March 11, 1930. J. W. LEGG 1,750,275

DEFLECTING SYSTEM

Filed Sept. 23, 1927

Fig. 1.

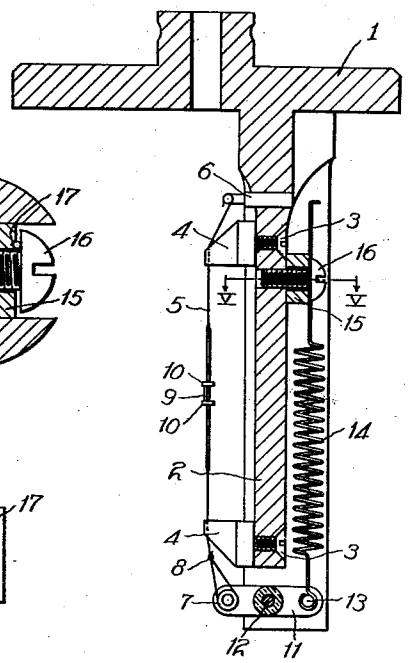


Fig. 5.

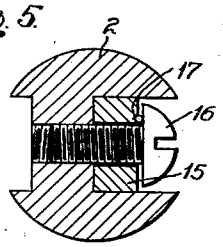


Fig. 6.

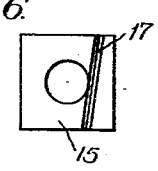


Fig. 3.

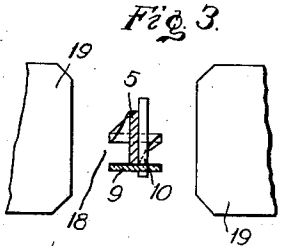


Fig. 2.

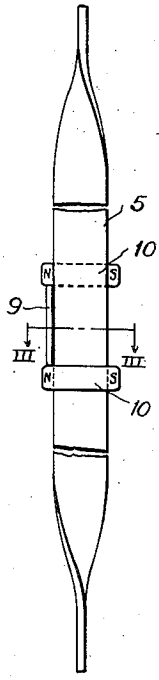
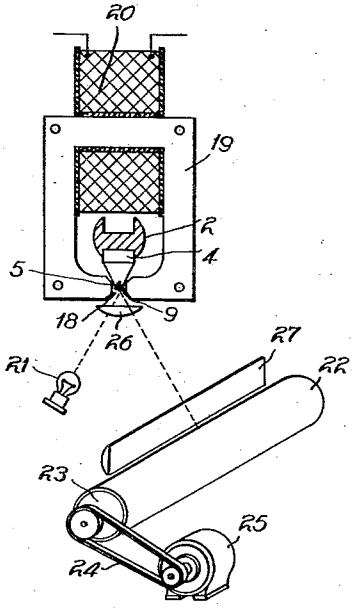


Fig. 4.



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Patented Mar. 11, 1930 1,750,275

UNITED STATES PATENT OFFICE

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DEFLECTING SYSTEM

Application filed September 23, 1927. Serial No. 221,601.

My invention relates to a deflecting system and has particular reference to an apparatus for effecting movement of a system, as aforesaid, in which one or more magnetized members is or are included.

In accordance with my invention, a magnetized member or vane included in, or movable with, the deflecting system of a galvanometer or the like, is disposed in a space or gap between the poles of a suitable magnetic structure with which coacts a coil or winding, for producing in said space or gap a magnetic field which varies in accordance with changes in a characteristic, as magnitude, of a quantity, either electrical or non-electrical, in character.

Further in accordance with my invention, the aforesaid magnetized member or vane comprises an alloy, particularly a cobalt-steel alloy and the aforesaid magnetizable structure comprises a group of magnetizable members, each formed preferably of an alloy, particularly a nickel-steel alloy, or of other material incapable, to any substantial extent, of becoming permanently magnetized and having a substantially straight line magnetization curve.

Further in accordance with my invention, the vibratory or deflecting system of a galvanometer, or the like, comprises a member or ribbon capable of withstanding large or great tension to which, preferably midway of its ends is or are secured one or more permanently magnetized members or vanes for coaction with a magnetic field in the space between the poles of a magnetizable structure.

Further in accordance with my invention, the aforesaid ribbon or member, or the usual parallel-conductor system of a galvanometer is maintained under a desired or suitable degree of tension by a helical spring or the like, one end of which is clamped between coacting members comprisng, preferably, a washer and the head of a screw or the like.

My invention resides in the system and apparatus and features of construction of the character hereinafter described and claimed.

For an understanding of my method, and for an illustration of one of the forms my apparatus may take, reference is to be had to the accompanying drawing, in which:

Figure 1 is a vertical sectional view, partly in elevation, of a deflecting or vibrating system constructed in accordance with my invention,

Fig. 2 is an enlarged elevational view of a part of the structure shown in Fig. 1,

Fig. 3 is a transverse horizontal sectional view taken on the line III—III of Fig. 2 and showing portions of a magnetizable structure,

Fig. 4 is a diagrammatic view of an oscillograph system.

Fig. 5 is a transverse horizontal sectional view taken on the line V—V of Fig. 1, and

Fig. 6 is an elevational view of a part of the clamping structure shown in Fig. 5.

Referring to Fig. 1, there is illustrated a member or disc 1 from which depends or projects a member or stem 2 having suitably secured thereto, as by screws 3, a plurality of spaced supporting members 4 formed of ivory or other suitable insulating material. Each member 4, as viewed in Fig. 1, comprises a slot or channel, both being disposed in vertical alinement with each other for the reception of a member or ribbon 5 formed of a material having great tensile strength, as a silver alloy composition. Member 5, at its upper end, as viewed in Fig. 1, may be soldered, or otherwise suitably secured, to a post 6 projecting from the stem 2. Member 5, when of ribbon-like form, should be disposed flat-wise in the passage in the upper supporting member 4, then turned through an angle of 180° and its other plane surface disposed in flat-wise fashion in the channel of the lower supporting member 4. The lower end of member 5 should then be looped or folded around a member 7 and soldered, or otherwise suitably secured, to an adjacent portion of the member 5 as indicated at 8. Or, if desired, the member or ribbon 5 may be entirely plane between the supports 4, that is, not twisted through an angle of 180°, as aforesaid.

Preferably, midway between the supporting members 4, the member or ribbon 5 has a light-reflecting mirror 9 cemented, or other-

wise suitably secured thereto. By preference, immediately adjacent the mirror 9, one or more magnetized members or vanes 10 is or are likewise cemented, or otherwise suitably secured to the member or ribbon 5. Ordinarily, to the end that the deflecting system may be mechanically balanced, it is desirable that there be provided even numbers of the magnetized members 10. Thus, there may be utilized two of such members, one disposed at each end of the mirror 9 and on opposite sides of the ribbon 5. Or, if desirable, four of the members 10 may be utilized, two disposed at each end of the mirror 9 and on opposite sides of the ribbon 5.

The aforesaid member 7, to which one end of the ribbon or member 5 is secured, is carried by one end of a lever 11 pivoted at 12, preferably in the bifurcated end of stem 2. The other end of lever 11 carries a pin 13 to which is secured one end of a helical spring 14 or the like. The helical spring 14 extends along the stem 2 and terminates preferably in a relatively straight section adapted to be clamped between a nut or member 15 and the head of a screw 16 or the like. As illustrated, screw 16 passes freely through the nut or washer 15 and is threaded into the stem 2, thereby holding the upper end of spring 14 between its head and a slot or passage 17 disposed in the washer 15, Figs. 5 and 6. The upper end of spring 14 may be manually moved until the member 5 is placed under the desired degree of tension whereupon the screw 16 may be tightened to positively clamp or retain said upper end of spring 14 in the position to which adjusted.

In accordance with my invention, the aforesaid magnetized member or members 10 is or are arranged for coaction with a magnetic field produced in the space or gap 18 between the poles of a suitable magnetizable structure 19 so supported that its poles define a space within which a magnetizable member 10, or a plurality of them, is or are disposed. As illustrated in Fig. 3, the flatwise section of ribbon 5 is disposed in parallel relation, or substantially so, with respect to the adjacent pole faces of the magnetizable structure 19. As a result, the magnetized vane or vanes 10 extends or extend in similar relation with respect to said pole faces and since, at opposite ends, it or they exhibits or exhibit poles of opposite polarity, it follows that oscillatory movement is imparted in one direction or the other to the deflecting system dependent upon the polarity of the pole faces of the magnetizable structure 19.

As stated above, the ribbon 5, between the supporting members 4, 4, may be turned through an angle of 180 degrees. Under such circumstances, the mirror 9 and the magnetized vanes 10 should be disposed midway between said members 4, 4, with the result that the mid-portion of the ribbon 5 assumes the position illustrated in Fig. 3, when the magnetizable structure 19 is not energized.

The flux in the gap 18 is produced by a coil or winding 20 coacting with or disposed upon the magnetizable structure 19. Coil 20 is traversed by an electrical current which varies in magnitude in accordance with changes in the quantity to be measured. As a result, there is produced in the flux gap 18 a magnetic field which varies in accordance with the magnitude of the current traversing said coil 20, and which coacts with magnetized vane or vanes 10 to impart movement to the deflecting system.

Ordinarily, the aforesaid deflecting or vibrating system comprising the ribbon or member 5, the thereby-carried mirror 9 and magnetized vane or vanes 10 is freely responsive to frequencies within the voice range. Therefore, the deflecting or vibratory system usually responds faithfully to changes in the instantaneous magnitudes of the current traversing coil 20 and, accordingly, the mirror on said vibratory or deflecting system functions to reflect a beam of light from a suitable light source 21 on to a light-sensitive surface or film 22 disposed, in the example shown, upon a drum or cylinder 23 to which rotation or movement may be imparted by a belt 24 driven by a suitable motive device 25. The aforesaid beam of light both before and after reflection by the mirror 9 may pass through a spherical lens 26 and, adjacent the light-sensitive surface 22, through a cylindrical condensing lens 27 by which the light beam is focused substantially as a point of light onto said surface. It shall be understood that the aforesaid light source 20, lens 26, mirror 9, lens 27, and light-sensitive surface 22 should be enclosed in a suitable light-proof housing.

The magnetizable structure 19 ordinarily comprises a stack or group of thin magnetizable members or laminations formed preferably of material incapable, to any substantial extent, of becoming permanently magnetized and also having a straight line magnetization curve. Preferably, said magnetizable members or laminations are formed of a nickel-steel alloy, for example, that known to the trade as "hypernick". Furthermore, it is desirable, ordinarily, that the magnetizable vane or vanes 10 be formed of highly coercive material capable of indefinitely retaining its or their magnetism. For example, for the vane or vanes 10 there may be thus utilized an alloy, particularly a cobalt-steel alloy. The utilization of materials of this charcater is desirable because their magnetic properties remain constant so that the deflecting system responds uniformly and faithfully only to the current in the coil 20 and is not affected by magnetic fluctuations in the stack 19 or vanes 10.

It shall be understood that the herein disclosed arrangement for imparting tension to the member or ribbon 5 may be utilized for imparting tension to the parallel-carrying conductors of a type well known to the art of galvanometer deflecting systems.

I claim as my invention:

1. In a deflecting system a ribbon under tension, means to support said ribbon at its ends and to prevent it from twisting at said ends, and a permanent magnet mounted on said ribbon.

2. In a deflecting system a ribbon under tension, means to support said ribbon at its ends and to prevent it from twisting at said ends, and a permanent magnet mounted on said ribbon and between pole portions of magnetic material.

3. In an electrical instrument, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions.

4. In an electrical instrument, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree and having a substantially straight line magnetization curve over the range of magnetizing forces encountered, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions.

5. In an electrical instrument, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a deflecting system including a permanent magnet supported between said pole portions, and means for mechanically balancing said deflecting system.

6. In an electrical instrument, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree, a coil wound on said core whereby a current to be measured passing through said coil magnetizes said pole portions, a deflecting system including a plurality of permanent magnets supported between said pole portions, said permanent magnets being so arranged that said deflecting system is mechanically balanced.

7. In an electrical instrument, a core having pole portions, said core being of magnetic material which does not become permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions, the support for said permanent magnet comprising a strip which is supported at each end.

8. In an electrical instrument, a core having pole portions, said core being of magnetic material which does not become permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions, the support for said permanent magnet comprising a strip which is supported at each end by means to prevent it from twisting at said ends.

9. In an electrical instrument, a core having pole portions, said core being of magnetic material which does not become permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions, the support for said permanent magnet comprising a metallic strip which is supported at each end by means to prevent it from twisting at said ends.

10. In an electrical instrument, a core having pole portions, said core being of magnetic material which does not become permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions, the support for said permanent magnet comprising a single

metallic strip which is supported at each end by means to prevent it from twisting at said ends.

11. In an electrical instrument, a core having pole portions, said core being of magnetic material which does not become permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions, the support for said permanent magnet comprising a single metallic strip which is supported at each end by means to prevent it from twisting at said ends, and a mirror mounted on said strip.

12. In an oscillograph, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a deflecting system freely responsive to frequencies of the order of 3000 cycles per second, said system including a permanent magnet supported between said pole portions and positioned, when no current is passing through said coil, with the line running through the pole portions of said permanent magnet transverse to the lines of force of said magnetized pole portions.

13. In an oscillograph, a core having pole portions, said core being of magnetic material incapable of becoming permanently magnetized to any substantial degree, a coil wound on said core, whereby a current to be measured passing through said coil magnetizes said pole portions, a deflecting system freely responsive to frequencies of the order of 3000 cycles per second, said system including a permanent magnet supported between said pole portions, and means for mechanically balancing said deflecting system.

In testimony whereof, I have hereunto subscribed my name this 9th day of September 1927.

JOSEPH W. LEGG.