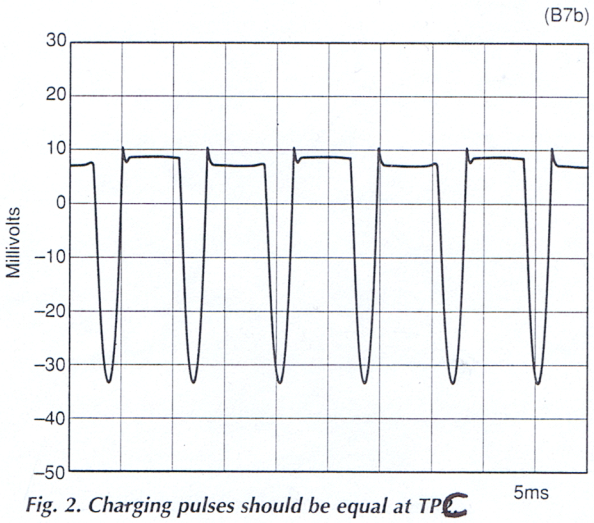

Fig. 2. Charging pulses should be equal at TPC

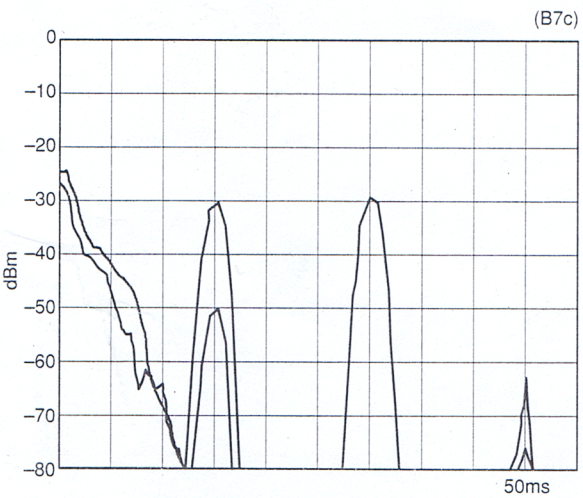

Fig. 3. 20dB improvement in power supply ripple after adjustment of R_2.

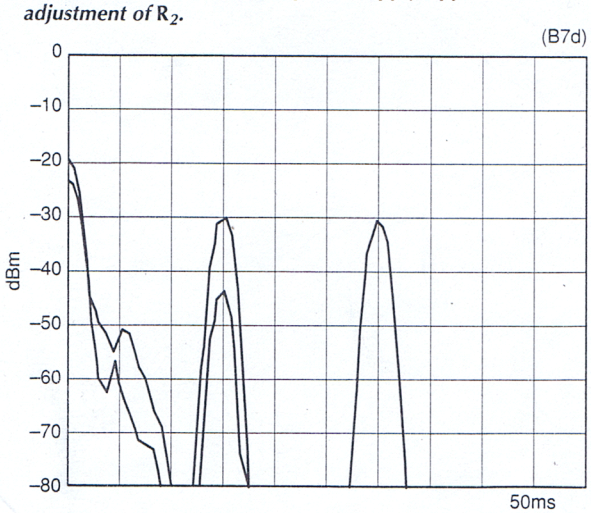

Fig. 4. Change of power frequency ripple when transformer heater leads to a directly-heated rectifier are reversed.

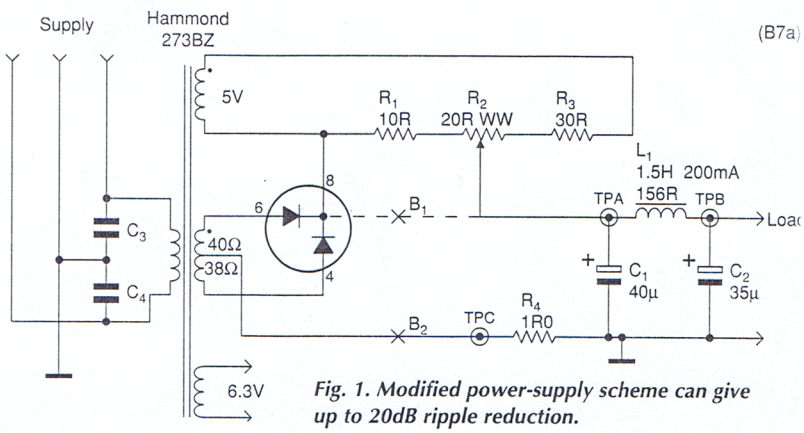

Fig. 1. Modified power-supply scheme can give up to 20dB ripple reduction.

Reducing power-supply mains-frequency ripple

If you have a centre-tapped mains transformer driving a full-wave rectifier, it is possible that 50/60Hz ripple is greater than it theoretically should be. This modification resolves the problem, producing a ripple reduction of about 20dB at mains frequency and odd harmonics.

With this modification, high voltages are present.

Because power transformers are normally wound serially, one side of the high-voltage winding is of higher resistance than the other. Although one expects the ripple to be primarily at even harmonics of the mains frequency, this effect inserts significant ripple at mains frequency and at odd harmonics, since the output filter network, *RC* or *LC*, is much less effective at the lower frequency.

The ripple does not occur in full bridge circuits and push-pull amplifiers are relatively invulnerable, but single-ended amplifiers, particularly the triode type, are affected. Depending on loading, between 2/3 to 4/5 of the ripple is applied to the load in a triode power stage and, since speakers have low-frequency resonances, the conditions are right for hum.

My own case is shown in **Fig. 1**, a power supply for a 1960s audio amplifier, the transformer being a 375V-0-375V model, the windings of which measure 38 and 40Ω. The 5V winding drives resistors $R_{1,2,3}$, which apply ac in series with the dc from the rectifier in place of the direct connection at B_1. Varying the potentiometer, which is a wirewound type, alters the polarity and aids or bucks each half of the ht winding.

The only other modification is R_4, which is included for use during adjustment, which is done by observing current pulses across this resistor at test point C; **Fig. 2** shows properly adjusted pulses. If the 6V ac winding is used, the break should be at B_2. Capacitors $C_{3,4}$ must be ceramic types, safety rated for connection the mains.

Both semiconductor and valve rectifiers have been tried, the valve type with varying results, and the same process can be applied to a choke-input filter. The improvement at 60Hz at the output was, in my case, from 75mV to 8.5mV and at 180Hz from 2.5mV to 1mV.

If your power supply has a directly-heated rectifier, there may be no need for all that. Simply reverse the heater leads to get about 15dB improvement. There is a 50:50 chance that they were the wrong way round.

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