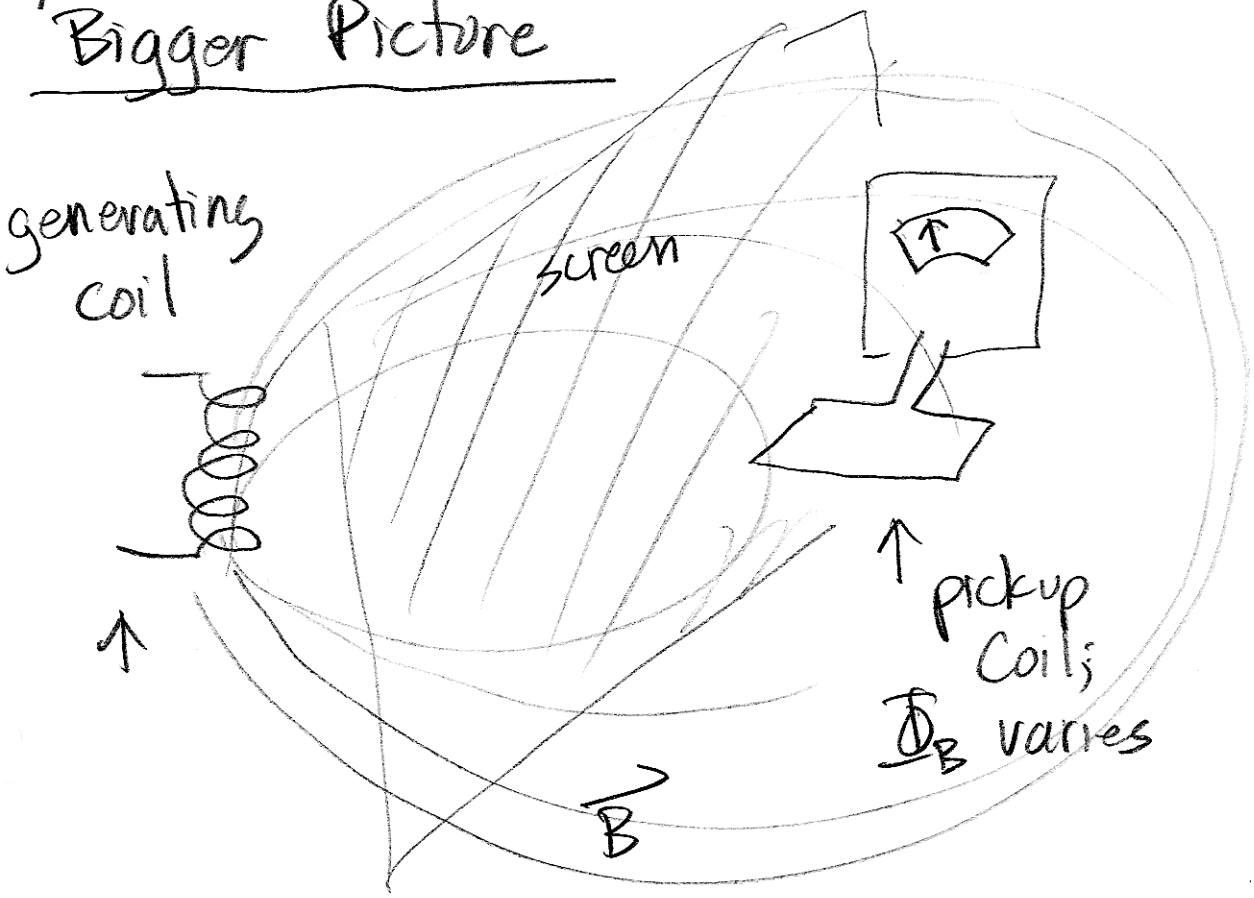
Bigger Picture



(1) move pickup.

(2) move generating coil

(3): vary current in generating coil

All 3 cause Φ_B to vary in pickup coil .. all 3 indistinguishable.

$$\mathcal{E} = \underbrace{\int_C \vec{E}\cdot d\vec{s}}_{\text{coil}} = -\frac{1}{c}\frac{d\Phi_B}{dt} = -\frac{1}{c}\frac{d}{dt}\int_S \vec{B}\cdot d\vec{a}$$

C bounds S

$$\int_C \vec{E}\cdot d\vec{s} = \int_S (\text{curl}\,\vec{E})\cdot d\vec{a} = -\frac{1}{c}\frac{d}{dt}\int \vec{B}\cdot d\vec{a}$$

go to infinitesimal area, circuit:

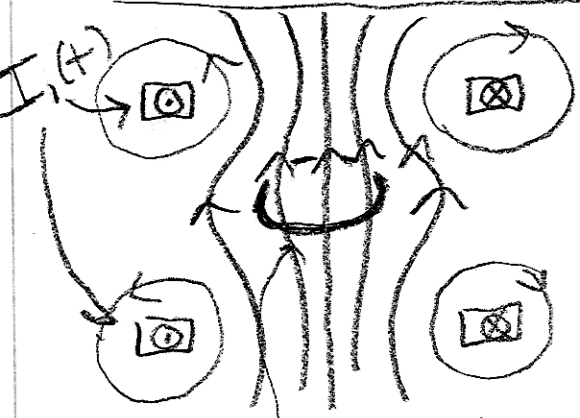
$$\boxed{\text{curl}\,\vec{E} = -\frac{1}{c}\frac{\partial \vec{B}}{\partial t}}$$

another of maxwell's equations

$$\text{div}\,\vec{E} = 4\pi\rho \qquad \text{div}\,\vec{B} = 0$$

$$\text{curl}\,\vec{B} = \frac{4\pi}{c}\vec{J} \quad \text{(a little more)}$$

Concrete Example



B at center for peak I_1 ...

$B_0 = 50$ gauss

$I \rightarrow$ 60 cycles/second A.C.

$$B(t) = B_0 \sin\left(\underbrace{2\pi\cdot 60}_{377\ \frac{1}{s}}\cdot t\right) \quad (2\pi f)$$

second "pickup" coil .. resistance R, $r = 10\text{cm}$

31" loop

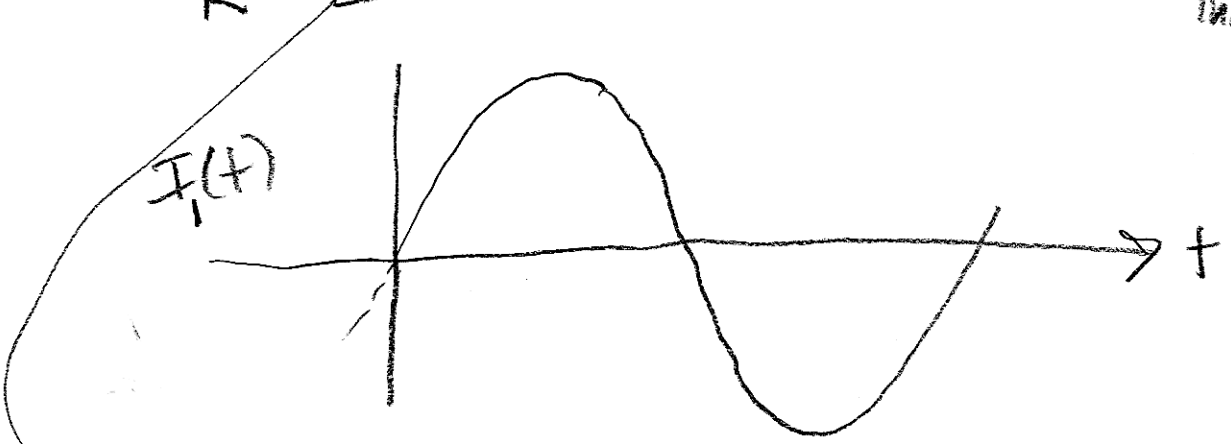
$$\Phi_B = \pi r^2 \cdot B(t)$$

$$\mathcal{E} = -\frac{1}{c}\frac{d\Phi_B}{dt} = -\frac{\pi r^2 \cdot B_0 \cdot 2\pi f}{c}\cos(2\pi f t)$$

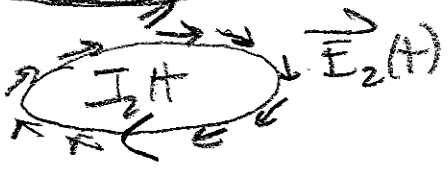
not stat volts

$$\mathcal{E}(\text{volts}) = -10^{-8}\cdot 3.14\cdot(10^2)\cdot 50\cdot 377\cos(377t)$$

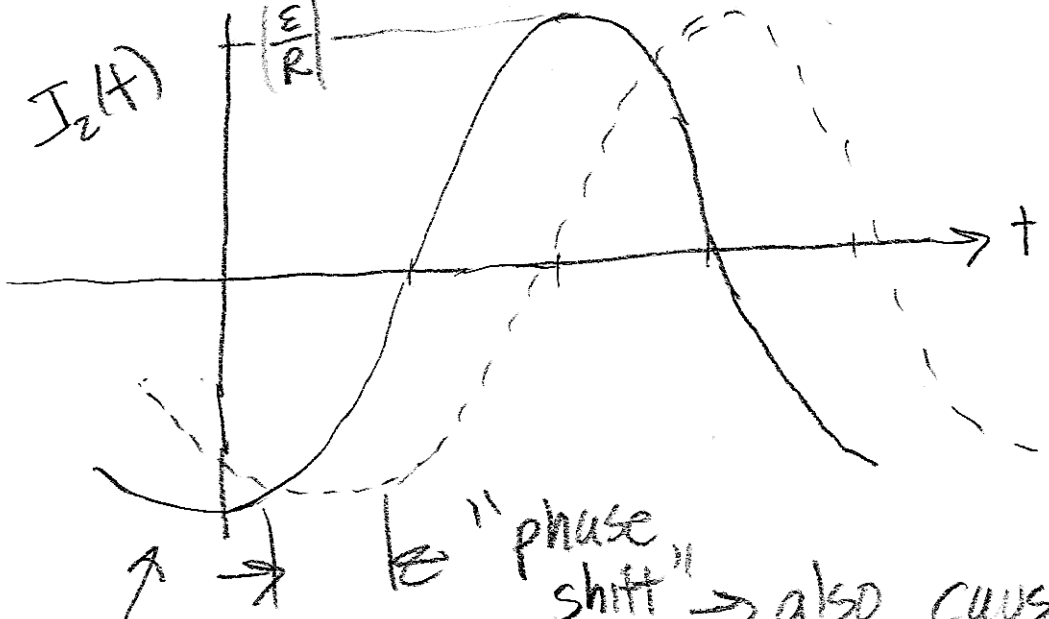
$I_2(t) = \frac{\mathcal{E}}{R} = \left[-(59)\cdot 10^{-3}\ V\right] \cos(377\,t)$ (ignoring self inductance).



(just after $t=$



– means other direction



"phase shift" → also causes ring to jump

inclusion of self inductan actually shifts this