March 2, 1943. J. L. BONANNO ET AL 2,312,382

TRANSFORMER

Filed Dec. 7, 1940 3 Sheets-Sheet 1

Fig. 1.

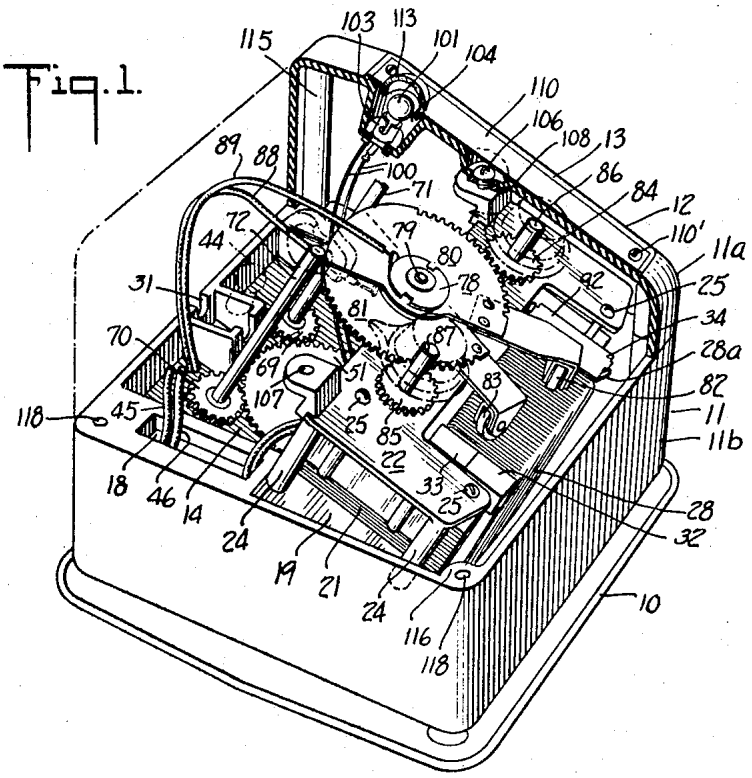
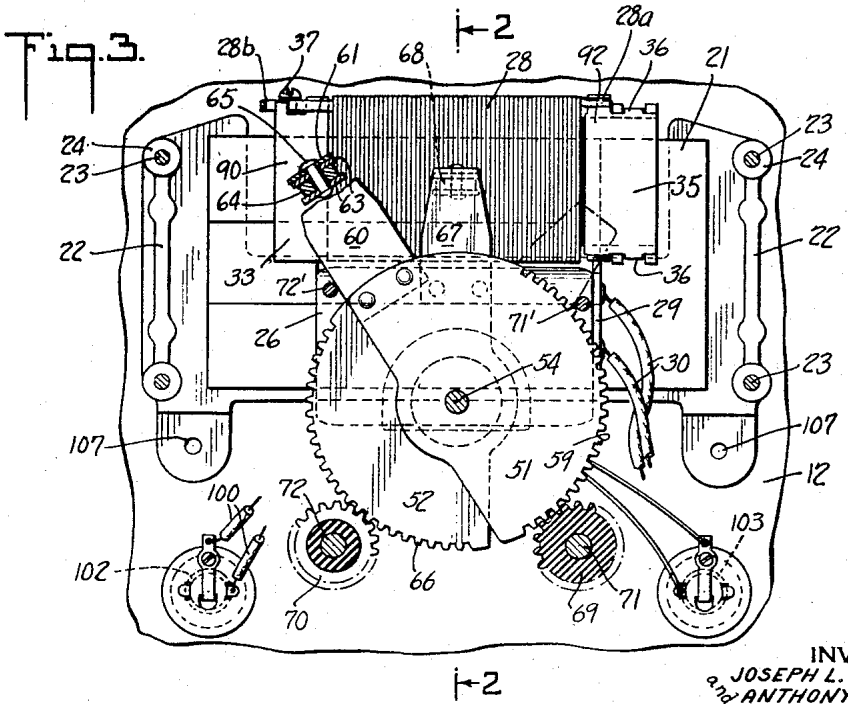


Fig. 3.



INVENTORS
JOSEPH L. BONANNO
and ANTHONY EHRET
BY
Jacob Shibberman
ATTORNEY

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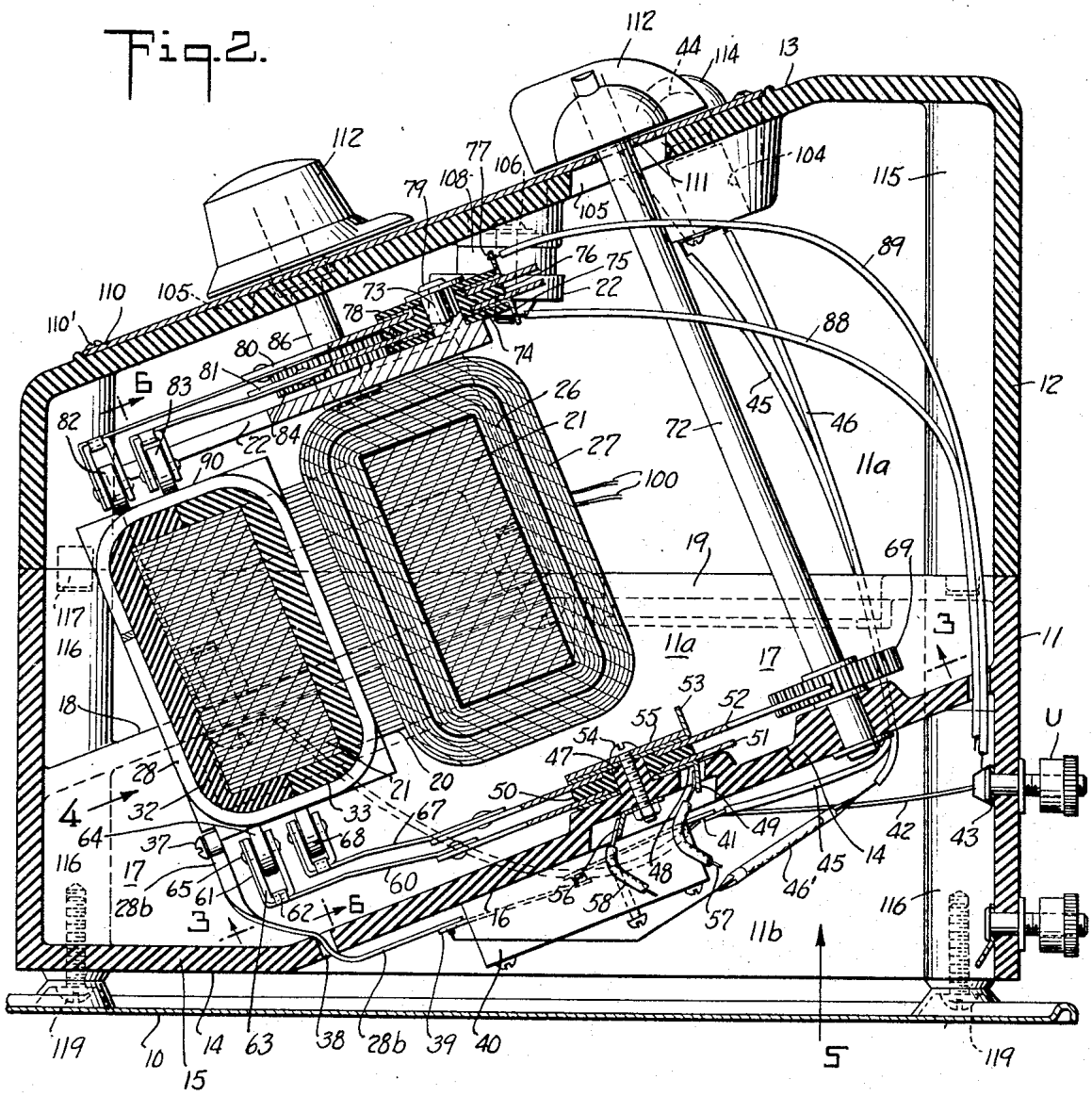
TRANSFORMER

Filed Dec. 7, 1940 3 Sheets-Sheet 2

Fig. 2.



INVENTORS
JOSEPH L. BONANNO
and ANTHONY EHRET
BY
Jacob Liberman
ATTORNEY

March 2, 1943. J. L. BONANNO ET AL 2,312,382

TRANSFORMER

Filed Dec. 7, 1940 3 Sheets-Sheet 3

Fig. 4.

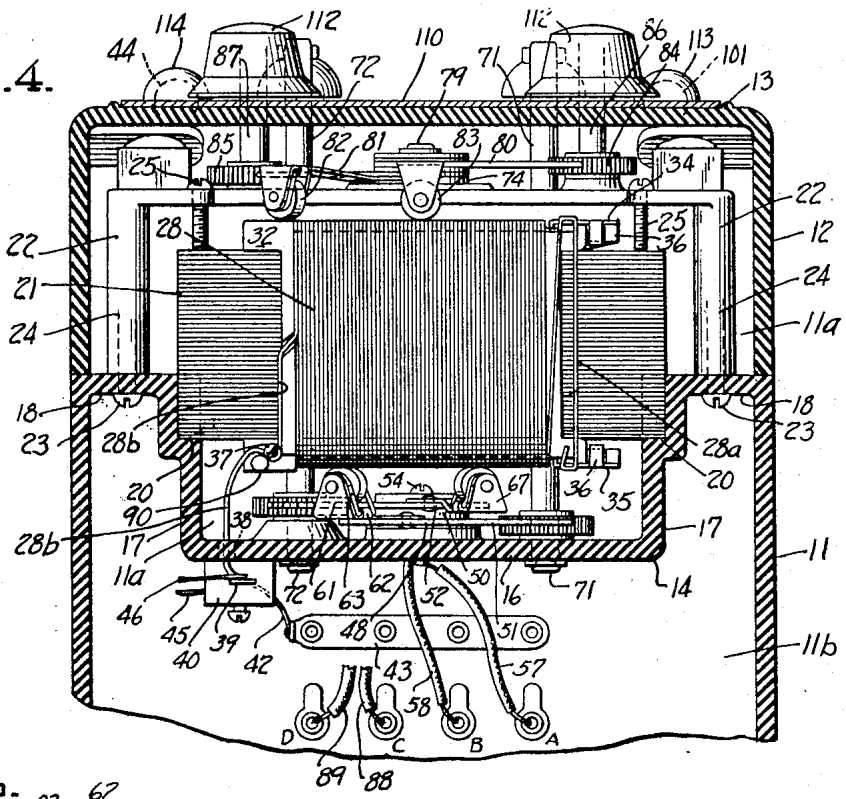


Fig. 6.

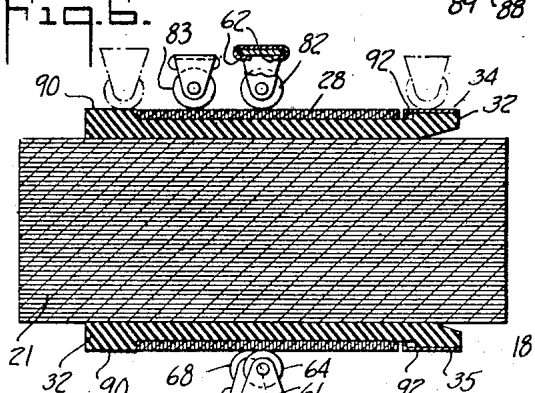


Fig. 7.

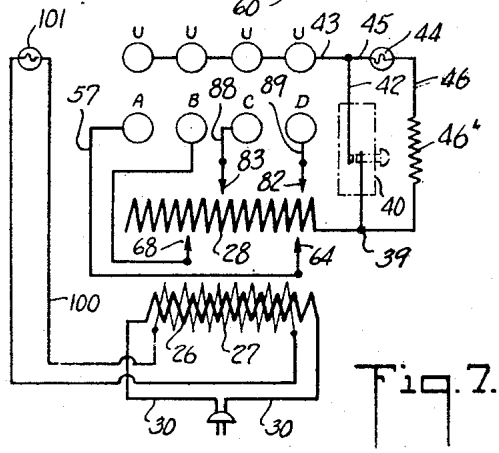
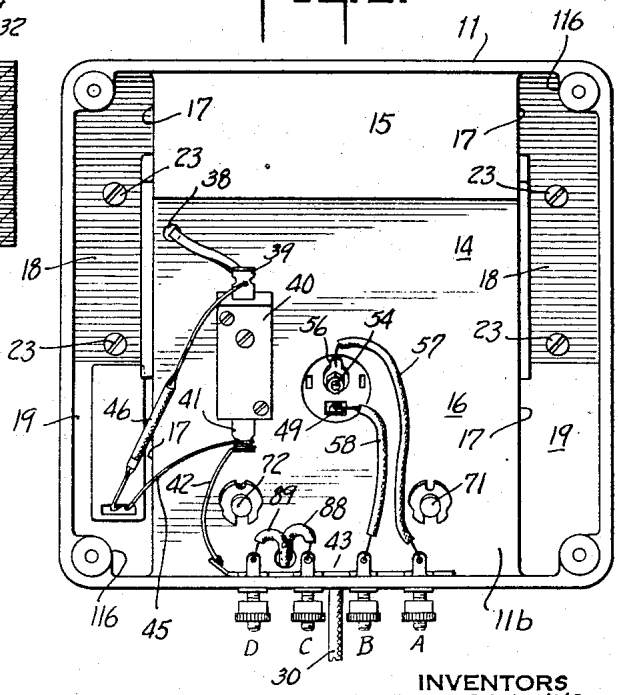


Fig. 5.



INVENTORS
JOSEPH L. BONANNO
AND ANTHONY EHRET
BY
Jacob Liberman
ATTORNEY

Patented Mar. 2, 1943 2,312,382

UNITED STATES PATENT OFFICE

2,312,382

TRANSFORMER

Joseph L. Bonanno, Maplewood, and Anthony Ehret, Hillside, N. J., assignors to The Lionel Corporation, New York, N. Y., a corporation of New York

Application December 7, 1940, Serial No. 369,056

18 Claims. (Cl. 171—119)

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 each having gear driving means operable by knobs. These arms may be concentric and arranged in pairs to operate on two opposite faces of the secondary.

A further object of the present invention is to provide transformers for the purpose indicated, having insulating casing parts about all the current conducting elements arranged so that there is the minimum likelihood of injury to the transformer or its parts, or accidental or unintentional short circuiting or grounding of any of the live parts in such a way as to injure the transformer.

A further object of the invention is to provide a signal lamp arranged to function whenever the total load drawn from the transformer through a circuit breaker, whether through one or all the circuits in use, exceeds a safe amount. This circuit breaker is preferably located where it can be adjusted without any possibility of interfering with the adjustable contacts whereby the variable voltages are secured.

Other and further objects of the invention will appear as the description proceeds.

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

In these drawings:

Figure 1 is a perspective view of a toy transformer with parts broken away to show interior construction;

Figure 2 is a transverse sectional view taken on the line 2—2 of Figure 3 and looking in the direction opposite to that of Figure 1;

Figure 3 is an inverted plan view with parts in section along the line 3—3 of Figure 2;

Figure 4 is a front elevational view taken in the direction of the arrow 4 in Figure 2 with parts in section;

Figure 5 is an inverted plan view of the transformer with the subbase removed, the same being taken in the direction of the arrow 5 of Figure 2;

Figure 6 is a sectional view through the transformer secondary and core taken on the line 6—6 of Figure 2; and

Figure 7 is a wiring diagram.

As illustrated more particularly in Figure 1, the transformer has a sheet metal subbase 10, an insulating body 11 of substantially square contour with walls of even height, and an insulating cover member 12 of corresponding contour with a sloping upper face 13. The insulating body 11 has a transverse partition 14 which divides the body into upper and lower compartments 11*a* and 11*b*. The partition has a flat central portion 15 near the front and an upwardly and rearwardly sloping portion 16 between the flat portion 15 and the upper part of the rear wall, as will be clear from Figure 2. It extends upwardly, as indicated at 17, 17, and is continued across to the side walls of the base, as indicated at 18, 18 and 19, 19.

The upper faces of the vertical portions 17 of this partition have seats indicated at 20, 20 of the proper depth and width to receive a transformer core 21. This core with the coils to be described later is received within a metal bridge or frame member 22 secured to the insulating body 11 by screws 23 passing up through the sloping portion 18 of the partition and entering downwardly extending legs 24 on the bridge. The outside corners 21*a*, 21*b*, 21*c*, 21*d* of the core fit into inside corners 22*a*, 22*b*, 22*c*, 22*d* provided by the cast frame 22. The transformer core is clamped downward against the shoulders 20 by four screws 25 threaded through the bridge or frame 22 so that the transformer core cannot loosen or vibrate. The construction just described provides an extremely rigid support for the massive core-coil assembly.

As here shown the core-coil assembly has a primary winding, indicated at 26, Figure 7, a fine wire secondary 27 wound on top of the primary and a heavy wire secondary 28 wound about the other leg of the transformer. The ends of the primary winding are anchored to an insulating plate 29 (Figure 3) and the lamp cord 30 is connected to these terminals and passes out through an opening 31 at the rear of the structure. The secondary winding 28 is in the form of a compact coil of flat enamelled wire having its outer surface exposed. This coil is wound on an insulating

spool made up of two parts 32 and 33. One end 28a of the wire forming the coil is anchored to two metal plates 34 and 35. These plates are provided with lugs 36 by which they are anchored to the insulating spool. The other end 28b of the length of wire used in making the secondary 28 is secured to the insulating spool by a screw, indicated at 37, Figure 4, and is passed downwardly through a hole 38 in the partition 14 and soldered to a lug 39 forming one of the terminals of a thermal circuit breaker 40. The other side 41 of the circuit breaker is connected by a heavy wire 42 with a strap 43 carried on the rear wall of the housing 11. This strap is connected with four binding posts marked U, U, U, U on the back of the structure.

The circuit breaker 40 is designed to operate on overload in the secondary circuit and when it opens this condition is indicated by a signal lamp 44 connected to the strap 43 by a wire indicated at 45 and to the circuit breaker terminal 39 through a wire 46 and a resistance 46'.

Central portion 16 of the bottom partition 14 is provided with an insulating boss 47. This boss receives a metal disk 48 having a lug 49 extending down through a hole in the partition, as indicated in Figure 2. The boss or post 47 rotatably receives an insulating disk 50 which provides bearings for two metal plates 51 and 52, the lower one being in contact with the disk 48. Above the insulating washer 50 is mounted a conducting plate 53 which is held down against the top of plate 52 by a bolt 54 and washer 55. The lower end of the bolt carries a soldering lug 56 accessible below the partition, as indicated in Figures 2 and 5. The soldering lugs 49 and 56 are connected by wires 57 and 58 with binding posts marked A and B, respectively, on the back of the transformer.

The plate 51 is in the form of a substantial sheet steel stamping with gear teeth 59 on its periphery, and it carries a phosphor bronze spring 60 which extends below the lower face of the secondary coil, as will be apparent in Figures 2, 3 and 4. The end of the strip 60 is bent at right angles, as indicated at 61, and the strip is provided with ears 62 to secure a heavy copper or aluminum yoke 63 in place. A roller 64 made of high resistance material, such as a copper graphite composition, is mounted for rotation on a pin 65. This roller is adapted to sweep over the lower exposed surface of the secondary winding 28 and pick off any voltage generated in the coil between the point of contact and the end connected with the circuit breaker. It touches only two adjacent turns at any time and thus minimizes the short circuiting and heating, and it also moves easily with little friction and negligible wear.

The plate 52 is similar to the plate 51. It has gear teeth 66 and carries a spring arm 67 provided with a roller 68 similar to the one previously described. The gear teeth 59 and 66 mesh with insulating pinions 69 and 70, respectively. These pinions are mounted on shafts 71 and 72 rotatably mounted in insulating body 11 and extending upwardly as shown. The movement of the sectors is limited by pins 71' and 72' carried by the partition 14.

The bridge or frame member 22 is provided with a non-circular post 73 coaxial with the bolt 54. This post non-rotatably carries an insulating washer 74, a conducting washer 75, an insulating washer 76, an upper conducting washer 77 and an insulating washer 78. The parts are held on the post 73 by a rivet element 79. The insulating washer 76 rotatably supports two sector-shaped plates 80 and 81 similar to the sector plates 51 and 52. The upper sector plates carry contact rollers 82 and 83 similar to the contact rollers above described and adapted to engage the upper face of the secondary winding. The sectors 80 and 81 mesh with pinions 84 and 85 made of insulating material and carried on shafts 86 and 87 extending upwardly as indicated. The insulating pinions 84 and 85 limit the movement of the plates 51 and 52. The conducting washers 75 and 77 on which the plates 81 and 80 bear are connected by wires 88 and 89 which extend down through the partition and are connected to binding posts marked C and D on the back of the transformer.

The transformers contemplated by the present invention are employed for comparatively high outputs such as 250 watts and load currents up to 15 amperes. With currents of this magnitude there is considerable tendency toward heating. The massive copper yokes which support the high resistance rollers, together with the comparatively short, large surface conducting springs which support these rollers and the large sectors to which the conducting springs are secured, all contribute to dissipating the heat generated in the contacts.

The insulating pieces 32 and 33 which form the spool for the secondary winding 28 have comparatively flat surfaces 90, 90 to receive the rollers when they are moved clockwise, as shown in Figure 1, to open the circuit controlled by the particular roller. The sheet metal anchoring plates 34 and 35 at the other end of the secondary spool have flat areas 92, 92 onto which the rollers pass when moved counterclockwise.

The method of manufacturing the secondary coil, together with its support and associated parts, forms the subject matter of application Serial No. 369,057 filed December 7, 1940, in the name of Joseph L. Bonanno.

The low output secondary 27 is connected by wiring indicated at 100 with a signal lamp 101. The signal lamps 44 and 101 are carried in sockets 102 and 103 supported in recesses 104 formed in the insulating cover 12. This insulating cover is also provided with holes, such as 105, to accommodate the shafts 71, 72, 86 and 87. The cover is secured in place by screws 106 threaded into tapped holes 107 formed in the casting 22, cushioning washers 108 being employed to prevent crushing the cover.

The sloping upper face 13 of the cover 12 receives a metal name plate 110 secured to it by screws 110'. This name plate is apertured, as indicated at 111, for the shafts connected with the gears and the upper ends of these shafts receive insulating knobs 112 whereby the shafts may be manipulated. The plate 110 is apertured to give access to the lamp bulbs and the bulbs are covered by colored plastic caps 113 and 114. The cover and base are stiffened by internal ribs 115 and 116 and aligning of the insulating parts is assured by dowel pins 117 extending down into sockets 118 in the base 11. The lower wiring chamber 11b in the base is closed off by the sheet metal subbase 10 secured in place by screws 119.

It is obvious that the invention may be embodied in many forms and constructions within the scope of the claims and we wish it to be understood that the particular form shown is but one of the many forms. Various modifications

and changes being possible, we do not otherwise limit ourselves in any way with respect thereto.

What is claimed is:

1. A transformer having a secondary winding provided with two parallel exposed faces, a fixed support, a plurality of contacts bearing on each of the exposed faces of the secondary winding, the contacts being concentrically pivoted to the support and insulated, a gear train for operating each contact, and an operating shaft for each gear train, the shafts for operating the contacts bearing on one face of the secondary extending past the gears for operating the other contacts so that all the shafts are accessible to one side of a coil face.

2. A transformer having a secondary winding provided with two parallel exposed faces, a fixed support, a pivotally supported insulated contact bearing on each face of the secondary, the pivots being concentric, a toothed sector connected with each contact, a pinion cooperating with each sector, and a shaft for operating each pinion, one shaft extending past the sector operated by the other shaft.

3. A transformer having a secondary winding provided with an exposed face, a fixed support having a pivot post, a metallic plate insulatedly and rotatably secured to the pivot post and having a toothed sector, an insulated current collector bearing on the plate, an insulated gear for operating the plate, and a spring pressed contact carried by the plate and bearing on the exposed secondary.

4. A transformer having a secondary winding provided with an exposed face, a fixed support having a pivot post, two metallic plates insulatedly and rotatably secured to the pivot post and having toothed sectors, an insulated current collector bearing on each plate, an insulated gear for operating each plate, and spring pressed contacts carried by the plates and bearing on the exposed secondary, one contact being at a shorter radius than the other.

5. A transformer having a secondary winding provided with an exposed face, a fixed support having a pivot post, a metallic plate insulatedly and rotatably secured to the pivot post and having a toothed sector, an insulated current collector bearing on the plate, an insulated gear for operating the plate, a contact spring extending from the plate to be opposite the exposed face of the coil, a heavy yoke carried by the end of the spring and high resistance roller carried by the yoke and bearing on the secondary.

6. A transformer having a secondary coil provided with an exposed face, a fixed metallic support, a pivot post carried by the support, metallic plates insulatedly and rotatably secured to the pivot post and having toothed sectors, an insulated current collector bearing on each plate, spring pressed contacts carried by the plates and bearing on the exposed secondary, metal shafts carried by the support, insulating gears on the shafts and meshing with the toothed sectors, and insulating knobs carried by the shafts.

7. A toy transformer comprising a core having primary and secondary windings, an insulating base below the core, a metallic frame secured to the base and extending above the core to hold the core in fixed position, the secondary winding having exposed upper and lower faces, a contact pivotally secured to the frame and adapted to swing over the upper face of the winding, a second contact pivotally secured to the base and adapted to swing over the lower face of the winding, a toothed sector for each contact, a shaft pivoted to the frame and carrying a pinion in mesh with the upper sector, and a second shaft pivoted to the base and carrying a pinion in mesh with the lower sector and extending up past the upper sector.

8. A toy transformer having a metal subbase, an insulating body secured to the subbase and having a downwardly opening wiring chamber, a coil and core assembly above the insulating body, a frame for securing the coil and core assembly to the insulating body, adjustable contacts cooperable with exposed faces of the secondary coil to vary the voltage output, upwardly extending operating shafts for shifting the contacts, an insulating cover secured to the frame and through which the shafts project, and operating knobs on the shafts.

9. A toy transformer such as claimed in claim 8, wherein the secondary circuit includes an adjustable circuit breaker housed in the wiring chamber and accessible by removal of the subbase.

10. A toy transformer such as claimed in claim 8, having a signal lamp carried by the frame and extending through the cover, and a thermostatic circuit breaker interposed in the secondary circuit and normally shunting the signal lamp.

11. In a toy transformer, a coil-core assembly wherein the secondary coil has an upper exposed face, a lower support for the assembly, an upper frame secured to the support and securing the coil-core assembly in place, a pivot post carried by the frame remote from the exposed secondary, a swingable arm carried by the pivot post and having a contact on the free end bearing on the exposed secondary, a shaft carried by the frame and extending upwardly, and gearing between the shaft and arm.

12. A toy transformer having a secondary coil with two opposite exposed faces, a plurality of independently operable, insulated, concentrically pivoted contacts bearing on each face each at a different radius from the other and movable over the entire face irrespective of the position of the other, parallel shafts parallel with the pivots for the contacts and corresponding in number with the contacts, and gear means for adjusting each of the contacts when the corresponding shaft is rotated.

13. A transformer comprising an insulating body having enclosing side walls and a transverse partition to provide an upper and a lower chamber, a coil and core assembly in the upper chamber, a plurality of contacts pivotally mounted on forwardly sloping axes and movable over the secondary of the coil and core assembly, forwardly sloping operating shafts for the contacts, an insulating cover closing off the upper chamber and having a sloping top wall through which the shafts extend, secondary output leads extending from one end of the secondary and from the contacts down through the partition into the lower chamber, and output binding posts carried by the body and connected to the secondary leads.

14. A transformer such as claimed in claim 13, wherein the common lead connection includes an overload circuit breaker, and having a signal lamp shunted about the circuit breaker.

15. A transformer such as claimed in claim 13, wherein the common lead connection includes an overload circuit breaker, and having a signal lamp shunted about the circuit breaker, the signal lamp being accessible through an opening in the cover.

16. A step down transformer for use on power mains and having a secondary for delivering low voltage currents of amounts to cause substantial heating of conducting parts, the secondary being in the form of a compact edgewise wound ribbon adapted to develop a substantial voltage per turn and having its outer edge exposed to form a longitudinally extending contact face, a conducting arm movable over the face of the winding and fixedly carrying a conducting shaft whose axis extends generally in the same direction as the wires in said contact face, and a high resistance copper graphite contact roller having rolling contact on the shaft and having rolling peripheral contact with two adjacent turns only of the exposed surface of the winding, the high resistance of the roller serving to limit the short circuit current flowing in the short circuited turns and thereby lessening local heating at the point of contact.

17. A transformer such as claimed in claim 16, wherein the shaft is fixedly secured to a heavy conducting yoke.

18. A transformer such as claimed in claim 16, wherein the conducting arm includes a high conductivity flat spring and the spring is secured to a movable heat radiator and current conductor of substantial area.

JOSEPH L. BONANNO.
ANTHONY EHRET.