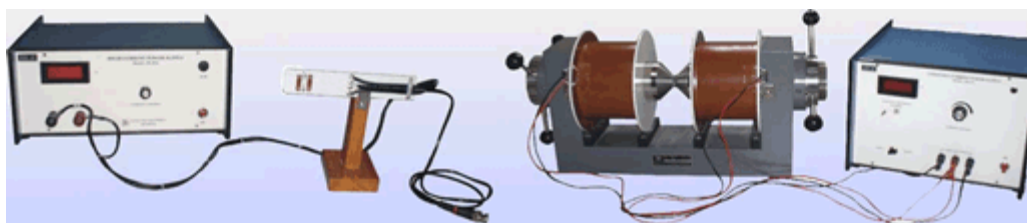


Hall effects in Metal



Hall Effect enables the charge carrier concentration and mobility to be determined by experiment. Direction of the Hall Voltage in silver indicates negative charge carriers, which is in agreement with concepts of the model of the ‘free electron gas’. Limitations of this model are shown by the so called ‘abnormal Hall Effect’ of tungsten. The experiment carried out under identical conditions for tungsten show the Hall Voltage to have about same magnitude but opposite direction as in silver. This can be explained by the ‘Energy Band diagram’. The tungsten atom has5s2 5p6 5d4 6s2 electronic structure. When the atoms come close together to form the solid, the close lying states 5d and 6s broaden into bands, with s band broadening considerably more than the d band. This is because of the larger size of the s orbital. The figure schematically shows the allowed energies as a function of the interatomic distance. The number of allowed states is ten per atom in the d band and two in the s band. In tungsten there are six electrons to be shared between these two bands. The result is that at the interatomic distance in tungsten there are holes in the d band and electrons in the s band, making tungsten predominantly a hole conductor. This sort of mixed (electrons and holes) conduction is a general characteristic of transition metals. The apparatus consists of the following:

Description of the experimental set-up

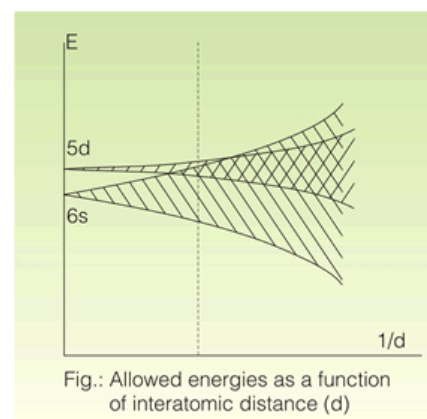
The set-up consists of the following.

a) Hall Probe-Silver (HP-Ag)

Material	Silver Strip (8 x 6 x 0.05 mm)
Contacts	Press type for current Spring Type for Voltage
Hall Voltage	~17 mV/10A/10KG (typical)

b) Hall Probe-Tungsten (HP-W)

Material	Silver Strip (8 x 6 x 0.05 mm)
Contacts	Press type for current Spring Type for Voltage
Hall Voltage	~15 mV/10A/10KG (typical)



c) High Current Power Supply, Model PS-20A

Range	0-20A continuously variable
Accuracy	±0.5%
Regulation	±0.5% for ±10% variation of mains
Display	3½ digit, 7 segment LED

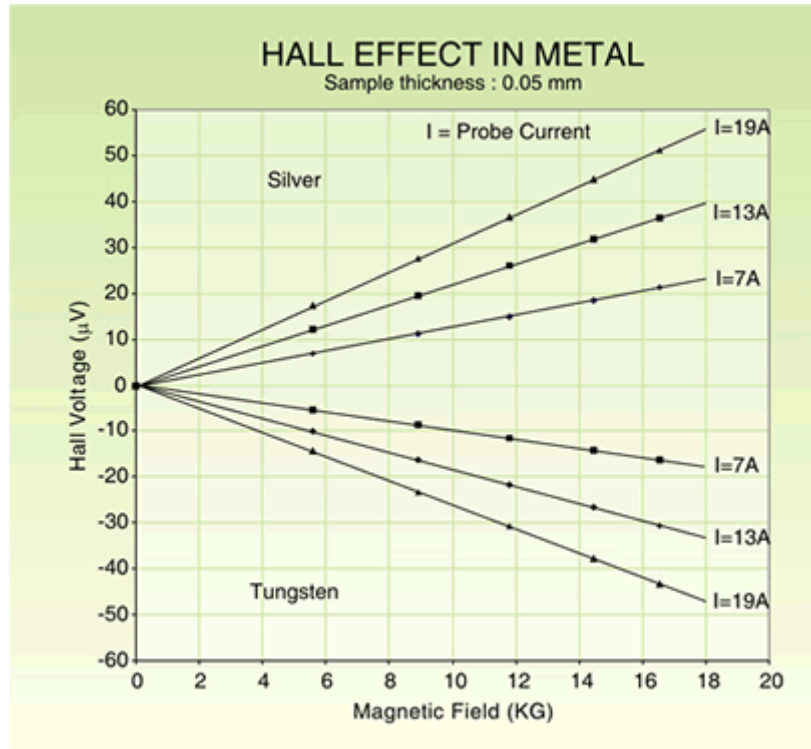
d) Digital Microvoltmeter, DMV-001

e) Electromagnet, EMU-75T

Pole Pieces	75mm tapered to 25mm
Mag. Field	20KG at 6mm airgap
Energising Coils	Two of approx. 13W each
Power	0-90Vdc, 3A, for coils in series 0-45Vdc, 6A, for coils in parallel

f) Constant Current Power Supply, DPS-175

g) Gaussmeter, DGM-202 or DGM-102



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