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J. R. BANKER

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ELECTRONIC VOLTMETER AND OHMMETER

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Fig. 1

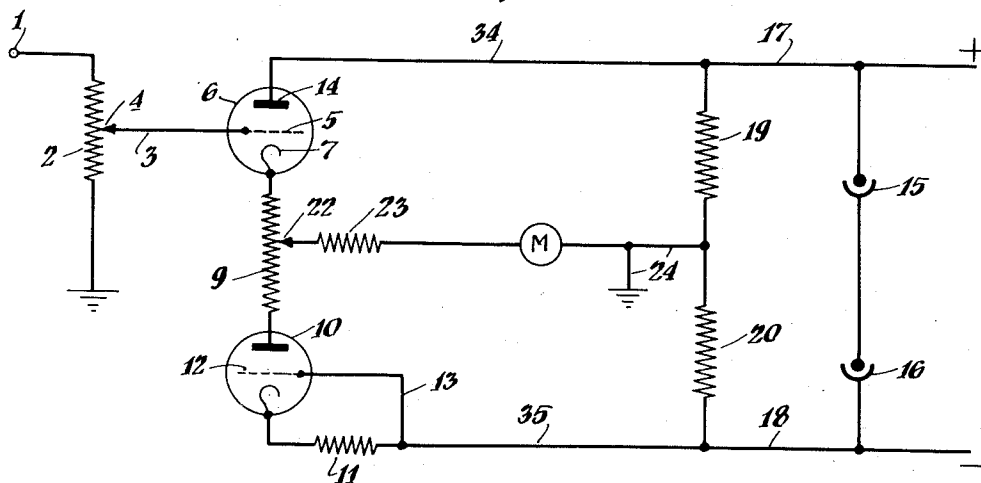
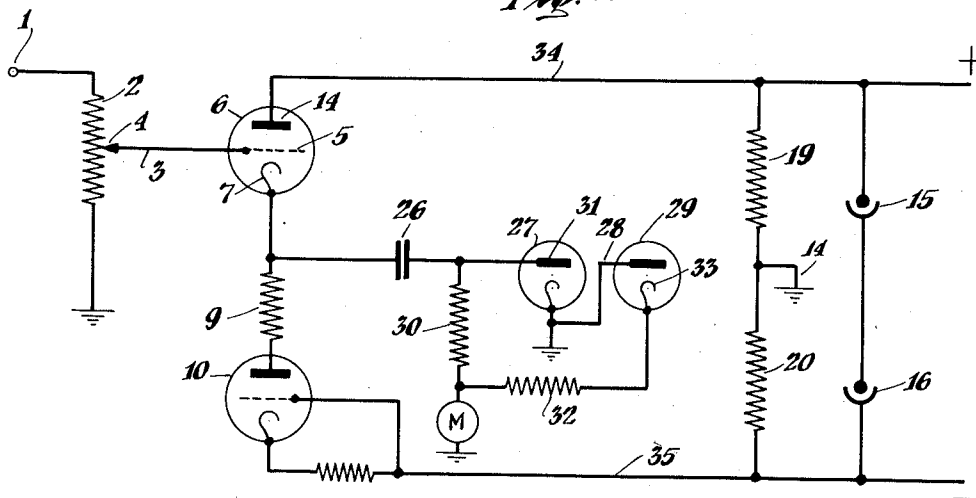


Fig. 2



John Richard Banker, INVENTOR.

BY

Charles W. Mortimer

ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRONIC VOLTMETER AND OHMMETER

John Richard Banker, Passaic, N. J., assignor to
Allen B. Du Mont Laboratories, Inc., Passaic,
N. J., a corporation of Delaware

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12 Claims. (Cl. 171-95)

This invention relates to an electronic circuit that may be used as a stable vacuum tube bridge.

In carrying out the invention for direct current measurements, a bridge is used that has a vacuum tube in one of its arms, and in carrying it out for alternating current measurements, a bridge that has a vacuum tube in one of its arms and a rectifier are used. A source of constant voltage is needed for operating the device, or a voltage regulator is needed where the voltage from the source fluctuates.

The invention may be understood from the description in connection with the accompanying drawing, in which:

Fig. 1 is a diagram of connection for direct current use; and

Fig. 2 is a modified diagram where alternating current is to be used in making the measurements.

In the drawing, reference character 1 indicates a terminal to which one side of direct current voltage E may be connected, the other side being connected to ground. A potentiometer resistance or voltage divider 2 which may be provided with fixed taps is connected between terminal 1 and ground. A lead 3 extends from the sliding contact 4 on resistance 2 to the grid 5 of the vacuum tube 6. The cathode 7 of this tube is connected by resistance 9 to the plate of vacuum tube 10 which has its cathode loaded with or biased by resistance 11. The grid 12 of tube 10 is connected by lead 13 to the other end of the resistance 11 which is connected to the negative side of a direct current potential that is applied to the device. The positive side of this potential is connected to the plate 14 of the tube 6 and a voltage regulator 15-16 with no grounded point between them is provided to keep a constant potential between the leads 17 and 18. The resistances 19 and 20 which may or may not be of equal value are connected in series between leads 17 and 18.

A sliding contact 22 is provided for the resistance 9 and is connected through a multiplying resistance 23 to one side of the meter M, the other side of this meter and the connection between resistances 19 and 20 being grounded as indicated at 24.

The connections described above constitute a bridge circuit, the tube 6 corresponding to the unknown arm, tube 10 to the standard arm, and resistances 19 and 20 to the ratio arms. The meter M indicates when a balanced condition exists with no signal at 1 and reads in accordance with increase of signal at 1. The cathodes of

tubes 6 and 10 should be heated from the same source, thus causing the tube 10 to regulate for any change in the heater potential of tube 6. The bias resistance 11 is of such a size that the operating characteristics of the tube 10 are the same or nearly the same as those of tube 6. The bridge can be easily balanced by means of sliding contact 22.

In the modification shown in Fig. 2 for measurements where alternating currents are used, similar parts are indicated by the same reference characters as before. In this modification the cathode 7 of tube 6 is coupled by condenser 25 to the plate 31 of diode 27, the cathode of this diode being grounded and also connected by lead 28 to the plate of diode 29 so that the emission currents to the cathodes of these tubes are balanced. Resistance 30 is connected between plates 31 of diode 27 and meter M. Resistance 32 is connected between the cathode 33 of diode 29 and this meter M.

The operation is as follows:

The voltage regulators 15 and 16 and resistances 19 and 20 and ground 24 keep the potentials on leads 17 and 18 constant and at equal opposite polarities. The contact 22 is adjusted so that the meter M reads zero when no signal is applied at 1. When a direct current potential or signal is applied at 1 in Fig. 1 the increased current through resistance 9 increases the potential at the point where contact 22 connects with resistance 9, thus causing a reading of the meter M due to the flow of current through the resistance 23 because of the increased potential at the point where the contact 22 contacts with the resistance 9. The stronger the signal is that is applied at the point 1 the larger the reading of meter M is.

When an alternating current potential is applied to the terminal 1 in Fig. 2, a corresponding amplified potential appears on the cathode 7 of tube 6 due to current from lead 34 through tube 6. The cathode 7 is coupled by condenser 25 to the plate 31 of diode 27 where rectification takes place. Direct current from cathode 7 is blocked by the condenser 25. The alternating current passing through condenser 25 has its positive component removed by diode 27 leaving only unidirectional current which passes through resistance 30 and is indicated by the meter M. The diode 29 and resistance 32 serve in the known way to balance out what is referred to as the residual or contact or emission current of tube 27 which would otherwise flow through the meter M and cause it to read too high. The tube 10 acts as

a balancing resistance in the cathode circuit of tube 6. Since the condenser 26 operates as a blocking condenser which removes direct current from the plate 31 of diode 27, only the alternating component of the current from tube 6 is left to be rectified and pass through the meter M to produce the reading thereon.

The meter M may be calibrated to read in volts, or it may be used as an ohmmeter, when using either direct or alternating current.

What is claimed is:

1. In a device of the character described, a bridge comprising two vacuum tubes connected in series, each tube having an anode, a grid and a cathode, a resistance between the cathode of one of said tubes and the plate of the other one, a resistance in the cathode circuit of said other tube, and a meter adjustably connected between a point on said first named resistance and ground.

2. The device of claim 1, in which the meter connection is adjustable on said first named resistance.

3. The device of claim 1, in which direct current potentials of opposite polarities are connected to the plate of the first and the cathode of the last tube.

4. The device of claim 1, in which direct cur-

rent potentials of opposite and equal polarities are connected to the plate of the first and the cathode of the last tube.

5. The device of claim 1, in which a resistance is in the meter connection.

6. The device of claim 1, in which a condenser is in the meter connection.

7. The device of claim 1, in which the bridge has a vacuum tube in each of two arms thereof and a resistance in each one of the other arms.

8. The device of claim 1, in which there is a bridge having a vacuum tube in each of two arms thereof and resistances of equal magnitude in the other two arms of said bridge.

9. The device of claim 1, in which a condenser is connected in series with said meter.

10. The device of claim 1, in which a condenser is connected in series with said meter and a diode is connected to said condenser.

11. The device of claim 1, in which a condenser and resistance are connected in series with said meter.

12. The device of claim 1, in which a condenser is connected in series with said meter and two diodes in opposition are connected to said condenser.

JOHN RICHARD BANKER.