

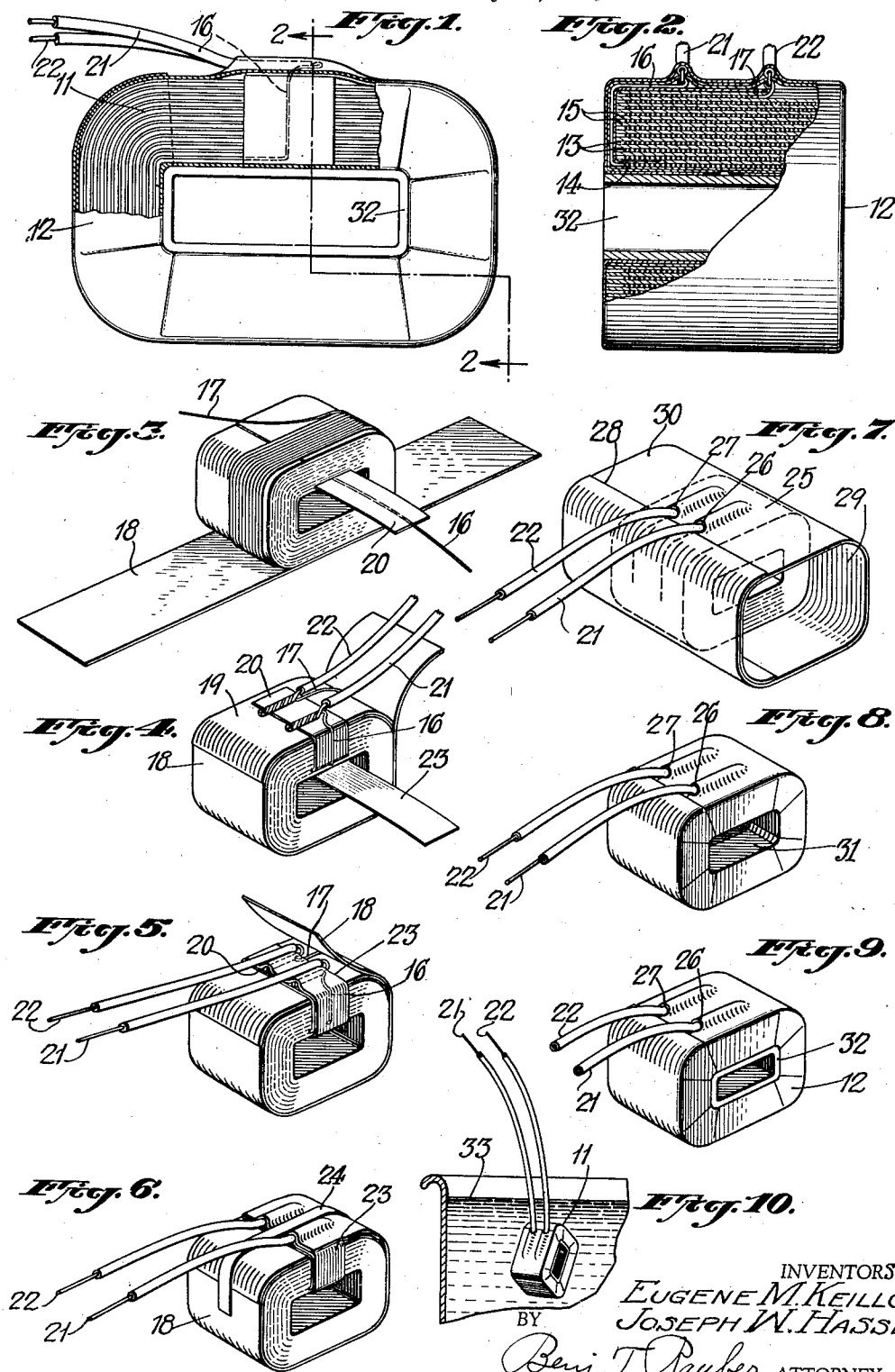
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ELECTRIC COIL

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ELECTRIC COIL

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Our invention relates to coils, such as solenoids and transformer coils for electric apparatus, and more particularly to a wrapping or covering for coils of the above type, of simple construction and which will adequately protect the coils from moisture or corrosive influence, and from dust or dirt.

Solenoids and coils of the above type are commonly made with several layers of parallel turns of wire insulated by a coating of enamel, or other insulating material. The coils may be wound on any suitable core in successive layers which are separated from each other by inserts or layers of separating material as, for example, paper or similar insulating material.

Coils constructed in this manner have one end or terminal at the inner part of the coil and next to the core, and the other end at the peripheral surface. The inner end is generally brought to the outer surface, for example, in parallel spaced relation to the other end and connected with lead wires.

A coil of the above, or any similar type, is enclosed by means of our invention in a wrapping which extends seamlessly around the assembled layers of turns of the coil and joined within the core and protected by a continuous seamless coating impervious to water or to moistened and corrosive atmospheres and hermetically sealing the coil.

In accordance with our invention a coil of wire, the ends of which have been attached to lead wires and secured in place on the surface of the coil, is wrapped in a circumferential direction by a sheet of wrapping material, rendered adhesive on its inner surface and projecting sideways from each of the flat sides or ends of the coil. Thereupon the projecting parts of this wrapper are folded inwardly over the sides of the coil toward the center thereof and thence into the hollow center or core thereof and thence secured adhesively to the inner surface of the hollow core. A hollow tube, closely fitting the inner surface of the coil or its core, is then inserted to finish the wrapping and cover the exposed ends.

If the wrapping material is in a moist or wet condition, it can be folded to conform very closely to the shape of the coil and upon drying may shrink to form a very tight wrapping or enclosure, thereafter it may be rendered waterproof and proof against the entrance of corrosive materials or atmospheres by dipping it into a bath or solution of a suitable covering material,

or otherwise forming a continuous hermetically sealed coating on the wrapping.

The various features of the invention are illustrated by way of example in the accompanying drawing in which

Fig. 1 is a side view of a wrapped coil embodying a preferred form of our invention, parts of the wrapper being broken away to show the interior construction.

Fig. 2 is an end view taken partly on the line 2—2 of Fig. 1 of the coil shown in Fig. 1, and

Figs. 3 to 10 inclusive show the various stages of making the coil of Figs. 1 and 2, these views taken on a somewhat smaller scale.

In the embodiment of the invention shown in the accompanying drawing, a coil or solenoid 11 of successive layers of insulated wire is wrapped by a sheet 12 of flexible material. The coil 11 may be of any suitable type and construction, that shown in the drawing being one in which successive layers 13 of insulated wire are wrapped on a paper core 14, each layer of the windings of wire being separated from the next adjacent windings by sheets 15 of thin separating material, such as glassine paper.

When a sufficient number of layers of wire have been formed to give the desired electric characteristics, the completed coil or solenoid will have an inner end of wire, such as indicated at 16 in Fig. 3, which may extend to one side between the windings and the paper core 14 and an outer end 17 extending circumferentially on the outermost separating sheet 15.

To protect the outermost layer of wires, they are wrapped in a circumferential direction by a strip 18 of a material of suitable strength and toughness as, for example, varnished cambric, the material being wrapped to the position shown in Fig. 4.

Preferably the face of this paper immediately below the terminal of the wire 17 is further protected by a covering of paper 19. To bring the end 16 of the coil to the peripheral surface of the coil and in parallelism with the wire 17, a strip 20 of a suitable material, such as vulcanized fiber or tough paper, is inserted between the wire 16 and the end of the coil and then wrapped over one side of the coil and across the peripheral surface to the position indicated in Fig. 4. The wire end 16 is then brought upwardly over the side of the coil on the strip 20 to a position of parallelism with the wire end 17, and then the wire ends 16 and 17 are secured to respective insulated lead wires 21 and 22. The ends thus secured may then be covered by a strip 23 overlying the strip

20. The free end of the wrapping strip 18 is then wrapped downwardly over the lead wires 21 and 22 and the ends of the wires 16 and 17, as indicated in Figs. 5 and 6 to cover and hold the wires, and the end of the strip 18 is then secured by a narrow strip 24 of gummed paper, such as Scotch tape. The coil is now ready to be covered by the protective covering of our invention.

In covering the completed coil, it is wrapped in a circumferential manner with a sheet 25 of suitable protective material as, for example, vulcanized fiber having slits or openings 26 and 27 through which the lead wires 21 and 22 extend, as indicated in Fig. 7. The outer or free end of the strip, indicated at 28, is preferably brought to a position immediately beneath the lead wires 21 and 22 covering the slits 26 and 27 and reinforcing the coil at this point with a double thickness of the wrapping material. The wrapping material is rendered adhesive or gummed on its inner surface so that the overlapped end seals by adhesion to the part of the wrapper it overlaps. The wrapping sheet 25 is wider than the width of the coil and, therefore, extends on each side as indicated at 29 and 30.

These projections are then folded over the sides of the coils toward the center and pushed into a hollow core, as shown in Fig. 8. If the material is in a moistened or wet condition and therefore very flexible, it can be folded to conform and fit the coil very closely, and being adhesive or gummed on its inner surface will adhere to the inner surface of the hollow core. In case a sheet of material, such as wet vulcanized fiber is used, which shrinks on drying, this will tend to form a taut drum-like covering for the coil. To insure a tight seal of the end portions 31 of the wrapping against the inner surface of the hollow core, the wrapping is preferably pressed tightly against the inner surface of the core by means of a mandrel and the entire coil pressed and heated to dry it on the core. The wrapping may then be finished by inserting a tube 32 within the coil to conform closely to the shape of the paper core. This spans the abutting edges of the parts 31 of the wrapping within the core and completes the enclosure.

The wrapping material may have some resistance to the penetration of moisture or corrosive gases, or may be quite permeable thereto, but is protected against water or the entrance of other corrosive materials by being coated with a continuous coating of waterproof or water resistant and corrosive resistant composition which thus forms a continuous unbroken or hermetic seal for the entire coil.

This material which may be rendered in a plastic liquid condition by means of solvents or heat, may be applied to the coil in any suitable manner; for example by dipping or spraying.

As indicated in Fig. 10 it is applied by dipping the wrapped coil into a bath 33 of the plastic or liquid coating material which has the further advantage of coating the lead wires 21 and 22 for a distance from the coil 11 with a coating that is continuous with that of the coil.

The wrapping of our invention may be applied to a wide variety of coils, such as the secondaries or primaries of transformers, or to random wrapped coils, such as used for dynamic speaker field coils. These coils may be moistureproofed in any suitable way, as was heretofore practiced. Such moistureproofing is generally not sufficient to form a complete waterproofing of the coils and complete protection against the entrance of

corrosive agents. The final complete wrapping and coating provided by our invention affords more effective and additional protection against the entrance of such agents.

5 • Vulcanized fiber has been mentioned as the wrapping material, but it will be understood that various other wrapping materials such as leatheroid, varnished cambric, varnished silk-vinylite film, or any permissible digested cellulose film or sheet may be employed. A wide variety of varnishes or coating materials may be used for the final finish of the wrapping, the selection of the particular varnish or coating material depending upon the uses to which the coil is to be subjected.

While the above construction enables the coil to be enclosed in a waterproof wrapping, it can also be used to hold together a random wound coil such as a dynamic speaker field coil, or to prevent the entrance of foreign particles into the winding. In such cases the final coating need not be waterproof or moistureproof.

Various modifications may be made by those skilled in the art without departing from the invention as defined in the appended claims.

What we claim is:

1. A coil of the type described which comprises concentric turns of wire on a hollow core and a covering comprising a continuous sheet of vulcanized fibre wrapped circumferentially about said coil to form a complete wrapping and extending over the sides of the coil and into the hollow core thereof and being shrunk and pressed about said coil and a continuous coating of sealing material enclosing said wrapping.

2. A coil of the type described which comprises concentric turns of wire on a hollow core and a covering comprising a sheet of vulcanized fibre wrapped circumferentially about said coil and extending sidewise over the sides of said coil and into the hollow core thereof, a tube in said core having its outer surface against the intumed parts of said sheet and a continuous coating of sealing material enclosing the wrapped sheet and tube.

3. A coil of the type described which comprises concentric turns of wire on a hollow core, lead wires extending from the circumference of said coil and connected to opposite ends of said wire and a covering comprising a continuous sheet of material through which said lead wires extend near one end of said sheet, said sheet being wrapped circumferentially about said coil with the opposite end thereof underlying the projecting ends of said lead wires, said sheet projecting over the ends of said coil centrally to and into the hollow core thereof, a tube inserted into said core to cover the ends of said wrapped sheet, said sheet being shrunk and pressed about said coils and a continuous coating of waterproofing material hermetically sealing said wrapping of sheet and tube and the lead wires projecting therefrom.

4. A method of sealing a coil of the type described which comprises wrapping said coil circumferentially with a wet sheet of wrapping material which shrinks on drying to completely enclose said coil, said sheet projecting over the sides of said coil, folding the projecting ends of said sheet over said sides of said coil centrally toward and into the core thereof while wet, drying said sheet to shrink it on said coil and coating said dried wrapping in a coating of sealing material to form a continuous hermetic seal therefor.

5. A method of enclosing a coil of the type described which comprises wrapping said coil circumferentially with a wet sheet of vulcanized fibre to completely enclose said coil and with ends of said sheet projecting over the sides of said coil, folding said projecting ends toward and into the core of said coil, inserting a tube into said core and drying and coating the completed wrapping with a moisture-proofing material to hermetically seal said wrapping and coil therein.

6. A method of enclosing a coil of the type described which comprises wrapping the coil circumferentially with a wet sheet of vulcanized fibre to form a complete circumferential enclosure thereof and with projections of said sheet over the sides of said coil, wrapping the projecting ends of said sheet to and into the hollow end of the core of said coil, drying and moistureproofing said wrapping to hermetically seal the coil therein.

7. A coil of the type described which comprises concentric coils of wires on a hollow core and having lead wires extending from the circumferential surface of said coil and a covering comprising a continuous sheet of vulcanized fibre wrapped circumferentially about said coil with one end underlying said lead wires and the opposite end overlapping said underlying end, said sheet extending from each side of said coil centrally toward said core and into said core, and a tubular member in said core and overlapping the intumed edges of said sheet, said sheet being shrunk onto said coil and moistureproofed.

8. A method of enclosing a coil of the type described which comprises wrapping the coil circumferentially with a wet sheet of vulcanized fibre to form a complete circumferential enclosure thereof and with the ends of said sheet

overlapping and with the sheet projecting over the sides of said coil, folding the projecting ends of said sheet to and into the hollow ends of the core of said coil while said sheet is soft and flexible and drying and treating said sheet to shrink it and render it stiff while pressing it into position about said coil and into said core.

9. A method of enclosing a coil of the type described which comprises wrapping the coil circumferentially with a wet sheet of vulcanized fibre to form a complete circumferential enclosure thereof and with the ends of said sheet overlapping and with the sheet projecting over the sides of said coil, folding the projecting ends of said sheet to and into the hollow ends of the core of said coil while said sheet is soft and flexible and drying and treating said sheet to shrink it and render it stiff while pressing it into position about said coil and into said core and inserting a hollow core into the core of said wrapped coil to cover the intumed edges of said wrapped sheet.

10. A method of enclosing a coil of the type described which comprises wrapping the coil circumferentially with a wet sheet of vulcanized fibre to form a complete circumferential enclosure thereof and with the ends of said sheet overlapping and with the sheet projecting over the sides of said coil, folding the projecting ends of said sheet to and into the hollow ends of the core of said coil while said sheet is soft and flexible and drying and treating said sheet to shrink it and render it stiff while pressing it into position about said coil and into said core, and immersing said wrapped coil into a water-proofing material to hermetically seal said coil in the wrapped enclosure.

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