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2,489,625

METHOD OF MAKING WOUND TRANSFORMER CORES

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Fig. 1.

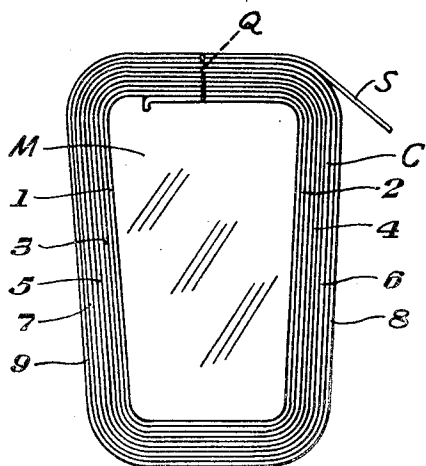


Fig. 2.

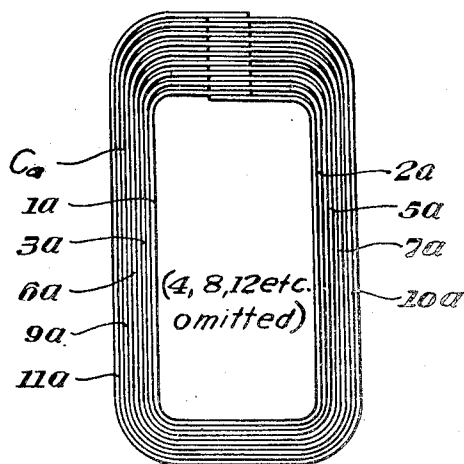


Fig. 3.

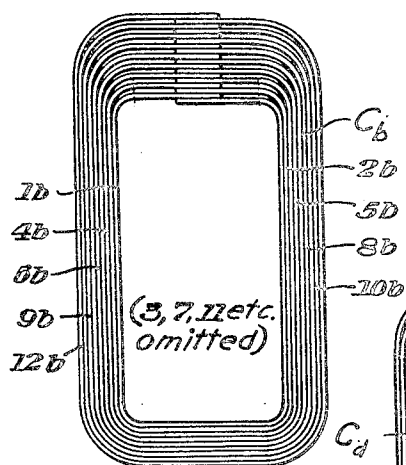


Fig. 4.

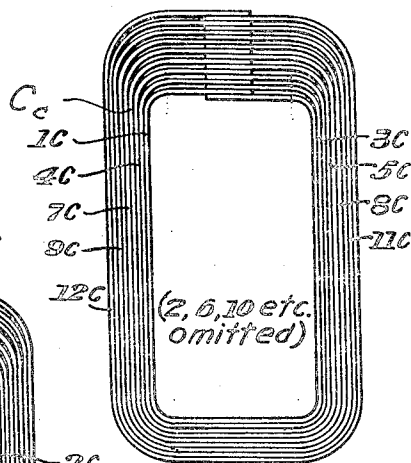
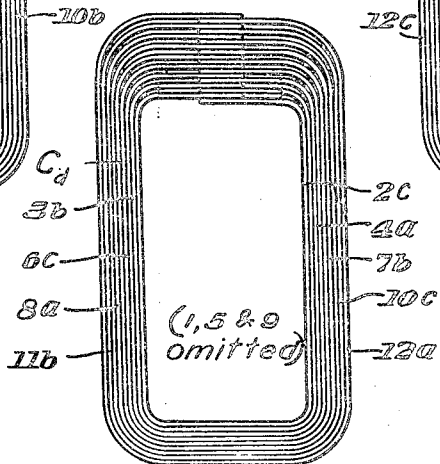


Fig. 5.



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METHOD OF MAKING WOUND
TRANSFORMER CORES

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5 Claims. (Cl. 29—155.61)

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This invention relates to the manufacture of so-called wound transformer cores, i. e., cores made by coiling a continuous strip of magnetic metal on a mold or form.

In one method of making wound transformer cores as disclosed in United States patent application Serial No. 665,045 filed April 26, 1946, the coil of strip is cut through once to produce a series of separate, concentric laminations of loop shape. After annealing, the laminations are assembled with preformed electrical windings and one end of each lamination is lapped over the other to form a closed core. In order to provide the necessary space factor, a strip of paper was wound between the turns of metal strip. This is objectionable not only because of the cost of the paper which has to be scrapped and is thus a total loss, and the labor of winding it in the core and removing it from the turns thereof, but also because it permits the formation of burrs on the laminations when they are cut through. This results from the fact that the composite coil is "spongy" since the paper is relatively soft and the successive turns of metal strip do not have firm bearing on each other. These burrs interfere with the lapping of the ends of the laminations in the final assembly of the core. In addition, the "spongy" character of the composite coil makes it difficult to control the tension during the winding process.

I have invented a novel method of making wound cores whereby the aforementioned objections are overcome with the result that the cost of manufacture is reduced. In a preferred practice, I wind magnetic strip in a tight coil on a mold or form, with each turn in direct contact with the preceding turn. I cut once through the several turns of the coil, converting it into a plurality of separate concentric laminations, and then remove every n th turn, n being a small whole number, say 4, to provide a space factor. I then lap one end of each remaining turn over the other end forming a closed core. I then anneal the core and open up the turns to permit assembly with preformed electrical windings after which the ends of the turns are again lapped and the closed core is bound to hold it in shape.

Preferably different series of turns are removed from successive cores, i. e., the 2d, 6th, 10th laminations, etc. from one core, the 3d, 7th, 11th, etc. from another, and the 4th, 8th, 12th, etc. from another. This provides a series of laminations which is complete except for every fourth one, so a core may be made from the laminations removed from the cores, thereby eliminating waste.

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A complete understanding of the invention may be obtained from the following detailed explanation referring to the accompanying drawings for illustration. In the drawings:

Figure 1 is a diagrammatic view of a form or mold and a coil of magnetic strip being wound thereon;

Figure 2 is an elevation showing a portion of a transformer core made in accordance with the invention; and

Figures 3, 4 and 5 are similar views showing portions of additional cores made in the same manner.

As the first step in the method of my invention, I wind a magnetic metal strip S in a tight coil on a mold M . The mold is preferably of trapezoidal shape for a purpose which will appear subsequently and may be mounted on any suitable driving spindle. The usual form of transformer core is of rectangular shape, the opposite sides being of equal length and one pair of opposite sides being longer than the other two. The strip S is wound on the mold with successive turns in direct contact with each other, i. e., without any separating medium therebetween, until a coil of the desired number of turns has been formed. These turns are numbered consecutively 1, 2, 3, etc., starting from the innermost turn. A completed coil may have as many as 100 turns.

When the coil of strip indicated generally at C has been wound to the desired number of turns, the strip is cut off from the supply reel and the outer end is fastened in any convenient manner to the coil as a whole. The coil may then be removed from the mold by a suitable press operation. I then cut once through the several turns of the coil C as indicated at Q , by means of a suitable saw or abrasive disc. This converts the coil into a plurality of concentric laminations of loop shape. In order to provide the desired space factor necessary to permit the lapping of one end of each lamination over the other end in assembling a finished core, in the manner to be described shortly, I remove selected laminations or turns from the coil C . Speaking generally, I remove every n th turn, n being a number less than 10 and preferably less than 5. For instance, in making a core of a certain size, I remove every fourth turn or lamination from the coil as wound.

Figure 2 illustrates the inner portion of a transformer core made from one coil C which may for convenience be designated coil C_a . This core includes all the turns or laminations of the coil as wound except the 4th, 8th, 12th, etc. That is to

say, every fourth lamination commencing with the 4th is omitted. This leaves in the core the laminations designated 1a, 2a, 3a, 5a, 6a, 7a, 9a, 10a, 11a, etc.

Preferably I omit a different series of turns or laminations from successive cores. In making a core C_b shown in Figure 3, for example, the turns or laminations which are omitted are the 3d, 7th, 11th, etc. In other words, every fourth lamination is omitted beginning with the 3d. In another core C_c shown in Figure 4, the laminations omitted are the 2d, 6th, 10th, etc. As a result, it will be found that the laminations omitted from the cores C_a, C_b, and C_c may be assembled to form a fourth core C_d shown in Figure 5. As there illustrated, the core C_d includes the turns 2c, 6c and 10c omitted from core C_c, turns 3b, 7b and 11b omitted from core C_b and turns 4a, 8a and 12a omitted from core C_a. These turns are assembled in order of their size, i. e., 2c, 3b, 4a, 6c, 7b, 8a, 10c, 11b and 12a, etc., thus forming a core in which every fourth turn is omitted, beginning with the first, the omitted turns being the 1st, 5th, 9th, etc. By this practice, I am able to form four cores from every three wound coils of magnetic strip. Each core, of course, has only three-fourths as many turns as the coil but there is no waste as the result of the omission of every fourth lamination since all the laminations omitted from the first three cores go to make up the fourth core.

In assembling the completed cores, I lap one of the several ends of each turn over the other as shown in Figures 2 through 5, this lapping being facilitated by the space factor resulting from the omission of every fourth turn. When the stacking or assembling of the turns has been completed, the cores are annealed and are then assembled with preformed electrical windings by opening up the several turns and inserting one leg through the windings after which the ends of each lamination are again restored to the overlapping relation shown in Figures 2 through 5. The core is then finally bound as by an encircling strap to hold the turns partly assembled.

It will be apparent from the foregoing that the invention provides a method of making transformer cores having numerous advantages over the prior practice. In the first place, the invention avoids the waste of material and extra work entailed by the use of paper separator strips between turns of magnetic strip, for the purpose of providing a space factor. In the second place, the invention permits the severing of the coil turns without the formation of a burr and thus facilitates assembly of the cores. The control of the operation of winding the magnetic strip is also facilitated by the fact that it is not necessary to introduce a paper separator strip between turns of magnetic strip.

Although I have disclosed only a preferred practice of the invention, it will be recognized that changes in the details thereof may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a method of making transformer cores, the steps including, winding magnetic metal strip to form a plurality of tight coils with each turn of each coil in direct contact with the preceding turn in said coil, cutting once through the turns of each coil to produce a plurality of cores each having single turns in the form of concentric laminations of loop shape, removing every n th lamination beginning with a different turn from

successive cores; e. g., turns 1, 1+n, 1+2n, etc. from one core, turns 2, 2+n, 2+2n, etc. from another core, turns 3, 3+n, 3+2n, etc. from another core, etc.; n being a whole number greater than 1 and less than 10, to provide a space factor, overlapping the respective ends of the remaining turns in each of the successive cores to form closed cores, and assembling the removed turns in order with their respective ends overlapped to form a complete new core.

2. In a method of making transformer cores, the steps including, winding magnetic metal strip to form a plurality of tight coils with each turn of each coil in direct contact with the preceding turn in said coil, cutting once through the turns of each coil to produce a plurality of cores each having single turns in the form of concentric laminations of loop shape, removing every fourth turn beginning with a different turn from three of said cores to provide a space factor, overlapping the respective ends of the remaining turns in each of said three cores to form closed cores, and assembling the removed turns in order with the respective ends of each turn overlapped to form a fourth closed core.

3. In a method of making transformer cores, the steps including, winding magnetic metal strip to form a plurality of tight coils with each turn of each coil in direct contact with the preceding turn in said coil, cutting through all of the turns of each coil to produce a plurality of original cores made up of single concentric turns, removing pre-selected turns from a predetermined number of said original cores in a predetermined order to provide a space factor in said original cores for the overlapping of the respective ends of each remaining turn in each of said original cores, and assembling said removed turns in said predetermined and in numerical order with their respective ends overlapped to form at least one new closed core.

4. In a method of making transformer cores, the steps including, winding magnetic metal strip on a trapezoidal mold to form a plurality of tight coils with each turn of each coil in direct contact with the preceding turn in said coil, cutting through all the turns of each coil along the longer parallel side of said trapezoidal mold to produce a plurality of original cores made up of single concentric discontinuous turns, removing pre-selected turns from a preselected number of said original cores in a predetermined order to provide a space factor in said original cores for the overlapping of the respective ends of each remaining turn in each of said original cores, overlapping said respective ends of each remaining turn in each of said original cores to form a succession of closed cores, assembling said removed turns in said predetermined and in numerical order with their respective ends overlapped to form at least one new closed core, and annealing said closed cores.

5. In a method of making transformer cores, the steps including, winding magnetic metal strip on a trapezoidal mold to form a plurality of tight coils with each turn of each coil in direct contact with the preceding turn in said coil, cutting through all the turns of each coil along the longer parallel side of said trapezoidal mold to produce a plurality of original cores made up of single concentric discontinuous turns, removing pre-selected turns from a preselected number of said original cores in a predetermined order to provide a space factor in said original cores for the overlapping of the respective ends of each remaining

turn in each of said original cores, and overlapping said respective ends of each remaining turn in each of said original cores to form a succession of closed cores.

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