Oct. 8, 1968 S. G. HAYTER 3,405,360

TOWER MEMBER INCLUDING A CEMENT RECEIVING APERTURE AND FILAMENT GUIDING APERTURE FOR A TAUT BAND SUSPENSION SYSTEM

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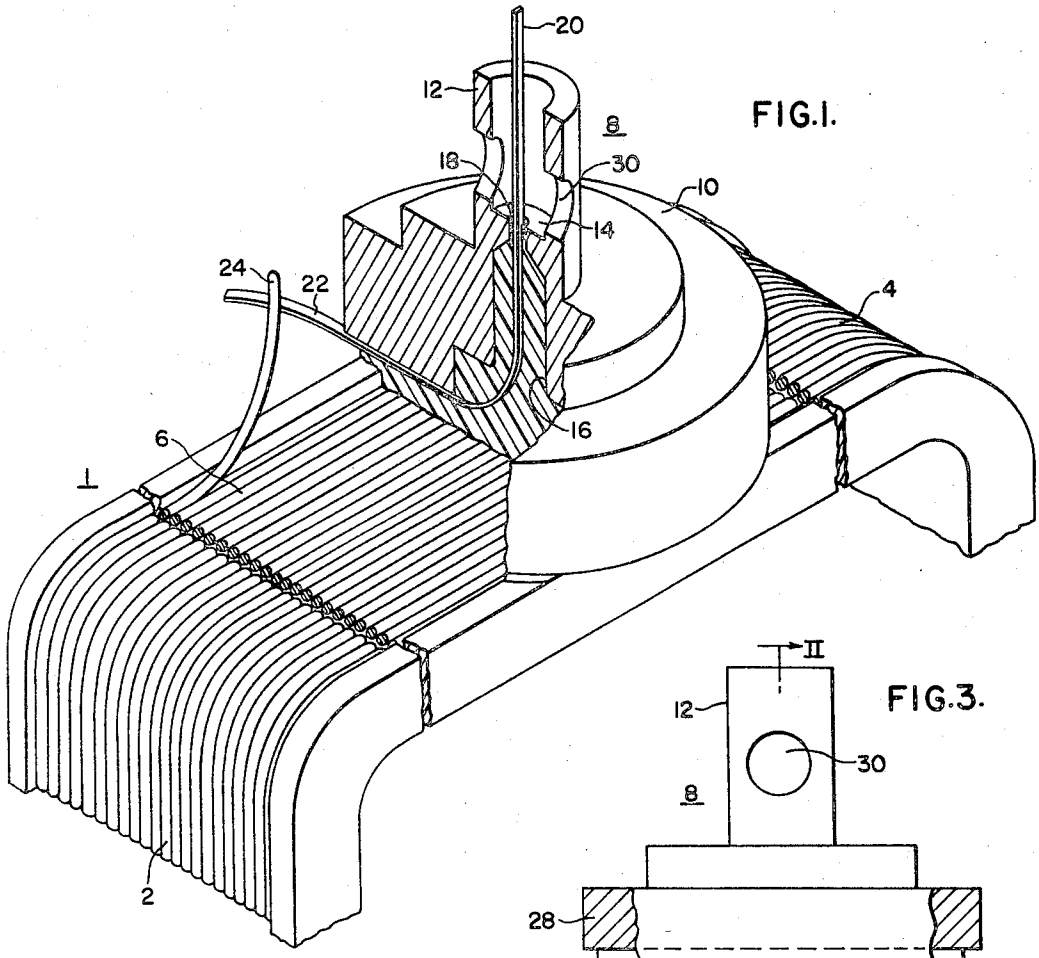


FIG.1.

FIG.3.

FIG.2.

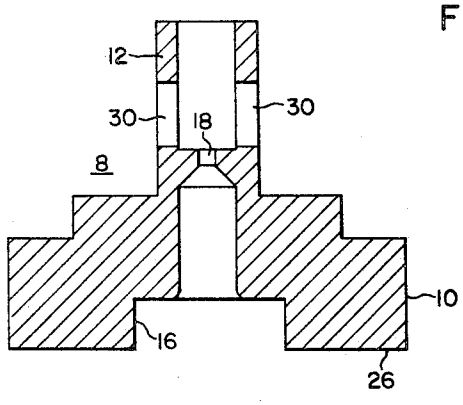
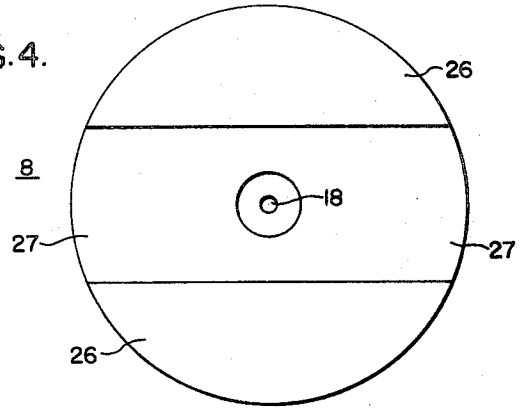


FIG.4.



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TOWER MEMBER INCLUDING A CEMENT RECEIVING APERTURE AND FILAMENT GUIDING APERTURE FOR A TAUT BAND SUSPENSION SYSTEM

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7 Claims. (Cl. 324—154)

This invention relates generally to indicating instruments and more especially to an indicating instrument in which the movable coil is suspended by two filamentary elements for rotation commonly known as a taut band instrument.

The conventional taut band instrument consists of a moving coil having at least one coil side rotatable in a flux gap in response to the torque produced by the interaction of the flux produced by the current flowing through the coil and a generated flux appearing across the gap. The torque so generated is balanced by the torque exerted by the twisting of the filamentary elements or ribbons. A typical instrument of this type is illustrated in U.S. Patent No. 3,111,623 to Thomander, dated Nov. 19, 1963 and in U.S. Patent No. 3,141,133 to Wahlstedt, issued July 14, 1964. Both of these patents are directed toward a filamentary suspension type of instrument. In the Thomander patent, the coil is arranged to have a single coil side rotating in a flux gap while in the Wahlstedt patent, both coil sides are located in a flux gap.

In each of these patents and as more particularly shown in greater detail in FIGS. 7 and 8 of the Thomander patent, the rotatable coil is supported by two filamentary elements. Each filamentary element is secured to the rotatable structure by means of a tower element, of a stepped formation, and a resilient clip. As is best illustrated in the lower part of FIG. 7, the clip has two outwardly extending arms. The clip is staked or otherwise secured to the tower. The ribbon is threaded down through the hollow interior of the tower and around the resilient portion of the clip and soldered to the one arm of the clip. The assembly is cemented to the coil supporting bracket, as illustrated in Thomander, or cemented to the flattened portion of the coil as indicated in Wahlstedt. The other arm of the clips serve as terminals for the ends of the movable coil.

This construction is rather expensive and this invention is directed to the elimination of the clip by the use of a specially designed tower which will assure the required ribbon centering and which may be fabricated and assembled at a greatly reduced cost either automatically or by hand.

It is an object of this invention to provide a new construction for connecting the end of the taut bands to the movable element of an apparatus such as an electrical measuring instrument.

A further object of this invention is to provide such a construction which requires a minimum number of parts and a minimum amount of labor for its fabrication.

Another object is to provide a structure which can be assembled with automatic machinery.

Other objects of this invention will be apparent from the specification, the hereinafter appended claims, and the drawings in which drawings:

FIGURE 1 is a partial isometric view of an electrical instrument illustrating the invention;

FIG. 2 is a cross-sectional view in elevation of the tower member;

FIG. 3 is a side view of the tower member with a portion thereof broken away to show the cross hole; and,

FIG. 4 is a top view of the tower member.

Referring to the drawings by characters of reference, the numeral 1 designates generally a movable instrument coil (such as the coil 22 illustrated in the said Wahlstedt patent). The coil 1 is provided with coil sides 2 and 4 a flattened out upper end portion 6. The lower end portion of the coil is not shown to permit a showing of the invention in greater detail.

A tower member 8 has a main section 10 which may be cylindrical in cross-section as shown and a smaller hollow guiding section 12 which is preferably cylindrical in cross-section as illustrated. A wall section 14 separates the hollow interior of the annular section 12 from an aperture or opening 16 in the main section 10. A small diameter passageway 18 extends through the wall section 14 to permit the filamentary supporting member 20 to extend through the section 14. The wall section 14 determines the location of the anchor point of the adjacent end of the filamentary member 20 in much the same manner as does the tongue 165 of Thomander and defines the outer terminus of the cement within the aperture 16. The thickness of the section is made small to facilitate the making of the passageway 18 which may be made by punching. The size of the passageway 18 should be just large enough to permit the end portion 22 of the filamentary member 20 to be easily passed therethrough to the position as illustrated.

The end portion 22 of the filamentary supporting member 20 terminates externally of the tower member 8 adjacent the upper end portion 6 of the coil. One end 24 of the instrument coil 1 is electrically secured thereto. The filamentary supporting member 20 preferably is a ribbon such as that set forth in Thomander. As such its thickness is about .0005 inch, its width is about .0055 inch, and it would be made of a material such as a platinum-nickel alloy. With such a ribbon, the diameter of passageway could be of a diameter between .006 and .009 inch. A suitable thickness for the wall section is between .005 and .010 inch.

The internal diameter of the annular guide section 12 may vary widely but, with a ribbon as described, a diameter of 0.25 inch and a length of .050 inch from the wall section 14 will suitably support the filamentary member or ribbon 20 and prevent bending thereof sufficient to rupture the ribbon. As illustrated in FIGS. 2 and 3, the aperture 16 opens outwardly through the lower end surface 26 of the tower member 8 and is provided with passageway portions 27 which open outwardly through opposite portions of the side wall 28 above the end surface 26.

The apparatus is assembled by inserting the end portion 22, of the ribbon 20, through the passageway 18 and along the lower end surface 26 with the end portion 22 external to the tower member 8. Thereafter a measured amount of a suitable adhesive such as an epoxy cement is deposited on the flattened out upper end portion 6 of the coil 1 at the approximate location to which the tower member is to be secured and the tower member with the

ribbon therein is positioned on the deposit of the epoxy cement and forced downwardly slowly toward the flattened out upper end portion **6**. The epoxy cement will be forced up inwardly into the aperture **16** as far as the passageway **18** and surround the portion of the ribbon **20**. A small amount of epoxy cement may go into the passageway **18**, however, it is desired that substantially no cement pass therethrough into the hollow interior of the annular section **12**. Any excess cement will, due to the relatively free areas of the passageways **18** and **27**, pass outwardly through the passageway portions **27**. Any excess cement may be thereafter wiped off of the coil **1**.

As illustrated in FIG. 1, the tower member **8** will have a coating of cement between its lower end wall **26** and the flattened out upper end portion of the movable coil **1**. The cement so placed anchors the ribbon **20** in the aperture **16** and determinates one dimension of the filamentary member **20**. The coil end **24** may be secured directly to the end **22** of the ribbon **20** as by soldering. If desired, a cross hole **30** may be provided just above the top surface of the wall section **14** to prevent any tendency of any cement which might pass through the passageway **18** from flowing by capillary attraction up around the portion of the ribbon **20** within the hollow portion of the annular section **12** and thereby altering the twistable length of the ribbon **20**.

As illustrated, the height of the hollow annular guiding section **12** is greater than its inner diameter, this limits bending movement of the ribbon **20** about its anchored portion to prevent a sharp bend and a consequent breaking of the ribbon. As described, the length of the section is twice that of its inner diameter. This relationship is desirable and has been found by applicant to be fully satisfactory and above the danger point of ribbon breakage.

Although the invention has been described with reference to a single embodiment thereof, numerous modifications are possible and it is desired to cover all modifications falling within the spirit and scope of the invention.

What is claimed and is desired to be secured by United States Letters Patent is as follows:

1. In a suspension type instrument in which a moving coil is supported by a filamentary element, a tower member for joining the moving coil to the filamentary element, said tower member having a first surface portion adapted to set against the coil and a second portion spaced from said first portion, said tower member being provided with a first cement receiving aperture opening outwardly through said first surface portion and a second filamentary guiding aperture opening outwardly through said second surface portion, said tower member being provided with an apertured wall separating said first and said second apertures, said wall aperture being not substantially greater in cross-sectional area than the cross-sectional area of the filamentary element, said tower member being provided with a venting passageway opening into said first aperture and opening externally of said tower member and spaced from said first surface to vent any excess material in said first aperture to the exterior of said tower member when said surface is being positioned in engagement with the coil, the cross-sectional area of said venting passageway being substantially larger than the difference in cross-sectional areas of said filamentary element at said wall and said aperture through said wall to reduce the passage of said material through said apertured wall during assembly to the coil.

2. In an apparatus of the character described, a first supporting member, a second member to be supported, a third filamentary member supporting said second member on said first member, said filamentary member being secured at one end portion to said supporting member and having a second end portion, and means securing said second end portion of said filamentary member to said second member, said means comprising a tower and an adhesive cementing said second end portion of said filamentary member to said tower and said tower to said second member, said tower comprising a first end surface facing said second member and a second end surface facing said first supporting member, said tower being provided with first and second outwardly opening apertures, said first aperture opening outwardly of said tower through its said first end surface, said tower having a passageway opening into said first aperture and opening outwardly of said tower in a position spaced from said first end surface, said second aperture opening outwardly of said tower through its said second surface, said first and second apertures being separated by a wall section, the thickness of said wall section being not substantially greater than the dimension of the largest cross-sectional dimension of said filamentary member, said wall section having an aperture therethrough of a diameter sufficient to permit passage of said filamentary member therethrough, an end portion of said filamentary member extending through said aperture of said wall section and between said tower and said second member, said adhesive being located within and substantially filling said first aperture, said wall sections forming a restriction to the passage of said adhesive into said second aperture, said second end surface of said tower being spaced away from said wall section by a dimension in excess of the cross-sectional dimension of said filamentary member whereby the walls of said second aperture provide stops to limit bending of said filamentary member about said wall sections.

3. In a measuring instrument, a supporting structure having a filament anchor, flux conducting parts carried by said structure and defining a path for flux, said path including an arcuate air gap, a coil having a coil side, means carried by said structure and supporting said coil for movement of said coil side in said gap, said means comprising an electric current conducting filament having a first end portion carried by said anchor and a second end portion held in fixed relation with said coil and an end part of said second end portion electrically connected to said coil, said means further comprising a tower having a first end surface facing said coil and a hollow cylindrical portion facing said anchor, said tower having an adhesive receiving aperture opening outwardly through said first end surface, said tower having a wall section separating said adhesive receiving aperture from the hollow interior of said cylindrical portion, said wall section being perforated to interconnect the interiors of said adhesive receiving aperture and said cylindrical portion, said filament extending through said cylindrical portion and said perforation and between said first end surface and said coil with said end part external to said tower, and an adhesive substantially filling said adhesive receiving aperture, said tower including a venting passageway to vent excessive adhesive from said adhesive receiving aperture to prevent adhesive from passing through said perforation.

4. In combination a coil having a flattened out end portion and an end turn terminating adjacent said portion, a tower member having a main section and a hollow guiding section, said main section having a aperture opening outwardly of its outer end wall and through at least one portion of a side wall of said tower member, said tower member having a wall section separating said aperture from the hollow interior of said hollow section, an elongated filamentary member, said wall section having a passageway therethrough of a size to receive said filamentary member, said filamentary member extending through said hollow section and said passageway and said aperture with one end portion terminating exteriorly of said tower member, adhesive material within said aperture and anchoring said filamentary member to said tower member and said tower member to said flattened out portion, said adhesive substantially filling the portion of said aperture adjacent said wall section, the interior of said hollow section being substantially free of said adhesive, and means electrically connecting said end turn of said coil to said end portion of said filamentary member.

5. The combination of claim **4** in which said main section of said tower member is cylindrical in cross-section, said guiding section is cylindrical in cross-section, and the dimension of said hollow section outwardly from said wall

section is greater than the diameter of said hollow section.

6. The combination of claim 5 in which said annular portion is provided with an opening through its side wall closely adjacent said wall section.

7. The combination of claim 4 in which said filamentary member is ribbon like in cross-section and said passageway is circular in cross-section and is of a diameter just greater than the largest cross-sectional dimension of said filamentary member, and said filamentary member extends between said end wall of said tower member and said flattened out portion of said coil with its said end portion spaced from said coil.

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