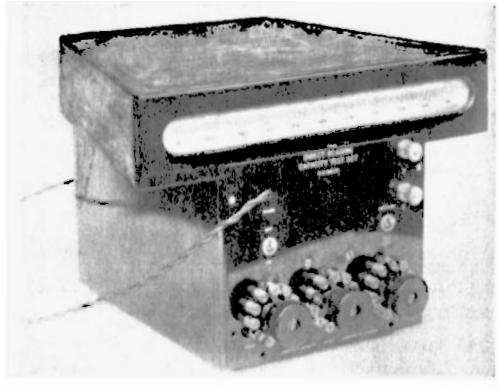
for the sorting of condensers between certain limits, such as occurs in mass production wireless components.

The principle upon which the instrument works is very simple. A vibrating contact allows the condenser under test to be charged, and then discharges it through the galvanometer, giving a sustained deflexion proportional to the quantity of electricity discharged exactly like the operation of the Fleming commutator*. When frequency-controlled mains are available the vibrator contact is a specially designed relay, the tongue of which performs the charging and discharging of the condenser. This relay is mounted upon a plug-in base for immediate removal and replacement, if desired. Where frequency-controlled mains are not available a tuning-fork is used in place of the relay. Under these conditions the precision of the instrument is of a still higher order. The current passing through the contacts is only a few micro-amperes, so there is no sparking, and the same type of contacts have been in continuous use, for other purposes, for years without renewal. The scale of the galvanometer can be calibrated at all the main divisions, by simply changing over to the "Test" position and so comparing the deflexion of the galvanometer for different settings of the galvanometer shunt, by which the various ranges are obtained.



Direct reading capacity meter

LABORATORY AND WORKSHOP NOTES

AUDIO-FREQUENCY VALVE OSCILLATORS FOR THE LABORATORY.

By G. R. TODD, B.Sc., The Physical Laboratory, The University, St Andrews.

[*MS. received 8th April*, 1933.]

In the design of this simple oscillator for students nothing original is claimed. The writer spent some time trying out various arrangements, and two of these which were found to work satisfactorily are described. It should be mentioned that no special precautions were taken to avoid harmonics.

The first arrangement, illustrated diagrammatically in Fig. 1, is intended for bridge measurements of electrolytic conductivity and gives a frequency of approximately 1000 cycles per second. An "Ostar Ganz" mains valve is used so that it may be run economically from D.C. mains. The insertion of an "Ostar Ganz" rectifier is all that is necessary to modify the circuit for A.C. mains. It was found desirable to insert a potentiometer for adjustment of the anode potential so that the performance of the oscillator might be easily controlled. The construction of the coils is shown in Fig. 2. In the second arrangement the fixed condenser is omitted and terminals are provided which may be connected to a condenser box so that by varying the capacity a range of frequencies may be obtained. Further, tapped coils are employed. The tuning coil consists of 1700 turns tapped at 1200 turns, the reaction coil of

* Fleming, J. A. and Clinton, W. C., *Proc. Phys. Soc.* **18** 1903 (386).

600 turns tapped at 400, while the output coil consists of two sections having 50 and 500 turns to suit external circuits of low and high impedance.

Another oscillator constructed uses a battery valve which necessitates a slight and obvious modification of the circuit. It is generally advisable to include a grid-bias battery,

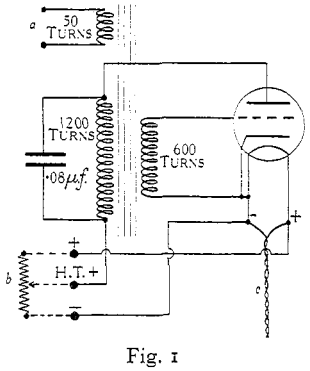


Fig. 1

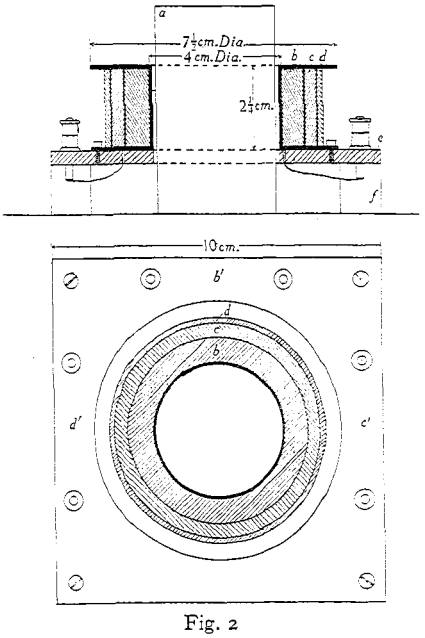


Fig. 2

Fig. 1. Oscillator circuit for bridge measurements. *a*, output terminals; *b*, external potentiometer; *c*, leads to D.C. mains

Fig. 2. Construction of coils. *a*, iron core; *b*, primary coil, 1200 turns, No. 36 D.S.C. wire; *c*, reaction coil, 600 turns; *d*, output coil, 50 turns; *e*, ebonite base; *f*, wooden block; *b'c'd'*, terminals of corresponding coils

which is inserted between the lower end of the reaction coil and the filament, while a fuse is connected between negative high tension and filament to protect the valve.

The range of this oscillator depends to some extent on the nature of the iron core but may be given roughly as 200 to 10,000 cycles per second.

The author wishes to thank Prof. H. S. Allen and Dr D. Jack who initiated and supervised this work.

A MODIFICATION OF MANCE'S METHOD OF MEASURING BATTERY RESISTANCE.

By L. M. CHATTERJEE, M.Sc., Demonstrator in Physics, Science College, Patna, India.

[*MS. received 15th May*, 1933.]

THE main difficulty in Mance's method of measuring the internal resistance of a cell is that the steady current in the galvanometer causes a deflexion which is inconveniently large. Many suggestions have been put forward from time to time to overcome this.

The modification here adopted is both simple and convenient and does not appear to have been previously described. A galvanometer (preferably a low resistance ballistic one)