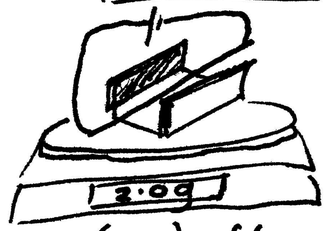
MAG FIELD STRENGTH
= MAG FLUX DENSITY
SYMBOL B
UNIT T (TESLA)
($Wb m^{-2}$, $N A^{-1} m^{-1}$)

flux

$B = \frac{\phi}{A}$ ∴ $\boxed{\phi = BA}$

FORCE ON WIRE

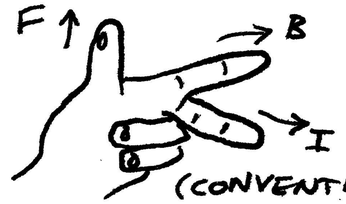
$\boxed{F = BIL}$



FORCE = (m×g) after taring

DIRECTION OF FORCE

FLEMING'S LH RULE



(CONVENTIONAL CURRENT: FLIP FOR FREE ELECTRONS) $e^- \rightarrow$, $\leftarrow I$

MOTOR EFFECT

MOTOR

SPLIT RING COMMUTATOR - TO FLIP CURRENT EVERY ½ TURN, SO IT KEEPS SPINNING.

FASTER → - HIGHER P.D.
- STRONGER MAG FIELD
- MORE TURNS

DYNAMO EFFECT/INDUCTION

IF WIRE EXPERIENCES CHANGING MAG FIELD/FLUX, CURRENT IS INDUCED. (DYNAMO SIMILAR) TO MOTOR, NO SPLIT RING NEEDED, ↓ A.C. OUT

* INCREASE OUTPUT
↓
- SPIN FASTER
- STRONGER MAG FIELD
- MORE TURNS IN COIL.

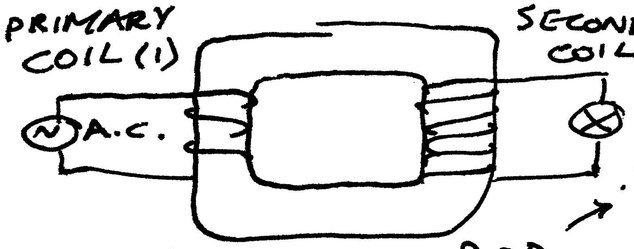
*USE FLEMING'S RH RULE ('GENERIGHTOR')

TRANSFORMERS

(WIRELESS ELECTRICITY). NEEDED TO STEP-UP VOLTAGE (+STEP DOWN CURRENT) OUTSIDE POWER STATION, SO LESS ENERGY LOST DUE TO RESISTANCE OF CABLES IN NAT. GRID.

- LOW R COILS
- SOFT IRON CORE (EASY MAGNETISED)
- LAMINATED CORE (EDDY CURRENTS)

PRIMARY COIL (1) SECONDARY COIL (2)



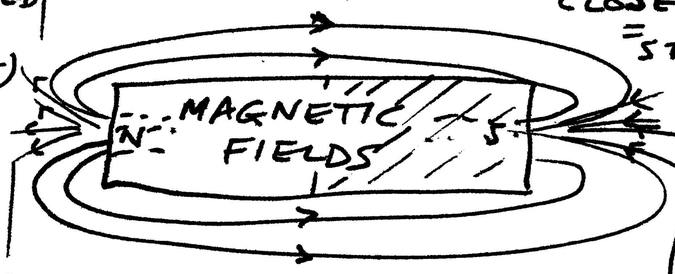
∴ $V_1 I_1 = V_2 I_2$ ...

IF 100% EFFICIENT, $P_1 = P_2$

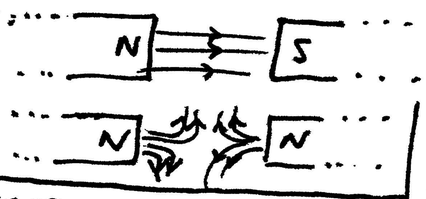
MORE TURNS = HIGHER V : $\boxed{\frac{V_1}{V_2} = \frac{N_1}{N_2}}$

IF CURRENT ALLOWED TO FLOW IN SEC. COIL, BACK E PRODUCED → I IN PRI. COIL SMALL (LENZ'S).

FIELD LINES: SHOW DIR OF FORCE ON 'MINI N POLE'. (N→S) NEVER BREAK/CROSS



CLOSER = STRONGER

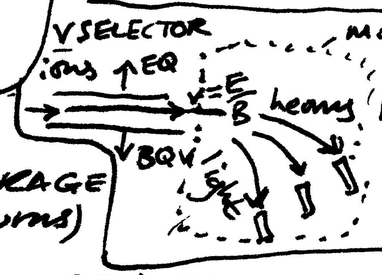


$\boxed{F = BQv = \frac{mv^2}{r}}$

CYCLOTRON (PROTONS)

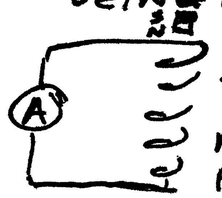
P.D. ACROSS GAP TO ACC PROTONS
↓
MUST FLIP (A.C).
↓
f = f of protons
(all same, f ∝ r)

MASS SPECTROMETER



LENZ'S LAW

"THE DIRECTION OF INDUCED EMF IS SUCH THAT IT WILL OPPOSE THE CHANGE THAT CAUSED IT"
(CURRENT INDUCED MAKES OWN FIELD TO STOP IT BEING INDUCED).



MAGNET DROPPED, I INDUCED, MAKES FIELD → OPPOSES MOTION. BALANCED FORCES → CONSTANT SPEED.

*CURRENT + FIELD FLIPS HALFWAY TO TRY STOP IT LEAVING. (FICKLE!)

BACK EMF - HAPPENS IN TRANSFORMERS, MOTORS.
↓
SPINNING COIL INDUCES BACK E, COUNTERS V IN MOTOR →
∴ SPIN FAST → HIGH BACK E, LOW CURRENT.
SPIN SLOW → LOW BACK E, HIGH CURRENT → BURN OUT!

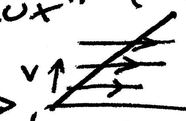
FARADAY'S LAW

"INDUCED EMF IS PROP TO RATE OF CHANGE IN FLUX"

$N\phi = BAN$ → FLUX LINKAGE (Wb turns)

$\boxed{\mathcal{E} = -(N)\frac{\Delta\phi}{\Delta t}}$

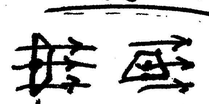
Lenz's, turns not imp.



$\boxed{\mathcal{E} = BLv}$

ε? CONSTANT! INTO PAGE

GENERATOR



max φ, no ε
no φ, max ε

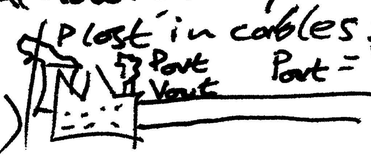
↑ (or max quad)

$\mathcal{E} = BAN\omega\sin(\omega t)$
∴ $\mathcal{E}_{max}$ $\boxed{\mathcal{E}_0 = BAN\omega}$ (= BLv!)

POWER STATION: 3 PHASES
① ② ③ CAN COMBINE FOR FACTORIES ETC.

CABLES: STEEL CORE (STRENGTH)
Al - low R cheaper than Cu.

Plost in cables:



$P_{out} = V_{out} I$ → $P_{lost} = I^2 R$.

Video
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