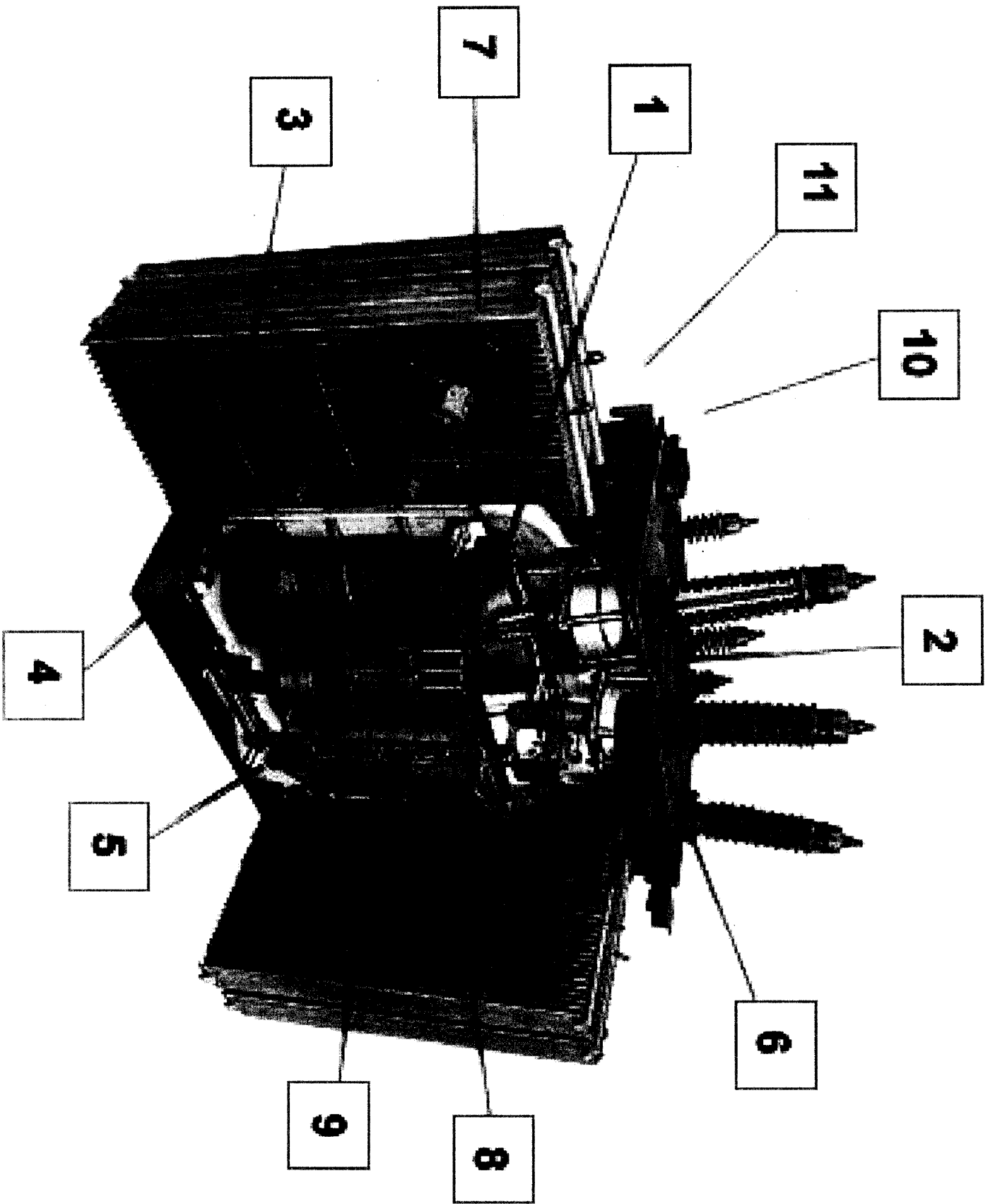


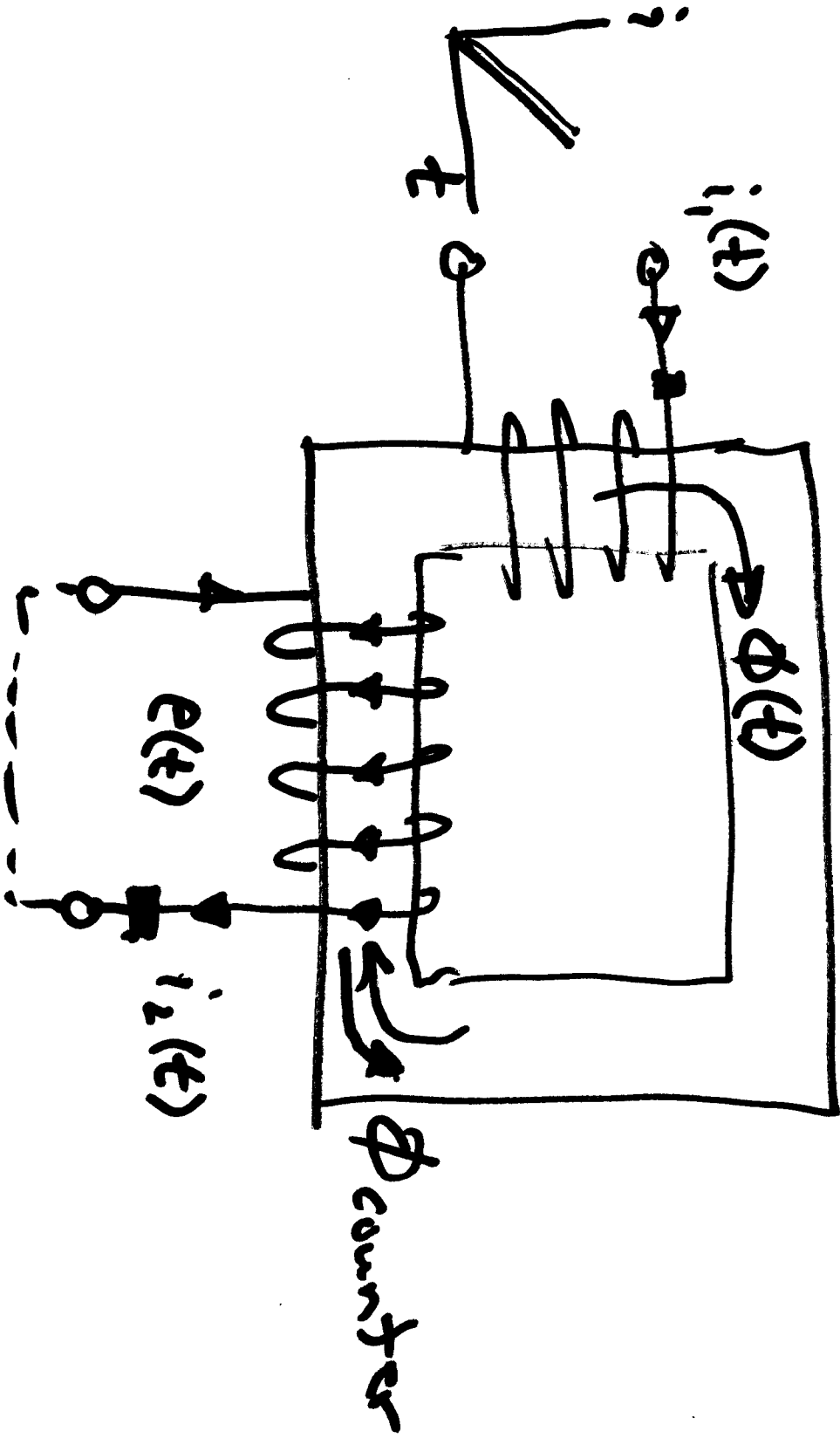
Topics for Today:

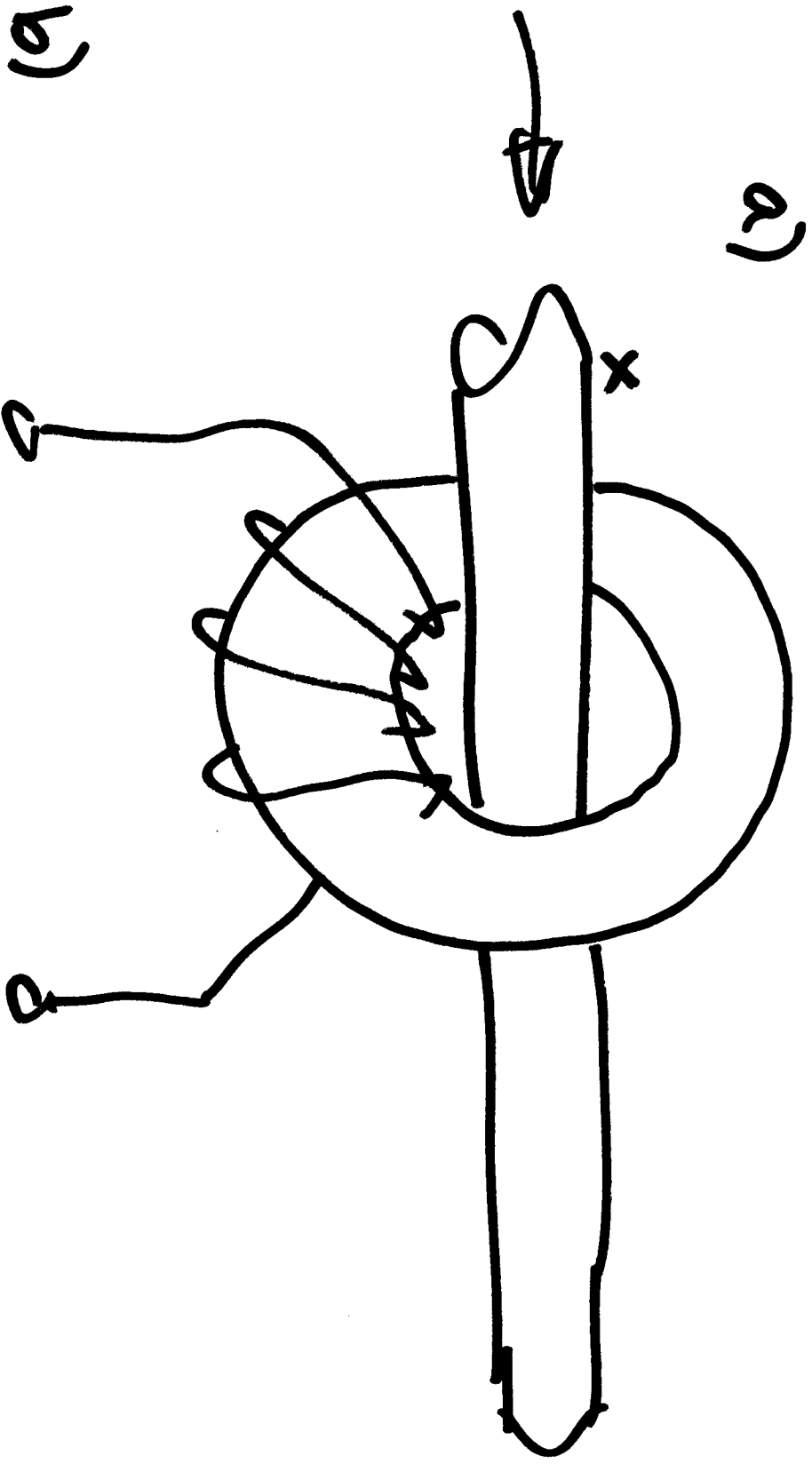
- Announcements
 - Software: Matlab? Will begin using as early as next week.
 - Office hrs: 2pm, M,W,F
 - Office: EERC 614. Phone: 906.487.2857
 - Ch.2 Solutions posted on web page, go thru them for review.
 - XFMR exercises will be posted, due earliest Sep 18th
- Chapter 2 - Review: Transformers and circuits w/transformers
 - Single phase transformers
 - Basic structure: winding R and Leakage, Core losses and saturation
 - 3-phase transformer banks and phase shifts (ANSI/IEEE vs. IEC)
 - Standard 30° shift transformers, non-standard connections
 - Pos/neg sequence phase shifts
 - Autotransformers
 - Load Tap Changing (LTC) transformers
- Comments on sequence networks

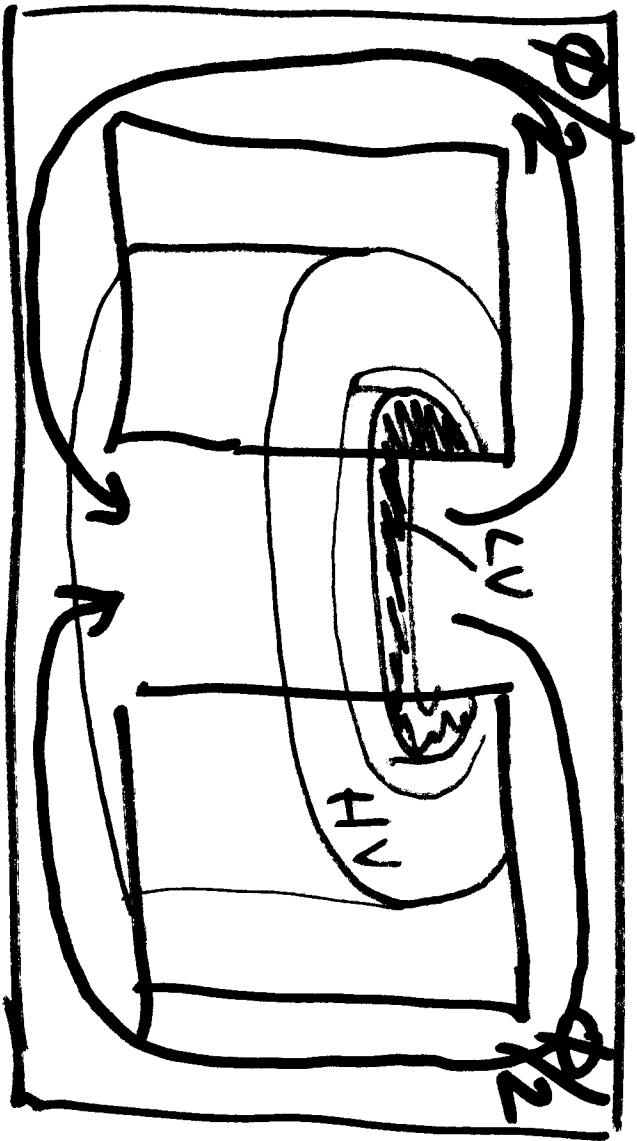


Test your knowledge: How many of the key features on the previous page could you identify? Source: Waukesha Electric, <http://www.waukeshaelectric.com/peg-T1.shtml>

1. Core (no-load) losses minimized by utilizing laser-scribed, super-grain-oriented steel.
2. Lamination width customized to achieve a near perfect-circle core cross section, resulting in the efficient use of materials plus a lighter, more compact, high performance transformer.
3. Coil assembly rigidly braced in a high-strength frame that distributes clamping forces around the full circumference of the windings.
4. Submerged-arc welding process produces deep penetration welds, virtually eliminating leakage from welded tank joints.
5. Inside tank surfaces are painted white to facilitate internal inspection.
6. Transformer exterior coated to a minimum thickness of 3 mils; this coating has superior endurance characteristics and meets the ANSI C57.12.28 standard.
7. Galvanized radiators provide excellent corrosion resistance and require minimal maintenance (fan guards and blades also galvanized).
8. Material-stabilized coils are pressure-fit within the core frame.
9. Patented DETC (De-Energized Tap Changer) features simple and compact in-line contact arrangement (Patent Number: 5,744,764)
10. Waukesha® Type UZD Load Tap Changer designed to withstand up to a half-million operations without the need for contact replacement.
11. Worldbox® Control Enclosure features IEC standard components and is easy to maintain and service in the field.



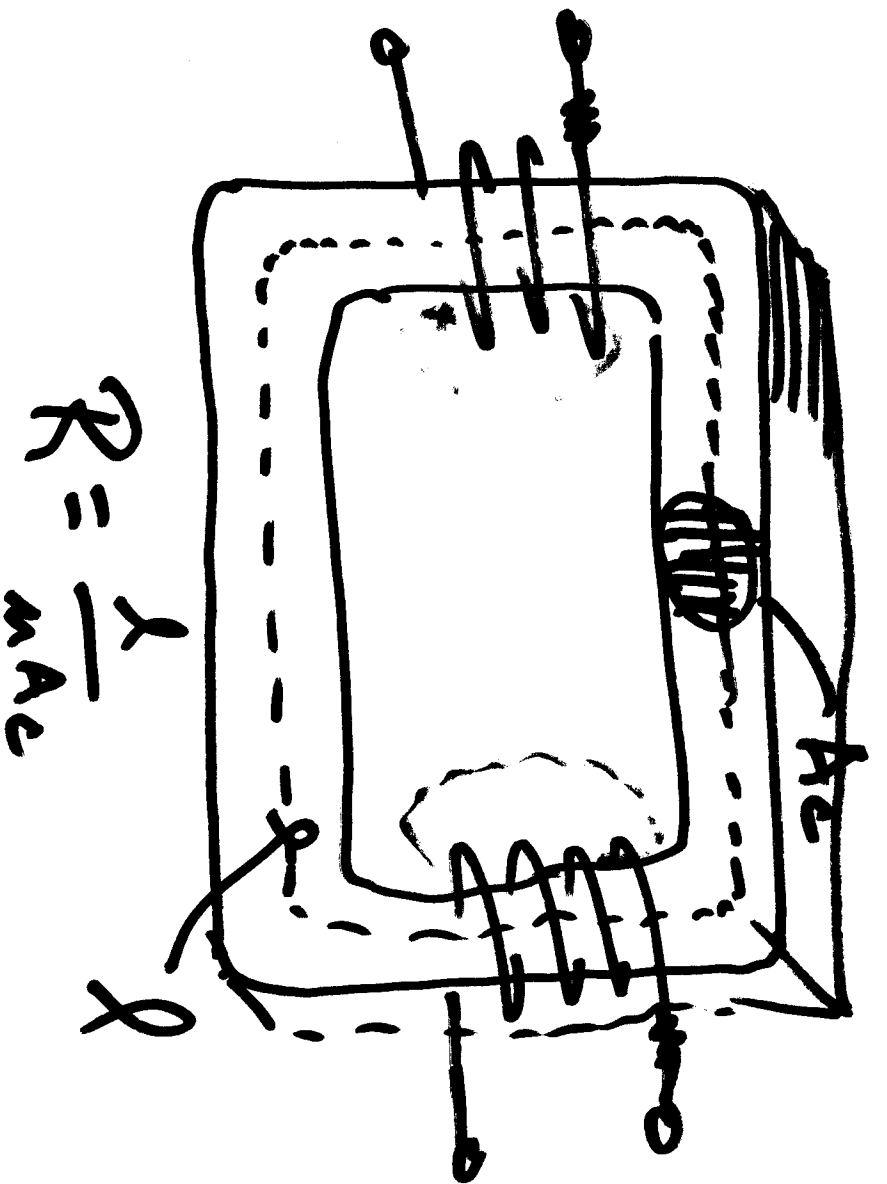




Shell-form



Core form.



$$R = \frac{l}{\mu A_c}$$

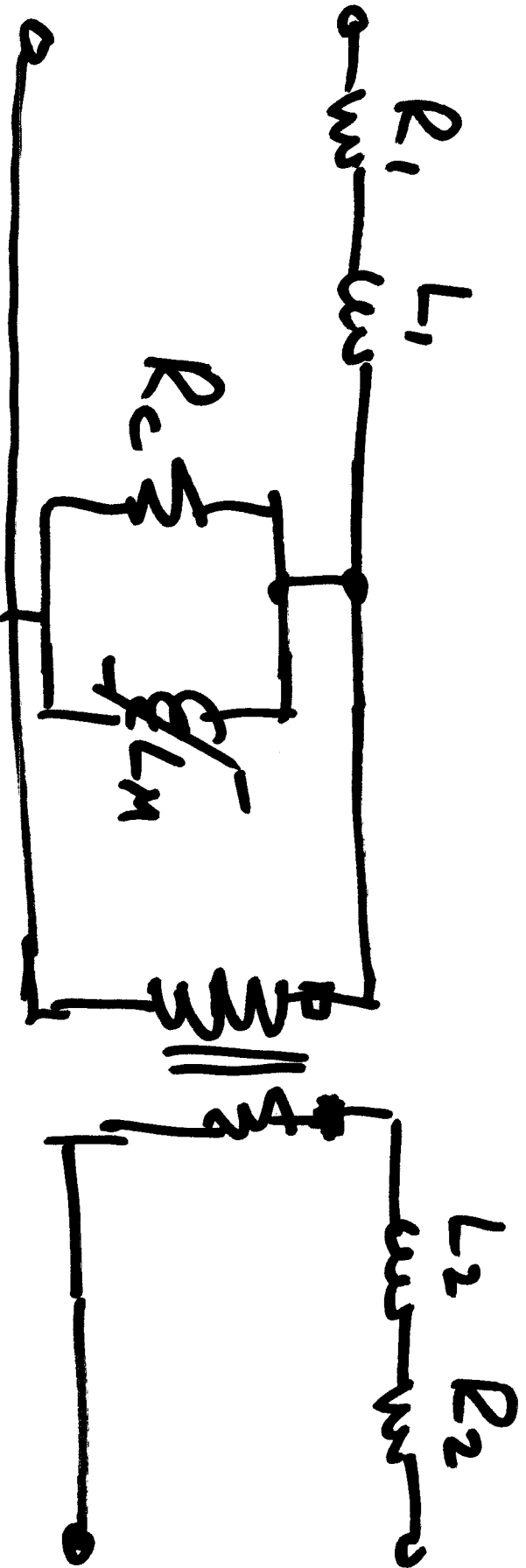
Laminations

$$P_E \propto \frac{1}{r^2}$$

$$4\pi \times 10^7$$

$\downarrow \downarrow$

$$\mu = \mu_r \mu_0$$

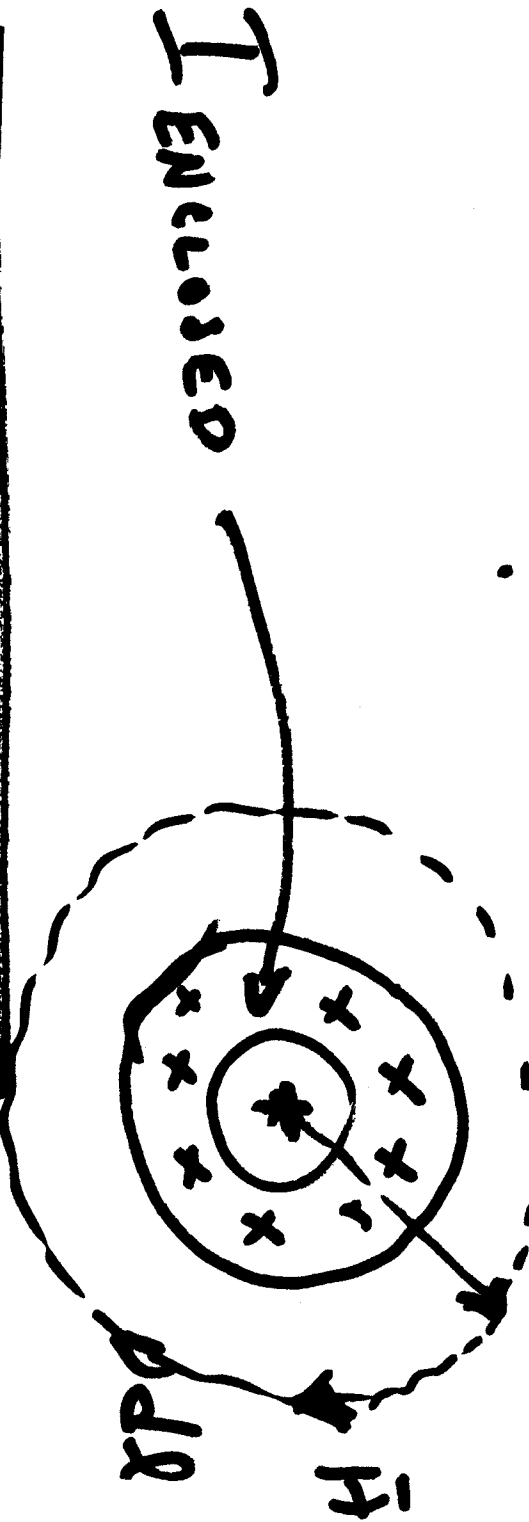


Ampere's Law

$$NI = \oint \mathbf{H} \cdot d\mathbf{R}$$

?

$$\mathbf{H} = \frac{I_{\text{enclosed}}}{2\pi r}$$

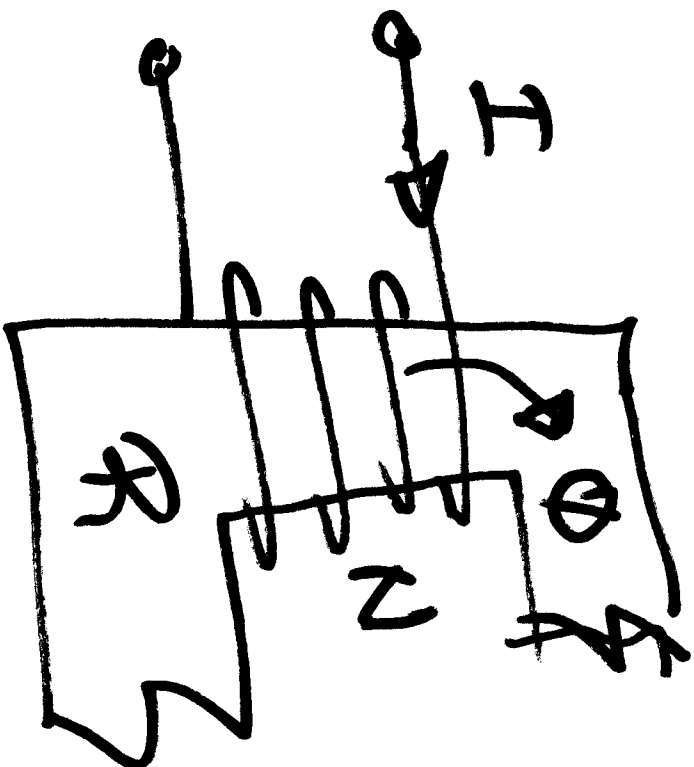


$$I_{\text{enclosed}} = \oint \mathbf{H} \cdot d\mathbf{R}$$

Clamp-on
ammeter
or
current
probe.

Next:

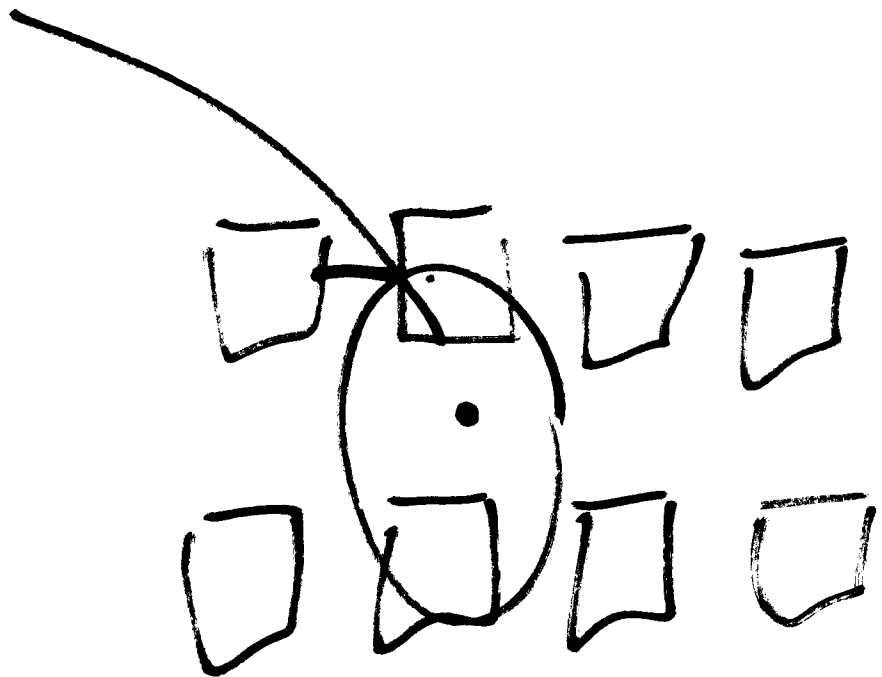
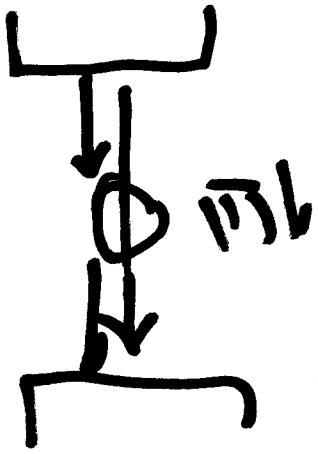
Amperes Law



MMF

$$NI = \Phi R$$

Electrical Magnetic



How many possibilities are there
for Δ -Y or Y- Δ phase shifts?

$\pm 30^\circ$
 $\pm 90^\circ$
 $\pm 150^\circ$)

6 each

\Rightarrow 12 total.

Auto- Δ

Zig-Zag

Extended Δ .

" Hoopner "

Zig-Zag w/ Δ

tertiary.