Oct. 26, 1943. J. KUPERUS 2,332,922

MAGNETIC CIRCUIT COMPRISING A LAMINATED COILED CORE

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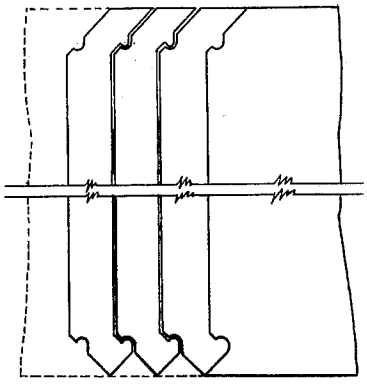


Fig. 1

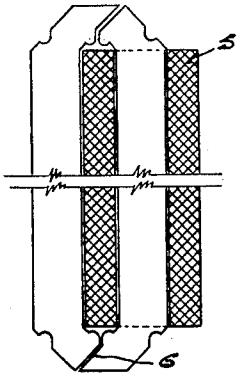


Fig. 2

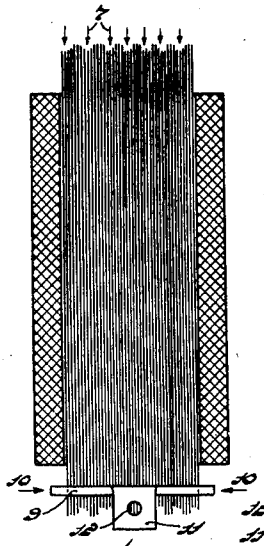


Fig. 3

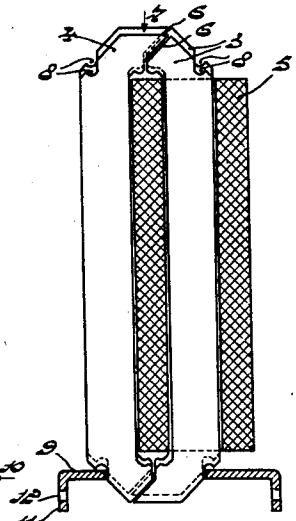


Fig. 4

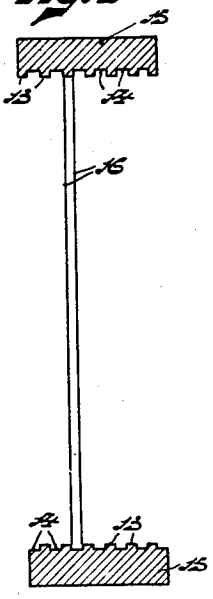


Fig. 5

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MAGNETIC CIRCUIT COMPRISING A LAMINATED COILED CORE

Jan Kuperus, Eindhoven, Netherlands; vested in the Alien Property Custodian

Application May 8, 1941, Serial No. 392,514
In the Netherlands June 26, 1940

3 Claims. (Cl. 29—84)

In the manufacture of magnetic circuits comprising a laminated coil-core one hitherto proceeded in practice in such manner that the laminations for the coil-core are arranged one by one within the coil, while during this operation the laminations destined to bridge the coil-core for closing the magnetic conductive path are braided together simultaneously with the laminations of the coil-core. The latter operation has for its purpose to reduce as much as possible the reluctance which occurs at the impact sides of the laminations and this is achieved by a relatively shifted position of the impact sides so that the latter are bridged by laminations located on each side.

The invention has for its object a considerable simplification and reduction in cost price of the manufacture of such magnetic circuits, in which due to the individual application and braiding of the laminations involves much loss of time and comparatively high manufacturing cost.

The magnetic circuit with laminated coil-core according to the invention has the characteristic that it is closed by bridging the core by a closing yoke which engages it and is also laminated, the influence of the air-gaps at the point of the impact sides being reduced by a shift, preferably comparatively small, of a number of parts of the magnetic circuit relatively to the other parts, the first-mentioned parts consisting of two or more laminations of the core and the closing yoke located in the same plane, so that a toothed engagement between the core and the closing yoke is established.

The advantage is thus obtained that the above-mentioned braiding of the laminations of the core and the closing yoke, which is a work taking much time, is avoided during the assembly of these parts, since according to the invention the desired magnetic contact between the core and the closing yoke is not established by the shift above referred to, before the core and the closing yoke each in itself are already finished as stapled units. Of course, the coil is already provided before the closing yoke is applied to it.

When a thickness of lamination is utilised as is usual, for example, for magnetic circuits for comparatively small choke coils and transformers, it is advisable that the parts of the magnetic circuit which are to be shifted should be given a thickness corresponding to 2 to 4 laminations; in this case the relative intervals, i. e. the non-shifted parts, may also have a thickness corresponding to 2 to 4 laminations. This measure has the effect of producing packets which may be shifted in a simple manner by comparatively rough tools.

Another advantage of the assembly of the magnetic circuit according to the invention is that the coil is arranged on the core preliminarily prepared so that it is possible for the coil to be wound directly on the core which is preferably insulated. Since in this case a coil bush is superfluous, which also results in a reduction of cost price, a highly advantageous filling factor may be obtained.

A further simplification of the assembly of the core and the closing yoke is obtained by making the laminations for these two components of the magnetic circuit uniform.

According to one advantageous embodiment of the invention the extremities of the laminations of the core and the closing yoke are compressed by a clamping member so that a simple fastening is obtained.

In order that the invention may be clearly understood and readily carried into effect, it will be explained more fully by reference to the accompanying drawing which shows, by way of example one embodiment thereof, and wherein Fig. 1 shows the manner of procuring uniform laminations from a strip of material, Fig. 2 shows in elevation the coil and core arrangement in the preliminary stage of assembly, Figs. 3 and 4 are respectively side and elevational views of the coil and core in the final stage of assembly, and Fig. 5 shows diagrammatically the means employed for shifting the laminations constituting the magnetic circuit.

Fig. 1 shows diagrammatically how the uniform laminations 1 for the core and the closing yoke are punched from a strip 2. Thus, a but very small loss of material occurs, i. e. the triangles at the bottom. The laminations are united to form two piles (shown in elevation in Fig. 2), of which one pile 3, after being turned, serves as a coil-core and for this purpose, after being suitably insulated is provided with the coil 5. As can be seen from Fig. 2, the other pile 4 is used as a closing yoke and laid against the core 3. Since all the air-gaps 6 between the impact sides of every two laminations of the core and the closing yoke located in the same plane overlap one another and would thus produce a harmful reluctance, the influence of these air-gaps is essentially reduced in accordance with the invention by a comparatively small shift of a number of two or more parts of the magnetic circuit relatively to the remaining parts, which

first-mentioned parts consist of two or more laminations located in the same plane, so that a toothed engagement between the core and the closing yoke is established.

In Fig. 3, which is a side-view of Fig. 2, a number of parts of the magnetic circuit at the points of the arrows 7 are shifted relatively to the remaining parts in a direction which differs from the direction of the air-gaps, in this case downwards so that, as can be seen from Fig. 4, the air-gaps 6 of the shifted packets are bridged by the non-shifted packets. A toothed engagement between the core 3 and the closing yoke 4 is thus produced at the point of the air-gaps.

The laminations are provided with recesses 8 which are so shaped that the core and the closing yoke at this point may be pressed on each other by means of a clamping piece 9. For this purpose, after the clamping piece is provided, a certain pressure is exerted on the sides, as indicated by means of the arrows 10, with the result that the laminations are compressed and held together. In Figs. 3 and 4 the clamping piece at the top ends of the laminations is not shown for clearness' sake. For the assembly the clamping piece are still provided with crooked ears 11 and apertures 12.

It is preferable to effect the shift of the laminations simultaneously in one operation. This may be achieved in a simple manner by using a device comprising two blocks 15 shown in Fig. 5, which are provided with teeth 13 and notches 14 between which the core together with the yoke is placed in such manner, i. e. in the position shown in Fig. 3, that by a movement of the blocks towards each other a number of laminations is pushed by the teeth of one block into the notches of the other block, and inversely.

In order to avoid during this operation that laminations might be bent and clamped fast, the teeth 13 are narrower than the notches 14, preferably at least about one lamination thickness narrower. As can be seen from Fig. 5, a lamination 16 which is still caught by a tooth in the upper block, can be pushed into a wider notch of the lower block without there being a risk that these laminations come on the teeth located on both sides of the notch. Due to the fact that the teeth are narrower than the notches it may occur that laminations which are located with both extremities opposite to notches either remain in place or are also shifted more or less due to the friction. This is the reason why the shifted and the non-shifted parts of the magnetic circuit sometimes comprise different numbers of laminations, as is shown in Fig. 3.

The means for clamping the clamping pieces 9 at the point of the arrows 10 in Fig. 3, for example consisting of two pressure pieces fastened to two movable levers, may be combined with the device shown in Fig. 5 to form one unit. In this case it is possible that the magnetic circuit, which is provided beforehand with the loosely arranged clamping pieces, is still in the tool clamped fast in the correct position immediately after the shift of the laminations.

What I claim is:

1. In a device for assembling a laminated magnetic circuit comprising a core having a coil mounted thereon and consisting of a plurality of superimposed laminations and a yoke for closing a magnetic circuit consisting of a plurality of superimposed laminations, means for clamping together both sets of laminations to form the closed magnetic circuit, and means for shifting certain of the laminations in both the core and yoke at spaced intervals whereby the spaces between abutting laminations are staggered to thereby reduce the reluctance of the circuit.

2. In a device as defined in claim 1 wherein the shifting means comprises two blocks provided with teeth and notches positioned at opposite ends of the two sets of laminations, said blocks being arranged transversely of the laminations and with the teeth of one aligned with the notches of the other, whereby upon movement of the blocks toward each other the laminations that are aligned with the teeth of either block are shifted into the aligned notches of the other block.

3. In a device for assembling a laminated magnetic circuit comprising a core having a coil mounted thereon and consisting of a plurality of superimposed laminations and a yoke for closing the magnetic circuit consisting of a plurality of superimposed laminations, means for clamping together both sets of laminations to form a closed magnetic circuit, and means for shifting certain of said laminations in both core and yoke in a direction of the axes of the coil, at spaced intervals whereby the spaces between abutting laminations are staggered to thereby reduce the reluctance of the circuit.

JAN KUPERUS.