**362.**

**Problem 31.17 (RHK)**

*Three capacitors are connected in parallel. Each has plate area A and plate spacing d. We have to work out* (a) *the spacing of a single capacitor of plate area A if its capacitance equals that of the parallel combination. We will also work out* (b) *the spacing of a single capacitor of plate area A if its capacitance equals that of the series combination.*

**Solution:**

(a)

Capacitance of a parallel plate capacitor of plate area *A* and plate spacing *d* is

$$C = \frac{\varepsilon_0 A}{d}.$$

When the three identical capacitors are connected in parallel the equivalent capacitance of the combination will be

$$C_p = 3C = 3\varepsilon_0 \frac{A}{d}.$$

Therefore, the spacing of a single capacitor of plate area *A* having the capacitance $C_p$ will have to be $d/3$.

(b)

When the three identical capacitors are connected in series, the equivalent capacitance of the combination will be

$$\frac{1}{C_s} = \frac{3}{C}, \text{ or } C_s = \frac{C}{3}.$$

Therefore, the spacing of a single capacitor of plate area *A* having the capacitance $C_s$ will be $3d$.