Aug. 13, 1957 A. H. WOLFERZ 2,802,987

ELECTRODYNAMOMETER INSTRUMENT

Filed June 26, 1952

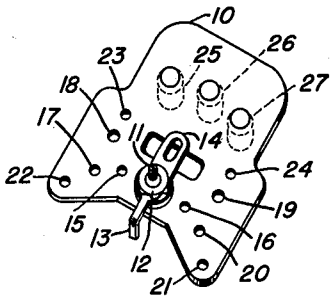


Fig-1

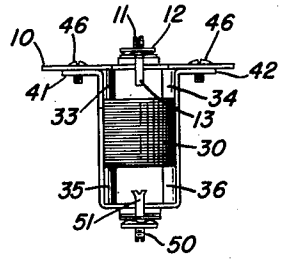


Fig-4

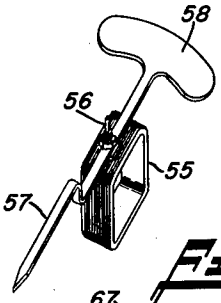


Fig-5

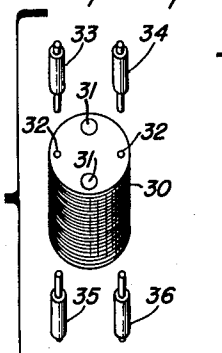


Fig-2

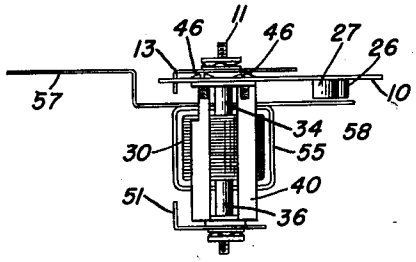


Fig-6

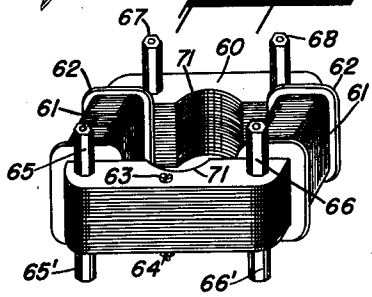


Fig-7

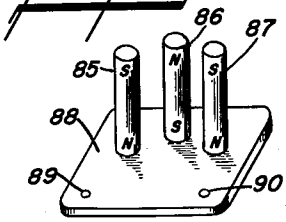


Fig-8

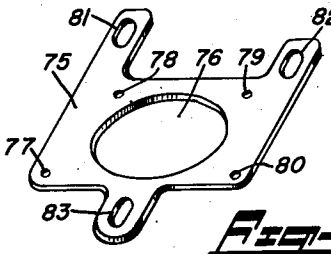


Fig-9

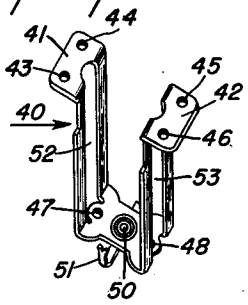


Fig-3

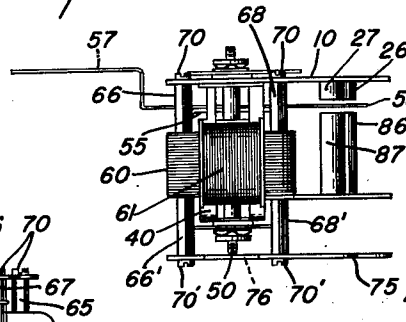


Fig-10

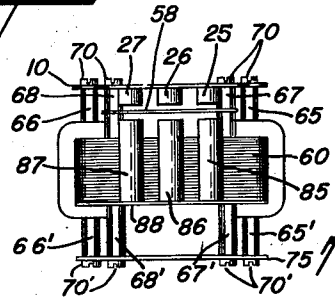


Fig-11

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ELECTRODYNAMOMETER INSTRUMENT

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3 Claims. (Cl. 324—144)

This invention relates to electrical measuring instruments and more particularly to instruments of the iron-core electrodynamometer type.

In manufacturing instruments of the class contemplated by this invention considerable difficulty has been experienced in the design of an instrument of small size, light weight and one which could be assembled conveniently and at relatively low cost.

An object of this invention is to provide an improved iron-core electrodynamometer instrument of small size, light weight and including a novel construction and assembly whereby the movable mechanism and core may be assembled as a unit apart from the field coil and yoke structure.

An object of this invention is the provision of a novel assembly for an electrodynamometer instrument wherein the movable coil and core are supported in proper, relatively-fixed position from a single mounting plate.

An object of this invention is the provision of an iron-core electrodynamometer instrument wherein the movable mechanism and core are assembled in a U-shaped bracket secured to a mounting plate and such assembly is adapted to be inserted as a unit into a rectangular yoke that carries the field coils.

An object of this invention is the provision of an iron-core electrodynamometer comprising a rectangular yoke carrying a pair of field coils, a lower mounting plate secured to the yoke and serving as a means for securing the instrument within an appropriate housing, an upper mounting plate secured to the yoke and carrying a jewel screw, a U-shaped bracket secured to the upper plate and extending through the yoke, said bracket carrying a jewel screw, a soft-iron core secured between the upper mounting plate and the base of the U-shaped bracket, and a wire wound movable coil pivotally supported between the two jewel screws and rotatable around said core.

These and other objects and advantages will become apparent from the following description when taken with the accompanying drawings of which;

Figure 1 is an isometric view of the top mounting plate;

Figure 2 is an exploded, isometric view of the soft-iron core and its associated locating studs;

Figure 3 is an isometric view of the U-shaped mounting bracket adapted for screw-attachment to the top mounting plate;

Figure 4 is a front, elevation view showing the core supported within the U-shaped bracket when the latter is secured to the top mounting plate;

Figure 5 is an isometric view of the wire-wound movable coil that carries the pointer and damping vane;

Figure 6 is a side elevation showing the assembly of the movable coil, core, U-shaped bracket and top mounting plate;

Figure 7 is an isometric view of the rectangular yoke carrying the two field coils;

Figure 8 is an isometric view of the intermediate mounting plate that carries the permanent magnet bars for damping the movement of the movable mechanism;

Figure 9 is an isometric view of the bottom plate that serves as a means for securing the assembled instrument within a suitable housing;

Figure 10 is a side elevation showing the assembled instrument; and

Figure 11 is a rear elevation of the assembly shown in Figure 10 but with the movable coil and U-shaped mounting bracket omitted for purposes of clarity.

Reference is now made to Figure 1 which shows the top mounting plate **10** made of soft-iron. The plate **10** has a suitable, threaded stud firmly secured thereto said stud receiving the upper jewel screw **11** and accommodating the nut **12** which secures the spring abutment **13** and zero-adjuster arm **14** in place. Those skilled in this art will understand that the jewel screw extends somewhat below the lower surface of the plate **10** and carries a V-shaped jewel that serves as an upper bearing for the pivotally mounted movable coil of the instrument. Also, the abutment **13** serves as an anchor for one end of the conventional, spiral springs through which current is conducted to the instrument movable coil. The abutment **13** and the zero-adjuster arm **14** are frictionally secured to the plate, by the nut **12**, whereby rotation of the arm **14** imparts a rotational movement to the abutment for altering the zero position of the movable coil. The plate **10** is provided with a series of accurately-spaced holes **15—24**, for purposes to be described below. Riveted to the plate, and extending downwardly therefrom, are three soft-iron discs **25, 26, 27** which form part of the instrument damping arrangement as will become apparent as the description proceeds.

Figure 2 illustrates the instrument core **30**, formed of soft-iron laminations secured together by the rivets **31**. The top and bottom surfaces of the core include a pair of bores **32**, the upper such bores receiving the reduced-diameter, lower ends of the positioning studs **33, 34**, and the lower such bores receiving the reduced-diameter, upper ends of the positioning studs **35, 36**. The parts are so dimensioned that the stud ends can be forced into the core bores upon the application of a relatively small force. When the studs are positioned on the core, the reduced-diameter free ends of the upper studs fit into the holes **15, 16**, in the top mounting plate **10**, and the free ends of the lower studs fit into corresponding holes in the base of the mounting bracket as will now be described.

Reference is made to Figure 3 which shows the U-shaped mounting bracket **40**, made of non-magnetic material such as sheet brass, and having outwardly-offset ends **41, 42**, provided with the threaded holes **43, 44**, and **45, 46**, respectively. It may here be pointed out that the holes **43—46** correspond, dimensionally, to the holes **17—20** in the top mounting plate **10** (see Figure 1), from which it is apparent the bracket **40** can be secured to the lower surface of the plate **10** by suitable fastening screws passing through the plate holes into the threaded bracket holes (see Figure 4 wherein the fastening screws are identified by the numeral **46**). As mentioned above, the base of the U-shaped mounting bracket includes the holes **47, 48** for accommodation of the free ends of the lower, core-positioning studs **35, 36**. Further, the bracket base carries an arrangement, similar to that carried by the top mounting plate **10**, that includes the bottom jewel screw **50** and bottom spring abutment **51**. The vertically-extending side arms of the U-shaped bracket include the slots **52, 53**, adapted to accommodate the diametrically-opposed surfaces of the core. Such construction reduces the weight of the mounting bracket in two ways, namely, by elimination of unnecessary material and by reducing the length of the bracket base with respect to a core of given diameter.

Disregarding, for the present, the instrument movable coil, the U-shaped bracket and core are assembled as fol-

lows. All the core studs are first inserted into the core bores after which the free ends of the lower studs are inserted in the holes 47, 48, in the bracket base, whereby the core is supported, loosely, within the bracket. The free ends of the upper core studs are now inserted into the holes 15, 16, in the top mounting plate, and the bracket holes 43—46 are then alined with the corresponding holes 17—20 in the plate. The fastening screws 46 are then threaded into place and the bracket is drawn up to the plate until the bracket ends 41, 42 abut against the lower surface of the plate, at which point the core studs are fully seated in the core bores and the core is positioned properly and securely within the bracket. Such assembly is shown in Figure 4 which also shows the axial alinement of top and bottom jewel screws 11 and 50.

The movable element of the instrument, illustrated in Figure 5, comprises a wire-wound movable coil 55 carrying conventional, alined pivots (the upper pivot 56 being visible in the drawing), an indicating pointer 57 and a damper vane 58, the latter preferably made of thin, sheet aluminum. In assembling the components thus far described, one set of alined positioning studs 34, 36 are inserted into the appropriate bores in the core and the movable coil is positioned around the core. Then the other set of alined positioning studs are inserted into the remaining core bores after which the free ends of the lower core-positioning studs are inserted into the holes 47, 48 in the base of the U-shaped bracket 40. The bracket, carrying the core and the encircling coil, is now secured to the lower surface of the top mounting plate 10, as has already been described. Upon the completion of such assembly the pivots of the movable coil are alined with the jewel screws and the latter are adjusted to space the top and bottom sides of the movable coil from the adjacent surfaces of the core and to establish the desired degree of play between the pivots and the jewel bearings, whereby the coil is conditioned for pivotal rotation about the core. Such assembled unit is shown in Figure 6. For purposes of clarity, the top and bottom spiral springs are not shown in the drawing, it being understood such springs are connected between the ends of the movable coil winding and the associated abutments 13 and 51. It will now be clear that the movable coil, pointer and core assembly constitutes a unit apart from the necessary field coil and yoke structure of the instrument. The assembly of such unit is simple, the parts are automatically positioned in proper relative position (except for the adjustment of the jewel screws) and all clearance gaps between the springs and the coil, and between the coil and the core, are open for inspection and, when necessary, readily cleared of fuzz, lint or other foreign matter. The important feature, here stressed, is the ease with which all necessary adjustments and tests can be made on the assembled unit shown in Figure 6. The drawings were made from an actual production instrument, drawn to full scale, and illustrate the small size of an iron-core electrodynamometer instrument made in accordance with this invention.

Reference is now made to Figure 7 which shows the field structure of the instrument comprising a substantially-rectangular yoke 60, made of suitable laminated material of conventional interlocked construction, and the field coils 61 wound on individual frames 62 of insulating material. Those skilled in this art will understand that the yoke is built up of C-shaped and relatively straight laminae. The C-shaped laminae are stacked in a pile and secured together by the studs 67, 68 after which the field coils are inserted over the opposed legs. The open ends of the laminae stack are then closed by a stack of straight laminae secured together by a screw 63, or rivet, the individual laminae of the straight stack having ends alternately abutting and overlying the ends of the C-shaped laminae. Four holes extend through the assembled yoke each hole accommodating a rod having threaded ends which protrude from the upper and lower core surfaces and upon which are threaded hexagonal spacer posts. Thus, the spacer posts 65, 65', are threaded on opposite ends of one such rod and the paired posts 66, 66', 67, 67' and 68, 68', similarly are threaded on opposite ends of the associated rods. The threads on the rods, passing through the yoke, extend below the surface of the yoke and the internal threads in the spacer posts extend the full length thereof. Thus, when the posts are threaded tightly into position they serve to secure the yoke laminae against vibration and as a means for securing other components with respect to the yoke, as by fastening screws threaded into the free ends of the posts. The positions of the upper posts 65, 66, 67, and 68, correspond to the spacings between the holes 21, 22, 23, and 24, in the top mounting plate, see Figure 1. Consequently, the assembled core-movable coil unit, shown in Figure 6, can be attached to the field structure and secured thereto by suitable screws passing through the plate holes and threaded into the upper posts. Figure 10, which is a side view of the assembled instrument, and Figure 11 which is a rear view of the assembled instrument but with the U-shaped mounting bracket, core and movable element omitted for purposes of clarity, show the top mounting plate 10 secured in position relative to the field structure by the fastening screws 70 threaded into the upper spacer posts 65—68. The U-shaped mounting bracket 40 extends through the yoke 60 and the front and rear sides of the wire-wound movable coil 55 are spaced a small distance from the arcuate surfaces 71 (see Figure 7) formed in the inside of the yoke.

Reference is now made to Figure 9 showing the bottom plate 75, made of brass, and provided with a circular opening 76, mounting holes 77—80 and the elongated holes 81, 82, and 83. The mounting holes 77—80 are spaced to correspond with the lower spacer posts 65', 66', 67', 68', extending rfom the yoke, whereby the plate may be secured to the field structure by fastening screws 70' threaded into the ends of the lower spacer posts, as shown in Figures 10 and 11. Access to the lower jewel screw 50 may be had through the circular opening 76 in the plate 75 and the entire instrument may be secured within a suitable housing by means of screws or bolts passing through the elongated plate holes 81, 82, 83.

Magnetic damping of the movable coil motion is provided by means of small permanent magnets establishing a magnetic flux field intersected by the damping vane of the instrument. As shown in Figure 8, the permanent bar magnets 85, 86, 87 have ends secured to a plate 88 made of magnetic material such as soft-iron, said plate having mounting holes 89, 90, provided therein. These holes are spaced apart a distance corresponding to that of the lower, rear spacer posts 67', 68', whereby the plate 88 may be secured to the lower yoke surface by these spacer posts, as shown in Figures 10 and 11. When the plate 88 is so secured in position the bar magnets 85, 86, 87, are alined with the soft-iron discs 25, 26, 27, respectively, carried by the top mounting plate 10. A magnetic flux field therefore is established between the adjacent ends of the bar magnets and discs, such field being cut by the damping vane 58. Movement of the vane through the flux field induces eddy currents to flow in the vane producing a damping effect upon the movable coil of the instrument as is well known in this art.

Having now described my invention in detail in accordance with the patent statutes, those skilled in this art will have no difficulty making variations and modifications to meet specific desired, or required, conditions. Such variations and modifications may be made without departing from the scope and spirit of the invention as set forth in the following claims.

I claim:

1. An iron-core electrodynamometer instrument comprising a laminated, four-legged, substantially rectangular

yoke having arcuate surfaces on the inner walls of opposed legs; field coils carried by the other opposed yoke legs; threaded studs extending through transverse holes in the yoke; upper spacing posts threaded on the ends of said studs; an upper plate carrying a bearing and secured to the upper spacing posts; a U-shaped bracket positioned within the yoke and having offset ends secured to the lower surface of said upper plate, said bracket including side arms having longitudinal slots therein and a base carrying a bearing alined with the bearing carried by the upper plate; a wire-wound movable coil pivotally supported by the two bearings and spaced a relatively small distance from the arcuate surfaces in the yoke; a pointer carried by the movable coil; a laminated cylindrical core positioned within the movable coil and having diametrically-opposed surface portions disposed within the longitudinal slots in the U-shaped bracket, said core having bores in the top and bottom surfaces; positioning studs having ends inserted into the bores in the top core surface and into alined holes in the upper plate; and positioning studs having ends inserted into the bores in the bottom core surface and alined holes in the base of the U-shaped bracket.

2. The invention as recited in claim 1 including a damper vane secured to the movable coil; soft-iron discs secured to the upper plate said discs having ends spaced a small distance from the vane; a soft-iron plate secured to the yoke; and permanent magnet bars having ends secured to the soft-iron plate and ends spaced a small distance from said vane and alined with the said discs.

3. The invention as recited in claim 1 and including lower spacing posts threaded on the other ends of said threaded studs; and a lower plate secured to the said lower spacing studs, said lower plate having a circular aperture proximate to the base of the U-shaped bracket.

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