Sept. 17, 1929. J. W. LEGG 1,728,555

GALVANOMETER

Filed Dec. 23, 1924

Fig. 1.

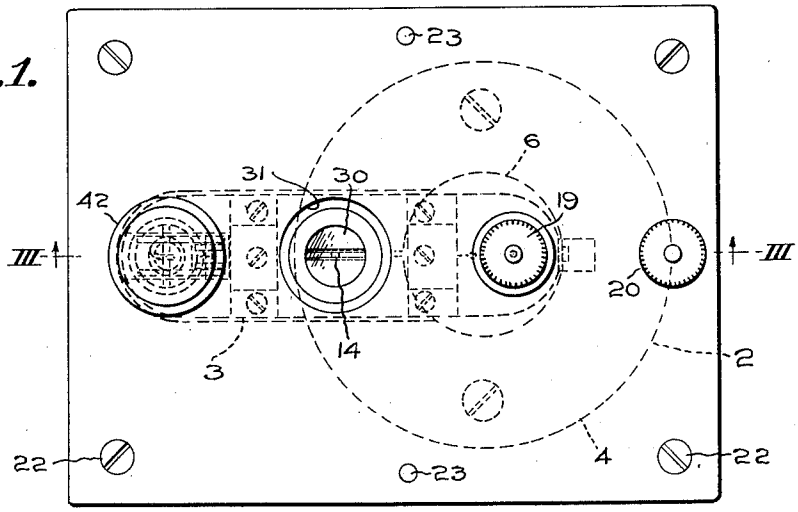


Fig. 2.

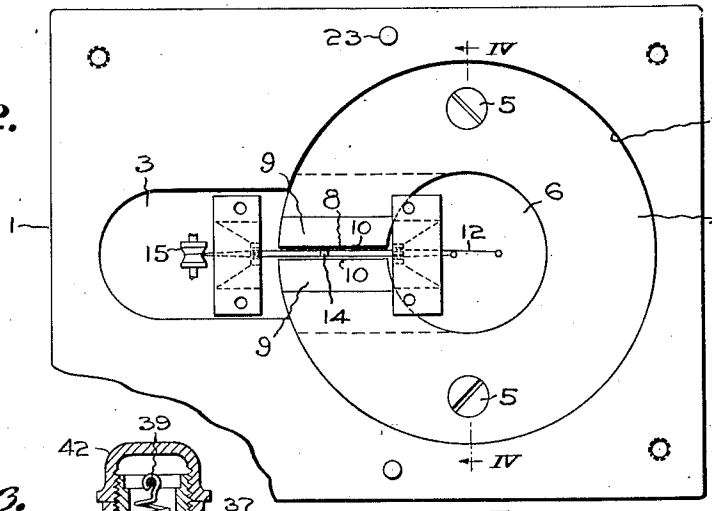
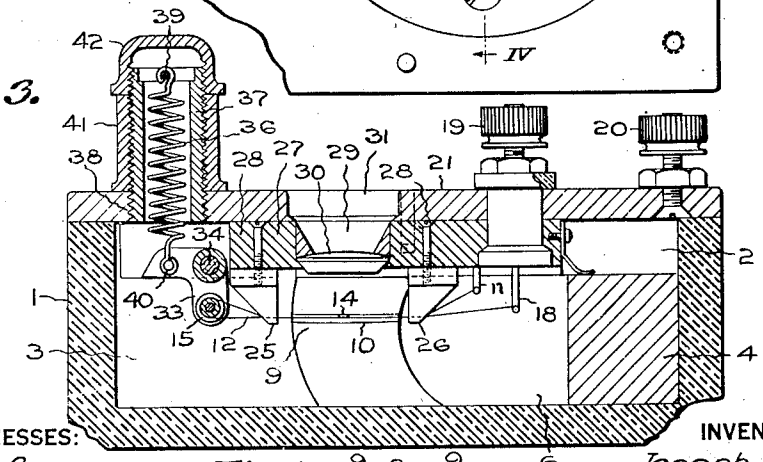


Fig. 3.

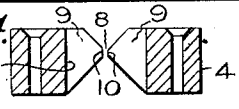


WITNESSES:

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Fig. 4.



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UNITED STATES PATENT OFFICE

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GALVANOMETER

Application filed December 23, 1924. Serial No. 757,586.

My invention relates to galvanometers and particularly to galvanometers for use in oscillographs.

One object of my invention is to provide a galvanometer that shall be simple and durable in construction, economical to manufacture and effective in its operation.

Another object of my invention is to provide an oscillograph galvanometer that shall be particularly adapted for use in an oscillograph employing only one galvanometer element.

Another object of my invention is to provide a galvanometer that shall be compact in construction and light in weight.

Another object of my invention is to provide an oscillograph galvanometer that shall embody a fluid-tight well structure of novel construction.

A further object of my invention is to provide a galvanometer embodying a liquid-containing vessel having a window and a galvanometer element therein in which bubbles are prevented from accumulating in the liquid between the element and the window.

Another object of my invention is to provide a galvanometer embodying a liquid-tight vessel and a galvanometer element therein that shall comprise a single or composite device constituting means for tensioning the element, for introducing liquid into the vessel and for sealing the vessel.

Further, the invention also embodies a permanent magnet of relatively high coercive force and is particularly constructed for cooperation with a horizontally disposed galvanometer element in a manner that renders the galvanometer very compact and light in weight.

By the specific construction of the magnet, as to size, shape and the relation thereof to the other parts of the device and in the particular combination of elements employed, a galvanometer is provided which is more compact, economical and effective than could be obtained by the use of the usual magnetic materials. It is, therefore, these features which constitute my present invention, and which I claim as new.

Figure 1, of the accompanying drawings, is a plan view of a galvanometer constructed in accordance with my invention,

Fig. 2 is a view, similar to Fig. 1, with a cover member and certain other parts removed,

Fig. 3 is a view, taken along the line III—III of Fig. 1, and

Fig. 4 is a view, on a reduced scale, taken along the line IV—IV of Fig. 2.

The galvanometer of my invention comprises a main base or supporting structure 1, preferably constructed of a single homogeneous mass of insulating material, and constituting a well. The structure 1 is provided with a main interior recess 2, of substantially cylindrical shape, having a laterally or radially offset auxiliary recess 3. The main recess 2 is adapted to snugly fit a permanent magnet 4, which is secured in position, as by screws 5.

The magnet 4 is provided with a concentric recess 6, and a lateral, or radial, slot 8 extending between the recesses 2 and 3, to provide pole ends 9. The latter are tapered, as shown more clearly in Fig. 4, to provide concentrated parallel pole end surfaces 10 that extend transversely or radially with respect to the longitudinal axis of the magnet, along and between which an elongated filamentary conductor 12 extends. The latter is bent double upon itself to provide parallel portions, in the slot 8, for the support of a mirror 14 and is supported, at its looped portion, by a pulley 15. The conductor 12 is connected, at its free ends, to posts 17 and 18 that are connected to binding posts 19 and 20. The latter are mounted on the cover member 21 that is secured to the well structure 1, as by screws 22 and positioning pins 23.

The filamentary conductor 12 is supported by spaced insulating members 25 and 26 that are mounted on a base member 27, as by screws, at opposite ends of the slot 8. The member 27 is secured to the cover member 21 and is provided with an opening 29 for the reception of a lens 30 in position opposite an opening or window 31 in the cover member 21. The under surface of the lens 30 extends below the bottom surface of the

member 27 on which it is supported and is normally adapted to lie below the upper level of a liquid in the well. Thus, bubbles tending to collect under the lens 30 will be urged away from the space between the mirror 14 and the lens and to seek a position at the upper level of the liquid.

The pulley 15 is mounted on a lever 33 that is pivotally mounted on a stationary pin 34 and is biased in a clockwise direction around the pin 34 by a spring 36. An externally-threaded tubular member 37 is secured in position in an opening 38 in the cover member 21 and is provided, adjacent to its outer end, with a pin 39 between which and a pin 40 on the lever 33, the spring 36 extends. An internally threaded sleeve 41 surrounds the tubular projection 37 and serves to hold the same in position on the cover member 21. A cover member 42 is also adapted to engage the outer end of the threaded member 37 for clamping liquid-tight engagement with the outer end of the member 41.

By constructing the magnet of annular shape, with the parallel concentrated pole-end surfaces extending transversely or radially with respect to the longitudinal axis of the cylinder, the galvanometer element and mirror are permitted to operate in horizontal position. This feature permits the oscillograph to have an optical lever arm of considerably greater length than the length of the casing in which the galvanometer is contained and is one of the principal features whereby the instrument is rendered smaller and more readily portable than oscillographs of the prior art. The annular shape of the magnet reduces the space volume occupied thereby for a given field strength.

Also, by providing means, represented by the parts 37, 41 and 42, whereby a damping oil may be introduced into the casing 1 after the cover member 21 has been secured and sealed in position, the assembly of the galvanometer is facilitated and the danger of leakage is reduced.

In similar galvanometer structures, where the damping oil is placed in the casing before the cover member is mounted in position, the sealing space between the cover member and the casing, which is adapted to receive a sealing medium such as shellac, is likely to receive a film of the oil. This objection renders the assembly of the instrument difficult and unsatisfactory, and causes undue labor and expense. Holes in the lid 21 and in the casing 1 for the screws 22 are provided during the manufacture of these parts, as are the holes in the lid 21 for the pins 23. However, the holes in the lid 21 for the screws 22 are made large as compared with the screws, and the holes in the casing for the pins 23 are not provided until the lid, with its accompanying parts, has been adjusted in position on the casing to have the mirror 14 in the center of the gap 10. Since the holes in the lid 21 for the screws 22 are large as compared with the screws, considerable latitude is allowed for adjusting the position of the mirror and still have the screws 22 enter the holes in the lid and casing.

After this operation, the holes in the casing for the pins 23 are provided, thus rendering the pins 23 means by which the lid 21 and the mirror 14 may subsequently be always accurately positioned. When ready for final mounting, the lid is sealed in position, as by placing shellac over the upper edges of the casing, after which the damping oil is introduced into the casing through the member 37.

While I have shown and described a particular form of my invention, changes may be effected therein without departing from the spirit and scope thereof, as set forth in the appended claims.

I claim as my invention:

1. A galvanometer comprising an annular permanent magnet, a well structure having a main recess to receive said magnet and an offset recess extending radially from the main recess, a galvanometer element, a support for the element disposed in said main recess and another support for the element disposed in said offset recess.

2. A galvanometer comprising a well structure, a cover member therefor, a control magnet and an elongated galvanometer element supported by the cover member in position extending transversely to the longitudinal axis of the well structure.

3. A galvanometer comprising a well structure having a main cylindrical recess and an offset recess extending laterally outwardly therefrom, a cylindrical outline permanent magnet of annular form fitting said main recess and having transversely-extending concentrated pole ends opposite said offset recess, a cover member for the well structure, an elongated galvanometer element and means on the cover member projecting into said recesses for supporting said element in position between said pole ends.

4. A galvanometer comprising a well structure for the reception of a liquid and having a light-transmitting opening through the top wall thereof, a galvanometer element including a mirror disposed opposite said opening and means for preventing the accumulation of bubbles in the liquid between the mirror and the opening.

5. A galvanometer comprising a well structure for the reception of a liquid and having a light-transmitting opening through the top wall thereof, a galvanometer element including a mirror disposed opposite said opening and a horizontal lens between

the opening and the mirror and constructed and disposed to prevent the accumulation of bubbles in the liquid in the path of light between said opening and said mirror.

6. A galvanometer comprising a well structure for the reception of a liquid, a horizontal cover member therefor having a light-transmitting opening, a galvanometer element including a mirror disposed opposite said opening and a horizontal lens disposed between the opening and the mirror and having its lower surface disposed below the lower surface of said cover member to prevent the accumulation of bubles in said liquid under the lower surface of said lens.

7. A galvanometer comprising a well structure for the reception of a liquid, a transparent member located within said well structure in a horizontal position, a galvanometer element including a mirror disposed opposite said transparent member, and means for preventing the accumulation of bubbles between the mirror and the transparent member.

8. A galvanometer comprising a well structure containing a liquid, a transparent member located within said well structure in a horizontal position, a galvanometer element including a mirror disposed opposite said transparent member, said transparent member being located with its lower surface beneath the level of said liquid to prevent the accumulation of bubbles between the mirror and the transparent member.

In testimony whereof, I have hereunto subscribed my name this 13th day of December, 1924.

JOSEPH W. LEGG.