



Fig. 12-13—In most applications, the filter chokes may be placed in the negative instead of the positive side of the circuit. This reduces the danger of a voltage breakdown between the choke winding and core.

ment is removed if the chokes are placed in the negative lead as shown in Fig. 12-13. With this connection, the capacitance of the transformer

secondary to ground appears in parallel with the filter chokes tending to bypass the chokes. However, this effect will be negligible in practical application except in cases where the output ripple must be reduced to a very low figure. Such applications are usually limited to low-voltage devices such as receivers, speech amplifiers and v.f.o.'s where insulation is no problem and the chokes may be placed in the positive side in the conventional manner. In higher-voltage applications, there is no reason why the filter chokes should not be placed in the negative lead to reduce insulation requirements. Choke terminals, negative capacitor terminals and the transformer center-tap terminal should be well protected against accidental contact, since these will assume full supply voltage to chassis should a choke burn out or the chassis connection fail.

## PLATE AND FILAMENT TRANSFORMERS

### Output Voltage

The output voltage which the plate transformer must deliver depends upon the required d.c. load voltage and the type of filter circuit.

With a choke-input filter, the required r.m.s. secondary voltage (each side of center-tap for a center-tap rectifier) can be calculated by the equation:

$$E_t = 1.1 [E_o + I(R_1 + R_2 + R_s)]$$

where  $E_o$  is the required d.c. output voltage,  $I$  is the load current (including bleeder current) in amperes,  $R_1$  and  $R_2$  are the d.c. resistances of the chokes, and  $R_s$  is the series resistance (transformer and rectifier) rectifier.  $E_t$  is the open-circuit r.m.s. voltage.

The approximate transformer output voltage required to give a desired d.c. output voltage with a given load with a capacitive-input filter system can be calculated with Fig. 12-11.

Example:

Required d.c. output volts — 500

Load current to be drawn — 100 ma. (0.1 amp)

$$\text{Load resistance} = \frac{500}{0.1} = 5000 \text{ ohms.}$$

Input capacitor — 10  $\mu$ f.

If the series resistance is 200 ohms, Fig. 12-6 shows that the ratio of d.c. volts to the required transformer peak voltage is 0.85. The ratio to the r.m.s. voltage is  $0.85 \times 1.414 = 1.2$ .

The required transformer terminal voltage under load with chokes of 200 and 300 ohms is

$$\begin{aligned} E_t &= \frac{E_o + I(R_1 + R_2 + R_s)}{1.2} \\ &= \frac{500 + 0.1(200 + 300 + 200)}{1.2} \\ &= \frac{570}{1.2} = 473 \text{ volts.} \end{aligned}$$

### Volt-Ampere Rating

The volt-ampere rating of the transformer depends upon the type of filter (capacitive or choke input). With a capacitive-input filter the heating effect in the secondary is higher because of the high ratio of peak to average current, consequently the volt-amperes handled by the transformer may be several times the watts delivered to the load. With a choke-input filter, provided the input choke has at least the critical inductance, the secondary volt-amperes can be calculated quite closely by the equation:

$$\text{Sec. V.A.} = 0.00075EI$$

where  $E$  is the total r.m.s. voltage of the secondary (between the outside ends in the case of a center-tapped winding) and  $I$  is the d.c. output current in milliamperes (load current plus bleeder current). The primary volt-amperes will be 10 to 20 per cent higher because of transformer losses.

### Broadcast & Television Replacement Transformers in Amateur Transmitter Service

Small power transformers of the type sold for replacement in broadcast and television receivers are usually designed for service in terms of use for several hours continuously with capacitor-input filters. In the usual type of amateur transmitter service, where most of the power is drawn intermittently for periods of several minutes with equivalent intervals in between, the published ratings can be exceeded without excessive transformer heating.

With capacitor input, it should be safe to draw 20 to 30 per cent more current than the rated value. With a choke-input filter, an increase in current of about 50 per cent is permissible. If a bridge rectifier is used (with a choke-input filter) the output voltage will be approximately doubled. In this case, it should be possible in amateur transmitter service to draw the rated current, thus obtaining about twice the rated output power from the transformer.