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COMPENSATED ELECTRICAL RECTIFIER AND METER

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FIG. 1

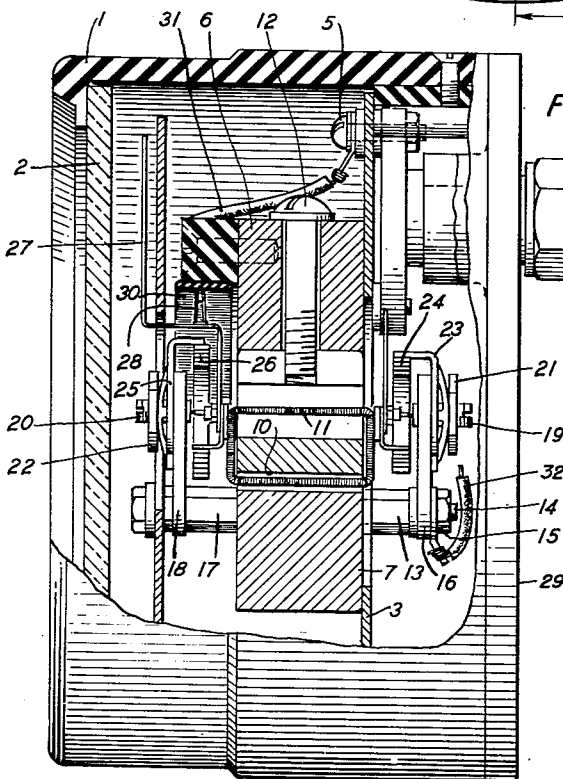
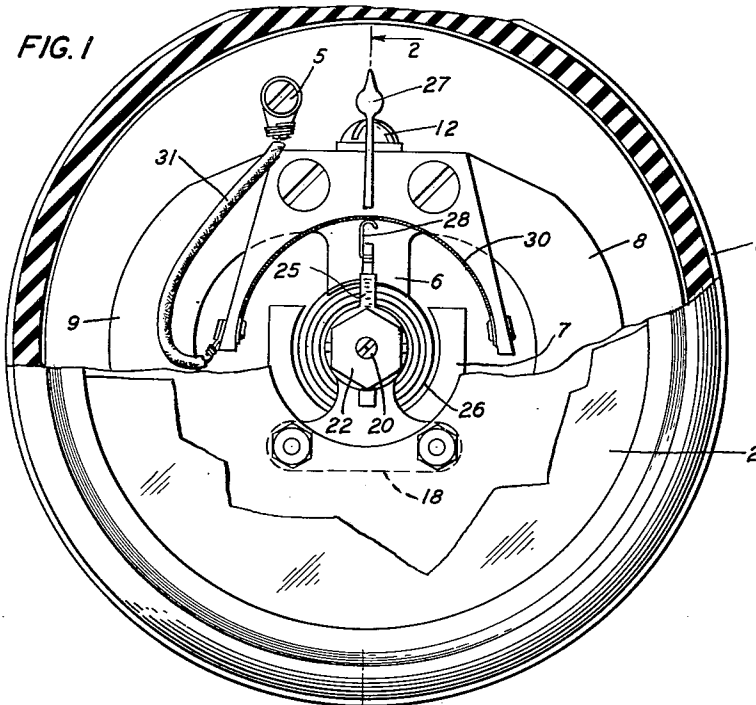
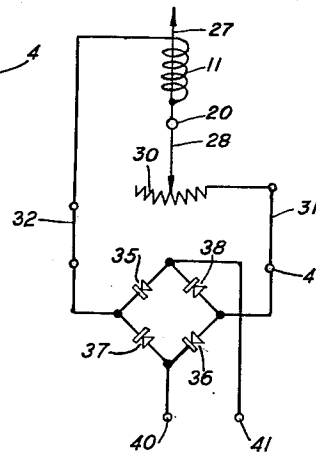


FIG. 2

FIG. 3



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1

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COMPENSATED ELECTRICAL RECTIFIER
AND METER

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3 Claims. (Cl. 324—119)

This invention relates to alternating-current meters for
use in circuits of relatively low impedance.

The object of the invention is means to compensate for
the variations in the impedances of the rectifier elements
forming part of the metering combination.

A feature of the invention is a resistor connected in
serial relationship with the meter and varied by the meter
movement to compensate for the variations in the impedances
of the rectifier elements.

Alternating-current meters commonly comprise a direct-
current meter of the d'Arsonval type connected to a recti-
fying network including one, or more, rectifier elements.
The rectifier elements are asymmetrically conductive de-
vices, such as thermionic diodes, or semiconductors, such
as copper-copper oxide couples. These elements usually
have a substantially exponential variation of impedance
with the amplitude of the current flowing in the element.
Thus, the impedance of the combination of meter and
network varies with the amplitude of the voltage or cur-
rent being measured. In accordance with the present
invention, a resistor is connected in serial relationship
with the meter, and is varied in resistance by the current
being measured to compensate for the variations in im-
pedance of the network.

In the drawings:

Fig. 1 shows a top view, in part section, of a meter
embodying the invention;

Fig. 2 shows a side view, in part section, of the meter
shown in Fig. 1; and

Fig. 3 shows in schematic form the complete metering
combination.

Figs. 1 and 2 disclose a conventional direct-current
meter, of the d'Arsonval type. While, for convenience
of description, a specific type of meter has been dis-
closed, the invention is not limited thereto, but may be
embodied in many other types of meters.

The case 1, which may be of metal, or some insulating
material, mounts the cover glass 2. A mounting plate 3
is secured to the enlarged base of the mounting stud 4
as by screw 5, but is insulated therefrom. Normally,
two or more, studs 4 are used, but only one has been
shown. The pole-pieces 6, 7 are secured to the mounting
plate 3 in any suitable manner, as by screws, not shown.
The magnets 8, 9 are pressed against the sides of the
pole-pieces 6, 7 and retained in position by magnetic
attraction. A cylinder 10, of magnetic material, slotted
longitudinally to admit the coil 11, is secured by screw 12
in contact with pole-piece 6, and forms with pole-piece 7,
an annular gap in which the coil 11 can move. A spacer
13 secured to the pole-piece 7, supports a plate 16, which
is secured to spacer 13 by screw 14 and nut 15, but
insulated therefrom. A similar spacer 17, secured to
pole-piece 7, supports the plate 18. The coil 11 is rota-
tably supported in jewelled bearings mounted in the
screws 19, 20, screwed through the plates 16, 18, and
retained by lock-nuts 21, 22.

The case 1 is completed by a rear cover plate 29, which

2

may be secured to the case 1 by screws, or by nuts on
the studs 4.

A washer 23, supported by the plate 16, is attached to
a hairspring 24, which is connected to the winding of
coil 11, and is secured to the former of coil 11, but insu-
lated therefrom. Similarly, a washer 25, supported by
the plate 18, is attached to hairspring 26, which is con-
nected to the winding of coil 11, pointer 27, and brush
28, and is secured to the former of coil 11, but insulated
therefrom.

The resistor 30 may be made of resistive material
shaped to produce the desired variation of resistance, or
of an insulating card, properly shaped and evenly wound
with enameled wire, which is suitably prepared to make
a good electrical contact with the brush 28. One end
of resistor 30 is connected by wire 31 and screw 5 to
the stud 4. The coil 11 is connected by wire 32 to the
other stud, not shown. Thus, current can flow from the
other stud, wire 32, plate 16, washer 23, hairspring 24,
coil 11, pointer 27, brush 28, winding 30, wire 31, screw
5, to stud 4.

As shown in Fig. 3, the meter is connected to a recti-
fier network, formed of the rectifier elements 35, 36, 37,
38, and the combination may be connected by terminals
40, 41 to the circuit to be tested.

The invention has particular utility in connection with
low current, and low voltage meters. Meters designed to
measure higher voltages are usually connected in series
with a high resistance, and this resistance is often so
large that the variations in the impedances of the varistors
are a small fraction of the total resistance, and, thus, may
not be of interest.

The invention may conveniently be described as em-
bodied in a db meter for audio frequency level measure-
ments in communication circuits, where it is desired that
the meter presents a constant impedance in the circuit.
The meter movement is actuated by currents up to 500
microamperes full scale, and is associated with a double
wave, bridge connected network of varistor elements of
the copper-copper oxide type.

The variation in terminal resistance of this typical meter
combination, and the values of the corrective resistor are
tabulated below for 1.5 and 3-volt ranges. The meter
coil has a resistance of 340 ohms; and the varistor resist-
ance is the effective resistance of the complete network.

Microamperes	Varistor Resistance	Terminal Resistance	Corrective Resist- ance	
			1.5-Volt Range	3-Volt Range
50.....	2,600	2,940	60	3,060
100.....	1,650	1,990	1,010	4,010
150.....	1,280	1,620	1,380	4,380
200.....	1,040	1,380	1,620	4,620
250.....	900	1,240	1,760	4,760
300.....	800	1,140	1,860	4,860
350.....	725	1,065	1,935	4,935
400.....	670	1,010	1,990	4,990
450.....	620	960	2,040	5,040
500.....	575	915	2,085	5,085

The fourth column of values of the corrective resist-
ance will produce a voltmeter having a range of 1.5 volts,
and a resistance of 2000 ohms per volt. The last column
gives the values of the corrective resistance for a similar
voltmeter having a range of 3.0 volts and a resistance of
2000 ohms per volt. It is evident that the added, con-
stant 3000-ohm resistance has materially reduced the
necessary range of variation of the corrective resistor.

What is claimed is:

1. Apparatus for measuring alternating currents com-
prising a rectifying network having an impedance vary-

3

ing with the rectified current and adapted to be connected to a source of current to be measured, a meter, and a resistor connected in series with said meter to said network and adjusted by said meter to compensate for the variation in impedance of said network.

2. Apparatus for measuring alternating currents comprising a bridge network of asymmetrically conductive elements having impedances varying with the amplitude of the rectified current and adapted to be connected to a source of current to be measured, a meter, and a resistor connected in series with said meter to said network and adjusted by said meter to compensate for the variations in impedance of said elements.

3. Apparatus for measuring alternating currents comprising a bridge network of copper-copper oxide couples,

4

a direct-current meter, and a resistor connected in series with said meter to said network and adjusted by said meter, said resistor having a resistance tapered in magnitude to compensate for the variation in impedance of said network.

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