CONDENSERS IN PARALLEL

In a TYPE 380 Decade-Condenser Unit four separate condensers are successively connected in parallel groups by means of the drum switch shown in Figure 7 to give the ten steps of a decade. The four units have capacitances in the ratio 1 : 2 : 3 : 4, giving the first four steps directly and are then combined in the manner shown in Table I to give the other steps. For the small values of dissipation factor which these condensers have, capacitances add directly,[11] while dissipation factor is calculated from the rule that the products, dissipation factor times capacitance, add.[12]

$$C = C_1 + C_2 + \cdots = \Sigma C$$

$$D = \frac{D_1C_1 + D_2C_2 + \cdots}{C_1 + C_2 + \cdots} = \frac{\Sigma(DC)}{\Sigma C} \quad (5)$$

To a good approximation all four units have the same dissipation factor, which thus becomes the value for all settings. Limiting values of the DC products for the various decades are given in Table II.

The TYPE 380 Switch and the wiring to the four condensers has a capacitance of about 11 $\mu\mu$f. This is the zero capacitance of the switch and must be added to the sum of the capacitances of the condensers used at any setting to get the total capacitance. The dissipation factor of this zero capacitance is about 0.05 at 1 kc, thus giving a DC product of 0.55 $\mu\mu$f. This is sufficiently large so that it must be included in calculating the dissipation factor for all settings of the TYPE 380-N Unit and the first several settings of the TYPE 380-M Unit. The

TABLE I

Step	*Units Used*	L/L_C *and* R/R_C
1–4	1 to 4	1.000
5	4 + 1	.680
6	4 + 2	.556
7	4 + 3	.510
8	4 + 3 + 1	.406
9	4 + 3 + 2	.358
10	4 + 3 + 2 + 1	.300

[11]Actually there are mutual capacitances among the four units which are successively shorted by the switch in its different positions. This causes the actual capacitance to be less than the sum of the separate capacitances. This difference is small and is significant only in the TYPE 380-N Decade.

[12]Note the analogy with loss factor which is dissipation factor times dielectric constant.

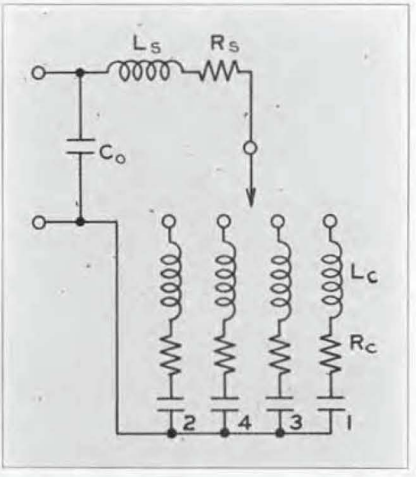

FIGURE 8. Schematic diagram of a TYPE 380 Decade Condenser Unit showing the residuals L_C and R_C associated with the separate condensers, residuals L_S and R_S of the leads, and the zero capacitance C_O with its dissipation factor D_O.

FIGURE 7. View of a TYPE 380 Decade Condenser Unit showing the switch and the metal container which holds the condensers.