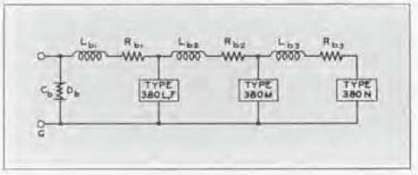

FIGURE 9. Schematic diagram of a TYPE 219 Decade Condenser, showing the added residuals L_B and R_B of the leads to the TYPE 380 Units and the added zero capacitance C_P and D_P.

variation with frequency of both the zero capacitance and its dissipation factor is shown in Figure 6.

The residual impedances of a TYPE 380 Decade-Condenser Unit are divided in the manner shown in Figure 8. Each condenser has the residuals L_C and R_C in its own leads to the switch, with the residuals L_S and R_S common to all for the L, M, and N types. Approximate values of these residuals are 0.10 μh and 0.15 μh for the inductances and 0.03 Ω and 0.04 Ω at 1 Mc for the resistances, respectively. Actually, because the leads from switch to condensers are of different lengths, the residuals L_C and R_C for the four condensers differ slightly. For a particular switch the measured values for the four lead inductances were 0.100, 0.076, 0.095, 0.076 μh in the order 1, 2, 3, 4. These values follow roughly the areas embraced by the leads as shown in Figure 7. These differences are not significant and it will be sufficient to use the rounded value 0.10 μh. There are also similar small differences in the resistance values. The residuals for the F type are 0.10 μh and 0.25 μh, 0.03 Ω and 0.07 Ω.

When capacitances with residual impedance are connected in parallel, the impedances add according to the following rules:

$$L = \frac{L_1C_1^2 + L_2C_2^2 + \cdots}{(C_1 + C_2 + \cdots)^2} = \frac{\Sigma(LC^2)}{\Sigma^2 C}$$
$$R = \frac{R_1C_1^2 + R_2C_2^2 + \cdots}{(C_1 + C_2 + \cdots)^2} = \frac{\Sigma(RC^2)}{\Sigma^2 C} \qquad (6)$$

When the residuals are all equal,

$$L = L_C \frac{\Sigma C^2}{\Sigma^2 C}$$
$$R = R_C \frac{\Sigma C^2}{\Sigma^2 C} \qquad (7)$$

which yield the ratios L/L_C and R/R_C for the ten positions of the switch given in Table I. For this case the residuals at maximum capacitance are only three-tenths of their values at minimum capacitance. The effect of this change in the apparent value of the residuals on the capacitance change and dissipation factor of the various TYPE 380 Units is shown in Figure 5. Curves for the maximum and minimum capacitance settings are shown for all four TYPE 380 Units.

TYPE 219 DECADE CONDENSERS

When several TYPE 380 Decade-Condenser Units are assembled to form a

TABLE II

Decade	*Material*	*Case*	*C* μf	*DC* $\mu\mu f$
F	Mica	505	.1 –1.0	20–200
M	Mica	Moulded	.01 – .1	5–50
N	Mica	Moulded	.001– .01	1–10
L	Wax paper		.1 –1.0	500–5000

TABLE III

Position	*Unit*	*L* μh	*R at 1Mc* Ω	*Total L* μh	*Total R at 1Mc* Ω
1	380–F & L	.16	.025	.16	.025
2	380–M	.10	.015	.26	.040
3	380–N	.10	.015	.36	.055