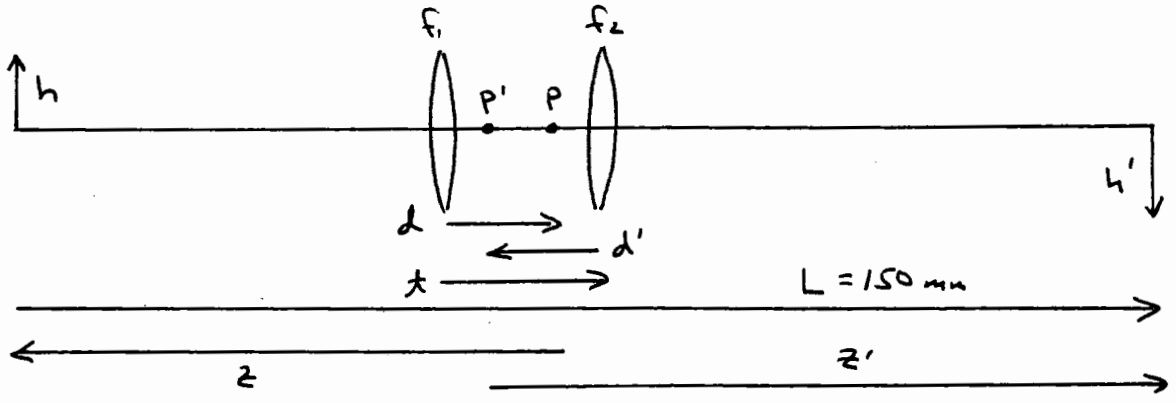
Reciprocal Magnification



$f_1 = f_2 = 50$ mm

$\phi_1 = \phi_2 = .02/\text{mm}$

$\phi = \phi_1 + \phi_2 - \phi_1 \phi_2 t$

$\phi = .03/\text{mm}$

$f = 33.333$ mm

$t = 25$ mm

$d = \frac{\phi_2}{\phi} t \qquad d' = -\frac{\phi_1}{\phi} t$

$d = -d' = \frac{\phi_2}{\phi} t$

$d = 16.667$ mm

$d' = -16.667$ mm

Object to image distance:

$L = -(z + d) + (z' + d') + t = -z + z' + \overline{PP'}$

$L = -z + z' - 8.333$ mm $\qquad \overline{PP'} = -8.333$ mm

$L' = -z + z' = L + 8.333$ mm

$L' = -z + z' = 158.333$ mm

Imaging

$$\frac{1}{z'} = \frac{1}{z} + \frac{1}{f}$$

$$z' = L' + z$$

$L' = 158.333$

$f = 33.333$

$$\frac{1}{L' + z} = \frac{f + z}{z f}$$

$$(L' + z)(f + z) = z f$$

$$z^2 + L' z + f L' = 0$$

$$z = \frac{-L' \pm \sqrt{L'^2 - 4 L' f}}{2}$$

$z = -47.709 \text{ mm}$ or -110.624 mm

$z' = 110.624 \text{ mm}$ or 47.709 mm

$$m = z'/z$$

$m = -2.319$ or $-.431$

Note that these are reciprocal magnifications

$$m_1 = \frac{1}{m_2}$$