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The Radio Club of America, Inc.

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SUGGESTIONS TO CONTRIBUTORS

CONTRIBUTORS to the Proceedings, by bearing in mind the points below, will avoid delay and needless expense to the Club.

1. Manuscripts should be submitted typewritten, double-spaced, to the Chairman of the Papers Committee.* In case of acceptance, the final draft of the article should be in the hands of the Chairman on or before the date of delivery of the paper before the Club.

2. Illustrations should invariably be in black ink on white paper or tracing cloth. Blueprints are inacceptable.

3. Corrected galley proofs should be returned within 12 hours to the office of publication. Additions or major corrections cannot be made in an article at this time.

4. A brief summary of the paper, embodying the major conclusions, is desirable.

5. The Club reserves the right of decision on the publication of any paper which may be read before the Club.

*For 1929 the Chairman of the Papers Committee is Mr. L. G. Pacent, 91 Seventh Avenue, New York City.

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A NEW TYPE OF MODULATION METER†

A Meter Indicating Directly the Percentage of Modulation

*By E. H. GREIBACH**

RADIO engineers are frequently confronted with the problem of measuring modulation. Modulation is defined as the ratio $\frac{A}{D}$ of two electrical quantities, A and D, where D represents the amplitude of oscillation for the unmodulated condition and A is the amount by which the amplitude D is increased or decreased during modulation.

In the case of a transmitting antenna, D is the amplitude of the unmodulated radio-frequency current and A is the amount by which the current amplitude varies during modulation. (See Fig. 1.)

It is ordinarily sufficiently satisfactory to indicate approximately the degree of modulation by merely measuring a quantity corresponding to A. In the case of a transmitting antenna this procedure is satisfactory because the value of D does not change greatly. The station operator is not vitally interested in the degree of modulation. Obviously, such a measurement gives the correct value of modulation for only one value of D. It is the purpose of this paper to describe a meter which will indicate directly the percentage of modulation regardless of the absolute values of A and D.

From the definition of modulation it is apparent that the meter in question must indicate directly the ratio of two electrical quantities. Therefore, the meter must be capable of indicating the ratio of two currents which are proportional to A and D respectively. Furthermore, the circuit energizing the meter must produce the two actuating currents. Such a circuit is shown in Fig. 2 as applied to a modulator of the Heising type.

The modulator supplies a variable voltage to the oscillator. This voltage is a d-c. voltage with a superposed variable audio-frequency voltage. The amplitude of the radio-frequency antenna current varies in the same way as the supplied voltage, therefore, the measurements of the ratio of the audio-frequency voltage to the d-c. voltage can serve as a direct indication of the percentage of modulation.

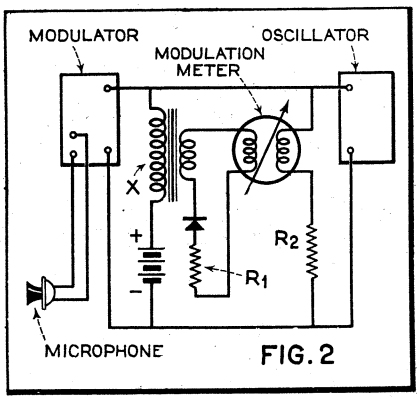


FIG. 2

Circuit for the modulation meter.

Description of Meter

Referring to Fig. 4, the modulation meter is shown with its two actuating windings, these windings being two bobbins moving in a steady magnetic field. One winding (B_2) is connected in series with resistor (R) across the supply voltage. The torque produced by this bobbin is proportional to the steady voltage(D). The other bobbin (B_1) is energized by a current proportional to the modulating voltage (A). This current is obtained by an auxiliary secondary winding wound over the modulator choke coil as shown in Fig. 2. The current supplied by this auxiliary winding is proportional to the voltage (A) and is rectified in order to produce torque in a permanent field. Instead of resorting to the auxiliary winding, the voltage drop across the choke coil (X) could be used. The ratio meter is designed in such a manner that the *position* of the pointer corresponds to the ratio of the currents actuating the bobbins. A suitable ratio meter for this work is described in the Appendix.

This modulation meter must be calibrated. For the purpose of calibration a cathode ray oscillagraph may be used. If the cathode ray oscillograph is not available, the following scheme can be used:

It is known that a current composed of d-c. and a-c. has an effective value which differs from its average value. If the effective and average values are known, the d-c. and a-c. components can be directly calculated. These values are easily measured by simply passing the current through an a-c. and a d-c. meter in series. (See Fig. 3.)

The a-c. meter measures the effective value and the d-c. meter measures the average value. If the d-c meter reading is maintained constant by means of a variable series resistance, the a-c meter can be marked to indicate directly the percentage of modulation. This arrangement can be used as a modulation meter, but requires an adjustment before making a reading.

The meter described is capable of measuring modulation correctly. It is, however, quite elaborate and expensive and may therefore be of value only as a laboratory device. The writer, however, is of the opinion that the principle involved is of sufficient academic interest to justify this paper.

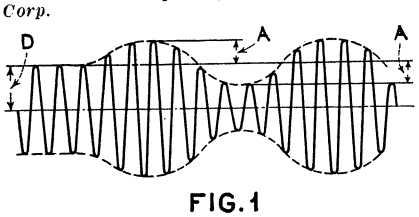


FIG. 1

D is the amplitude of the unmodulated r-f. current and A is the amount by which the current amplitude varies during modulation.

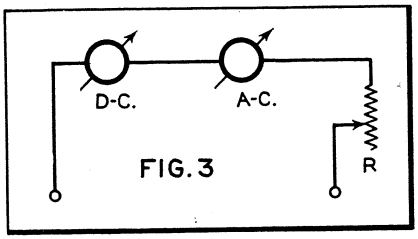


FIG. 3

Circuit arrangement of meters for determining d-c. and a-c. components.

† *Delivered before the Club, June 12, 1929.*

* *Research Engineer, Pacent Reproducer Corp.*

Appendix[1]

The meter contains a permanent magnet. In the cylindrical space between the poles of the permanent magnet is an eccentric core. In the eccentric core an opening is provided to receive a double bobbin consisting of two bobbins mechanically attached to each other and rotating about a common axis. The torques of the individual bobbins are arranged to oppose each other and the direction of the torque is such that each bobbin tends to move into a weaker field. For equilibrium the torques will be equal, therefore for a given ratio of currents the bobbin having the larger current will be in a weaker field. The torque is proportional to the product of the current and the flux density at a given deflection.

Therefore at equilibrium, (at the angle α)

$$C_1 I_1 H_{1\alpha} = C_2 I_2 H_{2\alpha}$$

$$\frac{I_1}{I_2} = \frac{C_2 H_{2\alpha}}{C_1 H_{1\alpha}} = \text{Constant.}$$

Where I_1 and I_2 are the currents in bobbins B_1 and B_2 respectively

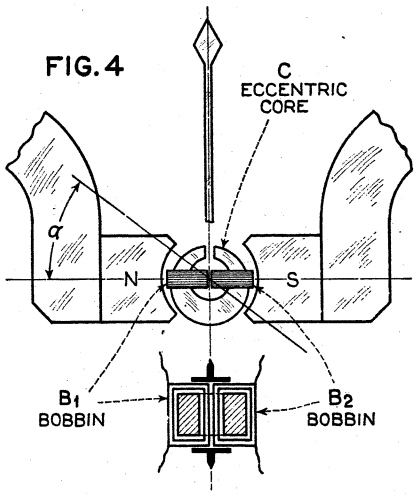
C_1 and C_2 are meter constants

$H_{1\alpha}$ and $H_{2\alpha}$ are the respective flux densities for the bobbins B_1 and B_2 at the position α.

The flux densities $H_{1\alpha}$ and $H_{2\alpha}$ are constant for a given angle. Therefore, a given ratio of currents is associated with a definite value of α without regard to the absolute values of the currents. Hence, the meter indicates directly the ratio of two currents.

[1] *The writer developed this meter in the laboratory of the Westinghouse Electric & Manufacturing Company as a temperature indicator and is indebted to Mr. B. H. Smith who originally suggested this development.*

FIG. 4



Details of the modulation meter.

CLUB NOTES

TESTIMONIAL DINNER TO CAPTAIN ROUND

As a pleasant variation of the usual monthly practice of the presentation before the membership and its guests at Columbia University of papers appertaining to the radio art, the Radio Club of America on October fourth at the Hotel McAlpin, New York, tendered a testimonial dinner to its honored guest, Captain Henry Joseph Round, of London, Chief Radio Engineer of Marconi's Wireless Telegraph Company, Limited. About sixty members and guests participated.

At the speakers' table were: Captain Round; Mr. Edwin H. Armstrong, Toastmaster; Mr. Lewis M. Clement, President; Messrs. David Sarnoff Robert H. Marriott and John V. L. Hogan, Honorary Club Members; Mr. Paul F. Godley. Draped above the speakers' table were British and American flags.

Captain Round spoke interestingly of his hitherto little-known contribution through radio channels toward the detection of the movements of the German fleet during the recent war, by direction finder means. This was a most important factor in deciding the battle of Jutland. Lantern slides served to illustrate the methods of making the necessary plottings of the war vessels' courses. Actual war-time wax records of intercepted signals of raiding Zeppelins, fed into amplifier equipment with power loudspeaker reproduction, terminated the dinner.

The early work of Captain Round in this country while with the Marconi Wireless Telegraph Company of America is quite generally known to radio pioneers, among his accomplishments here being the building of the Babylon station on Long Island about 1906.

New Members

Allen B. Dumont.
John J. Glauber.
Charles H. L. Isaacs.
Joseph H. Kerr.
Lawrence G. Kersta.
Joseph B. Miller.
Norman E. Wunderlich.
F. A. Klingenschmitt
(Elected a Fellow)
Paul G. Watson
(Raised to grade of Fellow)

New Business Connections

William F. Diehl.

Was ten years with A. H. Grebe & Co. Is now Assistant Chief Radio Engineer Product Design with the Audio Vision Appliance Company, Camden, N. J.

Carl Dreher.

Now Director of Sound at RKO and expects to remain out West for a year or two. Business address: RKO Studios, 780 Gower Street, Hollywood, California.

William N. Weeden.

Severed connections with Electrical Research Products, Inc., and is now in radio consulting business for himself.

Missing Members

If the present address of any of the following is known, please advise the Club office:

John S. Conway,
99 Oraton Street,
Newark, N. J.

Verner A. Hendrickson,
126 Wentworth Avenue,
Providence, R. I.

George E. Fleming,
44-15 - 43d Avenue,
Long Island City, N. Y.

Albert Strumza,
26 East 117th Street,
New York, N. Y.

Christopher G. Clarke,
157 Isabella Avenue,
Newark, N. J.

Harold W. Kephart,
110 Bridge Street,
Brooklyn, N. Y.

Alfred W. Saunders,
48 South 2nd Avenue,
Mt. Vernon, N. Y.

Fred Simpson, Jr.,
Box 2318,
Boston, Mass.

Alexander Strelzoff,
2164 Grand Avenue,
New York, N. Y.

Robert J. Sanford,
446 East 89th Street,
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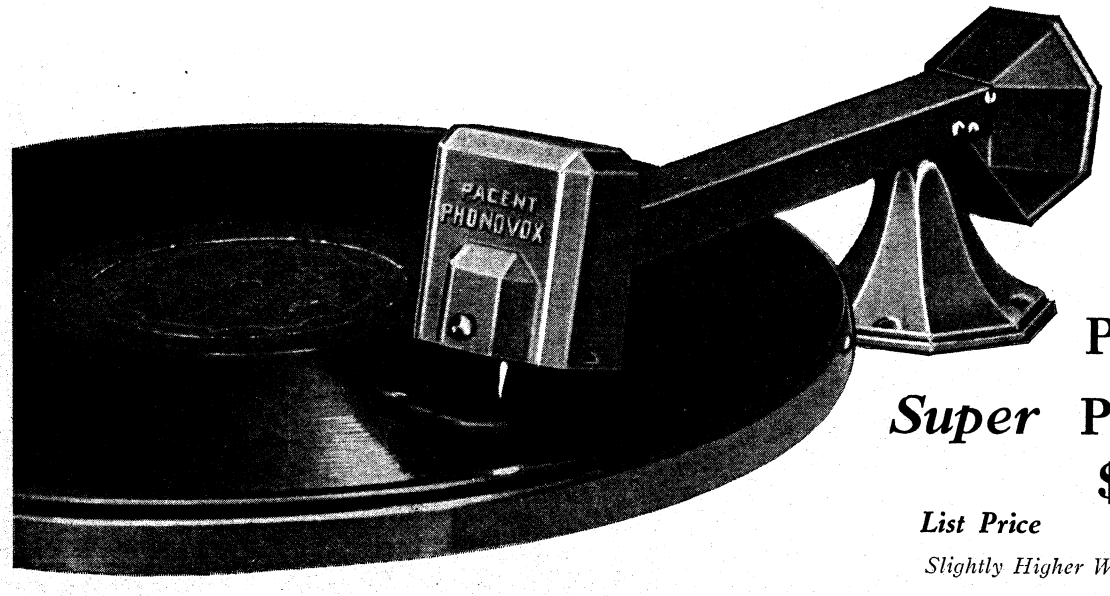

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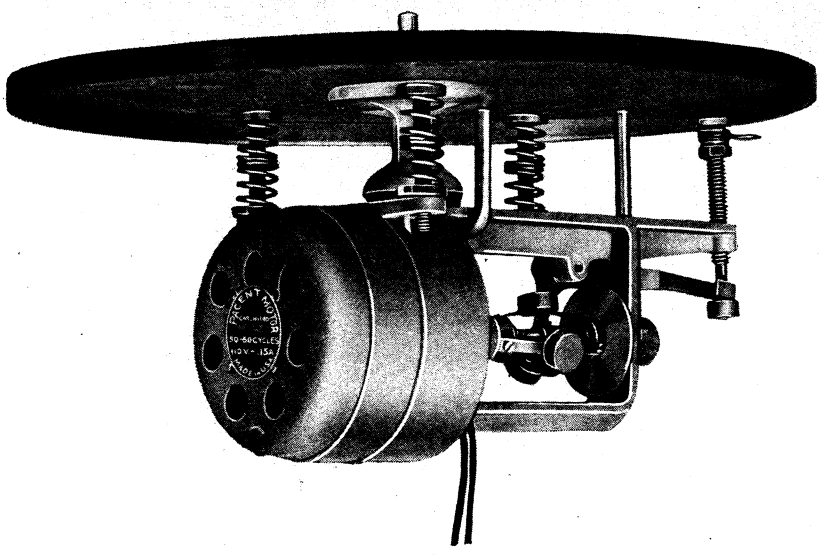

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