March 19, 1963 A. CHIKI 3,082,391

SHELL TYPE TRANSFORMER

Filed April 25, 1960 3 Sheets-Sheet 1

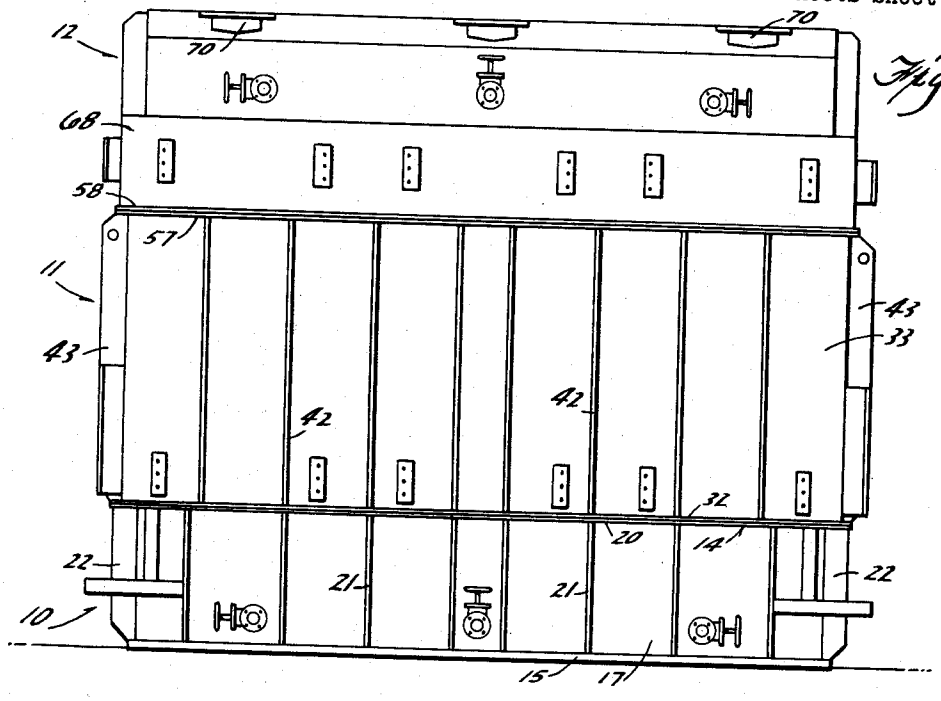

Fig. 1.

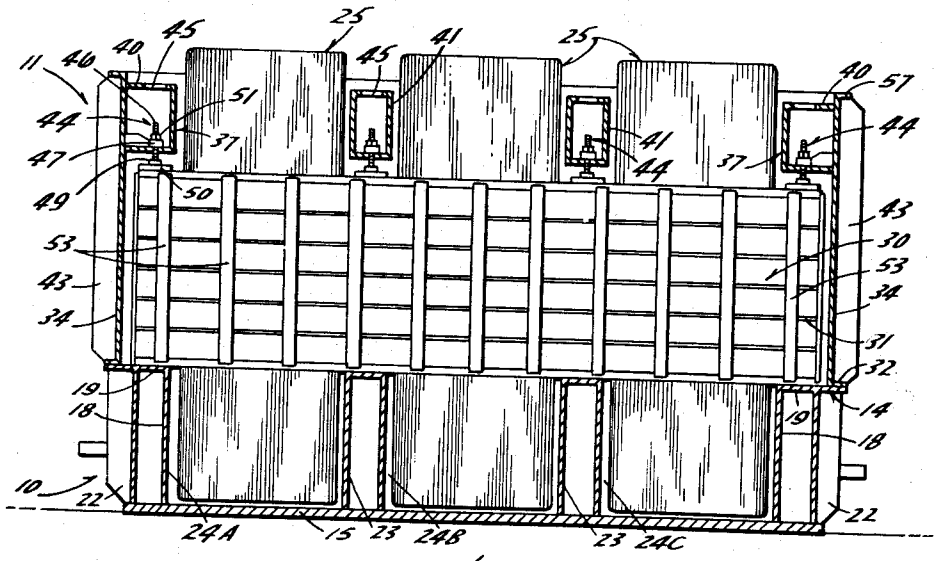

Fig. 2.

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SHELL TYPE TRANSFORMER

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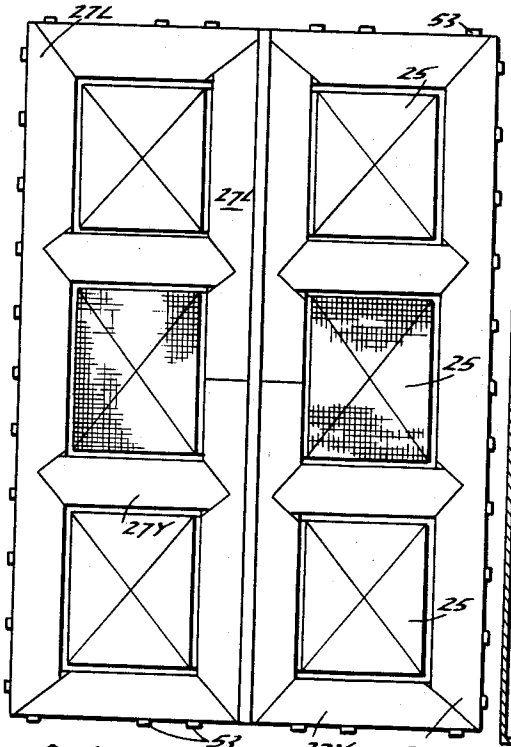

Fig. 4.

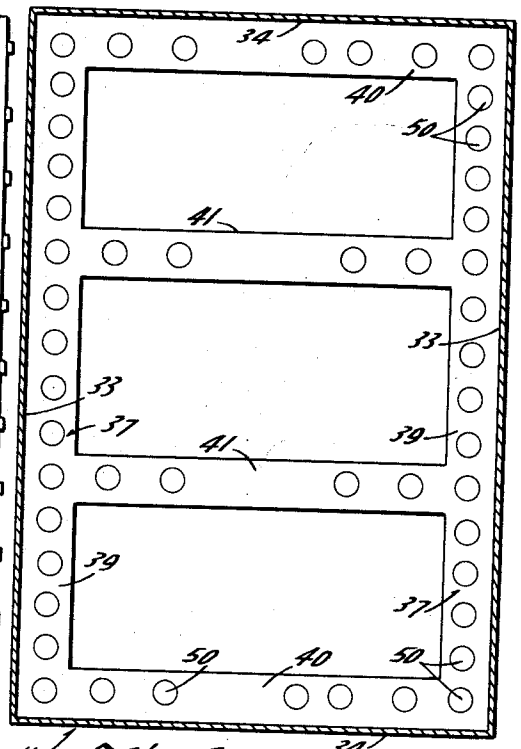

Fig. 5.

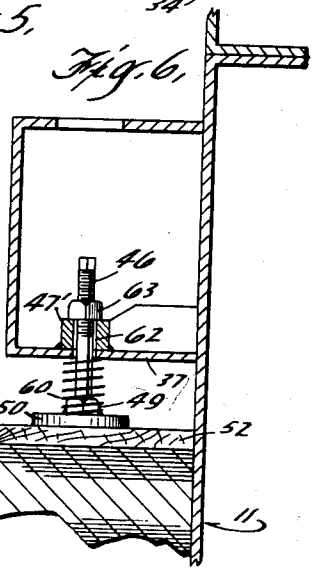

Fig. 6.

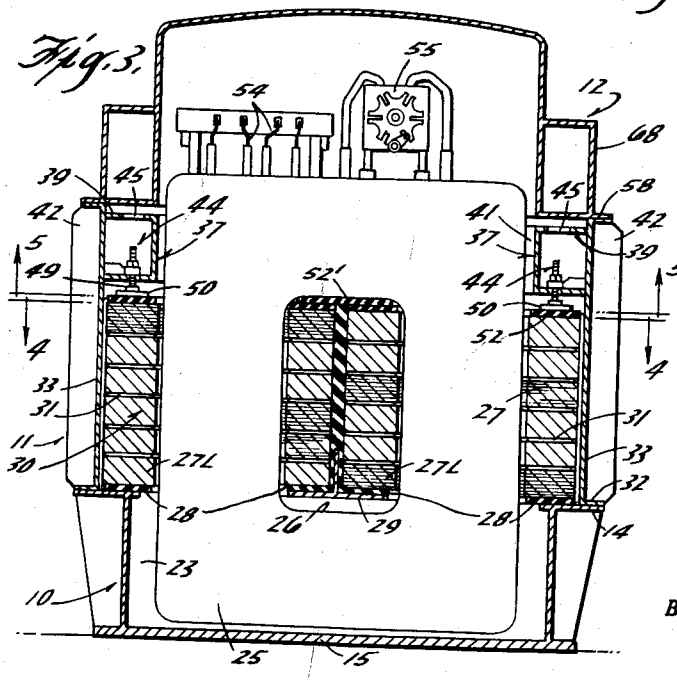

Fig. 3.

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SHELL TYPE TRANSFORMER

Filed April 25, 1960 3 Sheets-Sheet 3

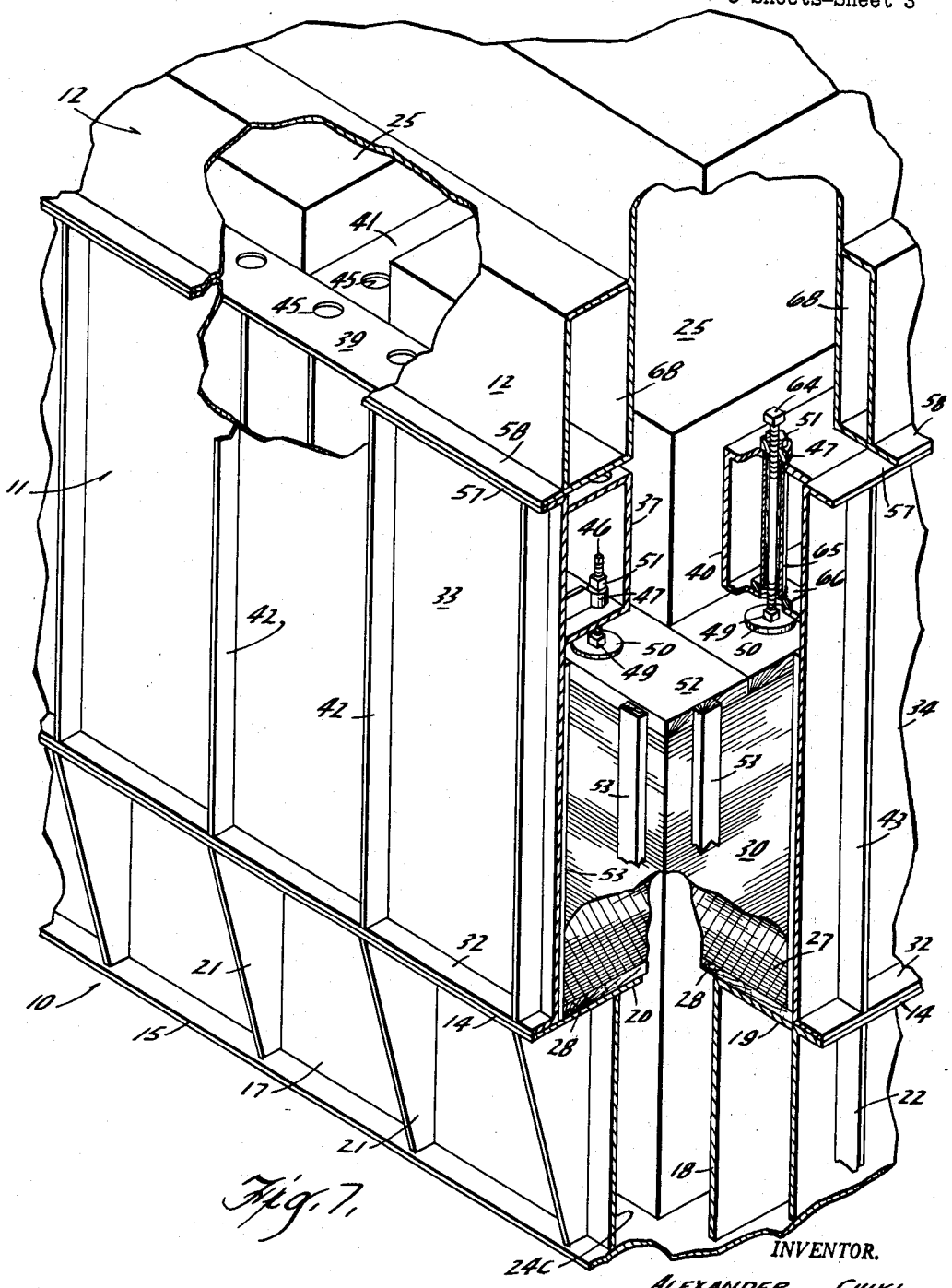

Fig. 7.

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United States Patent Office 3,082,391 Patented Mar. 19, 1963

3,082,391

SHELL TYPE TRANSFORMER

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Filed Apr. 25, 1960, Ser. No. 24,429
13 Claims. (Cl. 336—210)

This invention relates in general to a stationary induction apparatus and in particular to an improved construction for shell type transformers.

Holes are punched in the laminations of magnetic cores for conventional shell type transformers to receive bolts which clamp the core laminations to the structural iron frame members of the transformer. Such structural iron frame members must be sufficiently heavy to clamp the core and coil together as a rigid structure which can be handled separately as a complete subassembly. Heavy box-section iron members are also conventionally provided as part of the core frame to clamp the coils against mechanical forces during short circuit, and such heavy frame members add materially to the weight of the transformer. Other shell type transformers have tanks of two pieces which engage the upper and lower portions of the core and are urged together during assembly to clamp the core laminations to a predetermined pressure and are then welded to a banding plate around the periphery thereof to maintain the core laminations under pressure. With dimensional variations in the tank components, it is unlikely that such two-piece tank construction will result in uniform clamping of the core laminations. Further, it is impossible with such two-piece tank construction to untank the transformer or to gain access to the superstructure of the transformer for repair without disturbing the clamping of the core laminations.

It is an object of the invention to provide an improved method of assembling an enclosed stationary induction apparatus having a laminated magnetic core.

It is another object of the invention to provide an improved construction for shell type transformers which obviates the necessity of punching holes in the steel laminations and the use of bolts for clamping the laminations to frame members, thus resulting in a transformer having electrical characteristics superior to prior art apparatus and which is more economical to construct.

It is a further object of the invention to provide an improved shell type transformer construction which eliminates the heavy frame members used in prior art apparatus to clamp the core laminations and thus reduce the weight of the transformer and the amount of labor required to construct it.

A still further object of the invention is to provide an improved shell type transformer construction which provides (1) more uniform clamping pressure on the core laminations, (2) reduction in transformer weight, and (3) reduction in noise, in comparison to prior art apparatus.

A still further object of the invention is to provide an improved shell type transformer construction having adjustable core clamping means. Another object is to provide an improved shell type transformer construction wherein the superstructure of the transformer is more accessible than prior art apparatus. Still another object of the invention is to provide an improved shell type transformer construction wherein it is unnecessary to disturb the clamping of the core laminations in order to untank the transformer or work on any part of the transformer superstructure.

These and other objects and advantages of the invention will be more readily apparent from the following detailed description when considered in conjunction with the accompanying drawing wherein:

FIG. 1 is a front elevation view of a preferred embodiment of the invention;

FIG. 2 is a vertical sectional view taken longitudinally through the embodiment of FIG. 1 with the top tank section removed and the core and coils shown in full;

FIG. 3 is a vertical sectional view taken transversely through the embodiment of FIG. 1;

FIG. 4 is a view taken on lines 4—4 of FIG. 3 but omitting the transformer tank;

FIG. 5 is a view taken on lines 5—5 of FIG. 3 looking up into the center tank section;

FIG. 6 is a detailed sectional view through an alternative embodiment of jack screw means for clamping the core laminations to the tank base section; and

FIG. 7 is a perspective view of a portion of the embodiment of FIG. 1 with part of the tank wall broken away to better illustrate the internal construction and with an alternative embodiment of jack screw means shown in the end portion of the tank.

Referring to the drawing, the invention will be described as embodied in a three phase shell type transformer having a tank including three vertically superimposed, steel, box-like sections integrally welded together, namely, a base section **10**, a center section **11**, and a top section **12**. Flanges **70** on the top section **12** for mounting the transformer primary bushings are shown in FIG. 1. The core and coils of the shell type transformers are assembled on base section **10** without the use of a separate frame conventionally used in prior art construction, and the core laminations are not punched to provide bolt holes. Base section **10** is generally box-like in external configuration, i.e., in the general shape of a six-sided prism with rectangular sides, and is open at the top. Base section **10** provides shelf support for the core and coils. An outwardly extending, horizontal flange **14** extends around the entire periphery at the open end of the base section **10**. Base section **10** includes a heavy bottom plate **15** having welded thereto upwardly extending front and rear walls **17** and upwardly extending, box-section end walls **18** joined by welding to the front and rear walls **17**. Peripheral flange **14** is defined by horizontally extending top plates **19** of the box section end walls **18** and by horizontally extending plates **20** welded to the top of front and rear walls **17**. Horizontally spaced apart, vertically extending ribs **21** welded to and integral with the bottom plate **15**, the front and rear walls **17**, and the horizontal plates **20** provide additional bracing for the horizontal flange **14** at the front and rear of base section **10**. Similar horizontally spaced apart, vertically extending ribs **22** welded to and integral with bottom plate **15**, end walls **18**, and top plates **19** provide additional bracing for horizontal flange **14** at the ends of tank base section **10**.

A pair of transversely extending, horizontally spaced apart, box-section cross members **23** (see FIG. 2) welded to bottom plate **15** and to the front and rear walls **17** divide the interior of base section **10** into three compartments **24A**, **24B**, and **24C**. A rectangular shell type winding **25** for each phase is positioned in one of the compartments **24A**, **24B**, and **24C** and suspended so that it is held above the bottom plate **15**. The coils (not shown) of each winding **25** are in vertical planes transverse of the tank. Each rectangular winding **25** has a window **26** for the reception of core laminations and is provided with cooling ducts by spacers (not shown) between coils. Magnetic steel yoke laminations **27Y** and leg laminations **27L** are then assembled with the windings **25** and stacked so that leg laminations **27L** extend through the windows **26** and the leg yoke laminations meet in butt joints at right angle corners to form closed magnetic circuits linking each winding **25**. The butt joints between leg and yoke laminations are at such angles as to provide interleaved mitered joint corners

wherein the overlap between laminations in adjoining lamination layers tapers in a radially outward direction and results in minimum reluctance at the corners.

An elongated support **29** of inverted T-shape cross section extends longitudinally of the tank through the winding windows **26** and is supported on the cross members **23** and on the horizontal plates **19**. The leg laminations **27L** and yoke laminations **27Y** are disposed against sheet insulating members **28** which are supported on the radially inward portion of peripheral flange **14**, on the cross members **23**, and on the cross-bar portion of the inverted T-shape support **29**. The core **30** is thus divided by member **29** and is supported on base section **10**. The magnetic core **30** of stacked laminations **27** is preferably cooled by both vertical ducts and by horizontal ducts, the latter being provided by suitable insulating spacers designated by reference numeral **31** inserted at vertically spaced apart points in the stack of laminations **27**.

After the core laminations **27** are stacked, center tank section **11** is lowered over core **30** and welded to base section **10**. The center tank section **11** is also generally box-like in shape and is open at both top and bottom. The center tank-section **11** fits snugly over the core **30** formed by the stacked laminations **27** and has a horizontally extending flange **32** around the periphery thereof at the lower end of the front and rear walls **33** and end walls **34** of center tank section **11**. Flange **32** rests upon and is welded to peripheral flange **14** adjacent the outer margin thereof.

Center tank section **11** is provided with a channel cross section, internal brace **37** around the entire interior periphery adjacent the upper end of the front and rear walls **33** and end walls **34**. Internal brace **37** includes elongated side portions **39** welded to and integral with the front and rear walls **33**, end portions **40** welded to and integral with end walls **34**, and cross brace portions **41** extending transversely of the tank and disposed above the cross members **23** and welded to the side portions **39**. Horizontally spaced apart, vertically extending ribs **42** welded to and integral with flange **32** and the front and rear walls **33** and end walls **34** provide additional bracing for the center tank section **11**. Vertically extending insulating strips **53**, preferably of wood, spaced apart horizontally around the outer periphery of the stacked lamination core **30** insulate the core **30** from the center tank section **11**.

The core laminations **27** are clamped to base section **10** by a plurality of closely spaced jack screws **44** built into the internal bracing band **37** around the top of the center tank section **11** and which distribute the clamping pressure evenly along the magnetic core. Holes **45** are provided in the upper wall of the side portions **39**, end portions **40**, and cross portions **41** of the internal brace **37** to provide access to the jack screws **44**. Each jack screw **44** includes an adjusting stud **46** engaging an internally threaded sleeve **47** welded to the bottom wall of internal brace **37**. The lower end of adjusting stud **46** is secured to a nut **49** welded to a flat pressure plate **50** disposed above sheet insulating material **52** which rests upon a top core lamination **27** and helps distribute the load from the pressure plate **50** to the core **30**. It will be apparent that turning of adjusting stud **46** will advance pressure plate **50** toward or withdraw it away from base section **10** and thus provide controlled-pressure clamping of the core laminations **27** against the horizontal peripheral flange **14** and against cross members **23** of base section **10**. It has been found that careful control of the pressure exerted by the closely spaced jack screws **44** reduces the sound level of the transformer in comparison to prior art construction. All portions of the core including the yoke laminations **27Y** can be uniformly clamped to the pressure desired for the particular core, thus resulting in improved electrical characteristics for the transformer and reduction in noise. A

nut **51** provided on adjusting stud **46** above threaded sleeve **47** permits locking of adjusting stud **46** at the desired clamping pressure.

An elongated member **52'** of suitable insulating material such as wood inserted between the top laminations **27L** extending through the windows **26** and the internal margin of the rectangular coils **25** defining window **26** wedges the coils **25** tightly against the core **30** and supports them slightly off the bottom plate **15**. Insulating members (not shown) of suitable material such as wood are wedged between the windings **25** and the cross members **23** of base section **10** and between windings **25** and cross portions **41** of internal brace **37** to hold the coils **25** against movement longitudinally of the tank.

The transformer superstructure including electrical leads **54** to the terminal board and the tap changer **55** disposed above the windings **25** are covered by the generally box-shape top tank section **12** which is open at the bottom and welded to the middle tank section **11**. A horizontal flange **57** extending around the periphery at the top edge of center tank section **11** is disposed against and welded to a horizontal flange **58** extending around the periphery of the bottom edge of top tank section **12**. A box-section brace portion **68** extends around the periphery of the top tank section **12** adjacent the lower end thereof.

If it is desired to untank the transformer or to work on any part of the transformer superstructure, it is unnecessary to disturb the clamping of the core **30** as was required with prior art constructions. All that is necessary to gain access to the superstructure is to remove the upper tank section **12**. Further, the elimination of the separate frame accomplished by the disclosed shell transformer construction assures that less head room is required to untank the transformer than with prior art construction.

FIG. 6 illustrates an alternative means for clamping the core laminations **28** to the base section **10**. A compression spring **60** surrounds adjusting stud **46** between pressure plate **50** and the bottom wall of internal brace **37**. A clearance aperture **62** for adjusting stud **46** is provided in sleeve **47'** welded to the bottom wall of internal brace **37**. Before center tank section **11** is welded to base section **10**, nut **63** is turned on adjusting stud **46** to draw pressure plate **50** toward internal brace **37** and thus compress spring **60**. After center section **11** is welded to base section **10**, nut **63** is backed off to permit spring **60** to exert pressure on pressure plate **50** and thus clamp the core laminations **27** against the base section **10**.

An alternative embodiment of jack screw means which obviates the necessity of reaching into the interior of the internal brace **37** to clamp the laminations **27** is illustrated on the end portion **40** of the internal brace **37** in FIG. 7. An elongated clamping bolt **64** secured to the nut **49** which is welded to pressure plate **50** extends freely through a steel pipe **65** welded to the top wall of internal brace **37** and to a pad **66** affixed to the bottom wall of internal brace **37**. Clamping bolt **64** threadedly engages sleeve **47** welded to the top wall of internal brace **37**, and it will be apparent that turning of clamping bolt **64** advances or withdraws pressure plate **50** relative to the core laminations **27** and to the base section **10**. Pipe **65** adds stiffness to clamping bolt **64**, and a nut **67** engaging bolt **64** above sleeve **47** acts as a locking device.

The elimination of the heavy frame members conventionally used for clamping the core and coils together as a rigid structure materially reduces the weight of the transformer unit and the amount of labor required to construct the transformer. The internal brace **37** of the center tank section **11** provides sturdy side bracing for the internal assembly, and the cross portions **41** of the internal brace **37**, being integral with the side portions **39**, permit reduction in the height of the main brace in comparison to prior art construction. The disclosed con-

struction for three phase shell type transformers provides considerably greater kva. per pound and per cubic foot than prior art apparatus.

While only a single embodiment of the invention has been illustrated and described, many modifications and variations thereof will be apparent to those skilled in the art, and consequently it is intended in the appended claims to cover all such modifications and variations as fall within the true spirit and scope of the invention.

I claim:

1. A shell type, three phase electrical transformer comprising, in combination, a closed tank having three vertically superimposed, box-like sections integrally welded together, the lower section being open at the top and having a pair of cross braces secured to a pair of opposed walls of said box-like lower section dividing it into three compartments, three rectangular shell type windings, one being positioned in each of said compartments and having a window therethrough, said lower section having a horizontal flange extending around the periphery at the upper open end thereof at the vertical level of said cross braces, a stacked magnetic core having laminations in horizontal planes extending through the windows of said windings and being supported on said flange and on said cross braces, the middle tank section being open at the top and bottom and surrounding said core and said windings and resting on and being welded to the outer margin of said flange outward from said core, an internal brace integral with and extending around the inner periphery of the walls of said middle tank section and protruding inwardly therefrom above said core, said brace including a pair of integral cross members disposed above said cross braces, a plurality of adjustable clamping means mounted in horizontally spaced apart relation on said brace and said cross members for exerting pressure vertically downward against the laminations of said core supported on said flange and on said cross braces to clamp said core against said lower tank section, the upper section of said tank being open at the bottom and secured to the upper end of said middle tank section.

2. In a three phase shell type electrical transformer including three horizontally spaced apart windings provided with coils in parallel vertical planes and with windows in registry and a stacked magnetic core having laminations in horizontal planes defining closed magnetic paths linking said windings and certain of which laminations extend through said windows and support said windings; the improvement comprising a closed tank having three vertically superimposed, box-like sections integrally welded together, the bottom section being open at the top and having a pair of cross braces defining three compartments in said bottom section each of which is adapted to receive one of said windings and also having a horizontal flange around the periphery at said open upper end, said flange and said cross braces being adapted to support the laminations of said magnetic core, the middle section of said tank being open at the top and bottom and surrounding said core and being welded to said flange adjacent the outer margin thereof, said middle section having an internal brace integral with and extending around the interior periphery of the walls of said middle section and protruding inwardly above said core and including cross members disposed above said cross braces, said internal brace having horizontal wall portions spaced apart vertically and connected by at least one vertical wall portion, a plurality of jack screw means mounted on the bottom horizontal wall portion of said internal brace in spaced apart relation longitudinally of said brace and said cross members for clamping the laminations of said core against said flange and said cross braces of said lower tank section, each of said jack screw means including a pressure plate adopted to exert pressure against the laminations of said stacked core and a vertical threaded male member secured to said pressure plate and extending through the bottom horizontal wall portion of said internal brace and being accessible from the interior of said center tank section, and an internally threaded member engaging said male member and being integral with one of the horizontal wall portions of said internal brace, the upper section of said tank being open at the bottom and secured to the upper end of said middle tank section.

3. In a three phase shell type electrical transformer including three horizontally spaced apart windings provided with coils in parallel vertical planes and with windows in registry and a stacked magnetic core having laminations in horizontal planes defining closed magnetic paths linking said windings and certain of which laminations extend through said windows and support said windings; the improvement comprising a closed tank having three vertically superimposed, box-like sections integrally welded together, the bottom section being open at the top and having a pair of cross braces defining three compartments in said bottom section each of which is adapted to receive one of said windings and also having a horizontal flange around the periphery at said open upper end, said flange and said cross braces being adapted to support the laminations of said magnetic core, the middle section of said tank being open at the top and bottom and surrounding said core and being welded to said flange adjacent the outer margin thereof, said middle section having a channel cross section internal frame integral with and extending around the interior periphery of the walls of said middle section and protruding inwardly thereof above said core and including cross members disposed above said cross braces, a plurality of jack screw means mounted on the bottom wall of said internal frame in spaced apart relation longitudinally of said frame and said cross members for clamping the laminations of said core against said flange and said cross braces of said lower tank section, each of said jack screw means including a vertical threaded member adapted at its lower end to exert pressure vertically downward against said stacked core and extending through the bottom wall of said frame into the interior of said brace, said frame having a plurality of apertures affording access to said jack screw means, the upper section of said tank being open at the bottom and welded to the upper end of said middle tank section.

4. In the method of assembling an enclosed stationary induction apparatus having a stacked magnetic core of laminations in horizontal planes, the steps of providing three box-like tank sections the first of which is open at one end and has a horizontal shelf portion at said open end, the second of which is open at both ends and has a horizontal, internally extending brace around the inner periphery adjacent one end thereof, and the third of which is open at one end, supporting the laminations of said core in a stack on said shelf portion of said first section, positioning said second section above said first section and in surrounding relation to said stack of laminations and so that said brace is disposed above said stack of laminations, welding said second section to said first section, exerting pressure vertically downward from said brace at a plurality of points spaced apart longitudinally of said brace against said stack of laminations to clamp said core against said first section, positioning said third section above said second section with the open end thereof facing downward, and welding said third section to said second section.

5. In the method of assembling enclosed stationary induction apparatus having a box-like lower tank section open at its upper end and provided with a horizontal peripheral flange at said open upper end and a stacked magnetic core of laminations disposed in horizontal planes supported on said flange, the improvement comprising the steps of providing a center tank section open at both ends and having an internal horizontal frame integral therewith extending inwardly from the interior walls thereof, positioning said center tank section above said lower tank sec-

tion in surrounding relation to said core and so that said frame is disposed above said core, welding said center tank section to said lower tank section, and exerting pressure vertically downward at a plurality of horizontally spaced apart points between said internal frame and the top of the stack of laminations to clamp said core against said lower tank section.

6. In the method of assembling a transformer having a box-like lower tank section provided with a horizontal peripheral flange, a winding disposed in said lower tank section having coils in vertical planes and window therethrough, and a stacked magnetic core having laminations in horizontal planes supported on said flange certain of which extend through said window and support said core; the improvement comprising the steps of providing a box-like center tank section open at top and bottom, welding an inwardly extending horizontal brace to the inner periphery of said center section adjacent the top thereof, positioning said center section over said core and said winding and above said lower tank section so that said brace is disposed above said core and said center tank section rests upon said flange, welding the bottom end of said center tank section to the outer margin of said flange, and exerting pressure vertically downward at a plurality of points spaced apart longitudinally of said brace between said brace and the top laminations of said stacked core to clamp said core laminations against said lower tank section.

7. In the method of assembling a transformer having a box-like lower tank section open at its upper end and provided with a horizontal peripheral flange at said open end, three windings disposed in horizontally spaced apart relation in said tank and having coils in parallel vertical planes and windings therethrough in registry, and a stacked magnetic core having laminations in horizontal planes forming closed magnetic circuits linking said windings and having leg portions extending through said windows supporting said windings and yoke portions in the spaces between said windings; the steps of welding cross braces in said lower tank section at positions between said windings at the vertical level of said flange, stacking said laminations on the radially inward portion of said flange and on said braces to build up said stacked core, providing a box-like center tank section open at top and bottom, welding an inwardly extending horizontal brace to the inner periphery of the walls of said center tank section adjacent the top thereof and welding cross members between opposed portions of said brace, positioning said center tank section over said windings and said core and above said lower tank section so that the lower end of said center section rests on said flange and said brace is disposed above said core and said cross members are disposed above said braces and the yoke portions of the core between said windings, and exerting pressure at a plurality of horizontally spaced apart points vertically downward between said brace and the portions of said core supported on said flange and between said cross members and the yoke portions of said core disposed between said windings to clamp said core against said lower tank section.

8. In the method of assembling a transformer winding having a window therein and coils in a vertical plane with a stacked magnetic core linking said winding and having horizontally disposed laminations certain of which are inserted through said window and a tank enclosing said core and said winding; the steps of providing three separate box-like tank sections the first and third of which are open at one end and the second of which is open at both ends, welding a horizontal peripheral flange to said first section at the open end thereof, disposing said first section so that said open end and said flange face upward, placing said winding within said first section, inserting said certain laminations through said window and stacking said laminations on said flange as a support to build up said core, welding a horizontal, inwardly extending brace to the interior walls of said second section adjacent one open end thereof, disposing said second section above said first section and in surrounding relation to said core and said winding and so that said brace is disposed above said core, securing said second section to said flange adjacent the outer margin thereof, exerting pressure vertically downward at a plurality of horizontally spaced apart points between the lower surface of said brace and the top of said core to clamp said core against said flange, positioning said third section above said second section so that the open end thereof faces downward, and securing the lower open end of said third tank section to the open upper end of said second tank section.

9. A shell type transformer comprising, in combination, a tank having three vertically superimposed, box-like sections integrally welded together including a base section open at the top and having a horizontally extending peripheral ledge portion surrounding said open end, a center section open at top and bottom, and a top section open at the bottom, a magnetic core of stacked laminations supported on said ledge portion, said center section surrounding said core and being secured to said base section adjacent the external margin of said ledge portion, said center section having an internal brace integral therewith extending horizontally inward around the interior periphery thereof above said core, a plurality of adjustable clamping means accessible from the interior of said center section mounted in horizontally spaced apart relation on said brace and adapted to be advanced vertically toward and away from said stacked laminations for clamping said core against said ledge portion, said top section being affixed to the upper end of said center section.

10. An electrical transformer comprising, in combination, a closed tank having three vertically superimposed, box-like sections integrally welded together, the base section being open at the top and having horizontal shelf portions adapted to support a magnetic core, the center section being open at top and bottom, and the top section being open at the bottom, a magnetic core within said tank having stacked laminations disposed in horizontal planes resting on said shelf portions, a winding within said tank linked with and supported on said magnetic core and having a window surrounding a portion of said core, an internal brace welded to the internal periphery of the walls of said center section adjacent the upper end thereof and extending inwardly therefrom above said core, said brace having vertically spaced, horizontal wall portions integral with the walls of said center section and a vertical wall portion connecting said horizontal wall portions, a plurality of adjustable clamping means mounted in horizontally spaced apart relation on the lower horizontal wall of said brace for exerting pressure vertically downward against the laminations of said core to clamp said laminations against said base section, each of said means including a vertical male threaded member having a portion adapted to exert pressure against the stacked laminations and an internally threaded member disposed above said bottom horizontal wall of said brace and threadably engaging said male member.

11. An electrical transformer comprising, in combination, a closed tank having three vertically superimposed, box-like sections integrally welded together, the base section being open at the top and having horizontal shelf portions adapted to support a magnetic core, the center section being open at top and bottom, and the top section being open at the bottom, a magnetic core within said tank having stacked laminations disposed in horizontal planes resting on said shelf portions, a winding within said tank linked with and supported on said core, a channel cross section internal frame integral with the walls of said center section and extending inwardly therefrom above said stack of core laminations, and a plurality of adjustable jack screw means accessible from the interior of said center section and mounted in horizontally spaced apart relation on the lower wall of said frame

for exerting pressure vertically downward against said core laminations to clamp said core against said base section.

12. An electrical transformer comprising, in combination, a closed tank having three vertically superimposed, box-like sections integrally welded together, the base section being open at the top and having horizontal shelf portions adpated to support a magnetic core, the center section being open at top and bottom, and the top section being open at the bottom, a magnetic core within said tank having stacked laminations disposed in horizontal planes resting on said shelf portions, a winding within said tank linked with and supported on said core, a channel cross section internal frame integral with the walls of said center section and extending inwardly therefrom above said stack of core laminations, and a plurality of adjustable jack screw means accessible from the interior of said center section and mounted in horizontally spaced apart relation on the lower wall of said frame for exerting pressure vertically downward against said core laminations to clamp said core against said base section, each of said jack screw means including a pressure plate adapted to bear against the top of said core, an internally threaded member secured to the lower wall of said brace, and an adjusting stud secured to said pressure plate and threadably engaging said member and extending through said lower wall of said brace into the interior of said brace, said brace having a plurality of holes therethrough permitting access to said jack screw means.

13. A shell type transformer comprising, in combination, a tank having three vertically superimposed, box-like sections integrally welded together, the lower section having horizontal shelf portions including a pair of cross braces integral with a pair of opposed walls of said lower section and dividing it into three compartments, a magnetic core of stacked laminations disposed in horizontal planes supported on said shelf portions, three shell type windings, one being disposed in each of said compartments and having a window surrounding a portion of said core, the middle tank section having a channel internal frame integral with and extending inwardly from the interior walls of said middle section above said core and including a pair of cross members integral therewith disposed above said cross braces, and a plurality of means accessible from the interior of said middle section and mounted on said frame in spaced apart relation longitudinally of said frame for exerting pressure vertically downward against said stack of laminations to clamp them against said shelf portions and being adjustable to vary said pressure, each of said means including a vertically reciprocable threaded member extending through the lower wall of said channel frame and adapted, when rotated, to be advanced toward or withdrawn away from said core.

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