

Solution to: Measuring microscope with a long front focal length and variable power

I- Study of the measuring microscope :

1. $g_y=0,8$; $P_{ey}=80\delta$; $P_{mic}=64\delta$.
2. $F'_4F'_{ey}=-a/2$; $FF_{ey}=4,5a$; $f'_{ey}=1,5a$; $a=8,33\text{mm}=f'_4$; $f'_3=12,5\text{mm}$; $e=2a=16,7\text{mm}$.
3. $F'_{ey}P_s=0,98\text{mm}$; $\text{dia}P_s=1,56\text{mm}$. $O_1P_e=85,7\text{mm}$; $\text{dia}PE=28,6\text{mm}$; $NA=0,05$.
Diffraction $dy=\lambda/2NA=5\mu\text{m}$ gives depth of field = $\lambda/2(NA)^2=100\mu\text{m}$
Accommodation: $f'_{micr}=-15,6\text{mm}$ depth of field $FA=0,97\text{mm}$
Accommodation should be reduced by a factor of 10 using a graticle in F_4 (F_{ey} being virtual)
4. $\text{dia}L_1=23\text{mm}$. dia bright interm space: $2y'_{bf}=8\text{mm}$. dia bf image sp: $2\theta'_{bf}=0,64\text{rd}=37^\circ$.
- 5.
6. on the drawing: $\text{dia}L_3>9\text{mm}$; $\text{dia}L_4>5,5\text{mm}$. Exact calculation: $\text{dia}L_3=8,9\text{mm}$, $\text{dia}L_4=4,8\text{mm}$

II- Additional system to obtain different powers for the microscope :

1. $g_\alpha=2$ (position 1) $g_\alpha=1/2$ (position 3) $f'_{s1}=80\text{mm}$; $f'_{s2}=-40\text{mm}$.
2. field stop in F_4 with $\text{dia} 5,33\text{mm}$.
3. Position 1: dia bf object=5mm; position 2: 10mm; position 3: 20mm
4. on the drawing : $\text{dia}L_1>45\text{mm}$; $\text{dia}S_1>44\text{mm}$; $\text{dia}S_2>20,5\text{mm}$
Exact calculation: $\text{dia}S_2=20,5\text{mm}$; $\text{dia}S_1=45\text{mm}$; $\text{dia}L_1=45,25\text{mm}$ (position 1 most constraining).