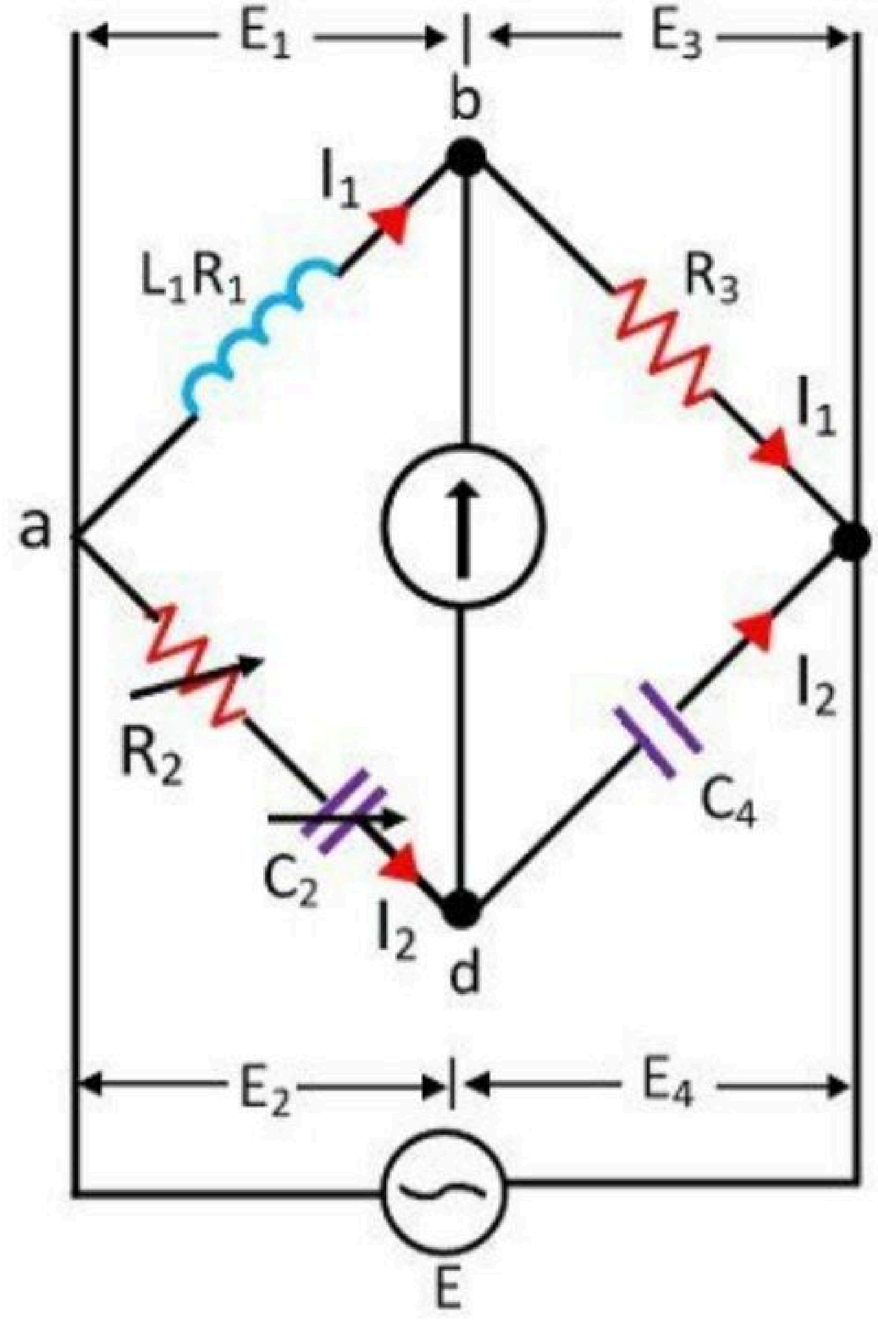
Owen's Bridge

Definition: The **bridge** which **measures** the **inductance** in terms of **capacitance** is known as Owen's bridge. It **works** on the **principle** of **comparison** i.e., the value of the **unknown inductor** is **compared** with the standard **capacitor**. The connection diagram of Owen's bridge is shown in the figure.



Owen's Bridge

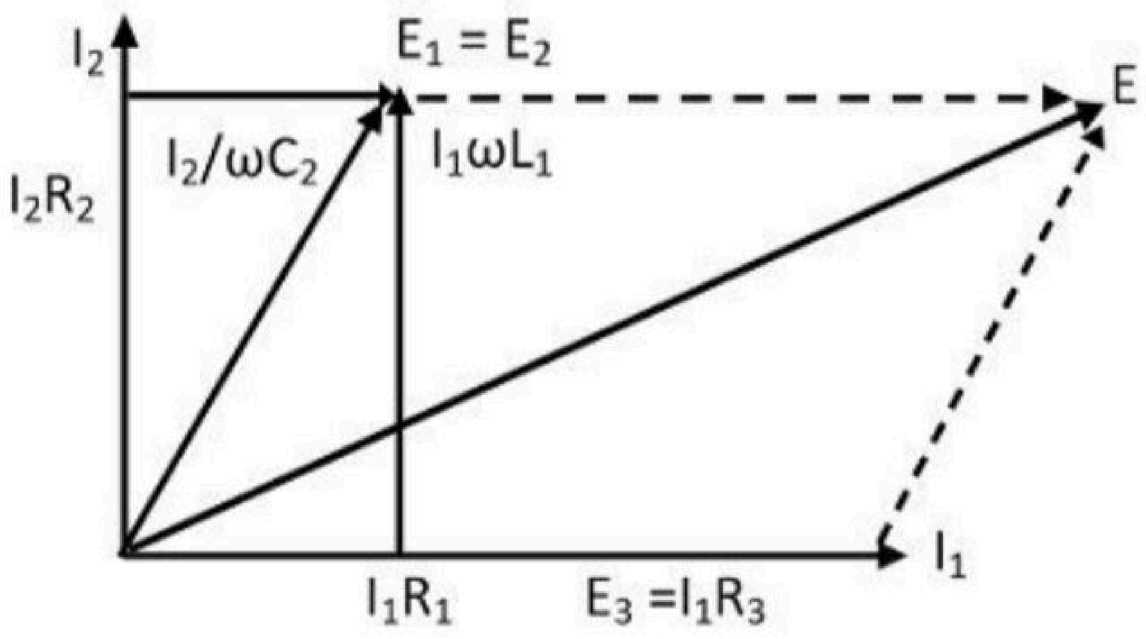
Circuit Globe

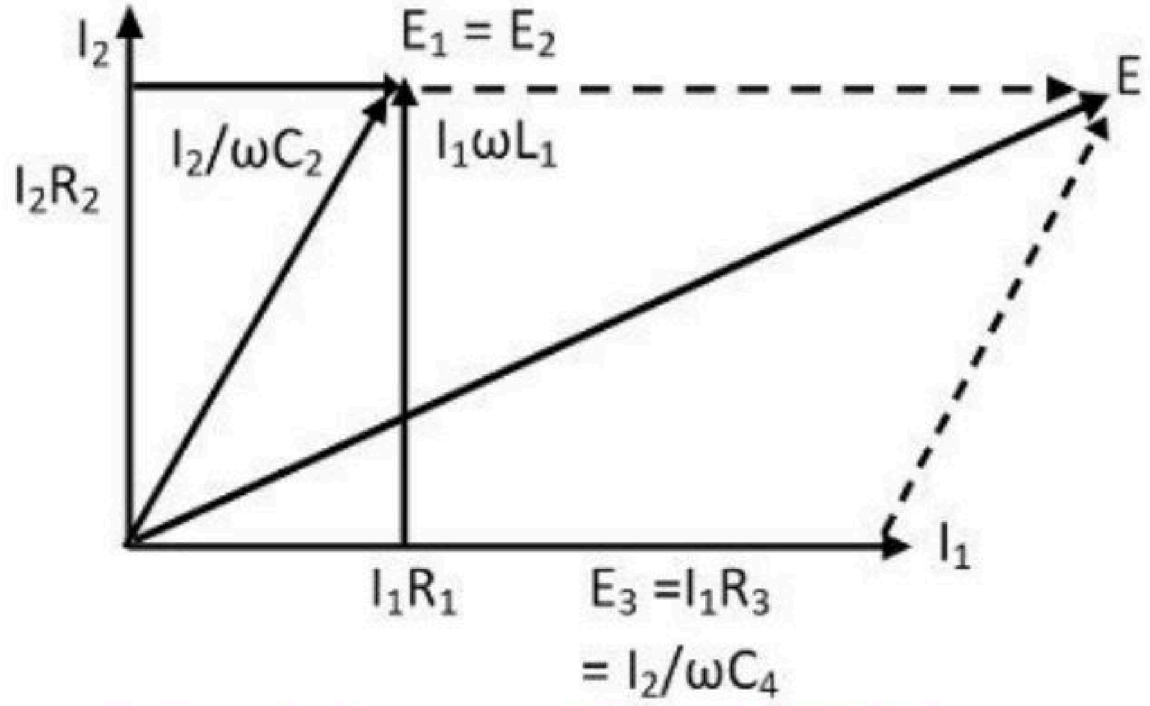
The **ab, bc, cd** and **da** are the four arms of Owen's bridge. The arms **ab** are purely inductive and the arm **bc** is purely resistive in nature. The arm **cd** has fixed capacitor and the arm **ad** consists the variable resistor and capacitor connected in series with the circuit.

The unknown inductor **L_1** of arm **ab** is compared with the known capacitor **C_4** connected to the arm **cd**. The bridge is kept in balanced condition by independently varying the resistor **R_2** and the capacitor **C_2**. At the balanced condition, no current flows through the detector. The end points (b and c) of the detector are at the same potential.

Phasor Diagram of Owen's Bridge

The phasor diagram of Owen's bridge is shown in the figure below.





Phasor Diagram of Owen's Bridge

The current $\mathbf{I_1}$, $\mathbf{E_3 = I_3R_3}$ **and** $\mathbf{E_4 = \omega I_2C_4}$ are all on the same phases and are represented on the horizontal axis. The voltage drop $\mathbf{I_1R_1}$ in the arm **ab** is also represented on the horizontal axis.

The sum of the inductive voltage drop $\mathbf{\omega L_1I_1}$ and the resistive voltage drop $\mathbf{I_1R_1}$ gives the voltage drop $\mathbf{E_1}$ of the arm **ab**. When the bridge is in the balanced condition the potential $\mathbf{E_1}$ and $\mathbf{E_2}$ across the arm **ab** and **ad** are equal. Thus, it is shown on the same axis.

The voltage drop V_2 is the summation of the resistive voltage drop I_2R_2 and capacitive voltage drop I_2/wC_2. The I_2 of the arm **ad** lead by **90°** with the voltage drop V_4 of the arm **cd** because of the fixed capacitor C_4.

The current I_2 and the voltage I_2R_2 are represented on the vertical phases shown in the figure above. The supply voltage is obtained by adding the voltage V_1 and V_3.

Theory of Owen's Bridge

Let, L_1 – unknown self-inductance of resistance R_1

R_2 – variable non-inductive resistance

R_3 – fixed non-inductive resistance

C_2 – variable standard capacitor

C_4 – fixed standard capacitor

At balance condition,

$$(R_1 + j\omega L_1)\left(\frac{1}{j\omega C_4}\right) = \left(R_2 + \frac{1}{j\omega C_2}\right)R_3$$

On separating the real and imaginary part we get,

$$L_1 = R_2 R_3 C_4$$

And,

$$R_1 = R_3 \frac{C_4}{C_2}$$

Advantages of Owen’s Bridge

The following are the advantages of Owen’s bridge.

1. The balance equation is easily obtained.
2. The balance equation is simple and does not contain any frequency component
3. The bridge is used for the measurement of the large range inductance.

Disadvantages of Owen's Bridge

1. The bridge uses an expensive capacitor which increases the cost of the bridge and also it gives a one percent accuracy.
2. The value of the fixed capacitor C_2 is much larger than the quality factor Q_2

The Owen's bridge is modified by connecting the voltmeter in parallel with the resistive arms of the bridge. The direct and alternating both the supply is given to the bridges. The ammeter is connected in series with the bridge for measuring the DC current. and the alternating current is measured by the help of voltmeter.