5.22 Similar to 5.17. Set the boundary at $z=0$. Even though we have only used magnetic scalar potential to calculate the magnetic induction for a cylindrical bar in Prob. 5.19. we could have used vector potential to obtain the same result, where the current would be parallel to the z-axis. Then, with the presense of the permeable material, the image current would be identical to the original current, which is in the same direction as the original and thus produces an attractive force. At the end of Prob. 5.19, we have shown that, at the end of the bar, the magnetic induction is $\mu_0 M/2$, for $L \gg a$. Therefore, using the result in Prob. 5.20, the force is given by

$$\vec{F} = \oint (\vec{M}\cdot\vec{n})\vec{B}_e \, da = \frac{\mu_0}{2} A M^2$$