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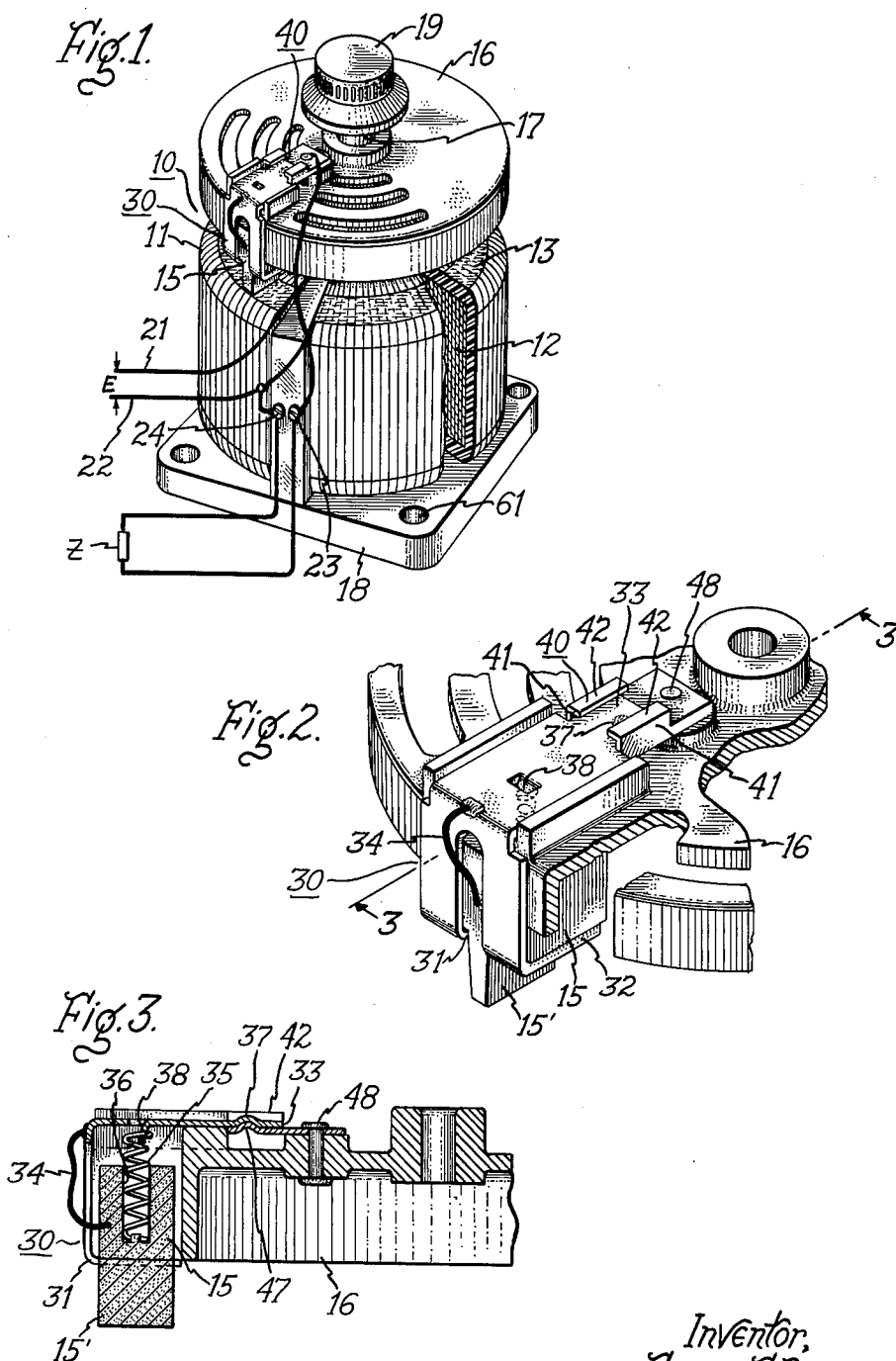
F. E. DIXON

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ADJUSTABLE SLIDING BRUSH TRANSFORMER

Filed Dec. 4, 1961

2 Sheets-Sheet 1



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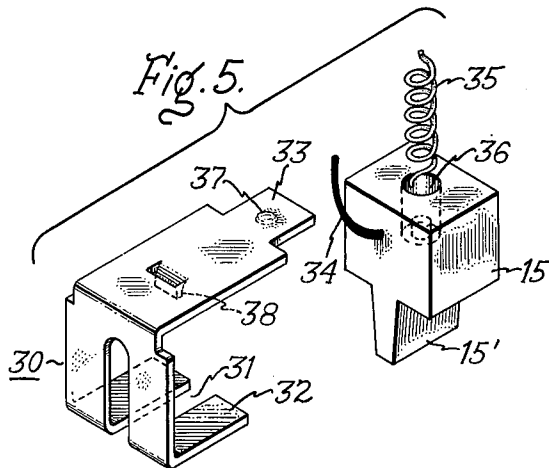
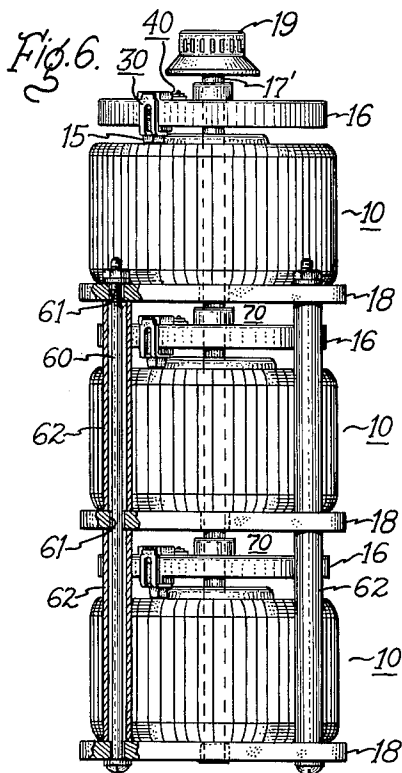
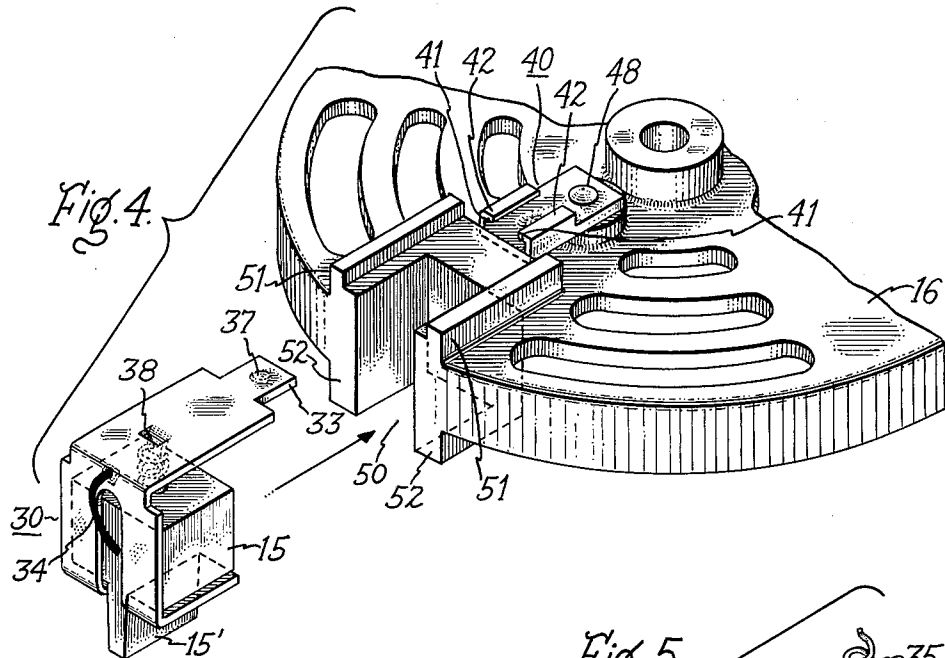
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2 Sheets-Sheet 2



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3,212,041

ADJUSTABLE SLIDING BRUSH TRANSFORMER
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7 Claims. (Cl. 336-149)

This invention relates to adjustable sliding brush transformers, and in particular to improved means for detachably connecting the brush to the transformer.

Some autotransformers employ a rotatable high resistance brush that slides along the commutator surface of the autotransformer winding for adjustably connecting the winding to an external circuit. Prior art arrangements for holding the brush in place require the use of threaded fasteners such as screws. The brush must be electrically connected to some sort of current collector, usually a circular ring; the electrical connection was usually made through a lead attached to a conducting element by a screw. The use of screws or other threaded fasteners is undesirable because it increases the cost of the apparatus by requiring tapped holes and hand labor for assembly of the autotransformer.

The brush usually becomes worn out or damaged during use. This requires the user of the autotransformer to remove the screws before the brush can be replaced. This is undesirably time-consuming, and may be exceedingly difficult when several autotransformer units are attached together to provide an integral assembly.

Accordingly, it is an object of my invention to provide a brush attaching arrangement for adjustable transformers that does not require the use of screws or other threaded connections.

Another object is to provide adjustable transformers with a brush mounting arrangement in which the brush can be disconnected without removing fastener elements.

Another object of the invention is to provide a brush attaching arrangement for transformers in which the brush can be attached to the transformer and removed from the transformer by a radial sliding movement alone.

Another object of the invention is to provide a brush attaching arrangement for sliding brush transformers in which clamping pressure exerted by a spring clip is the sole means for connecting a brush assembly to the transformer.

Another object of the invention is to provide an economical yet rugged arrangement for holding the brush of a variable autotransformer in place.

A further object of the invention is to provide an assembly of sliding brush transformer units in which brushes which may be in inaccessible locations can be attached or detached without the necessity for unscrewing threaded fasteners.

Other objects and advantages of the invention will become apparent from the drawings, specification, and claims, and the scope of the invention will be pointed out in the claims.

Briefly stated, according to one aspect of my invention, an adjustable sliding brush transformer may have a winding with a circular commutator surface thereon. A high resistance brush slidably contacts the commutator surface for connecting the winding to an external circuit. My invention resides in an improvement in means for detachably connecting the high resistance brush to the transformer. The connecting means comprises brush holding means electrically connected to the brush, and a rotatable support including means electrically connected to the external circuit. The brush holding means is attached to the transformer by resilient clamp means that also may be used to establish electrical contact with the external circuit.

In the drawing:

FIGURE 1 is a schematic, isometric, partially broken-away view of a sliding brush autotransformer in accord with the teachings of my invention.

FIGURE 2 is an enlarged, isometric, broken-away view of a portion of the autotransformer shown in FIG. 1.

FIGURE 3 is a cross-sectional view taken along the line 3-3 in FIG. 2.

FIGURE 4 is an isometric broken-away view, corresponding to FIG. 2, showing the brush assembly detached from the transformer.

FIGURE 5 is an exploded view of the brush assembly.

FIGURE 6 is a partially cross-sectional, side elevational view of a plurality of transformers of the type shown in FIG. 1 assembled in a "gang stack."

FIG. 1 shows an adjustable sliding autotransformer 10 in accord with my teachings. The autotransformer may comprise a toroidal winding 11 coiled about an annular magnetic strip core 12 in accord with conventional practice. An outer surface of the winding 11 may have a circular commutator-like electrical contact surface 13 of known construction. A high resistance contact brush 15 of carbon or graphite material slides along the surface 13 for connecting the transformer to an external circuit, such as an impedance load Z. A conventional radiator plate 16 may be attached to a positioning shaft 17 passing through the hole in the center of the core and winding assembly, and the shaft 17 may be rotatably journaled in a base 18. An insulated knob 19 may be provided on the end of the shaft 17 to facilitate turning thereof. The brush 15 is removably attached to the radiator 16 so as to rotate therewith, as will be described more fully in paragraphs that follow.

To operate the autotransformer 10 in the customary manner, the ends of the winding coil 11 are connected to an external source E of alternating current, as for example, by plugging them into an ordinary 120 volt outlet, as indicated schematically by the leads 21 and 22. The autotransformer output terminals 23 and 24 are connected respectively to the brush 15 (by means described hereafter) and to one of the input leads 22. The external load Z can then be connected across the output terminals 23 and 24, and the voltage and current received by the load will be determined by the position of the brush 15 on the commutator-like contact surface 13.

As shown more clearly in FIGS. 2-5, the brush 15 is held in a support bracket 30. The bracket 30 should be a good electrical conductor, such as brass or copper, and may have a generally J-shaped configuration. A slot 31 may be provided in a portion 32 of the bracket 30 for receiving a reduced portion 15' of the brush. A plug-in connector portion 33 that extends beyond the brush is provided on the support means for removably attaching the brush assembly to the radiator 16 and providing an electrical connection to the external load. The brush 15 is electrically connected to the bracket 30 by a lead 34. A coil spring 35 may be provided for resiliently urging the brush against the contact surface 13, and the spring may be held in place by inserting it into a hole 36 in the brush, and by inserting into the spring a tang 38 pressed out of the bracket 30.

The brush and bracket assembly is removably attached to the transformer by resilient clamping means, such as a clamp 40 having opposed clamping arms 41. Bent-over edges 42 are provided on the clamping arms 41 for exerting clamping pressure on the connector portion 33, and detent means, such as a circular indentation 37 on the connector portion 33 and a mating protrusion 47 on the clamp 40, may be provided also. The clamping arms 41 open radially with respect to the path of movement of the brush 15 for slidably receiving the connector portion 33. The clamp 40 and connector portion 33 co-

operate as a plug-in-socket electrical connector in addition to serving as the means for removably attaching the brush to the transformer.

As shown in FIG. 4, a notch 50 may be provided in the radiator plate 16 for receiving the brush assembly, and pairs of guides 51 and 52 may be employed to properly position the brush with respect to the winding commutator surface 13.

Electrical connection between the brush 15 and external circuit or load Z may be made by means of a conducting fastener, such as a brass rivet 48, for attaching the clamp 40 to the radiator 16. The structure connecting rivet 48 to the terminal 23 may be any commonly employed expedient, such as a conventional circular collector ring; specific examples of such structure have not been shown because their details form no part of the present invention.

As indicated by the arrow in FIG. 4, the brush assembly is attached to or removed from the rotatable radiator 16 merely by sliding radially with respect to the path of movement of the brush into the notch 50. No screws or other threaded fasteners which must be unthreaded or tightened are required.

FIG. 6 shows an arrangement in which three transformers 10 essentially identical to the transformer shown in FIG. 1 have been attached together as a single "gang-stacked" assembly. The transformers may be attached one above the other by any conventional arrangement, such as tie-rod bolts 60 passing through openings 61 in the bases 18, the units being properly separated by spacer cylinders 62. A common positioning shaft 17' attached to the radiator plates 16 passes through the center of each transformer and is journaled in each base 18. Consequently, turning of the knob 19 rotates each brush 15 simultaneously.

In the multiple unit type of arrangement shown in FIG. 6, the connector arrangement of my invention is particularly advantageous because the space 70 separating the bottom of the bases 18 from the adjacent radiator plates 16 should be kept to a minimum. In general, the space 70 will be less than the distance required to attach or detach the brush assembly from the transformer in a conventional manner. Consequently, the ability to change brushes merely by sliding them radially outwardly, without the necessity of unscrewing fasteners located between a base plate 18 and a radiator plate 16, is of great importance because it eliminates the time lost in disassembly of the units, as by removing the tie-rods 60. Disassembly of the units by removal of the tie-rods is also undesirable because it often requires breaking of the electrical connections by which the individual autotransformer units are connected in an electrical circuit.

It will be understood, of course, that while the forms of the invention herein shown and described constitute preferred embodiments of the invention, it is not intended herein to illustrate all of the equivalent forms or ramifications thereof. It will also be understood that the words used are words of description rather than of limitation, and that various changes may be made without departing from the spirit or scope of the invention herein disclosed, and it is aimed in the appended claims to cover all such changes as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An assembly of adjustable transformer units, each unit comprising a winding having a circular commutator surface and a contact brush slidable in a circular path in contact with said surface, means for detachably connecting said brush to said unit comprising brush holding means electrically connected to said brush, a portion of said holding means extending radially beyond said brush and having first detent means in said radially extending portion, a rotatable support including an opening that faces radially with respect to said path and second detent means,

said second detent means cooperating with said first detent means for clamping said brush holding means thereto so that said brush is attachable and detachable from said transformer by sliding said brush holding means radially with respect to its circular path of movement to engage and disengage said first and said second detent means, and means securing together a plurality of axially stacked transformer units.

2. An adjustable autotransformer comprising a toroidal winding surrounding an annular magnetic core, said winding having a circular commutator surface thereon, a high resistance brush slidable in a circular path in contact with said surface for connecting said winding to an external load circuit, means for detachably supporting said brush on said transformer comprising a brush holding bracket having opposed arms, one of said arms providing a connector portion electrically connected to said brush and extending radially therebeyond, the opposite arm having a slot therein receiving a reduced portion of said brush that contacts said surface, there being a hole in said brush, a coil spring received in said hole for urging said brush against said surface, a tang pressed out of said connector portion being received by said coil spring for holding same in place, detent means on said connector portion, a rotatable radiator plate having a brush receiving notch in its circumference, a resilient clamp secured to said radiator plate, said clamp having opposed arms opening radially with respect to said circular path for slidably and detachably receiving said connector portion, detent means on said clamp mating with the detent means on said connector portion, and said clamp being electrically connected to said external load circuit.

3. An adjustable transformer comprising a toroidal winding surrounding an annular core, said winding having a circular commutator surface thereon, a high resistance brush slidable in a circular path in contact with said surface for connecting said winding to an external circuit, means for detachably connecting said brush to said transformer comprising a brush holding bracket having a connector portion extending beyond said brush and electrically connected thereto, a first detent means in said connector portion, a rotatable radiator plate including a resilient clamp electrically connected to said external circuit, a second detent means in said resilient clamp for cooperating with said first detent means, said clamp opening radially with respect to said circular path for slidably receiving said connector portion to engage said second detent means and thereby connecting said brush to said external circuit while simultaneously detachably supporting said brush on said radiator plate.

4. An adjustable transformer comprising a toroidal winding having a circular commutator surface and a high resistance brush slidably contacting said surface for connecting said winding to an external circuit, means for detachably connecting said brush to said transformer comprising a brush holding bracket having a connector portion electrically connected to said brush and extending beyond said brush, said connector portion including a first detent means in a part thereof extending beyond said brush, a rotatable radiator plate having a resilient clamp thereon, said resilient clamp including a second detent means, said connector portion being received in said clamp to engage said first and said second detent means by moving said bracket radially with respect to said winding, to thereby support said brush on said radiator plate, and said clamp being electrically connected to said external circuit.

5. An adjustable sliding brush transformer having a circular brush track lying in a flat plane, a member mounted for rotation about a central axis of said brush track perpendicular to the plane thereof, a radially open clamp member in said rotating member, a notch in said rotating member, a brush holder having a main body portion and an end projection, an electrical brush permanently mounted in said main body portion and having a

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projection extending beyond said main body portion for contacting said brush track, said main body portion fitting into said notch and said end projection of said brush holder fitting into said clamp, said end projection of said brush holder and said clamp being provided with cooperating detent means constituting a quick detachable plug and socket type electrical and mechanical connector between said member and said brush holder, said brush being movable in said holder perpendicular to the plane of said brush track, and a spring in said brush holder for urging said projection on said brush into contact with said brush track.

6. An assembly for holding a brush in contact with an electrical commutator surface as said brush and said commutator surface are moved relative to each other in a plane, comprising: a shaft; a plate fastened to said shaft and radially extending therefrom in said plane; a pair of opposed clamping arms fastened to said plate and forming a generally radially extending opening therebetween; a brush holder having a connector portion and a support bracket fastened to one end of said connector portion; said clamping arms being dimensioned to receive the other end of said connector portion between said opposed clamping arms; said support bracket being shaped so that a brush may be removably held therein and may engage said electrical commutator surface; and said other end of said connector portion of said brush holder being positioned in said opening between said opposed clamping arms so that said brush is confined in radial directions by said support bracket and a portion of said plate in the vicinity of said clamping arms.

7. An assembly for holding a brush in contact with an electrical commutator surface as said brush and said commutator surface are moved relative to each other, comprising: a shaft; a plate fastened to said shaft, said

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plate having a pair of opposed clamping arms that form a generally radially extending opening therebetween; a brush holder comprising a connector portion and a support bracket fastened thereto at an outer end of said connector portion; said clamping arms being dimensioned and spaced to receive the inner end of said connector portion in said opening; said inner end of said connector portion being positioned in said opening; said support bracket comprising a transverse arm connected to said outer end of said support bracket and a slotted arm connected to said transverse arm, said slotted arm opposing said outer end of said connector portion for receiving a reduced portion of a brush to contact said commutator surface; said transverse arm and said plate being arranged to confine said brush there between when said inner end of said connector portion is positioned in said opening.

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JOHN F. BURNS, *Primary Examiner*.