Feb. 15, 1949. W. J. OPOCENSKY 2,461,843

POTENTIOMETER

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Fig. 1.

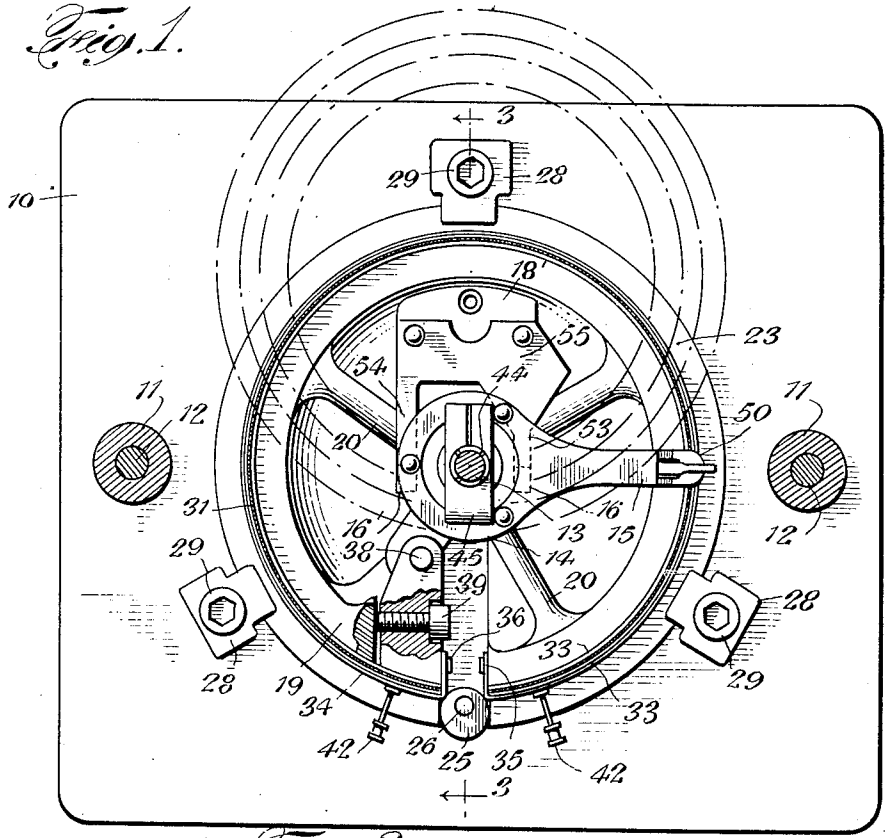
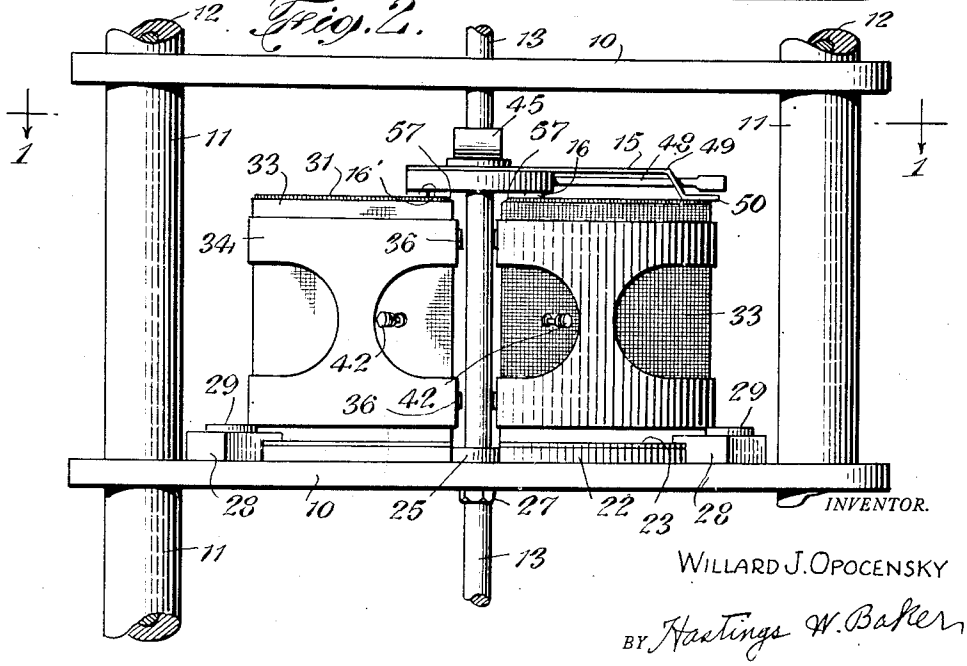


Fig. 2.



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Fig. 3.

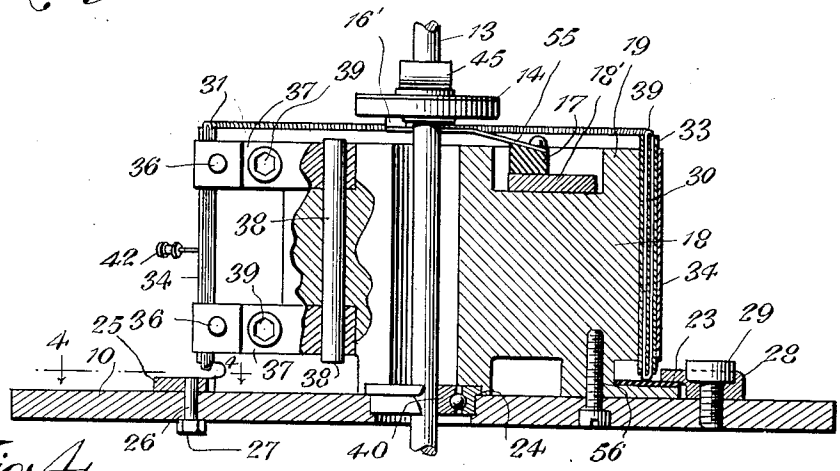


Fig. 4.

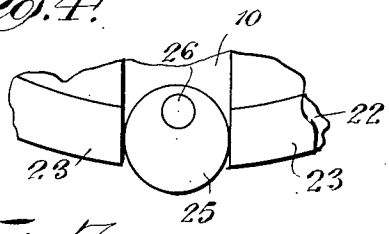


Fig. 5.

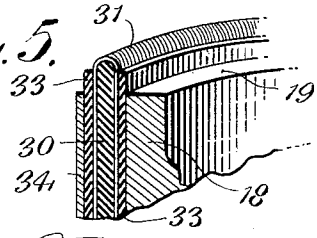


Fig. 7.

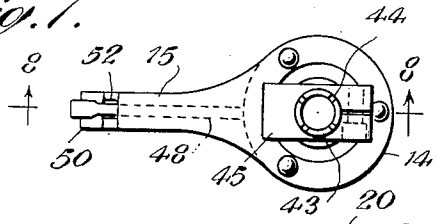


Fig. 8.

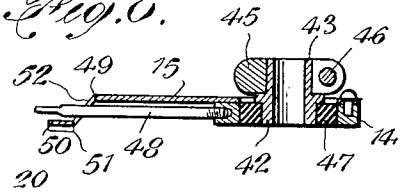
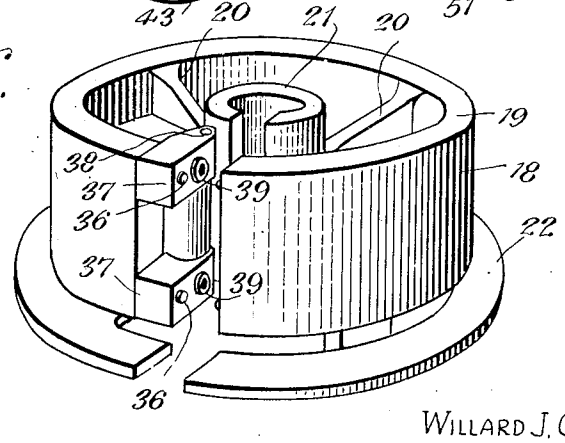


Fig. 6.



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POTENTIOMETER

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Application March 11, 1946, Serial No. 653,549

17 Claims. (Cl. 201—56)

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This invention relates to a new and useful improvement in the construction of potentiometers.

It has for a principal object the provision of a construction in which the potentiometer coil and its support may be quickly and easily introduced into and removed from its operative position with a minimum expenditure of time and effort.

A further object is to provide a potentiometer coil so simply assembled that it is a matter of a few minutes to disassemble it into its component parts for inspection, rep'acement and repair.

Yet another object is to provide a structure in which the coil can be easily and very accurately set initially into its so-called "zero" position and will thereafter maintain that position.

Still another object is to provide a construction in which the resistor coil mounting is accurately positioned in a very simple and ready manner with respect to a related operating shaft and then may be quickly locked or clamped in this position.

A still further object is to provide a construction in which the resistor coil is tightly wrapped in position around its support and the tightness of this wrapping can be readily and quickly varied at will.

Another object of the invention is to provide two brush arms, one of which is offset from the other so that the brushes thereof contact different portions of the slip ring, which arms are also of a different shape so that if the potentiometer is subjected to vibrations, the brush arms will not vibrate at the same frequency. The potentiometer arm is provided with a rod which serves a double purpose in that it protects the arm from careless hands and it permits of the rotation of the arm for the full revolution.

Another object is to provide a construction of coil which when inserted into operative position, automatically makes contact with cooperative elements, such as a movable brush.

Further and more specific objects, features, and advantages will more c'early appear from a consideration of the following detailed description especially when taken in connection with the accompanying drawings which form part of the specification and which illustrate the preferred form of the invention.

Briefly and generally considered, the invention includes a metallic block having a central bore and with a circular periphery around which is wrapped an insulated resistance coil in the form of a toroid of rectangular cross section. This coil and its insulating elements are tightened on the

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block by means of a retaining band fastened at one end to the block and at the other end to adjustable means pivoted to the block, thus allowing the retaining band to be wrapped around the coil and tightened thereagainst as desired.

The block and related parts are cut away to form a transverse radial slot extending from the block bore to the periphery thereof, thus permitting the block and the coil as a unit to be slipped into position around an operating shaft and to be as quickly removed therefrom. Means in the form of a ring-like bushing around the shaft, preferably on a base plate on which the block slides, permits the bushing to be centered with respect to the bottom of the shaft bore in the block, whereby the block and therefore the resistance coil are accurately centered.

The invention further comprises means in the form of a cam which can be operated to engage the block, the cam preferably lying in the slot therein, to position it accurately and finely with respect to a so-called "zero" point. Furthermore, clamping means disposed on the base plates are peripherally disposed with respect to the circumference of the block to clamp the same firmly in position after it has been properly and accurately adjusted as above mentioned.

The invention further relates to a potentiometer arm on the operating shaft which will automatically contact the resistance coil as the coil is slipped into place and having suitable brushes and terminals whereby connections to outside electrical circuits may be made. The construction is adapted to the use of a series of coils all mounted in a series along the same operating shaft, the movement of the shaft being effective to adjust the resistance contact arm of each unit in the series while permitting each arm to be differently set from each of the others.

A present preferred form which the invention may assume is illustrated in the drawings, of which—

Fig. 1 is a plan view, partly in cross-section, taken on the line 1—1 of Fig. 2;

Fig. 2 is a front elevation of the device showing the coil in position;

Fig. 3 is a vertical cross-sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a partial horizontal cross-section taken on the line 4—4 of Fig. 3, and showing the means for adjusting the coil to zero position;

Fig. 5 is a partial vertical section through the potentiometer coil showing the manner of supporting and insulating the resistance wires;

Fig. 6 is a perspective view of the coil support-

ing block with portions broken away to show the means for tightening the coil strips and supports around the block;

Fig. 7 is a plan view of the potentiometer arm; and

Fig. 8 is a cross-sectional view of the potentiometer arm taken on the line 8—8 of Fig. 7.

As shown in the drawings above described in general, the present preferred form of the invention has to do with a potentiometer in which the coil employed may be readily inserted and removed for inspection, replacement, and repair and with a minimum of time and effort.

The device includes a base plate 10. If the potentiometers are to be used in multiple more than one base plate is used as shown in Fig. 2, and in this case the plates 10 are spaced by sleeves 11 through which extend connecting rods 12, so that a vertical series of coils can be operated in gang fashion if desired.

An operating shaft 13 extends upwardly through the base plate 10 or series of plates 10, as the case may be. A ring-like bushing 24 is tightly fitted in a central hole in each of the plates 10 and bearings 40 insure that the operating shaft 13 is held in central position relative to the bushing 24. For each coil employed the shaft is provided with an insulated metallic collar or slip ring 14 integral with or secured to a horizontally extending wiper contact arm 15 adapted by the turning of the shaft 13 to sweep over the exposed turns of the potentiometer coils as later described.

As shown in Figs. 7 and 8, there is a central metallic bushing 42 through which the shaft 13 extends. The bushing 42 has an upstanding extension 43 having radially extending slots 44. A slotted clamp 45 fits around the extension 43 and by tightening the screw 46 the bushing 42 may be securely clamped to the shaft 13. Insulation 47 is secured to the metallic collar 14 and to the bushing 42, so that the wiper contact arm 15 is insulated from the shaft 13. A strengthening rod 48 is screwed into the collar 14. The arm 15 extends radially from the collar 14 and at the point 49 it bends downwardly and then again outwardly, forming the extension 50 which, on its lower surface, is provided with a wiper 51, which contacts the upper turns of the resistance wire 31, the rod 48 passing through a hole 52 in the arm 15. The under surface of the collar 14 is contacted by a pair of brushes 16 and 16' on opposite sides of the shaft 13. These brushes are carried by arms 53 and 54, respectively, which arms at their outer ends are integral with a plate 55 fixed to a block of insulating material 17 suitably supported on the block 18' mounted on the supporting block 18. By means of suitable terminals (not shown) these brushes may be connected to desired circuits in any proper manner. Attention is called to the different shapes and positions of the arms 53 and 54. If the potentiometer is subjected to vibration these arms will have different vibration frequencies, thereby tending to eliminate any inaccuracy, in case the vibration should be so severe as to move one of the brushes momentarily out of contact with the collar 14. Also it is to be noted that the brush 16' is spaced a greater distance from the center of shaft 13 than is the brush 16 so that the two brushes engage different contact surfaces on the slip ring.

A potentiometer coil unit is adapted to be associated with each plate 10 and brush set above described. This unit in the preferred form shown

comprises a coil supporting block 18 preferably of cast metal, having a preferably circular annular wall 19 connected by radial ribs 20 to a central hub sleeve 21, through which the shaft 13 is adapted to extend when the coil is in position. Integral with the block 18 is a circular metal plate or flange 22 supporting an insulating layer 23. This flange 22 is adapted to rest on the base plate 10 when in position and may be secured thereto by screws 56 or by the clamps 28.

The casting including the sleeve 21, the block 18, and the flange 22 are cut away as shown to form a substantially radially extending slot whereby the coil unit may be slipped laterally on the base plate 10 to center the coil with respect to the shaft 13, as shown in Fig. 1. In introducing the coil unit into position, it is raised a slight extent so that the bottom of the bore in the sleeve 21 will pass over and then be lowered around the projecting ring-like bushing 24 disposed in an opening in the base plate 10 around the bearings 40 for the shaft 13. This will permit the block to be accurately centered with respect to the shaft 13.

When the coil unit is adjusted and centered, its angular position with respect to the shaft 13 and the brush or wiper arm 15 may be precisely adjusted by turning the coil unit about its vertical axis. To enable it thus to be adjusted angularly with exactitude a cam 25 is disposed to lie between the split ends of the plate 22, as shown in Figs. 1 and 4. This cam is mounted on an adjusting shaft 26 extending downwardly through the base plate 10 to be operated by means of a nut 27 forming a part of the shaft 26, as seen in Figs. 2 and 3. In this manner the exact positioning of the coil unit may be effected. After the coil unit is thus set, it may be clamped to the base 10 by means of a series of flanged clamps 28 disposed around the periphery of the flange 22, which is seen to be greater in diameter than the block 18. The clamping members may be tightened into engagement therewith by screws 29 which extend into the base plate 10.

The coil itself is adapted to be wrapped around the periphery of the block 18 and is therefore generally constructed in the form of a flexible strip or band which in detail is formed as follows:

A flexible band of insulating material 30 forms the direct support for the potentiometer resistance wire 31, which is wrapped therearound in a transverse direction to form a toroidal coil of rectangular cross section. These wires are wrapped directly around the band 30 and the adjacent turns are insulated from each other by insulating material which holds the succeeding turns of the wire separated from each other. Flexible bands of insulating material, such as 33, are disposed on both sides of the resistance unit, as shown. The top of the band 30 is higher than the tops of the adjacent bands 33 so that the upper edges of the wires 31 are exposed and may be contacted by the contact or wiper arm 15. The wiper 51 of the wiper arm 15 rests on the upper ends of the resistance wire 31, the arm 15 being made of flexible material which tends to move the wiper 51 into contact with the resistance wires. However, if the arm 15 is moved so that the wiper 51 is out of contact with the resistance wire; that is, when it is passing across the radial slot in the block 18, the arm 15 can move downwardly only a very slight distance before it is arrested by engaging the rigid rod 48. By slightly rounding the ends of band 30 at the points 57, Fig. 2, on each side of the slot, the

wiper 51 carried by the arm 15 will not catch on these corners but will glide onto the band 30 and the wire 31 wound thereon.

The unit just described is wrapped around the periphery of the block 18 and is held in place adjustably thereon by an adjustable tightening and retaining band 34, one end of which is bent over around one of the spaced ends of the circular wall 19 of the block 18 and fastened thereto by suitable means such as pins 35. The other end of the retaining band 34 is similarly bent over, as shown in Fig. 1, and fastened by pins 36 at its top and bottom (Figs. 3 and 6) to adjustable plates 37 pivoted on a vertical rod 38. Each adjusting plate is provided with a set screw 39 adapted to contact with the wall of the block adjacent thereto, whereby the pivotal position of the plates 37 with respect to the block may be varied to tighten the resistor coil unit on the periphery of the block 18.

As shown in Figs. 1 and 2, terminals, such as 42, may be tapped into the resistance coil at desired points for the purpose of making suitable fixed connections or taps to the coil.

From a consideration of the specific construction shown in the drawing it will be apparent that the coil unit and the block may be quickly and easily introduced into proper position and removed therefrom by merely moving the unit over the base plate 10 as above described, from the dotted line position to the full line position, as shown in Fig. 1, centering it, dropping it over the ring-like bushing 24, adjusting the cam 25 for the zero position of the coil, and then tightening the flanged clamp elements 28 around the periphery of the flange 22 which forms part of the coil supporting block 18. To remove the coil it is merely necessary to remove the upper clamping member shown in Fig. 1, lift the coil slightly with the block so as to elevate it above the bushing 24, and then slide it out to or beyond the position shown in Fig. 1, whereupon the unit can be more intimately and definitely examined at will.

After such a removal, the resistor unit itself can be readily removed by releasing the tightening screws 39, releasing it from pins 35 and 36, and removing the tightening band 34, whereupon the strips on each side of the wire support and the supporting strip 30 may be removed as one unit or separately, depending upon how they are related. The block 18 being of metal will hold its shape and its accurate adjustment by means of the cam 25.

While the present preferred form of the invention has been illustrated, it is to be understood that many changes and modifications in the invention may be made without departing from the spirit and scope of the invention in its broadest aspects. Hence it is desired to cover any and all forms and modifications of the invention which may come within the language or scope of any one or more of the appended claims.

What I claim as my invention, is:

1. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft to center it with respect to the central bore.

2. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block, and a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on opposite sides of said slot.

3. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block, a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on opposite sides of said slot, a retaining band wrapped around the coil, one end of the band connected to the block, and adjustable means on the block and to which the other end of the band is connected to tighten the band around the coil.

4. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein from the bore to the periphery thereof whereby the block may be slipped on to the shaft, and a ring-like bushing around the shaft adapted to be received in the bottom of the bore to center the block with respect to the shaft.

5. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block, a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on opposite sides of said slot, and a ring-like bushing around the shaft adapted to be received in the bottom of the bore to center the block with respect to the shaft.

6. A potentiometer including a coil-supporting block having a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block, a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on opposite sides of said slot, a retaining band wrapped around the coil, one end of the band connected to the block, adjustable means on the block and to which the other end of the band is connected to tighten the band around the coil and a ring-like bushing around the shaft adapted to be received in the bottom of the bore to center the block with respect to the shaft.

7. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft, a base plate through which the shaft extends and on which the block is adapted to rest, a ring-like bushing on the plate and around the shaft and adapted to be received in the bottom of the bore to center the block with respect to the shaft, and adjustable clamping elements disposed on the plate at spaced points around the block and adapted to be clamped to the block to hold it in a desired position.

8. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft, a base plate through which the shaft extends and on which the block is adapted to rest, a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on op-

posite sides of said slot, a ring-like bushing on the plate and around the shaft and adapted to be received in the bottom of the bore to center the block with respect to the shaft, and adjustable clamping elements disposed on the plate at spaced points around the block and adapted to be clamped to the block to hold it in a desired position.

9. A potentiometer including a coil-supporting block having a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft, a base plate through which the shaft extends and on which the block is adapted to rest, a resistance coil in the form of a toroid of substantially rectangular cross section wrapped around the periphery of the block with its ends disposed on opposite sides of said block, a retaining band wrapped around the coil, one end of the band connected to the block, adjustable means on the block and to which the other end of the band is connected to tighten the band around the coil, a ring-like bushing on the plate and around the shaft and adapted to be received in the bottom of the bore to center the block with respect to the shaft, and adjustable clamping elements disposed on the plate at spaced points around the block and adapted to be clamped to the block to hold it in a desired position.

10. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft to center it with respect to the central bore, and a movable cam element disposed in the slot when the block is slipped into position to angularly adjust the block with respect to the shaft.

11. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft, a ring-like bushing around the shaft adapted to be received in the bottom of the bore to center the block with respect to the shaft, and a movable cam element disposed in the slot when the block is slipped into position to angularly adjust the block with respect to the shaft.

12. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block whereby the block may be slipped on to the shaft, a base plate through which the shaft extends and on which the block is adapted to rest, a ring-like bushing on the plate and around the shaft and adapted to be received in the bottom of the bore to center the block with respect to the shaft, a movable cam element disposed in the slot when the block is slipped into position to angularly adjust the block with respect to the shaft, and adjustable clamping elements disposed on the plate at spaced points around the block and adapted to be clamped to the block to hold it in a desired position.

13. A potentiometer which includes in combination a metallic block having a circular exterior and having a plate at the bottom thereof extending beyond the periphery of the block, said block having a central shaft-receiving bore, said block and said plate having a radial slot extending from the bore of the block to the periphery thereof, the periphery of the block at its lower portion just above said plate having a peripheral notch therein, a resistance coil on said block and having the lower portion of its turns spaced above said plate and outwardly of said peripheral notch and insulation material between said coil and said plate.

14. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, a coil wrapped around the block in the form of a toroid of substantially rectangular cross section, said block having a slot cut therein and extending from the bore to the periphery thereof, a contact arm disposed in fixed relation to the shaft, said coil when slipped into position automatically establishing contact between said arm and the wires of the coil.

15. A potentiometer including a coil-supporting block with a central shaft-receiving bore therein, said block having a slot cut therein and extending from the bore to the periphery of the block, pivoted plates disposed along one side of said slot and adapted to be connected to one end of a resistor wire strip or band and means adjustable to alter the position of said plates with respect to the block.

16. A potentiometer having a supporting block having a circular periphery, a coil on the periphery, a rotatable shaft at the center of the coil, a contact arm disposed in fixed relation to the shaft and contacting said coil, said arm being made of spring-like material so formed as to press the arm into engagement with the coil, and a rod to limit the movement of the arm toward or away from the coil.

17. A potentiometer including a shaft; a slip ring and a contact arm fast with the shaft, and insulated therefrom, a circular band having a gap formed between its ends; a coil mounted on the band; the contact arm being shiftable by the shaft over the circumference of the coil on the circular edge of the band, and across the gap in either direction; and a rigid rod supported by and projecting from the slip ring, to support the contact arm in its passage across the gap, the opposed upper edges of the circular band at the gap being rounded to facilitate the passage of the arm across the gap.

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