

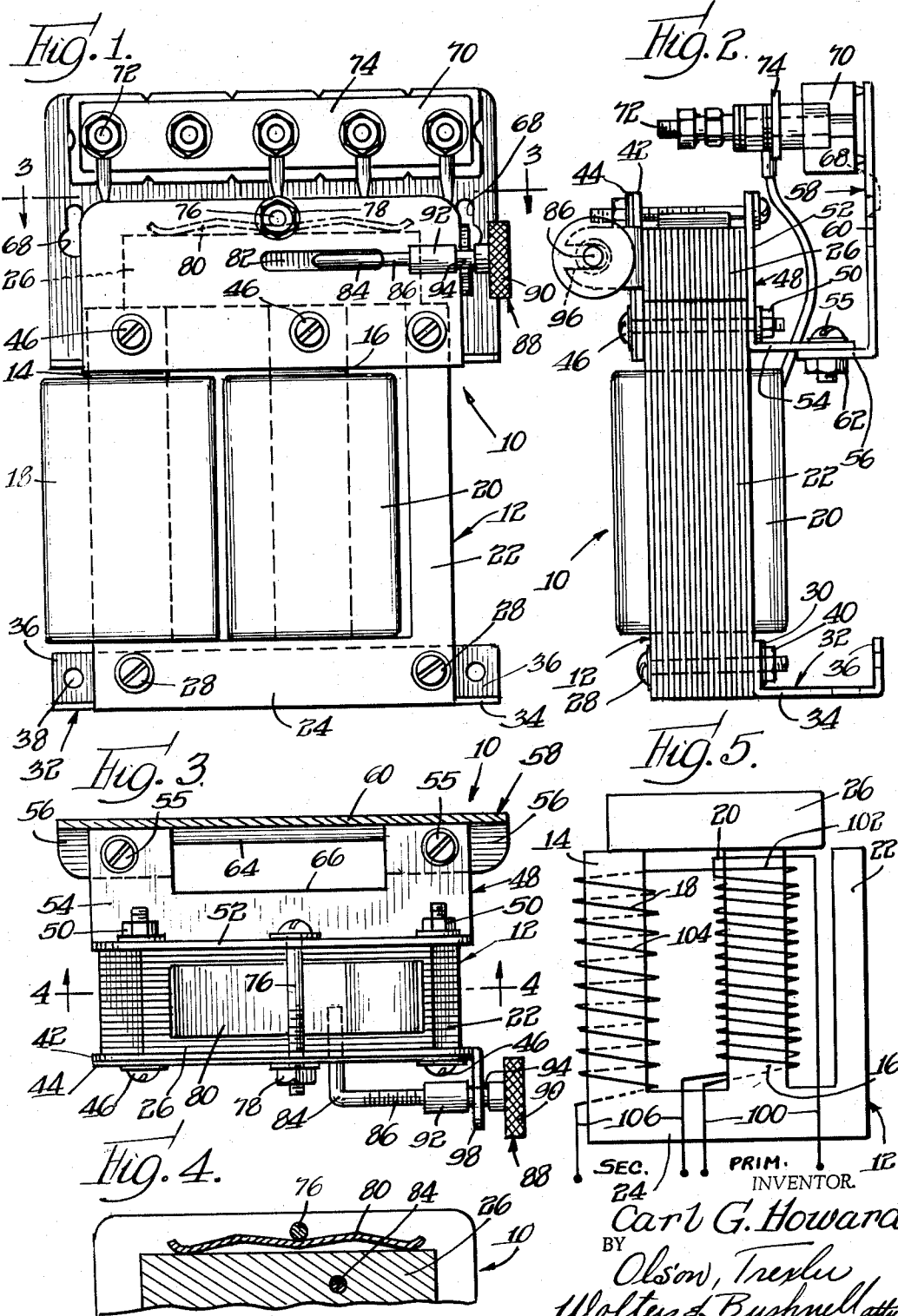
July 12, 1966

C. G. HOWARD

3,260,975

ADJUSTABLE VOLTAGE TRANSFORMER

Filed April 8, 1964



1

3,260,975

ADJUSTABLE VOLTAGE TRANSFORMER

Carl G. Howard, 261 Lakeside Place, Highland Park, Ill.
Filed Apr. 8, 1964, Ser. No. 358,350
2 Claims. (Cl. 336—133)

This invention relates to the art of railway lighting, particularly at crossings, and more specifically to an improved transformer for such lighting.

Railway signal lights operate at relatively low voltages, generally in the order of ten to fifteen volts. Where practical, power is supplied by step-down transformers from power lines, generally with stand-by batteries to insure proper operation should the power line supply fail. The requirements for power in any given installation can vary quite substantially. For example, some intersections or crossings may have as little as one or two lights, while others may have as many as sixteen lights. Most transformers have a certain amount of regulation variance, whereby the voltage output changes to a greater or lesser degree with load. The best prior art transformers for this purpose have utilized a fixed core and have had a plurality of taps on the secondary or output winding. A considerable degree of effort was necessary in order for the installer to connect the load to the proper tap or taps to obtain the correct voltage.

There is in existence another type of transformer having a core which is in part movable. This allows ready setting of the output voltage to quite a precise level. Unfortunately, prior art transformers of this type have had very poor output voltage regulation. For example, with an eight lamp circuit with the transformer set at ten volts, if one lamp were to burn out, the voltage might easily go up to as much as fifteen volts, thus greatly overvoltage and quickly burning out the remaining lamps.

In view of the foregoing, it is the primary object of this invention to provide an improved railway signal lighting transformer which is less expensive than prior art transformers for this purpose and which gives satisfactory regulation and simplifies adjustment.

It is another object of this invention to provide a railway signal lighting transformer having a micrometer adjustment.

More specifically, it is an object of this invention to provide a railway signal lighting step-down transformer having a movable core portion and having a dual output winding providing micrometer adjustment and satisfactory regulation.

Other and further objects and advantages of the present invention will be apparent from the following description when taken in connection with the accompanying figures wherein:

FIG. 1 is a front view of a transformer constructed in accordance with my present invention;

FIG. 2 is a side view thereof;

FIG. 3 is a horizontal view partly in section taken substantially along the line 3—3 in FIG. 1;

FIG. 4 is a fragmentary vertical sectional view taken substantially along the line 4—4 in FIG. 3; and

FIG. 5 is an electrical wiring diagram of the transformer.

Referring now in greater particularity to the drawings, and first to FIGS. 1—3, there will be seen a transformer 10 constructed in accordance with the principles of the present invention. The transformer includes a core 12

2

of the usual E and I lamination type. The core comprises first and second upright legs 14 and 16 on which the secondary 18 and primary 20 windings are mounted. A third upright leg 22 is spaced to the right of the secondary coil or winding and all three legs upstand from and are integral with a base 24. A movable laminated bar or slug 26 is mounted across the upper ends of the upstanding legs 14, 16 and 22, and the mounting structure therefor will be set forth shortly hereinafter.

The core laminations are held together at the bottom by bolts 28 extending through apertures in the laminations, and also through the upstanding flange 30 of a bracket 32. The bracket has a horizontal web 34, and a rear upstanding flange 36. Both the rear flange 36 and the web 34 are provided with apertures for receipt of screws or bolts for mounting the transformer. End portions of the bracket web 34 and flange 36 extend past the ends of the core 12 to provide access for a screwdriver or the like for securing the bracket 32 in place. As will be apparent, nuts 40 are threaded on the rear ends of the bolts 28.

A clamping plate 42 is provided at the top of the core and has a name plate 44 directly in front thereof. Bolts 46, preferably having washers under the heads thereof, as also is preferably the case with the bolts 28, extend through the plates 44 and 42, and also through apertures in the tops of the vertical legs 14, 16 and 22 of the transformer core. At the rear end, these bolts also pass through apertures in an angle bracket 48, and have nuts 50 threaded on the ends thereof, preferably with washers therebeneath. The angle bracket 48 includes vertical flange 52 through which the bolts 46 pass, and also a horizontal flange 54. Bolts 55 pass through apertures in the horizontal flange 54 and also through a horizontal flange 56 of a right angle bracket 58 which also has an upstanding vertical wall 60. Nuts 62 are threaded on the bolts 55 beneath the flange 56. As may be seen in FIG. 3 the flange 56 is in the form of a pair of ears with a central discontinuity therebetween, except for a rather narrow connecting shelf 64. Similarly, the horizontal flange 54 of the bracket 48 is provided with a central cut out 66. The cut out and the discontinuity provide clearance for wires, as will be apparent shortly hereinafter.

As readily may be seen in FIGS. 1 and 3, the bracket 58 extends in each direction beyond the core 12. The limit at one side is approximately coterminous with that of the secondary coil, as is the corresponding portion of the bracket 32. The key hole shaped slots 68 are provided in the vertical flange 60 for mounting the transformer against a vertical wall.

An insulating terminal block 70 is mounted at the upper end of the vertical flange 60 and carries a plurality of binding posts of the screw and nut type at 72 in horizontal alignment and extending from the front thereof, conveniently with a label plate 74 for indicating the connections. The insulating block and binding posts are standard, and hence five binding posts are shown. The left and center binding posts are connected to the primary winding 20, while the two right most binding posts are connected to the secondary winding 18.

As will be seen particularly in FIGS. 2, 3, and 4, the magnetic shunt or core portion 26 rests on top of two or three of the legs 14, 16 and 22 and fits closely between the plates 42 and 50. A bolt 76 extends through these plates and has a nut 78 on the front thereof for drawing

the plates toward one another to clamp the shunt 26 in adjusted position. A leaf spring member 80 is held down by the bolt 76 against the magnetic shunt 26 whereby to hold it down against the tops of the upright legs, and also to provide a frictional resistance to movement.

The front wall 42 and name plate 44 are provided with a horizontally elongated slot 82. An L-shaped stud 84 extends from the magnetic shunt 26 through this slot and is provided with a threaded shank portion 86. This threaded shank portion is received in the nut member 88 having a knurled thumb wheel 90 and an axially extending internally threaded sleeve 92. The sleeve or cylinder 92 is provided with a reduced neck portion 94. The reduced neck is received in a slot or recess 96 in an ear or lug 98 formed on the edge of the wall 42 and extending at right angles therefrom. Thus, with the nut 78 loosened, turning of the thumb wheel 90 will shift the shunt to the left or to the right, according to the direction of rotation of the thumb wheel. When the proper output voltage has been obtained, then the nut 78 is tightened to clamp the plates 42 and 52 against the magnetic shunt, and thereby to hold it firmly in place.

Reference now should be had to the magnetic and electric circuit of FIG. 5. The primary coil previously indicated generally by the numeral 20 is provided with the leads 100, which go to the left and to the center binding posts, as previously indicated. This primary coil is wound on the center upstanding leg 16. The secondary coil heretofore indicated by the number 18 is actually a split coil. Somewhat over half of the secondary coil is wound at 102 on top of or under the primary coil on the leg 16, and the remainder of the secondary coil is wound at 104 on the leg 14, the leads to the primary coil being identified at 106, and leading to the two right binding posts, as heretofore noted. The two portions of the secondary are connected in series additive relationship.

The portion of the secondary winding on top of or under the primary winding on the leg 16 is sufficient to give the minimum desired output voltage. With the magnetic shunt or slug 26 all of the way to the right, it will overlie the legs 16 and 22, but will be spaced slightly to the right of the top of the leg 14. In one actual specimen rated at eight amperes, 13.5 volts, the aforesaid spacing is about one-eighth of an inch, with the total distance across the core amounting to approximately four and three-eighths inches.

As the magnetic shunt is advanced to the left, more voltage is obtained from the winding 104 of the secondary, and this adds to the voltage obtained from the winding 102. Approximately an additional four volts (could be wound for any voltage) can be obtained by shifting the magnetic shunt all of the way to the left, thus placing substantially all of the magnetic flux through the legs 14 and 16, whereas substantially all of it was through the legs 16 and 22 with the magnetic shunt all of the way to the right. Obviously, at intermediate positions part of the magnetic flux will be through the leg 14, and part through the leg 22. The portion of the output voltage obtained from the winding 102 is substantially invariable regardless of load, at least within rated limits. The voltage obtained from the winding portion 104 drops somewhat with increasing load, but the portion of the output voltage obtained from this winding 104 is never more than about half of that obtained from the winding portion 102, and hence regulation in the winding portion 104 is minimized. In actual tests it has been found that for load changes of zero to five amperes the total change in voltage is not more than about one volt, and this is not sufficient to cause rapid burning out of lamps.

In general, it has been found desirable to provide two different transformers to cover the range of seven to fourteen volts. One transformer is constructed to provide from seven to eleven volts, while the second is constructed to provide from ten to fourteen volts. Any other range of voltage can be provided.

Tests have been performed on such transformers operating with 115 volts on the primary, and with different settings of the secondary as summarized hereinafter. Such results are as follows:

5	N. L. full setting -----	12.0
	1 amp load -----	12.8
	2 amp load -----	12.8
	3 amp load -----	12.6
	4 amp load -----	12.2
10	5 amp load -----	12.0
	N. L. full setting -----	11.5
	1 amp load -----	12.2
	2 amp load -----	12.2
	3 amp load -----	12.0
15	4 amp load -----	11.8
	5 amp load -----	11.3
	N. L. full setting -----	10.0
	1 amp load -----	10.4
	2 amp load -----	10.2
20	3 amp load -----	9.9
	4 amp load -----	9.4
	5 amp load -----	9.2
	N. L. full setting -----	9.5
25	1 amp load -----	10.2
	2 amp load -----	10.0
	3 amp load -----	9.8
	4 amp load -----	9.3
	5 amp load -----	9.0

Thus, I have been able to produce a transformer with a micrometer adjustment which is built entirely from standard parts, used in other products, thereby maintaining costs at a minimum. The transformer is simple for anyone to use and has satisfactory regulation while providing the simple micrometer adjustment.

Various changes in structure will no doubt occur to those skilled in the art, and will be understood as forming a part of the invention insofar as they fall within the spirit and scope of the appended claims.

The invention is hereby claimed as follows:

1. A voltage transformer comprising:

(a) a magnetic core having three substantially parallel legs, respectively, a first leg, a second middle leg and a third leg,

(b) means connecting each of said three legs together at a first end portion of said legs,

(c) the second end portion of said legs being separate from each other, there being a first dimension spanning said first and second legs and a second dimension spanning said first and third legs,

(d) a magnetic shunt movable across said second end portion,

(e) said shunt having a length greater than said first dimension and less than said second dimension, said shunt being adjustably movable from a first position spanning said second leg and substantially all of said first leg through a second position spanning all of said second leg and parts of both of said first and third legs to a third position spanning said second leg and substantially all of said third leg and back through said second position to said first position to vary the reluctance of the magnetic path between said first and second legs,

(f) a primary winding on said second middle leg,

(g) a secondary winding on said second middle leg,

(h) said secondary winding on the middle leg providing substantially the minimum rated voltage of said transformer,

(i) a secondary winding on the first leg in series addition with the secondary winding on said second leg, the secondary winding on said first leg providing substantially one-half the voltage of the secondary winding on the second leg,

(j) screw thread means for moving said magnetic shunt on the second end portion of said three legs, and

5

(k) lock means for locking said magnetic shunt in a predetermined position.

2. A voltage transformer as set forth in claim 1

(l) bracket means is attached to said second end portion of said legs,

(m) said screw means is mounted on said bracket means,

(n) said bracket means provides a channel to guide the movement of said magnetic shunt, and

(o) said bracket means has terminal means connected thereto.

5

10

6

References Cited by the Examiner

UNITED STATES PATENTS

2,192,312	3/1940	Holslag	336—135
2,248,070	7/1941	Fanger	336—133
3,154,756	10/1964	Bojarski	336—133

ROBERT K. SCHAEFER, *Primary Examiner.*

JOHN F. BURNS, *Examiner.*

C. TORRES, *Assistant Examiner.*