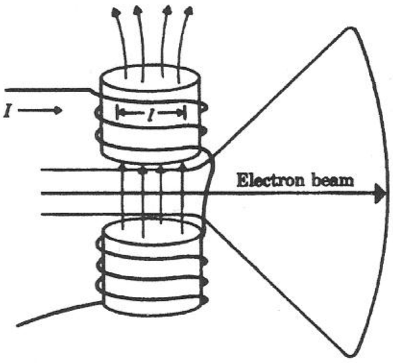
International System Units

Feynman 's model

(Fundamental Physics – Orear)

Fig. 8–11. Side view of television picture tube showing horizontal deflection coils.



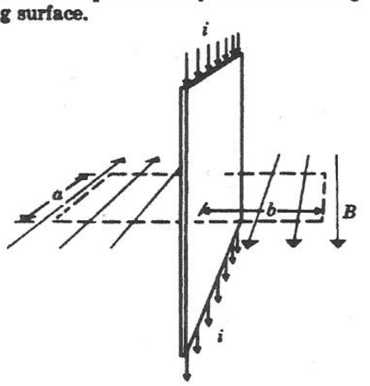
spot on the screen is to sweep to the right (while facing the screen), what must be the direction of the current in the upper conductor?

This example is an exercise in the use of the right-hand rules. First, rule II must be used to determine the direction of B. One must be careful in the use of this rule to note that in Fig 8–11 the beam current is to the left even though the electrons are moving to the right. We want the force on this current to be into the page. In applying rule II we point the thumb (I) left and the palm (F) into the page. This puts the fingers (B) pointing up. Now use right-hand rule I on current element l. If the thumb (I) along l is pointed to the right, then the fingers (B) on the inside of the coil point in the desired up direction. Thus the current flows along l to the right. The answer to the problem is that the current enters the upper conductor and leaves at the lower conductor.

→ *Magnetic field produced by current in a plane*

Our final application of Ampere's law will be to determine the magnetic field produced by an infinite plane of current. Figure 8–12 shows a rectangular section of the infinite plane with the current traveling down. This situation is approximated when a current flows along a sheet of metal. Let i be the current per horizontal centimeter along the plane. We have chosen a rectangle of sides a and $2b$ which encloses a current ia. Because the plane is infinite the lines of B must run horizontally as shown in the figure. In calculating $\overline{B}_L$ around the closed path, the sides of length $2b$ do not contribute because B is perpendicular to sides $2b$.

Fig. 8–12. Magnetic field produced by current flowing down a conducting surface.



Thus $$\overline{B}_L = \frac{B \cdot a + 0 + B \cdot a + 0}{a + 2b + a + 2b} = \frac{2Ba}{L}$$

and $\overline{B}_L \cdot L = 2Ba$

Since the enclosed current is $I = ia$, Eq. 8–12 becomes

$$2Ba = \frac{4\pi ia}{c}$$

or $$B = 2\pi\left(\frac{i}{c}\right) \qquad (8\text{–}17)$$

$2Ba = \mu_0 i a$

$B = \frac{\mu_0}{2} i$

$E = \frac{\sigma}{2\varepsilon_0}$

Again we note the similarity to the corresponding formula ($E = 2\pi\sigma$) for the electric field due to a charged plane.