July 31, 1956

E. L. LAHAYE

2,757,346

HIGH-FREQUENCY COIL

Filed Jan. 4, 1952

FIG. 1

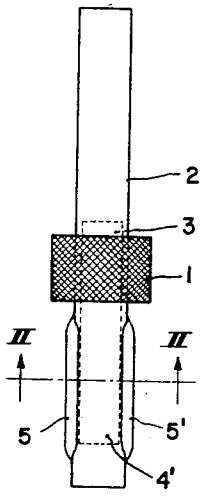


FIG. 2

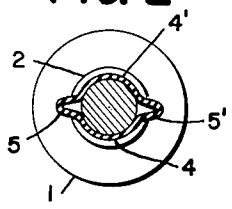


FIG. 3

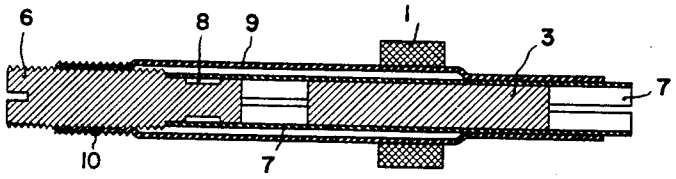
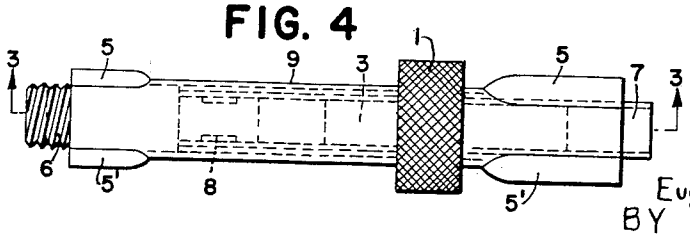


FIG. 4



INVENTOR

Eugene Lambert Lahaye

BY

AGENT

United States Patent Office 2,757,346 Patented July 31, 1956

2,757,346

HIGH-FREQUENCY COIL

Eugene Lambert Lahaye, Eindhoven, Netherlands, assignor to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

Application January 4, 1952, Serial No. 264,937

Claims priority, application Netherlands February 21, 1951

4 Claims. (Cl. 336—136)

This invention relates to high-frequency coils comprising a substantially tubular coil former which is made from resilient insulating material and resiliently embraces a core member mainly consisting of ferromagnetic material and displaceable in an axial direction. This coil construction has the advantage of the core member being fitted free from play in the coil former without very high tolerance requirements needing to be imposed on the fitting of the core member in the former, whereby the manufacture would be rendered too expensive.

High-frequency coils are known comprising a screw core and a coil former of elastic material, for example, hard rubber. These coils have a limitation in that the core is not smoothly rotatable in the rubber. To prevent excessive slackness the coil former should have a sufficiently thick wall, due to which the quantity of material required for the coil former is rather considerable and a considerable difference exists between the inner diameter of the coil and the diameter of the core, whereby the quality of the coil and the range of variation are adversely affected.

This limitation is mitigated in a known coil construction comprising a screw core, in which construction the coil former of resilient material is split in a longitudinal direction. In this case, however, difficulties are experienced due to the fact that the winding surrounding the coil former prevents free expansion of the latter.

As an alternative, the ferromagnetic core may be surrounded by a resilient sleeve provided with an external screw-thread and split in a longitudinal direction, the sleeve and core being so arranged as to permit to be screwed into and out of the coil former. However, this construction comprising a resilient screw is too complicated for mass-production of small-sized coils.

This objection also holds for the known construction, in which a U-shaped spring engages the screw-threaded core through a transverse slot provided in the coil former. Moreover, it is difficult here to avoid axial play of spring and core.

The present invention has for its object to provide an improved high-frequency coil whose construction is eminently adapted for cheap mass-production of very small coils in a particularly simple manner.

According to the invention, a high-frequency coil comprising a substantially tubular coil former of resilient insulating material, this former resiliently embracing a core member which is displaceable in an axial direction and substantially consists of ferromagnetic material, is characterised in that the wall of the coil former is folded together or pinched flat over part of its length and its circumference about at least one line parallel with the longitudinal axis of the coil former in such manner that the cross-section of the former consists of a mainly circular part and at least one adjoining U-shaped part, the circular part resiliently embracing the core member and the winding being provided on the undeformed part of the coil former.

The strains exerted on the wall of the coil former upon introduction of the core member are not unduly high, since the U-shaped pinch permits of an increase in diameter of the circular part of the cross-sectional area of the former, without the latter being forced and damaged. As a result of this resilient construction, the coil former may have a thin wall and additional resilient elements can be dispensed with. Since, furthermore, the winding is arranged on an undeformed, and hence circular, part of the coil former, the difference between the inner diameter of the winding and the thickness of the core may be small.

Preferably, two pinches are provided diametrically opposite each other on the coil former; in this event the core is concentrically guided in the coil former.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described more fully with reference to the accompanying diagrammatic drawing, given by way of example, in which:

Figs. 1 and 2 are an axial section and a cross-section taken on the line II—II of Fig. 1, respectively, of one embodiment of the invention and

Figs. 3 and 4 show a second embodiment of the invention in axial section and plan view at right angles thereto, respectively.

The high-frequency coil shown in Figs. 1 and 2, which may be used in a radio or television set, comprises a coil winding **1** and a coil former **2** of resilient insulating material, the former **2** containing a ferromagnetic core **3** which is displaceable in the axial direction of the coil former **2** and made, for example, from mixed cubic crystal material (ferrite). In this coil, the ferrite core **3** is displaceable, for adjustment of the inductance, by means of a tool, for example, a glass rod.

The wall of part of the coil former **2** (in Fig. 1 the lower part) is pinched together about two lines parallel with the axis of the coil former such that the cross-sectional area of the former **2** consists of a mainly circular part (in this case two semi-circular parts **4** and **4'**) and two adjoining U-shaped parts **5** and **5'**, the circular part **4**, **4'** resiliently embracing the core member **3**.

The wall so formed is better shown in Fig. 2 which shows that the two U-shaped pinches **5** and **5'** are located diametrically opposite each other.

When the ferrite core is introduced into the deformed part of the coil former **2**, the wall is subjected to bending strains about the folding lines of pinches **5** and **5'**. The strains in the wall of the base are light, so that the wall may be very thin.

The coil winding **1** is wound on the undeformed part of the former **2**, the diameter of which is only slightly different from that of core **3**. The coil winding is consequently filled up as much as possible by the core which is vital to the quality of the coil and its range of variation.

If desired, the coil former **2** may be deformed in the aforesaid manner at each side of the coil winding **1**, the coil winding again being provided on the undeformed part.

Figs. 3 and 4 show a modification of the coil construction shown in Figs. 1 and 2, corresponding elements bearing the same reference numerals in the four figures.

In this second embodiment, the core member displaceable in the axial direction of the coil former **2** comprises an adjusting screw **6** of non-magnetic material, for example brass, and a ferrite core **3** which is spaced apart therefrom and is arranged in alignment therewith, both members being glued in a tight-fitting longitudinally split insulating envelope **7** extending past the ferrite core **3**. In this embodiment, the envelope **7** embraces an unthreaded end of screw **6** which is provided with an annular groove **8** containing adhesive.

A female thread 10 co-operating with the adjusting screw 6, is provided at the left-hand end of the coil former 9. The screw-thread 10 is provided in a part of the coil former 9 which is deformed similarly to part 4, 5, 4', 5' in Figs. 1 and 2, more particularly in the cylindrical part corresponding to part 4, 4' in Figs. 1 and 2. The other end of coil core is deformed but not threaded.

The core member 3, 6, 7 is resiliently embraced by the coil former 9 near its two ends and is axially adjustable by means of screw 6.

The high-frequency coils according to the invention are eminently adapted for mass production. They permit the use of cheap seamless tubing of thermoplastic material, for example cellulose acetate, which may surround the ferromagnetic core with a little clearance, since a resilient fit is ensured by deformation of the tube in the aforesaid manner. Hence, close tolerances need not be considered.

The coil base shown in Figs. 1 and 2 may be made from the seamless tubing by a single pressing operation, the coil base end to be deformed being pressed around a cylindrical mandrel by means of pressing blocks. These blocks together surround a circular cylindrical cavity but, in pressing, leave two diametrically opposed slots into which a part of the wall of the coil base, heated approximately to its softening temperature, is allowed to enter, thus forming the U-shaped pinches designated 5 and 5' in Figs. 1 and 2.

The screw-thread in the coil base 9 shown in Fig. 3 may be provided by means of an analogous pressing operation, the pressing mandrel then having a male screw thread and being constituted, for example, by the adjusting screw itself. In the latter case, non-profiled elastic pressing blocks, for example of hard rubber, are used. During the pressing operation these pressing blocks assume the form of the screw-thread onto which they are pressed, so that previous adjustment of screw 6 in an axial direction relatively to the pressing blocks is not necessary.

This construction permits of the manufacture of very small-sized coils. In one practical case, for example, the diameter of the core was 1.6 mm. and that of the coil winding 4.5 mm., the quality factor

$$Q=\omega\frac{L}{r}$$

of this coil being about 110 at a frequency of 450 kcs./sec.

What I claim is:

1. A high-frequency induction device comprising a rigid ferromagnetic core member, a substantially tubular coil former of resilient insulating material closely surrounding said core, said core being axially displaceable within said coil former, said coil former having a pair of axially spaced transversely flattened U-shaped wall portions with the bottom of the U being more remote from the core than the ends of the U and disposed axially along only a portion of said former and whereby the remaining circumferential portions of the wall tightly embrace the core, and a coil winding on an undeformed portion of the former and disposed between the pair of flattened U-shaped wall portions.

2. A high-frequency induction device comprising a core member having a rigid ferromagnetic portion and a threaded portion, a substantially tubular coil former of resilient insulating material closely surrounding said core, said core being axially displaceable within said coil former, said coil former having a pair of diametrically-opposed transversely flattened U-shaped wall portions with the bottom of the U being more remote from the core than the ends of the U and disposed axially along only a portion of said former, the remaining circumferential portions of the wall being threaded and tightly embracing the threaded portion of said core, and a coil winding on an undeformed portion of the former.

3. A high-frequency induction device comprising a core member having a rigid ferromagnetic portion and a threaded portion, a substantially tubular coil former of thermoplastic resilient seamless tubing closely surrounding said core, said core being axially displaceable within said coil former, said coil former having a transverely flattened U-shaped wall portion with the bottom of the U being more remote from the core than the ends of the U and disposed axially along only a portion of said former, the bottom of the U radially extending beyond the undeformed portion of the former, the remaining circumferential portions of the wall being threaded and tightly embracing the threaded portion of said core, and a coil winding on an undeformed portion of the former.

4. A high-frequency induction device comprising a rigid ferromagnetic core member, a threaded adjustable member spaced from said core, a split insulating sleeve tightly embracing said core and a portion of said adjustable member and secured thereto, a substantially tubular coil former of resilient insulating material closely surrounding said sleeve, core and adjustable member, said sleeve-enclosed adjustable member and core being axially displaceable within said coil former, said coil former having transversely flattened U-shaped wall portions with the bottom of the U being more remote from the core than the ends of the U and disposed axially along only a portion of said former and whereby the remaining circumferential portions of the wall tightly embrace the sleeve-enclosed core and the other portion of the adjustable member, and a coil winding on an undeformed portion of the former.

References Cited in the file of this patent

UNITED STATES PATENTS

1,052,081	Miltner	Feb. 4, 1913
2,248,898	Ross	July 8, 1941
2,279,388	Cox	Apr. 14, 1942
2,318,415	Patzschke et al.	May 4, 1943
2,462,822	Wood	Feb. 22, 1949
2,607,826	Barnes	Aug. 19, 1952
2,631,192	Wallin	Mar. 10, 1953