May 19, 1970 W. HEINRICH ET AL 3,513,391

VIBRATING MEMBER FOR LIGHT RAY OSCILLOGRAPHS

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Fig.1

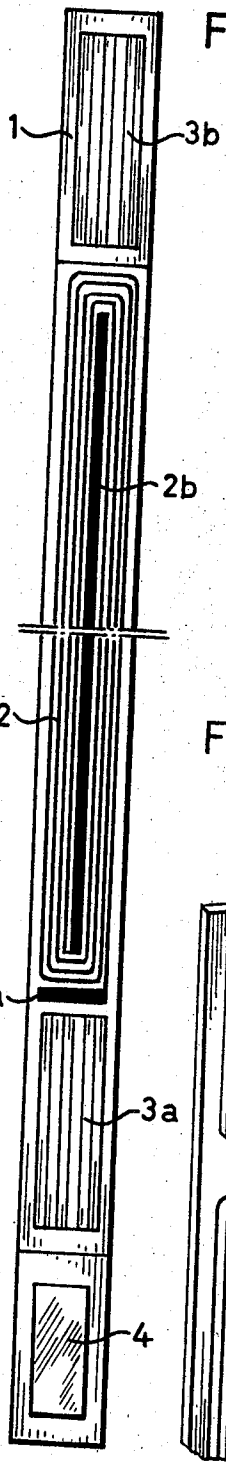


Fig.2

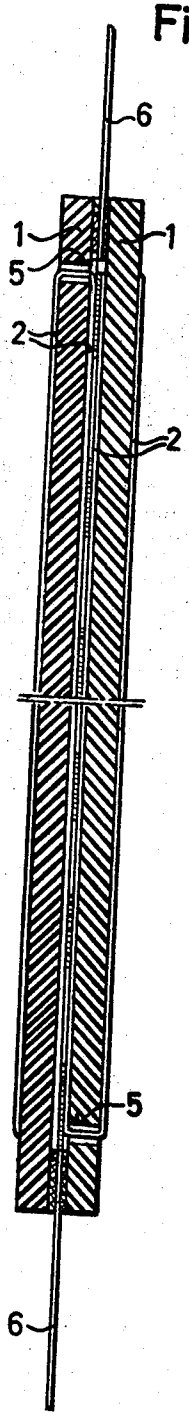


Fig.3

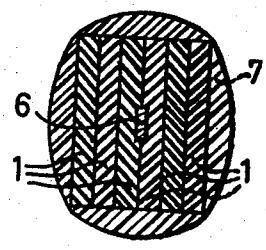


Fig.4

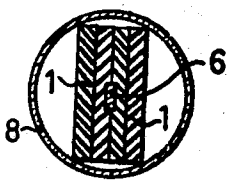


Fig.6

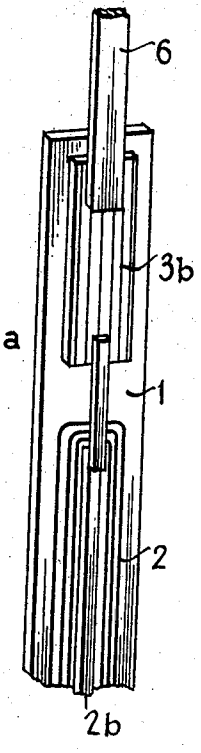
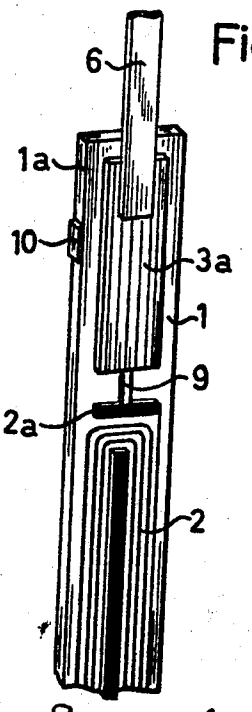


Fig.5



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VIBRATING MEMBER FOR LIGHT RAY OSCILLOGRAPHS

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U.S. Cl. 324—97 7 Claims

ABSTRACT OF THE DISCLOSURE

There is described a vibrating member for light ray oscillographs or the like comprising an electrically insulating carrier plate, a conductor spiral constituting an electric coil and formed on at least one of the faces of the plate by vapor deposition, a mirror carried by said plate, and suspension bands extending at opposed directions lengthwise of said plate and secured thereto.

BACKGROUND OF THE INVENTION

In recent years light ray oscillographs have been developed that include up to several dozens of vibrating coils for simultaneously recording a large number of phenomena on a recording tape. In developing these instruments it has been a natural endeavor to keep their overall volume as small as possible despite the large number of vibrating coils. For this purpose the dimensions of the vibrating coils have been continuously reduced and, as a simultaneous benefit, the upper limit of the frequency of vibration has been raised. The manufacture of the vibrating coils, however, has encountered ever-increasing difficulties due to their very small size. These coils have been wound on special apparatus and then embedded in, or otherwise stabilized by a synthetic resin. The ends have been provided (e.g. by bonding) with armatures which simultaneously serve as support for the suspension bands. Vibrating members manufactured individually in this manner do not have a desired degree of uniformity. It is a further disadvantage that the coils have to be wound by highly specialized labor. As a consequence, the manufactured amount of the vibrating members does not satisfy the large demand therefor; and, further, the outlined method is not economical and results in a high unit price.

SUMMARY OF THE INVENTION

The object of the invention is to provide an improved vibrating member for a light ray oscillograph or the like that may be manufactured in a highly automated manner with a high degree of uniformity.

Briefly stated, the novel vibrating member comprises an electrically insulating carrier plate, the length dimension of which is preferably 30–40 times the dimension of its width, a preferably elongated conductor spiral constituting an electric coil disposed on the carrier plate and formed, e.g. by means of vapor deposition.

The invention will be better understood, as well as objects and advantages will become more apparent, from the ensuing specification of several exemplary embodiments taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a frontal elevational view of an embodiment of the invention;

FIG. 2 is a sectional elevational side view of another embodiment of the invention;

FIG. 3 is a cross-sectional view of a further embodiment of the invention;

FIG. 4 is a cross-sectional view of another embodiment of the invention;

FIG. 5 is a partial isometric view of still another embodiment of the invention; and

FIG. 6 is a partial isometric view of the other end of the element shown in FIG. 5.

DESCRIPTION OF THE EMBODIMENTS

Turning now to FIG. 1, there is shown at a substantially enlarged scale a preferred embodiment of the invention. The novel vibrating member comprises a base or carrier plate **1**, the dimensions of which may be, for example, 12.2 x 0.34 x 0.1 millimeters. The carrier plate may be made, for example, of hard glass or of semiconductive silicon coated with an electrically insulating thin oxide layer.

On at least one of its large faces the carrier plate **1** is provided with a conductor **2** arranged in an elongated spiral configuration lying in a single plane and having a plurality of turns. The conductor spiral **2** ends in an external terminal **2***a* and an internal terminal **2***b*, both being wider than the width of conductor **2** forming the body of the spiral. The inner terminal **2***b* extends centrally in the length direction of the plate **1** along almost the entire length of the innermost turn of the conductor spiral **2**. This particular arrangement of inner terminal **2***b* makes possible a selective connection thereof to contact face **3***a* or **3***b* carried by plate **1** at either end of the conductor spiral **2**. The connection between terminal **2***b* and either contact face **3***a* or **3***b* is preferably made only during the installation of the vibrating member.

The conductor spiral **2** and the contact faces **3***a*, **3***b* may be formed on plate **1** by any appropriate technique known in the printed circuit art. It has been found that a coating technique, such as vapor deposition, is particularly advantageous since, by means of a preformed suitable mask, a great number of plates may be simultaneously treated. The process may be entirely automated. The deposited conductor spiral, constituting the electric coil of the vibrating member, is uniform to a very high degree. It is extremely thin and, consequently, it lies substantially in the plane of the plate face. The conductor obtained by vapor deposition may, if conditions require, be subsequently reinforced by a galvanization step.

Plate **1** further carries, below the contact face **3***a*, a mirror **4** for deflecting the light rays of a light ray oscillograph. Mirror **4** may also be formed by vapor deposition or may be bonded to plate **1** as a preformed thin reflecting member.

Turning now to the embodiment shown in FIG. 2, there are shown two carrier plates **1** bonded together in a face-to-face relationship. Each plate carries on both faces a conductor spiral **2** connected in parallel or in series through apertures **5** disposed in the line of symmetry of the plate **1**. Sandwiched between the two carrier plates **1** are two suspension bands **6** extending lengthwise in opposed directions at both ends of the member. The conductor spirals of the two carrier plates **1** are also interconnected. It is preferred to make the parallel or serial connections between the conductor spirals on opposed faces of carrier plates **1** only during the installation of the vibrating member.

Vibrating members adapted to oscillate at elevated frequencies are usually disposed in a damping fluid. In order to provide an evenly-exposed surface in the damping fluid and thus avoid deviations in the damping effect, it was found expedient to round out the angular shape of the plate stock. Thus, as shown in sectional FIG. 3, a stack of six carrier plates **1** bonded together (each plate being provided at least on one face thereof with a conductor spiral, not shown for clarity) is embedded in a rounded envelope **7** made, for example, of synthetic resin. The suspension

band is sandwiched between the two innermost carrier plates **1**. As shown in FIG. 4, instead of being embedded in a synthetic resin envelope, the stack (consisting here of four carrier plates **1**) is inserted into a thin walled glass sleeve **8**.

Turning now to FIG. 5, there is shown one end portion of a further embodiment of a single-plate carrier member. It is seen that a suspension band **6** is soldered to the contact face **3***a* which is further electrically connected by strip **9** to the outer terminal **2***a* of the conductor spiral **2**. To the other contact face **3***b*, which is shown in FIG. 6, there is also soldered a suspension band **6**. To the polished or smoothened small face or edge **1***a* of carrier plate **1** trere is bonded or deposited a mirror **10**.

The novel vibrating member as described hereinabove is installed and held in a light ray oscillograph or like instrument in such a known manner that it may oscillate, usually about its longitudinal axis of symmetry, upon the action of a varying magnetic field on conductor spirals **2** constituting the vibrating electric coils.

Although several embodiments of the invention have been depicted and described, it will be apparent that these embodiments are illustrative in nature and that a number of modifications in the apparatus and variations in its end use may be effected without departing from the spirit or scope of the invention as defined in the appended claims.

That which is claimed is:

1. In a light ray oscillograph or like instrument of the type including at least one vibrating member of rounded cross-section, said vibrating member having a coil, a mirror, and suspension means, the improvement in said vibrating member comprising a plurality of carrier plates secured together in a face-to-face relationship to form a stack, said stack and mirror being disposed within a transparent sleeve, and a conductor spiral constituting said coil disposed on at least one face of each of the said plates, said conductor spiral lying in a single plane substantially coplanar with said face.

2. The improvement as defined in claim **1** including

two contact faces carried by each of the said plates and each disposed at diametrically opposed sides of said conductor spiral and adapted to be electrically connected to each end of said spiral.

3. The improvement as defined in claim **2**, including at least two suspension bands extending in opposed directions from said stack plate, one end of each of said bands is soldered to each of said contact faces.

4. The improvement as defined in claim **1**, wherein said conductor spiral has an external terminal and an internal terminal both disposed on each of the said plates coplanar with said conductor spiral and both having a width greater than that of the conductor forming said spiral.

5. The improvement as defined in claim **4**, wherein said internal terminal extends substantially along the entire length of the innermost turn of said spiral.

6. The improvement as defined in claim **1**, wherein each of the said plates carries on opposed faces thereof at least one of said spirals, at least one aperture provided in each of the said plates in the centerline thereof adapted to receive means electrically interconnecting said spirals on said opposed faces of said plate.

7. The improvement as defined in claim **1**, wherein said mirror is affixed to and disposed in the plane of the outward face of the outermost of the said plates.

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U.S. Cl. X.R.

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