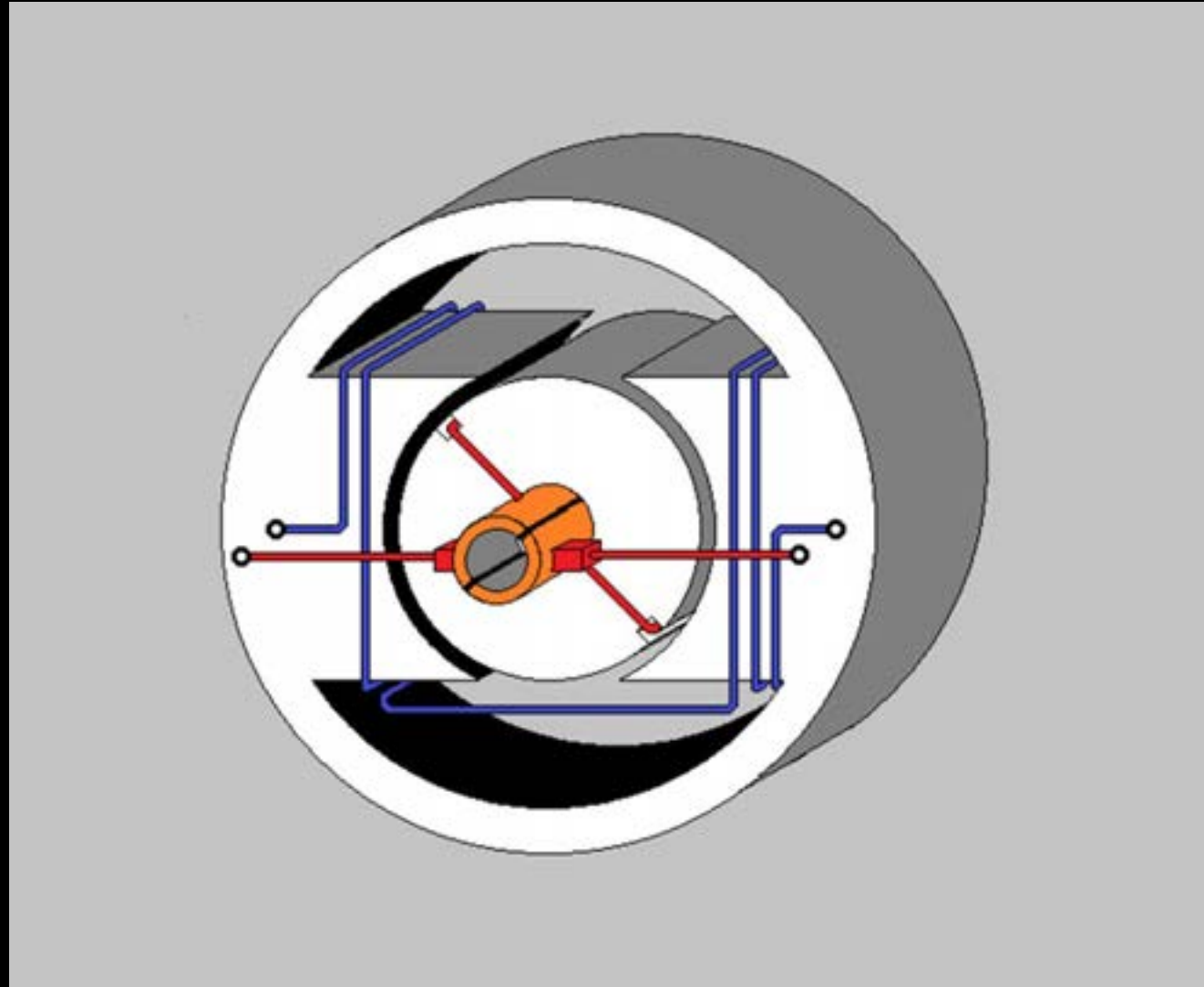
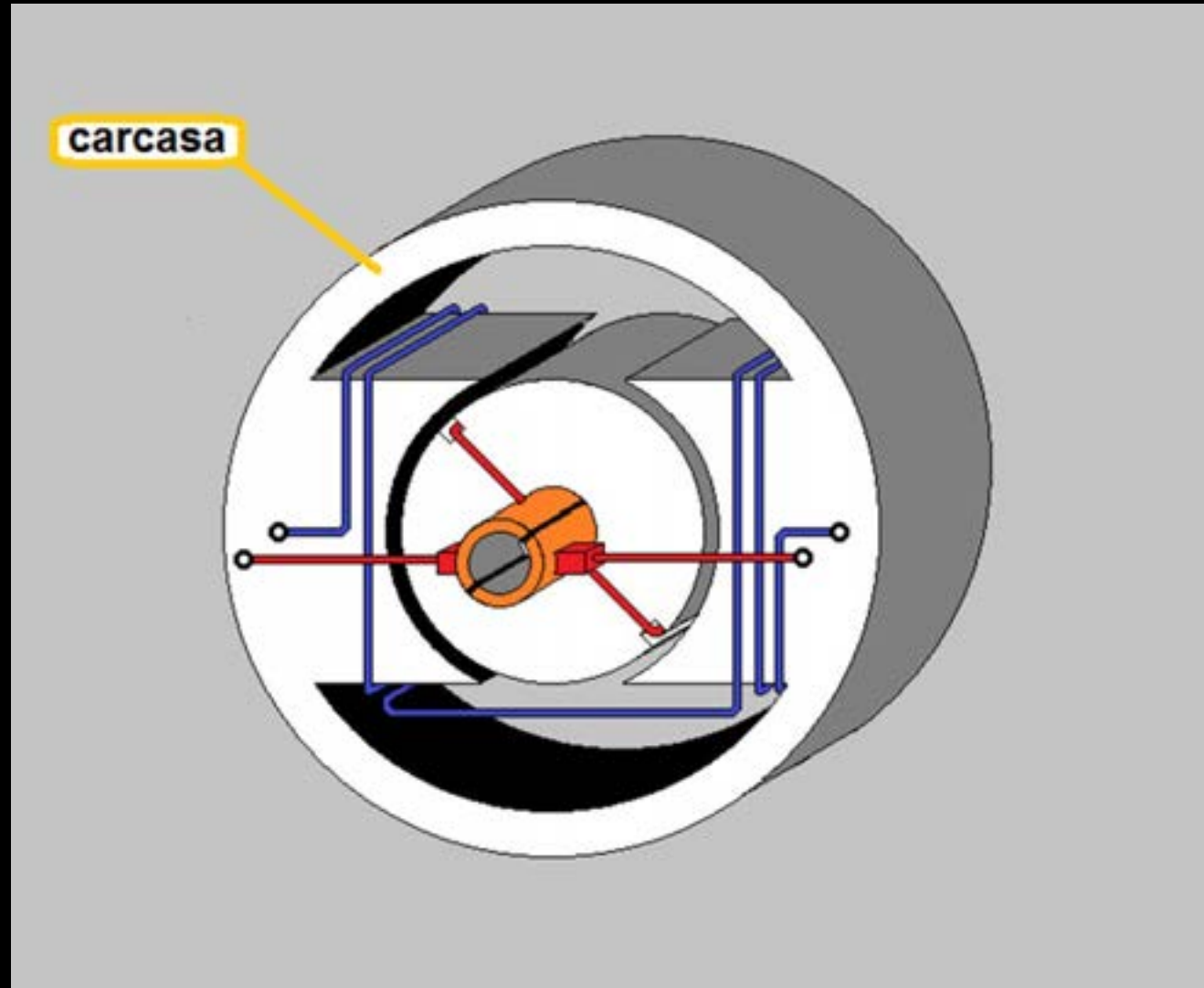


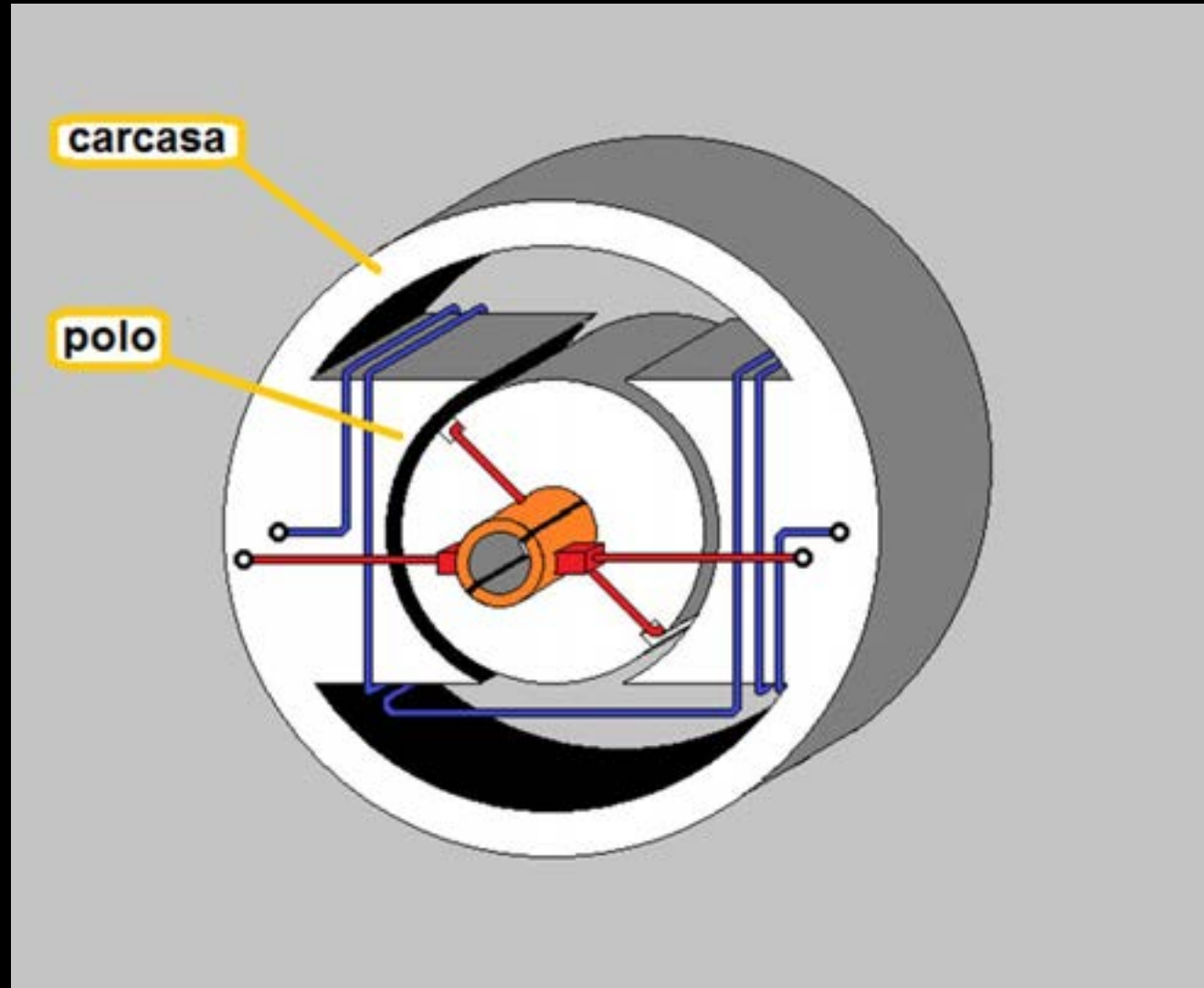
MOTOR DE TRACCIÓN



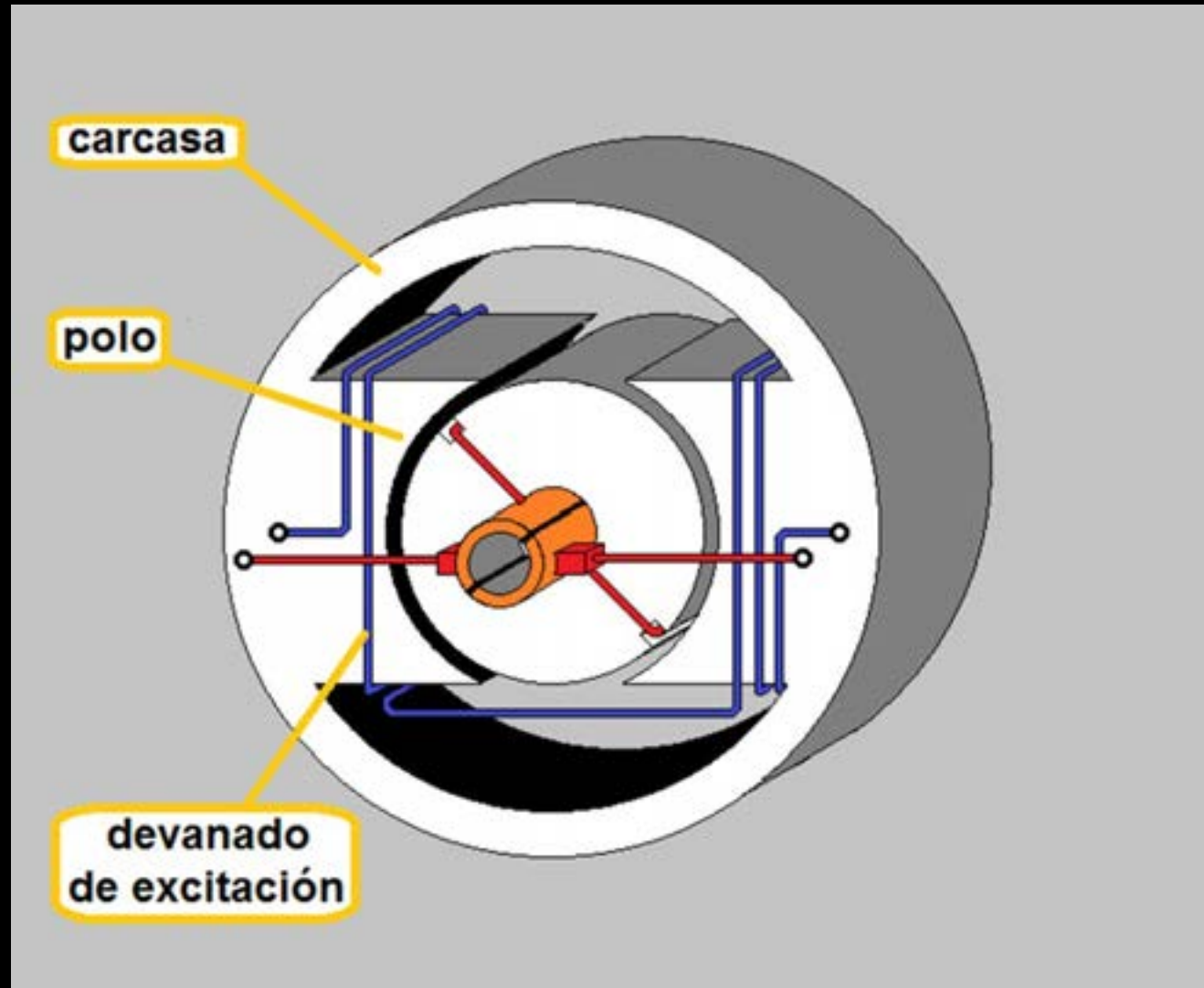
Máquina elemental de corriente continua



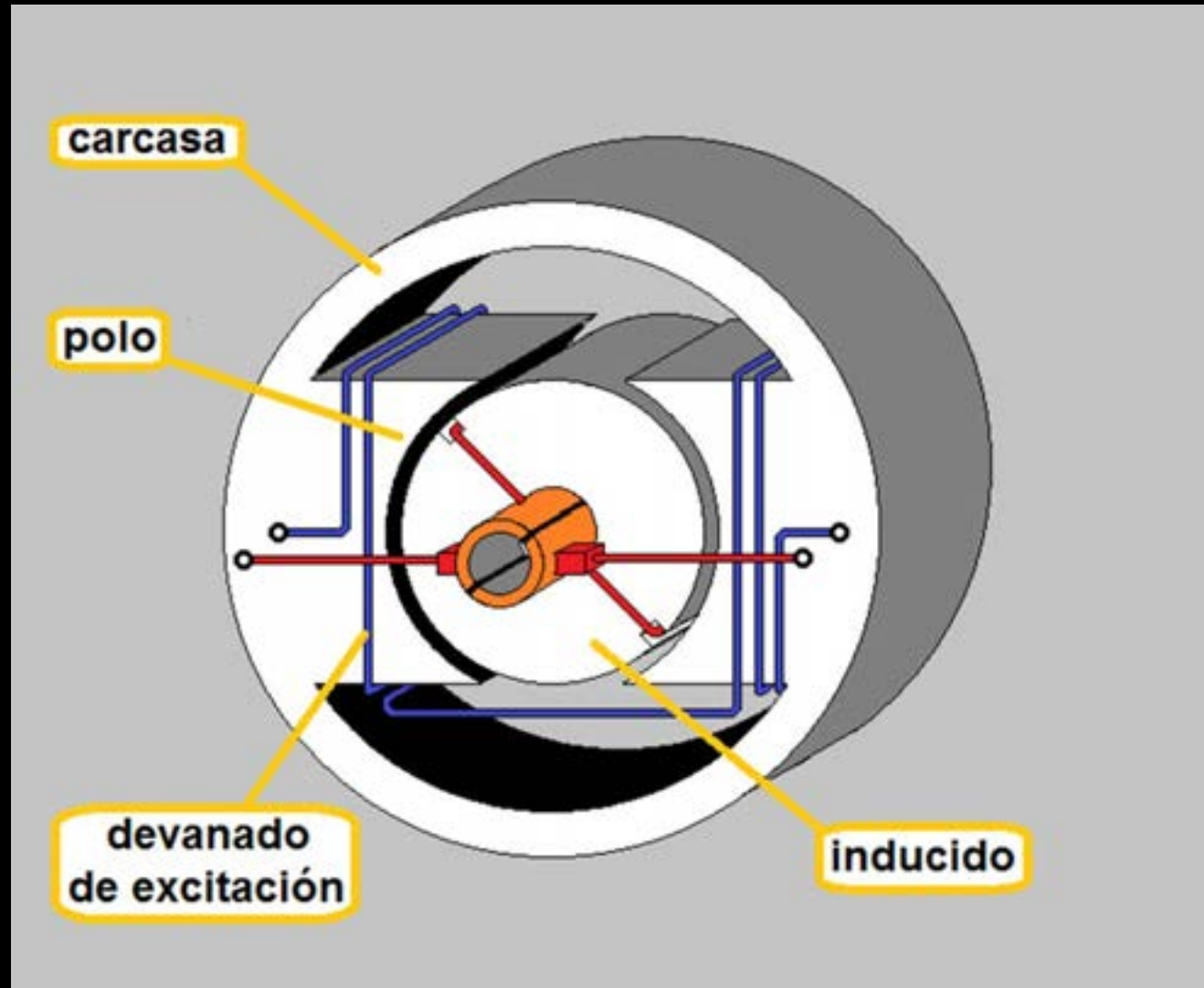
Máquina elemental de corriente continua



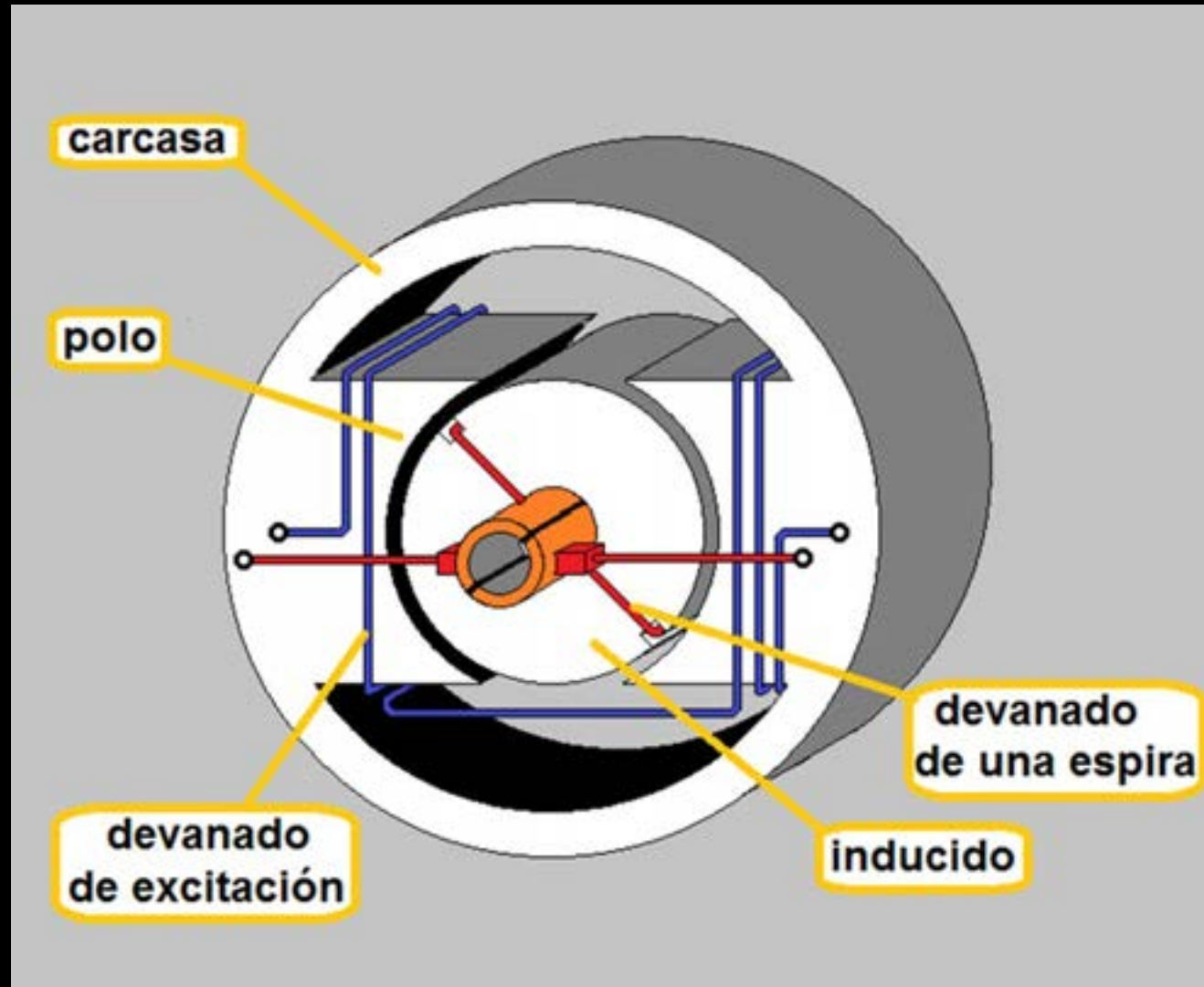
Máquina elemental de corriente continua



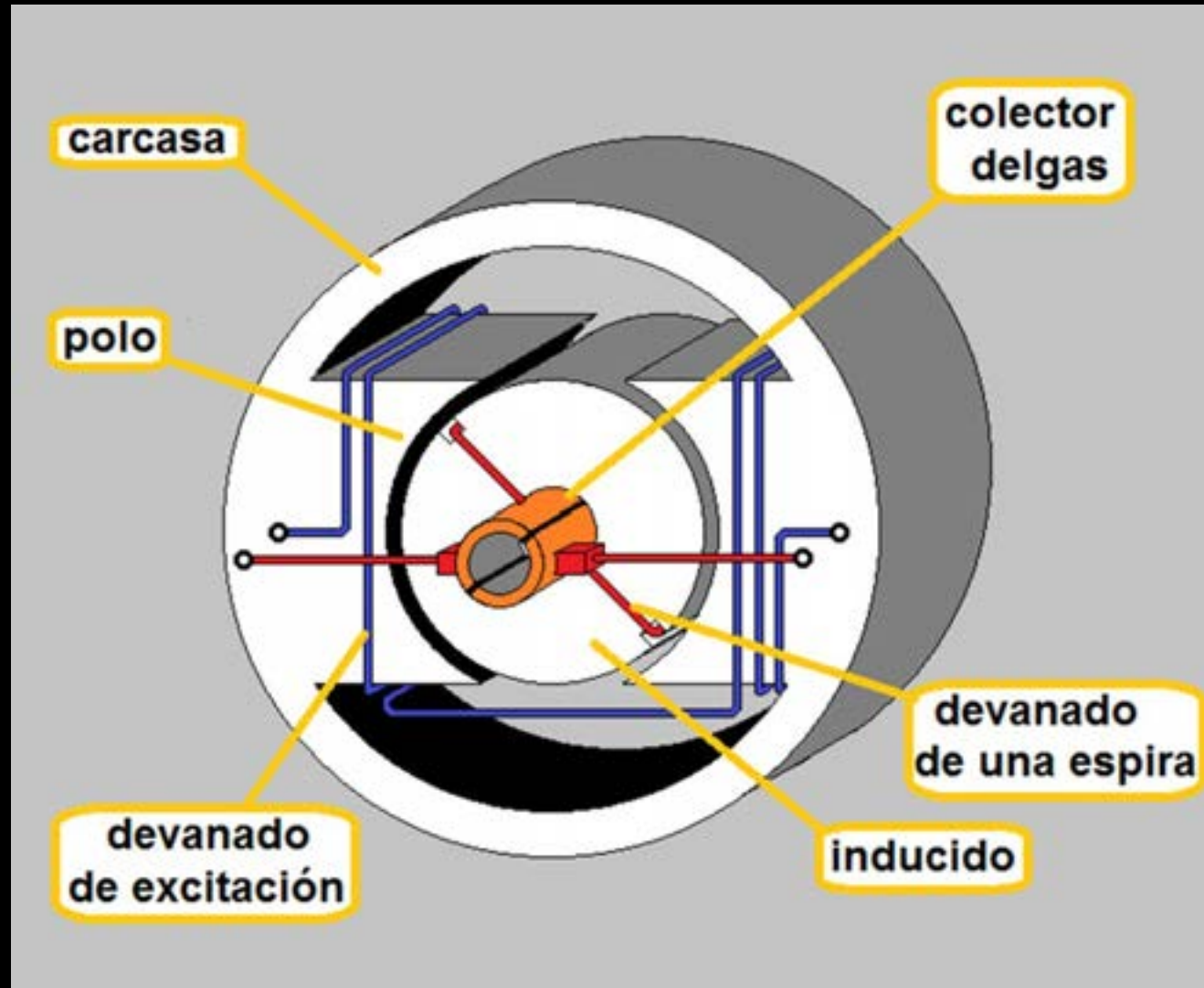
Máquina elemental de corriente continua



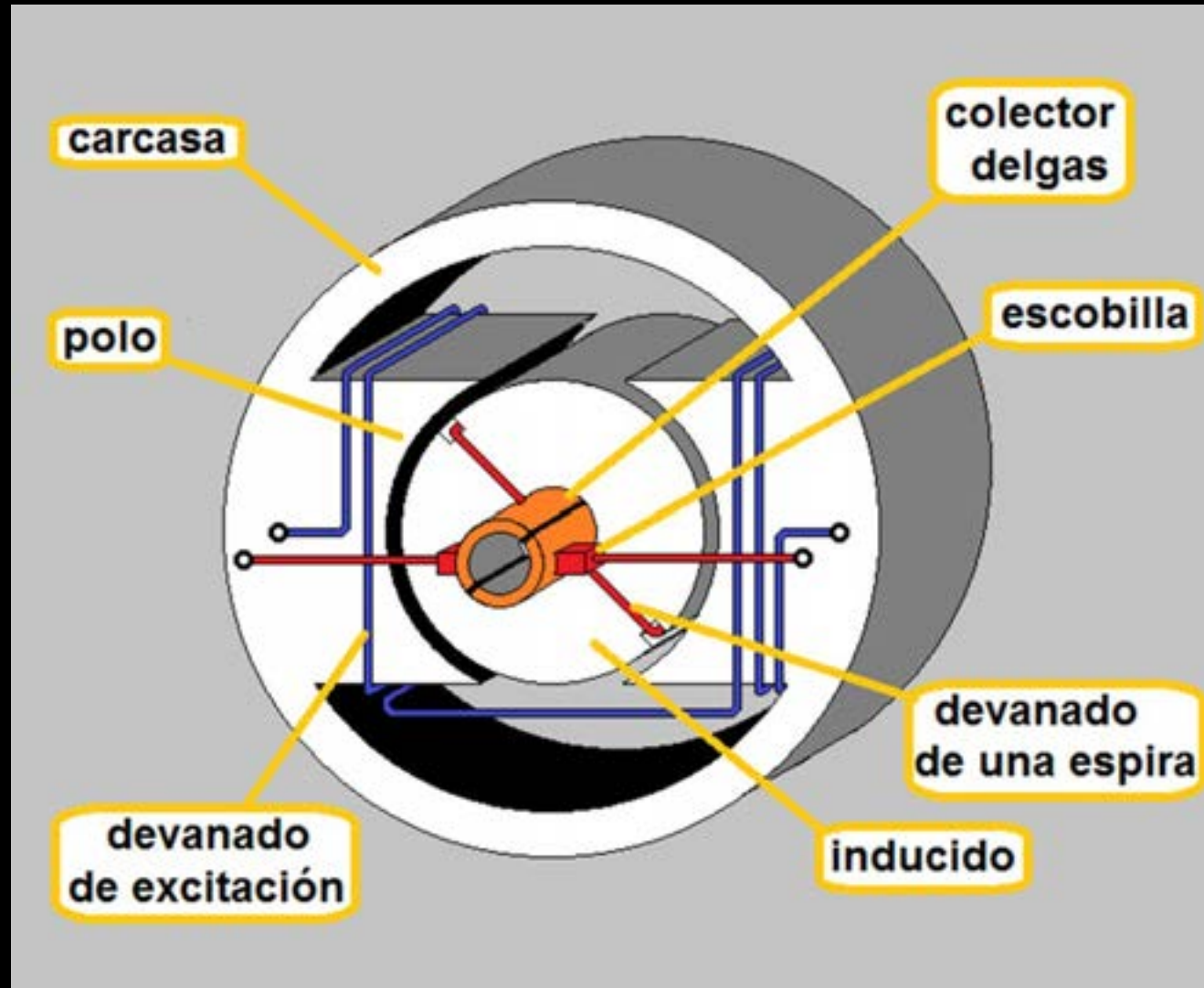
Máquina elemental de corriente continua



Máquina elemental de corriente continua



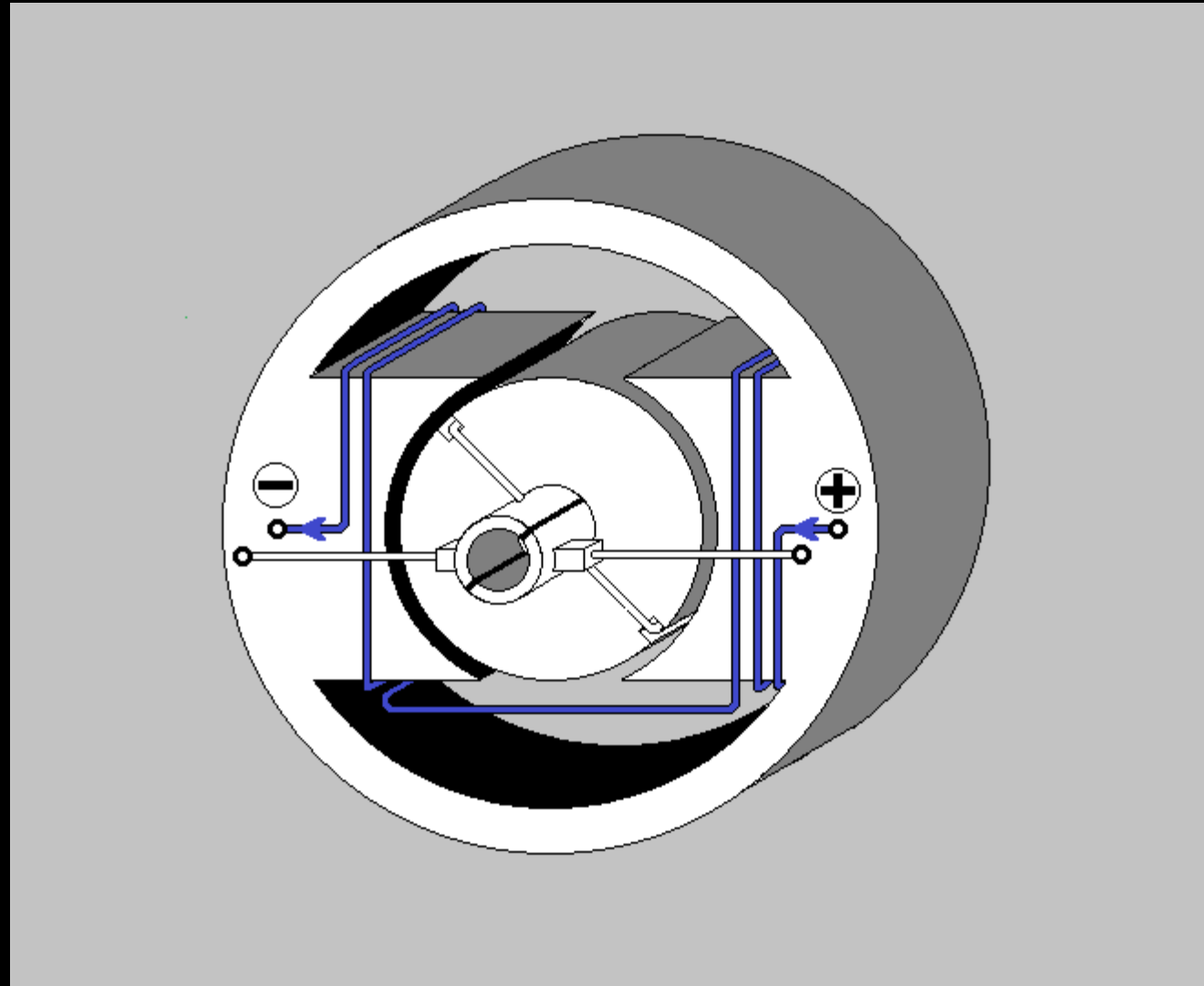
Máquina elemental de corriente continua



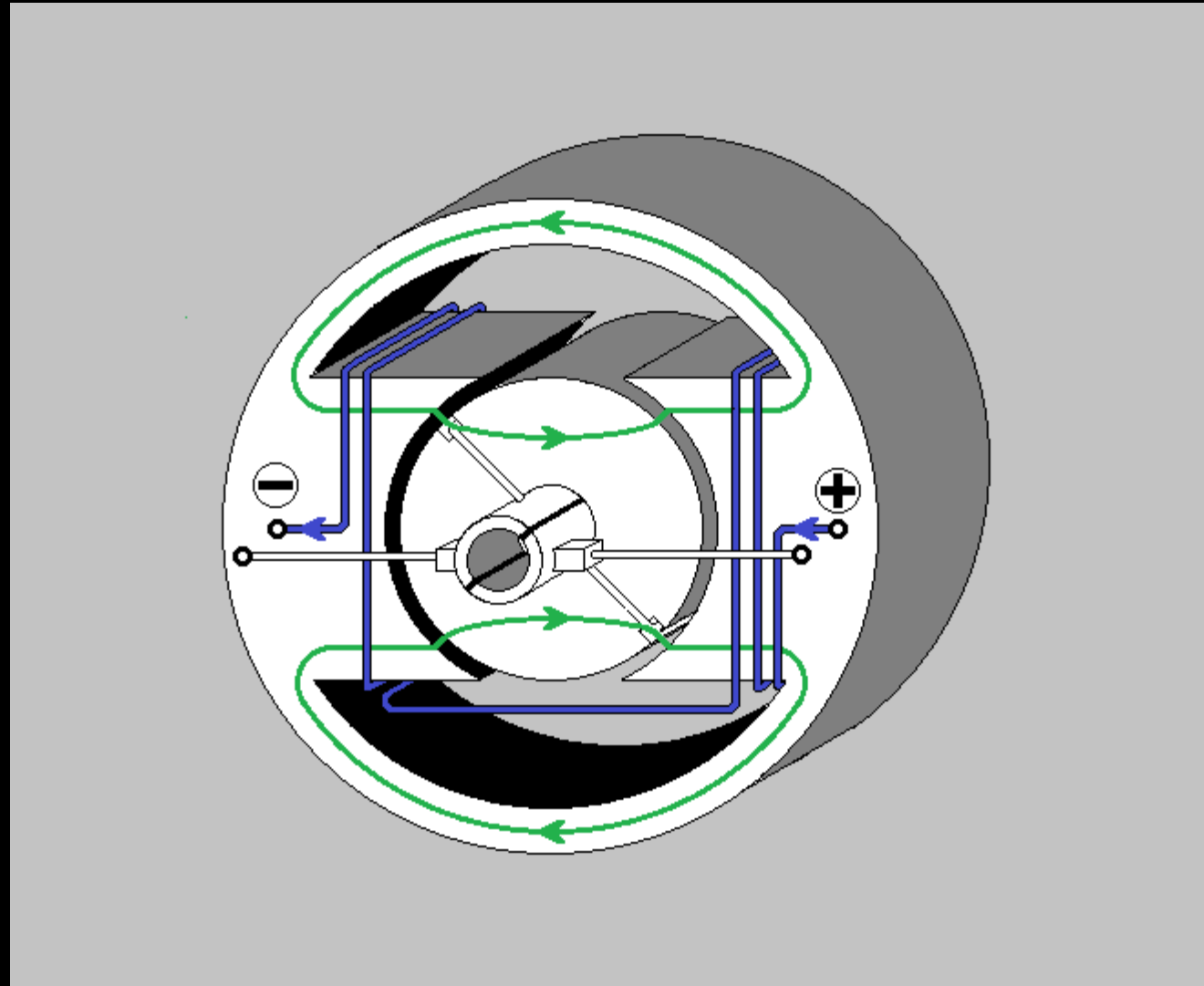
Máquina elemental de corriente continua



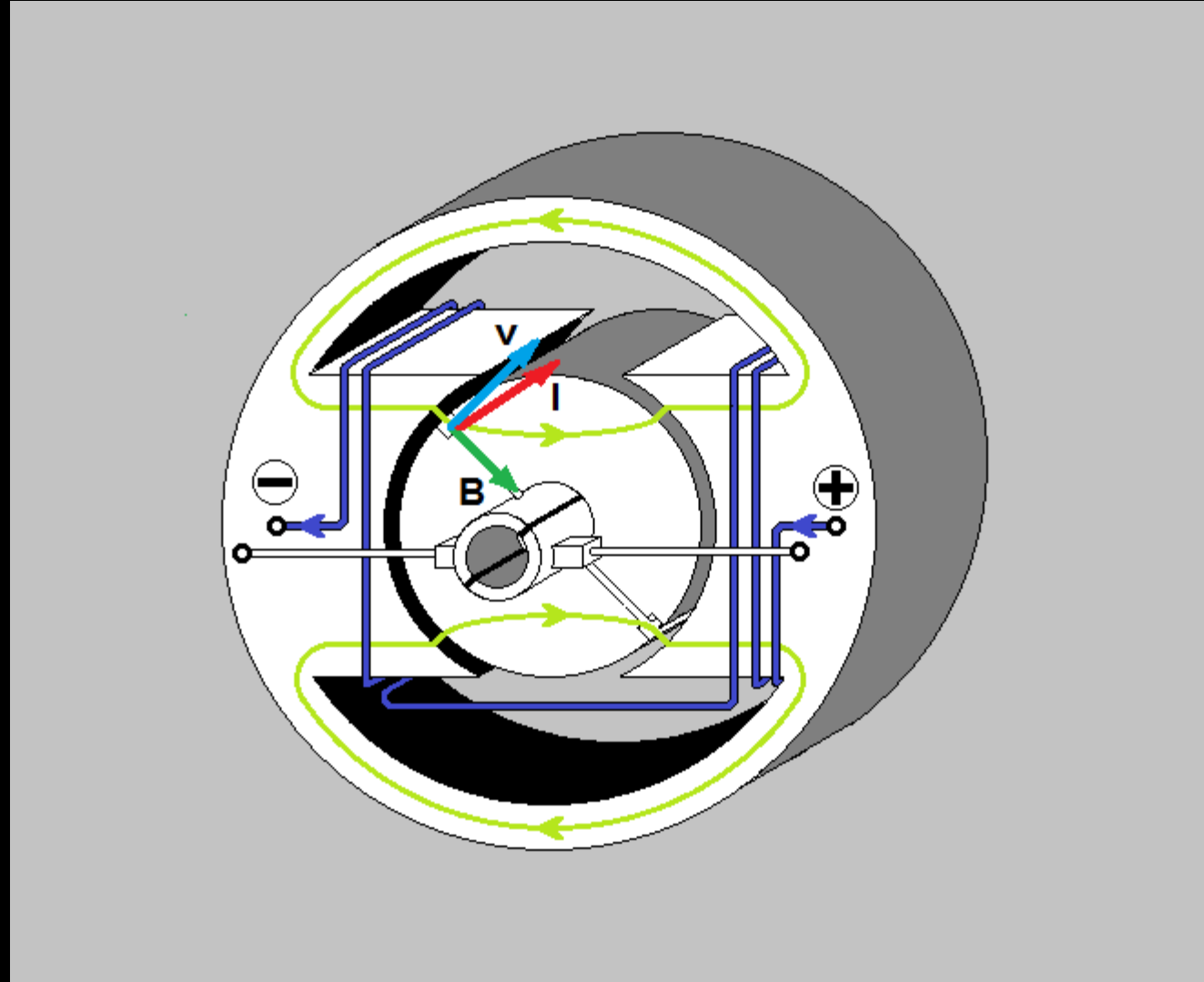
Insulation inserted prior to coil insertion



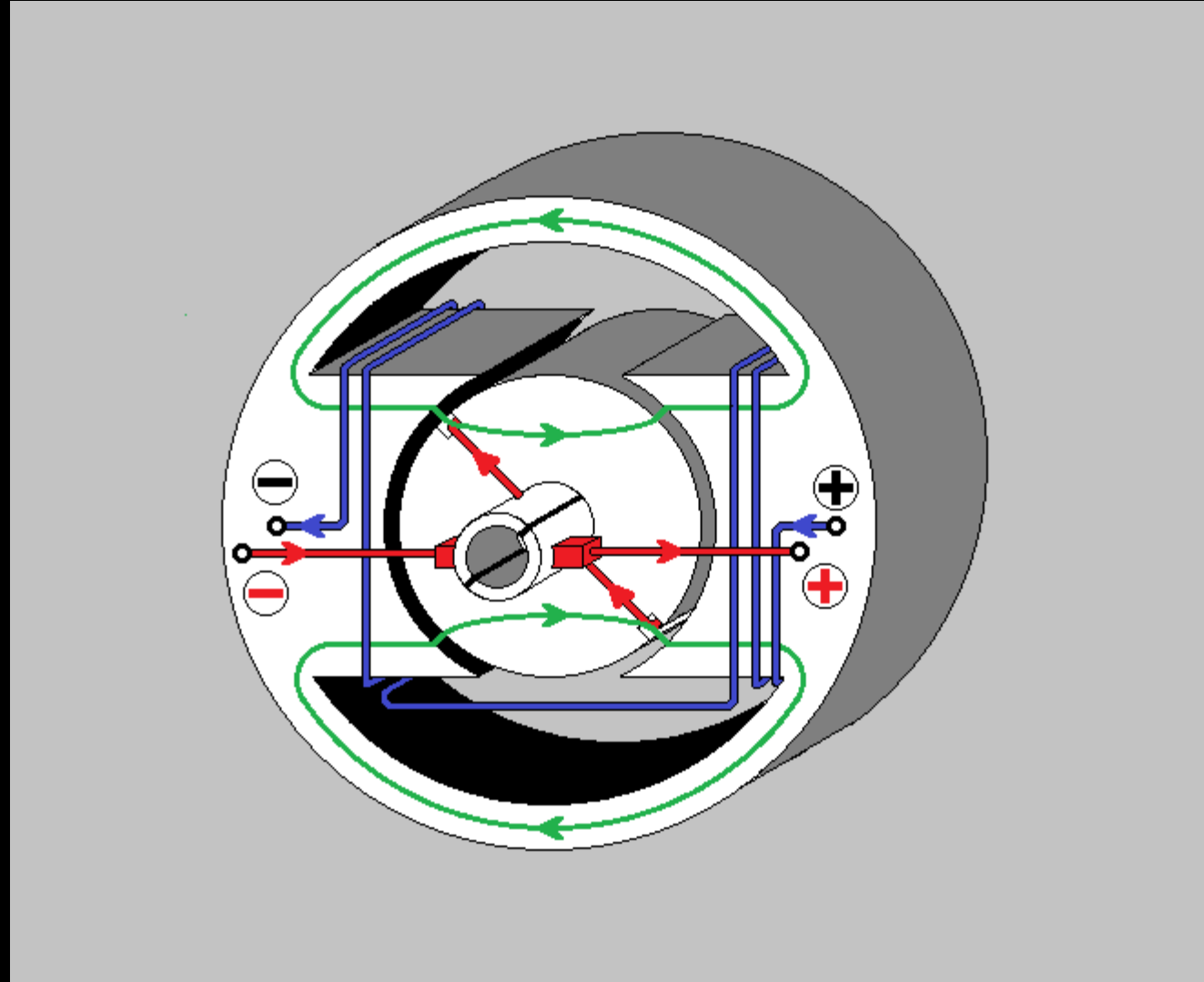
Polos de excitación



Sentido del campo magnético

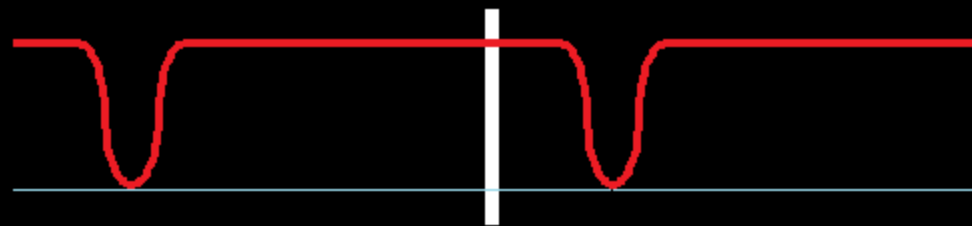
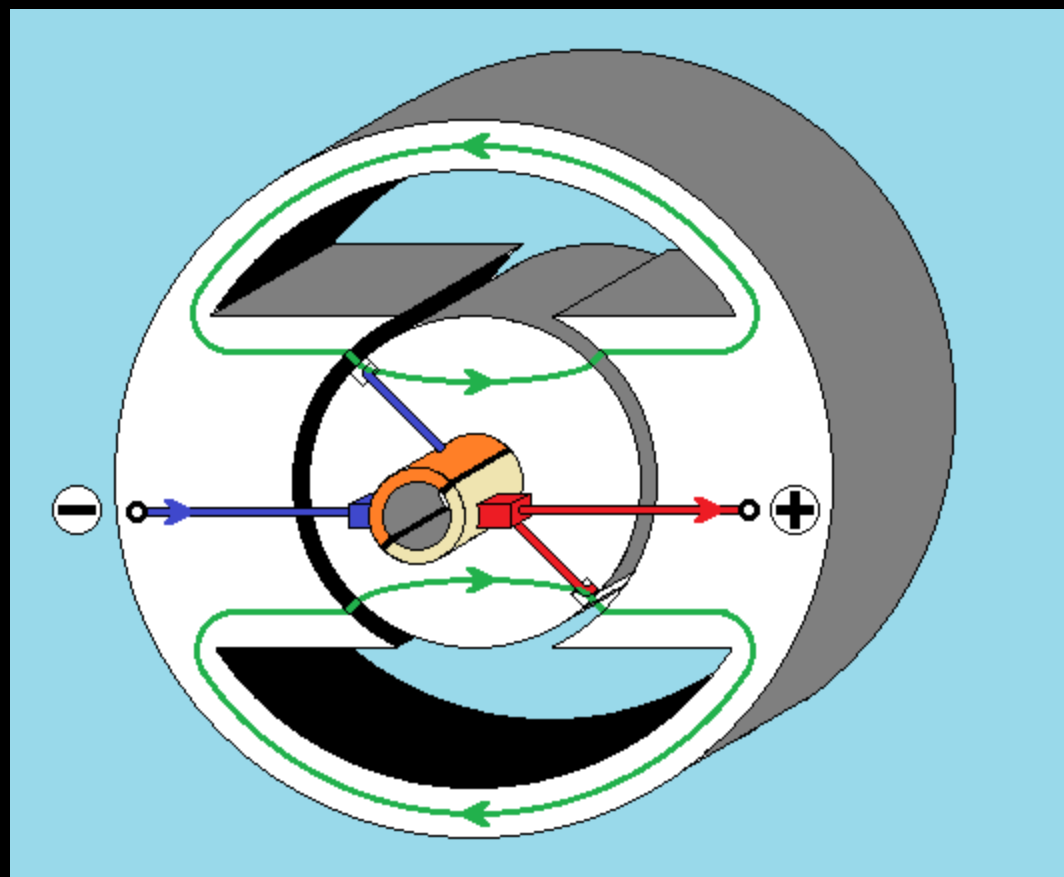


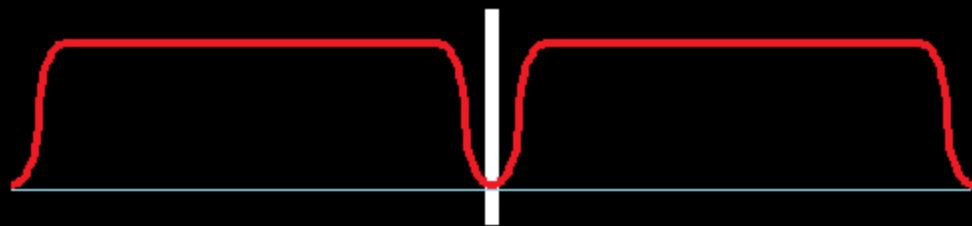
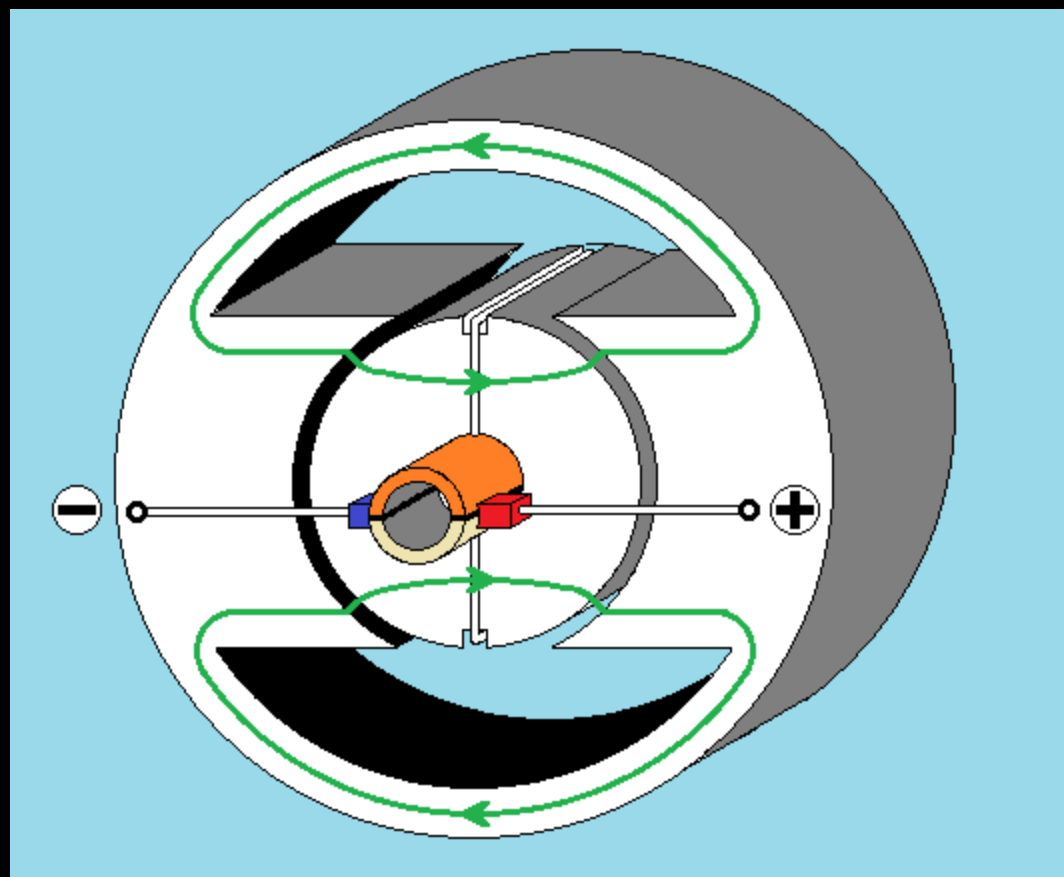
Funcionamiento como generador

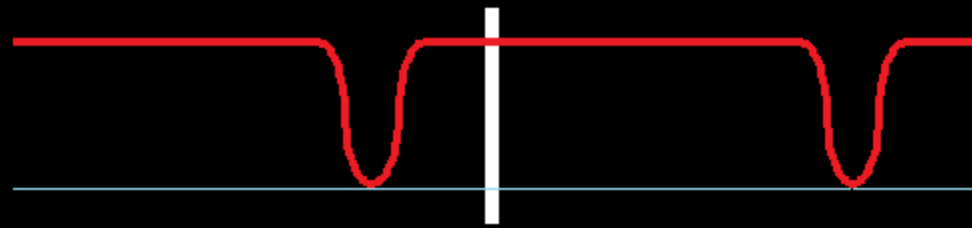
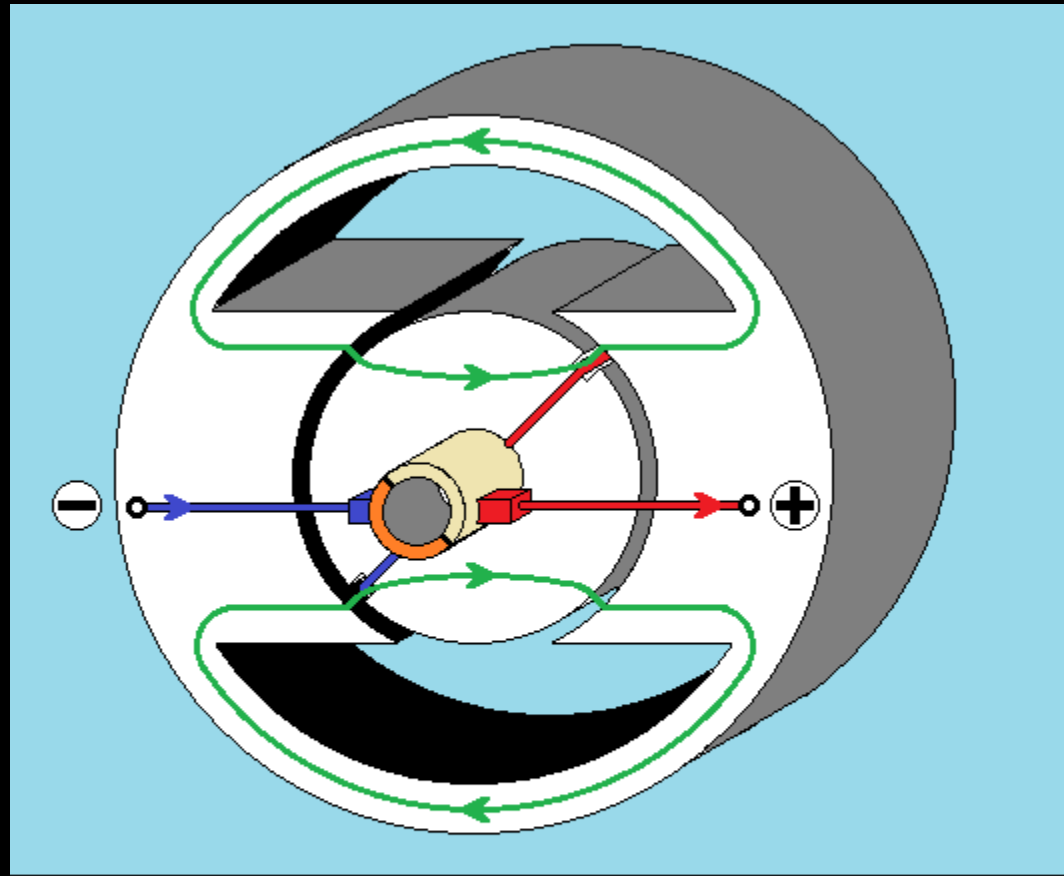


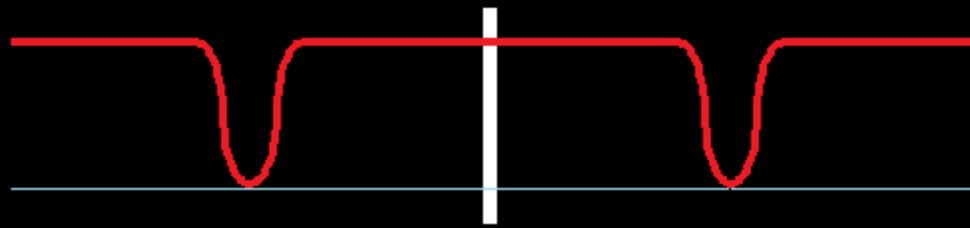
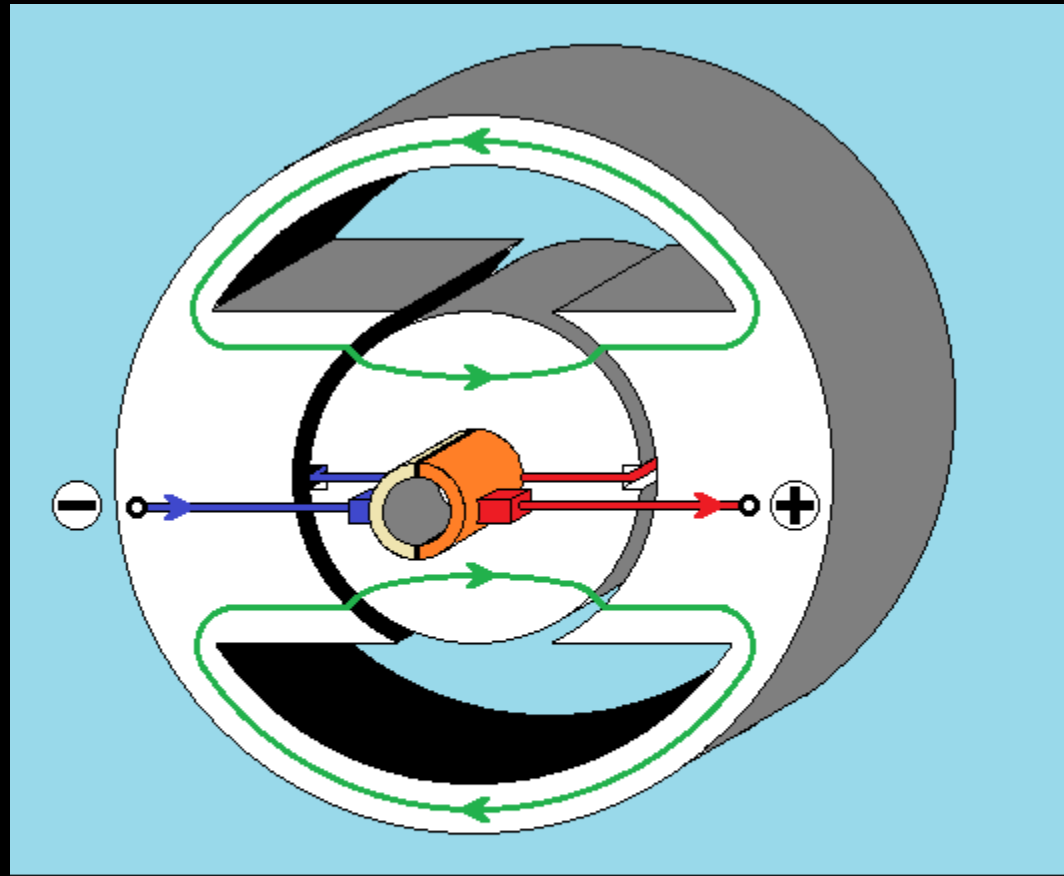
Sentido de la corriente de inducido

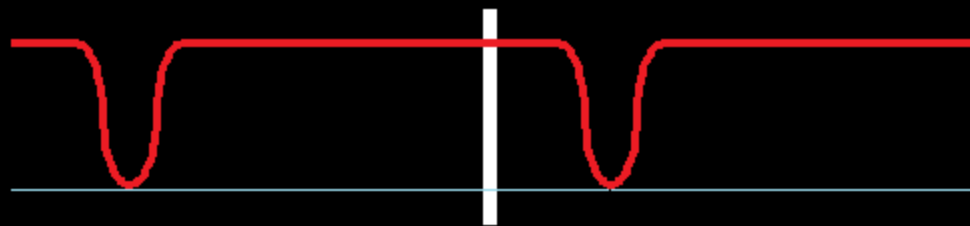
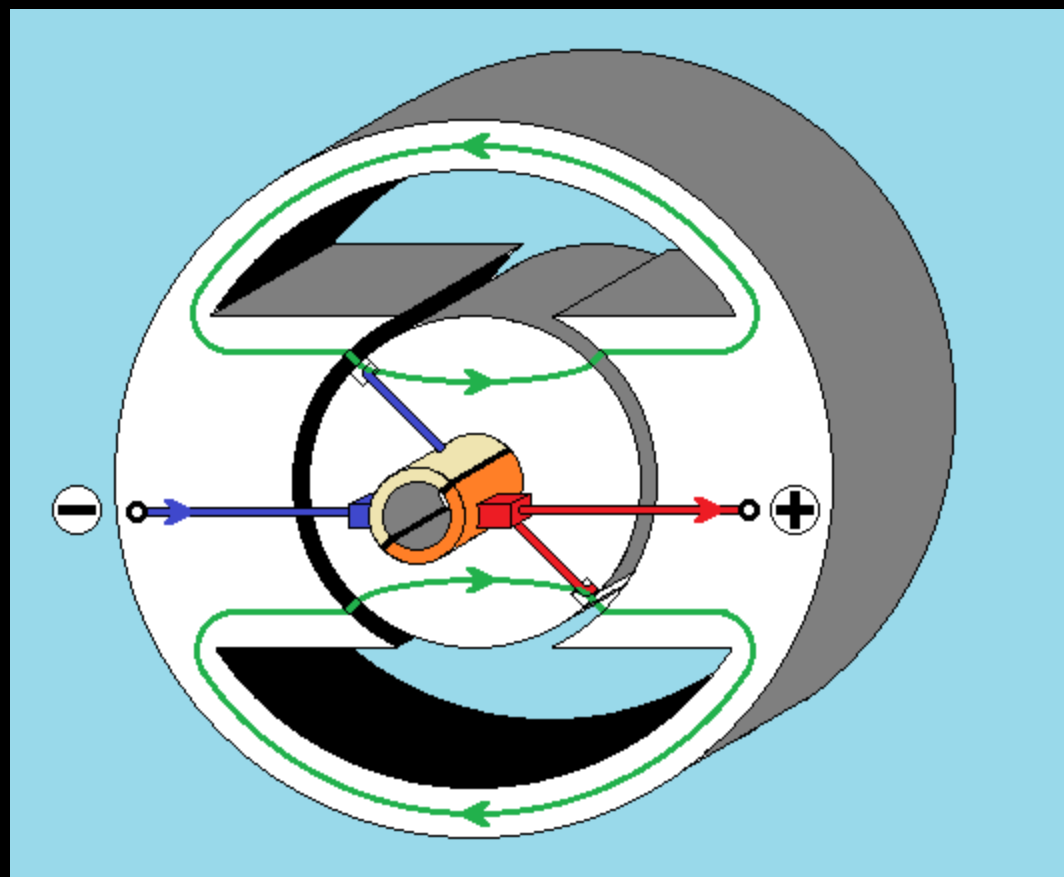
Conmutación

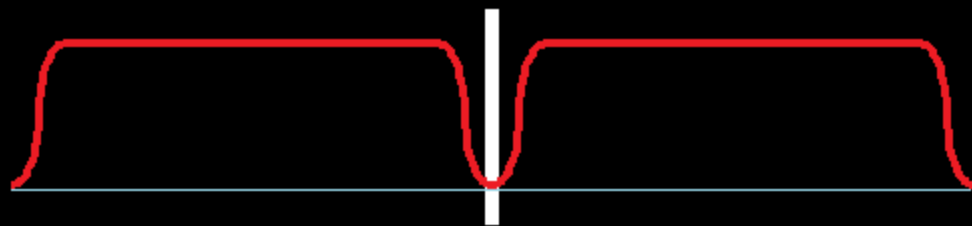
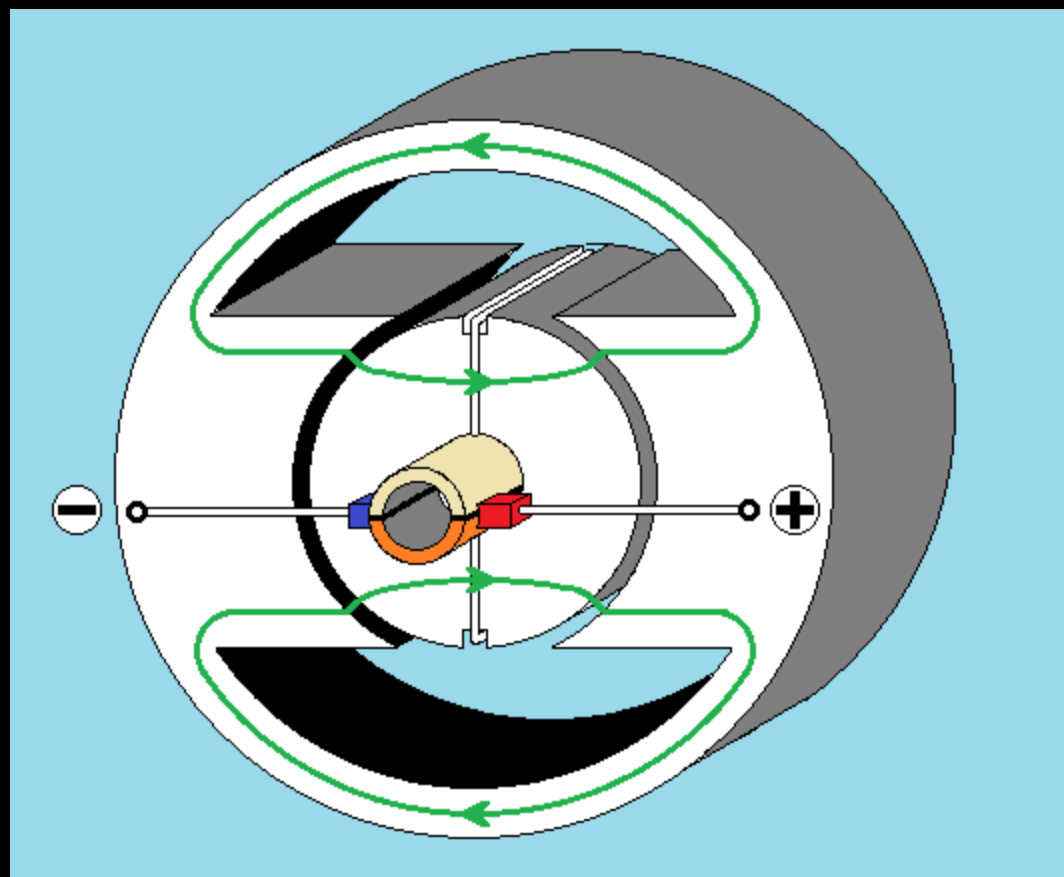


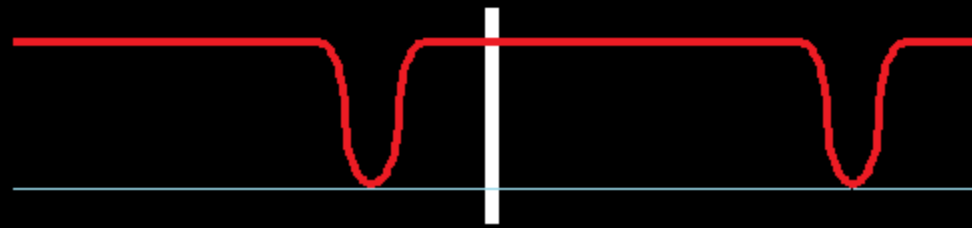
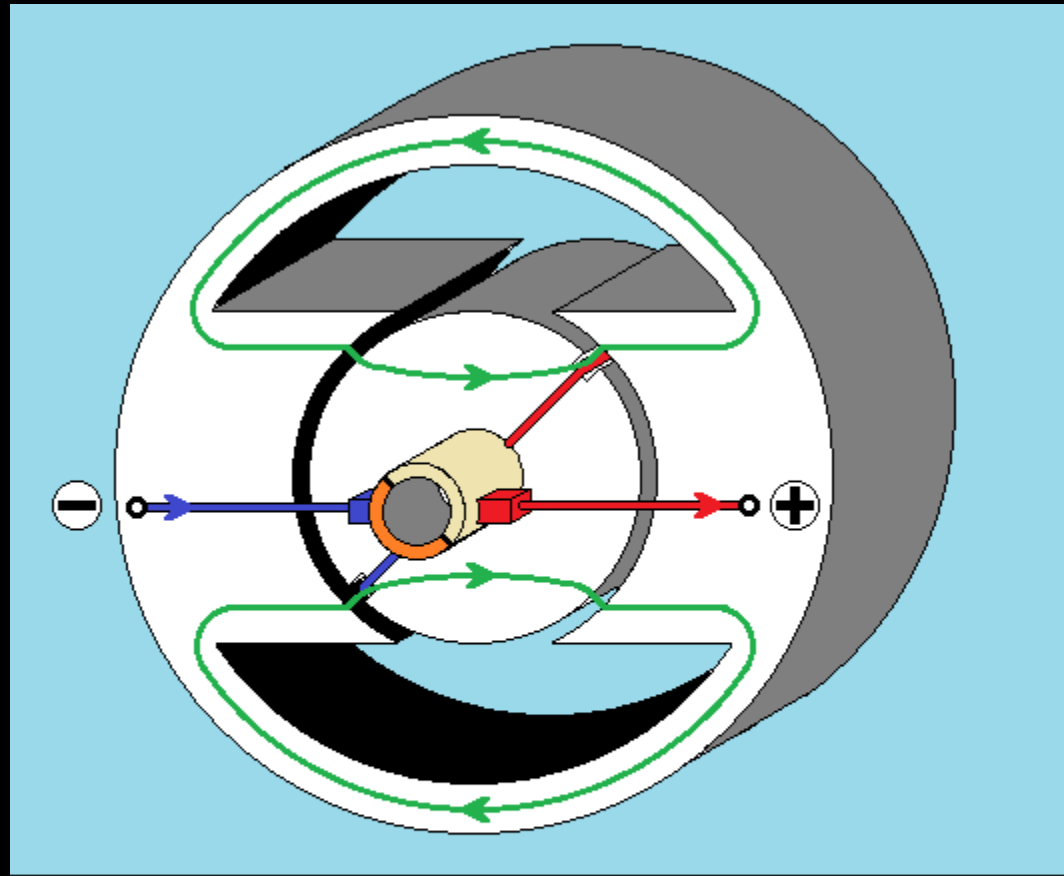


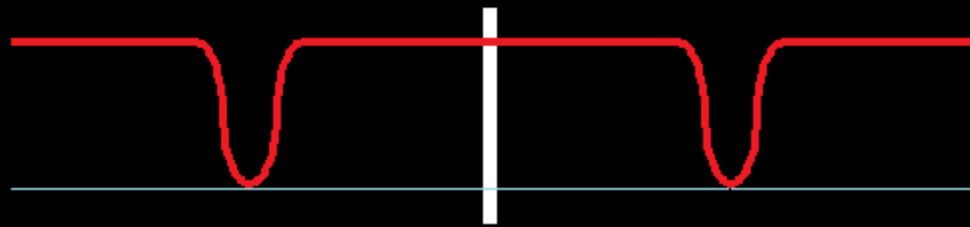
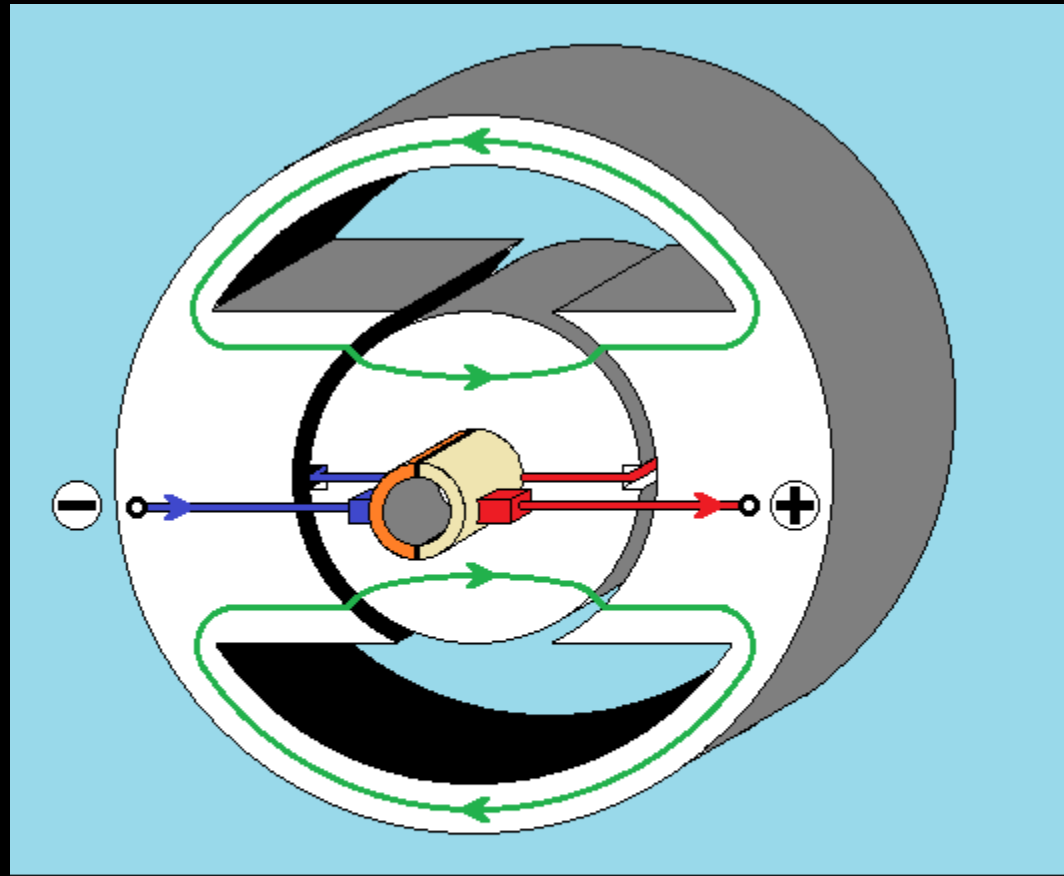


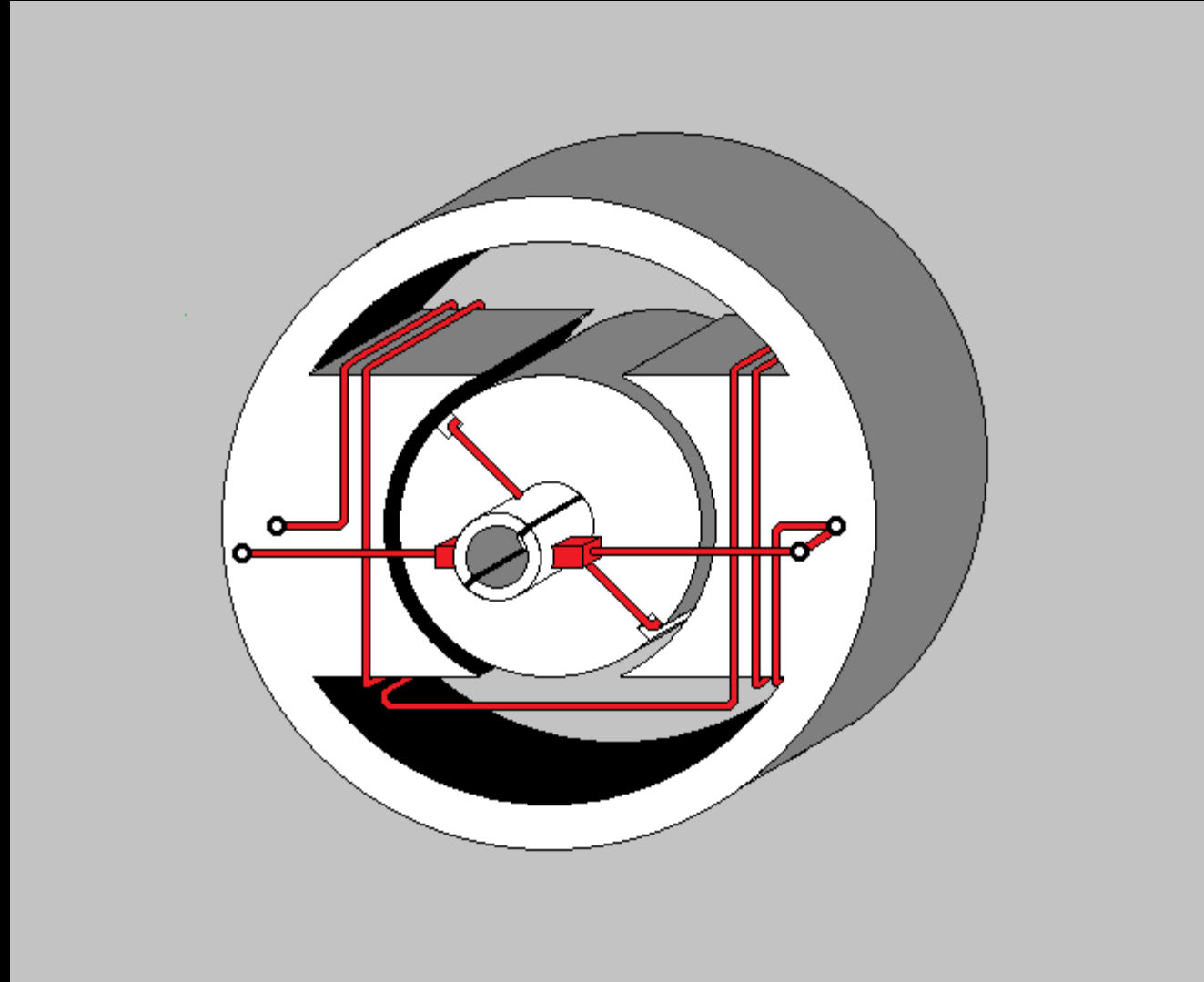




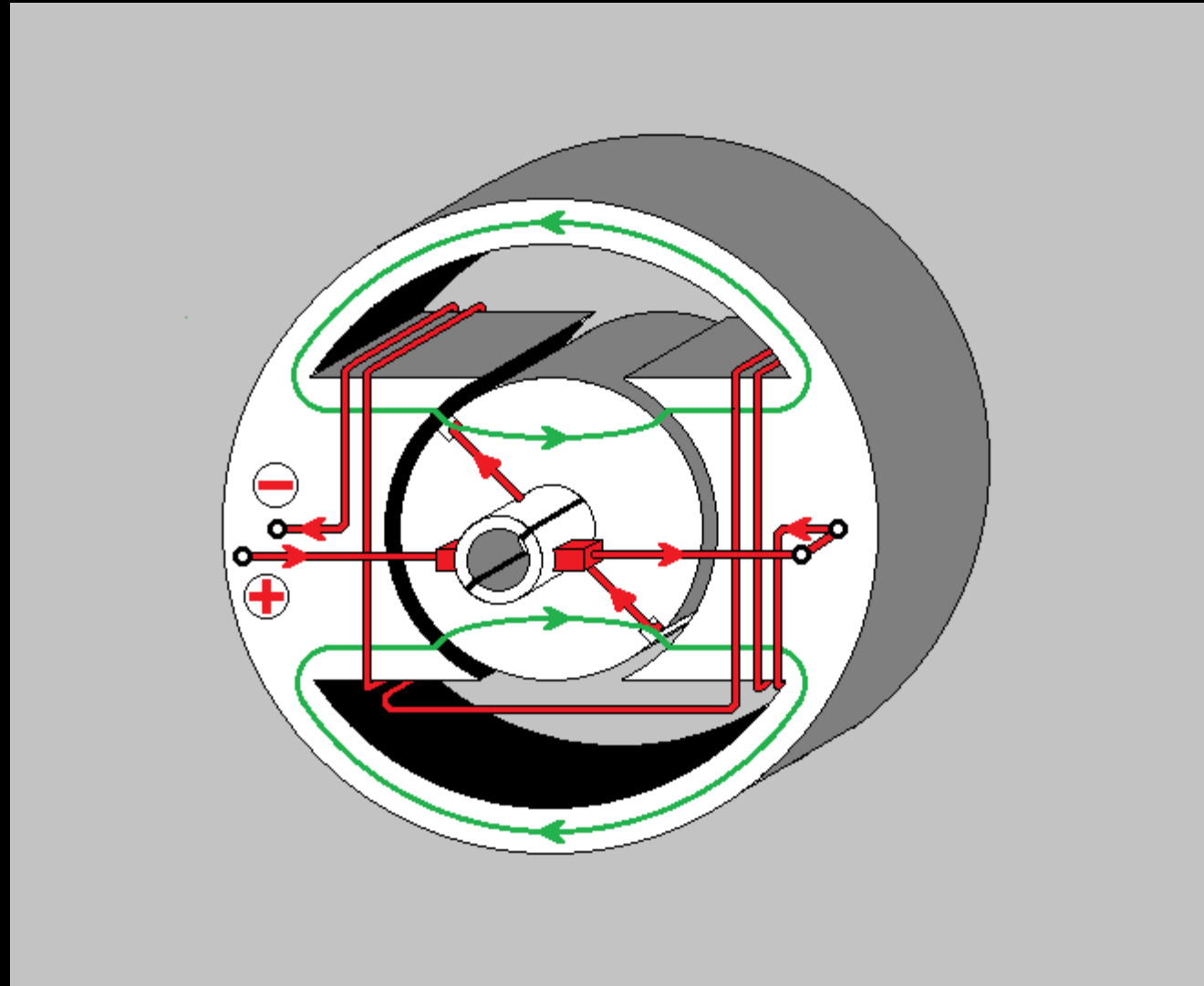




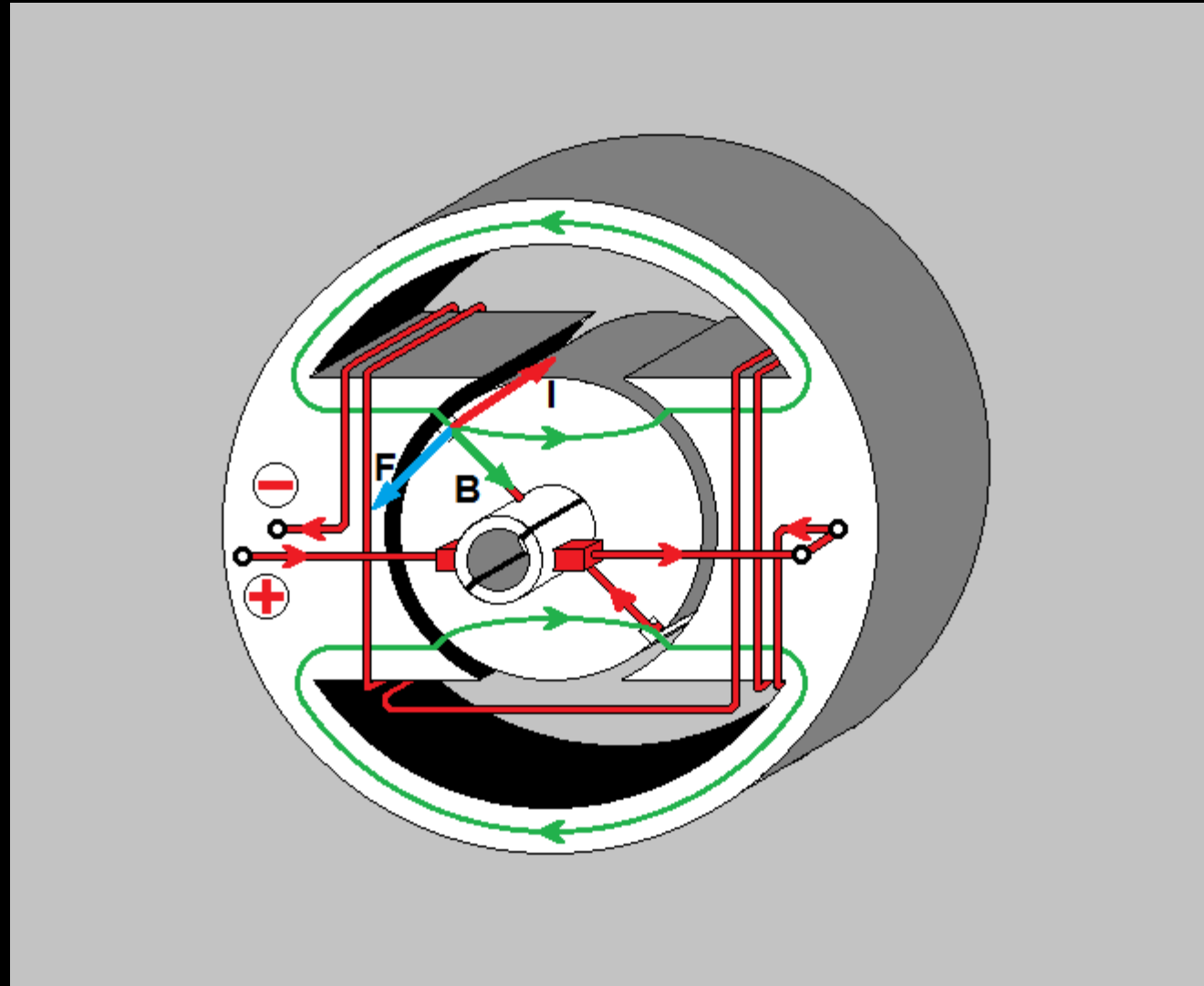




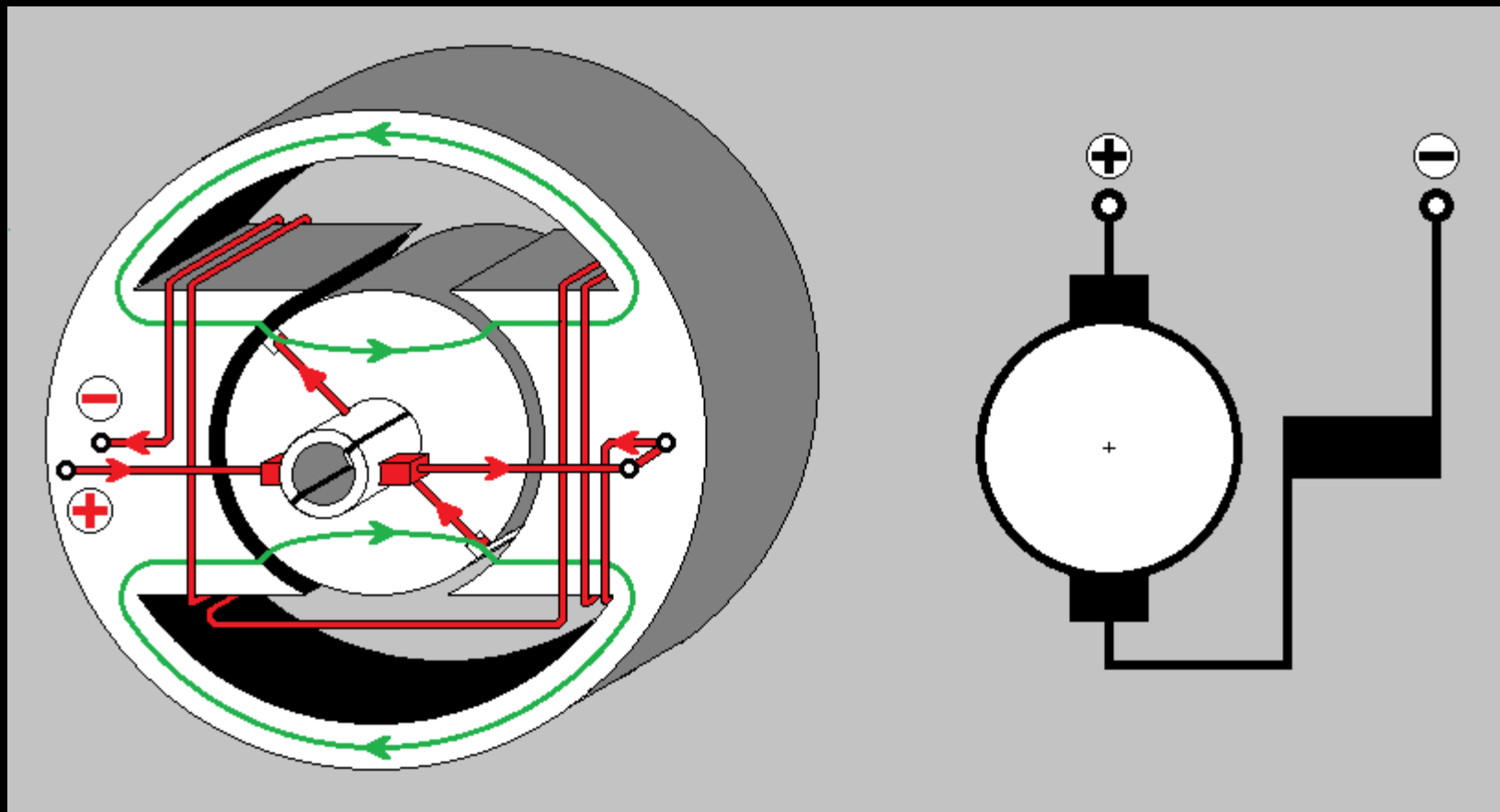
Conexión en serie



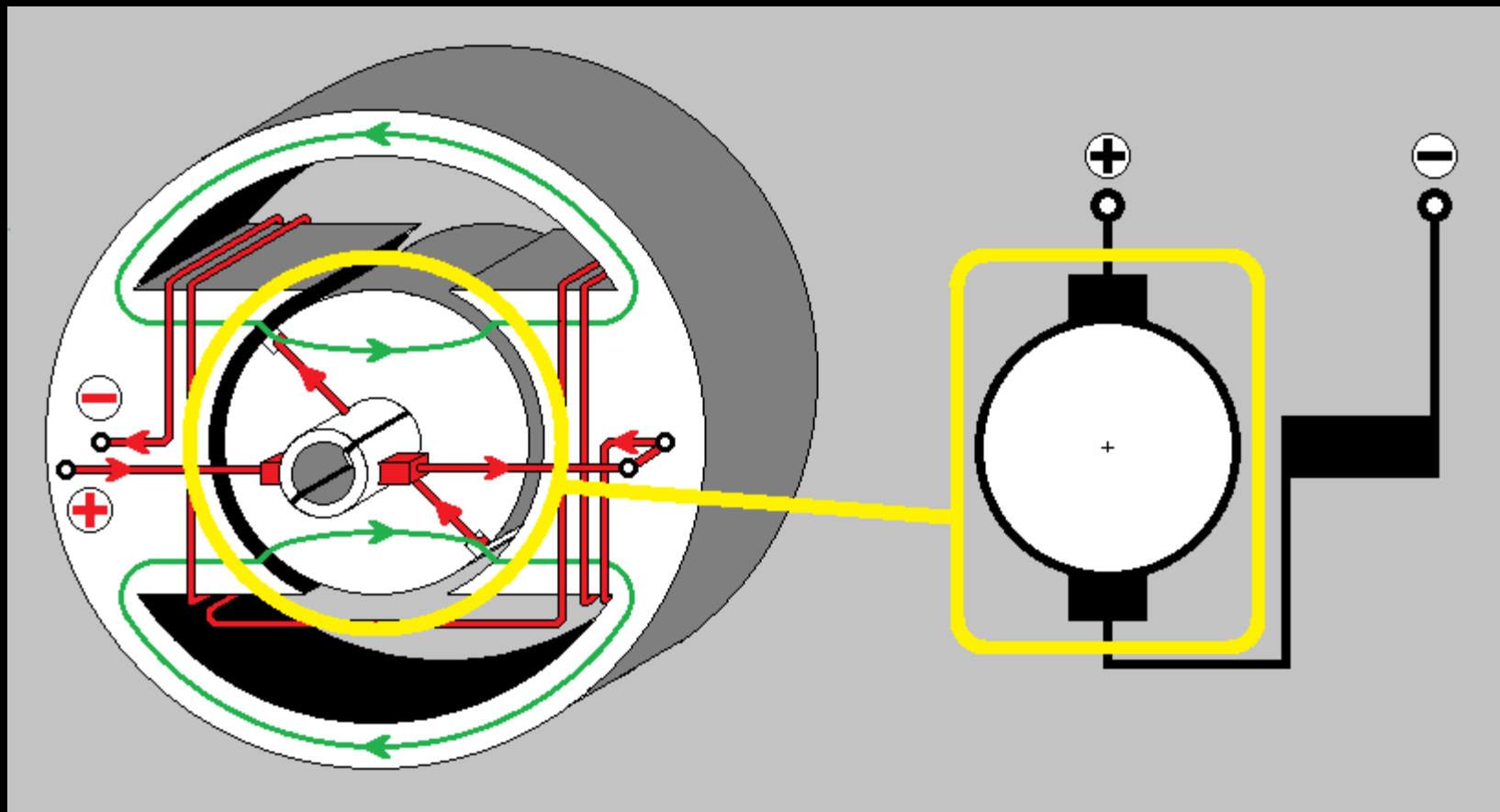
Sentido del campo magnético



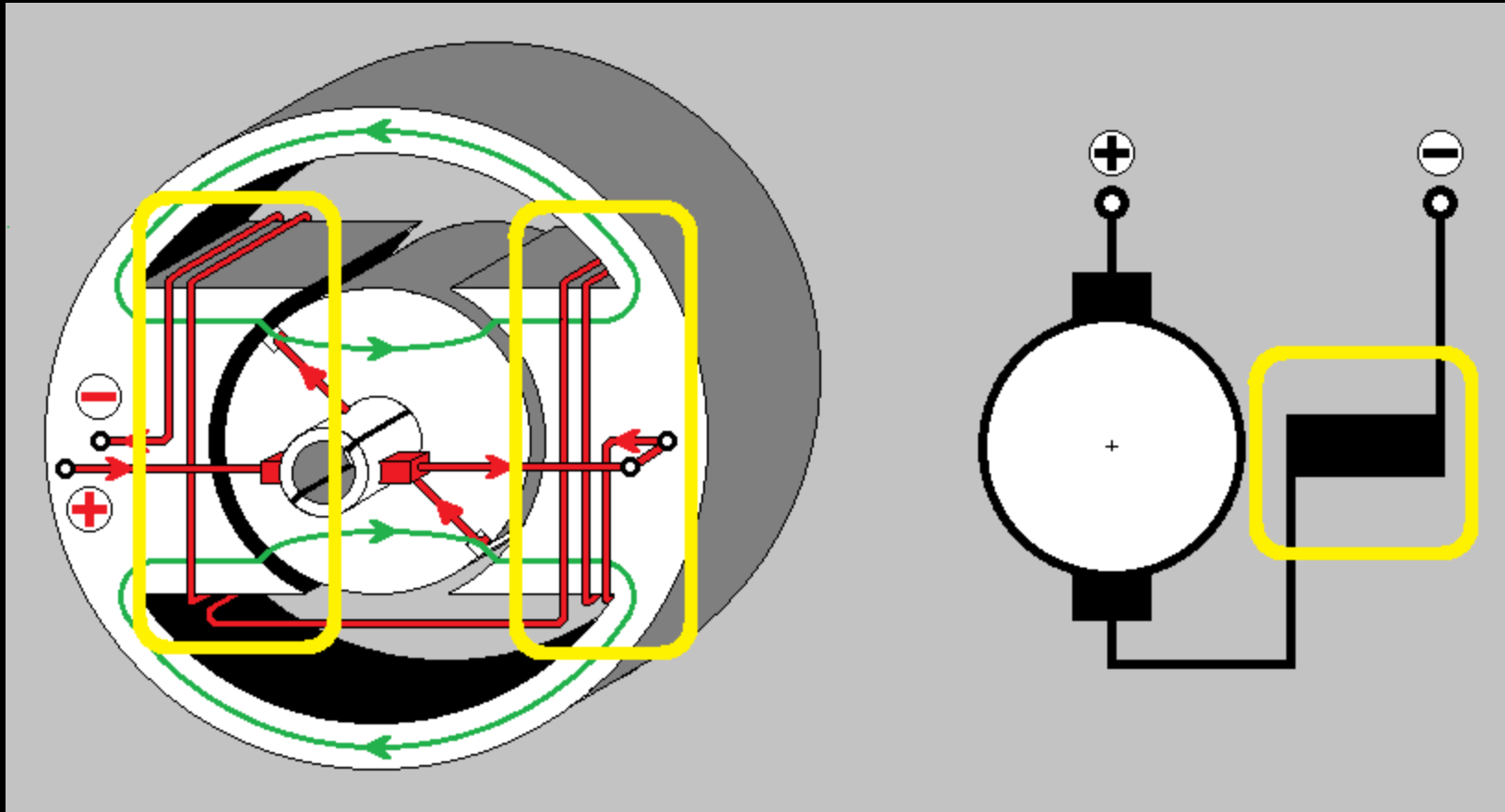
Funcionamiento como motor



Símbolo



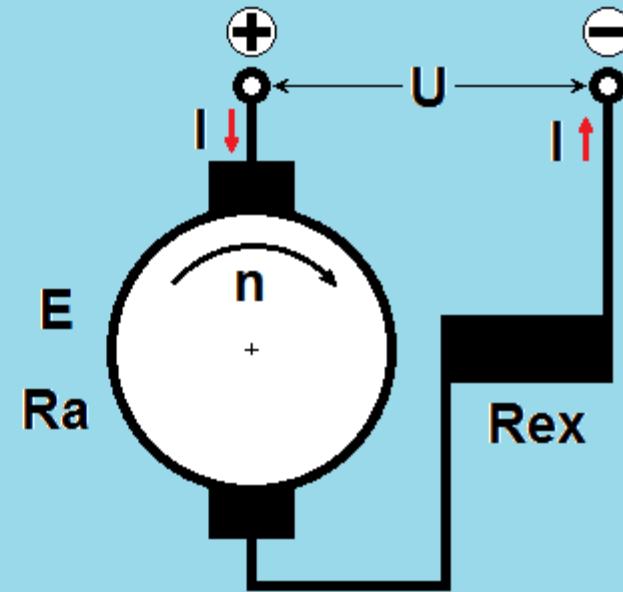
Inducido



Polos

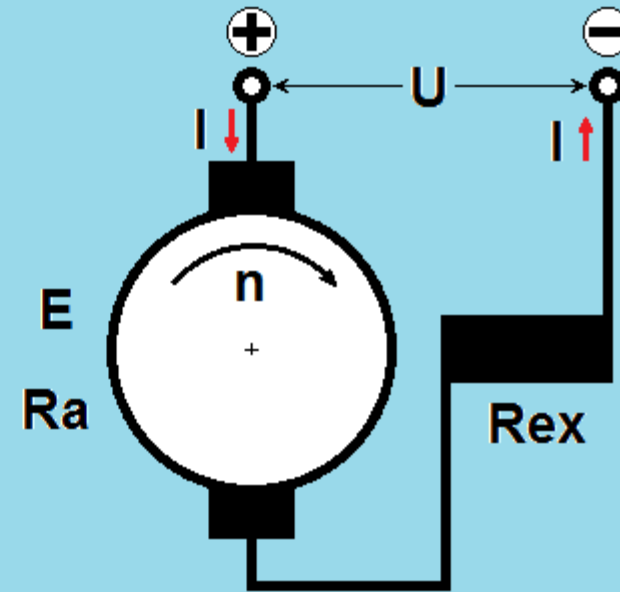
**Curvas U-I
para cada valor de n**

$$U = E + I(R_a + R_{ex})$$



$$U = E + I(R_a + R_{ex})$$

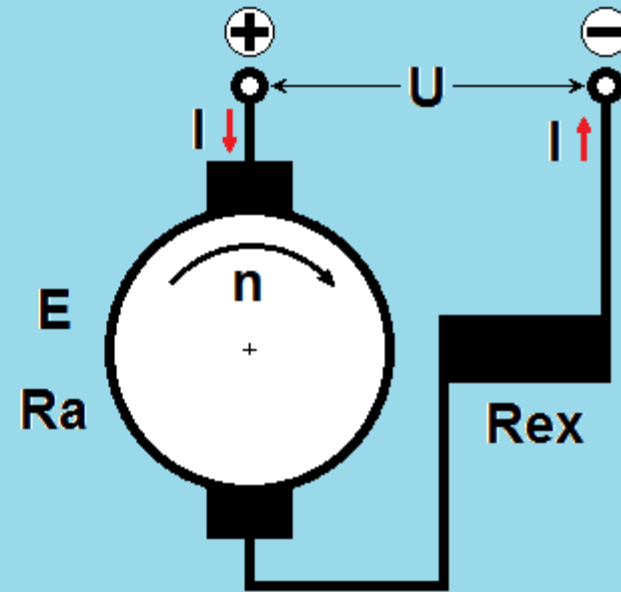
$$E = k \Phi n$$



$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$



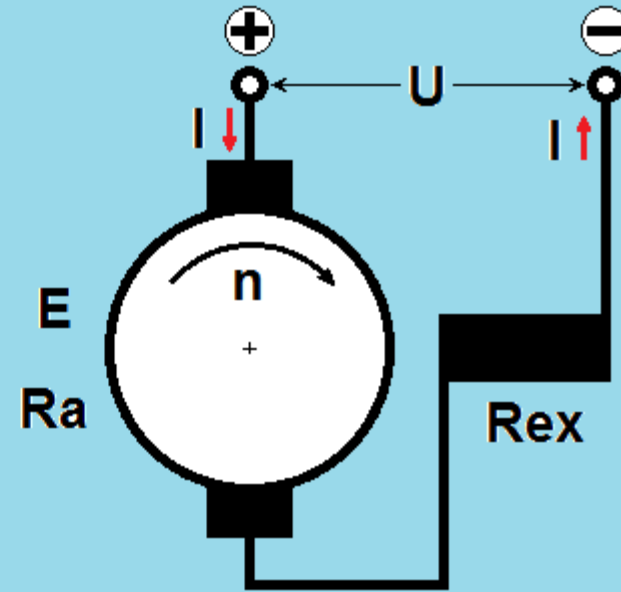
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I$$

$$E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$



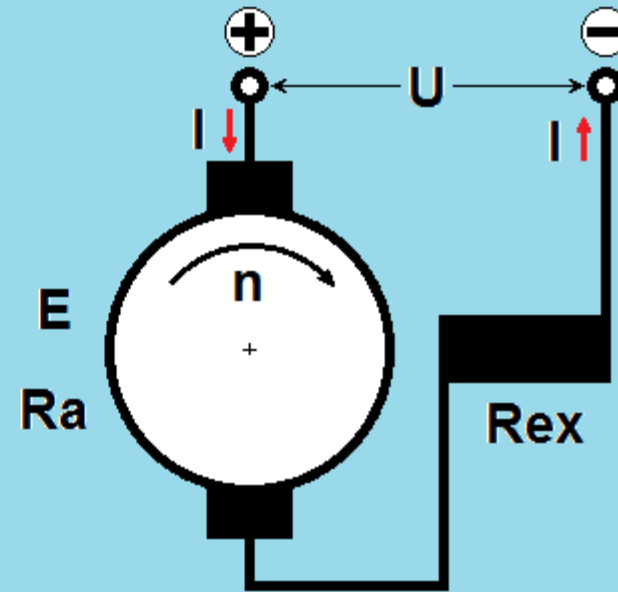
$$U = E + I (R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I (R_a + R_{ex})$$

$$U = [k n + (R_a + R_{ex})] I$$



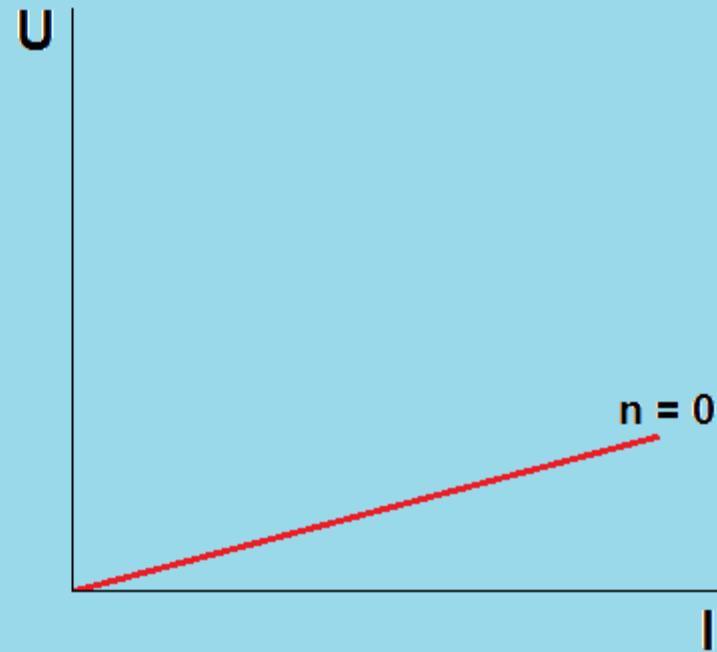
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$

$$U = [kn + (R_a + R_{ex})] I$$



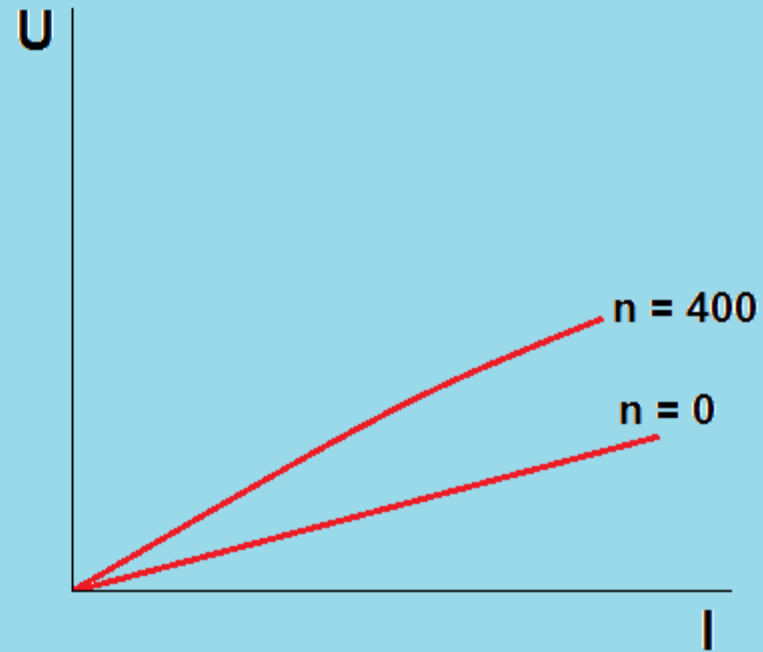
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$

$$U = [kn + (R_a + R_{ex})] I$$



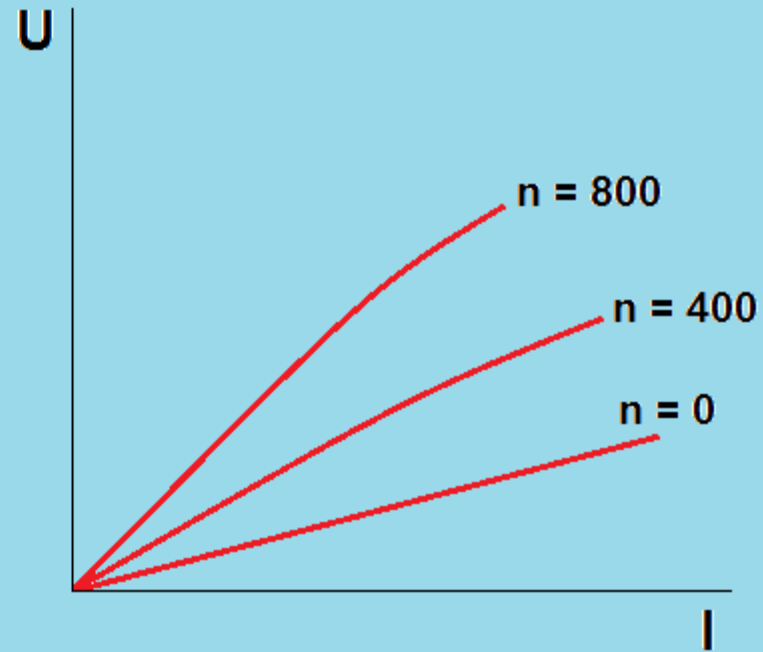
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$

$$U = [kn + (R_a + R_{ex})] I$$



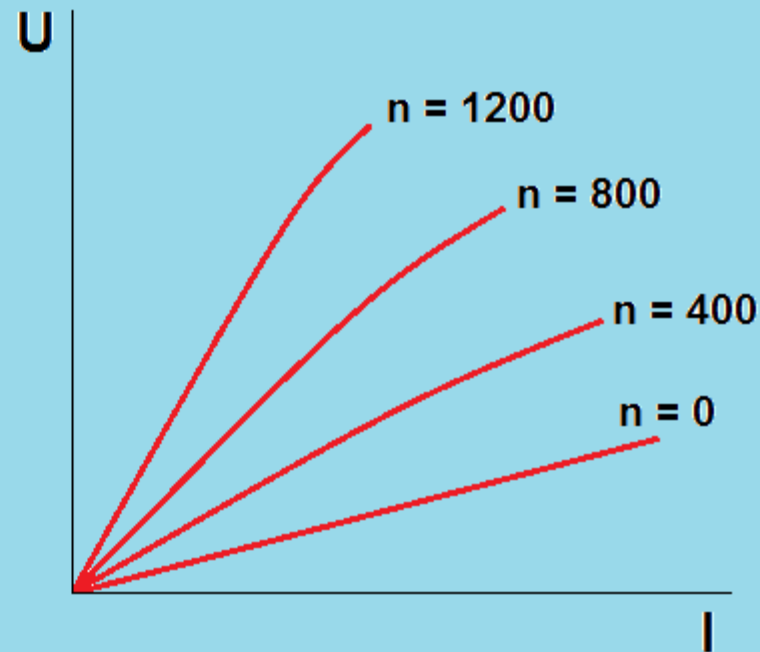
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$

$$U = [kn + (R_a + R_{ex})] I$$



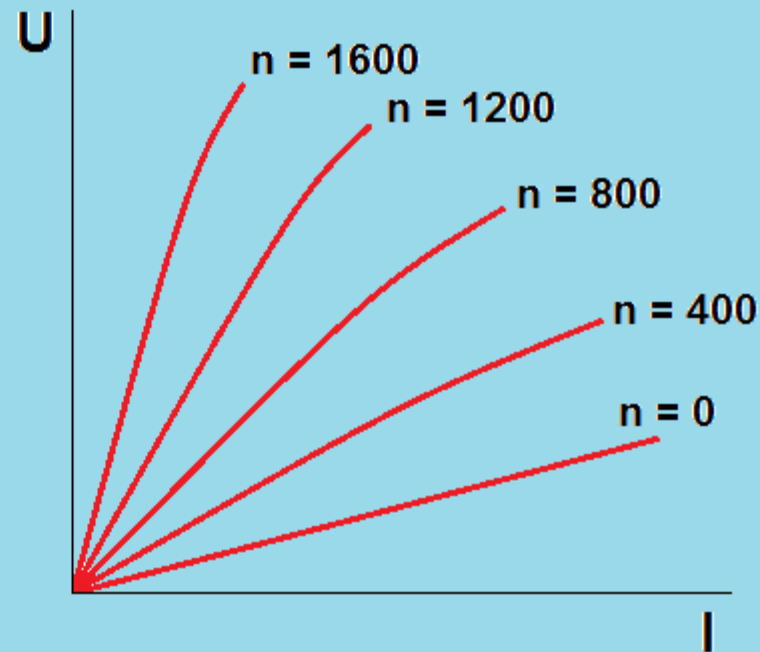
$$U = E + I(R_a + R_{ex})$$

$$E = k \Phi n$$

$$\Phi \sim I \quad E = k I n$$

$$U = k I n + I(R_a + R_{ex})$$

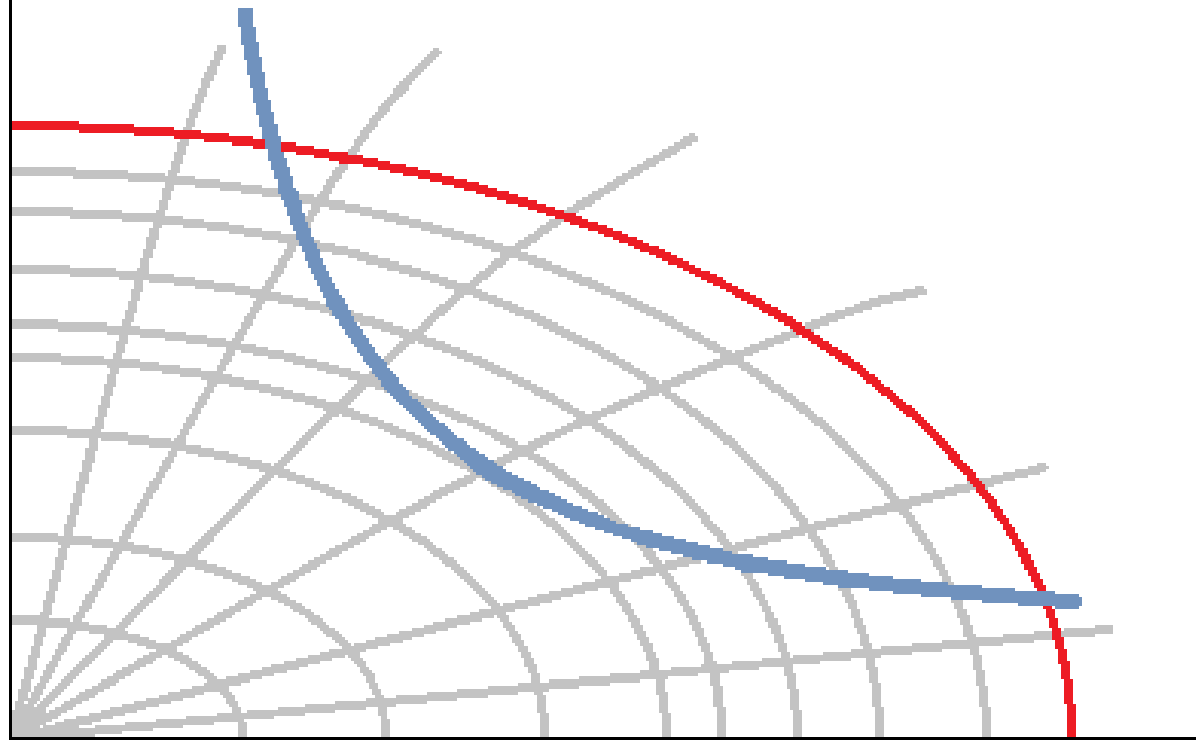
$$U = [kn + (R_a + R_{ex})] I$$



funcionamiento del conjunto alternador-motor

U

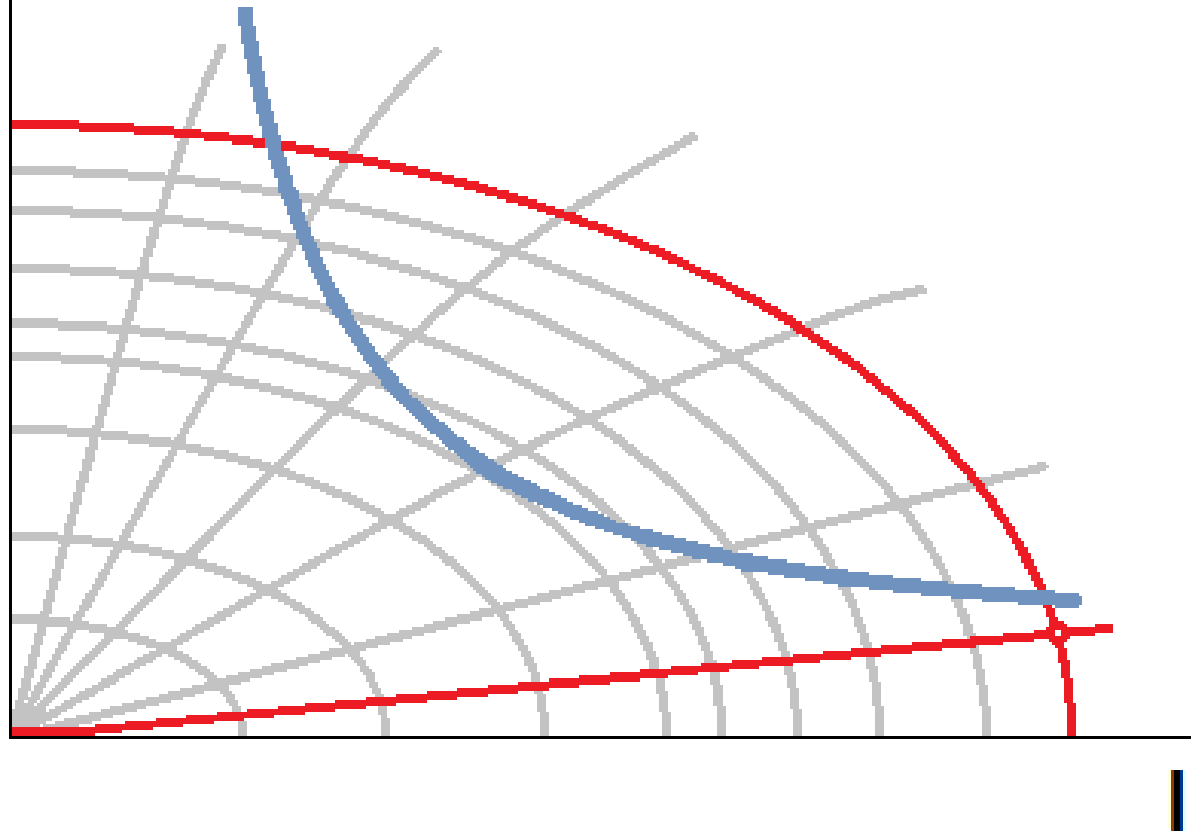
$P = \text{cte}$



I

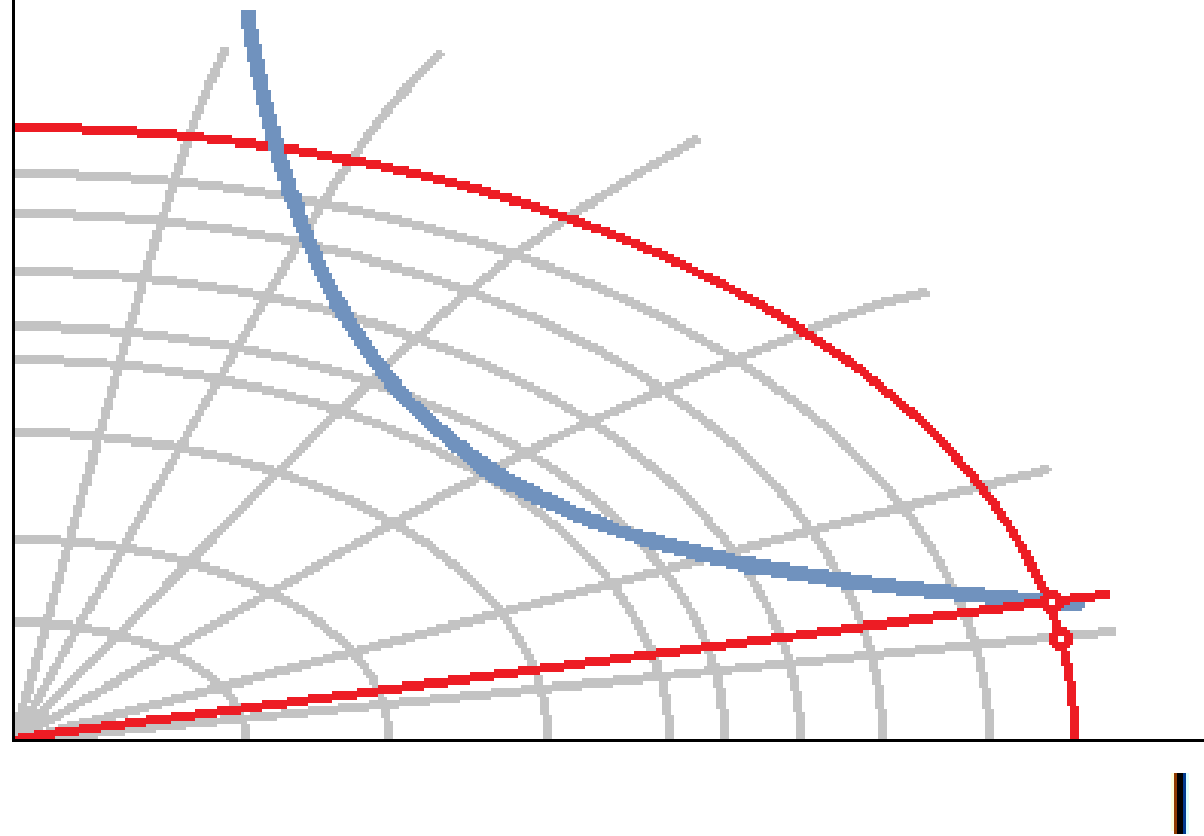
U

$P = \text{cte}$



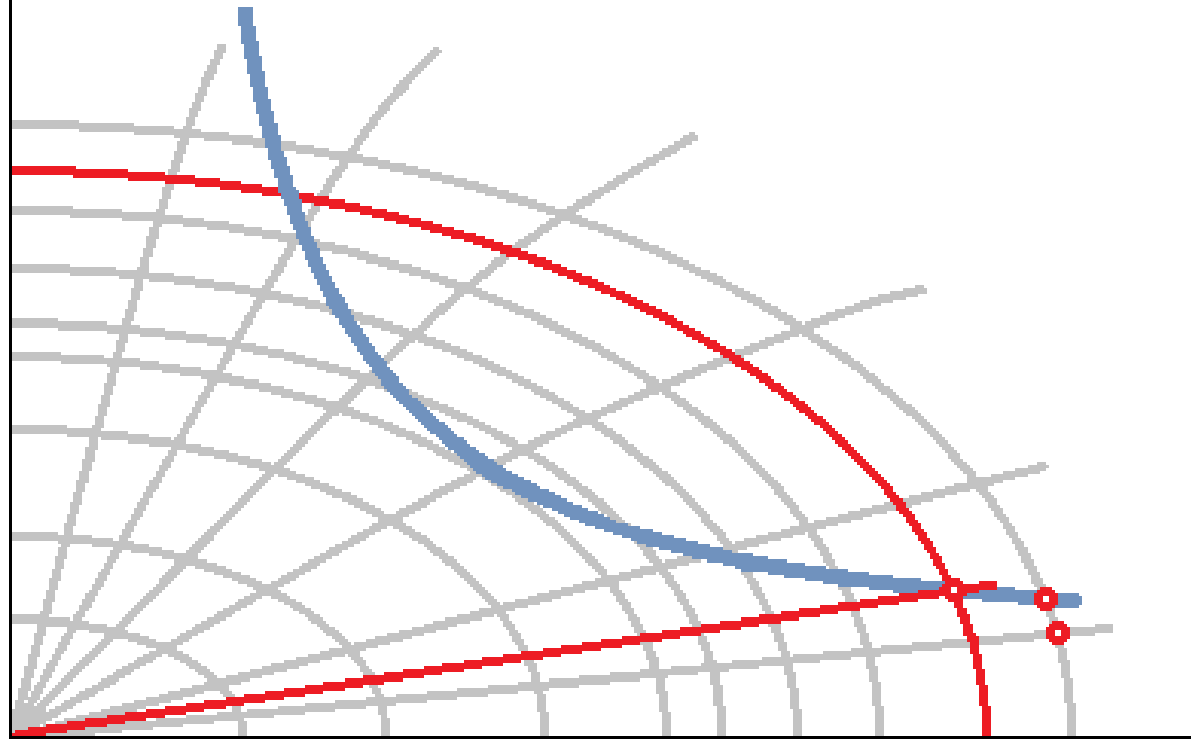
U

$P = \text{cte}$



U

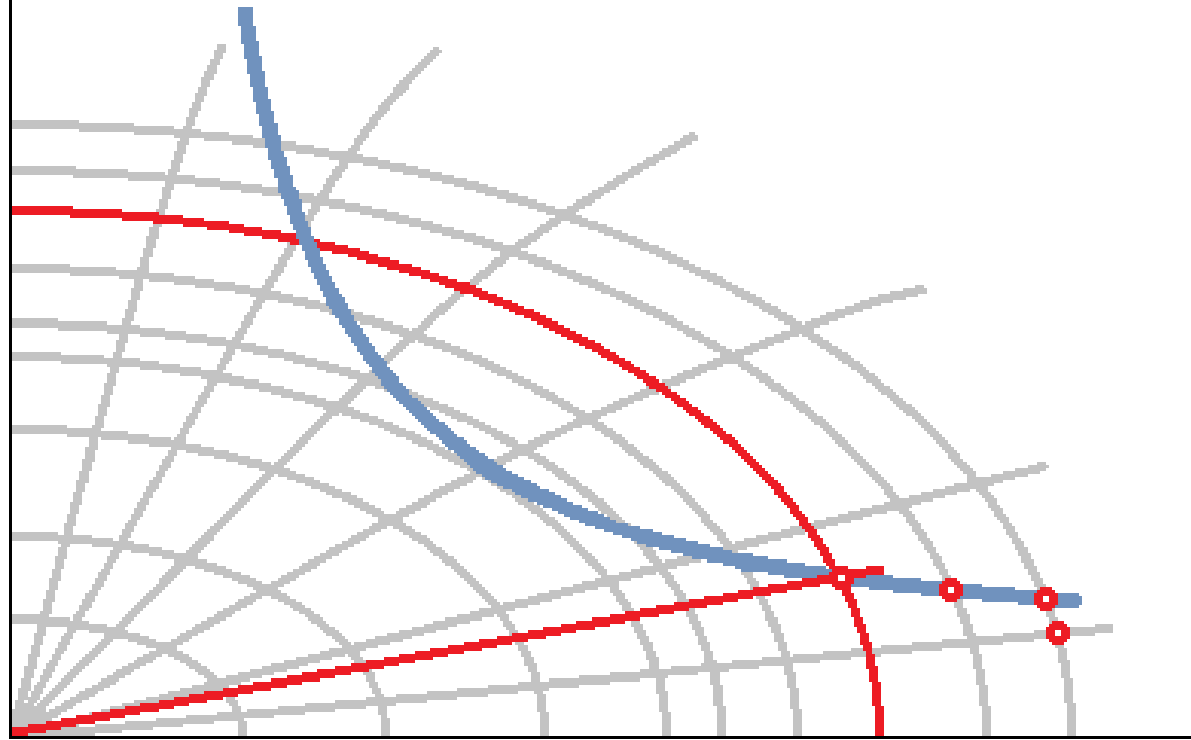
$P = \text{cte}$



I

U

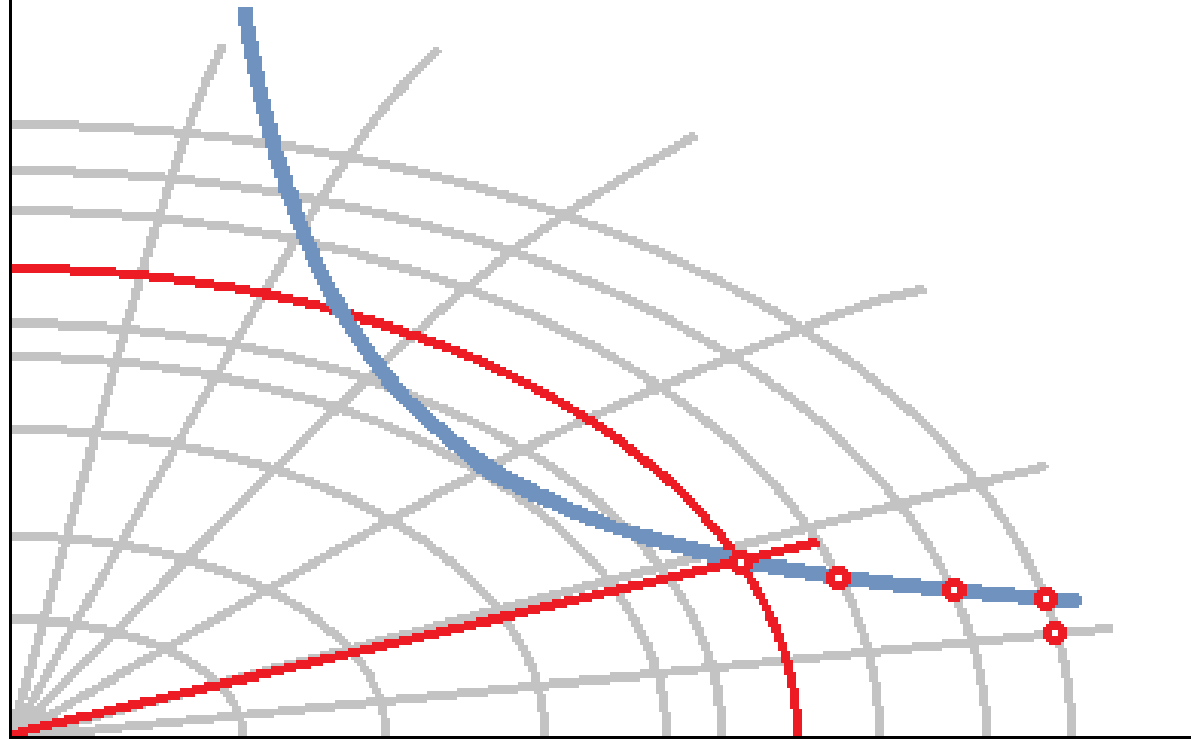
$P = \text{cte}$



I

U

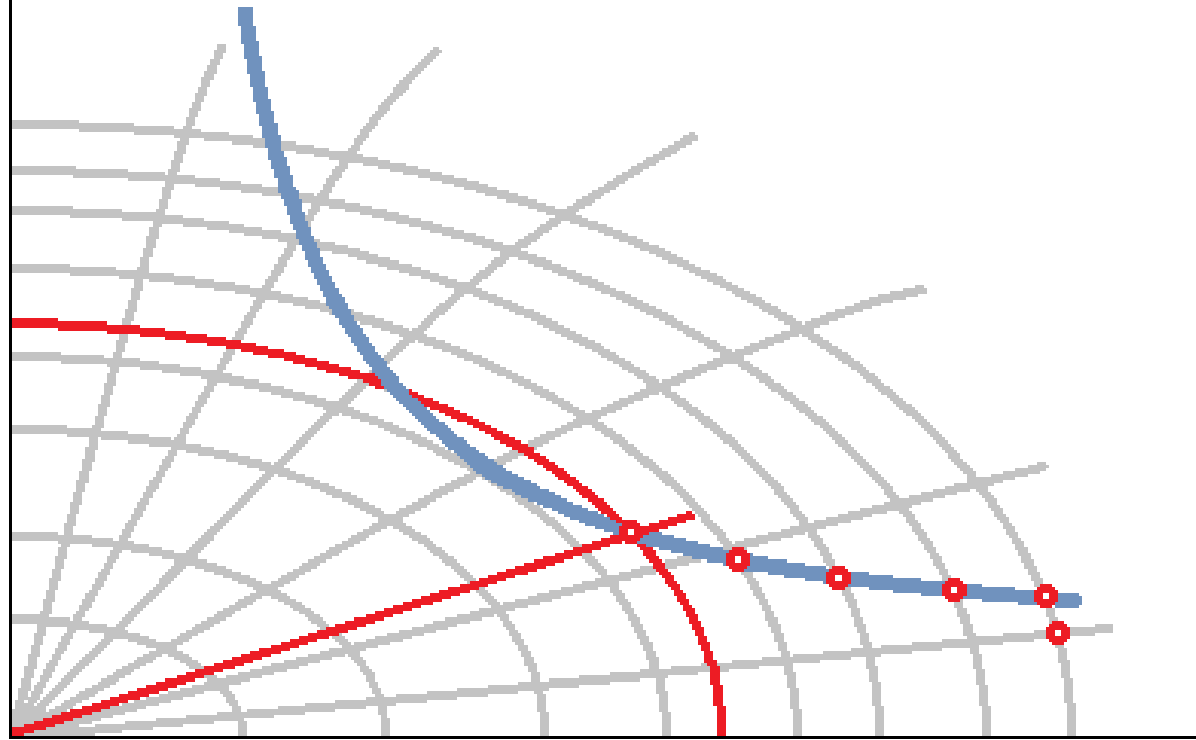
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I

U

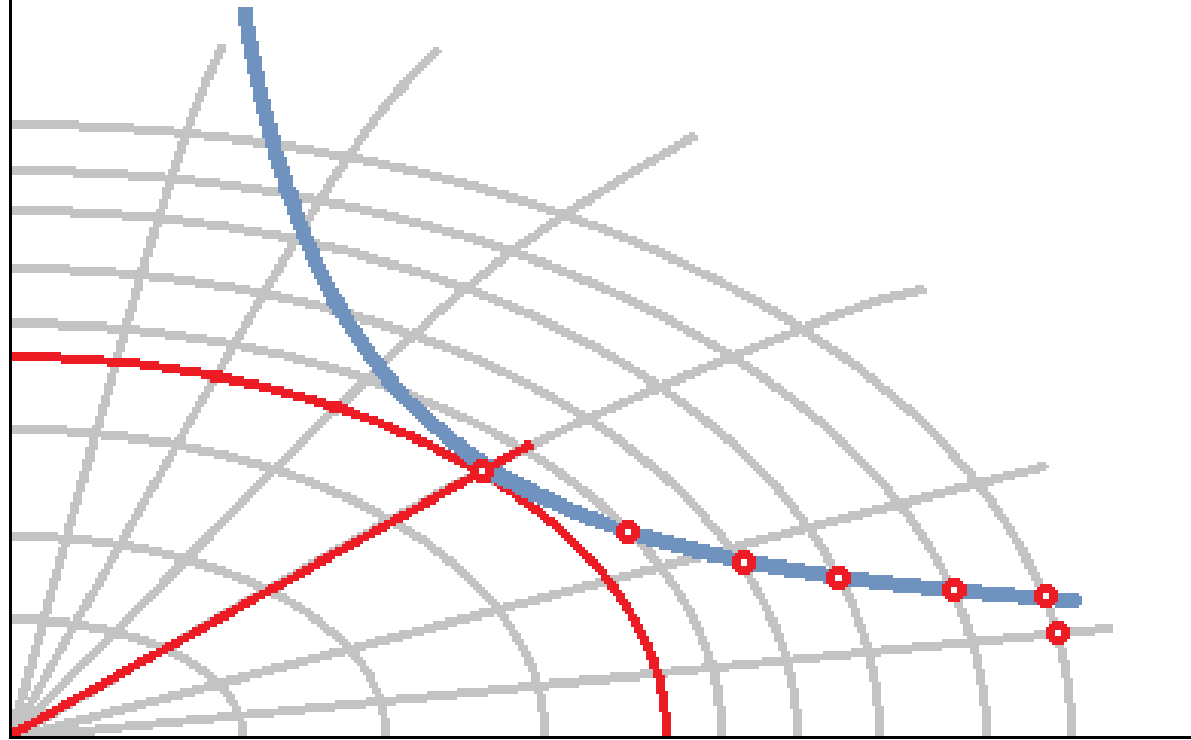
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I

U

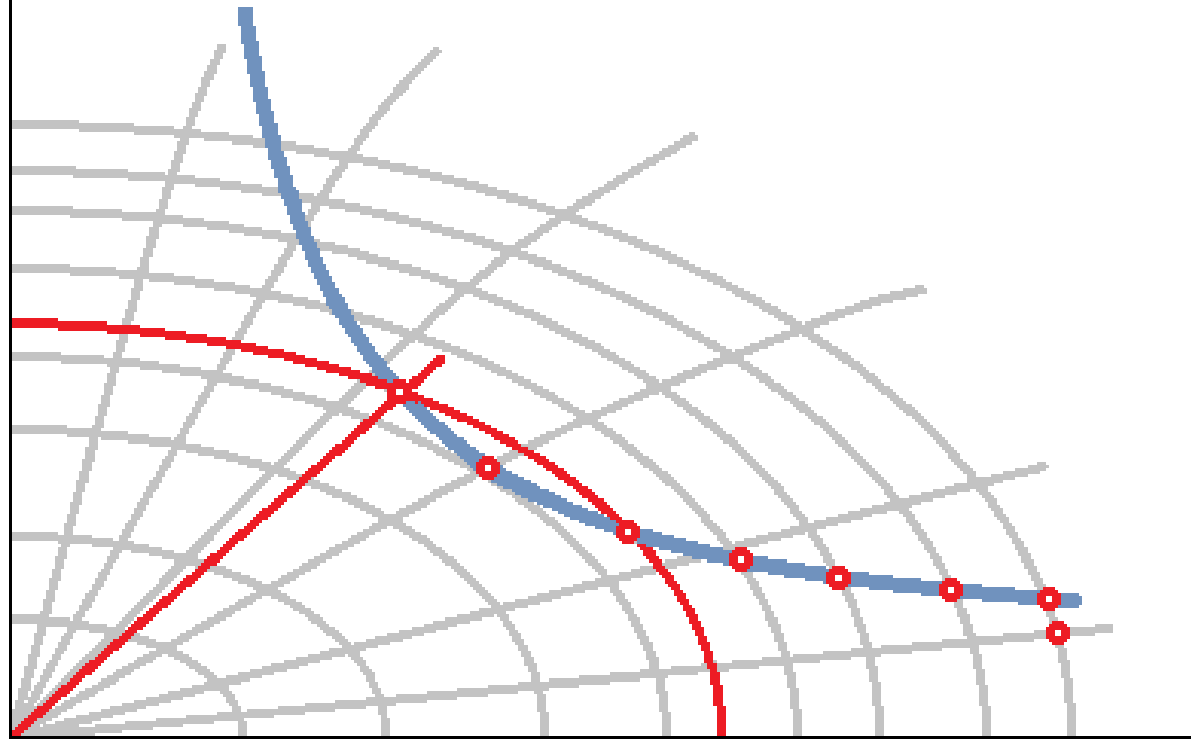
$P = \text{cte}$



I

U

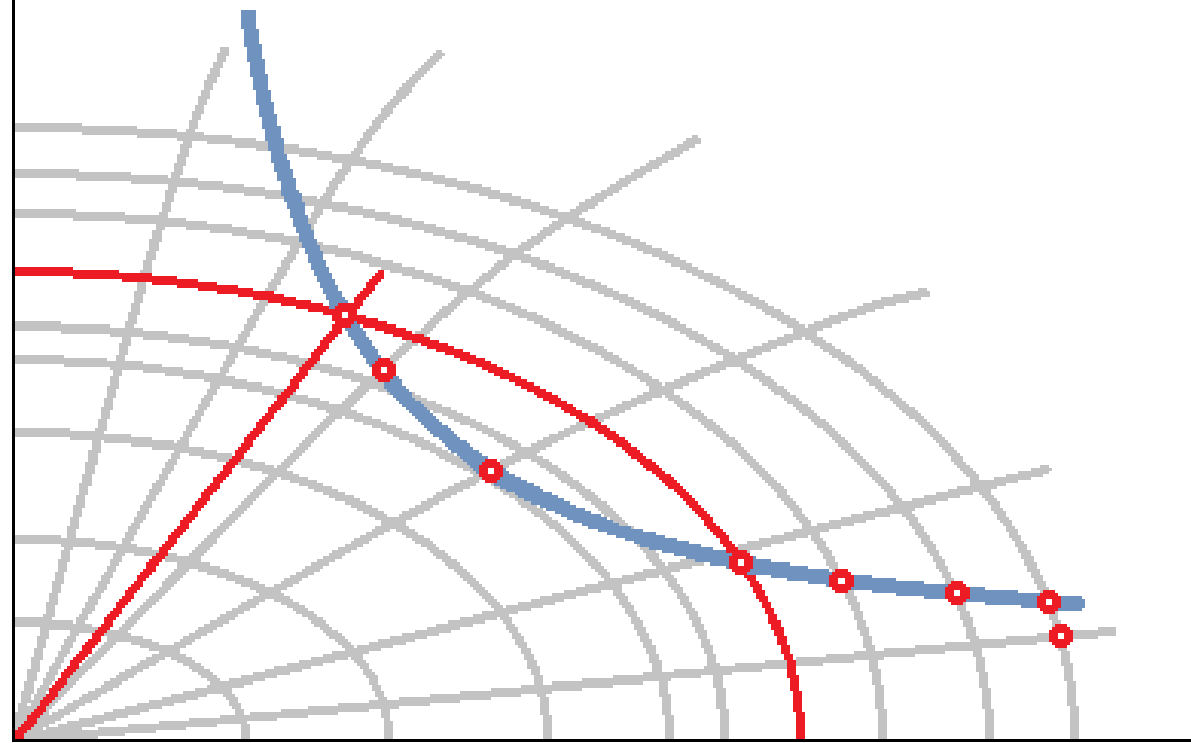
$P = \text{cte}$



I

U

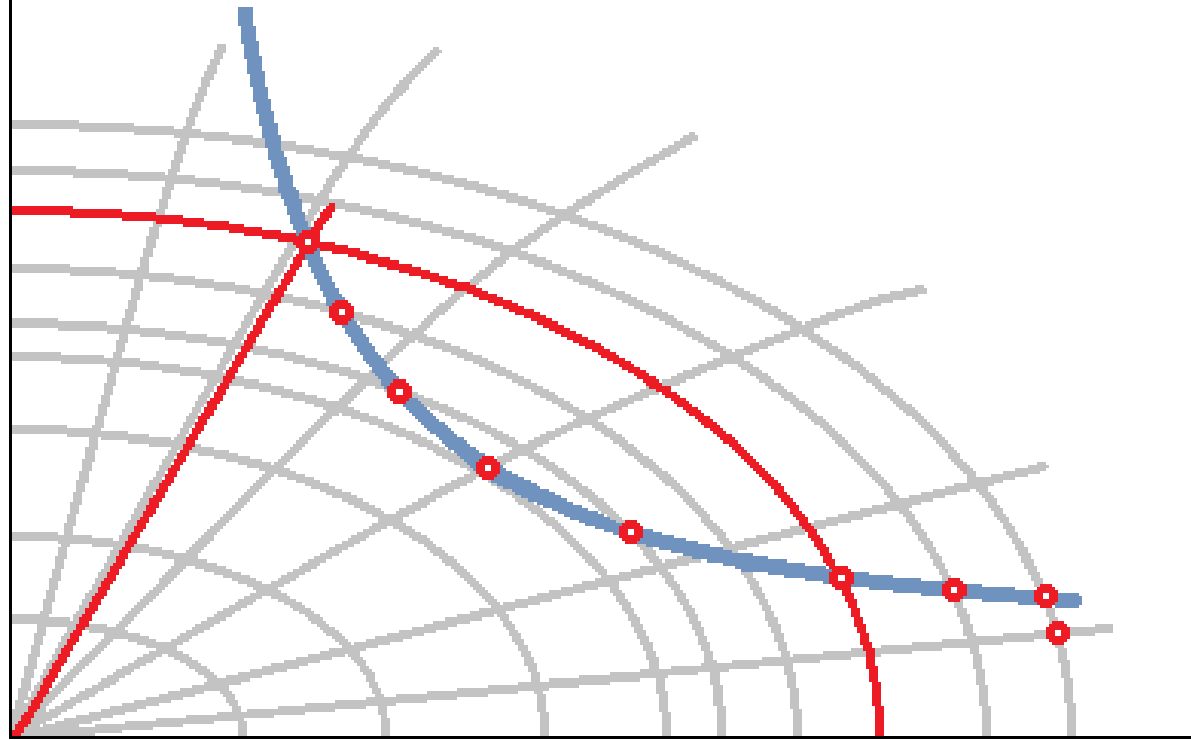
$P = \text{cte}$



I

U

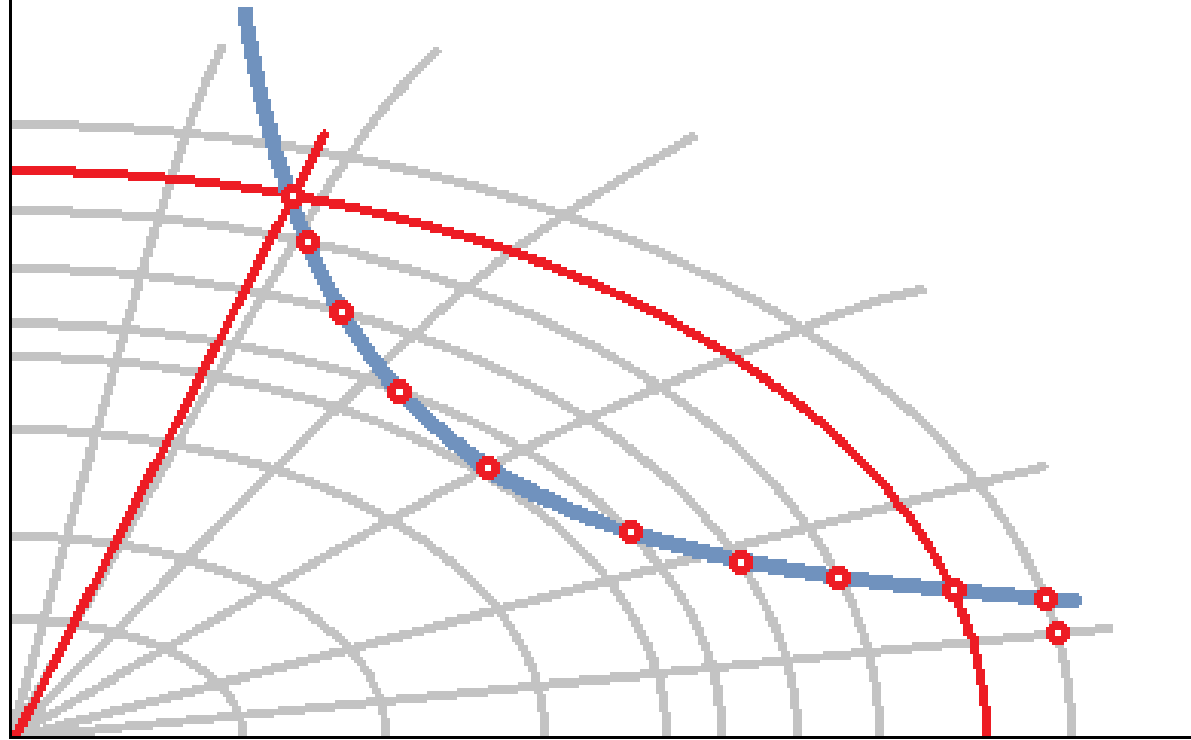
$P = \text{cte}$



I

U

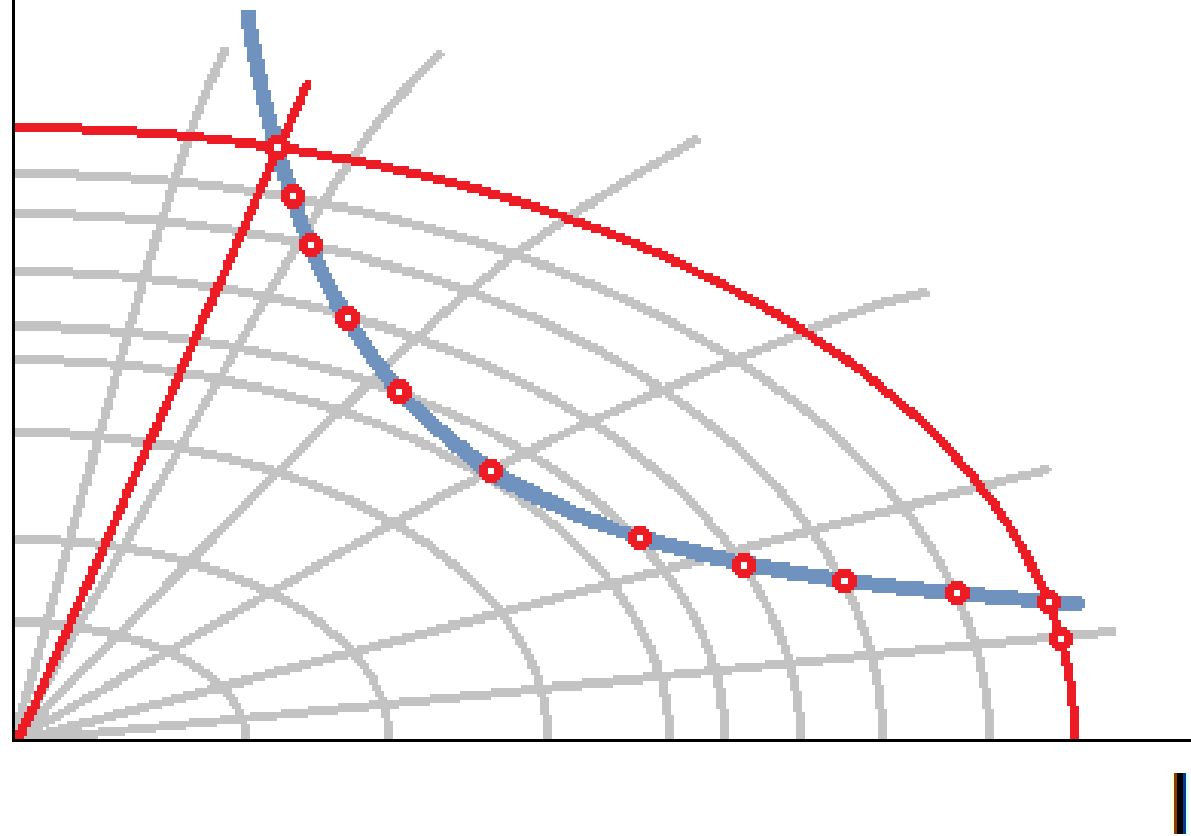
$P = \text{cte}$



I

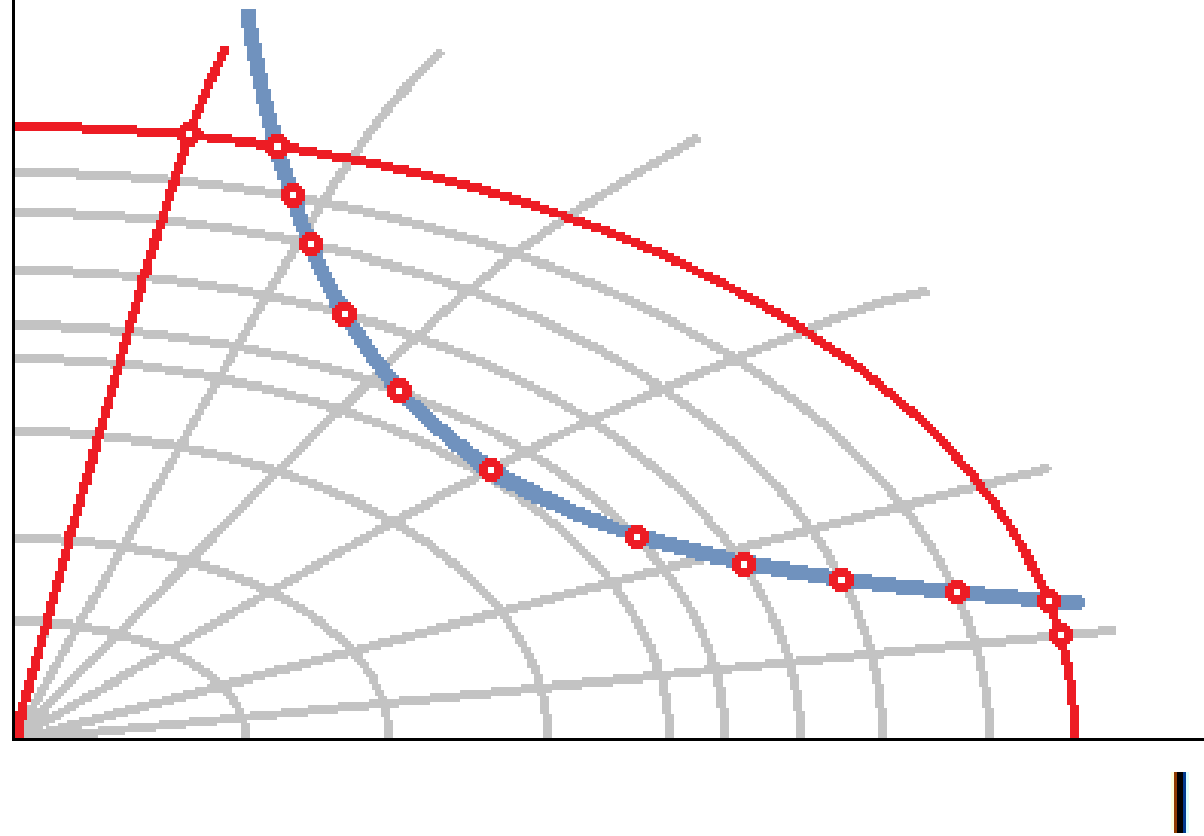
U

$P = \text{cte}$

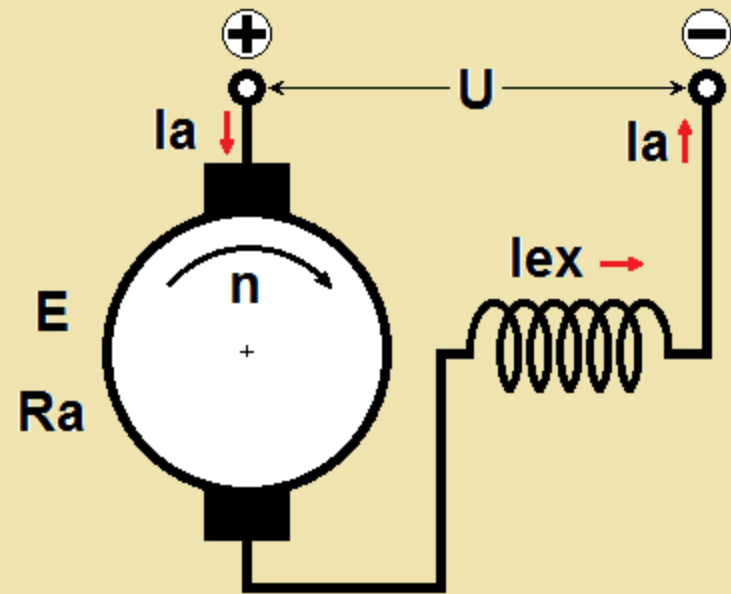


U

$P = \text{cte}$

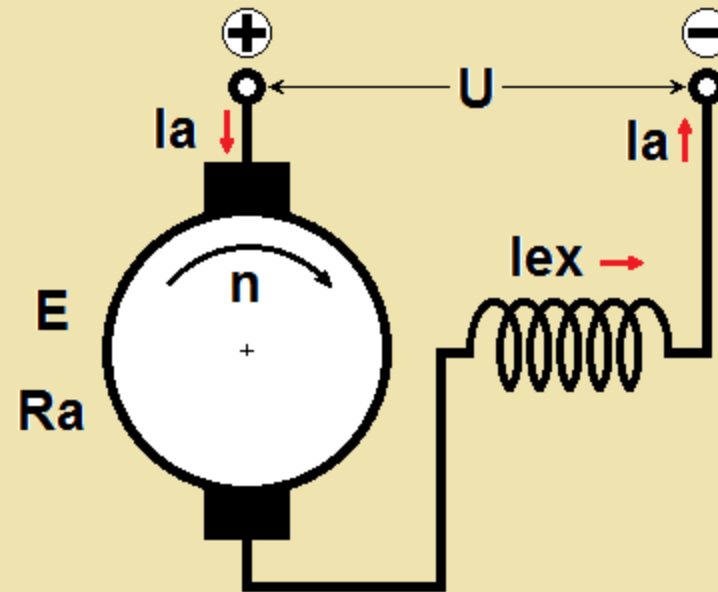


Shuntado de campos



Motor a pleno campo

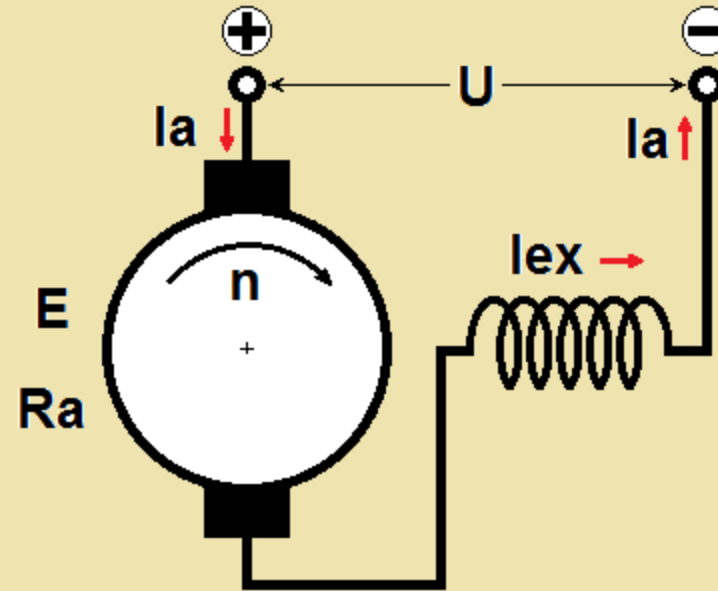
$$U = E + I_a(R_a + R_{ex})$$



Ecuaciones de funcionamiento

$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

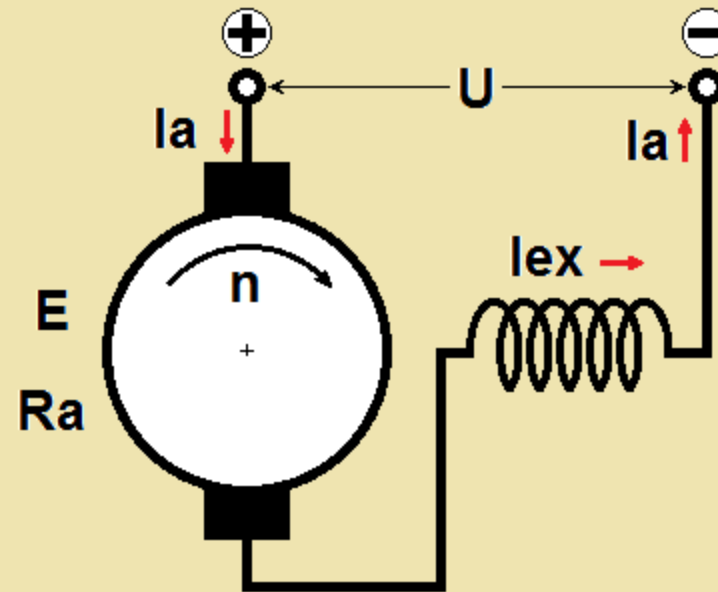


Ecuaciones de funcionamiento

$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$



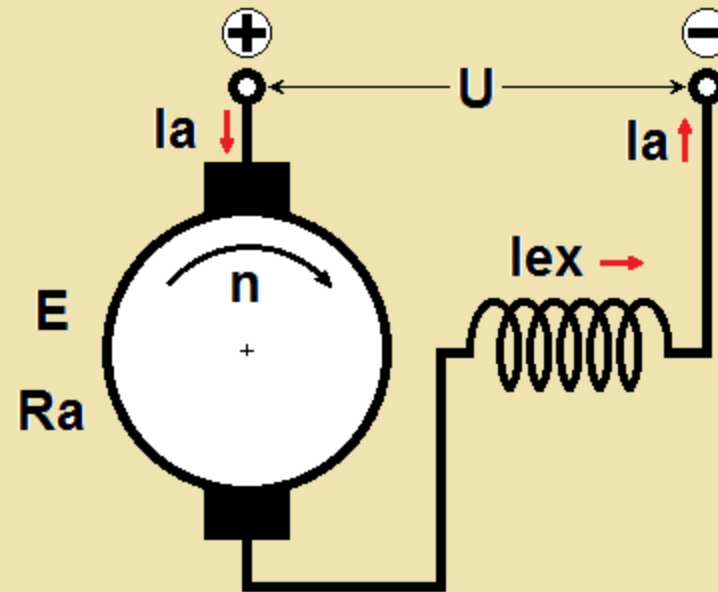
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$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$



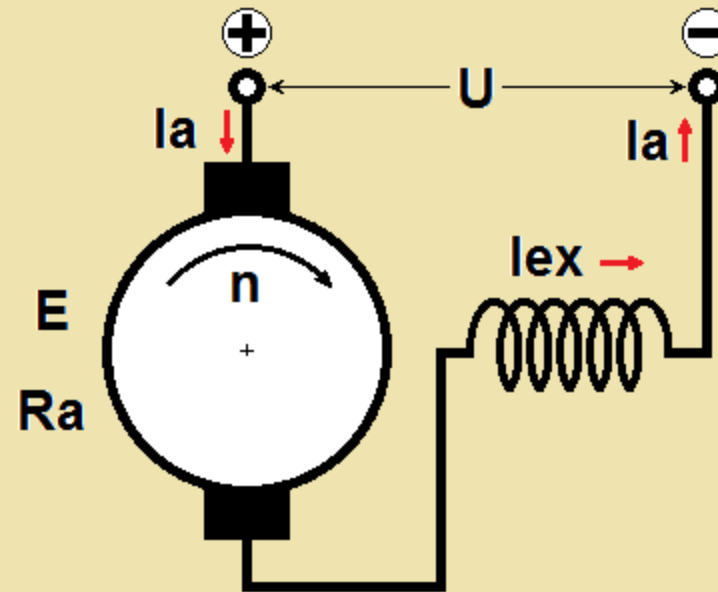
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Ecuaciones de funcionamiento

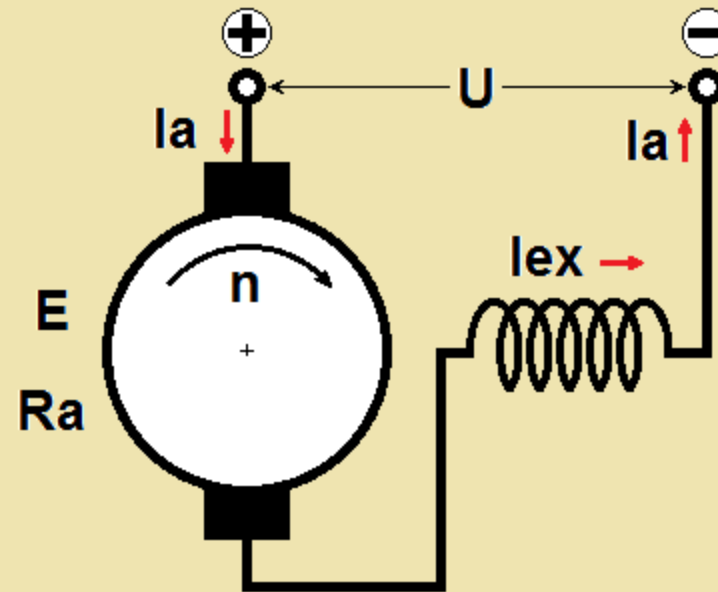
$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$

Si $I_{ex} \downarrow \Rightarrow n \uparrow$



Ecuaciones de funcionamiento

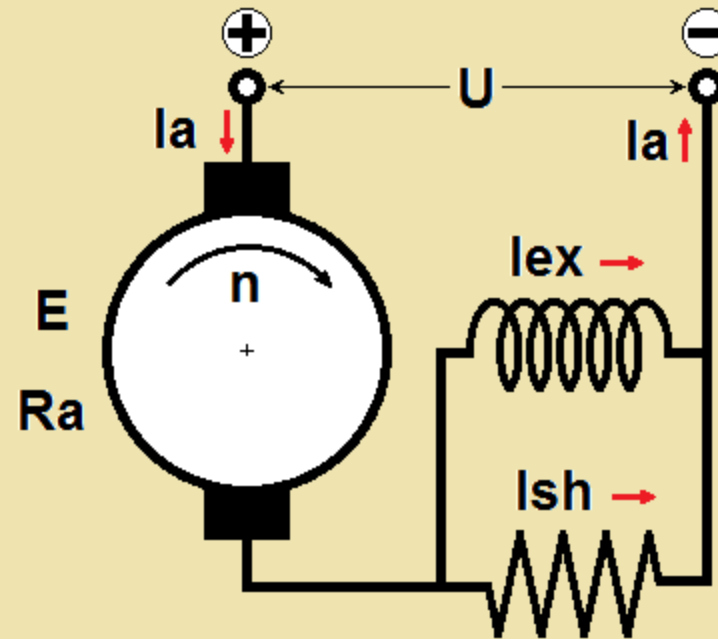
$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$

Si $I_{ex} \downarrow \Rightarrow n \uparrow$



Shuntado del campo

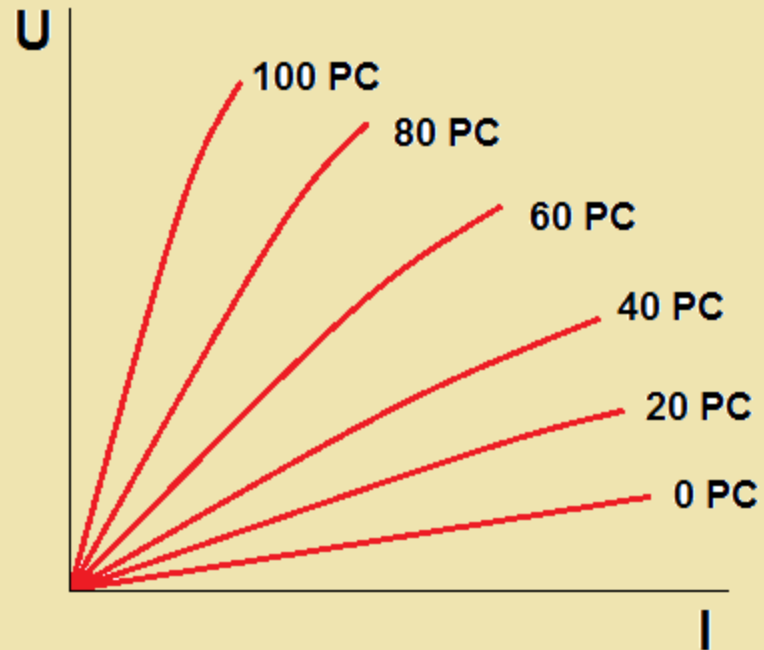
$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$

Si $I_{ex} \downarrow \Rightarrow n \uparrow$



Velocidades a pleno campo

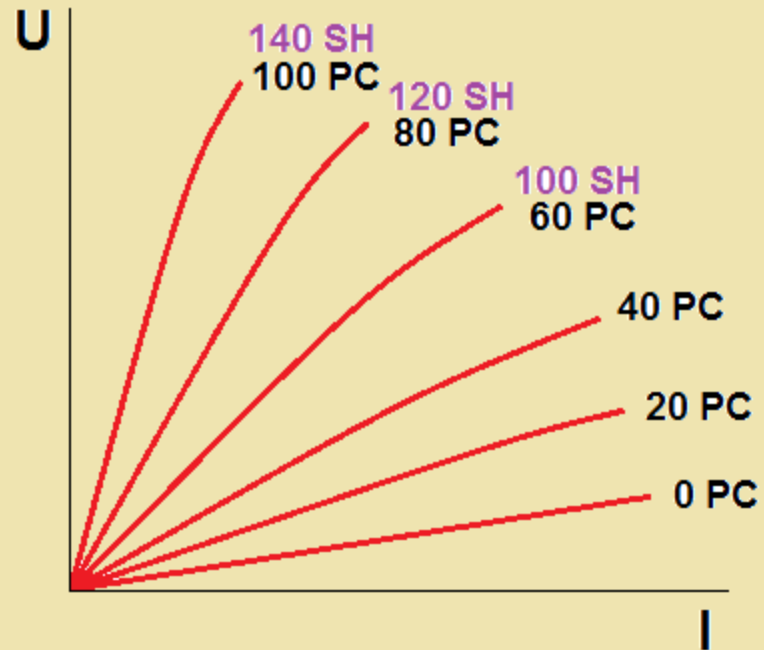
$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$

Si $I_{ex} \downarrow \Rightarrow n \uparrow$



Velocidades con shuntado de campos y pleno campo

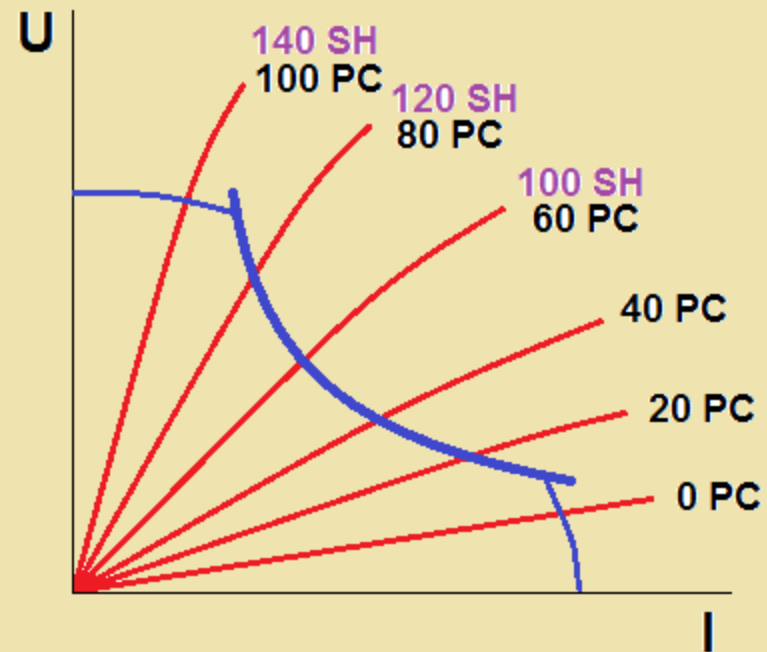
$$U = E + I_a(R_a + R_{ex})$$

$$E = k \Phi n$$

$$n = \frac{U - I_a(R_a + R_{ex})}{k \Phi}$$

$$\Phi \sim I_{ex}$$

Si $I_{ex} \downarrow \Rightarrow n \uparrow$



Funcionamiento a potencia constante