April 10, 1956 J. R. CLARK ET AL 2,741,528

INDUCTIVE DEVICE

Filed June 4, 1954 2 Sheets-Sheet 1

Fig. 1.

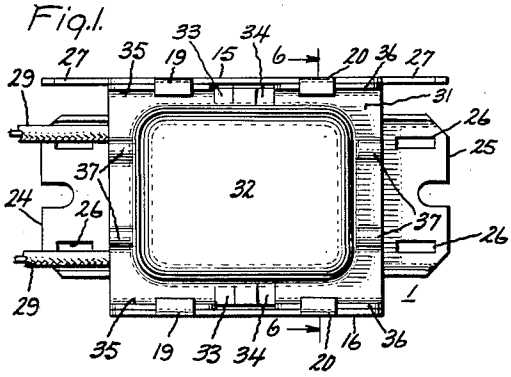


Fig. 3.

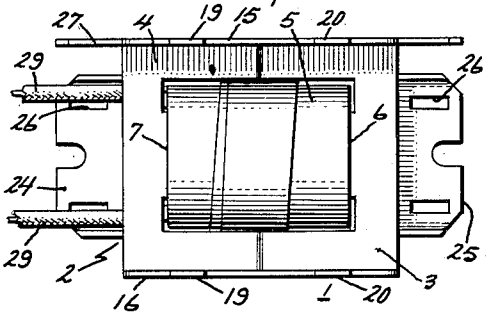


Fig. 4.

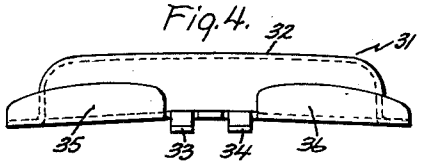


Fig. 5.

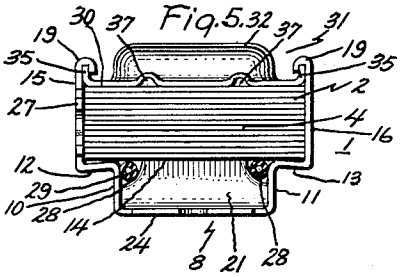


Fig. 2.

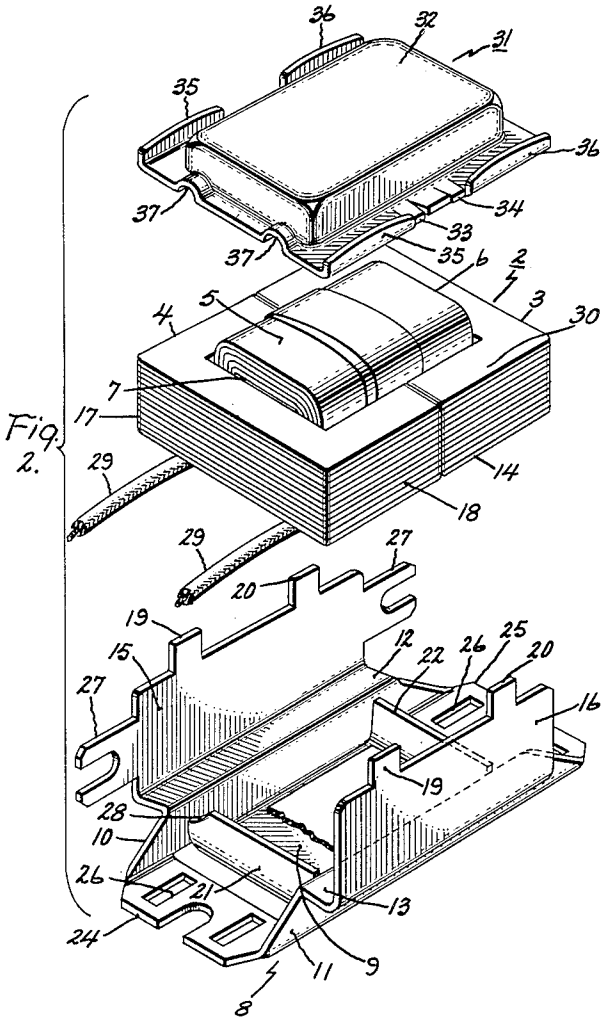
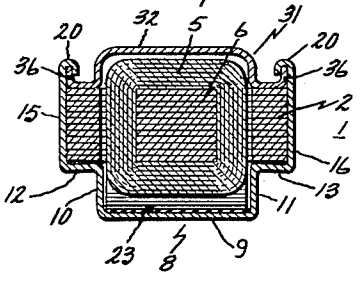


Fig. 6.



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INDUCTIVE DEVICE

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Fig. 7.

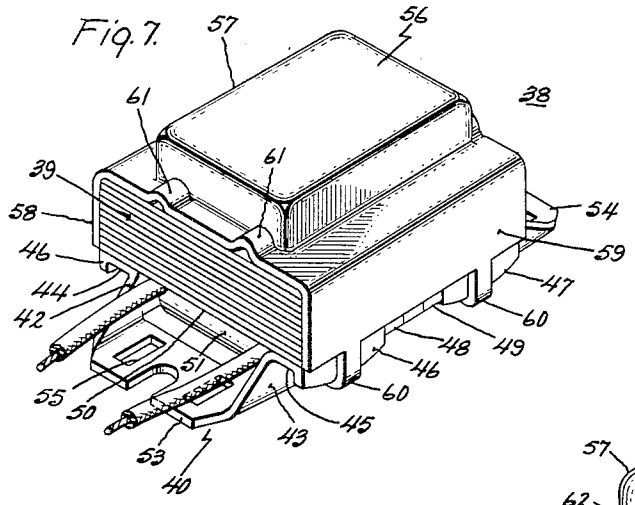


Fig. 8.

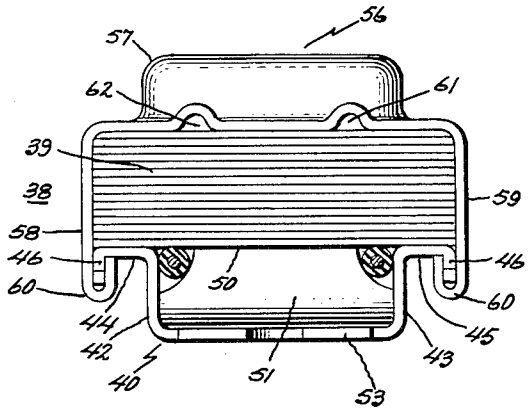
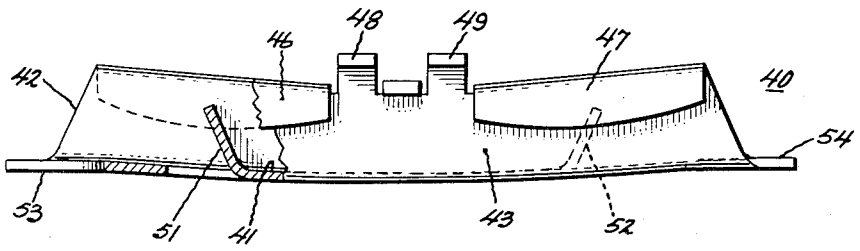


Fig. 9.



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2,741,528

INDUCTIVE DEVICE

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Application June 4, 1954, Serial No. 434,526

16 Claims. (Cl. 336—98)

This invention relates to inductive devices such as reactors for use with fluorescent lamps, and more particularly to core and coil assemblies for small inductive devices.

Arc discharge devices, such as fluorescent lamps, require a ballasting device in order to limit the current flow after the device has fired. Reactors are commonly used to perform the ballasting function and conventionally comprise a core formed of a plurality of relatively thin laminations of magnetic material with a coil mounted thereon. One form of reactor frequently used with low wattage fluorescent lamps comprises two stacks of E-shaped laminations with the legs of each stack respectively abutting and with a coil mounted on the center leg. In the design of such a core and coil assembly it is necessary that the laminations be clamped in order to maintain the requisite air gap and to prevent noise, and it is also necessary to provide means for mounting the device. It is further desirable that the device be simple, economical, and lend itself to manufacture with automatic machinery. A reactor which satisfies these requirements is shown and described in U. S. Patent 2,680,219—Gould, granted June 1, 1954, upon an application filed May 16, 1952, and assigned to the assignee of the present application. This application discloses a reactor comprising two stacks of E-shaped laminations with their legs respectively abutting and with the coil mounted on the center leg. A single clamping and mounting member not only provides for tightly clamping the laminations to maintain the air gap and to prevent noise, but also provides for mounting the device.

In addition to the foregoing requirements, there are certain applications where the Underwriters Laboratories require a completely enclosed construction, i. e. a construction having the coil enclosed in a metallic case. With such a totally enclosed construction, it is nevertheless desirable that the core be exposed on its two ends to facilitate adjustment after assembly in order to obtain the desired electrical characteristics. Furthermore, since the two stacks of laminations are formed from sheets of magnetic steel which may not have uniform thickness, it is possible that one stack may be slightly thicker than the other and it is therefore further desirable that the laminations be tightly clamped regardless of variations in stack height. In addition, these reactors are customarily impregnated with a suitable material, such as varnish, after assembly and it is therefore desirable to provide means for draining excess impregnating material during the treating process. It is of course still a basic requirement that such a device be simple, economical, and lend itself to manufacture with automatic machinery.

It is therefore an object of this invention to provide an inductive device including the desirable features set forth above.

Further objects and advantages of this invention will become apparent by reference to the following description and 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.

This invention in its broadest aspects provides an inductive device comprising a core having a pair of abutting stacks of laminations with a coil positioned on the core. A base member is provided having portions respectively supporting the bottom surface of the core and a cover member is provided for enclosing the upper side of the core. One of the members has side portions respectively extending along the sides of the core and these side portions respectively engage the other member thereby securing the cover member to the core and tightly clamping the laminations. Portions may be formed from the base member to enclose the bottom side of the coil and one of the members may be initially longitudinally bowed in order to accommodate variations in height of the individual stacks of laminations.

In the drawings,

Fig. 1 is a top view of the preferred embodiment of the improved inductive device of this invention;

Fig. 2 is an exploded view in perspective further illustrating the device of Fig. 1;

Fig. 3 is a top view of the device prior to assembly of the cover thereon;

Fig. 4 is a side view of the cover member of the device of Fig. 1;

Fig. 5 is an end view of the improved device of Fig. 1;

Fig. 6 is a cross sectional view taken along the 6—6 of Fig. 1;

Fig. 7 is a view in perspective of a modified form of the improved inductive device of this invention;

Fig. 8 is an end view of the improved inductive device of Fig. 7; and

Fig. 9 is a side view of the base member of the device of Fig. 7.

Referring now to Figs. 1 to 6 of the drawing, the reactor 1 comprises a core member 2 formed of two E-shaped stacks 3 and 4 of relatively thin laminations of magnetic material. The inner and outer legs of the E-shaped stacks of laminations 3 and 4 are arranged in abutting relationship, as best seen in Figs. 2 and 3, and a suitable coil 5 is arranged on the center legs 6 and 7 of stacks 3 and 4 respectively between the outer legs or "yoke portions" of the core. Center legs 6 and 7 may have an air gap therebetween if desired in order to secure the desired reactance. While a core formed of two abutting E-shaped stocks of laminations has been shown, it will be readily understood that this is by way of illustration only and that other core and coil configurations may be utilized in accordance with this invention.

In order to support and clamp the core 2 and to enclose the coil 5, the arrangement now to be described is provided. A base member 8 is provided having a center section 9 and side sections 10 and 11 formed at right angles thereto on either side thereof. Side sections 10 and 11 of base 8 respectively have core supporting portions 12 and 13 extending outwardly therefrom. As will best be seen in Figs. 5 and 6, the bottom surface 14 of core 2 is supported by portions 12 and 13 of base 8. Core supporting portions 12 and 13 of base 8 respectively have extension portions 15 and 16 extending upwardly therefrom adjacent the sides 17 and 18 of core 2 respectively. Extension portions 15 and 16 are respectively provided with tabs 19 and 20 on their upper edges for a purpose to be hereinafter described.

Center section 9 of base 8 has two coil enclosing portions 21 and 22 respectively formed therefrom on either side of coil 5 and extending toward bottom surface 14 of core 2 in order to enclose the bottom side of the coil, i. e. that portion of coil 5 extending beyond bottom surface 14 of core 2. As shown in Figs. 2 and 6, a sheet of

insulating material 23 may be placed between upwardly extending portions 21 and 22 if desired. Center section 9 of base 8 is also provided with mounting portions 24 and 25 formed at either end beyond coil enclosing portions 21 and 22. Mounting portions 24 and 25 are joined respectively to side sections 10 and 11 and are provided with suitable openings 26 for mounting the reactor 1. Since it may be desirable to mount the reactor from its side rather than from its base, suitable mounting portions 27 may be formed at either end of one or both of the extension portions, as shown in Fig. 2. The corners of one of the coil enclosing portions 21 or 22 may be recessed such as by being folded down or cut away, as at 28 to accommodate the external leads 29 of coil 5, as shown in Figs. 2 and 5.

In order to enclose the upper side of coil 5, i. e. that side of coil 5 which projects above the upper surface 30 of core 2, a cover member 31 is provided having a suitable indentation 32 formed therein for enclosing the upper side of the coil. As best seen in Fig. 4, cover member 31 is initially longitudinally bowed for the reason now to be described. As will be best seen in Fig. 2, cover member 31 is positioned with its four corners initially abutting the upper surface 30 of core 2 adjacent the corners thereof. A pair of spaced apart initially downwardly inclined tabs 33 and 34 are provided on each side of cover member 31 and respectively engage lamination stacks 4 and 3. It is thus seen that by virtue of the initially bowed configuration of cover member 31 and initially downwardly inclined tabs 33 and 34, cover member 31 will engage the upper surface 30 of core 2 at eight points even though one of the stacks of laminations, for example, stack 3, is slightly thicker than or has one more lamination than stack 4. This eight point engagement is secured by deflection of tabs 33 and 34, as the case may be, to conform the height of lamination stacks 3 and 4. The clamping action is accomplished by the provision of upwardly extending flanges 35 and 36 formed on each side of cover member 31 and respectively on either side of tabs 33 and 34. The upper edges of flanges 35 and 36 are curved, as seen in Fig. 2 for the purpose now to be described. Tabs 19 and 20 on extension portions 15 and 16 of base member 8 are preferably respectively folded over flanges 35 and 36 of cover member 31 as seen in Figs. 1, 5 and 6. It will be readily apparent that extension portions 15 and 16 may be secured to flanges 35 and 36 by other means, for example by welding or riveting.

It will now be seen that a folding over of tabs 19 and 20 to engage flanges 35 and 36 of cover member 31 tightly clamps cover member 31 to the upper surface 30 of core 2, tightly clamps the entire core 2 to base member 8, and further tightly clamps the laminations of core 2 together. Assuming that one of the stacks of laminations is thicker than the other, the clamping of cover member 31 by means of tabs 19 and 20 will cause one set of the tabs 33 or 34 to be deflected or bent upwardly to a greater degree than the other thereby to accommodate the difference in thickness of the two stacks and still retain the eight point contact. Since a difference in thickness of the two stacks will result in the cover member 31 being slightly tilted with respect to the plane of the base member 8, the curved upper edges of the flanges 35 and 36 permit the tabs 19 and 20 to be properly located so that they tightly engage the flanges and in turn tightly clamp the cover member 31 against the upper surface 30 of core 2. It will be readily seen that without the provision of the initially bowed configuration of cover member 31 and the downwardly inclined tabs 33 and 34, an eight point contact with the upper surface of the core would be difficult to secure unless the two core stacks were of exactly the same height. It will further be readily apparent that the curved configuration of the upper edges of flanges 35 and 36 permit the cover member 31 to be slightly tilted with respect to the plane of the base member and yet still be firmly engaged by the tabs 19 and 20 of base member extensions 15 and 16. Indentations 37 may be formed in one end of cover member 31 defining with upper surface 30 of core 2 passages communicating with the coil 5. These passages serve to admit impregnating material to the coil 5, to allow the air displaced thereby to escape, and to drain off excess impregnating material during the impregnating treatment.

Referring now to Figs. 7, 8 and 9, there is shown an inductive device, generally identified as 38, which may be either a reactor or a transformer. The device 38 includes a core member 39 formed of a stack of relatively thin laminations of magnetic material. Core 39 may be formed in a manner similar to the core member 2 of Figs. 1 to 6 inclusive, i. e., having two abutting E-shaped stacks of laminations.

In order to support and clamp the core 39 and to enclose the associated coil (not shown), a base member 40 is provided having a center section 41 and side sections 42 and 43 formed at right angles thereto on either side thereof. Side sections 42 and 43 respectively have core supporting portions 44 and 45 extending outwardly therefrom. As will best be seen in Fig. 9, the upper surface of base member 40 defined by core supporting portions 44 and 45, is longitudinally bowed for the purpose to be hereinafter more fully described. Core supporting portions 44 and 45 are respectively divided into two spaced-apart segments respectively having downwardly extending flanges 46 and 47 formed thereon. A pair of spaced-apart initially upwardly inclined tabs 48 and 49 are formed on each of the side portions 42 and 43, intermediate flanges 46 and 47.

As best seen in Figs. 7 and 8, the bottom surface 50 of core 39 is supported by portions 44 and 45 of base member 40. As in the embodiment of Figs. 1 to 6 inclusive, center section 41 of base member 40 has two coil enclosing portions 51 and 52 formed therefrom on either side of the coil and extending toward bottom surface 50 of core 39 in order to enclose the bottom side of the coil. Center section 41 of base member 40 is also provided with mounting portions 53 and 54 formed at either end thereof beyond coil enclosing portions 51 and 52. Mounting portions 53 and 54 are joined respectively by side sections 42 and 43 and are provided with suitable openings 55 for mounting the device.

In order to enclose the upper side of the coil, a cover member 56 is provided having a suitable indentation 57 formed therein for enclosing the upper side of the coil. Cover member 56 is provided with extension portions 58 and 59 formed on either side thereof extending along the sides of core 39. Extension portions 58 and 59 of cover member 56 have tabs 60 formed thereon respectively folded over flanges 46 and 47 of base member 39. Indentations 61 may be formed in the ends of cover member 56 defining with upper surface 62 of core member 39 passages communicating with the coil for admitting impregnating material to the coil, allowing the air displaced thereby to escape, and for draining off excess impregnating material during the impregnating treatment.

It will now be readily seen that with core 39 formed of two abutting E-shaped stacks of laminations, of the type shown in Fig. 2, and by virtue of the initially bowed configuration of base member 40 and the initially upwardly inclined tabs 48 and 49, base member 40 will engage the bottom surface 50 of core member 39 at eight points even though one of the stacks of laminations is slightly higher than the other stack. This eight point engagement is secured by deflection of tabs 48 or 49, as the case may be, to conform to the height of the lamination stacks. In this embodiment, the clamping action is accomplished by the folding over of tabs 60 to engage flanges 46 and 47 of base member 40 thus tightly clamping cover member 56 to the upper surface 62 of core 39, tightly clamping the entire core 39 to base member 40, and further tightly clamping the laminations of core 39 together. Here again, flanges 46 and 47 are curved, as seen in Figs. 7 and 9, to accommodate slight tilting of core 39

with respect to base 40. It will be further readily apparent that mounting portions similar to portion 27 of the embodiment of Figs. 1 to 6 inclusive may be formed on extension portions 58 and 59 of cover member 56 if desired.

It will now be readily seen that this improved reactive device requires only two parts to clamp and mount the core and also to encase the coil. It will be further readily seen that these parts are simple and lend themselves to fabrication and assembly on automatic machinery. While this improved construction has been shown in connection with a reactor, it will be readily apparent that it is equally applicable to other inductive devices such as transformers or autotransformers.

While we have shown and described a particular embodiment of this invention, further modifications and improvements will occur to those skilled in the art. We desire that it be understood therefore that this invention is not limited to the particular forms shown and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

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

1. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, and a cover member for enclosing the upper side of said coil, one of said members having extension portions adjacent two opposite sides of said core, one of said members being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the surface of said core, each side of said bowed member having a pair of tabs formed thereon each engaging the surface of a different one of said core stacks, each side of said bowed member having a pair of flanges formed on the edge thereof and at right angles thereto respectively on either side of said tabs, said flanges having their edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

2. A reactive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, said center section having portions formed therefrom respectively extending toward said bottom surface of said core on either side of said coil to enclose the bottom side thereof, said center section having end portions extending respectively beyond said last-named portions adapted to mount said device, and a cover member for enclosing the upper side of said coil, one of said members having extension portions respectively extending adjacent two opposite sides of said core, one of said members being biased toward a longitudinally bowed configuration and having all its corners respectively engaging a surface of said core adjacent the corners thereof, each side of said bowed member having a pair of spaced apart tabs formed thereon each engaging the surface of a different one of said core stacks, each side of said bowed member having a pair of flanges formed on the edge thereof and at right angles thereto respectively on either side of said tabs, said flanges having their edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

3. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having portions respectively supporting the bottom surface of said core and side portions respectively extending along the sides of said core, and a cover member for enclosing the upper side of said coil, said cover member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the upper surface of said core, each side of said cover member having a pair of tabs formed thereon each engaging the upper surface of a different one of said core stacks, said base member side portions respectively engaging said cover member thereby securing said cover member to said core by tightly clamping said laminations.

4. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, said side sections respectively having extension portions adjacent two opposite sides of said core, and a cover member for enclosing the upper side of said coil, said cover member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the upper surface of said core, each side of said cover member having a pair of tabs formed thereon each engaging the upper surface of a different one of said core stacks, each side of said cover member having a pair of upwardly extending flanges formed on the edge thereof respectively on either side of said tabs, said flanges having their upper edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

5. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, said center section having portions formed therefrom respectively extending toward said bottom surface of said core on either side of said coil to enclose the bottom side thereof, said center section having end portions extending respectively beyond said last-named portions adapted to mount said device, said side sections respectively having extension portions adjacent two opposite sides of said core, and a cover member for enclosing the upper side of said coil, said cover member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the upper surface of said core adjacent the corners thereof, each side of said cover member having a pair of spaced apart tabs formed thereon each engaging the upper surface of a different one of said core stacks, each side of said cover member having a pair of upwardly extending flanges formed on the edge thereof respectively on either side of said tabs, said flanges having their upper edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

6. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, said core having portions extending beyond said coil, a base member having portions respectively supporting the bottom surface of said core, and a cover member for enclosing the upper sides of said coil, said cover member having portions engaging the upper surface of said core and side portions respectively extending adjacent two opposite sides of said core, said base member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the bottom surface of said core, each side of said base member having a pair of tabs formed thereon each engaging the bottom surface of a different one of said core stacks, said side portions respectively overlapping said base mem-

ber thereby securing said cover member to said core and tightly clamping said laminations.

7. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, and a cover member for enclosing the upper side of said coil, said cover member having extension portions respectively extending adjacent two opposite sides of said core, said base member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the bottom surface of said core adjacent the corners thereof, each side of said base member having a pair of spaced apart tabs formed thereon each engaging the bottom surface of a different one of said core stacks, each side of said base member having a pair of downwardly extending flanges formed on the edge thereof respectively on either side of said tabs, said flanges having their lower edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

8. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, a base member having a center section spaced from the bottom surface of said core with side sections extending therefrom respectively supporting said core bottom surface, said center section having portions formed therefrom respectively extending toward said bottom surface of said core on either side of said coil to enclose the bottom side thereof, said center section having end portions extending respectively beyond said last-named portions adapted to mount said device, and a cover member for enclosing the upper side of said coil, said cover member having extension portions respectively extending adjacent two opposite sides of said core, said base member being biased toward a longitudinally bowed configuration and having all its corners respectively engaging the bottom surface of said core adjacent the corners thereof, each side of said base member having a pair of spaced apart tabs formed thereon each engaging the bottom surface of a different one of said core stacks, each side of said base member having a pair of downwardly extending flanges formed on the edge thereof respectively on either side of said tabs, said flanges having their lower edges longitudinally curved, said extension portions having tabs formed thereon respectively folded over said flanges thereby securing said cover member to said core and tightly clamping said laminations.

9. An inductive device comprising a core having a pair of abutting stacks of laminations, a coil positioned on said core, said core having portions extending beyond said coil, a base member for enclosing a bottom surface of said coil, and a cover member enclosing an upper surface of said coil, one of said members being biased toward a longitudinally bowed configuration having all its corners respectively engaging one surface of said core, each side of said bowed member having a pair of tabs formed thereon each engaging the surface of a different one of said core stacks, and the other of said members having side portions engaging an opposite surface of said core and extending along opposite sides of said core, said side portions having portions respectively overlapping said bowed member thereby securing said bowed member to said core and tightly clamping said laminations.

10. An inductive device comprising a laminated core having a central leg portion and outer yoke portions, a coil positioned on said central leg portion between said yoke portions, a base member having core supporting portions underlying the bottom surfaces of said yoke portions and a center section extending parallel to the bottom surface of said coil and side sections joining said core supporting portions to said center section, said center section having punched-in upwardly bent portions extending to the bottom surface of said core between said side sections to enclose the bottom side of said coil and having end portions extending beyond the sides of said core with mounting means formed therein, a cover member overlying the upper surface of said yoke portions and having a central indented portion covering the upper side of said coil, one of said members having opposite edges bent away from said core at substantially right angles thereto and the other of said members having side extension portions overlying the sides of said yoke portions, said extension portions having tabs folded over the bent edges of said one member to support and tightly encase said core and coil assembly.

11. The inductive device of claim 10 wherein the cover member has the bent away opposite edges and the base member has the side extension portions.

12. The inductive device of claim 10 wherein the base member has the bent away opposite edges and the cover member has the side extension portions.

13. The inductive device of claim 10 wherein the cover member has upwardly formed indentations in its overlying outer portions providing passages communicating with said coil to permit coil impregnation after assembly of said device.

14. The inductive device of claim 10 wherein one of the side extension portions has end portions extending beyond said core with mounting means formed therein.

15. The inductive device of claim 10 wherein one of the upwardly bent portions of the center section of said base member has recessed corners and said coil has leads extending through said recessed corners.

16. An inductive device comprising a core having abutting stacks of laminations forming a central leg portion and outer yoke portions, a coil positioned on said central leg portion between said yoke portions, a base member having core supporting portions underlying and bearing against the bottom surfaces of said yoke portions and a center section extending parallel to the bottom surface of said coil and side sections joining said core supporting portions to said center section, said center section having upwardly bent portions cooperating with said side sections to enclose the bottom side of said coil and having end portions extending beyond said core with mounting means formed therein, a cover member having outer portions overlying and bearing against the upper surfaces of said yoke portions and having a center indented portion covering the upper side of said coil, one of said members having opposite edges bent away from said core at substantially right angles thereto and the other of said members having side extension portions overlying the sides of said yoke portions, said extension portions having tabs folded over the bent edges of said one member to clamp said members together and to compress said laminations of said core between the portions of said members bearing against opposite surfaces of said core.

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