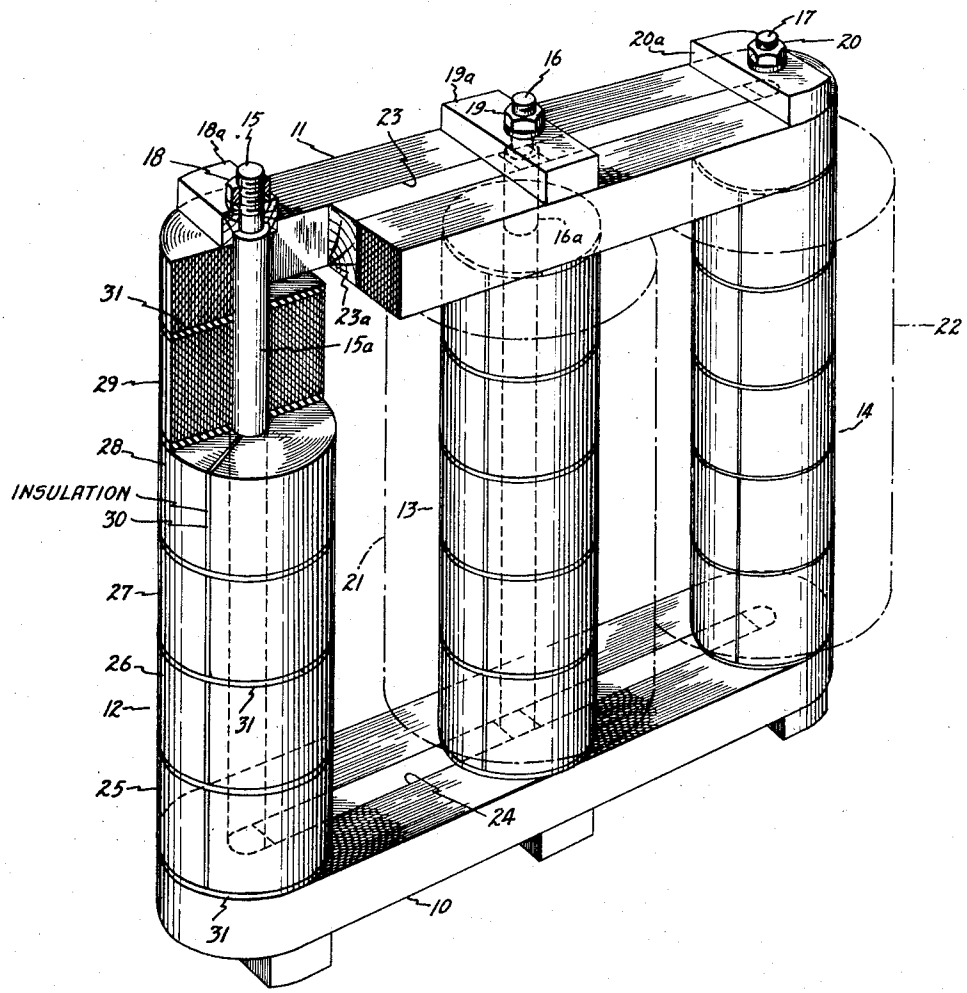
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MACHINE WOUND MAGNETIC CORE

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MACHINE WOUND MAGNETIC CORE

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This invention relates to a machine wound magnetic core of a type suitable for use in a transformer or reactor.

Magnetic cores of the type which provide paths for magnetic flux in electrical apparatus such as transformers and reactors normally consist of a pair of spaced yoke members and two or more leg members positioned in spaced longitudinal configuration between the yoke members. Normally, both the yoke members and leg members consist of a plurality of relatively thin flat plates in stacked relationship and insulated from each other. While this construction is entirely satisfactory from the standpoint of performance it necessitates for reactor cores the stocking of a large variety of flat plates and involves considerable manual labor in assembly.

It is an object of the present invention to provide a magnetic core and method of fabricating the core wherein the assembly is simplified and reduced in size.

It is another object of the invention to provide a magnetic core in which the magnetic elements are machine wound.

Briefly stated, in accordance with one of its aspects, this invention consists of a magnetic core comprising a pair of spaced oblong yoke sections of spirally wound magnetic strip material, a plurality of leg members positioned between the yoke sections, each leg member being composed of a plurality of spaced coaxial sections of spirally wound magnetic material, a radial portion of each section being free of the magnetic material, and electrical insulation positioned in the radial portion and between adjoining sections of each leg member.

The drawing is a perspective view of a magnetic reactor core made in accordance with this invention.

The magnetic core illustrated comprises a pair of yoke members **10** and **11**, three leg members **12**, **13**, and **14**, and three tierods **15**, **16**, and **17**, on which the yoke member **11** may be mounted in electrically insulated relationship as by sleeves **15***a* and **16***a* which are composed of insulating material. The ends of the tierods **15**, **16** and **17**, are threaded to receive nuts **18**, **19**, and **20** which bear against wood insulating blocks **18***a*, **19***a*, and **20***a*, respectively, to hold the yoke member **11** firmly against the legs **12**, **13**, and **14**. The legs **13** and **14** have a pair of coils **21** and **22** shown in phantom mounted thereon. The coils **21** and **22** may be wound directly on assembled core legs to constitute a unit of core leg and coil. A similar coil has been omitted from the leg **12** in order to illustrate the device more clearly.

The yoke members **10** and **11** are formed by winding a strip of magnetic material, such as magnetically oriented 3% silicon steel, on a form of the desired diameter. Although the strip may be wound on an oblong form, it is easier to maintain uniform tension on the strip if it is wound upon a circular form and subsequently given a rigid oblong shape by a pressing and annealing operation. After the pressing operation the yoke members **10** and **11** will have the oblong shape illustrated and will define a pair of longitudinal slots **23** and **24** having a perimeter

which is equal to the circumference of the form on which the yoke members were wound. The slots **23** and **24** which may be filled in part by an insulating material such as wood blocks **23***a*, serve as a means for mounting the yoke members upon the tie-rods **15**, **16**, and **17**. The area between the studs may be filled either with steel or a non-magnetic material. The tie-rods **15**, **16**, **17** provide central clamping in a manner which exerts pressure on core in most effective way. Pressure exerted on core leg must be sufficient to compress the insulation material to a point where the forces due to flux across the gap will not compress the material further and thus change characteristics.

Since the leg members **12**, **13**, and **14** are all the same a description will be only of the elements forming the leg member **12**. The leg member **12** consists of a plurality of stacked core pieces such as the pieces **25**, **26**, **27**, **28**, and **29**. These core pieces are all identical and are fabricated by winding a strip of magnetic material, such as the steel used in fabrication of the yoke member except that the magnetic orientation is different, on a form slightly larger in diameter than the diameter of the tie-rods **15**, **16**, and **17**. As soon as each wound piece reaches the desired thickness it is prevented from unraveling by means such as a clamp or spot weld and a radial cut is taken through the piece to leave a gap across which electrical conduction cannot take place. This gap is then filled with an electrically insulating material as shown at **30** on the element **28**. A wide variety of resins, varnishes, and plastic substances, such as the phenol formaldehyde plastics and alkyd resins are available for this purpose. Thus, each wound element of each leg consists in effect of a plurality of laminations and the presence of the gap prevents large circulating currents from flowing in the laminations when the core is energized. The laminations are coated with an electrically insulating material prior to the winding operation in order to prevent the passage of currents through the strip surfaces.

In forming the leg members a plurality of the elements **25–29** are assembled in stacked relationship with an electrically insulating material positioned between elements as shown at **31**. It is desirable to have the insulating layer **31** between the leg and yoke as thin as possible. This material is preferably of such dimension and configuration as to position tie rods and coils with respect to leg members.

In assembling a magnetic core in accordance with this invention, the tie-rods are positioned in spaced relation to extend upward through the center slot of a yoke member and the desired number of leg elements, separated by electrically insulating material, are positioned on each tie-rod. The coils **21** and **22** are then mounted over the legs **12–14** and the yoke **11** is positioned against the legs **12–14** with the tie-rods **15–17** extending through the slot **23**. The nuts **18–20** are then tightened on the tie-rods and this part of the assembly is complete. The clamping structure and lead supports are secured in place by the three central studs. Additional mounting fixtures are incorporated in the device to the extent necessitated by operating requirements.

A magnetic core made in accordance with this invention can be very quickly assembled with the exercise of very little skill. All of the component parts may be quickly fabricated by a machining operation. Yet this speed of construction and assembly has been achieved without the sacrifice of efficiency of performance.

While the present invention has been described with reference to particular embodiments thereof, it will be understood that numerous modifications may be made by those skilled in the art without actually departing from the invention. Therefore, I aim in the appended claims

to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

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

1. A magnetic core comprising a pair of spaced oblong yoke sections of spirally wound magnetic strip material each having a pair of oppositely disposed faces, a plurality of spaced apart leg members extending between said yoke sections and perpendicular to the faces thereof, each leg member being composed of a plurality of spaced coaxial sections of spirally wound magnetic material, a gap extending radially and axially completely through each section being free of said magnetic material, and electrical insulation positioned in said radial gap, between adjoining sections of each leg member, and between adjoining leg and yoke members.

2. A magnetic core comprising a pair of oblong yoke sections of spirally wound magnetic strip material each having a pair of oppositely disposed faces, a plurality of leg members each of which is formed of a plurality of coaxial sections of spirally wound magnetic material, a gap extending radially and axially completely through each section and the space between sections being occupied by electrically insulating material, electrically insulating material between adjoining leg and yoke members and means for maintaining said leg members in spaced relation to each other and perpendicularly adjoining the faces of said yoke sections.

3. A magnetic core comprising a plurality of parallel spaced leg members joined at the ends by a pair of yoke members, said leg members being comprised each of a plurality of coaxial circular cylindrical sections formed of spirally wound magnetic strip material, electrically insulating material positioned in a gap extending radially and axially completely through each of said sections, electrically insulating material between adjoining sections of each leg member, and electrically insulating material between adjoining leg and yoke members, said yoke members being comprised of spirally would oblong discs of magnetic strip material each having a pair of oppositely disposed faces, one face of each of said discs being held rigidly against the ends of said leg members.

4. A magnetic core comprising a plurality of parallel spaced leg members joined at the ends by a pair of yoke members, said leg members being comprised each of a plurality of coaxial circular cylindrical sections formed of spirally wound magnetic material, threaded members extending coaxially through said sections, electrically insulating material positioned in a gap extending radially and axially completely through each of said sections, electrically insulating material between adjoining sections, and electrically insulating material between adjoining leg and yoke members, said yoke members being comprised of spirally wound oblong discs of magnetic strip material, the centers of said discs being free of magnetic material, said threaded members extending through said free centers and being provided with threaded means for clamping said yoke members to said leg members.

5. A magnetic core comprising a plurality of parallel spaced leg members joined at the ends by a pair of yoke members, said leg members being comprised each of a plurality of coaxial circular cylindrical sections formed of spirally wound magnetic material, threaded members extending coaxially through said sections, electrically insulating material positioned in a gap extending radially and axially completely through each of said sections, electrically insulating material between adjoining sections, and electrically insulating material between adjoining leg and yoke members, said yoke members being oblong discs formed of spirally wound magnetic strip material and each having an elongated central coaxial portion free of magnetic material and a pair of oppositely disposed faces, said threaded members extending through said central portions of said yoke members and being provided with means extending across the outer faces of said discs for clamping said yoke members to said leg members.

6. A magnetic core comprising first, second, and third parallel spaced leg member joined at the ends by a pair of yoke sections, said leg sections being comprised each of a plurality of coaxial circular cylinder sections formed of spirally wound magnetic material, threaded tie rods extending through each of said sections, electrically insulating material positioned in a gap extending radially and axially completely through each of said sections, electrically insulating material between adjoining sections, and electrically insulating material on the ends of each leg member, said yoke members being oblong discs formed of spirally wound magnetic strip material and each having an elongated central coaxial portion free of magnetic material, the tie rod of said first leg members extending through one end of said central portions, the tie rod of said second leg member extending through the other end of said central portions, the tie rod of said third leg member extending through said central portion equidistant from said first and second leg tie rods, and means on said tie rods for clamping said yoke members to said leg members.

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