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B. Sc. Part II
Paper - IV
Current Electricity

Exp No-2 :-

S.G. Starling gave a better and easier method of demonstration of Peltier effect which is given below :

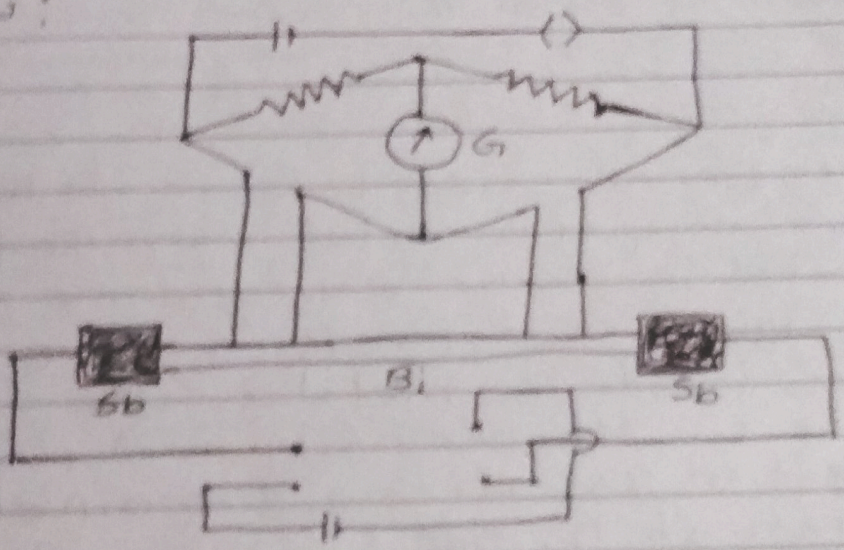

fig-5

A Compound bar of Bismuth with Antimony at the ends (as shown in fig-5) as taken. Two identical coils consisting of insulated thin Copper wire are closely wound at the junctions and are placed in the two arms of a wheatstone bridge.

Teachers Signature _____

The resistances in the other arms of the bridge are adjusted so that the bridge is initially balanced. When a current is passed through the bar, then due to Peltier effect, one junction is cooled, while the other is heated. Due to high temp. coefficient of copper, the resistance of the coil round the cooled end decreases, therefore, the bridge is out of balance and the galvanometer shows a deflection. If the direction of the current is reversed, the effects are reversed and therefore the galvanometer now gives the deflection in opposite direction.

Explanation of Seebeck And Peltier effects

According to electronic Theory, the free electrons inside the metal move freely like the molecules of a gas in a container. Therefore the free electrons are said to form a gas known as electron gas. This electron gas is uniformly distributed inside the entire volume of a metal. When the temp. of a metal is same everywhere, then the density and pressure of the electron gas inside the metal is also same everywhere. The density and pressure of an electron gas differs from metal to metal even at the same temp. When two metals are joined together, the electron gas diffuse from one metal to the other and vice versa in such a way that the net diffusion of the electron gas is from a metal at high pressure to that at low pressure. Due to the diffusion of the electron gas, an e.m.f is produced at the junction of the two metals; which opposes the diffusion the electron gas.

When this e.m.f. is sufficient to stop the further net diffusion of the electrons, then the ~~two metals~~ state of the dynamic equilibrium is reached. In the state of the dynamic equilibrium three exists a certain e.m.f. at the junction of the two metals, which is known as a Peltier e.m.f. π.

Seebeck effect :- when two dissimilar metals A and B (say Cu and Fe) are joined together to form a Thermocouple fig. 6 Then at each junction of Thermo-couple, a Peltier e.m.f. is produced. If the two junction are at the same temp. Then the Peltier e.m.f's are equal equal and opposite. Therefore the net e.m.f. and hence the current in the Thermo-couple is Zero. If however the junctions are at different temp. T_1 and T_2 ($T_2 > T_1$), the Peltier e.m.f's π_1 and π_2 at the junctions are no longer equal so there is a resultant e.m.f $\pi_2 - \pi_1$ in the circuit, due to which a current flows in the Thermo-couple. This explains Seebeck effect.

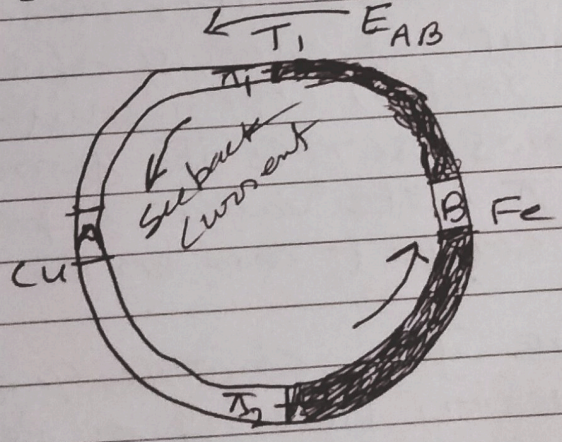

fig - 6

Teacher's Signature :