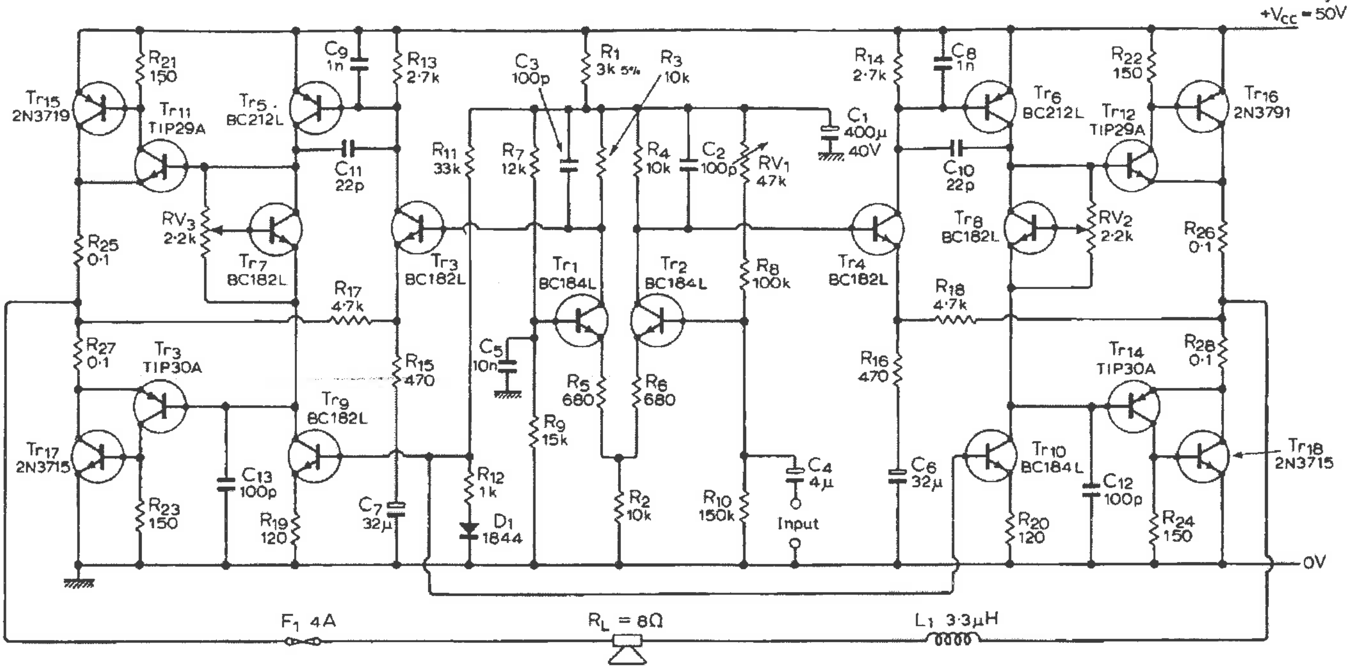

Fig. 5. Full circuit of 100-W amplifier. Resistors can be 10% types except R_1.

stantiates any reason for its selection. Additionally, small signal transistors are far more readily available than the electrolytic capacitors at the time of writing and in the foreseeable future. Since our 100-W Figuration employs two identical power amplifiers, the cost of providing the constant potential divider chain for this additional transistor has been reduced by making use of the same bias chain for both amplifiers.

Input stage

To complete the power amplifiers, a different input stage is used from the version shown in Fig. 1. The long-tailed pair has been replaced by a single transistor with its collector connected directly to the base of Tr_5, the base-emitter junction of which is partially shunted by R_{13} to reduce variation in the collector current of Tr_3 due to variations in the current gain of the driver transistor. Resistors R_{17} and R_{15}, together with capacitor C_7 provide an a.c. feedback path to the emitter of Tr_3 and set the somewhat low a.c. closed loop gain of 11. In our original article several benefits were claimed for using the long-tailed pair as an input stage. These included good stability of d.c. level of output mid-point, and high input impedance to the input and feedback circuits.

In the 100-W amplifier, the stability of the d.c. level of the two output mid-points is certainly worse than that of the 15-W amplifier. The reason for this is that changes of both the base-emitter voltage to Tr_3 and the current gain in Tr_5 will affect the d.c. output level. Under normal conditions the results of these changes due to temperature variations would be expected to be small, for example, a 20°C change will cause an output level shift of 40 mV and a change in gain of Tr_5 and Tr_6 from 60 to 300 will cause the output level shift of 400 mV. However, this is not really important since what we are interested in is any changes of voltage across the load creating a d.c. unbalance in the bridge, because at all costs large direct currents must be prevented from flowing in the load. However such currents are unlikely to occur since any temperature change affecting the left hand power amplifier will similarly affect the right hand power amplifier. Such changes in both amplifiers would simply result in a similar shift of output mid point voltage at both ends of the load, resulting in a cancellation of effect and the preservation of bridge balance.

The high impedance feature of the feedback circuits in the original design has become unnecessary in the 100-W version, since the closed loop gain has been made small.

The advantage of having low value decoupling capacitors is retained since resistor R_{15} is relatively large (470Ω) and needs only a 32μF decoupling capacitor to give a low-frequency −3dB point at 10Hz—once again comparing favourably with the 15-W version. If this arrangement were used in a simple amplifier with a gain of, say 100 where the feedback loop encompassed the whole amplifier, a capacitor of ten times this value would be required to give the same —3dB frequency. Despite the change of configuration from long tailed pair to single transistor the input impedance looking in at the base of Tr_3 is still high, due to the presence of the large in-phase feedback signal at the emitter. As the entire amplifier is d.c. coupled, the stability of the output mid-point voltage needs to be ensured by a d.c. reference provided at the base of Tr_3. Two alternatives present themselves at this point.

(a) To provide an independent potential divider bias chain for Tr_3 and Tr_4, the doubling up being necessary to allow compensation for individual variations in V_{BE} of these two transistors together with the potential drop tolerance in R_{17} and R_{18}.

(b) To make use of the d.c. level present at the output of the phase splitter as a reference.

The latter alternative represents a considerable simplification and has therefore been chosen.

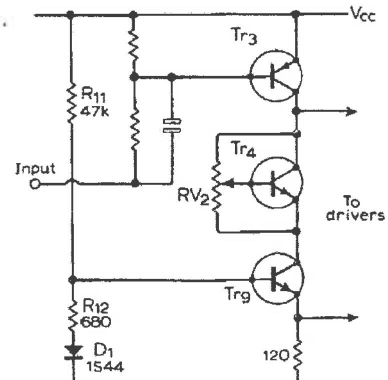

Fig. 6. Replacement of bootstrap resistor by transistor.

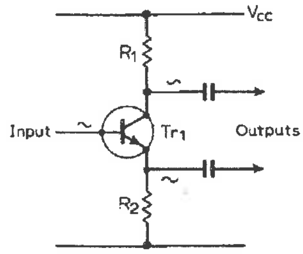

Fig. 7. Single-stage phase splitter.

Phase-splitter stage

Readers will note that the phase splitter used consists of a long-tailed pair formed by the transistors Tr_1 and Tr_2. Other