Dec. 7, 1954 M. H. DOLE 2,696,593

REACTOR AND TRANSFORMER CONSTRUCTION

Filed July 11, 1951

Fig.1.

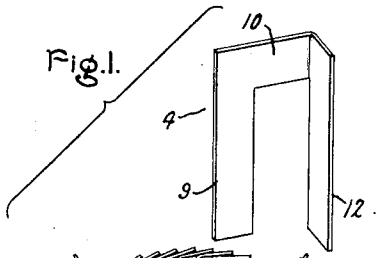
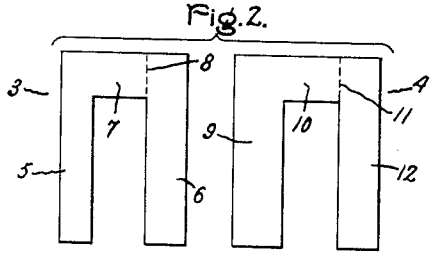


Fig.2.



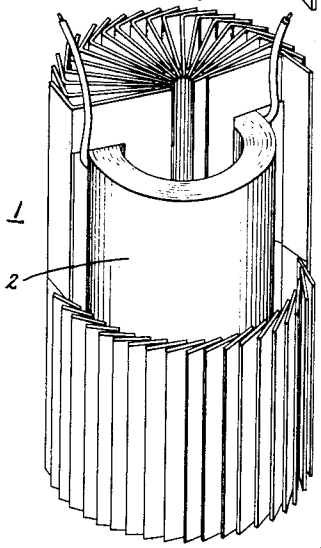


Fig.3.

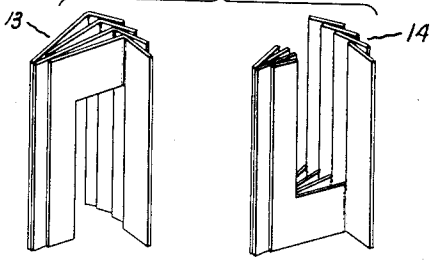


Fig.4.

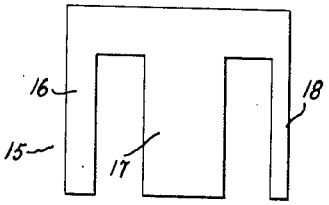


Fig.5.

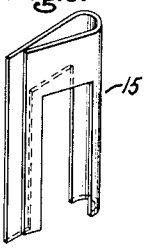


Fig.11.

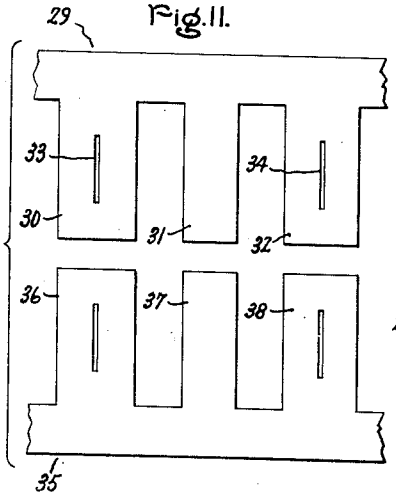


Fig.7.

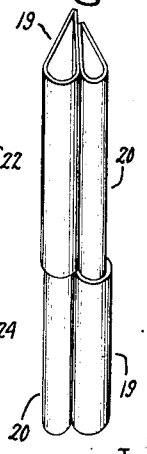


Fig.10.



Fig.6.

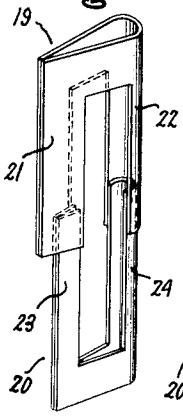


Fig.8.

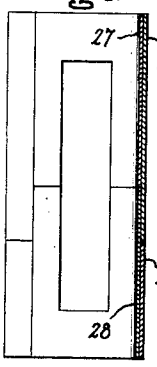
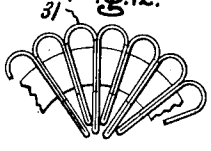


Fig.9.



Fig.12.



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United States Patent Office

2,696,593

Patented Dec. 7, 1954

2,696,593

REACTOR AND TRANSFORMER CONSTRUCTION

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Application July 11, 1951, Serial No. 236,148

12 Claims. (Cl. 336—83)

This invention relates to magnetic cores for electrical apparatus, and more particularly to cylindrical-shaped magnetic core structures for stationary electrical induction apparatus.

In the development of the art of constructing stationary electrical induction apparatus, most of the development has occurred in the field of magnetic cores of generally rectangular configuration, since previously known methods of construction have tended toward the conclusion that cores of rectangular configuration are generally easier to assemble and manufacture. This trend toward cores of rectangular shape has occurred in spite of the fact that cores of cylindrical shape have certain magnetic advantages over cores of rectangular configuration.

Cylindrical magnetic cores have heat dissipation characteristics which are superior to those of rectangular-shaped cores. Also, from a magnetic characteristic viewpoint, cylindrical-shaped cores, when used for reactors, have the advantage that an air gap may be located in the center of the core, permitting the outer portion of the core to act as a shield.

It is an object of this invention to provide a new and improved construction for magnetic cores of cylindrical shape, having an ease of assembly and manufacture comparable to those obtained with rectangular-shaped magnetic core structures.

In accordance with this objective, this invention provides a construction for cylindrical-shaped magnetic cores in which the core structure is built up of a plurality of core elements formed from flat steel punchings of generally U-shape. These punchings have a leg member extending parallel to the axis of the core, and about which the electrical winding is placed, another leg which is displaced from but substantially parallel to the first-mentioned leg and serves as a part of the outer periphery of the core, and a connecting member between these two legs, which radiates outwardly to connect the two legs together. In a modified embodiment of my invention, I combine two U-shaped laminar elements together to form an E-shaped element which I bend about the center leg. In still another modified form of my invention, I place a plurality of E-shaped elements on a single laminar strip which I then bend to form a cylindrical-shaped magnetic core.

The features of this invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to organization and use, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which Fig. 1 represents a cylindrical-shaped magnetic core and coil, partially cut away, in accordance with my invention; Fig. 2 represents a view of two of the core elements used in forming the cylindrical-shaped magnetic core of Fig. 1; Fig. 3 represents a view of several groups of punchings of the type used in the upper and lower sections of the cylindrical magnetic core of Fig. 1; Fig. 4 represents an E-shaped punching of the type which may be used in a modified form of cylindrical core construction in accordance with my invention; Fig. 5 represents an E-shaped punching of the type shown in Fig. 4, which is bent over upon itself in a manner necessary for assembly in a cylindrical core structure; Fig. 6 is a side view of mating upper and lower cylindrical core sections embodying core elements of the type shown in Figs. 4 and 5; Fig. 7 is view taken on the outer peripheral surface of several core elements of

the types shown in Figs. 4, 5 and 6; Fig. 8 is a sectional view of a double lap joint arrangement for core elements of the type shown in Figs. 5–7; Fig. 9 is a view looking at the outer peripheral surface of the core elements of Fig. 8; Fig. 10 is an end view of the core elements of Figs. 8 and 9; Fig. 11 is a view of a modified core element construction in which the plurality of core elements are on a single continuous strip; while Fig. 12 is an end view of a plurality of core elements of the type shown in Fig. 11 after being bent to form a cylindrical core section.

Referring now to Fig. 1, there is shown a cylindrical-shaped magnetic core 1 having positioned thereon a cylindrical-shaped electrical winding 2. The magnetic core 1 is built up of a plurality of U-shaped laminar members made of flat sheet steel and bent and assembled in such manner as to provide the cylindrical-shaped core configuration shown in Fig. 1.

The U-shaped flat laminar members used to construct the cylindrical-shaped core of Fig. 1 may best be seen in Fig. 2, where two such laminar members 3 and 4 are shown. Laminar members 3 and 4 represent adjacent laminations in either the upper or lower part of the core structure. Both laminations 3 and 4 are of generally U-shape. Lamination 3 is provided with two leg members 5 and 6 and a connecting member 7 at one end which serves to connect legs 5 and 6 together. Lamination 4 is provided with leg members 9 and 12 and a connecting member 10 at one end which serves to connect legs 9 and 12 together.

In order to provide closer spacing of the overlapped legs 6 and 12 on the outer periphery of the assembled core as will be explained hereinafter, the adjacent laminations 3 and 4 are made of slightly different size. As a result, lamination 4 extends radially inwardly further than lamination 3 in the assembled core. Thus, laminations 3 and 4 are substantially similar to one another except for the fact that one of the leg members of each of the respective laminations is different in width than the corresponding leg member of the other lamination. Leg 9 of lamination 4 which corresponds to leg 5 of lamination 3 is wider than leg 5 of lamination 3. However, legs 6 and 12 of laminations 3 and 4, respectively, are of the same width. The connecting portion 7 of lamination 3 which connects legs 5 and 6 together is of the same width as the connecting portion 10 of lamination 4 which connects legs 9 and 12 together. Due to the fact that leg 9 has a greater width than leg 5, the over-all width of lamination 4 is greater than the over-all width of lamination 3.

In accordance with my invention, the respective leg members 6 and 12 are bent upwardly, with respect to the plane of the paper, at substantially right angles to the plane originally occupied by the respective leg members 6 and 12. The leg 6 is bent upwardly along the line 8 as shown on lamination 3, and leg 12 is bent upwardly along the line 11 as shown on lamination 4.

After the respective laminations 3 and 4 have been bent in the manner just described, a plurality of such laminations 3 and 4 are alternately assembled as shown in Fig. 3, in which the number 13 represents a group of alternately arranged laminations 3 and 4 arranged to form a section of the upper core section of the cylindrical core of Fig. 1, and the number 14 has been assigned to represent the group of laminations which form a part of the lower core section of the cylindrical core of Fig. 1. It will be noted from an examination of the group of laminations 13 of Fig. 3 that the respective bent leg members 6 and 12 of adjacent laminations are arranged in an overlapping relation with respect to one another, the bent legs 6 and 12 forming the outer surface of the cylindrical core. The respective legs 5 and 9 of adjacent laminations 3 and 4 ultimately form the center core leg of the cylindrical core 1, about which the electrical winding 2 is positioned.

In order to form a cylindrical-shaped core 1, a plurality of laminations 3 and 4 are alternately arranged in an overlapping relation with one another, as shown at 13 in Fig. 3, until a sufficient number of such laminations have been stacked to form a cylindrical-shaped core section. In a similar manner, a group of laminations 3 and 4 are alternately arranged as shown at 14 of Fig. 3

to form the lower part of cylindrical-shaped core **1**. In order that the upper and lower laminar members in a given radial plane match with one another, the respective outer legs **6** and **12** for the core elements forming the lower part of the core are bent in an opposite direction to the respective center leg portions **5** and **9** than are the corresponding legs **6** and **12** for the laminar elements forming the upper part of the core.

In applications where core loss, exciting current, and leakage fields need not be held to extremely low values, the laminations of both core sections may be bent in the same direction, thus simplifying the forming and assembly operations.

The winding **2** may be positioned around the center leg portion formed by alternately positioned leg members **5** and **9** of either the upper or lower half of the cylindrical-shaped core **1**. The remaining core half may then be placed in position and any suitable clamping means may be used to hold the core structure in assembled relation. If desired, the whole core and coil assembly may be impregnated and coated with a suitable insulating compound.

There is shown in Figs. 4 and 5 a modified form of core construction in accordance with my invention, in which non-symmetrical E-shaped punchings are used to form the core in lieu of the C-shaped or U-shaped punchings used in the core constructions of Figs. 1, 2 and 3. There is shown in Fig. 4 a generally E-shaped lamination **15** having three legs **16**, **17** and **18**. Legs **16** and **18** are the end legs of the lamination, and leg **17** is the center leg. As will be seen in the drawing, end leg **16** is wider than end leg **18**, and middle leg **17** is considerably wider than either leg **16** or **18**. Lamination **15** is bent along the center line of leg **17** and folded back on itself as shown in Fig. 5. The center leg **17** of punching **15** then forms a curved outer surface and the end legs **16** and **18** of lamination **15** lie adjacent one another, with end leg **16** projecting further radially inwardly than leg **18**, due to the fact that lamination **15** is nonsymmetrical. A plurality of such laminations **15** are assembled to form a cylindrical-shaped core portion, which may be either the upper or lower portion of the core. The opposite end of the core is constructed by bending laminations **15** in an opposite direction to those shown in Fig. 5, so that the short leg **18** is now on the opposite side as compared to its position in Fig. 5. A plurality of the second group of laminations is assembled together to form the opposite portion of the core to that formed by assembled laminations as shown in Fig. 5. When this particular construction is used the respective laminations for opposite ends of the core are butt jointed to each other.

There is shown in Figs. 6 and 7 a modified construction using E-shaped laminations of the same general type as those shown in Fig. 4, but using two different size symmetrical laminations having a different bending radius in order to provide a lapped joint construction between the respective laminations forming the upper and lower halves of the completed core. There is shown in Fig. 6 a pair of bent laminations **19** and **20** which are respectively parts of the upper and lower core sections. The legs **22** and **24** respectively of the upper and lower laminar members **19** and **20** are formed from the center leg portions of the respective laminations. Legs **22** and **24** each have a curved surface which forms a part of the outer surface of the cylindrical core which is ultimately produced by the plurality of assembled laminations. The upper laminar member **19** has a greater radius of curvature than the lower laminar member **20**, permitting outer leg **24** of lamination **20** to fit within or adjacent the inner surface of leg **22** of lamination **19**, and similarly, leg **23** of lamination **20** fits inside of leg **21** of lamination **19**. Lamination **20** is preferably made longer than lamination **19** by an amount equal to the overlapped portion.

As shown in Fig. 7, the bent laminations **19** and **20** of Fig. 6 are arranged in an alternate manner so that laminations **19** and **20** are alternately at the upper and lower ends of the core.

There is shown in Figs. 8, 9, and 10 a still further modification of my invention in which E-shaped laminations of the type shown in Fig. 4 are used in such manner as to provide a double lap joint between the upper and lower halves of the assembled core. In order to provide a double lap joint, it is necessary to use laminations of four different sizes, as shown in Fig. 8. As will be seen in Fig. 8, the laminations **25** and **26** surround laminations **27** and **28**. All of these four laminations are E-shaped laminations of the type shown in Figs. 4 and 5, but the outer laminations **25** and **26** have a larger radius of curvature and are longer than laminations **27** and **28**. The outer curved surface of laminations **25** and **26** forms a portion of the outer peripheral surface of the cylindrical-shaped core which is formed of a plurality of double lap joint laminations such as are shown in Figs. 8, 9 and 10. Outer lamination **25** is abutted to lamination **26**, these two laminations respectively lying at opposite ends of the core. It will be noted that lamination **25** is considerably longer than lamination **26**, whereas lamination **27** lying within the bent-over portion of lamination **25** is shorter than inner lamination **28**. Due to the particular combination of sizes of the inner and outer laminations shown in Figs. 8 and 9, the butt joints between the respective inner laminations are offset from the joints between the respective outer laminations, thereby providing a mechanically strong joint. Fig. 9 shows a view of the laminations of Fig. 8, viewed from the outer periphery of the core elements, whereas Fig. 10 is an end view of the laminations of Fig. 8 showing how lamination **25** surrounds lamination **27**.

There is shown in Figs. 11 and 12 a further modification of my invention in which the generally U-shaped members which are used to form the cylindrical-shaped magnetic core are on one continuous strip of magnetic material, rather than in the form of separate laminations. The strip **29** of Fig. 11 has a repetitive sequence of leg members **30**, **31** and **32**, with legs **30** and **32** being provided with slots **33** and **34** respectively, for a purpose to be hereinafter described. The strip **29** is provided with 180-degree bends along the centerlines of legs **30** and **32** to form a resultant series of hairpin-type U-shaped loops as will be best seen in Fig. 12. One of the legs **30** or **32** is made slightly narrower than the other so that after the strip is bent in the manner shown in Fig. 12, the narrower of the two legs will not project radially inwardly as far as the other. Due to the manner of bending strip **29** as just described, the leg portion **31** lies on the outer periphery of the core, while the slots **33** and **34** are at the radially innermost portion of the bent strip members. The strip is bent sharply along the lines defined by slots **33** and **34**, the strip reversing its direction along these lines. The presence of slots **33** and **34** facilitates the bending of legs **30** and **32**. The legs **30** and **32** project axially of the completed core, and form the center leg upon which the core winding is placed. The legs **31** project axially along the outer periphery of the core and form the outer surface of the core. In order to form a completed core a second strip **35** having the same configuration as leg **29** is formed in a similar manner to that just described for strip **29**, and forms the other half of the core, the two core halves so formed being rigidly clamped together with their respective radially innermost ends in abutting relation. Legs **36**, **37**, and **38** of strip **35** are respectively in abutting relation to legs **30**, **31**, and **32** of strip **29** in the assembled core.

If it is desired to have an air gap in the center leg portion of any of the core embodiments shown in Figs. 1, 2, 3, 4, 5, 11, or 12, the respective leg members lying in the center leg portion of the assembled core may be made shorter than the leg portions lying on the outer periphery of the core to provide the necessary air gap.

It can be seen that in the various embodiments of my invention shown in the drawing and hereinbefore described, I have provided a new and improved type of cylindrical magnetic core construction. The types of core construction as hereinbefore described are ideally suited to automatic production and assembly, and provide greater economy of space and materials than conventional core structures. These cylindrical cores also provide better heat dissipation than conventional rectangular-shaped cores, and due to the symmetry of the cylindrical core, magnetic forces are balanced, resulting in reduced audio noise output.

While there have been shown and described particular embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention and, therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements having a first leg member extending axially of said magnetic core, each of said laminar elements also having a radially extending member lying in the same plane as said first leg member and positioned substantially perpendicularly to said first leg member, and a second leg member lying plane positioned substantially perpendicularly to the plane of said radially extending member and said first leg member, said radially-extending member connecting an end of said first leg member to an end of said second leg member and lying substantially perpendicular to both of said leg members, said second leg member extending axially in the same direction as said first leg member, said second leg member forming part of the outer surface of said core, said first group of laminar elements being arranged to form a generally cylindrical-shaped magnetic core section, and a second group of laminar elements of magnetic material arranged to form a cylindrical core section similar to that formed by said first group of laminar elements, the respective first leg members of said first and second groups of laminar elements collectively serving as a winding leg for an electrical winding, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially adjacent relation to each other and having their corresponding ends placed in abutting relation to each other with their respective open ends facing each other, with means for clamping said axially abutting core sections together.

2. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements having a first leg member extending axially of said core, a radially extending member lying in the same plane as said first leg member and positioned substantially perpendicularly to said first leg member, and a second leg member lying in a plane positioned substantially perpendicularly to the plane of said radially extending member and said first leg member and extending axially in the same direction as said first leg member, the respective first leg members of said first group of laminar elements being positioned in abutting relation to each other to define an axially extending winding-receiving element, said respective laminar elements radiating outwardly by means of said radially extending members from the axis defined by said first leg members to form a cylindrical-shaped core section, the respective second leg members of said first group of laminar elements being in overlapping relation with adjacent second leg members and collectively defining the outer surface of the cylindrical core section formed by said first group of laminar elements, and a second group of laminar elements of magnetic material arranged to form a cylindrical core section similar to that formed by said first group of laminar elements, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other with their respective open ends facing each other, with means for clamping said axially abutting core sections together.

3. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements being of substantially U-shape and having a first and a second leg member and a connecting member uniting the ends of said leg members, said first leg member and said connecting member lying in the same plane, said second leg member being bent to lie in a plane substantially perpendicular to the plane of said first leg member and said connecting member, a plurality of said U-shaped laminar elements being arranged in side-by-side relation to form a generaly cylindrical-shaped core element, the respective first leg members of said laminar elements being positioned in abutting relation to each other to form an axially-extending winding-receiving element, said connecting members of said U-shaped laminar elements extending radially outwardly, said second leg members of adjacent U-shaped laminar elements being overlapped with respect to each other and defining the outer surface of the cylindrical core section formed by said first group of laminar elements, and a second group of substantially U-shaped laminar elements of magnetic material arranged to form a cylindrical core element similar to that formed by said first group of laminar elements, the respective cylindrical core elements formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other with their respective open ends facing each other, with means for clamping said axially abutting core elements together.

4. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements being of substantially U-shape and having a first and a second leg member and a connecting member uniting the ends of said leg members, said first leg member and said connecting member lying in the same plane, said second leg member being bent to lie in a plane substantially perpendicular to the plane of said first leg member and said connecting member, a plurality of said U-shaped laminar elements being arranged in side-by-side relation to form a generally cylindrical-shaped core section, the respective first leg members of said laminar elements being positioned in abutting relation to each other to form an axially-extending winding-receiving element, the first leg members of alternate of said laminar elements being of greater width in a radially extending direction than the width of the corresponding leg members of laminations adjacent said alternate laminations, said connecting members of said U-shaped laminar elements extending radially outwardly, said second leg members being overlapped with respect to each other and defining the outer surface of the cylindrical core section formed by said first group of laminar elements, and a second group of substantially U-shaped laminar elements of magnetic material arranged to form a cylindrical core section similar to that formed by said first group of laminar elements, the respective cylindrical core sections formed by said first and second group of laminar elements being positioned in axially abutting relation to each other with their respective open ends facing each other, with means for clamping said axially abutting core sections together.

5. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements being of generally E-shape, with the center leg of said E being substantially wider along the stem axis of said E than the two outside legs thereof, one of said outside legs being wider along the stem axis of said E than the other of said outside legs, said laminar elements each being bent about the center line of said center leg which is perpendicular to the stem axis of said E, so that said two outer legs of said E-shaped lamination are in superposed but not coinciding relation to each other, said bent laminar elements being assembled together to form a core section of generally cylindrical shape, with said superposed outer leg members of said E-shape laminar elements lying adjacent one another and together defining a winding-receiving member extending axially of said cylindrical-shaped core element, and the bent center leg portions of said laminar elements collectively forming the outer surface of said cylindrical-shaped core section, and a second group of laminar elements similar to said laminar elements of said first group and arranged to form a generally-cylindrical-shaped core section similar to that formed by said first group of laminar elements, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other with their respective open ends facing each other, with means for clamping said axially abutting core sections together.

6. A magnetic core of generally cylindrical shape formed of a first and a second continuous strip of magnetic material, said first strip of magnetic material comprising a stem portion extending longitudinally of said strip and a repetitive sequence of displaced leg members projecting from said strip, said repetitive sequence including a first leg member, a second leg member, and a third leg member, said leg members and said stem portion all originally lying in the same plane of said strip, the stem portion connecting each group of said three leg members subsequently being bent into a generally U-shaped loop, with said first and third leg members of each group of leg members then lying in adjacent relation to each other, each of said first and third leg members being respectively bent back upon themselves at substantially a 180 degree angle at the respective center lines of said first and third leg members, each of said second leg

members and the stem portion joined thereto assuming an arcuate form, the plurality of leg member sequences comprising said first strip of laminated material thereby being bent into a plurality of connected U-shaped loops, said plurality of U-shaped loops being collectively bent into the shape of a cylinder, the respective second leg members and the stem portion joined thereto constituting the outer surface of said cylinder, the plurality of said first and third leg members being positioned adjacent one another and together defining a winding-receiving member extending axially of said cylindrical-shaped core element, said second strip of laminar magnetic material being arranged to form a cylindrical core element similar to that formed by said first strip, the respective cylindrical core elements formed from said first and second laminar strips being positioned in axially abutting relation to each other with the open ends of the respective cylindrical-shaped core elements facing each other, with means for clamping said axially abutting core elements together.

7. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements being of generally E-shape, each of said laminar elements being respectively bent about the center line of its center leg which is perpendicular to the stem axis of said E, so that the two outer legs of each E-shaped lamination are in superposed relation to each other, said bent laminar elements being assembled together to form a core section of generally cylindrical shape, with said superposed outer leg members of said E-shape laminar elements lying adjacent one another and together defining a winding receiving member extending axially of said cylindrical-shaped core section, said bent center leg portions of said laminations comprising the outer surface of said cylindrical core section, and a second group of laminar elements similar to said laminar elements of said first group and arranged to form a generally cylindrical-shaped core section similar to that formed by said first group of laminar elements, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other, with their respective open ends facing each other, each of said respective core sections comprising alternate laminar elements having a greater radius of curvature than laminar elements adjacent said alternate elements in the same core section, each laminar element in each core section lying in the same radial plane as a laminar element having a different radius of curvature lying in the other core section, the end of the laminar element of smaller radius of curvature being fitted in wedging relation with the end of the laminar element of larger radius of curvature which lies in the same radial plane, with means for maintaining said axially abutting core sections in assembled relation with respect to each other.

8. A magnetic core of generally cylindrical shape comprising a first generally cylindrical core section formed of a plurality of core elements, each of said core elements comprising a first and a second E-shaped lamination, each of said E-shaped laminations being bent about the center line of its center leg which is perpendicular to the stem axis of said E, so that the two outer legs of each of said E-shaped laminations are in superposed relation to each other, one of the E-shaped laminations of each core element being bent to a greater radius of curvature than the other E-shaped lamination of the same core element, said lamination of greater radius of curvature surrounding the lamination of lesser radius of curvature of said core element, a plurality of said core elements being assembled together to form said first cylindrical core section, the bent center leg portions of the laminations comprising said core elements collectively forming the outer surface of said cylindrical core section, the superposed outer leg members of said E-shape laminations together defining a winding-receiving member extending axially of said cylindrical-shaped core section, and a second core section constructed similarly to said first core section and being formed of a plurality of E-shaped laminations forming core elements like those of said first core section, said first and second cylindrical core sections having their corresponding ends placed in abutting relation with their respective open ends facing each other, each core element in one of said core sections being jointed to a corresponding core element in the other of said core sections, the respective outer laminations in each pair of said jointed core elements having the same radius of curvature and being in abutting relation to each other, the respective inner laminations in each pair of said mating core elements having the same radius of curvature and being in abutting relation to each other, the joint between the outer laminations of each mating pair of core elements being offset from the joint between the inner laminations of the same pair of core elements.

9. A magnetic core arranged substantially in the form of a cylinder, said magnetic core comprising a first group of laminar elements of magnetic material, each of said laminar elements having a first leg member positioned adjacent and substantially parallel to the longitudinal axis of said cylinder, each of said laminar elements also having a radially-extending member lying in substantially the same plane as said first leg member and attached at its radially innermost portion substantially perpendicularly to an end of said first leg member, said laminar elements having a second leg member attached at one of its ends to the radially outermost portion of said radially-extending member, said second leg member having a substantial portion of its area lying on the outer peripheral surface of said cylinder, said second leg member extending in the same axial direction as said first leg member, said first group of laminar elements being arranged to form a generally cylindrical-shaped magnetic core section, and a second group of laminar elements of magnetic material arranged to form a cylindrical core section similar to that formed by said first group of laminar elements, the respective first leg members of said first and second groups of laminar elements collectively serving as a winding leg for an electrical winding, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other to form a substantially closed cylinder.

10. A magnetic core substantially in the shape of a cylinder comprising a first group of laminar elements of magnetic material, each of said laminar elements having a first leg member extending axially of said magnetic core, each of said laminar elements also having a radially-extending portion lying in substantially the same plane as said first leg member and positioned substantially perpendicularly to said first leg member, and a second leg member attached at one of its ends to the radially outer portion of said radially-extending member and having a substantial portion of its area lying on the outer peripheral surface of said cylinder, said radially-extending member connecting an end of said first leg member to an end of said second leg member, said second leg member extending axially in the same direction as said first leg member, said first group of laminar elements being arranged to form a generally cylindrical-shaped magnetic core section forming substantially one-half of said magnetic core, and a second group of laminar elements of magnetic material arranged to form a cylindrical core section similar to that formed by said first group of laminar elements, the respective first leg members of said first and second groups of laminar elements collectively serving as a winding leg for an electrical winding, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other to form a substantially closed cylinder.

11. A magnetic core of generally cylindrical shape comprising a first group of laminar elements of magnetic material, each of said laminar elements being of generally E-shape and comprising a pair of outer legs and a center leg, each of said laminar elements being respectively bent about the center line of its center leg which is perpendicular to the stem axis of said E, so that the two outer legs of each E-shaped lamination are in superposed relation to each other, said bent laminar elements being assembled together to form a core section of generally cylindrical shape, with said superposed outer leg members of said E-shape laminar elements lying adjacent one another and together defining a winding receiving member extending axially of said cylindrical-shaped core section, said bent center leg portions of said laminations comprising the outer surface of said cylindrical core section, and a second group of laminar elements similar to said laminar elements of said first group and arranged to form a generally cylindrical-shaped core section similar to that formed by said first group of laminar elements, the respective cylindrical core sections formed by said first and second groups of laminar elements being positioned in axially abutting relation to each other, with their respective open ends facing each other.

12. A magnetic core substantially in the shape of a cylinder comprising a first group of laminar elements of

magnetic material radially arranged to form a cylindrical core section, each of said laminar elements having at least one first leg member extending axially of said magnetic core, each of said laminar elements also having a radially extending portion lying in the same plane as each of said first leg members and attached at its radially innermost portion substantially perpendicularly to an end of said first leg member in the same plane therewith, and a second leg member attached at at least one end to the radially outermost portion of a radially extending member, said second leg member having a substantial portion of its area lying on the outer peripheral surface of said cylinder, each of said radially extending members connecting said end of said first leg member in the same plane therewith to an end of said second leg member, said second leg member extending axially in the same direction as each of said first leg members, and a second group of laminar elements of magnetic material radially arranged to form

a cylindrical core section similar to that formed by said first group of laminar elements, the respective first leg members of said first and second groups of laminar elements collectively serving as a winding leg for an electric winding, the respective cylindrical core sections formed by said first and second groups of laminar elements being arranged in axial relationship to each other.

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