core.

3. An inductive component as claimed in claim 1, wherein the laminations at the ends of said first, second, third and fourth stacks are alternately of different lengths so that projecting laminations formed at the ends of the limbs of each of said third and fourth stacks extend between projecting laminations formed at the ends of said corresponding limbs of said first and second stacks.

4. An inductive component as claimed in claim 1, wherein further laminations extend between intermediate points on the limbs of at least one stack of said first and second stacks.

5. An inductive component as claimed in claim 4 wherein said further laminations are parallel to the laminations of the limbs at those points.

6. An inductive component as claimed in claim 4 wherein said further laminations are normal to the laminations of the limbs at those points.

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