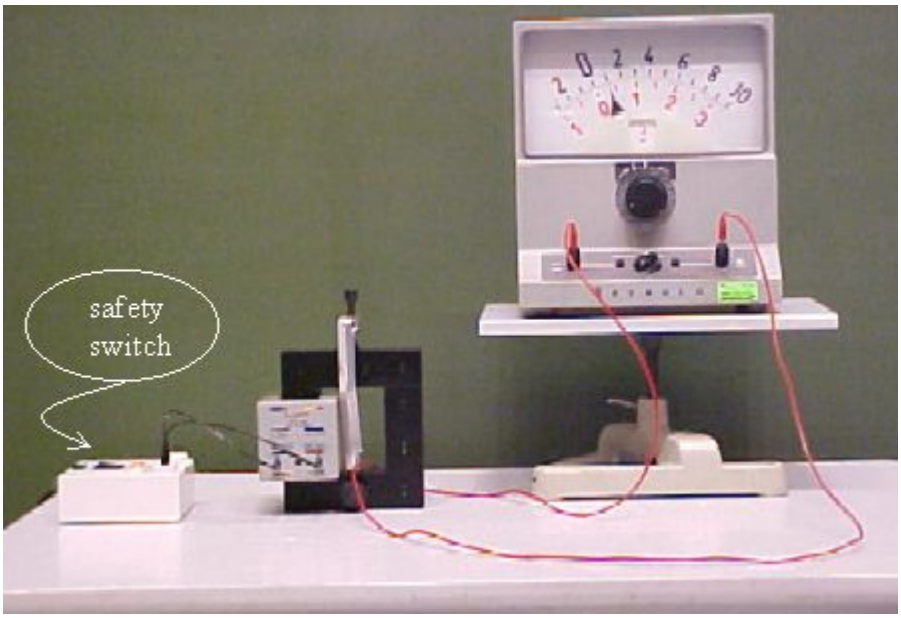
Transformer

Aim: To verify the relationship between the voltages and the number of turns in the coils.

Subjects: 5K30 (Transformers)

Diagram:



Equipment:

- 220V mains safetyswitchbox (we use Leybold 50206).
- U-core with bar and clamping device.
- Coil, n=500.
- Multiscale voltmeter with large display.
- Long wire.

Safety:

- Applying the 220V mains is done via a safety switchbox that switches both connectors ON/OFF. When ON, a red light appears on the box; when OFF a green light shows, indicating that it is safe to manipulate the circuit.

Transformer

Presentation: The demonstration is set up as shown in Diagram and Figure 1.

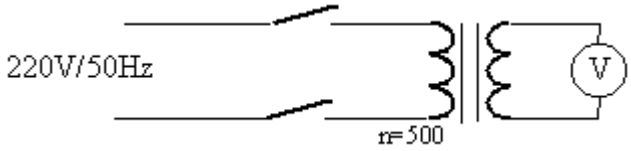


Figure 1

The 220V is switched on and the students can read on the V-meter that in the loop around the core a voltage of around .4V is induced.
Then the demonstrator makes the wire go round the core in two loops. Again the induced voltage is read and a doubling is observed. Then make the wire go round the core three times (see Figure2). And so on, as long as the length of the wire enables it.

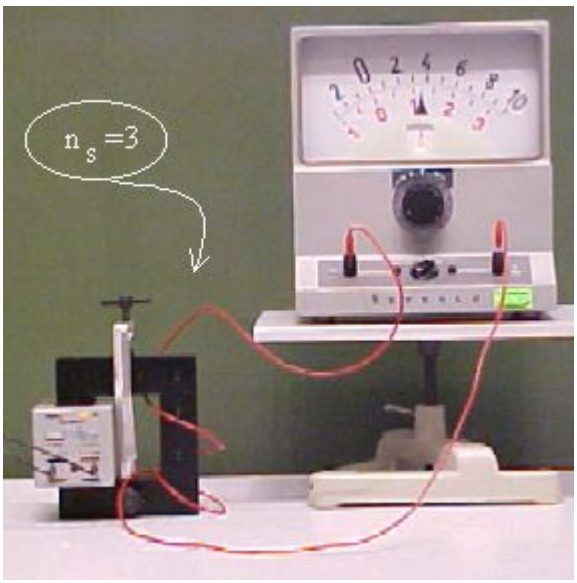


Figure 2

Clearly the proportionality between induced voltage and the number of turns is observed.

Explanation: When an alternating voltage (E_p) is applied across the primary coil of a transformer and there is no flux leakage, then the emf induced in the secondary coil is given by:

$E_s = \frac{n_s}{n_p} E_p$. This demonstration verifies this:

- 1 turn: E_s=1/500(220)=.44V.
- 2 turns: E_s=2/500(220)=.88V.
- Etc.

Sources:

- Mansfield, M and O'Sullivan, C., Understanding physics, pag. 527-529