

April 1, 1958

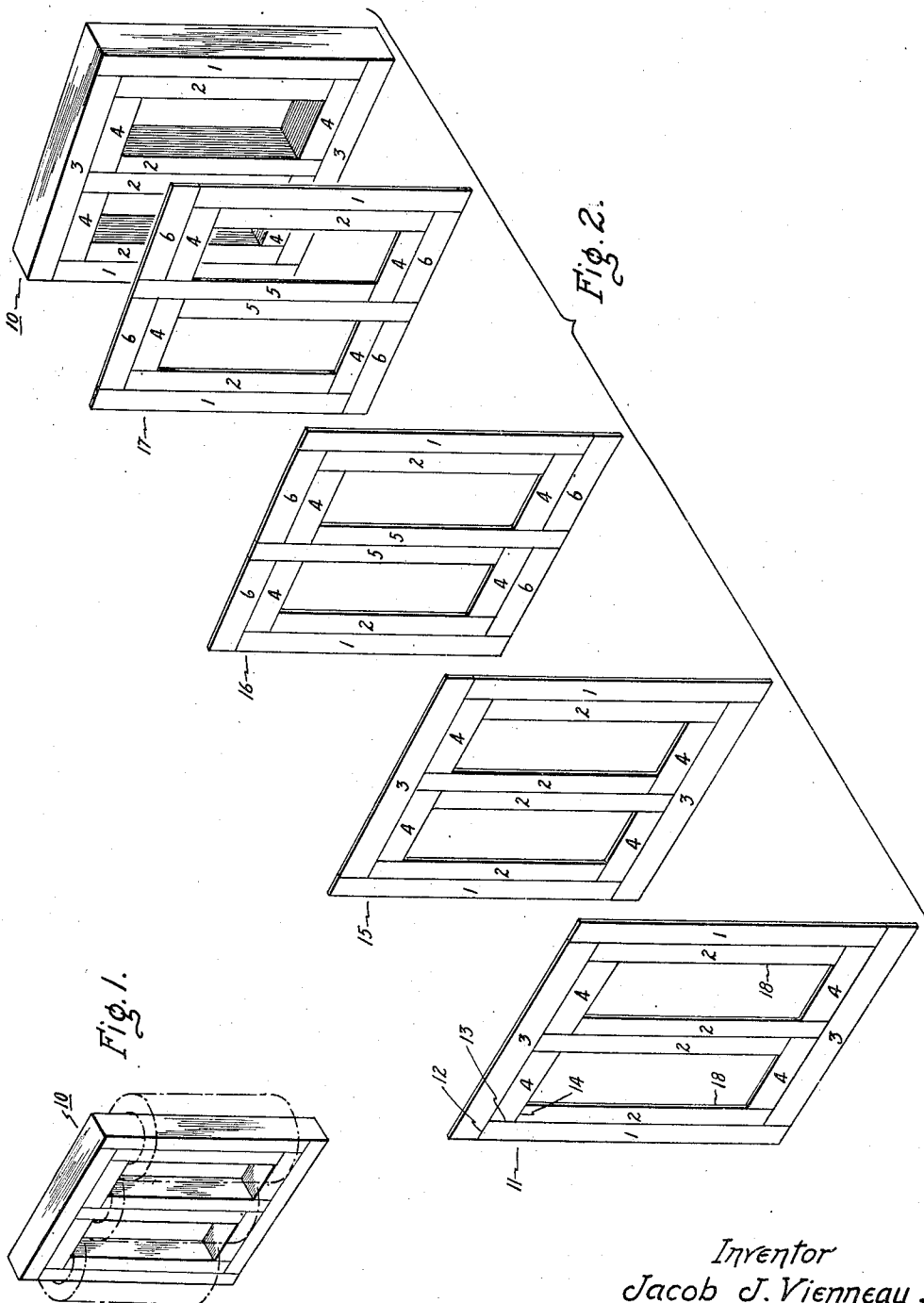
J. J. VIENNEAU

2,829,353

THREE PHASE STACKED MAGNETIC CORE SECTION

Filed March 29, 1954

2 Sheets-Sheet 1



Inventor
Jacob J. Viennau,
by *Silvest P. Tarleton*
His Attorney.

April 1, 1958

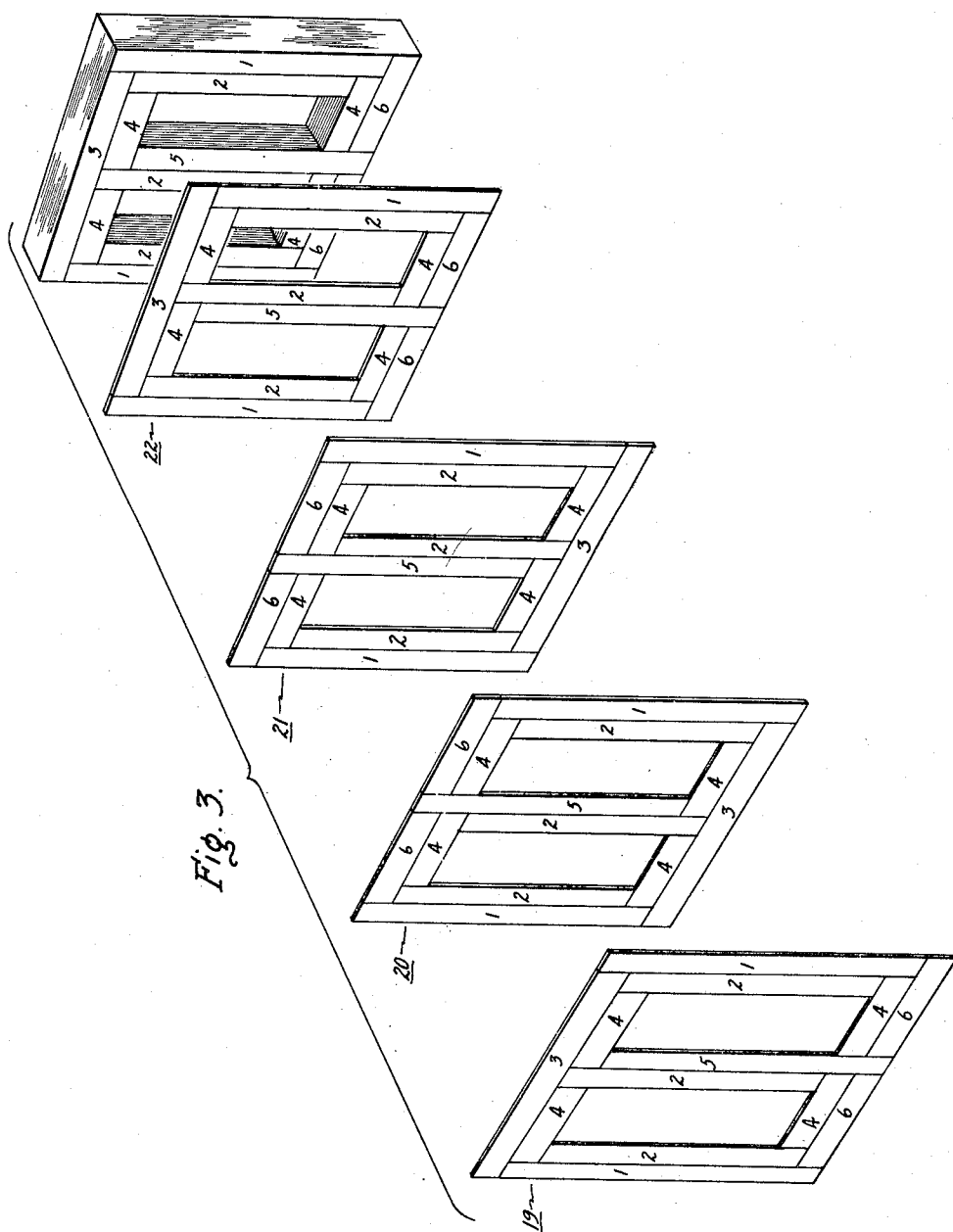
J. J. VIENNEAU

2,829,353

THREE PHASE STACKED MAGNETIC CORE SECTION

Filed March 29, 1954

2 Sheets-Sheet 2



Inventor
Jacob J. Viennau,
by *Gilbert P. Tarleton*
His Attorney.

1

2,829,353

THREE PHASE STACKED MAGNETIC CORE SECTION

Jacob J. Vienneau, Pittsfield, Mass., assignor to General Electric Company, a corporation of New York

Application March 29, 1954, Serial No. 419,423

6 Claims. (Cl. 336—5)

This invention relates to a three-phase magnetic core section and more particularly, to an improved three-phase stacked magnetic core section of the split or divided leg and yoke type.

It is an object of this invention to provide an inexpensive low core loss and exciting current three-phase stacked magnetic core section of the split or divided leg and yoke type.

My invention comprises a three-phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having three parallel split leg portions and parallel split yoke portions extending perpendicular to said split leg portions and interconnecting the ends of said split leg portions, said split leg and yoke portions together defining two window openings therebetween, said split leg and yoke portions each comprising two elongated rectangular-like strip laminations abutting each other along a lengthwise edge thereof, said leg strip laminations having equal widths and said yoke strip laminations having equal widths, all of said strip laminations comprising said layers having not more than six different lengths, each of said layers and window openings having identical dimensions, each corner of each of said layers having a generally Z-shaped butt joint therein between the split leg and yoke portions thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers offset with respect to each other, an outer strip lamination of a split yoke portion of some of said layers extending continuously between an outermost two split leg portions of said core section.

My invention further comprises a three-phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having two outer legs and a central leg therebetween, all of said legs parallel to each other and parallel yokes extending between and perpendicular to said two outer legs and interconnecting the ends of all of said legs, all of said legs and yokes together defining two window openings therebetween, each of said layers and the window openings therein having identical dimensions, all of said legs and yokes comprising two elongated rectangular like flat strips abutting each other along a lengthwise edge thereof, all of the strips comprising said layers having identical widths, and all of said strips comprising said layers having not more than six different lengths, each of said layers having a generally Z-shaped butt joint in each corner thereof between the outer legs and yokes thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers staggered with respect to each other, in some of said layers all of the yoke strips therein interrupted by only one end of the central leg strips of said some layers, in other of said layers all inner yoke strips of said other layers being interrupted by only one end of the central leg strips of said other layers, and the outer yoke strips of said other layers extending uninterruptedly between said two outer legs.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims.

2

My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings, Fig. 1 is a perspective view of one form of my invention. Fig. 2 is an exploded perspective view of the transformer core section shown in Fig. 1. Fig. 3 is an exploded perspective view of another form of my invention. Like reference numerals will be used throughout the various figures to indicate identical parts.

Referring now to the drawings, in Fig. 1 is illustrated a three-legged stacked three-phase magnetic core section 10. As is well known in the electrical transformer art, each leg of the magnetic core section is adapted to have electrical windings, illustrated in broken-line outline, disposed thereabout.

In Fig. 2, said magnetic core section 10 has its first four layers removed therefrom. All of the layers have identical dimensions and are constructed from elongated rectangular-like strips which preferably have a lengthwise grain orientation. All of said strips preferably have identical widths, and as will be more clear hereinafter, said magnetic core section is built up out of strips having not more than six different lengths, thereby reducing the number of pieces to be handled and the cost of said magnetic core section.

The first layer 11 has a left-hand outer leg comprising strips 1 and 2, a right-hand outer leg comprising strips 2 and 1, and a central leg comprising strips 2 and 2. Said three legs are disposed parallel to each other and the two strips of each leg abut each other along a lengthwise edge thereof. The central leg is disposed equidistant of the two outer legs, and all of the strips 1 have identical lengths, and all of the strips 2 have equal lengths.

The three legs of the core section are interconnected at the upper ends thereof by an upper yoke, and at the lower ends thereof by a lower yoke. Said upper and lower yokes each comprise strips 3 and 4, 4; strips 3 and 4, 4 abutting each other along a lengthwise edge thereof. All of the strips 3 have equal lengths, and all of the strips 4 have equal lengths. The yokes are parallel to each other and perpendicular to the legs of the core section, and said yokes and legs together define two identical window openings 18 therebetween.

It will be noted that the outer legs and yokes make a generally Z-shaped butt joint with each other at each corner of the first layer 11. Thus, referring to the upper left-hand corner of first layer 11, the strip 1 of the left-hand outer leg and the strip 3 of the upper yoke abut each other along a line 12; strip 1 of the left-hand outer leg is abutted by the left-hand strip 4 of the upper yoke along a line 13; and strip 2 of the left-hand outer leg abuts the left-hand strip 4 of the upper yoke along a line 14; lines 12, 13, and 14 being arranged with respect to each other substantially in a Z-shaped manner.

The outer strips 3 of the upper and lower yokes extend continuously between the upper and lower ends of the two outer legs to provide an easy magnetic flux path along the outer perimeter of layer 11 substantially free of cross grain or butt joint gap effect along the central portions of the yokes intersected by the central legs of the core section. The inner strips 4, 4 of the upper and lower yokes however, do not extend continuously between the upper and lower ends of the two outer legs. The inner strip 4, 4 of the upper yoke is interrupted by the upper end of the left-hand central leg strip 2, and the inner strip 4, 4 of the lower yoke is interrupted by the lower end of the right-hand central leg strip 2.

The second layer 15 is identical to the first layer 11. Second layer 15 in reality is first layer 11 rotated 180° about an axis disposed in the plane of first layer 11 ex-

tending perpendicular to the legs thereof. With the first and second layers reversed with respect to each other the Z-shaped butt joints in each corner of said first and second layers will be offset or staggered with respect to each other. As will be obvious to those skilled in the art, said offset of the Z-shaped butt joints provides a structurally compact core section having a low noise level, and reduces core losses due to corner cross grain and butt joint gap effect.

The third layer 16 is identical to the first layer 11 except that the outer yoke strips 3 of layer 11 in layer 16 have been replaced by interrupted outer yoke strips 6, 6; and the central leg strips 2 and 2 of layer 11 in layer 16 have been replaced by longer central leg strips 5 and 5. Strips 5 have equal lengths, and strips 6 have equal lengths. The upper end of the left-hand central leg strip 5 of layer 16 interrupts the upper inner and outer yoke strips 4, 4 and 6, 6; and the lower end of the righthand central leg strip 5 of layer 16 interrupts the inner and outer lower yoke strips 4, 4 and 6, 6. It will be noted that in any two immediately adjacent layers the butt joints in said adjacent layers formed between the central legs and yokes of said adjacent layers are substantially offset with respect to each other; said offset providing a structurally compact low noise level core section with low core loss easy magnetic flux paths along the perimeter of the window openings and the outer perimeter of the core section substantially free of cross grain and butt joint gap effect.

The fourth layer 17 is identical to third layer 16 and in reality is layer 16 rotated 180° about an axis disposed in the plane of layer 16 extending perpendicular to the legs thereof. This sequence of layers 11, 15, 16 and 17 is repeated until the magnetic core section is built up to the desired thickness.

Referring now to Fig. 3, shown therein is another core section built up out of a single layer thereafter rotated first 180° about a horizontal axis, then 180° about a vertical axis, and then 180° about a horizontal axis to in effect give four different layers; whereas in Fig. 2 the core section was built up out of two different layers each of which was rotated 180° about a horizontal axis to in effect give four different layers.

The core section shown in Fig. 3 is magnetically equivalent to the core section shown in Fig. 2. It will be noted that the upper half of the first layer 19 thereof is identical to the upper half of the first layer 11 of Fig. 2, and that the lower half of first layer 19 is identical to the lower half of the third layer 16 of Fig. 2. Said first layer 19 can be formed by substituting the lower outer yoke strip 6, 6 of layer 16 of Fig. 2 for the lower outer yoke strip 3 of layer 11 of Fig. 2; and then substituting the right-hand central leg strip 5 of layer 16 of Fig. 2 for the righthand central leg strip 2 of layer 11 of Fig. 2.

The second layer 20 is first layer 19 rotated 180° about a horizontal axis, the third layer 21 is second layer 20 rotated 180° about a vertical axis, and the fourth layer 22 is third layer 21 rotated 180° about a horizontal axis. This sequence of layers 19, 20, 21 and 22 is repeated until the magnetic core section is built up to the desired thickness.

In both the Fig. 2 and Fig. 3 forms of invention, only six different strips are used, preferably all of said strips having identical widths whereby all of said strips can be cut from the same width stock. However, it is to be noted that if the yoke strips are assigned different widths than the leg strips, still only six different pieces need be used.

While there have been shown and described particular embodiments of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention, and that it is intended by the appended claims to cover all such changes

and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A three-phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having three parallel split leg portions and parallel split yoke portions extending perpendicular to said split leg portions and interconnecting the ends of said split leg portions, said split leg and yoke portions together defining two window openings therebetween, said split leg and yoke portions each comprising two elongated rectangular-like strip laminations abutting each other along a lengthwise edge thereof, all of said leg strip laminations having equal widths and all of said yoke strip laminations having equal widths, all of said strip laminations comprising said layers having not more than six different lengths, each of said layers and window openings having identical dimensions, each corner of each of said layers having a generally Z-shaped butt joint therein between the split leg and yoke portions thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers offset with respect to each other, an outer strip lamination of a split yoke portion of some of said layers extending continuously between an outermost two split leg portions of said core section.

2. A three-phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having two outer legs and a central leg therebetween, all of said legs parallel to each other and parallel yokes extending between and perpendicular to said two outer legs and interconnecting the ends of all of said legs, all of said legs and yokes together defining two window openings therebetween, each of said layers and the window openings therein having identical dimensions, all of said legs and yokes comprising two elongated rectangular-like flat strips abutting each other along a lengthwise edge thereof, all of the strips comprising said layers having identical widths, and all of said strips comprising said layers having not more than six different lengths, each of said layers having a generally Z-shaped butt joint in each corner thereof between the outer legs and yokes thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers staggered with respect to each other, all of said layers having all inner yoke strips thereof interrupted by only one end of the central leg strips thereof, some of said layers having at least one outer yoke strip thereof extending continuously between said two outer legs.

3. A three phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having three parallel split leg portions and parallel split yoke portions extending perpendicular to said split leg portions and interconnecting the ends of said split leg portions, said split leg and yoke portions together defining two window openings therebetween, said split leg and yoke portions each comprising two elongated rectangular-like strip laminations abutting each other along a lengthwise edge thereof, all of said strip laminations having identical widths, and all of said laminations comprising said layers having not more than six different lengths, each of said layers and window openings having identical dimensions, each corner of each of said layers having a generally Z-shaped butt joint therein between the split leg and yoke portions thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers offset with respect to each other, both outer strip laminations of the split yoke portions of some of said layers extending continuously between an outermost two split leg portions of said core section.

4. A three phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers

5

having two outer legs and a central leg therebetween, all of said legs parallel to each other and parallel yokes extending between and perpendicular to said two outer legs and interconnecting the ends of all of said legs, all of said legs and yokes together defining two window openings therebetween, each of said layers and the window openings therein having identical dimensions, all of said legs and yokes comprising two elongated rectangular-like flat strips abutting each other along a lengthwise edge thereof, all of the strips comprising said layers having identical widths, and all of said strips comprising said layers having not more than six different lengths, each of said layers having a generally Z-shaped butt joint in each corner thereof between the outer legs and yokes thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers staggered with respect to each other, in some of said layers all of the yoke strips therein interrupted by only one end of the central leg strips of said some layers, in other of said layers all inner yoke strips of said other layers being interrupted by only one end of the central leg strips of said other layers, and the outer yoke strips of said other layers extending uninterruptedly between said two outer legs.

5. A rectangular-like three phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having two outer legs and a central leg therebetween, all of said legs parallel to each other, said central leg positioned equidistant of said two outer legs, parallel yokes extending between and perpendicular to said two outer legs and interconnecting the ends of all of said legs, all of said legs and yokes together defining two rectangular-like window openings therebetween, each of said layers and the window openings therein having identical dimensions, all of said legs and yokes comprising two elongated rectangular-like flat strips abutting each other along a lengthwise edge thereof, all of the strips comprising said layers having identical widths, all of the strips comprising said layers having not more than six different lengths, all of the strips comprising said layers having a lengthwise grain orientation, each of said layers having a generally Z-shaped butt joint in each corner thereof between the outer legs and yokes thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers staggered with respect to each other, every first one of said layers having both outer yoke strips thereof extending continuously between the two outer legs thereof, inner yoke strips of said first layers bisected by only one end of the central leg strips of said first layers whereby each of said inner yoke strips is divided into two equal yoke strip portions ex-

6

tending continuously only from one outer leg to a central leg, every second one of said layers comprising a layer identical to said first layers rotated 180° about an axis disposed in said first layers perpendicular to the legs thereof, every third one of said layers having both inner and outer yoke strips thereof bisected by only one end of the central leg strips thereof, every fourth one of said layers comprising a layer identical to said third layers rotated 180° about an axis disposed in said third layers perpendicular to the legs thereof.

6. A rectangular-like three-phase stacked magnetic core section having a plurality of stacked flat layers, each of said layers having two outer legs and a central leg therebetween, all of said legs parallel to each other, said central leg positioned equidistant of said two outer legs, parallel yokes extending between and perpendicular to said two outer legs and interconnecting the ends of all of said legs, all of said legs and yokes together defining two rectangular-like window openings therebetween, each of said layers and window openings therein having identical dimensions, all of said legs and yokes comprising two elongated rectangular-like flat strips abutting each other along a lengthwise edge thereof, all of the strips comprising said layers having identical widths, all of the strips comprising said layers having not more than six different lengths, all of the strips comprising said layers having a lengthwise grain orientation, each of said layers having a generally Z-shaped butt joint in each corner thereof between the outer legs and yokes thereof, the Z-shaped butt joints in each corner of said core section in every immediately adjacent two of said layers staggered with respect to each other, every first one of said layers having only one outer yoke strip thereof extending continuously between the two outer legs thereof, every first one of said layers having the other outer yoke strip and all inner yoke strips thereof bisected by only one end of the central leg strips of said first layers, every second one of said layers comprising layers identical to said first layers rotated 180° about an axis disposed in said first layers perpendicular to the legs thereof, every third one of said layers comprising layers identical to said second layers rotated 180° about an axis disposed in said second layers parallel to the legs thereof, and every fourth one of said layers comprising layers identical to said third layers rotated 180° about an axis disposed in said third layers perpendicular to the legs thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

1,891,178	Porter	Dec. 13, 1932
2,467,823	Gordy	Apr. 19, 1949
2,467,824	Granfield	Apr. 19, 1949