INTRODUCTION

- *Magneto hydrodynamics (MHD) (magneto fluid dynamics or hydro magnetics) is the academic discipline which studies the dynamics of electrically conducting fluids. Examples of such fluids include plasmas, liquid metals, and salt water. The word magneto hydro dynamics (MHD) is derived from magneto- meaning magnetic field, and hydro- meaning liquid, and -dynamics meaning movement. The field of MHD was initiated by Hannes Alfvén , for which he received the Nobel Prize in Physics in 1970*

Hannes Alfvén

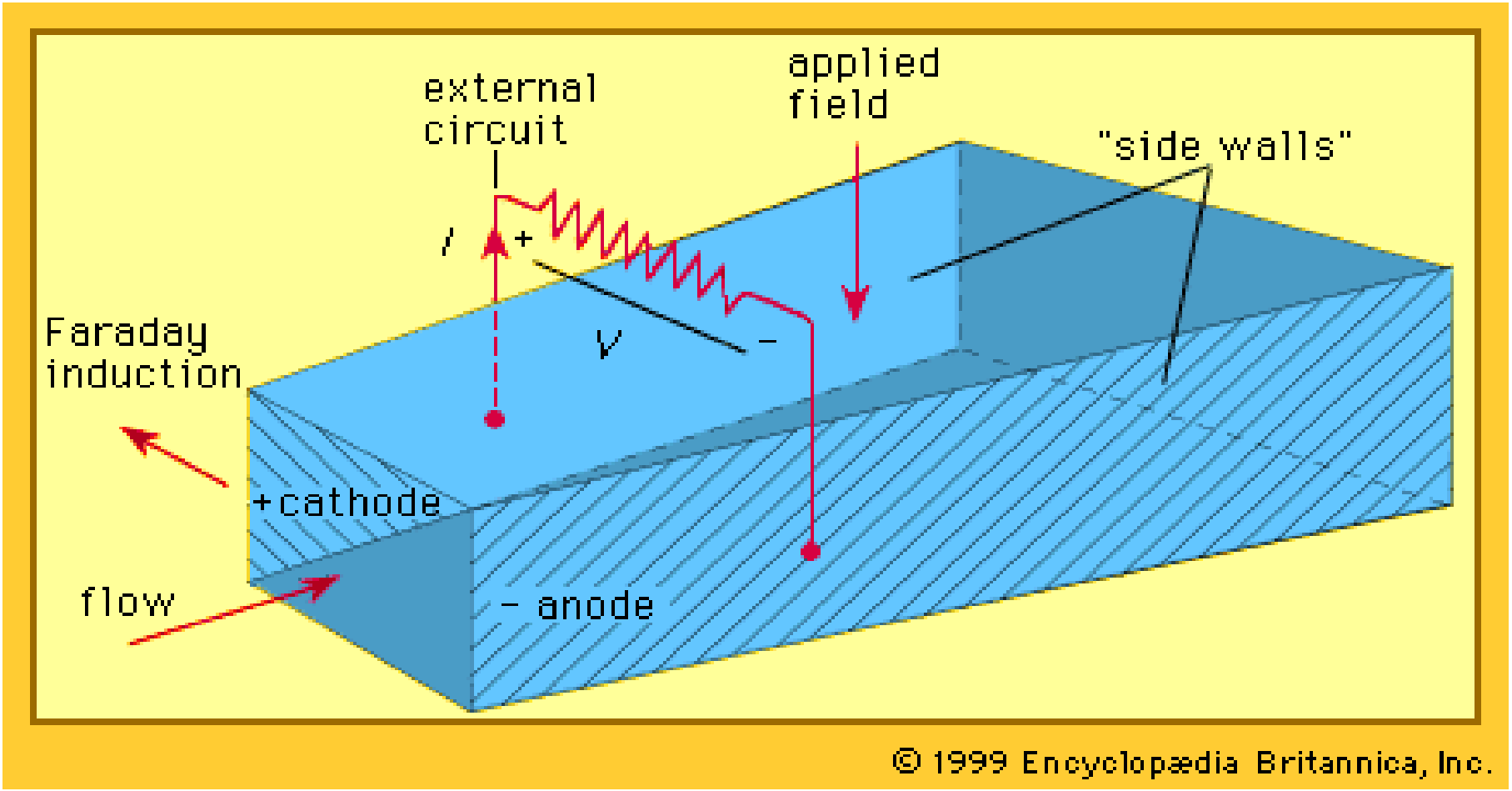
INTRODUCTION

- *As its name implies, magneto hydro dynamics (MHD) is concerned with the flow of a conducting fluid in the presence of magnetic and electric field. The fluid may be gas at elevated temperatures or liquid metals like sodium or potassium.*
- *An MHD generator is a device for converting heat energy of a fuel directly into electrical energy without conventional electric generator.*
- *In this system. An MHD converter system is a heat engine in which heat taken up at a higher temperature is partly converted into useful work and the remainder is rejected at a temperature. Like all heat engines, the thermal efficiency of an MHD converter is increased by supplying the heat at the highest practical temperature and rejecting it at the lowest practical temperature.*

PRINCIPLES OF MHD POWER GENERATION

- *When an electric conductor moves across a magnetic field, a voltage is induced in it which produces an electric current.*
- *This is the principle of the conventional generator where the conductors consist of copper strips.*
- *In MHD generator, the solid conductors are replaced by a gaseous conductor, an ionized gas. If such a gas is passed at a high velocity through a powerful magnetic field, a current is generated and can be extracted by placing electrodes in suitable position in the stream.*
- *The principle can be explained as follows. An electric conductor moving through a magnetic field experiences a retarding force as well as an induced electric field and current.*

PRINCIPLES OF MHD POWER GENERATION



PRINCIPLES OF MHD POWER GENERATION

- *This effect is a result of **FARADAYS LAWS OF ELECTRO MAGNETIC INDUCTION**.*
- *The induced EMF is given by,*

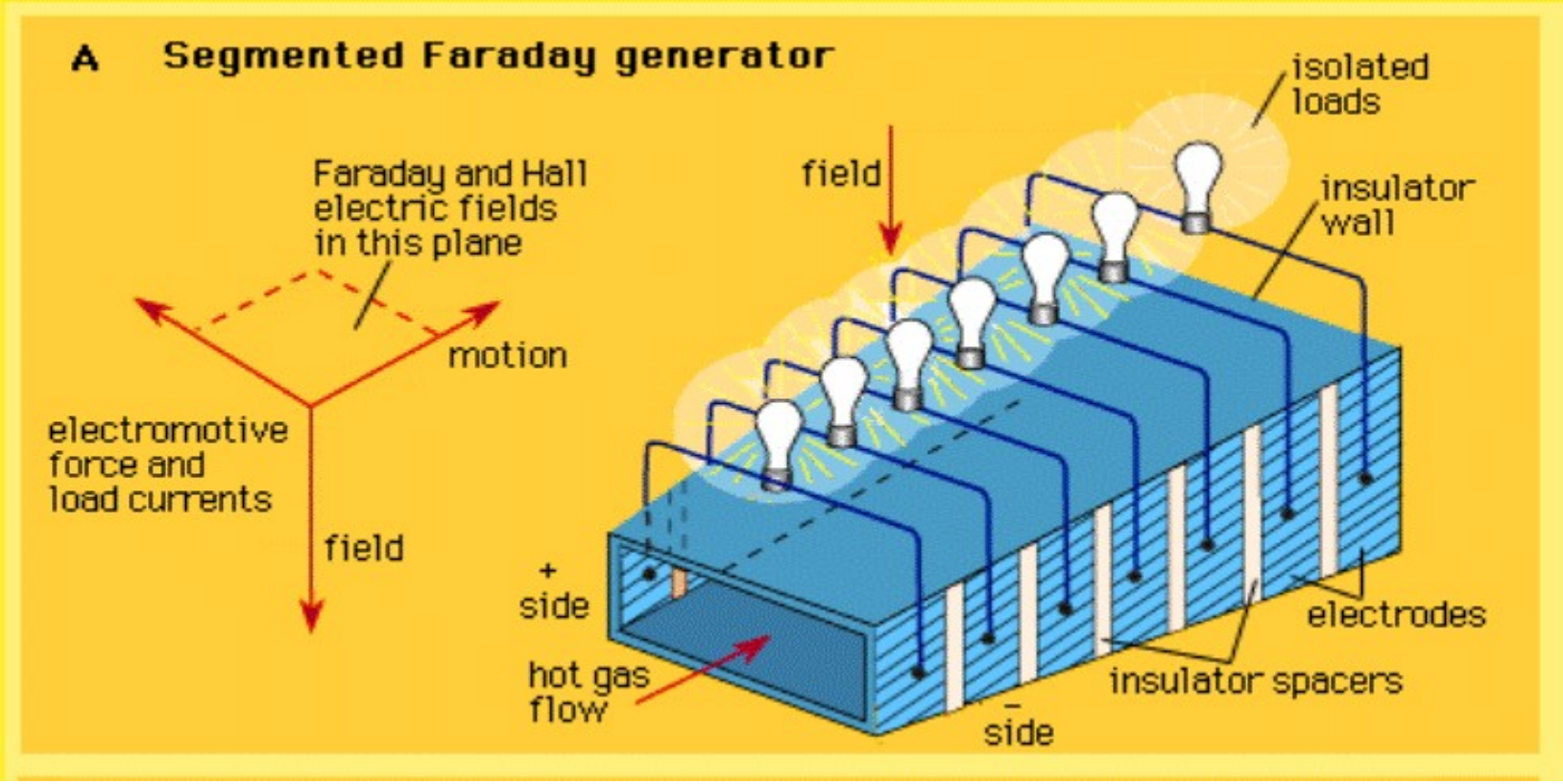
  $E_{ind} = u \times B$ *where u = velocity of the conductor.*

  B = magnetic field intensity.
- *The induced current is given by,*

  $J_{ind} = \sigma \times E_{ind}$ *where σ = electric conductivity*
- *The retarding force on the conductor is the Lorentz force given by*

  $F_{ind} = J_{ind} X B$
- *The flow direction is right angles to the magnetic fields direction. An electromotive force (or electric voltage) is induced in the direction at right angles to both flow and field directions, as shown in the next slide.*

PRINCIPLES OF MHD POWER GENERATION



How Electrical Conductivity Is Achieved?

- *There are several ways to achieve electrical conductivity with an MHD generator.*
- *The conducting fluids that are usually considered are all gases that are made from alkali metal vapors, noble gases and combustion.*
- *When combustion gases are chosen as the conducting fluid, then potassium carbonate is added to the flow in tiny amounts.*
- *It is thermally ionized and makes up the electron density necessary for conductivity.*
- *Cesium is used in the case of monatomic gases, and the electron temperature is raised above the gas, which makes electrical conductivity possible at a lower temperature than would be the case with thermal ionization.*
- *Finally, in the case of liquid metal, electrical conductivity happens when the liquid metal is injected directly into the vapor or gas stream. This makes a continuous liquid phase possible.*