May 12, 1931. J. E. ESHBAUGH 1,805,447

AMMETER

Filed April 19, 1929

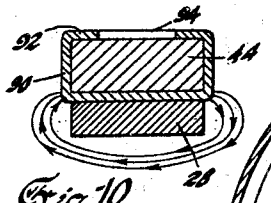


Fig. 10

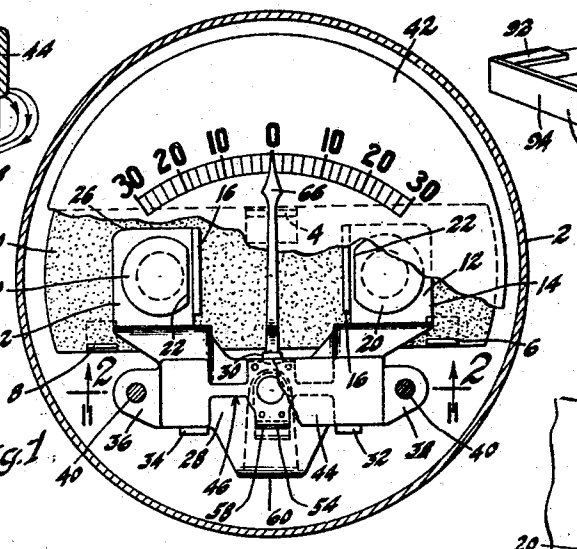


Fig. 1

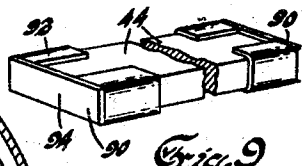


Fig. 9

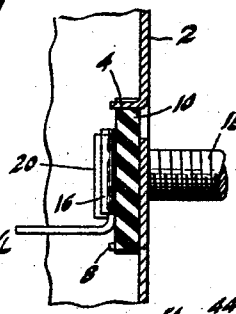


Fig. 4

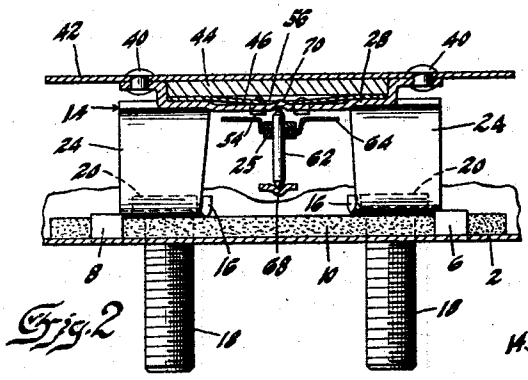


Fig. 2

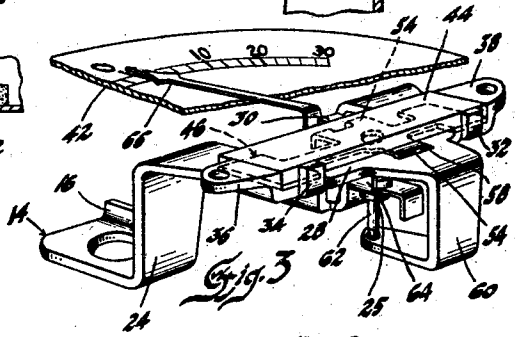


Fig. 3

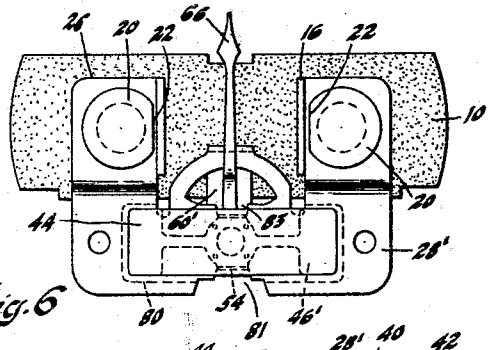


Fig. 6

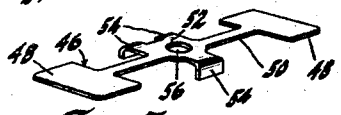


Fig. 5

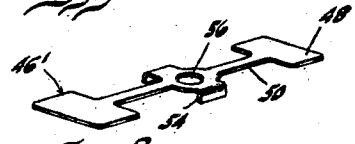


Fig. 8

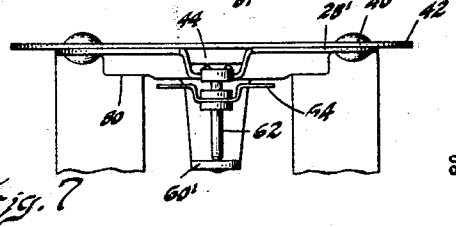


Fig. 7

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Patented May 12, 1931 1,805,447

UNITED STATES PATENT OFFICE

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AMMETER

Application filed April 19, 1929. Serial No. 356,478.

This invention relates to electrical measuring instruments and has particular reference to improvements in ammeters.

In ammeters in use today, where the permanent biasing magnet is positioned closely adjacent the conductor, it has been found that the lines of force of the conductor tend to demagnetize or de-energize the permanent magnet and thereby interfere with the proper operation of the ammeter. It is an object of the invention to provide a means which will prevent the demagnetization of the permanent magnet. This object is accomplished by placing between the magnet and conductor a soft iron plate or piece of metal which will concentrate the lines of force of the conductor and thereby remove the de-energizing force from the permanent magnet. The magnet is preferably mounted directly on the conductor but if desired it may be positioned in a depression formed in the conductor.

The piece of soft iron which serves to concentrate the magnetic lines of force is preferably provided with enlarged ends which are positioned directly at the poles of the magnet in order to pull away from the magnet the lines of force of the conductor. The soft iron piece therefore serves to shunt the lines of force by providing an iron path instead of the usual air path.

The invention also aims to provide a plurality of tongues on the instrument casing to position the insulating strip on which the frame and conductor of the instrument are mounted; and to provide a means for holding the securing bolts in place and at the same time preventing tilting of the frame when the bolts are applied. This latter is accomplished by providing the feet of the conductor frame with flanges which are positioned in a plane transverse to the plane of the legs of the frame. As the bolts are applied the flat sided heads will strike against the flanges and prevent the tilting of the frame.

On the drawings:

Fig. 1 is a front view of an ammeter with the dial removed and parts broken away and shown in section for purposes of clearer illustration.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of the conductor frame and the mechanism of the ammeter.

Fig. 4 is a detail view of the means for positioning the insulating material on the casing.

Fig. 5 is a perspective view of the soft iron flux concentrating piece.

Figs. 6 and 7 are plan and side views of a modification.

Fig. 8 is a perspective view of the flux concentrating piece used in Figs. 6 and 7.

Fig. 9 is a view of a permanent magnet with a modified form of flux concentrating means.

Fig. 10 is a section through the conductor, flux concentrator, and permanent magnet showing the concentration of the lines of force of the conductor away from the magnet.

Referring to the drawings, 2 indicates the case of an ammeter. The case is provided at its bottom with the integral tongues 4, 6 and 8, the purpose of which is to suitably position the insulating material 10. By referring to Fig. 1 it will be noted that but one tongue 4 is provided on one side, while the two tongues 6 and 8 appear on the opposite side of the insulation 10.

On the insulation 10 there are positioned the feet 12 of the conductor frame 14. The feet are provided with the flanges 16 on their inner sides and likewise with suitable openings to allow for the passage of the terminal bolts 18. Each terminal bolt has the head 20 provided with a flat 22 which is adapted to abut against or conform to the flange 16 as shown in Figs. 1 and 6. This structure is an improvement over prior devices in that when the bolts 18 are rigidly applied to hold the feet in place, the flats 22 and flanges 16 will tend slightly to bend the legs 24 toward each other or tend to push the flanges 16 slightly inwardly. If the flat 20 were shifted through 90 degrees so as to press against either the legs 24 of the frame 14, or against a flange positioned at the edge 26, the application of the bolts 18 would tend to tilt the whole frame either forward or backward, a feature which has been found to be very objectionable. With the construction as shown there will be no tilting of the frame.

The integral conductor 14 includes the bridge 28 which connects the legs 24. The

bridge is provided with the tongues or ears 30, 32, 34, 36 and 38, all of which are upwardly bent away from the conductor. Two of the ears 36 and 38 are provided with openings adapted to receive rivets 40 which secure the dial 42 in place.

Received between the ears 30—38 inclusive is the permanent magnet 44. By referring to Figs. 1, 2 and 3, it will be apparent that the ears hold the magnet against transverse movement in all directions.

Positioned between the magnet 44 and the bridge 28 of the conductor is the flux concentrating member or soft iron piece 46. This member is better shown in the perspective view in Fig. 5. The member comprises the enlarged end pieces 48 and the connecting arms 50. At its mid-portion it is provided with an enlarged portion 52 having the prongs 54 by means of which it is secured to the conductor bridge 28. An opening 56 is provided at its center for a purpose which will be later described.

By referring to Fig. 10 it will be seen that as the lines of force of the conductor pass between magnet and conductor the function of the enlarged ends 48 will be to concentrate the flux lines so as to divert them away from the magnet 44. The enlarged ends 48 therefore act as a shunt for the magnetic lines of force and prevent them from exerting their influence on the permanent magnet 44 which removes therefrom the tendency toward deenergization or de-magnetization.

The bridge 28 is provided with the opening 58 and with the arm 60 at one side thereof. The opening 58 is for the purpose of receiving the tongue 54 of the soft iron piece 46, while the arm 60 is suitably bent so as to underlap the bridge and serve as a mounting for the shaft 62 which has attached thereto the armature 64 and the pointer 66, held in place by means of the collars 25. Both the end of the arm 60 as well as the central portion of the bridge 28 are provided with depressed portions 68 and 70 which are adapted to receive the pointed ends of the shaft 62. The depressed portion 70 is received in the opening 56 in the flux concentrator 46.

By referring to Figs. 6 and 7 it will be noted that a modification of the invention is provided. The essential difference in this species resides in the provision in the conductor of a recess or depressed portion 80 which is adapted to receive the magnet 44 and the flux concentrator 46′. The flux concentrator is shown in Fig. 8 and is essentially the same as that shown in Fig. 3, except that it has but two prongs or tongues 54 instead of three shown in Fig. 5. Both the flux concentrator 46′ and the magnet 44 are mounted in the depression 80 so as to leave the magnet substantially flush with the top thereof. This construction results in the elimination of the ears 30—38 inclusive. The dial 42 is mounted by means of the rivets 40 directly on the bridge 28′. The central part of the bridge 28′ is provided with a pair of cut-outs 81, 83 and each prong 54 is received in one of the cut-outs.

By referring to Figs. 9 and 10 it will be seen that a modified form of flux concentrator is provided. In these figures the flux concentrators are formed of end caps 90 having suitable bendable flange portions 92 and 94 which extend about the permanent magnet 44. The pieces 90 are shown as separated in Fig. 9, but if desired they may be united by means of connections similar to that shown at 50 in Figs. 5 and 8 and the flux concentrator slipped onto the magnet by allowing one of the flanges 90 to remain unbent until the concentrator is placed on the magnet. The operation of the flux concentrators of Fig. 9 is the same as that of Figs. 2 and 6.

In the species of Figs. 6 and 7 the arm 60′ is bent from the side of the frame opposite that of the species of Fig. 3 and is provided with a suitable opening to allow for the passage and swing of the pointer 66.

I claim:

1. In an electric measuring instrument, a conductor, a magnet secured to the conductor, and a soft iron member positioned between the conductor and the polar areas of the magnet to concentrate the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

2. In an electric measuring instrument, a conductor, a magnet secured to the conductor, and means comprising magnetic material having enlarged ends interposed between said conductor and magnet to concentrate the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

3. In an electric measuring instrument, a conductor, a magnet secured closely adjacent the conductor, and an iron member secured adjacent the conductor in extension over the polar area of the magnet for concentrating the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

4. In an electric measuring instrument, a conductor, a magnet, and a soft iron member having enlarged ends positioned adjacent the conductor and magnet to concentrate the lines of force of the conductor to reduce the effects of demagnetization of the magnet.

5. In an electric measuring instrument, a supporting frame acting as a conductor, a magnet mounted on said frame, a piece of iron mounted on said frame and adapted to concentrate the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

6. In an electric measuring instrument, a conductor, a depressed portion on said conductor, a magnet seated in the depression,

and means in the depression to concentrate the lines of force of the conductor to decrease the effects of demagnetization on the magnet.

7. In an electric measuring instrument, a conductor, a depressed portion on said conductor, a magnet seated in said depressed portion, and a piece of iron between said conductor and magnet for concentrating the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

8. In an electric measuring instrument, a conductor, a depressed portion on said conductor, a magnet seated in said depressed portion, and a piece of iron between said conductor and magnet, said piece of iron having enlarged ends adjacent the poles of the magnet for concentrating the lines of force of the conductor to reduce the effects of demagnetization on the magnet.

9. In an electric measuring instrument, a conductor, a magnet rigidly held on said conductor, and a piece of iron between said conductor and magnet to concentrate the lines of force of the conductor to reduce the effect of demagnetization of the magnet, said piece of iron having enlarged ends at the poles of the magnet and fingers at its mid portion by means of which it is secured to the conductor.

10. In an electric measuring instrument, a conductor, a magnet positioned on the conductor, and a piece of iron between said conductor and magnet to concentrate the lines of force of the conductor to reduce the effects of demagnetization on the magnet, said conductor having an opening and said piece of iron having a tongue received in the opening to hold the piece of iron on the conductor.

11. In an electric measuring instrument, a casing, a supporting frame in the casing, insulating material between the frame and casing, tongues pressed from the casing to position said insulating material, and means to secure the frame and insulating material to the casing.

12. In an electric measuring instrument, a casing, a supporting frame in said casing, insulating material between the frame and casing, a plurality of tongues pressed from said casing and engaging said insulation on one side thereof, a single tongue pressed from said casing and engaging said insulation on the other side, said tongues positioning said insulation in said casing, and means to secure said frame and insulation to said casing.

13. In an electric measuring instrument, a casing, a frame in said casing, feet on said frame, legs integral with said feet, bolts to secure said feet to said casing, a flat on the head of each bolt, and a flange on each foot against which the flat abuts to prevent relative rotation of the bolts and frame, said flange positioned in a plane intersecting the plane of the legs whereby to prevent tilting of the frame when the bolts are applied.

14. In an electric measuring instrument, a conductor, a pointer having an armature rigidly mounted relative thereto and subject to the field of the conductor, a magnet mounted adjacent the conductor, and a piece of iron having a portion to concentrate the magnetic flux of the conductor for the armature and other portions to concentrate the conductor's lines of force at the ends of the magnet to prevent demagnetization of the magnet.

In testimony whereof I affix my signature.

JESSE E. ESHBAUGH.