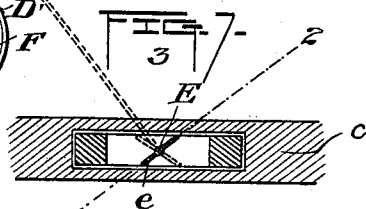
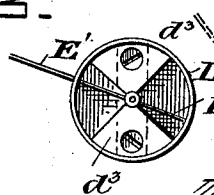
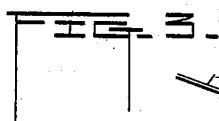
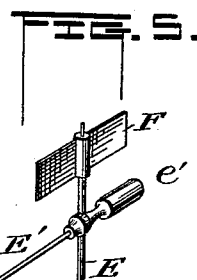
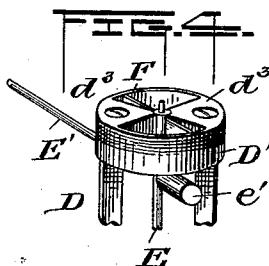
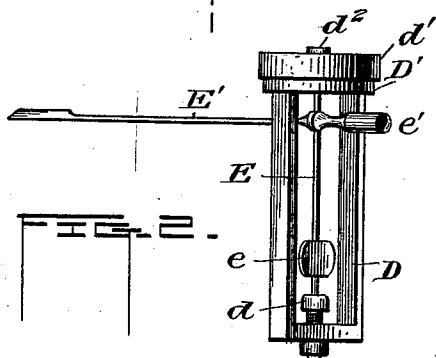
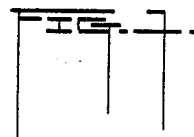
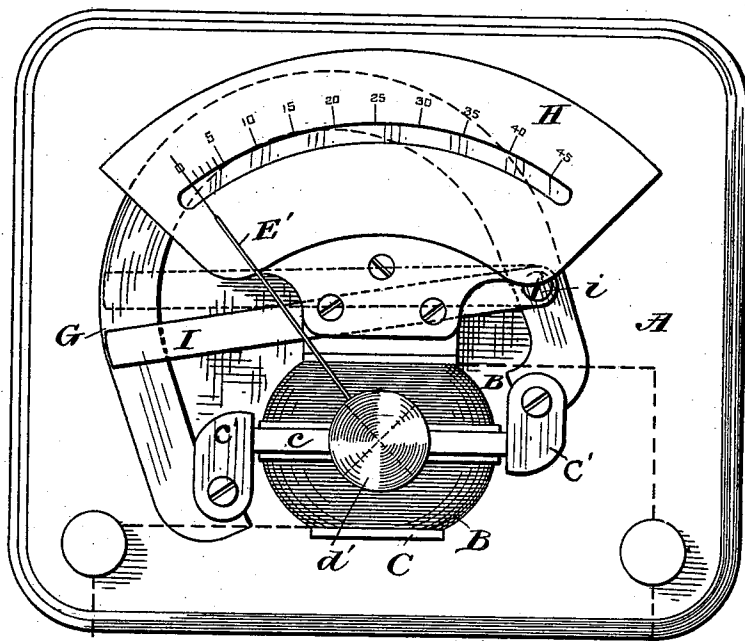


(No Model.)

E. R. KNOWLES.
VOLT METER.

No. 520,964.

Patented June 5, 1894.



Witnesses:

Nathan W. Loring
J. A. Comer

Inventor:

Edward R. Knowles
By Bently H. Bridges
att'y.

UNITED STATES PATENT OFFICE.

EDWARD R. KNOWLES, OF MIDDLETOWN, CONNECTICUT, ASSIGNOR TO THE SCHUYLER ELECTRIC COMPANY, OF CONNECTICUT.

VOLTMETER.

SPECIFICATION forming part of Letters Patent No. 520,964, dated June 5, 1894.

Application filed December 14, 1893. Serial No. 493,674. (No model.)

To all whom it may concern:

Be it known that I, EDWARD R. KNOWLES, a citizen of the United States, residing at Middletown, in the county of Middlesex and State of Connecticut, have invented certain new and useful Improvements in Voltmeters, of which the following is a specification.

The object of the invention is to enable the field coils to be brought close together so as to nearly surround the needle and thus give a stronger action thereon. The damping device is placed outside of the coils and consists of a fan blade in a closed chamber. The strength of the permanent magnet is adjustable by means of a soft iron bridge, and the magnet is set at an angle to the field coils in order to give the needle a longer range of movement.

In the drawings, Figure 1 is a front elevation of the instrument. Fig. 2 shows the removable needle frame, needle and index. Fig. 3 is a top plan view of the same with the cap removed. Fig. 4 is a perspective view of the upper part of the frame with the cap removed. Fig. 5 shows the spindle, index and fan. Fig. 6 is a cross section of the cap and Fig. 7 is a cross section of the frame.

On an insulating base A are mounted the field coils B wound on a core C of non magnetic material, and symmetrically arranged above and below a middle flange c on the core. In this flange is a transverse socket to receive snugly a removable frame D, preferably rectangular and quite thin, as shown in Fig. 2. The inner end of the frame carries an adjustable bearing d for the spindle E, the upper end of which passes through the bottom of a box D' forming the outer end of the frame. A cap d' closes the top of the box and has in it a bearing d² for the outer end of the spindle. These spindle bearings are preferably jeweled. The spindle carries the needle e of soft iron made quite thin to compel it to stand exactly in line with the lines of force. The index E' is also secured to the spindle at substantially right angles to the needle and is provided with a counterweight e' which tends to bring it to a vertical position. Inside the box are two radial partitions preferably quadrant sectors d³ placed opposite each other. The spin-

dle is provided with a fan F composed of two oppositely disposed blades, each lying in the space between the sectors. When the cover of the box is on, the fan makes a close fit with the inside of the box, but does not touch it at any point. Any movement of the spindle moves the fan with it, but because the fan fits closely in the box the air confined between it and the sectors cannot readily escape, and so the sudden movement of the spindle is damped.

The permanent magnet G is secured to non-magnetic ears c' on the core C with the line 1—2 joining its poles at an oblique angle to the vertical axis 3—4 of the core C, instead of at right angles thereto, as is usually the case. The object of this arrangement is to allow the needle to stand in the position in which it appears in full lines in Fig. 7, and to swing to the dotted line position when the index reaches the outer end of the graduated scale H. This not only permits the minimum thickness for the frame D, with the longest range for the needle and index, but also admits of a better division of the scale, the division being much more uniform and regular.

To facilitate the standardizing of the permanent magnets, I provide a movable soft iron bridge preferably consisting of a flat bar I spanning the poles of the magnet and serving to weaken its strength. The bridge is preferably hinged at one end on a screw i tapped into one leg of the magnet. By swinging the bar one way or the other, as indicated by the dotted lines, a position will be found at which the strength of the magnet will equal a given standard. The bridge is then secured in this position by setting up the screw. The bar also acts as an armature or keeper for the magnet and tends to keep it permanent in strength.

Having thus described my invention, what I claim is—

1. In a volt meter, a core containing a narrow transverse socket, in combination with a flat frame removably inserted in said socket and containing bearings for the needle spindle, substantially as described.

2. In a volt meter, the combination with a core having a transverse socket, of a flat frame removably inserted therein, and a spin-

dle mounted in bearings in said frame and carrying a thin needle, and a damping device, substantially as described.

3. In a volt meter, the combination with the
5 field coils, of a permanent horse shoe magnet arranged with its poles on a line oblique to the axis of the field coils, said coils lying between said poles, substantially as described.

4. In a volt meter, the combination with the
10 bobbin C having a central flat socket at right angles to its axis, of a horse shoe magnet G having its poles on each side of said bobbin on a line oblique to the axis thereof, and a frame D received in said socket and carrying
15 a needle e adapted to stand normally in the line between the poles of the magnet, substantially as described.

5. In a volt meter, a damping device for the
20 spindle, consisting of a fan secured to the spindle and inclosed in a box fitting it closely and provided with radial partitions, substantially as described.

6. In a volt meter, a damping device for the

spindle, consisting of a box containing two opposite sectors, and a fan composed of two
25 blades secured to the spindle and lying in the spaces between the sectors, substantially as described.

7. In a volt meter, the removable spindle frame D, carrying the bearing d, and the box
30 D' containing the sectors d³, and the cap d' having the bearing d², substantially as described.

8. In a volt meter, the combination with the permanent magnet, of a setscrew tapped into
35 one leg thereof, and a soft iron bridge bar hinged on said screw, and adapted to be clamped thereby when adjusted, substantially as described.

In testimony whereof I have hereunto set
40 my hand in the presence of two witnesses.

EDWARD R. KNOWLES.

Witnesses:

D. J. GLAZIER,
F. S. CODY.