July 21, 1964 W. S. LENOX ETAL 3,142,030

COIL CONSTRUCTION TO FACILITATE TAPPING

Filed Nov. 10, 1958 2 Sheets-Sheet 1

Fig. 1.

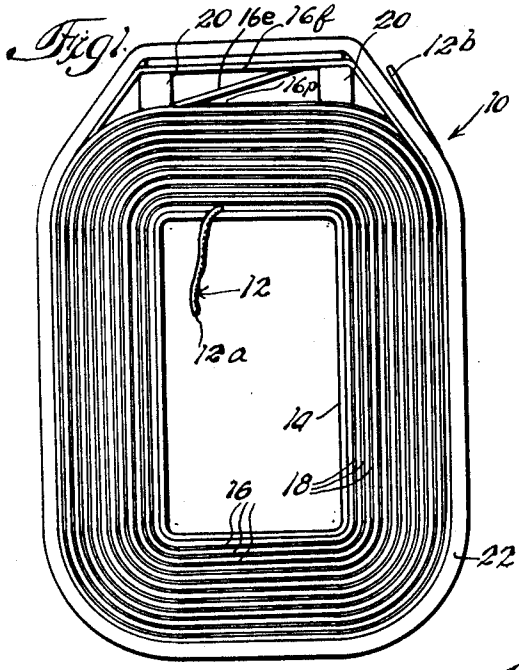


Fig. 2.

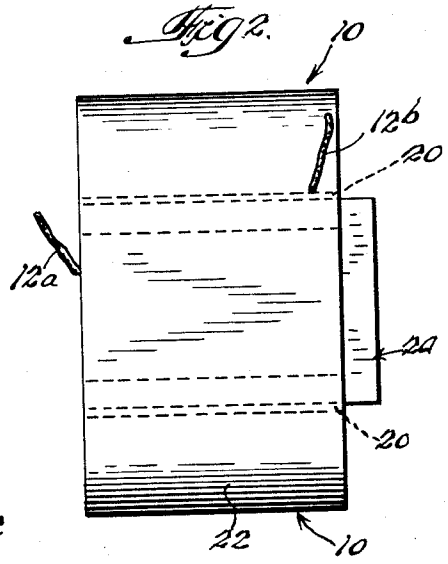


Fig. 3.

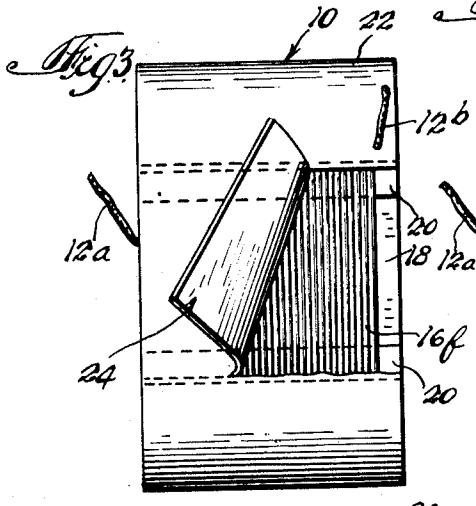


Fig. 4.

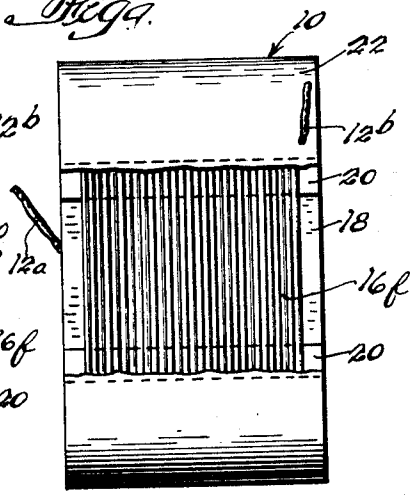
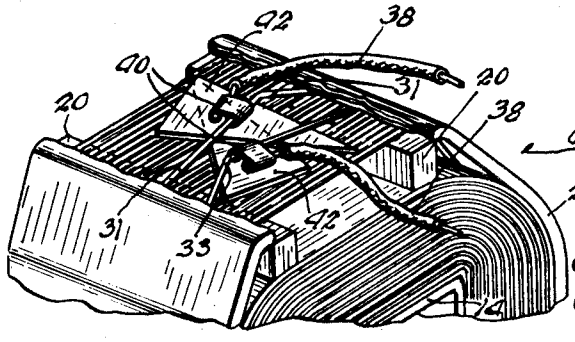


Fig. 10.



INVENTORS
Warren S. Lenox &
Joseph T. Gurnick
BY
Olson, Trecklenburger, van Hoek,
Pendleton & Nemmers.
Attys.

July 21, 1964 W. S. LENOX ETAL 3,142,030

COIL CONSTRUCTION TO FACILITATE TAPPING

Filed Nov. 10, 1958 2 Sheets-Sheet 2

Fig. 5.

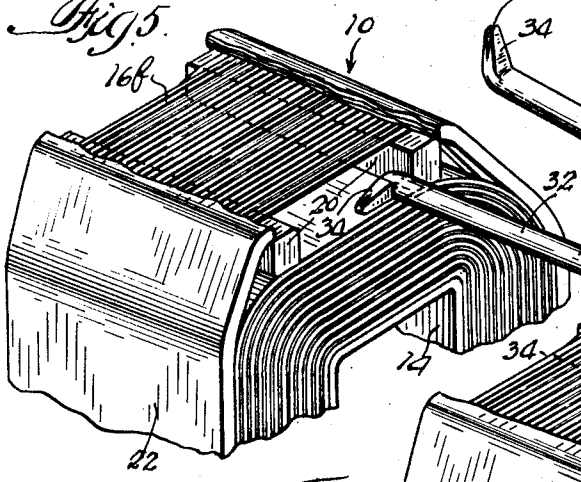


Fig. 11.

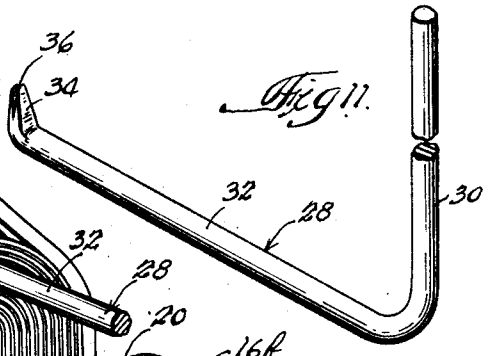


Fig. 6

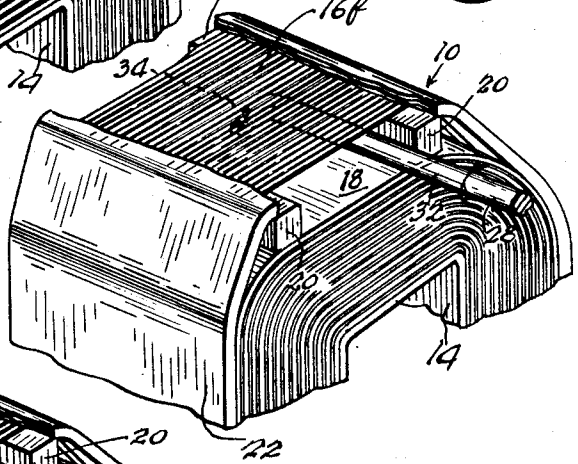


Fig. 7.

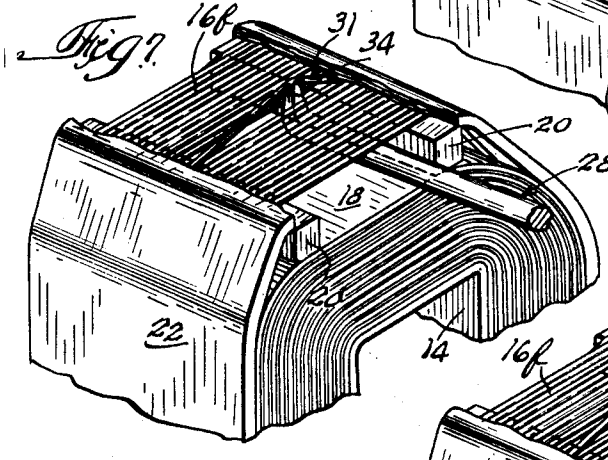


Fig. 8.

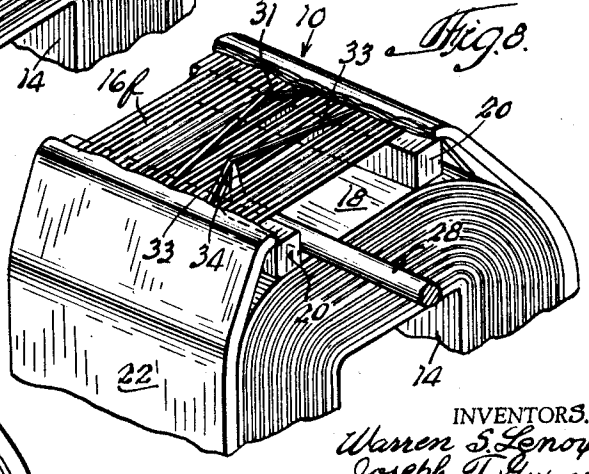
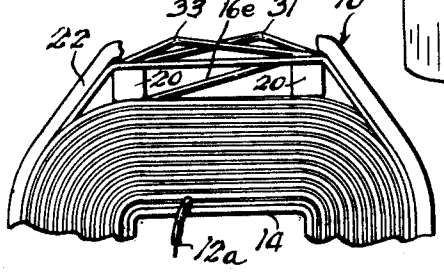


Fig. 9.



INVENTORS.
Warren S. Lenox &
Joseph T. Gurnik
BY.
Olson, Mecklenburger, van Holst,
Pendleton & Neuman Attys.

United States Patent Office 3,142,030 Patented July 21, 1964

3,142,030

COIL CONSTRUCTION TO FACILITATE TAPPING

Warren S. Lenox, Oak Park, and Joseph T. Gurnik, Berwyn, Ill., assignors to Basic Products Corporation, Milwaukee, Wis., a corporation of Wisconsin

Filed Nov. 10, 1958, Ser. No. 772,948
6 Claims. (Cl. 336—207)

The present invention relates to a novel coil construction. More particularly, this invention pertains to a coil construction whereby a lead may be readily secured to a desired turn thereof with a minimum of effort and without damaging the particularly turn or turns selected.

In constant voltage transformers, for example of the type disclosed in U.S. Patent No. 2,143,745 to Joseph G. Sola, as well as other types, it is frequently necessary or desirable to adjust turns in the secondary winding in order to achieve desired output voltage or other effects. Heretofore, the selection of the proper turn of the secondary winding or coil in such instances has been a trial and error technique necessitating utilization of a prying tool. The coil is prone to damage in the course of such turn selection which at times is of such magnitude as to render the completed coil unfit for use.

It is an object of this invention, therefore, to provide an improved coil construction in which leads may be applied to desired coil turns without damage.

It is a further object of this invention to provide an improved coil construction which enables a lead to be secured to a desired coil turn in a facile and rapid manner.

It is a still further object of this invention to provide a coil with an outermost wrapper which may have a desired portion readily removed whereby application of a lead to a coil tap is facilitated.

It is another object of this invention to provide a novel tool construction which is particularly adapted for use with the provided coil construction and which assists in the ready formation of a desired tap portion in a selected turn.

The above and other objects of this invention will become more apparent from the following detailed description when read in the light of the accompanying drawing and appended claims.

In one embodiment of the provided invention a coil is formed defining a plurality of turn layers about a coil form and having the usual insulating paper or other equivalent insulating means disposed between the turn layers. Spacer means are disposed between the outermost turn layer and the next underlying layer thereof whereby a portion of the outermost layer is spaced from such underlying layer. The coil is then dipped in insulating varnish and further processed in accordance with well known procedures. In the normal course of forming a tap in the coil outer layer a tool comprising a rod having two arm portions disposed at right angles, and a projecting distal end finger portion is inserted in the space beneath the outermost layer and manipulated so as to quickly and efficiently remove a portion of a selected turn in such layer from its normal plane without disturbing other turns as will hereinafter be explained in greater detail.

For a more complete understanding of this invention reference will be made to the drawing wherein:

FIGURE 1 is a side elevational view of a coil in an intermediate stage of construction in accordance with the teachings of this invention;

FIG. 2 is a top elevational view of the coil illustrated in FIG. 1;

FIG. 3 is a top elevational view similar to FIG. 2 in which a portion of the coil outer wrapper has been removed;

FIG. 4 is a top elevational view similar to FIG. 3 with a strip of the outer wrapper completely removed;

FIG. 5 is a fragmentary perspective view of the coil of FIG. 1 prior to insertion of a tap-forming tool therein fragmentarily shown;

FIG. 6 is a fragmentary elevational view similar to FIG. 5 illustrating the tap-forming tool in position prior to raising a coil turn;

FIG. 7 is a fragmentary perspective view similar to FIG. 6 of a coil member in which a turn of the coil is shown raised from its normal position by means of the tool according to the invention;

FIG. 8 is a fragmentary perspective view similar to FIG. 7 in which the illustrated tool is shown raising a second turn of the coil;

FIG. 9 is a side elevational view of the coil illustrated in FIG. 8 with the tool removed;

FIG. 10 is a fragmentary perspective view of the upper portion of the coil illustrated in FIG. 8 with tap leads attached to the raised tap portions of the coil; and

FIG. 11 is a fragmentary perspective view on an enlarged scale of the tool employed in accordance with the teachings of this invention.

Referring now to the drawing, and more particularly to FIG. 1, a coil **10** formed in accordance with the teachings of this invention is illustrated comprising a conductor **12**, which may be a soft copper enameled wire wound about a coil form **14**, made, for example, of heavy insulating paper. The conductor **12** has the turns thereof arranged in a plurality of layers **16** having insulation **18**, which may comprise paper or other equivalent means, disposed therebetween.

As will be seen in FIG. 1, reference numeral **12***a* defines the beginning of the conductor **12** which is wound about form **14**; the terminus of the conductor **12** comprises end **12***b* which of course also comprises the terminal portion of outermost layer **16***f*.

As will be noted from the various figures in the drawing, outermost coil layer **16***f* is spaced from the penultimate layer **16***p*; the latter spacing is made possible by means of spacers **20** disposed between the latter two layers. The spacers are preferably of uniform cross-sectional configuration and have a length substantially equal to the coil width, as will be seen from FIGS. 5 through 9 of the drawing. The spacers **20** are held in place by the turns of conductor **12** wound relatively tightly thereover and the angular portion **16***e* between the last two layers since this portion is disposed over one of the spacers **20** and under the other, forming a bind, in effect, as shown in FIG. 1. A heavy paper wrapper **22** or other equivalent insulating means covers the final turn layer **16***f*. A strip of heavy industrial tape **24** or other equivalent strip means is secured to the undersurface of the paper wrapper **22** disposed over the raised portion of coil layer **16***f*. It is the purpose of strip **24** to facilitate removal of the latter portion of the wrapper **22** in a ready, facile manner. While the tear strip is shown extending beyond the edge of the coil, it will be clear that this is not essential. The coil **10** is treated with insulating varnish or asphalt, for example, following its assembly. The wrapper **22** thereof so impregnated after drying is brittle in nature but will be readily torn along the path defined by the edges of strip **24** when pulled transversely across the upper surface portion of the coil in the manner illustrated in FIG. 3. Following such strip removal the coil will have the appearance depicted in FIG. 4. The raised portion of the final turn layer **16***f* is thus readily accessible following removal of the wrapping portion strip **24**.

Following previously employed trial and error coil tapping techniques a completed coil would at times be so

damaged as to be unfit for use. This occurred because the outermost layers in prior art coil constructions are in close layer relation, and the raising of a particular turn for purposes of securing a tap lead thereto oftentimes resulted in the abrasion and removal of insulation from a number of turns. Following removal of insulation, short circuits between the turns resulted, rendering the coil of no practical use. Also in some prior constructions, taps were provided on the coil to be used for test purposes only. In such constructions there were problems of being able to provide sufficient test taps within the space available.

By spacing a portion of the outermost layer **16***f* of the coil from the penultimate layer **16***p* as above described, the formation of taps is facilitated, and turn abrasion and insulation removal are substantially completely obviated.

Assuming that only a particular portion of the illustrated coil **10** is to be employed as the winding or coil in a circuit, the following tapping procedure is carried out.

Since a portion of all turns of the outermost layer **16***f* of the coil is spaced from the penultimate layer **16***p*, a gap therebetween is available wherein a tool **28** (such as is illustrated in FIG. 11) may be inserted and employed for the purpose of engaging the desired turn only of the exposed layer without damaging in any way the engaged turn or adjacent turns. As will be seen from FIG. 11, tool **28** has a general right angle configuration and comprises a bent rod. Arm portion **30** of the illustrated tool is readily engageable and serves as a handle; arm **32** of the tool is adapted for insertion between the spaced turn layer portions in the manner illustrated in FIGS. 5 through 8.

Formed integrally with and defining the terminal end limit of arm **32** is a projecting finger **34** which is adapted to engage the particular turn of the outermost layer to be tapped. To facilitate turn engagement, projecting finger **34** of tool **28** is slotted at **36** and is so designed and manufactured with no sharp edges or corner portions that might scrape off enamel insulation. Slot **36** of finger **34** preferably has a width slightly less than the diameter of conductor **12**, enabling ready engagement to be effected with a selected turn without scraping or abrading adjacent turns.

In the normal course of raising a particular turn of the outermost layer for purposes of securing a tap lead thereto, tool portion **32** is inserted between the two outer turn layers until projecting finger **34** is immediately below the portion of the selected turn to be raised, as depicted in FIGS. 5 and 6. The finger **34** is disposed substantially parallel to the raised turn portions in the course of insertion (as illustrated in FIGS. 5 and 6) so that the tool **28** will not engage and abrade the same. The tool **28** is then rotated, the arm **32** being disposed against the spacer **20** for support, until the recessed portion **36** of the finger **34** engages a desired turn **31**, and the tool is rotated further by means of handle portion **30** until the desired turn has a portion thereof projecting above the plane of the turn layer in the manner illustrated in FIG. 7.

The raised turn portion is then scraped to remove the enamel insulation after which a tap lead may be secured thereto such as a lead **38** illustrated in FIG. 10. It is apparent that a number of trials may have to be made before the desired or proper turn is located. If any selected turn is unsuitable, it may readily be pressed into the space between the last two layers to avoid the need of providing insulation and a second turn engaged and raised above the plane of the turn layer **16***f*. As illustrated in FIGS. 8 and 9, it may be advantageous to raise opposed portions of adjacent turns to reduce any chance of shorting between the turns being tapped.

The length of the projecting finger **34** should obviously exceed the distance between the two outermost layers (illustrated in FIGS. 7 and 8). Since the tool **28** rotates on the insulating paper disposed between the turn layers, the danger of scraping insulation from the penultimate layer of turns is obviated.

FIG. 10 illustrates the final coil assembly in which tap leads **38** having metallic terminals or clips **40** are securely engaged to taps **33** and **31** (illustrated in FIG. 9). Insulators **42** are secured between the raised turns and the remaining turns of the turn layer **16***f* to minimize any possibility of damage by means of the metallic terminals **40** engaging and scraping insulation from adjacent turns of layer **16***f* and underlying turn layer **16***p*. It is also feasible to simply wrap the exposed copper of lead **38** about the clean raised turn and soldering; thus obviating the need of clips **40**.

It is apparent, therefore, that a novel coil construction and method for forming the same have been provided which greatly facilitates experimental tapping of coil turns that heretofore has been a tedious and time-consuming operation. In addition, damage previously occasioned by the prying tools employed for raising the turns and the provision of special taps are obviated by the provided coil construction and tool employed therewith.

It is believed obvious that the spacer means employed may have a number of configurations and need not necessarily comprise the elongate wooden members illustrated. It is apparent that a single spacer member would work to advantage if it raises the engaged portion of the final turn layer a sufficient distance from the penultimate layer to permit insertion of a tool (such as that illustrated in FIG. 11).

As will be noted from FIGS. 6 through 8, the tool **28** in the course of its turn-raising operation should bear against either of the spacer means in the course of rotating. If a single spacer member is employed, the tool portion **32** should similarly bear against such spacer in the course of rotation not only to facilitate tap formation but also to eliminate any possibility of an abrading action being effected between portion **32** of the tool and a portion of the turn layer **16***f*.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since many modifications may be made, and it is, therefore, contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

The invention having thus been described, what is claimed and desired to be secured by Letters Patent is:

1. In a coil construction, the combination comprising a plurality of turns, said turns being arranged in layers having insulating means disposed between said layers, spacer means interposed between a portion of the outermost layer of turns and an underlying layer of turns for spacing a portion of said outermost layer from said underlying layer whereby the spaced portion of turns in said outermost layer may be accessible both from directions interiorly and exteriorly of said coil, wrapper means surrounding said outermost layer of turns and means secured to the portion of said wrapper means which is disposed over the outermost coil layer portion spaced from said underlying layer for enabling such portion of said wrapper means disposed over said outermost layer portion spaced from the underlying layer to be readily detached from the remainder thereof.

2. In a coil construction of general rectangular configuration, comprising an eletcrical conductor defining a plurality of turns arranged in layers, each layer disposed about the innermost layer being in supported relation with the underlying turn layer, the improvement comprising at least two spacer means interposed between the outermost and penultimate layer of turns along one side of such coil whereby a portion of said outermost layer of turns is spaced from the penultimate layer, said spacer means spacing a portion of said outermost layer of turns

from the penultimate layer of turns; the interval between the spaced portion of turns and said penultimate layer being sufficient so that said spaced portion of turns may be accessible both from directions interiorly and exteriorly of said coil to enable individual turns in said outermost layer to be raised from their normal disposition in said spaced portion, said spacer means comprising parallel elongate means of uniform cross-sectional configuration having a length substantially equal to the width of said outermost layer.

3. The spacer means of claim 2 in which the peripheral surfaces thereof are smooth and free from sharp corner portions.

4. A coil construction comprising an electrical conductor arranged in a plurality of turn layers, at least two spacer means adapted to space a portion of the outermost layer of turns from the penultimate layer of turns therebeneath interposed between the latter two turn layers, said spacer means spacing a portion of said outermost layer of turns a sufficient distance from a penultimate layer of turns so that said spaced portion of turns may be accessible both from directions interiorly and exteriorly of said coil to enable individual turns in said outermost layer to be raised from their normal disposition in said spaced portion, a coil portion interconnecting the penultimate layer of turns and the spaced portion of the outermost layer of turns spanning the interval between said latter two layers, one of said spacer means being disposed over and the other of said spacer means being disposed beneath the coil portion interconnecting said outermost and penultimate layers of turns whereby said spacer means are locked in spaced relationship.

5. In a coil construction comprising an electrical conductor defining a plurality of turns arranged in layers, each layer disposed about the innermost layer being in supported relation with the underlying turn layer, the improvement comprising means for spacing a portion of the outermost layer of turns from the underlying layer of turns; the interval between said underlying layer and the spaced portion of turns in said outermost layer being sufficient so that the spaced portion of turns may be

accessible both from directions interiorly and exteriorly of said coil; the spacing means having exterior surface portions which are smooth and free from sharp corner portions; each of the turns in said portion of the outermost layer of turns spaced from the underlying coil layer being supportably positioned on an exterior surface portion of the spacing means.

6. In a coil construction comprising a plurality of contiguous turns of a conductor, having an insulating coating, arranged in layers; each of said layers disposed about the innermost layer being in supported relation with the underlying turn layer; the improvement comprising means for spacing a portion of the outermost layer of turns from the layer of turns therebeneath, the spacing means being interposed between the outermost and underlying turn layers; the spacer means supportably spacing on a smooth external surface portion thereof a portion of the contiguous turns of said outermost layer of turns; the interval between the spaced portion of turns of said outermost layer and said underlying layer being sufficient so that said spaced portion of turns may be accessible both from directions interiorly and exteriorly of said coil so as to enable individual turns in said outermost layer spaced portion to be raised from their normal disposition.

References Cited in the file of this patent

UNITED STATES PATENTS

1,529,560	Thomas	Mar. 10, 1925
1,607,341	Crost	Dec. 7, 1926
1,636,266	Wilkinson	July 19, 1927
2,154,070	Franz	Apr. 11, 1939
2,275,967	Keillor et al.	Mar. 10, 1942
2,544,845	Link	Mar. 13, 1951
2,807,869	Rue	Oct. 1, 1957
2,827,616	Manning	Mar. 18, 1958
2,863,130	Gray et al.	Dec. 2, 1958
2,865,086	Whipple	Dec. 23, 1958

FOREIGN PATENTS

229,157	Great Britain	Feb. 19, 1925