

June 3, 1930.

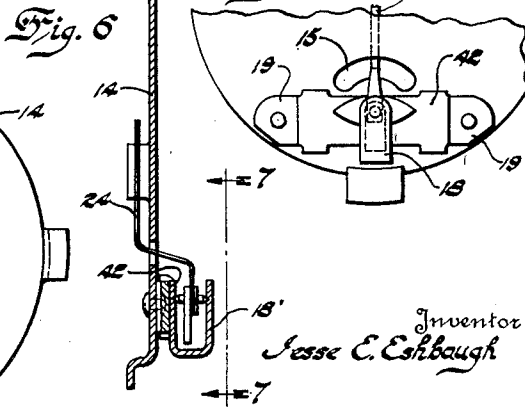
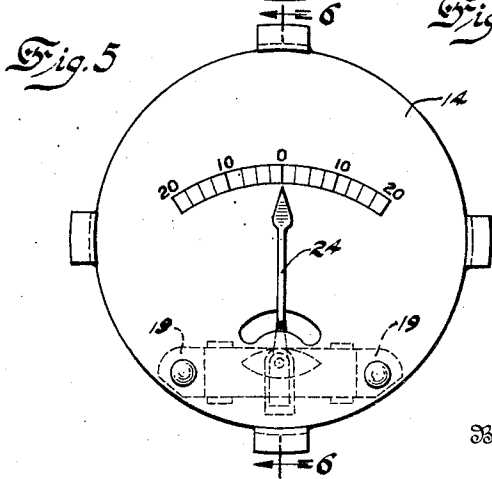
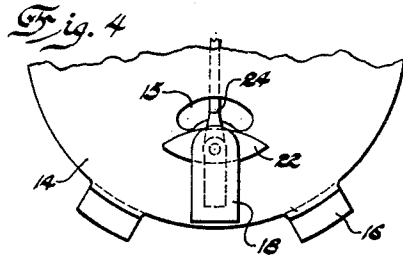
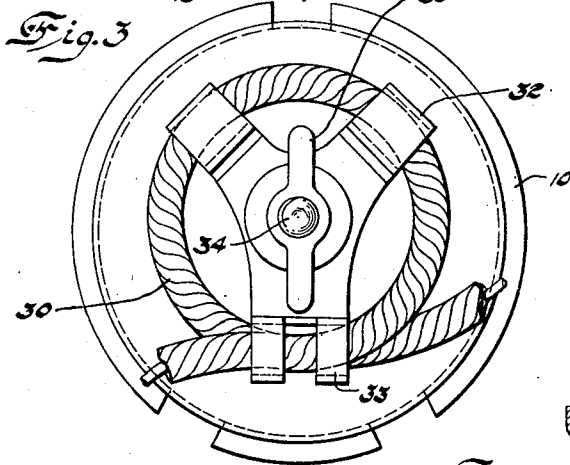
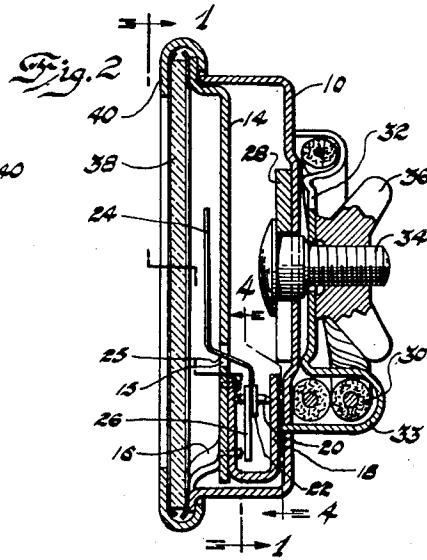
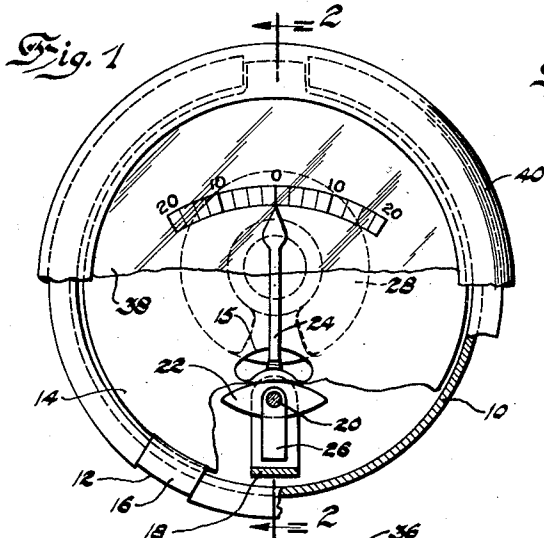
J. E. ESHBAUGH

1,761,908

AMMETER

Filed Aug. 19, 1927

2 Sheets-Sheet 1



Inventor
Jesse E. Eshbaugh

By Blackmore, Spencer & Hall
Attorneys

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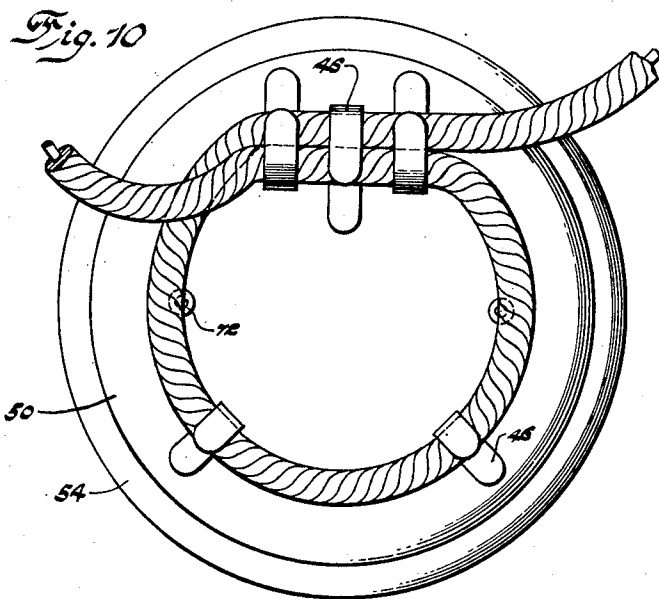
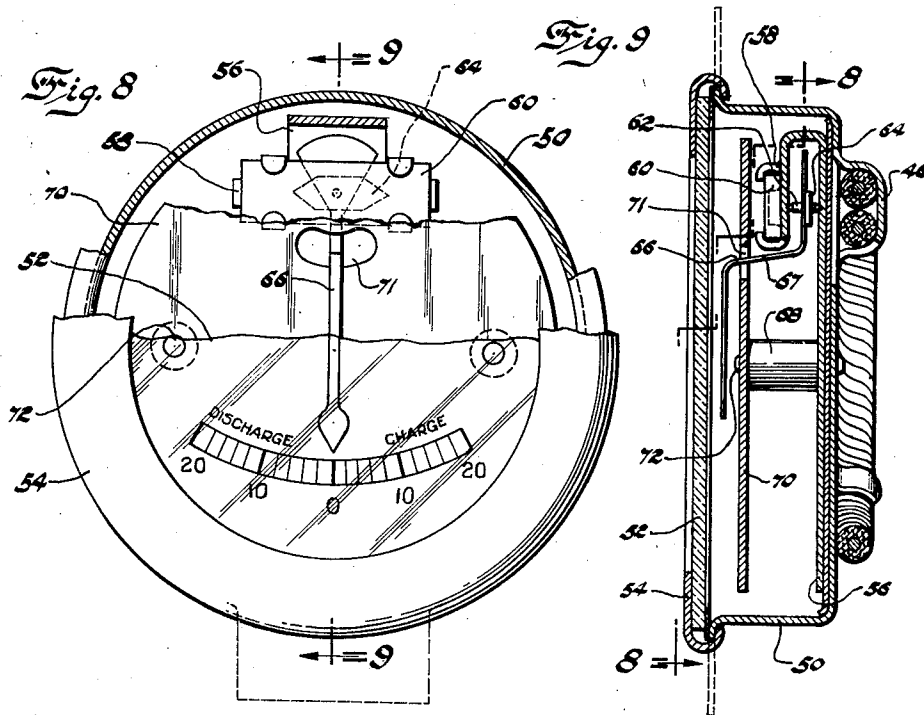
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AMMETER

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2 Sheets-Sheet 2



Inventor
Jesse E. Eshbaugh

By *Blackwell, Spencer & Paul*
Attorneys

UNITED STATES PATENT OFFICE

JESSE E. ESHBAUGH, OF FLINT, MICHIGAN, ASSIGNOR TO A C SPARK PLUG COMPANY,
OF FLINT, MICHIGAN, A COMPANY OF MICHIGAN

AMMETER

Application filed August 19, 1927. Serial No. 214,159.

This invention relates to ammeters and more particularly to those of the type ordinarily mounted on the dashboard of an automobile to indicate the direction and magnitude of the flow of current through the electrical system.

In ammeters of this type, simplicity is a cardinal requirement. This is necessary in the interests of long life and uniform good service, in economy of manufacturing, and in ease of assembling. It is desirable in any electrical device that there be a minimum of the surface of the conductor left uninsulated, consistent with good service. An uninsulated surface always carries with it the probability of a short circuit, with the consequent inaccuracy in the operation of the instrument and probably injury to the surrounding material. It is for these reasons that it is desirable that an ammeter be without terminals. Each terminal must of necessity have a certain amount of uninsulated surface, which is objectionable for the reasons stated above. A further disadvantage is that the contact may become loose as a result of the vibration of the car.

It was with the object in view of avoiding the difficulties enumerated that the present device was evolved. It is the object of the present invention to provide a simple yet efficient ammeter which is mounted in an insulated casing without terminals for the conductor. It is the object to so construct the ammeter that the insulated conductor, ordinarily an insulated copper wire, may be fastened in a predetermined position on the back of the case by a simple clamp. The magnetic lines of force incident to the passage of a current through the conductor then extend within the casing and their direction and magnitude are measured by a magnet controlled armature connected with an indicating needle.

Other objects of the invention will appear in the course of the following description, taken in connection with the accompanying drawings and appended claims.

In the drawings:

Figure 1 is a front view of my ammeter with parts broken away along the line 1—1

of Figure 2, this embodiment including a horseshoe magnet.

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

Figure 3 is a rear view showing the conductor clamped to the back side of the case.

Figure 4 is a section along the line 4—4 of Figure 2.

Figure 5 is a front view of the device, with the bezel and glass cover removed, showing a bar magnet and armature, which are underneath the dial, in dotted lines.

Figure 6 is a section on the line 6—6 of Figure 5.

Figure 7 is a front view of part of the casing with the dial removed.

Figure 8 is a front view of a further modification of my device, with parts broken away as indicated by the line 8—8 in Figure 9.

Figure 9 is a section on the line 9—9 of Figure 8.

Figure 10 is a rear view showing the means for fastening the coil of the conductor.

Referring to Figures 1 to 4 in the drawings, the numeral 10 indicates a substantially cup-shaped case composed of a non-magnetic material such as aluminum. The rim of the case is bent out, the bent out or flanged portion being cut away at spaced intervals, as at 12. The numeral 14 indicates a dial which fits over the face of the case, the dial being provided with spaced flanges 16 for fitting in the cut away portions 12 of the case. Riveted or otherwise fastened to the underside of the dial is the U-shaped frame or bearing member 18 provided with punched cone-shaped bearing surfaces for rotatably supporting the shaft 20 on which is non-rotatably mounted the armature 22, needle 24 and the counterbalance weight 26 for the needle. The needle is ordinarily made of aluminum and the counterbalance ordinarily but not necessarily of some heavier non-magnetic material. The needle is provided with an offset portion 25 which extends through the arcuate slot 15 in the dial for permitting swinging of the needle. The armature is of magnetic

material. With this construction, the dial, needle and armature are mounted in the case as a unit.

A permanent horseshoe magnet 28 is used in the present embodiment and fits within the case against the back side. At 30 I have indicated the insulated conductor through which the current to be measured passes. A loop of this conductor is held against the back of the case by the U-shaped clamp 32.

A bolt 34 extends through the center of the horseshoe magnet 28, the back of the case 10 and the clamp 32. The parts are held clamped together by the wing nut 36. I have illustrated a single loop of the conductor, with the two unidirectional strands of the conductor fixed directly in rear of the armature and held by the U-shaped portion 33 of the clamp. As it is the field of force around the conductor adjacent the armature that acts to deflect the needle during the passage of the current, that part of the conductor within the U-shaped portion 33 of the clamp 32 is hereinafter called the operating section of coil.

It is well-known that the strength of the magnetic field about a conductor through which a current is flowing is dependent, among other factors, on the magnitude of the current and the number of turns of the coil at that point. With this in view, I do not wish to be limited to two strands of the conductor through the operating section, as one may be sufficient or more than one may be desirable.

In the present embodiment I have constructed the Y-shaped or three-armed clip 32 of magnetic material, such as steel. With the parts in position as illustrated and with a current flowing through the conductor, the U-shaped portion 33 of the clip acts to concentrate the resultant magnetic lines of force through a fixed arc across the terminals of the U. The location of the arc and the magnitude of the field are not measurably affected by looseness or movement of strands of the operating section. While one side of the U-shaped portion 33 merges into the rest of the clamp 32, its operation in concentrating the lines of force as described is substantially the same as if the portion 33 were a separate clip. The concentration of the magnetic lines of force in an arc adjacent the armature as described gives a stronger armature deflecting force for a given current than would be obtained without such a device.

At 38 I have indicated the transparent cover, ordinarily of glass, and this is held to the case by the bezel 40. The shape of the bezel is determined by the requirements of the panel or the dashboard on which it is mounted.

My device operates in the usual manner. When no current is flowing through the con-

ductor, the magnet 28 holds the armature with the needle in zero position, as indicated by the scale on the dial. As the current passes through the conductor a magnetic field is set up about the conductor. The field about the operating section is at right angles to the armature and its direction is determined by the direction of flow of the current through the conductor. The field thus set up tends to move the armature to a position perpendicular to or, in the case of a curved operating section, normal to the operating section. This force deflects the armature an angular distance proportional to the strength of the field, as the opposing force of the permanent magnet remains the same.

In Figures 5, 6 and 7, the structure is the same as that described except that the horseshoe magnet is omitted and a straight permanent bar magnet is used. The magnet 42 fits between the frame 18' and dial 14. In this modification the frame 18' is bent up on its edges and the two end portions 19 fixed to the underside of the dial by screws or rivets. In this modification, the dial, magnet, frame and needle and armature are mounted as a unit in the case.

In Figures 8, 9 and 10 I have illustrated a further modification. In these figures, I have shown the usual cup-shaped non-magnetic case 50 with its transparent face 52 and bezel 54. The non-magnetic frame 56 extends across the back of the case and is bent back at its upper end to provide a flanged portion 58 for supporting a bar magnet 60. Within the bent portion of the frame is journaled the shaft 62 on which is non-rotatably supported the armature 64 and counterbalanced needle 66. A spacing cylinder 68 separates the frame 56 and the dial 70, the parts being held firmly in place by a bolt or rivet 72 extending through the dial, frame and base of the case. The dial is provided with an arcuate slot 71 to allow lateral movement of the offset portion 67 of the needle.

The magnetic clamp is omitted from this modification. Instead, I provide punched out clips on the back of the case. In assembling, the conductor is looped through these clips and the clips bent in slightly to hold the loop in place. As indicated above, it is essential, in the absence of a magnetic concentrating element, that the operating section be held firmly in a fixed position.

In any of these modifications, the operating section need not be straight but may be curved, in which case the curve is arranged so that the armature is tangent to the curve at the point where it passes beneath the shaft on which the armature and needle are mounted.

While I have illustrated my improved ammeter as mounted in a separate case, its advantages may be secured in a larger case,

such as a separate instrument panel, which may carry other instruments and I desire the claims to be construed in view of this fact.

I claim:

5 1. In an ammeter, a case having pivotally supported therein an armature, a permanent magnet supported adjacent thereto and tending to hold said armature against movement, and a clamp removably fixed on the back of
10 said case and adapted to hold a loop of a conductor whereby an operating section comprising more than one strand of the conductor may be held in fixed position on the
15 back of the case adjacent the armature, and means for indicating the position of said armature.

2. In an ammeter, a case having movably supported therein an armature, a permanent
20 magnet tending to hold said armature against movement, a clamp removably connected to the back of said casing and formed adjacent the armature with a portion bent away from the case to receive an operating
25 section of a conductor whereby the lines of force about said conductor will be concentrated by said bent portion, and means for indicating the position of said armature.

3. In an ammeter including a case and a
30 permanent magnet, a clamp on the outside of said case and including a portion bent away from said case for holding an operating section of a conductor, said bent portion comprising magnetizable material adapted
35 to concentrate the lines of force adjacent the ends of said bent portion, a connecting element extending through said case and clamp for permitting removal of said clamp, an armature of magnetizable material movably supported within said case adjacent
40 said operating section and the poles of the magnet, and means for indicating the position of said armature.

4. In an ammeter, a case having movably
45 supported therein an armature, a permanent magnet tending to hold said armature against movement, a clamp on the back side of said case having a plurality of spaced arms for receiving a coil of a conductor, one
50 of said arms being disposed adjacent the armature for concentrating the field of force adjacent thereto, and means for connecting said clamp to said case.

In testimony whereof I affix my signature.

55 JESSE E. ESHBAUGH.