April 14, 1959 G. W. HOLZ 2,882,507

TRANSFORMER WINDINGS

Filed Jan. 22, 1957

Fig. 1

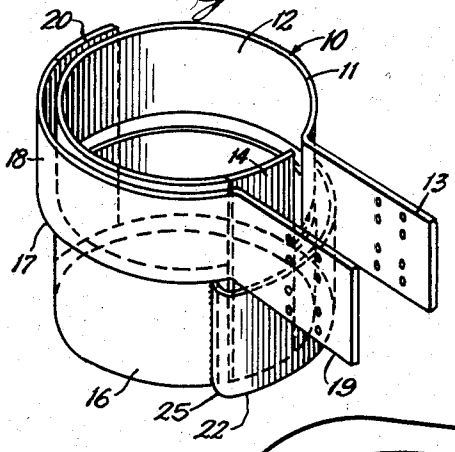


Fig. 2

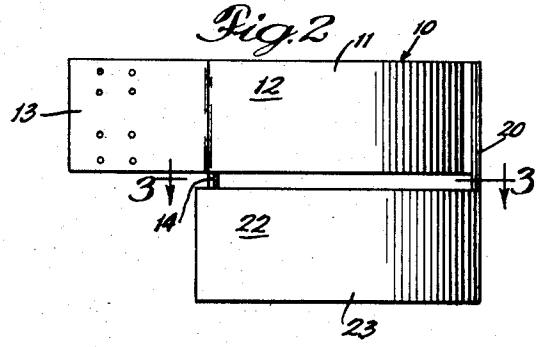


Fig. 4

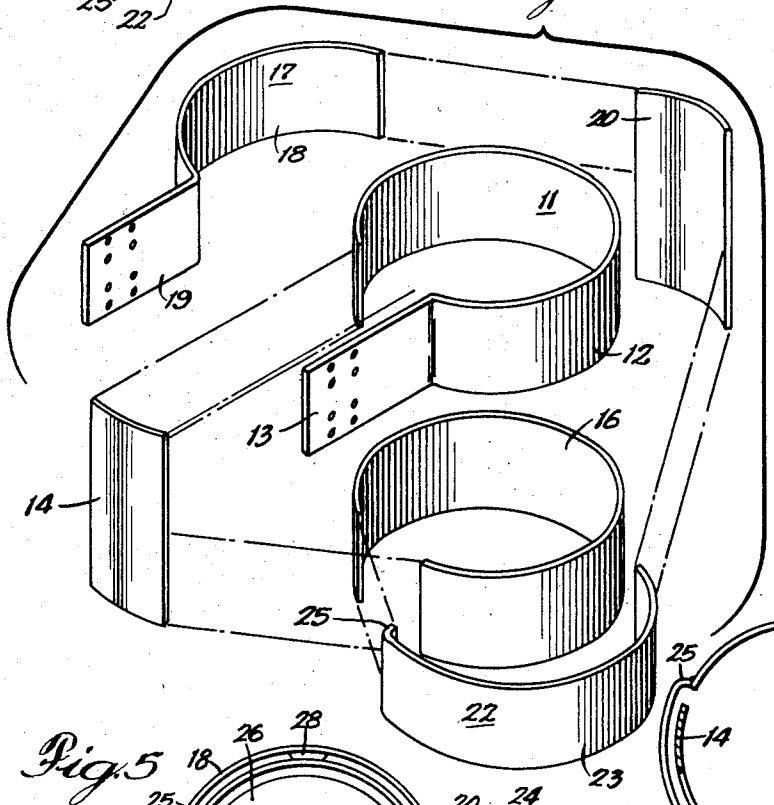


Fig. 3

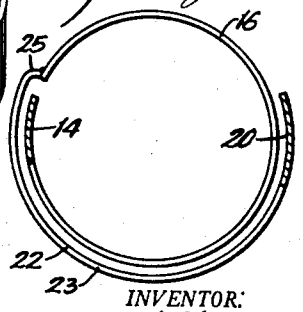
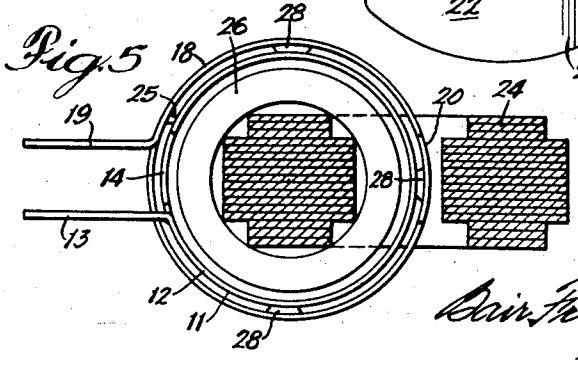


Fig. 5



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TRANSFORMER WINDINGS

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3 Claims. (Cl. 336—223)

This invention relates to electric transformers and more particularly to the construction of a transformer adapted for relatively high current, low voltage operation.

In the manufacture of electric transformers for high current applications it has been customary to form the transformer secondary winding of metal strap such as aluminum or copper. For example, in electric furnaces for heat treating, melting and the like, the heavy current capacity of the electric heating elements utilized therein requires that the conductive elements supplying power to the furnace be of relatively large cross section. Thus, it is desirable that the terminals extending through the furnace wall for transmitting current to the heating elements together with the bus bars connecting the terminals to the transformer, and the transformer secondary winding all be made of material having a large cross section to the end that the IR drop through them, and thereby heat losses, be minimized as much as possible.

As a result of this consideration, priorly known transformers utilizing secondary windings of strap metal have tended to be excessively large in over-all size and, therefore, cumbersome to handle and expensive to manufacture. Consequently, transformers of the prior art have not proved readily adaptable to compact electric furnace construction but, conversely, generally have had to be placed a substantial distance away from the furnace such as to require undesirably long lengths of bus bars. Manifestly this has unnecessarily added to the expense of electric furnace construction and installation.

Accordingly, it is an object of this invention to provide an improved construction for electric transformers. More specifically it is an object of this invention to provide an improved construction for transformer windings of the type utilizing metal strap.

It is still another object of this invention to reduce construction costs for heavy current transformers by providing a relatively simple yet efficient method of making a plural turn secondary winding comprising conductors of large cross section.

It is a further object of this invention to provide an improved transformer secondary winding of high current capacity and of construction adapted to minimize heat losses therein.

These and other objects are realized in a specific embodiment of the invention wherein the transformer secondary winding is constructed of a number of individually shaped sections of metal strap connected together in a predetermined manner to form a compact and composite unitary structure.

It is a feature of this invention that a plural turn transformer secondary winding comprises a plurality of coaxial arcuate conductive members wherein some of said members have the same radial dimension and are in axial alignment with each other, and some of said members have different radial dimensions and are disposed in concentric relation to each other. Still another feature of this invention is that the axially aligned arcuate conductive members of equal radial dimenison be linked by elongated arcuate conductive members of height substantially greater than the axially aligned members.

The above and other features of novelty which characterize this invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects attained with its use, reference is had to the accompanying drawing and descriptive matter in which is shown and described an illustrative embodiment of the invention.

In the drawing:

Figure 1 is a perspective view of a multiturn transformer winding embodying the invention;

Figure 2 is a side elevational view of the transformer winding of Figure 1;

Figure 3 is a cross section taken on line III—III of Figure 2;

Figure 4 is an exploded view of a transformer winding embodying the invention and showing its manner of assembly; and

Figure 5 is a top plan view of a transformer winding embodying the invention together with the transformer primary windings utilized therewith.

Referring now to the drawing, the specific illustrative embodiment of the invention shown therein comprises composite unitary transformer winding having a plurality of turns of metal strap. The metal strap, which advantageously may be a highly conductive material such as aluminum or copper, is desirable for applications having a heavy current load such as electric heating furnaces and the like. In accordance with the present invention a plurality of turns is provided in a relatively compact construction by a novel method of assembly of a number of preshaped sections of metal strap.

The transformer winding of the instant invention comprises a terminal member **11**, which advantageously may be substantially in the shape of a question mark and has an arcuate portion **12** and a straight terminal portion **13** at one end of arcuate portion **12** adapted to extend outwardly from the transformer winding **10** for connection to a bus bar. A first link member **14** is connected to the other end of arcuate portion **12** of terminal member **11** such as by welding or the like. In accordance with the invention link member **14** is arcuate in shape, having a radial dimension equal to that of arcuate portion **12** and a longitudinal dimension substantially greater than that of arcuate portion **12**.

A conductive turn **16** of the same radial dimension as portion **12** has one end thereof connected to link member **14** such that terminal member **11** and conductive turn **16** are positioned in vertical alignment and in coaxial relation with respect to each other.

A conductive turn **22** of larger radial dimension than conductive turn **16** is comprised of an arcuate portion **23** and flange portion **25** at one end thereof. Flange portion **25** is connected to the free end of conductive turn **16** such that conductive turn **16** and conductive turn **22** are coaxially related and substantially concentrically disposed with respect to each other.

The other end of arcuate portion **23** of conductive turn **22** is connected to a second link member **20**, which link member is arcuate in shape and has a radial dimension equal to that of the arcuate portion **23**. Link member **20** also has a longitudinal dimension substantially greater than the longitudinal dimension of conductive turn **22** so as to extend axially thereabove and be in concentric relation with arcuate portion **12** of terminal member **11**.

A second terminal member **17** having an arcuate portion **18** of said larger radial dimension and a straight terminal portion **19** at one end thereof is connected at the former to second link member **20** such that arcuate portion **18** is substantially concentric with arcuate portion **12**

of terminal member **11**. Also as shown in Figures 1, 4 and 5 of the drawing, the terminal portion **19** extends outwardly from the transformer winding **10** adjacent and substantially parallel to terminal portion **13** for connection to a bus bar.

In a preferred method of assembling the several portions comprising the multiturn transformer winding of the invention the terminal member **11** of smaller radial dimension first is connected to link member **14** of smaller radial dimension. Secondly, conductive turn **16** of smaller radial dimension is connected to link member **14**. Then terminal member **17** of larger radial dimension is connected to link member **20** of larger radial dimension. The latter then is connected to conductive turn **22** of larger radial dimension. Finally the two subassemblies are joined by connecting conductive turn **16** of smaller radial dimension to conductive turn **22** of larger radial dimension.

It is a further aspect of this invention that spacers **28**, which may be of any suitable insulating material, are placed between the various turns of the transformer secondary winding to enhance ventilation between the turns and to aid in the dissipation of heat therefrom.

Figure 5 shows the manner in which the transformer secondary winding **10** may be utilized with a suitable primary winding. The latter may be of any type known in the art as, for example, a rectangular core **24** shown in dotted form within secondary winding **10**, constructed of a plurality of iron laminations. The primary winding **26**, which advantageously is wound of copper wire, is wound around the leg of core **24** within the secondary winding **10** and is connected to a suitable source of power. Still other ways of inductively coupling the primary winding to secondary winding **10** will be readily devised by those skilled in the art.

Although I have disclosed a particular illustrative construction and method of assembly of a transformer winding having three turns of strap metal it will be understood by those skilled in the art that the inventive principles disclosed herein may be applied to the construction of other transformer windings of different material and of different numbers of turns. Consequently it is contemplated that changes may be made in the construction and arrangement of the parts of the disclosed illustrative embodiment without departing from the real object and purpose of my invention and that it is my intention to cover by the appended claims any modified forms of structure, their use, or equivalents thereof which reasonably may be included within their scope.

What is claimed is:

1. A transformer winding of a composite unitary arrangement of flat metal straps comprising a pair of terminals, a first group of coaxial arcuate conductive straps connected to said pair of terminals, said straps each having a different radial dimension and being substantially concentric with each other, a second group of coaxial arcuate conductive straps said latter straps each having a different radial dimension and being substantially concentric with each other and connected end to end, a first conductive link connecting the arcuate conductive strap of smallest radial dimension in said first group with the arcuate conductive member of smallest radial dimension in said second group, and a second conductive link connecting the arcuate conductive strap of largest radial dimension in said first group with the arcuate conductive strap of largest radial dimension in said second group said straps being connected end to end in series to define a plurality of turns between the terminals.

2. A composite unitary winding for a transformer in accordance with claim 1 wherein insulating separators are selectively positioned between the concentric metal strap members of different radial dimension in each of said first and second groups for maintaining a desired spacing therebetween.

3. A transformer winding comprising a first arcuate conductive member of given radial dimension having a terminal at one end and extending arcuately from the terminal in one direction, a second arcuate conductive member of said given radial dimension in axial alignment with said first arcuate conductive member, a first conductve link connecting the other end of said first member to one end of said second arcuate conductive member, said second conductive member extending arcuately from the first link in said one direction, a third arcuate conductive member connected at one end to the other end of said second arcuate conductive member so as to be substantially concentric therewith and spaced radially therefrom and extending arcuately therefrom in said one direction, a fourth arcuate conductive member substantially concentric with and spaced radially from said first arcuate conductive member, a second conductive link connecting the other end of said third member to one end of said fourth arcuate conductive member, said fourth member extending in said one direction from the second link and terminating in a terminal adjacent to said first named terminal, said members forming a plurality of turns between the terminals.

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