

into account in estimating the shifts accurately. A discussion of these applied to the band head shifts and the shifts in the rotational structure of the individual bands will be presented in detail elsewhere.

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¹ *Ind. Jour. Phys.* (in press).

² Jevons, *Report*, p. 209.

³ Tanaka and Koana, *Proc. Phys. Math. Soc.* (Japan), 1934, **16**, 365.

⁴ *Rev. Mod. Phys.*, 1935, **7**, 83.

⁵ Jeppesen, *Phys. Rev.*, 1934, **45**, 480.

⁶ Van Vleck, *Jour. Chem. Phys.*, 1936, **4**, 327.

MAGNETIC SUSCEPTIBILITY OF STRONTIUM

THE thermomagnetic properties of some sixty elements were measured in a comprehensive manner by Honda¹ and Owen.² The specific magnetic susceptibility of strontium was found to be -0.20 .³ The observed values of the susceptibility of this element were, however, all positive. Stoner⁴ suggested the possibility of an overcorrection for the relatively large iron content. In view of the present uncertainty of the susceptibility of strontium, a careful thermomagnetic investigation of this element was undertaken.

A pure Merck specimen of the metal was available. A spectroscopic examination showed traces of calcium and lead. The Curie method was adopted, taking small quantities of the fused metal in light pyrex glass bulbs. The susceptibilities were determined at field strengths between 3 and 8 kilogauss. The variation of the specific susceptibility with field strength showed traces of ferromagnetic impurities. The susceptibility at infinite field strength was determined from the $\chi, \frac{1}{H}$ graph. The mean specific susceptibility of strontium calculated from observations made on eight samples, was found to be $+1.05$. The element was thus found to be paramagnetic.

The gram atomic susceptibility of the metal is therefore $+92.0$. Kido's⁵ value for the ionic susceptibility of Sr^{+2} is -15.6 . This shows that the two valence electrons of the strontium atom have a susceptibility of $+107.6$ (per gram atom of the metal). The width of the occupied energy range in the completely degenerate state of the valence electrons works to about 0.6 volt. Our result supports Stoner's⁴ observation that in the alkaline earth elements, the electron energy bands are much narrower than for free electrons.

Experiments on the temperature variation of the paramagnetic susceptibility of strontium are in progress. A detailed account will be given elsewhere.

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¹ *Ann. der Phys.*, 1910, **32**, 1027.

² *Ibid.*, 1912, **37**, 657.

³ All susceptibility values are given in 10^{-6} unit.

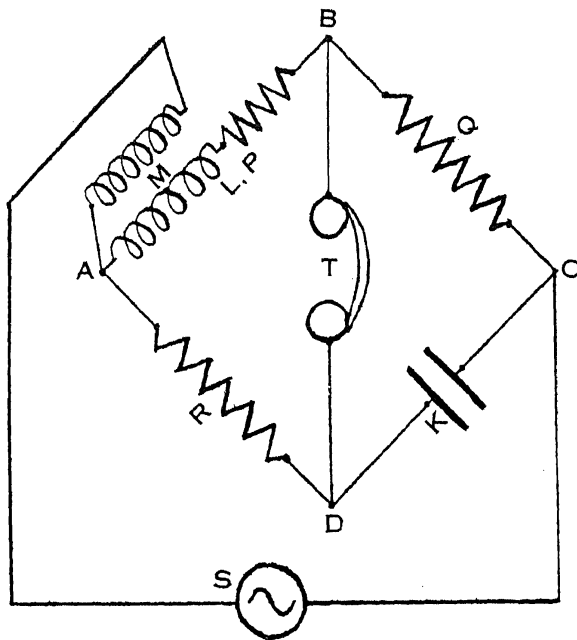
⁴ *Magnetism and Matter*, 1934, p. 512.

⁵ *Sci. Rep. Tohoku Imp. Univ.*, 1933, **22**, 835.

A BRIDGE METHOD FOR DETERMINING THE FREQUENCY OF AN ALTERNATING CURRENT IN THE AUDIO-FREQUENCY RANGE

THE various bridge methods for measuring the frequency of alternating current, so far suggested and employed, have been classified by Hague¹ with reference to their adjustment characteristics and their arm elements. The new bridge whose circuit diagram is shown below has an adjustment characteristic of the form $f = a\sqrt{x}$, which is a parabola.

The branch AB of the bridge contains the primary coil of the mutual inductor M; its self-inductance is L; in series with it an adjustable non-inductive resistance box is connected; P denotes the total resistance, including that of the coil, in the branch AB.



The arms BC and AD contain adjustable non-inductive resistance boxes only; K is a good mica condenser in the branch DC; one end of the secondary coil of the mutual inductor M is connected to that of the primary at A and the other end is connected to the source S of the alternating current whose frequency has to be estimated; T is a telephone used as a detector of the balanced state.

Applying Kirchhoff's rules to the meshes of the impedance network carrying harmonic alternating current and simplifying the equations thus obtained, we get for zero current in the telephone the following two conditions:—

$$(1) \frac{L+M}{K} = QR;$$

$$\text{and } (2) \omega^2 = \frac{P}{KMQ},$$

where $\omega = 2\pi \times \text{frequency}$.

These conditions of balance can be secured without mutual interference by making R the variable in (1), and P the variable in (2). The practical procedure is as follows: L, M, K and Q being fixed, balance, i.e., silence in telephone is attained by successive adjustment of R and P. The process is easy and rapidly convergent since the two conditions of balance are mutually independent. When the proper values of P and R have thus been fixed up for any frequency, the first condition which is independent of frequency remains satisfied for

all frequencies and the bridge may now be employed for determining various frequencies by altering P alone, so that virtually a single adjustment is all that is needed in order to measure the frequencies.

The formula representing the frequency f may be written

$f = a\sqrt{P}$, where $a = (2\pi\sqrt{KMQ})^{-1} = \text{a constant}$. The details of the theory of this frequency bridge and measurements with it will be published elsewhere.

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¹ B. Hague, *Alternating Current Bridge Methods* (Pitman, 1938) p. 515.

CHROMOSOME NUMBER OF *SESAMUM RADIATUM*, SCHUM AND THONN. BESKR.

IN connection with breeding work on *Sesamum indicum*, L. various types and certain other species of *Sesamum* have been collected in this Section. Seeds of *Sesamum radiatum* which occurs in a wild state in tropical Africa were obtained from Yandev, Makurdi in Nigeria in 1933 through the kind courtesy of the Superintendent of Agriculture, Nigeria. Since then, this species has been grown with fair success at Coimbatore and at the Agricultural Research Station, Tindivanam. The chromosome number of this species has been determined to be $2n = 64$ (Fig. 1), the technique employed being

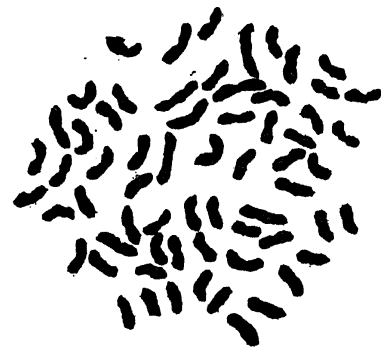


FIG. 1
 $\times 3500$.