United States Patent

[11] 3,620,395

[72] Inventor **Robert S. Farmer, Sr.**
Muncie, Ind.

[21] Appl. No. **866,341**
[22] Filed **Oct. 14, 1969**
[45] Patented **Nov. 16, 1971**
[73] Assignee **Westinghouse Electric Corporation**
Pittsburgh, Pa.

[54] METHOD FOR UPRIGHTING ELECTRICAL INDUCTIVE APPARATUS

10 Claims, 3 Drawing Figs.

[52] U.S. Cl. ..... **214/152,** 214/148, 214/1 Q, 254/94
[51] Int. Cl. **B65g 7/08**
[50] Field of Search ..... 214/1 QE, 1 Q, 148, 152, 1 H, 12; 254/94

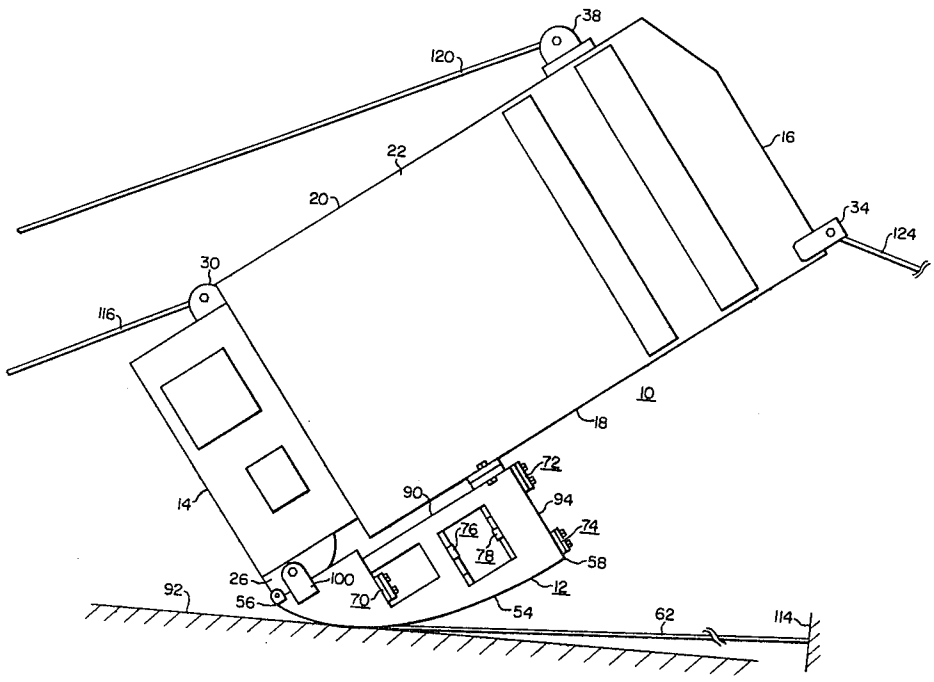
[56] **References Cited**

UNITED STATES PATENTS

2,424,258	7/1947	Smith	214/1 QE X
2,787,385	4/1957	Campbell	214/1 Q
2,862,629	12/1958	Aberle	213/148 R

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Frank E. Werner
Attorneys—A. T. Stratton, F. E. Browder and D. R. Lackey

ABSTRACT: A method for uprighting electrical inductive apparatus after shipment in a horizontal position, including the steps of mounting a rocker assembly having a curved base to the underside of the inductive apparatus to be uprighted, rotating the inductive apparatus on the curved base for a predetermined portion of the uprighting cycle, restraining the inductive apparatus from suddenly completing its turning cycle, and controllably releasing the restraint on the inductive apparatus during the remaining portion of the turning or uprighting cycle.



PATENTED NOV 16 1971

3,620,395

SHEET 1 OF 2

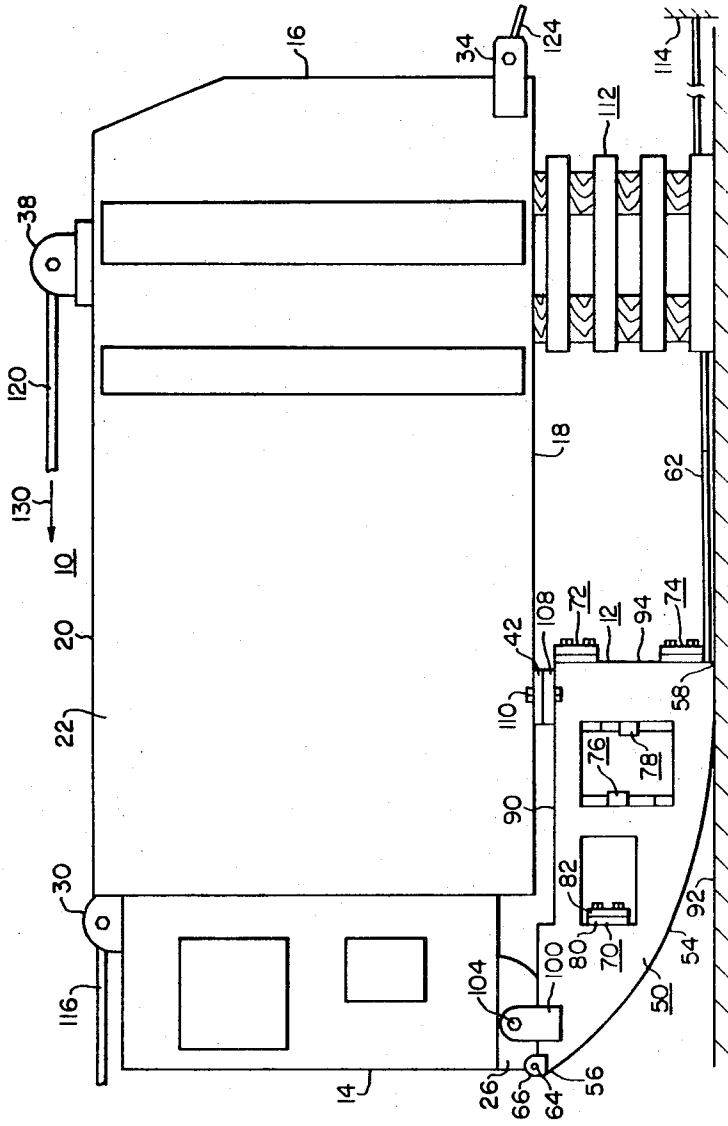


FIG. 1.

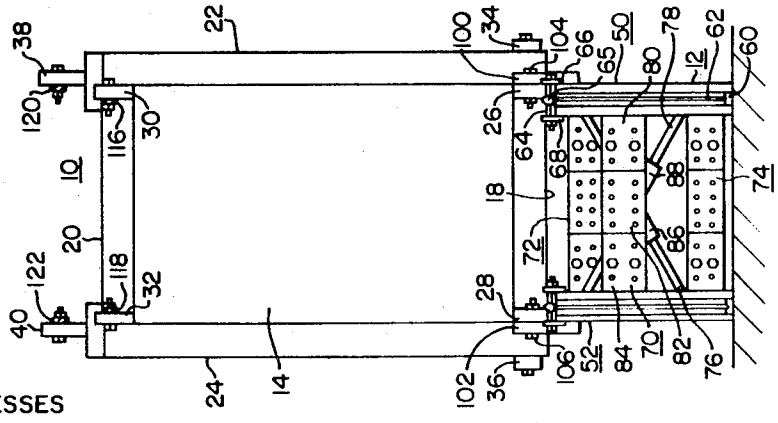


FIG. 2.

WITNESSES

Theodore H. Wrobel

James F. Young

INVENTOR

Robert S. Farmer, Sr.

BY

Donald E. Jackey

ATTORNEY

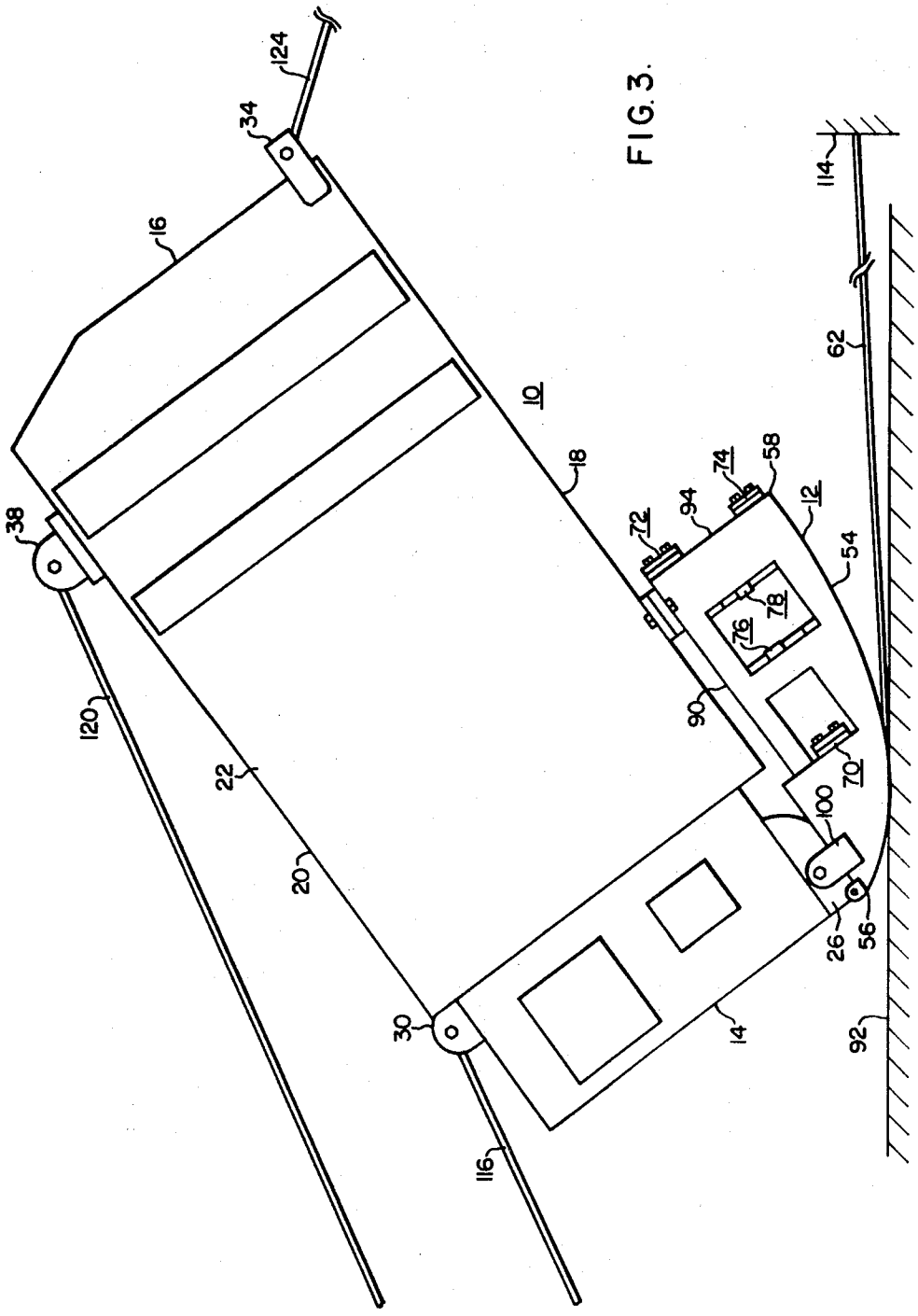

124
34
16
10
18
38
120
22
20
30
116
72
94
74
58
12
54
78
76
90
70
100
26
56
14
92
114
62

FIG. 3.

METHOD FOR UPRIGHTING ELECTRICAL INDUCTIVE APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates in general to electrical inductive apparatus, such as power transformers and reactors, and more specifically to a method for uprighting such inductive apparatus after shipment in a horizontal position.

2. Description of the Prior Art

Many large power transformers and reactors of the shell-form type are turned over on their sides and shipped horizontally, in order to meet shipping clearances imposed by bridges, tunnels, and the like. There is no problem in laying the apparatus on its side at the manufacturing site, as large cranes, high-capacity slings, and lifting beams are readily available. However, when the apparatus reaches its destination, high-capacity lifting devices may not be readily available. Thus, it would be desirable to provide new and improved methods for uprighting large power inductive apparatus after horizontal shipment, which eliminates the need for large, high-capacity lifting devices.

SUMMARY OF THE INVENTION

Briefly, the present invention is a new and improved method for uprighting large electrical inductive apparatus, such as transformers and reactors, from a horizontal shipping position. The method includes the steps of attaching the rocker assembly to the underside of the horizontally disposed inductive apparatus, and attaching cables to the inductive apparatus as predetermined locations. Certain of the cables are used to provide a pulling force on the inductive apparatus such that the inductive apparatus is rotated on the curved base of the rocker assembly, other cables are used to restrain the inductive apparatus from completing the turning cycle suddenly once the center of gravity of the inductive apparatus advances past the end of the curved base of the rocker assembly, and still other cables are used to prevent rectilinear movement of the inductive apparatus as it is being turned between its horizontal and vertical positions.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and uses of the invention will become more apparent when considered in view of the following detailed description and drawings, in which:

FIGS. 1 and 2 are side and end elevational views, respectively, of horizontally disposed electrical inductive apparatus, with a rocker assembly shown attached to the inductive apparatus prior to the uprighting cycle; and

FIG. 3 is an elevational view of the electrical inductive apparatus shown in FIGS. 1 and 2, in the process of being uprighted according to the teachings of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and FIGS. 1 and 2 in particular, there is shown side and end elevational views, respectively, of electrical inductive apparatus 10, such as a power transformer, shown ready for the uprighting cycle after shipment in a horizontal position. Large power transformers and reactors are normally shipped on a railroad car, and often must be turned on one side to meet shipping limitations on maximum height. Turning the apparatus on its side is easily accomplished at the manufacturing site, because high-capacity lifting devices are available. Such lifting devices are not always readily available, however, at the installation site, making it necessary to bring high-capacity cranes from long distances to perform the lifting required, or other time-consuming uprighting procedures are resorted to. The present invention discloses new and improved apparatus and methods for uprighting large power transformer and reactors, which will quickly and easily upright such apparatus without requiring high-capacity lifting devices.

More specifically, inductive apparatus 10, herein after referred to as a transformer, has bottom and top ends 14 and 16, respectively, and a generally rectangular configuration defined by four sidewall portions which, in the horizontal position shown in FIGS. 1 and 2, may be referred to as an underside portion 18, and upper side portion 20, and two vertical sidewall portions 22 and 24. Transformer 10 is prepared during manufacturing for receiving a rocker assembly 12, which is attached to the transformer 10 at its destination point, by welding suitable fittings to the transformer. Since the transformer 10 normally requires rugged fittings with openings therein for lifting hooks, to facilitate handling during manufacturing, some of these fittings may be located to also serve as fittings for the rocker assembly 12. For example, fittings 26 and 28 having an opening therein, are welded near the bottom end 14 of transformer 10, at the two spaced corners thereof which will be the two lower corners when the transformer is shipped in a horizontal position, fittings 30 and 32 having openings therein are welded near the bottom 14 of the transformer, at the two upper corners, fittings 34 and 36 are welded near the top end 16 of the transformer 10, at the two bottom corners, and fittings 38 and 40 are welded near the top end 16, at the two upper corners thereof. In addition to these fittings, two metallic pads having openings therein, such as pad 42, are welded at a predetermined location between the bottom and top ends 14 and 16, respectively, at or immediately adjacent to the intersection of underside portion 18 with the sidewall portions 22 and 24, respectively.

The rocker assembly 12 has first and second rocker members 50 and 52, respectively, Since each of the rocker members 50 and 52 are of similar construction, only rocker member 50 is described in detail. Rocker member 50 includes a curved base portion 54 having first and second ends 56 and 58 respectively. The curved base is provided with a channel or trough 60 which extends inwardly from the outer periphery of the base, and which extends along the complete length of the base between the first and second ends 56 and 58 thereof. A cable 62 is disposed in channel 60 which has one end secured adjacent end 56 of the curved base member, such as by a bolt 64 disposed through an "eye" or opening at the end 65 of cable 62, and through fittings 66 and 68 which are welded to the rocker members, and which have openings therein for receiving a bolt 64. Or, instead of securing end 65 of the cable 62 to the rocker assembly, it may be secured to a suitable fitting on the transformer 10, at the time the rocker assembly is assembled with the transformer 10.

Rocker members 50 and 52 are securely held in spaced parallel relation by adjustable metallic plate assemblies, such as assemblies 70, 72 and 74, and by adjustable cross bracing members 76 and 78. The structural plate assemblies may be made adjustable, to accommodate a wide range of transformer tank sizes, by using three plate members, such as plate members 80, 82 and 84 for assembly 70, each of which have a large plurality of openings therein for receiving nut and bolt combinations. Plates 80 and 84 are fixed to rocker members 50 and 52, respectively, and plate 82 is bolted to both plate members 80 and 84, inserting the bolts through openings in the plate members selected to provide the desired width of the rocker assembly 12. The cross bracing members 76 and 78 have their ends fixed to rocker members 50 and 52, and they are oriented substantially perpendicular to one another, each extending between an upper portion of one rocker member and a lower portion of the other rocker member. The cross bracing members are made adjustable by turn buckles 86 and 88, respectively.

Each of the rocker members 50 and 52, in addition to their curved base portions 54, have an upper side 90 which conforms generally to the configuration of the underside 18 of the transformer 10, starting at the bottom end 14 thereof and extending to a predetermined point between the bottom and top ends of the transformer, such as approximately midway between these ends. The first end 56 of the curved base member 54 starts at one end of the upper side 90, and curves

smoothly outwardly therefrom, towards the top end 16 of the transformer, until reaching end 58 of the curved base member which is at ground level 92. At this point, the curved base 54 is separated from the upper side portion 90 by vertically extending side or end portion 94.

Fittings 100 and 102 are welded to rocker members 50 and 52, respectively, near the intersection of the upper side 90 with the curved base portion 54, with these fittings cooperating with fittings 26 and 28 on the transformer 10, respectively, to enable the rocker assembly 12 to be pinned or bolted to the transformer 10. Bolts or pins 104 and 106 are inserted through the openings in the fittings and secured by suitable nuts. Two additional fittings are disposed on the upper side 90 of rocker members 50 and 52, such as fitting 108 on rocker member 50, which are adapted to cooperate with the pads welded to the transformer, such as pad 42. Suitable bolts, such as bolt 110, is inserted through the openings in the fittings, to complete the assembly of the rocker assembly 12 to the transformer 10.

The method of uprighting transformer 10 from its horizontal position shown in FIGS. 1 and 2 will now be described. When the horizontally disposed transformer 10 arrives at its destination point on a railroad car, the transformer is unloaded from the car sideways onto suitable cribbing. At this point, the transformer is still on its side, 2 to 4 feet above the ground level 92. Transformer 10 is then raised vertically, still in its horizontal shipping position, by jacks and cribbing, such as cribbing 112, until the transformer is high enough to attach the rocker assembly 12, as shown in FIGS. 1 and 2 and hereinbefore described. The cribbing which supports the bottom end of the transformer 10 may now be removed, supporting this end of the transformer 10 by end 58 of the curved base portions 54 of the rocker members 50 and 52.

Cables 62, which extend through channels in the curved base portions of the rocker members 50 and 52, have their ends which extend outwardly from the rocker members 50 and 52 securely anchored or fixed as shown at 114. The other ends of cable 62 are fixed either to the rocker members, as illustrated, or to the transformer 10 near the bottom end 14 thereof. Cables are also securely attached to the transformer 10 near the remaining corners of the transformer, with cables 116 and 118 being secured to fittings 30 and 32, respectively, near the upper corners of the bottom end 14 of the transformer, cables 120 and 122 are secured to fittings 38 and 40, respectively, near the upper corners of the top end 16 of the transformer, and cables are secured to fittings 34 and 36 at the bottom corners of the top end 16, such as cable 124 to fitting 34. Cables 120, 122, 116 and 118 extend outwardly and away from the bottom end 14 of the transformer 10, while cables 62 and 124 extend outwardly and away from the top end 16 of the transformer 10.

As hereinbefore stated, cables 62 are securely anchored at point 114. Cables 120 and 122 are connected to pulling apparatus of the type conventionally available in the field, such as light cranes, A-frames, or winches. Cables 116, 118 and 124 are connected to means for keeping the cable taut throughout the uprighting cycle, and for smoothly and adjustably providing restraint on the transformer, which restraint is gradually removed to allow controlled turning of the transformer.

The uprighting of transformer 10 is to be performed by rotary movement only of the transformer. Rectilinear movement of the transformer is to be avoided. The complete turning cycle has first and second portions. The first portion requires an outside energy source to pull certain of the cables until the center of gravity of the transformer moves past the first end of the curved base portion of the rocker members. The transformer is restrained at this point from suddenly completing the remaining or second portion of the turning cycle, and this restraint is controllably released to allow the transformer to slowly complete the second portion of the turning cycle, during which time pulling from the outside source is no longer required. There are two points in the turning cycle where it is necessary to prevent rectilinear motion. At the start of the pulling step, transformer 10 is horizontal and the pulling will attempt to slide the transformer horizontally. This must be prevented. Also, during the second portion of the turning cycle, after the center of gravity of the transformer passes the end of the rocker assembly, the bottom end of the transformer may try to skid backwards, and this must be prevented. The functions of pulling the transformer during the first portion of its turning cycle is performed by cables 120 and 122, which are connected to suitable external pulling means (not shown), the function of preventing rectilinear motion of the transformer during the initial portion of the turning cycle is performed by anchored cables 62 and 64, the functions of restraining the transformer from suddenly completing its turning cycle as the center of gravity of the transformer moves past the rocker assembly, and controllably releasing this restraint, is performed by cables 124, which are connected to suitable controlable restraining means, and the function of preventing the transformer from skidding backwards as the center of gravity of the transformer moves past the first end 56 of the curved base portion of the rocker members if performed by cables 116 and 118, which are connected to external means selected to keep the cables taut throughout the uprighting cycle.

After the rocker assembly 12 is connected or attached to the underside 18 of transformer 10, such that the first end 56 of the curved base portion of the rocker assembly starts at the bottom end 14 of the transformer, and the various cables have been attached to the transformer and connected to external pulling or restraining means, as required, the process of uprighting the transformer may be initiated. In describing the uprighting process, FIG. 3 will be referred to, as well as FIGS. 1 and 2, with FIG. 3 illustrating transformer 10 at a point in the turning cycle.

The external pulling means, such as a light crane, or winch, starts pulling cables 120 and 122. Since ends 56 of the rocker assembly 12 cannot move in the direction of the pulling force, due to cables 62 being fixed to ends 56 of the rocker assembly 12, or to the bottom end 14 of the transformer, and to anchor 114, rectilinear motion of the transformer in the direction of arrow 130 will be prevented, resulting in a torque or turning force being exerted on transformer 10 which rotates transformer 10 on the curved base portion 54 of the rocker assembly 12. The pulling force on cables 120 and 122 is continued until the center of gravity of transformer 10 moves past end 56 of the curved base portion 54, at which point cables 124 restrain transformer 10 from suddenly completing the turning cycle, and cables 116 and 118 prevent the transformer from skidding backwards. The restraint on the transformer applied via cables 124, 116 and 118, is slowly and controllably released to allow the transformer 10 to slowly complete the turning cycle, resulting in uprighting the transformer. The rocker assembly 12 is then removed and shipped back to the manufacturer for use on other horizontally shipped electrical inductive apparatus.

The uprighting of transformer 10 is, therefore, accomplished without high-capacity lifting devices, requiring only light cranes, winches, or the like, which devices are commonly used in the field by riggers. The rocker assembly 12, being adjustable in width, may be used again and again on different sizes of inductive apparatus.

In summary, there has been disclosed a new and improved method for uprighting electrical inductive apparatus in the field, after shipment in a horizontal position. A rugged, low-cost rocker assembly is quickly and easily secured to the transformer in the field. The rocker assembly includes curved base portion, upon which the transformer may be turned from a horizontal position to a semivertical position. Cables attached to suitable external restraining means prevent rectilinear motion of the transformer during the turning cycle, and allow the transformer to slowly complete its turning cycle, after the center of gravity of the transformer moves past the ends of the curved base portions. The new and improved methods of uprighting the large electrical inductive apparatus disclosed

herein enable the uprighting of the apparatus to be accomplished without high-capacity lifting cranes and other devices which are not readily available in the field. Low-capacity cranes, winches, or A-frames commonly available in the field, may be used to upright the inductive apparatus.

Since numerous changes may be made in the above-described apparatus and methods, and different embodiments of the invention may be made without departing from the spirit thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative, and not in a limiting sense.

I claim as my invention:

1. A method of uprighting electrical inductive apparatus from a horizontal position, comprising the steps of:
- attaching a rocker assembly having a curved base, to the underside of the horizontally disposed apparatus,
- lowering the horizontally disposed apparatus until the curved base of the rocker assembly contacts a support,
- rotating the apparatus on the curved base of the rocker assembly, through a first portion of the uprighting cycle,
- restraining the apparatus from suddenly completing the uprighting cycle when the center of gravity of the apparatus reaches a predetermined point relative to the rocker assembly,
- and controllably releasing the restraint on the apparatus through the remaining portion of the uprighting cycle, to upright the apparatus.

2. The method of claim 1, including the step of raising the horizontally disposed apparatus to the height required to enable the step of attaching the rocker assembly to be performed.

3. The method of claim 1 including the steps of attaching first and second cable means to the apparatus, with the step of rotating the apparatus on the rocker assembly, through the first portion of the uprighting cycle, being accomplished by pulling the first cable means, and with the steps of restraining and controllably releasing the restraint on the apparatus being accomplished with the second cable means.

4. The method of claim 3, wherein the first and second cable means are attached near the top end of the apparatus.

5. The method of claim 3 including the steps of attaching third and fourth cable means to the apparatus, to prevent rectilinear movement thereof during the uprighting cycle.

6. The method of claim 5 wherein the third and fourth cable means are attached near the bottom end of the apparatus.

7. The method of claim 5 wherein the third cable means is attached near the bottom end of the apparatus, extending through channels in the curved base of the rocker assembly, and including the step of anchoring the free ends of the third cable means.

8. The method of claim 5 wherein the fourth cable means is comprising near steps of: end of the apparatus and including the step of keeping the fourth cable means taut as the apparatus completes the remaining portion of its uprighting cycle.

9. A method of uprighting electrical inductive apparatus from a horizontal position, comprising the steps of:
- attaching a rocker assembly having a curved base to the underside of the apparatus, with the curved base having a first end starting at the bottom end of the apparatus and curved outwardly, terminating at a second end at ground level between the bottom and top ends of the apparatus,
- lowering the apparatus until the curved base of the rocker assembly contacts a support,
- attaching first and second cable means near the top end of the apparatus, and third and fourth cable means near the bottom end of the apparatus, and third and fourth cable means near the bottom end of the apparatus,
- pulling the first cable means in a direction which rotates the apparatus on the curved base of the rocker assembly,
- anchoring the third cable means to prevent rectilinear movement of the apparatus during the pulling step,
- restraining the apparatus with the second cable means when the center of gravity of the apparatus moves past the first end of the rocker assembly,
- controllably removing the restraint placed on the apparatus by the second cable means, allowing controlled completion of the uprighting cycle,
- and preventing rectilinear movement of the apparatus with the fourth cable means, during the controlled completion of the upright cycle.

10. The method of claim 9 including the step of raising the horizontally disposed apparatus to the height required to enable the step of attaching the rocker assembly to be performed.

* * * * *