April 24, 1951 M. W. SIMS 2,550,501

GAP BRIDGING LAMINATION FOR NOISE REDUCTION IN MAGNETIC STRUCTURES

Filed Dec. 31, 1949

Fig. 1.

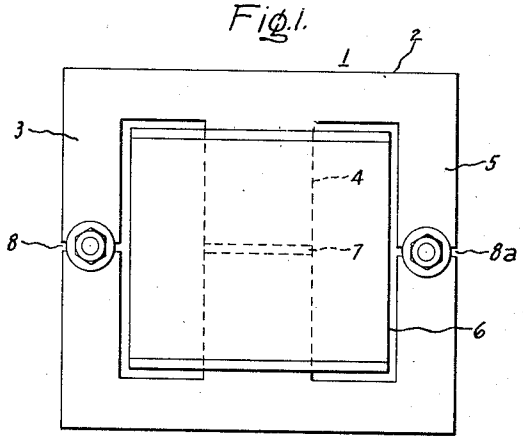


Fig. 2.

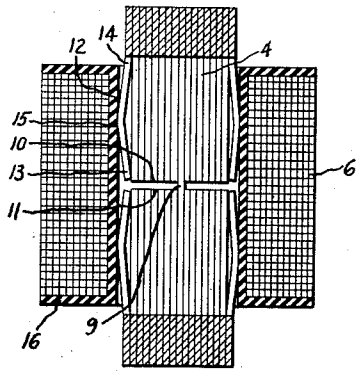


Fig. 3.

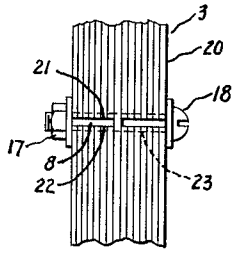
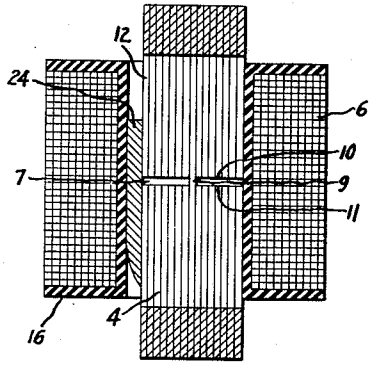


Fig. 4.



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Patented Apr. 24, 1951

2,550,501

UNITED STATES PATENT OFFICE

2,550,501

GAP BRIDGING LAMINATION FOR NOISE REDUCTION IN MAGNETIC STRUCTURES

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Application December 31, 1949, Serial No. 136,197

3 Claims. (Cl. 171—242)

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This invention relates to reactors and other magnetic structures of the type provided with an air gap to interrupt a flux path.

Magnetic structures or reactors having an air gap are frequently used as ballast transformers in conjunction with gas filled tubes of the luminescent variety, such as household fluorescent lamps. It is necessary, in this type lamp, to produce an initial peak voltage to ionize the gas contained within the tube before a flow of electrons can take place that causes the tube to glow. After the initial breakdown, the reactor serves the purpose of limiting the current passing through the lamp.

With the use of air gaps, however, there is also an elastic deformation of the magnetic structure resulting from the pulsating magnetic forces. The elastic deformation produces a noise which, in some circumstances, is very objectionable.

It is an object of this invention to provide a new and improved laminated magnetic structure of the type having an air gap.

It is a further object of this invention to provide a new and improved laminated magnetic structure of the type having an air gap in which the noise level produced by the magnetic forces is considerably reduced.

Broadly, this invention comprises a structure for locking the ends of the magnetic laminations at an air gap to prevent almost all of the elastic deformation of the structure resulting from magnetic forces and thereby reducing noise.

Further objects and advantages of this invention will become apparent and the invention will be more clearly understood from the following description referring to the accompanying drawing, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In the drawing, Fig. 1 is a front view of this new and improved magnetic structure; Fig. 2 is an end view, partly in section, of the central leg of the magnetic structure shown in Fig. 1; Fig. 3 is an end view of one of the outer legs of the magnetic structure; while Fig. 4 is a variation of the embodiment shown in Fig. 2.

While the following description refers to a magnetic structure provided only with a primary winding, it is to be understood that this is by no means to be considered a limitation on the application of this invention, but rather as an example to more clearly demonstrate the purpose which it is intended to serve.

Referring to the drawing, a magnetic structure

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1 is shown, including a core 2 having three parallel legs 3, 4 and 5. A winding 6 is placed around central leg 4 which, in turn, is provided with an air gap 7. Legs 3 and 5 are provided with air gaps 8 and 8a. Air gap 7 in leg 4 is suitably bridged by one or more thin laminations of either magnetic or non-magnetic material 9.

In the normal use of an air gap, such as that shown by 7, wherein the leg, such as 4, is surrounded by a winding 6, the change in direction of magnetic flux through the leg 4 causes a pulsating force at the faces 10 and 11 that produces an audible noise. The use of bridging lamination 9 in conjunction with a structure for rigidly securing pole faces 10 and 11 to the bridging lamination 9 prevents deformation of leg 4 and, consequently, reduces the noise.

It is important that the mean effective length of bridging lamination 9 be kept as short as possible; otherwise, the elasticity of this lamination might be enough to allow deformation of the magnetic structure and thereby produce a noise. To achieve this end, in the preferred embodiment of this invention shown in Fig. 2, the outer laminations 12 of leg 4 are deformed to the extent that each of the ends 13 and 14 of laminations 12 are in contact with adjacent laminations, while the central portion 15 is bowed away from adjacent laminations. Forces transverse to the axis of leg 4 when applied at points 15 are translated to ends 13 to provide a gripping structure that rigidly holds the ends of the laminations at faces 10 and 11. In addition, this translated transverse force clamps bridging lamination 9 at each side of air gap 7 to produce a short mean effective length of the bridging lamination.

To provide the required transverse force at points 15 on outer laminations 12, a coil case 16 is provided that fits tightly over leg 4 to squeeze points 15 towards one another and thereby produces the required clamping force at points 13 of laminations 12. With this structure, all the laminations, including bridging lamination 9, are securely clamped together and the mean effective length of bridging lamination 9 is limited to substantially the thickness of the air gap 7.

In the embodiment of this invention shown in Fig. 3, an ordinary nut 17 and bolt 18 engage outer laminations 20 of leg 3 to clamp the faces 21 and 22 that are separated by air gap 8 to produce a rigid noise reducing structure. In this embodiment, a hole 23 is drilled through leg 3 to accommodate bolt 18.

In a still further embodiment of this invention shown in Fig. 4, the outer laminations 12 of leg

4 are not deformed as those shown in Fig. 2. In this embodiment, coil case 16 is loosely placed around leg 4 and a wedge 24 is driven between the coil case and the laminations 12 on one side of leg 4. The wedge clamps all the laminations, including bridging lamination 9, at faces 10 and 11 separated by air gap 7 to produce a rigid structure which once again limits the mean effective length of bridging lamination 9 substantially to the thickness of the air gap 7. This structure prevents most of the elastic deformation resulting from the pulsating magnetic forces, and, therefore, reduces noise. Wedge 24 may be made of either magnetic or non-magnetic material.

In the many tests that have been made on this type magnetic structure, it has been definitely determined that in each of the embodiments of this invention that have been disclosed a considerable reduction has been made in the noise level that would normally be produced by the elastic deformation of the magnetic structure resulting from magnetic forces.

Modifications of this invention will occur to those skilled in the art and it is desired to be understood, therefore, that this invention is not to be limited to the particular embodiment disclosed, but that the appended claims are meant to cover all the modifications which are within the spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a laminated magnetic structure of the type wherein a core is provided with an air gap, a single lamination for bridging said air gap, means for clamping the free ends of the laminations separated by said air gap to reduce the noise produced by elastic deformation of the structure resulting from magnetic forces, said means comprising an arrangement for applying a transverse force to the laminations on each side of said air gap and immediately adjacent thereto to rigidly clamp said single bridging lamination and thus give a minimum mean effective free length thereto.

2. In a laminated magnetic structure of the

type wherein a core is provided with a plurality of parallel legs, one of said legs provided with an air gap, at least one lamination of the magnetic structure bridging said air gap intermediate the outer laminations thereof, an arrangement for reducing the elastic deformation of the structure resulting from magnetic forces, said arrangement comprising the deformation of each of the outer laminations of the leg separated by the air gap, said deformation comprising an outwardly bend away from adjacent laminations and an inwardly bend towards adjacent laminations causing the ends of said outer laminations to meet adjacent laminations substantially at said air gap, means for exerting a transverse force on said deformed laminations whereby the ends of said laminations adjacent the air gap are rigidly clamped to said bridging lamination to give a minimum mean effective free length thereto.

3. In a laminated magnetic structure of the type wherein a core is provided with an air gap, at least one lamination for bridging said air gap, said bridging lamination being so positioned that equal numbers of gap forming laminations are on either side thereof, means for clamping the free ends of said gap forming laminations to reduce the noise produced by elastic deformation of the structure resulting from magnetic forces, said means comprising a structure for applying a transverse force to the laminations on each side of said air gap and immediately adjacent thereto to rigidly clamp said gap bridging laminations and thus give a minimum mean effective free length thereto.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,319,775	Mittermaier	May 18, 1943
2,350,029	Glass	Mar. 30, 1944
2,353,511	Short	July 11, 1944