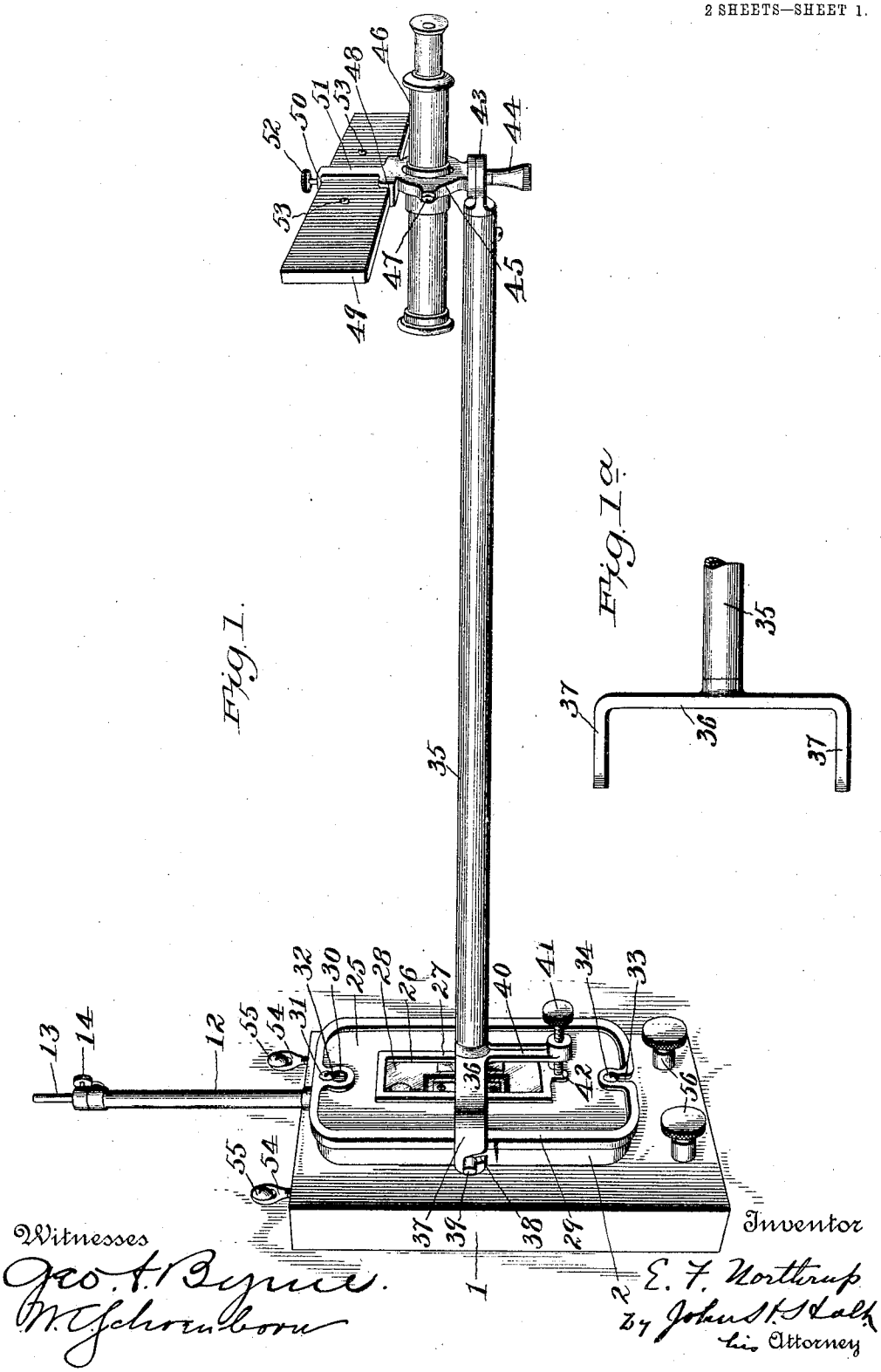
No. 792,843. PATENTED JUNE 20, 1905.

E. F. NORTHRUP.

GALVANOMETER.

APPLICATION FILED APR. 1, 1905.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2.

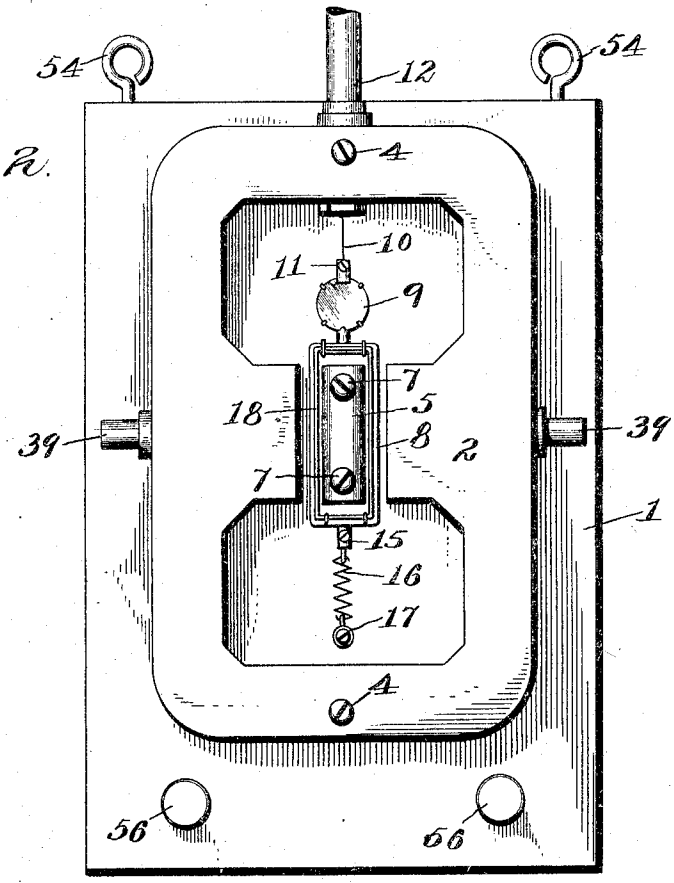


Fig. 3.

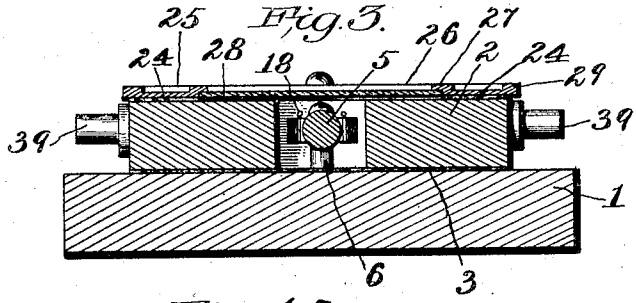


Fig. 4.

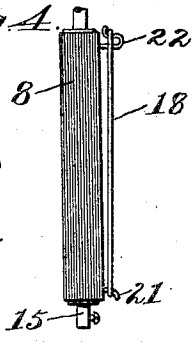
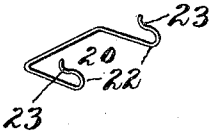


Fig. 5.

Fig. 6.



Witnesses

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No. 792,843. Patented June 20, 1905.

UNITED STATES PATENT OFFICE.

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GALVANOMETER.

SPECIFICATION forming part of Letters Patent No. 792,843, dated June 20, 1905.

Application filed April 1, 1905. Serial No. 253,354.

To all whom it may concern:

Be it known that I, EDWIN F. NORTHRUP, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Galvanometers, of which the following is a specification.

A galvanometer in order to satisfactorily meet its requirements must first of all have ample sensibility for the particular work for which it is intended. After that it should be quick in its action, so that the user will not waste time while it is returning to its zero position. It must have a positive zero, so that there may be no question about reading small deflections and determining the value of deflections. Unless it is to be used as a ballistic instrument it must be dead-beat, and finally it must be arranged so that it can be easily set up, the suspensions easily replaced, and the suspended system easily gotten at for inspection or repair. It has been generally assumed that many of these desirable qualities could not be expected of a D'Arsonval galvanometer, in spite of which this type of galvanometer is very widely used on account of its freedom from magnetic disturbances and its general robustness as compared with other types.

Long and extensive experiments and experience in galvanometer construction and design have enabled me to produce a D'Arsonval galvanometer which I believe embodies all of the above good qualities and in addition the advantage of having the moving system at all times entirely visible and combining with this an arrangement of telescope and scale support which is extremely simple and at the same time of the highest order of efficiency. Moreover, I have devised a form of removable damping device which may be readily attached to the moving system and removed therefrom at will.

A galvanometer embodying all of the above valuable characteristics constitutes the subject of my present invention and is illustrated in one form in the accompanying drawings, wherein—

Figure 1 represents a wall type of the instrument in perspective, showing the telescope and scale arm lowered for reading; Fig. 1ª, a detail top plan view of the yoke and of said telescope and scale arm; Fig. 2, a front elevation of the instrument with front plate and telescope and scale arm removed; Fig. 3, a cross-section of said instrument with said arm removed; Fig. 4, a side elevation of the movable-coil system with removable damper attached; Fig. 5, an enlarged detail perspective view of one of the small damper-holding devices, and Fig. 6 a similar view of the upper damper-holding device.

In carrying out the form of my invention herein shown I mount upon a flat base 1, which may be a block of wood, slate, non-magnetic metal, or other suitable material, a cast-iron consequent-pole field-magnet 2, having two flat faces, one of which rests upon a piece of felt 3 upon the base-block, such magnet being secured to said base by means of the screws 4. Between the poles of the magnet is mounted a cylindrical iron core 5, supported upon lugs 6 and held in place by screws 7. Around this core and between the poles of said magnet is the moving coil 8, to which is attached the mirror 9. A suitable suspension 10 is secured to the terminal 11 above the mirror and extends through the upper end of the magnet, through the vertical tube 12, which is screwed into the top of the magnet, and thence to the adjustable suspension-terminal 13, extending into the end of the tube and held in position by an adjusting-screw 14. At the lower end of the coil 8 is a connecting device 15, which is secured to a spring 16, the lower end of which is attached to a screw 17.

When a very decided damping action is desired, I provide the moving system with a removable damper consisting of a rectangular copper-wire loop 18, which is secured to the system by means of the small retaining-springs 19 and 20. The former, 19, consists of a small U-shaped piece of brass wire having its ends bent downward, as at 21, and is made fast in the lower end of the coil, with its ends 21 projecting out, as shown in Fig. 4. The device 20 consists also of a small U-shaped piece of wire having its ends bent up to form hooks

22, having curved-in portions 23. This device is made fast in the upper end of the coil, with its hooked ends projecting forward, as shown. By passing the lower end of the damper 18 under the hooked ends 21 and over the ends 23 the damper will be held firmly in place on the system and may still be readily removed.

Over the upper face of the magnet is placed a strip of felt 24, extending around the edges of the magnet, and upon this strip of felt is placed a brass plate 25, having an opening 26, provided with a flange 27, against which is held a glass 28. This opening is large enough to render the entire moving system at all times visible, so that it will not be necessary in all cases to remove the top plate to inspect the system.

The plate 25 is provided with a flange 29 or raised portion around its outer edge, which may be polished, and thus add to the appearance of the instrument. The method of attaching the said plate to the magnet is simple, yet unique and very desirable, in that while the screws may be employed for holding the plate in position still the screws do not have to be removed to remove the plate. This is accomplished by providing an aperture 30 in the upper end of the plate of a size larger than the head of the attaching-screw 31 and having said aperture open into a vertical slot 32, smaller than the head of the screw, but large enough to accommodate the screw-shank. At the bottom of the plate is merely a slot 33, opening through the edge of the plate, large enough to accommodate the shank of the attaching-screw 34. When it is desired to remove the plate, it is necessary only to loosen the screws 31 and 34, slip the plate upward, and then lift it from the instrument.

For supporting the telescope and scale I provide a metal rod 35, preferably tubular, which carries at one end a yoke 36, having arms 37 extending at right angles thereto and each provided with a slanting slot 38. In position for use these slots engage, respectively, lugs 39, either cast integral with or attached to the side of the magnet. The arm is held up in the proper position by the brace-arm 40, cast integral with the yoke 36 and provided at its lower end with an adjusting-screw 41, the point of which is adapted to engage a bearing-surface 42, provided for the purpose, on the face of the cover-plate. This arrangement for the attachment of the telescope and scale arm allows of ready adjustment of said arm and in addition permits of the arm being easily removed from the instrument and, if desired, hung up on the wall when not in use. Secured to the other end of said telescope and scale supporting rod is a flattened supporting-piece 43, to which is secured, by means of the thumb-screw 44, a bracket 45 in which is mounted the telescope 46 on adjustable screw-trunnions 47. Upon the upper portion of the bracket 45 is formed a scale-supporting bracket having a guide-support 48, adapted to engage the lower edge of the scale 49, and a guide 50, engaging the upper edge of the scale and carried upon the upright 51. Passing through the top guide 50 is a thumb-screw 52, by which the scale may be clamped in position. The screws 53 prevent the scale from being pulled out of its support.

For supporting the instrument against the wall I provide two adjustable hangers in the form of screw-eyes 54, screwed into the upper edge or top of the block 1. These screw-eyes may then be placed on two screws 55 or the like secured to the wall. By means of this arrangement the instrument may be readily leveled by merely adjusting the screw-eyes. On the block 1, near the lower edge thereof and outside of the instrument proper, I provide a pair of binding-posts 56.

Instead of using the galvanometer as a wall instrument it may obviously be mounted on a suitable stand or tripod by merely securing the stand or tripod to the lower edge of the magnet.

What I claim is—

1. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, and a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to register with and expose to view the moving system, substantially as described.

2. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to register with and expose to view the whole moving system, and a glass over said opening, substantially as described.

3. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an open-

ing arranged to expose to view the moving system, a telescope and scale supporting arm provided with a yoke arranged to extend across the face of said front plate and removably pivoted to the sides of said magnet, and an arm extending down from said yoke and arranged to brace the said arm against the said front plate, substantially as described.

4. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to expose to view the moving system, a telescope and scale supporting arm provided with a yoke arranged to extend across the face of said front plate and removably pivoted to the sides of said magnet, a downwardly-extending arm for bracing the telescope and scale arm, and an adjusting-screw carried by the lower end of said arm and arranged to engage the said front plate, substantially as described.

5. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces and an opening through its top for a suspension, a suspension-tube mounted upon the top of said magnet and arranged to register with said opening, an adjustable suspension-head at the upper end of said tube, a suspension secured to said head, a substantially rectangular elongated movable coil supported by said suspension between the poles of said magnet, the said magnet forming the sides of an inclosing case for the moving system, a mirror mounted above said coil, a stationary iron core around which said coil is arranged to move, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to expose to view at all times the whole of the moving system, a glass over said opening, a telescope and scale supporting arm provided with a yoke arranged to extend across the front face of the instrument and removably pivoted to the sides of said magnet, and a downwardly-extending arm for bracing the said telescope and scale arm, and an adjusting-screw carried by the lower end of said arm and arranged to engage the front of the instrument, substantially as described.

6. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet, which magnet forms the sides of an inclosing case for said system, a base-block having a flat face extending over one of the faces of said magnet and forming the back of said case, adjustable leveling devices secured to said base for supporting the instrument, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening therein arranged to expose to view, at all times, the whole of the suspended system, a telescope and scale supporting arm removably pivoted to the sides of said magnet and provided with a downwardly-extending arm arranged to brace the said telescope and scale arm against the front of the instrument, substantially as described.

7. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet, which magnet forms the sides of an inclosing case for said system, a base-block having a flat face extending over one of the faces of said magnet and forming the back of said case, screw-eyes screwed into the upper edge of said base-block and forming adjustable leveling means for supporting the instrument in a pendent position, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening therein arranged to expose to view, at all times, the whole of the suspended system, a telescope and scale supporting arm removably pivoted to the sides of said magnet and provided with a downwardly-extending arm arranged to brace the said telescope and scale arm against the front of the instrument, substantially as described.

8. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, of a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to expose to view at all times the whole of the suspended system, a telescope and scale supporting arm provided with a yoke at one end arranged to extend across the face of the instrument and provided with rearwardly-extending arms each having near its end a slot, a lug on each side of said magnet adapted to be engaged by said slots, a downwardly-extending arm projecting from said yoke for bracing said telescope and scale arm, and an adjusting-screw passing through the lower end of said arm and arranged to engage the front plate of the instrument, substantially as described.

9. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel faces, of a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate adapted to extend over the other face of said magnet to form the front of said case, said plate having an opening arranged to expose to view the whole of the moving system, said plate being further provided at its upper end with an aperture leading into an upwardly-extending slot narrower than the diameter of said aperture, and also with an upwardly-extending slot opening through the lower edge of said plate, an attaching-screw having a head which will pass through said aperture but not through the slot communicating therewith and screwed into the upper end of said magnet, and a second attaching-screw screwed into the outer face of said magnet near its lower end and arranged to pass through the said slot in the lower end of the front plate of the instrument, substantially as described.

10. In a galvanometer, the combination with a moving-coil system, of a removable damping attachment consisting of a non-magnetic metal loop of substantially the same shape as the movable coil, and means for detachably securing said loop to said coil.

11. In a galvanometer, the combination with a moving-coil system, of a removable damping attachment consisting of a non-magnetic metal loop of substantially the same shape as the said moving coil, two upwardly-extending retaining-hooks arranged to project from the lower end of the said moving coil to one side thereof for holding the lower end of the damper, and two resilient hooks secured to the upper end of said coil and arranged to engage the upper portion of said damper to hold the same in position, substantially as described.

12. In a galvanometer, the combination with a consequent-pole field-magnet having two substantially parallel flat faces, a moving system suspended between the poles of and surrounded by said magnet which forms the sides of an inclosing case for said system, a removable damping attachment consisting of a non-magnetic metal loop, means for detachably securing the said loop to the coil of said moving system, a covering extending over one of the faces of said magnet and forming the back of said case, a removable plate secured to and extending over the other face of said magnet and forming the front of said case, said plate having an opening arranged to expose to view the whole of the moving system, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN F. NORTHRUP.

Witnesses:

JOHN B. HENKELS,

W. PRESTON RASIN.