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The vector diagrams for the bridge circuit of Figure 1 are given in Figures 2A and 2B.

The power source and the detector used will depend on the inductance to be measured. Choke coils and ironed coils should be measured at 60 or 120 cycles, the frequency at which they are used. Air core coils can be measured at 1000 cycles. Radio frequency coils should be measured at their operating frequency. Power frequency coils can be obtained directly from the line through transformers, and 120 cycles can be gotten from the ripple through the choke. This can be done by connecting the polarizing source as shown in Figure 8. The choke coil in series with the battery must be large compared with inductance of the coil being measured. The capacity of C must be large so that its reactance is small compared to the reactance of the coil. This circuit is not satisfactory for the measurement of iron core coils as the Hay bridge.

The Hay bridge for the measurement of incremental inductance is given in Figure 5. The equations of the bridge are not independent of frequency but if the Q of the coil under test is greater than 10 the equations for inductance reduce to

\[ L = \frac{R_i}{C} \text{ HENRIES} \]

with an error of 1%.

The vector diagrams for this bridge can be as that in Figure 3, with the 120 cycle sources connected in series with the d.c. polarizing circuit. A potentiometer should be used to control the d.c. current through the circuit. The resistance \( R_i \) must be capable of carrying the polarizing current flowing through the choke coil. The resistance \( R_2 \) and \( R_3 \) must be continuously variable if C is fixed. Since this bridge is not independent of frequency a generator having a fairly pure sine wave output must be used or difficulty will be experienced in obtaining a sharp balance.

When iron core chokes are to be measured provision must be made to pass a polarizing current through the choke. This can be done by connecting the polarizing source as shown in Figure 6. The choke coil in series with the battery must be large compared with inductance of the coil being measured. The capacity of C must be large so that its reactance is small compared to the reactance of the coil. This circuit is not satisfactory for the measurement of iron core coils as the Hay bridge.

The vector diagrams of the Anderson bridge is shown in Figure 7. When the bridge is balanced the voltage drop between the points \( \omega \) is zero, which means that the drop across \( R_i \) which is equal to \( L_2 \), is equal to the drop across C which is

\[ -jQ X_C \]

This drop must be in phase with the current I, so that the current I, will lead the current I, by 90°.

The detector used will depend on the frequency of the voltage applied to the bridge and the sensitivity desired. For 60 and 120 cycles some form of amplifier and a.c. voltmeter is necessary as the lack of aural sensitivity precludes the use of phones. At frequencies greater than 250 cycles, phones are satisfactory and when preceded by an amplifier are entirely satisfactory. Amplifiers used in connection with bridges should be carefully constructed to eliminate hum which will tend to mask the signal as a balance is approached.

Another bridge which uses a condenser as a comparison standard is the Owens bridge. The bridge circuit is given in the diagram of Figure 8. The resistance \( R_i \) can be made zero if C is made continuously variable. \( R_2 \) is made adjustable in units of 10, and \( R_3 \) is continuously variable. The inductance is directly proportional to the product of \( C\sqrt{R_0R} \) and the equivalent series resistance of the coil is equal to

\[ C \frac{\sqrt{R_0R}}{R_3} \]

If C, can not be made continuously variable \( R_i \) and \( R_3 \) must be variable. \( R_2 \) is fixed and the balance is obtained by successive adjustments of \( R_i \) and \( R_3 \). The balance is independent of frequency and wave form of the applied voltage provided the circuit elements are independent of current and voltage.

This bridge has the advantage of covering an extremely wide range of values with a relatively small variation in standards. A bridge having the following constants has a range from 0 to 11.111 henries and 0 to 111.111 ohms. \( R_1 \), 1000 and 10000 ohms; \( C \), 1 mfd. \( R_2 \), 0 to 111.11 ohms. With \( C \) and \( C_i \) fixed at 0.3 mfd. and \( R_2 \) adjustable over values from 1 to 1000 ohms; \( R_i \) and \( R_3 \), continuously variable from 0 to 111.11 ohms, the bridge has a range from 0.3 micro- henries to 3 henries.

The vector diagram of the Anderson bridge is shown in Figure 7. When the bridge is balanced the voltage drop between the points \( \omega \) is zero, which means that the drop across \( R_i \), which is equal to \( L_2 \), is equal to the drop across C which is

\[ -jQ X_C \]

This drop must be in phase with the current I, so that the current I, will lead the current I, by 90°.