Sept. 15, 1953 J. L. BONANNO 2,652,500

VARIABLE VOLTAGE TRANSFORMER

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Fig. 1.

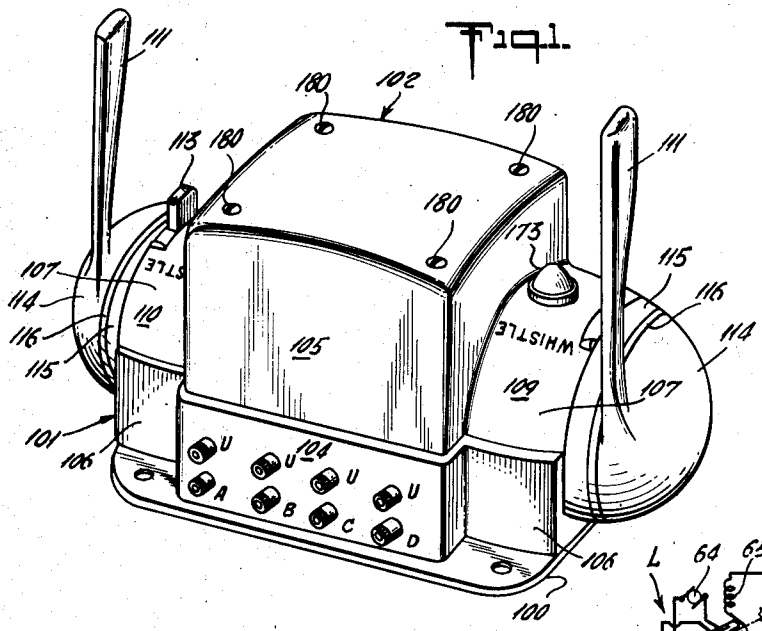


Fig. 2.

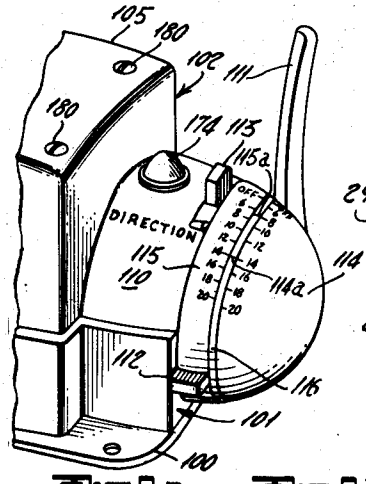


Fig. 3.

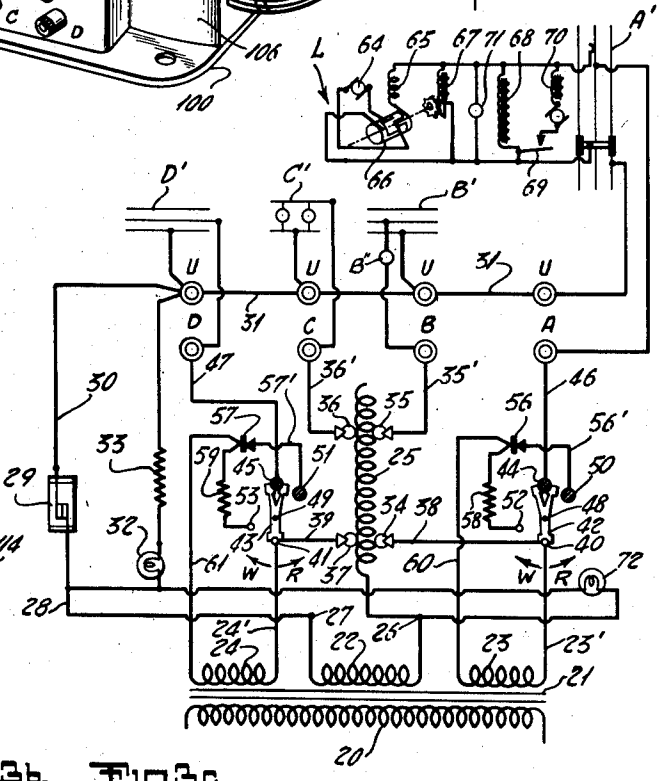


Fig. 3a.

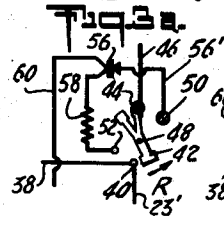


Fig. 3b.

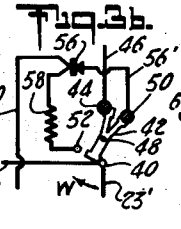
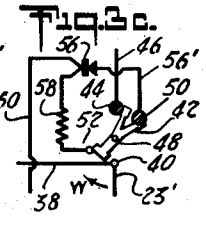


Fig. 3c.



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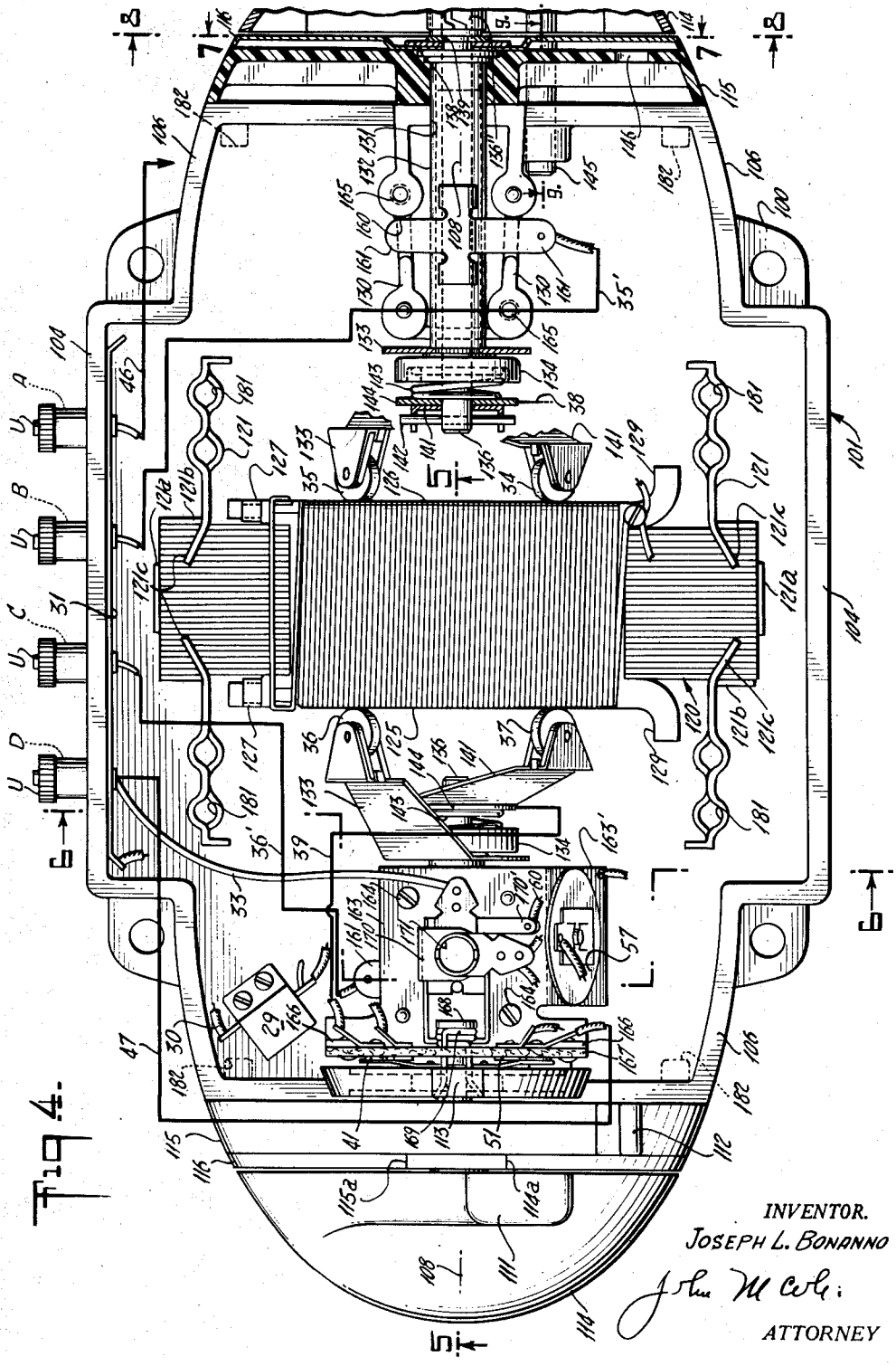


Fig 4.

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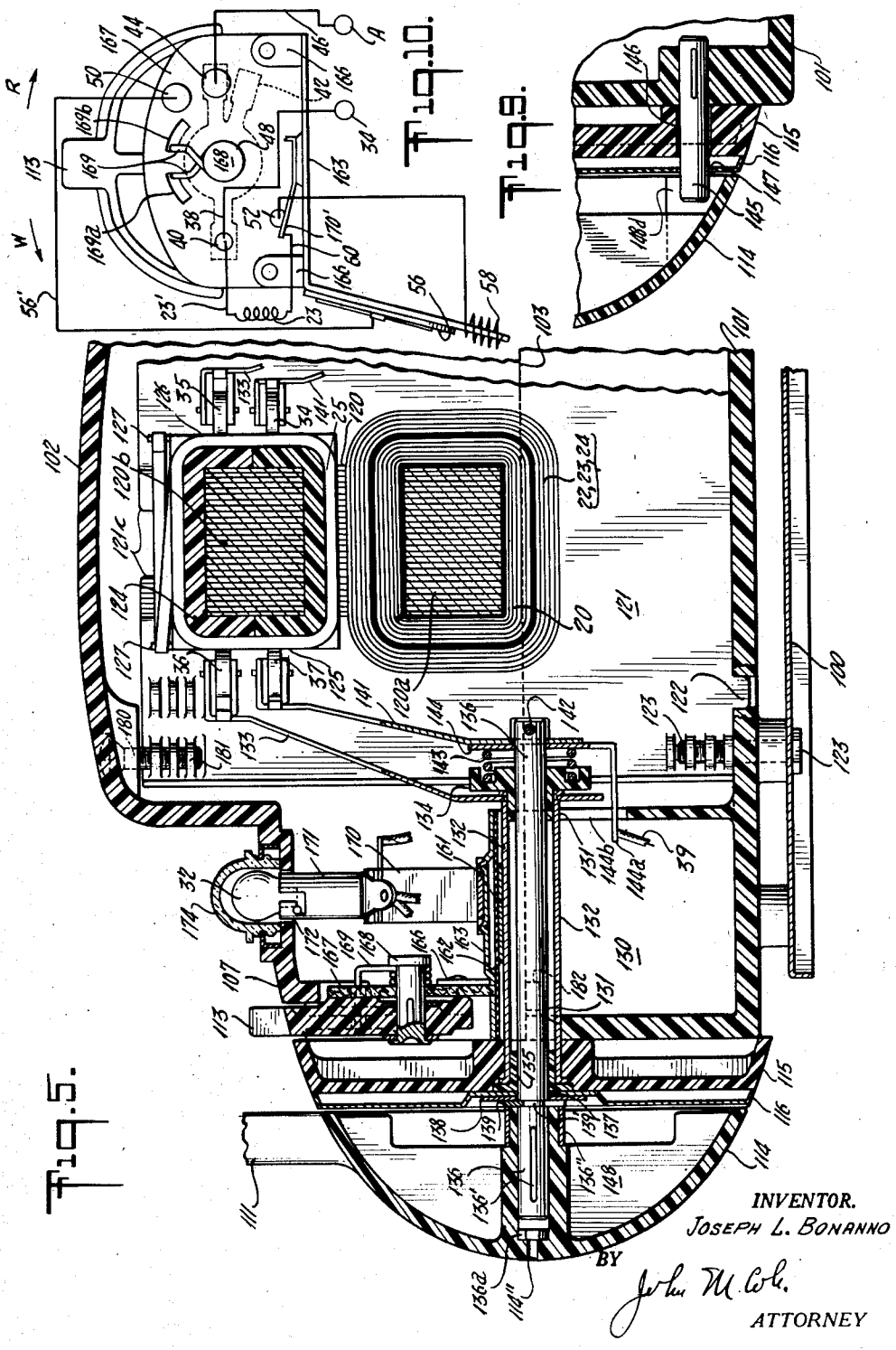


FIG. 10.

FIG. 9.

FIG. 5.

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Fig. 6.

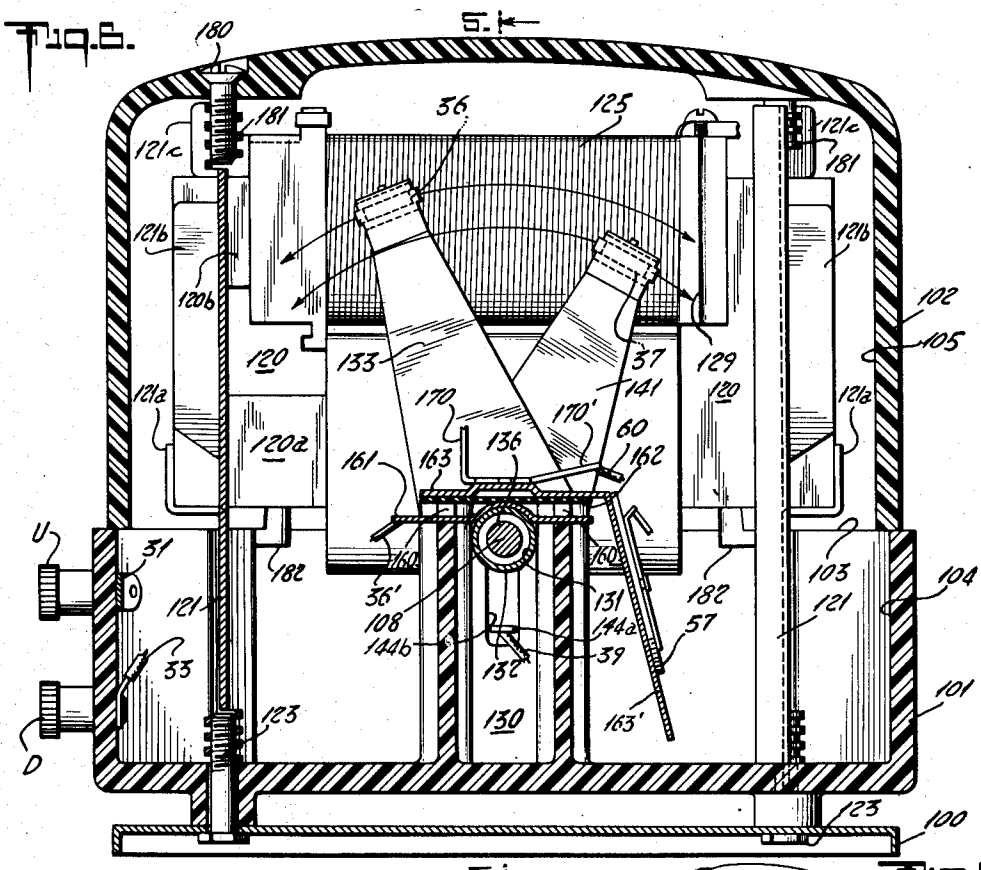


Fig. 8.

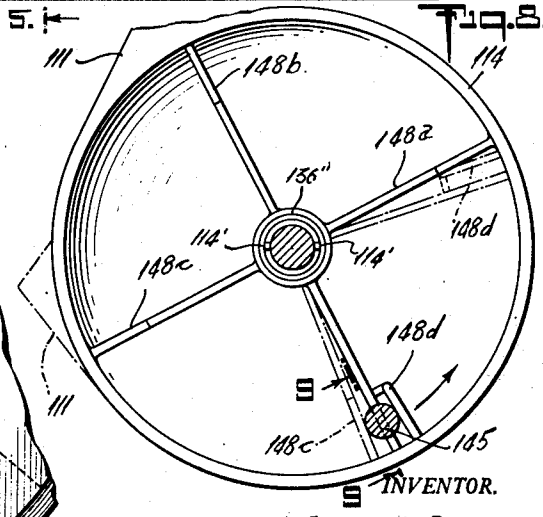
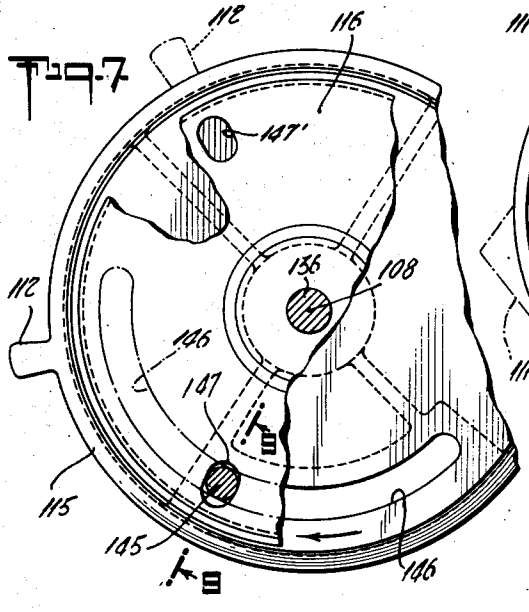


Fig. 7.



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Patented Sept. 15, 1953 2,652,500

UNITED STATES PATENT OFFICE

2,652,500

VARIABLE VOLTAGE TRANSFORMER

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Application October 8, 1949, Serial No. 120,269

17 Claims. (Cl. 307—2)

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The present invention relates to transformers, and is more particularly directed toward transformers for use with toy railroads and the like having provisions for furnishing a plurality of circuits with independently variable voltages.

In the embodiment to be described herein in detail the device is arranged to deliver to four independent circuits alternating current voltages of a predetermined range.

The variable voltages are taken off by movable contacts, preferably rollers, adapted to traverse exposed surfaces on the secondary. Where four circuits are to be controlled, the four rollers may, according to the present invention, be conveniently mounted on swinging arms, these arms being arranged in pairs on opposite sides of a transformer whose secondary faces extend horizontally in vertical planes. Two contact rollers engage each side face of the secondary and each pair is mounted to one side of the coil for swinging movement about a horizontal axis, preferably below the coil.

A further object of the present invention is to provide transformers for the purpose indicated wherein many of the parts used on the ends of the transformer structure may be duplicates of one another, while other parts are of the same design but left or right handed.

A further object of the present invention is to incorporate into the transformer structure a controller for effecting start-stop-reverse operation of the locomotive and whenever desired the operation of a whistle. In the preferred from of construction two such controls are provided, one on each end of the device and one is connected to one of the four load circuits, while the other is connected to the other of the four load circuits.

A further object of the invention is to provide a transformer with controls of the nature above referred to, wherein all of the wiring connections are accessible when the cover is removed and wherein the parts are arranged for ease of assembly during manufacture, or disassembly for inspection or test.

Other and further objects will appear as the description proceeds.

The accompanying drawings show, for purposes of illustrating the present invention, one embodiment in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In the drawings:

Figure 1 is a perspective view of the transformer taken from the rear;

Figure 2 is a fragmentary perspective view taken from the front;

Figure 3 is a wiring diagram;

Figures 3*a*, 3*b* and 3*c* illustrate the whistle-reverse controller in three different positions;

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Figure 4 is a top plan view, with the cover removed and parts broken away at the right to show interior construction;

Figure 5 is a vertical sectional view on the line 5—5 of Figures 4 and 6;

Figure 6 is a transverse sectional view on the line 6—6 of Figure 4, looking toward the coil-core assembly and cooperative movable contacts;

Figures 7 and 8 are sectional views taken in opposite directions as indicated by the arrows 7—7 and 8—8 respectively of Figure 4;

Figure 9 is a fragmentary section on line 9—9 of Figures 4, 7 and 8; and

Figure 10 is a fragmentary view of the whistle-reverse switch.

The electrical characteristics of the transformer are fully shown in Figure 3. Here the primary coil, suitable for using 110–125 volt, 60 cycle alternating current is shown at **20**, the field structure at **21** and the secondary at **22**, **23**, **24** and **25**. The secondary **22** is a fixed secondary adapted to have an output of 8 volts; the secondaries **23** and **24** are compensating windings with an output of approximately 5 volts. The secondary **25** is in the form of an exposed winding, and as indicated at **26** is connected in series with **22**. It is capable of developing up to 12 volts so that output voltages can be obtained from it of from 8 to 20 volts.

The other end **27** of secondary winding **22** is connected by wire **28** to a circuit breaker **29** which in turn is connected by wire **30** with strap **31** to which are secured four return binding posts marked U. The circuit breaker is in the common return line and is shunted by a short circuit pilot light **32** and resistor **33**.

The secondary coil **25** may be contacted by any or all of four roller contacts which may traverse the entire face of the coil or be moved off it to open the circuit. These contacts are marked **34**, **35**, **36** and **37**. Contact rollers **35** and **36** are connected to output binding posts marked B and C by wires **35'** and **36'**, while contact rollers **34** and **37** are connected through wires **38** and **39** with contacts **40** and **41**, pivoted switch arms **42** and **43**, contacts **44** and **45** and wires **46** and **47** with output posts A and D, respectively, so that the selected variable secondary voltage may be supplied to A, B, C or D.

The switch arms **42** and **43** are pivoted at **48** and **49** and biased to the position shown by mechanism to be described. When either is moved in the direction of the arrow R (Fig. 3*a*) it opens the circuit at the contact **40** and deenergizes the track. When it is shifted in the direction indicated by the arrow W (Fig. 3*b*) the movable contact **42** (or **43**), before it moves off contact **40** (or **41**), engages contact **50** (or **51**) and then without leaving **44** (or **45**) reaches a contact **52** (or **53**) (Fig. 3*c*). Contacts **40** and **41** are connected to secondaries **23** and **24** by wires **23'** and

24'. The contact 50 (or 51) is connected to a rectifier 56 (or 57) by wire 56' (or 57'), and the rectifier is connected through a resistor 58 (or 59) with contact 52 (or 53). The rectifier is also connected by wire 60 (or 61) with the other side of compensating winding 23 (or 24).

The binding posts A and D are provided for the purpose of supplying variable voltage to track layouts such as indicated at A' and D' respectively, and for controlling reverse and whistle mechanism such as shown in my Patent 2,155,343. Such a locomotive is indicated at L, on track layout A'. It has a motor with armature 64, field 65, reversing switch 66, indexing mechanism 67 for operating the reversing switch, a relay 68 sensitive to superposed direct current, and relay contact 69 in the circuit of a whistle motor 70, and a lamp or other load 71. Shifting switch 42 in the direction R opens the circuit to the track. This stops the motor and extinguishes the lights. Releasing the switch 42 restores power to the track and causes the indexing mechanism 67 to advance the reversing switch to open circuit position so that the train does not move. The next manipulation in direction R starts the motor in the opposite direction. Shifting switch 42 in the direction W brings the secondary winding 23 and rectifier 56 in series with the load circuit A—A' and introduces a direct current component to actuate the relay and blow the whistle.

The binding posts C and B are provided for supplying variable voltages to an accessory load such as lamps C' or another track layout such as at B'. To control a train on such a track an independent reverse whistle controller such as shown in Patent No. 2,317,727 may be inserted in the circuit as at B''. A "power on" pilot light 72 is connected between points 26 and 28 to show that the transformer is connected to an energized circuit.

The stationary, externally visible parts of the transformer include a generally rectangular sheet metal base 100, adapted to support the device on a suitable support, a molded insulating body member 101 and a cover 102 which meet along a horizontal plane 103. The body member and cover have wide central portions 104 and 105 and narrowed ends 106 and 107, the latter being arc-shaped about a longitudinal axis 108 slightly below the plane 103, so as to provide a generally box-shaped central portion and two reduced drum-shaped ends 109 and 110. The body member 101 carries at the rear the binding posts A, B, C, D and U.

Beyond each of the reduced ends 109 and 110, the transformer carries a long throttle control lever 111, a short control knob 112 and at the end a whistle reverse lever 113. The long levers 111 are connected to movable contact rollers 34 and 37 for controlling voltage to posts A and D respectively, while short control levers 112 are connected to movable contact rollers 35 and 36 to control voltage to posts B and C respectively, and the whistle-reverse levers 113 are connected to contacts 48 and 49 respectively. The control levers 111 and 112 turn about the axis 108, and have hub portions 114 and 115 provided with voltage markings as indicated in Figure 2, and movable past an indicia ring 116, provided with corresponding reference marks 114a and 115a. Adjacent the whistle-reverse levers 113, which project up through the notched ends of cover 102, are legends "whistle" and "direction." Hence it is apparent that all circuit controls may be effected by highly realistic mechanism and all wiring is completely enclosed.

The field structure 21 of the wiring diagram is shown structurally at 120. It extends transversely of the body member 101 and is centrally located. It is secured to mounting plates 121 by means of brackets 121a, lugs 121b and ears 121c. These plates are positioned in the body member 101 by lugs 122, Figure 5, and secured to the base 100 and body member 101 by screws 123. The part 120a of the field structure 120 carries the primary winding 20, and the secondary windings 22, 23 and 24. The upper part 120b of the field structure 120 carries the secondary winding 25 on an insulating core 124, so that the secondary 25 can have two exposed contact faces 125 and 126 in vertical planes. This secondary is preferably made as described in my Patent No. 2,312,382.

Rearwardly of the exposed faces of the secondary, the insulating core 124 has conducting plates 127 onto which the contact rollers may move. At the front it carries insulating stop lugs 129 which engage the rollers after they have left the winding.

All the operating parts for controlling output voltages and for the whistle and reverse are alike end for end, except that some of them are made right and left handed. Corresponding reference characters will be used for corresponding parts. They are all carried from interiorly disposed, cored out pedestals 130 at the ends of the body member 101, and provided with upwardly opening bearing seats 131 concentric with axis 108.

The seats 131 in the pedestals receive metal tubes 132 whose inner ends non-rotatably carry arms 133 provided with rollers 36 (or 35). The outer ends of the tubes 132 non-rotatably carry the hub portions 115 for levers 112. Insulating bushings 134 and 135 received in the ends of tubes 132 carry shafts 136 which protrude beyond the tubes in both directions. The outer end of each shaft 136 passes through a central opening 137 in the indicia plate 116, a loose washer 138, a split washer 139 (received in an undercut 139') and is non-rotatably secured to the hub portion 114 of throttle lever 111 by splines 136' entering slits 114'. A clamping spring 136'' provides a friction grip and a nut 136a opposite hole 114'' makes it possible to attach a screw when it is desired to pull the hub off the shaft.

To angularly locate the indicia plate 116 and the control handles 111 and 112, the body member 101 carries a pin 145 (Figure 9) which extends through an arcuate slot 146 in the hub 115 of control arm 112, a hole 147 (or 147') in the indicia plate 116, and enters into the hollow interior of hub 114 for throttle control handle 111. The latter is provided with three reinforcing ribs 148a, 148b, 148c, and one rib 148d. A 70° slot 146 gives the arm 112 the proper swing and a somewhat greater angular spacing between rib 148c and rib 148d gives the arm 111 the proper swing. The parts just mentioned are made right and left.

The inner end of shaft 136 carries a contact carrying arm 141 provided with a roller 37 (or 34). The arm and shaft are secured together by a pin 142. Spring 143 bears against bushing 134 and conducting washer 144 with lug 144a in notch 144b in the pedestal to hold it against rotation, and holds the latter against arm 141. The split washer 139 bears against the washer 138 so that

the parts are carried in definite position along the axis of shaft 136. Lugs 144a are soldered to leads 38 and 39 which connect to contacts 40 and 41.

The top of each pedestal 130 is notched as indicated at 160 to receive a contact 161 bearing on top of the tube 132. This contact is connected by wires 35' or 36' to binding post B or C. The contacts 161 are covered by insulating sheet 162 and held in place by plates 163 fastened in place by screws 164 threaded into holes 165 in the pedestals, so that the plates are completely insulated. These plates form the return for the rectifiers.

The plates 163 each carry a whistle-reverse controller and one carries the power on pilot light 72 while the other carries the short circuit pilot light 32. To carry the whistle-reverse controller, the plate 163 is provided with brackets 166 to which is secured an insulating plate 167. This plate carries a shaft 168 on which is pivotally mounted the lever 113 above referred to. The lever is biased to mid-position by a spring 169 whose ends are in slots 169a and 169b in the insulating plate 167 and carries the switch arm 42 (or 43). The stationary plate 167 carries the contacts 40, 44, 50 and 52, arranged so that 44 and 50 (or 45 and 51) are toward the front of the transformer. The plate 163 also has a downwardly extending bracket 163' on which is mounted the rectifier 56 (or 57) and resistor 58 (or 59). The resistor is wound about the bracket and soldered to it.

The plate 163 carries an upwardly extending yoke 170 with soldering lug 170' for lead 60 (or 61). This yoke carries an upwardly opening lamp socket 171. These sockets are opposite holes 172 in the cover 102 and carry lamps 32 and 72 projecting above the covers so as to provide exposed signals. The lamps are provided with colored covers 173 and 174.

When the cover is off the entire interior of the device is available for inspection, test or repair. The cover is held in place by screws 180 threaded into the sockets 181 at the top of the plates 121. Alignment of the cover on the body is assured by lugs 182.

The transformer shown herein is well adapted for controlling from one to four toy railroad circuits and may readily have a rating of 150 or 250 watt depending upon the windings. The entire load may be delivered to any one of the four load circuits and as all of the current must necessarily flow through the circuit breaker 29, the device is protected against accidental overload or short circuit. The complete transformer provides a train controller of very realistic appearance, and it is symmetrical. The controls on one end of the transformer unit may be used to control one track circuit with accessories, whistle and train control and the like, while the other end of the transformer may be used for controlling another independent track layout or four track layouts may be controlled, if desired.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular forms shown are but a few of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. A transformer having an elongated, upwardly opening housing member, a coil-core assembly secured centrally in the housing member, said assembly having at the bottom thereof a primary coil and at the top thereof a secondary coil having exposed side contact faces extending transversely of the housing, each end of the housing having along a horizontal axis normal to the faces of the secondary coil and below such faces a bearing seat, a tube insulatedly supported in each bearing seat, and carrying a contact movable over the adjacent secondary coil face, a shaft insulatedly supported in each tube and carrying a contact movable over the adjacent coil face, insulated operating handles for the tubes and shafts beyond the ends of the housing, secondary leads connected to the shaft and tube, output binding posts carried by the housing, one of which is connected to the secondary and the others to the secondary leads, and a cover which engages the housing and encloses the coil-core assembly, tubes, shafts, leads and contacts, the handles being beyond the ends of the cover.

2. A transformer as claimed in claim 1, wherein the end portions of the cover and housing are narrower than the central portions thereof and the end portions of the cover are surfaces of revolution about said horizontal axis so as to be substantially lower than the central portion.

3. A transformer as claimed in claim 1, wherein the cover is open at the ends and the handles on the tubes have hubs closing off the ends of the cover.

4. A transformer as claimed in claim 1, wherein the cover is open at the ends, the end portions of the cover and housing are narrower than the central portions thereof and the end portions of the cover are surfaces of revolution about said horizontal axis so as to be substantially lower than the central portion, the handles on the tubes closing off the ends of the cover.

5. A transformer as claimed in claim 1, wherein the shafts and housing non-rotatably support an indicia plate between adjacent handles and the handles carry cooperative indicia to indicate the voltage outputs corresponding to handle positions.

6. A transformer as claimed in claim 1, wherein the housing member at its ends carries upwardly extending switch levers each pivoted about a horizontal axis above the first mentioned axis and cooperative fixed and movable contacts in the circuit of an adjacent secondary lead for effecting auxiliary control of said circuit, and the cover is notched to accommodate said switch levers.

7. A transformer having an elongated upwardly opening housing member, a coil-core assembly secured centrally in the housing member, said assembly having at the bottom thereof a primary coil and at the top thereof a secondary coil having exposed side contact faces extending transversely of the housing, each end of the housing having along a horizontal axis normal to the faces of the secondary coil and below such faces a bearing seat, a tube insulatedly supported in each bearing seat, and carrying a contact movable over the adjacent secondary coil face, a shaft insulatedly supported in each tube and carrying a contact movable over the adjacent coil face, a spring contact bearing on the tube and connected to a secondary lead, a ring carried on each shaft connected to another secondary lead and spring pressed against the shaft carried contact, output binding posts to which the leads are connected, a control handle carried by each tube beyond the end of the housing, a control handle carried by each shaft beyond the corresponding tube carried control handle, and housing carried

stops limiting the swing of the control handles.

8. A transformer having an elongated upwardly opening housing member, a coil-core assembly secured centrally in the housing member, said assembly having at the bottom thereof a primary coil and at the top thereof normally open circuit compensating secondary windings and a secondary coil having exposed side contact faces extending transversely of the housing, each end of the housing having along a horizontal axis normal to the faces of the secondary coil and below such faces a bearing seat, a tube insulatedly supported in each bearing seat, and carrying a contact movable over the adjacent secondary coil face, a shaft insulatedly supported in each tube and carrying a contact movable over the adjacent coil face, insulated operating handles for the tubes and shafts beyond the ends of the housing, secondary leads connected to the shaft and tube, output binding posts carried by the housing, one of which is connected to the secondary and the others to the secondary leads, a pedestal cover plate carried by each pedestal, an insulating contact carrying plate carried by each pedestal cover plate and carrying a movable switch arm with a handle adjacent the tube carried handle, the cover plate carrying contacts cooperable with the switch arm, a rectifier, a shunting resistance, and wiring connections between each set of cover plate carried contacts, with rectifier, and resistance and one of the compensating windings and one of the secondary leads for either opening the circuit to the corresponding binding post or for introducing into said circuit the direct current output of the rectifier without opening said circuit.

9. A transformer as claimed in claim 8, having an insulating cover which engages the housing and encloses all said conducting parts.

10. A transformer having an upwardly opening insulating housing with an enlarged central portion and narrower end portions, a coil core assembly mounted with central portion of the housing and having a secondary winding with one end connected to an output terminal and with exposed transversely extending faces, two concentric shafts mounted in each end portion of the housing and insulated from one another, a contact arm secured to each shaft and bearing on the secondary winding, upwardly extending control handles carried by each shaft for operating the respective shafts to move the contacts across the faces of the secondary winding, and output leads connected to the respective shafts.

11. A transformer as claimed in claim 10, having pedestals disposed inwardly of the housing, the pedestals having bearings for the outer shafts, the inner shafts being insulatedly supported on the outer shafts.

12. A transformer as claimed in claim 10, having an insulating cover over the housing and enclosing the coil core assembly, the contacts and leads.

13. A transformer as claimed in claim 10, having in one of the output leads from a shaft at each end a switch with a fixed contact and a movable contact biased to engage the fixed contact and provided with an operating handle adjacent one of the other handles for shifting the movable contact to effect a manual opening of the circuit irrespective of the position of the control handle for said circuit.

14. A transformer as claimed in claim 10, having in one of the output leads from a shaft at each end a switch with a fixed contact and a movable contact biased to engage the fixed contact and provided with an operating handle adjacent one of the other handles for shifting the movable contact to effect a manual opening of the circuit irrespective of the position of the control handle for said circuit, said switch also having two fixed contacts engageable with the movable contact when shifted in the other direction, a supplemental secondary coil, a resistance and a rectifier and connections whereby rectified current may be superimposed on the secondary output current in response to such shifting of the movable contact.

15. A stepdown transformer having a secondary winding with two exposed faces in vertical planes, two contactors bearing on each of the faces, horizontal shafts laterally of the secondary coil faces, each carrying one of the contactors for the face, and two tubular shafts concentric with the first shafts and carrying the other contactors, and handles carried by each of the four shafts for individually shifting the corresponding contactors across the faces of the secondary coil.

16. A transformer having a coil-core assembly with a secondary coil having an exposed face, a support for the coil-core assembly, the support having shaft bearings at right angles to the plane of the coil face and laterally displaced from the coil face, an outer tubular shaft in the shaft bearings, an inner shaft insulatedly carried in the tube, the tube and shaft each carrying at the ends adjacent the coil face a contact arm swingable over the coil face, a tube operating handle having a hub portion, and a shaft operating handle having a hub portion, the support carrying a stop member which extends through an arcuate slot in the first mentioned hub and engages stop members in the second mentioned hub, the second hub having a closed end which covers the stop member.

17. A transformer having a coil-core assembly with a secondary coil having an exposed face, a support for the coil-core assembly, the support having shaft bearings at right angles to the plane of the coil face and laterally displaced from the coil face, an outer tubular shaft in the shaft bearings, an inner shaft insulatedly carried in the tube, the tube and shaft each carrying at the ends adjacent the coil face a contact arm swingable over the coil face, the shaft bearing an abutment engaging the opposite end of the tube for limiting the movement of the shaft toward the coil, a spring surrounding the shaft and holding the shaft abutment against the tube, handles carried by the shaft and tube for actuating the contact arms, the shaft handle having a hub portion covering the hub portion of the tube operating handle, the support having a stop engageable with the hub portions to limit the movement of the handles and concealed by the shaft handle hub.

JOSEPH L. BONANNO.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,312,382	Bonanno	Mar. 2, 1943
2,316,551	Bonanno	Apr. 13, 1943
2,325,470	Bonanno et al.	July 27, 1943