

the output subamplifiers are oriented toward the use of integrated components. It has become obvious that past problems with class B amplifiers originated with the stabilization of the quiescent current to give zero cross-over distortion. Attempts were made to use diodes to compensate for device  $V_{BE}$  changes with fluctuations in the ambient temperature—the independent variations due to device dissipation could not be eliminated. Most of the time the diode did its job and the voltage defined by the combination of transistor and diode remained constant. This constant voltage was used in conjunction with low-value resistors to set the quiescent current in the output circuits.

If now an integrated component is used both the diode and the transistor are on the same chip and, apart from minor fluctuations, the combination is isothermal. As a result the quiescent current is a function *only* of the setting voltage and not ambient temperature or differential device temperatures. The accuracy with which the current can be set is largely governed by the offset voltage of the transistor pair. Typical values of  $\pm 4\text{mV}$  which would represent a  $\pm 8\text{mA}$  inaccuracy in the quiescent current using  $0.5\text{-ohm}$  feedback resistors are readily obtained. With such an arrangement a reasonable quiescent current for the sub-amplifiers would be  $30\text{mA}$ , the worst case figures would be  $24\text{mA}$  and  $38\text{mA}$ . Both of these values are well above the low conductance current level ( $5\text{mA}$ ) which is required for good linearity of the sub-amplifiers.

The advantage of the new approach is fairly evident when it is realized that as long as the amplifiers are above the non-linear region, the spreads introduced in the sub-amplifier quiescent current will not cause the class AB situation of over-biasing (shown last month) characteristic of present designs. It is now possible to design an output stage without the normal trim potentiometers, thus giving a degree of freedom in production not possible with current amplifiers. The performance of the amplifier, once checked at the end of a

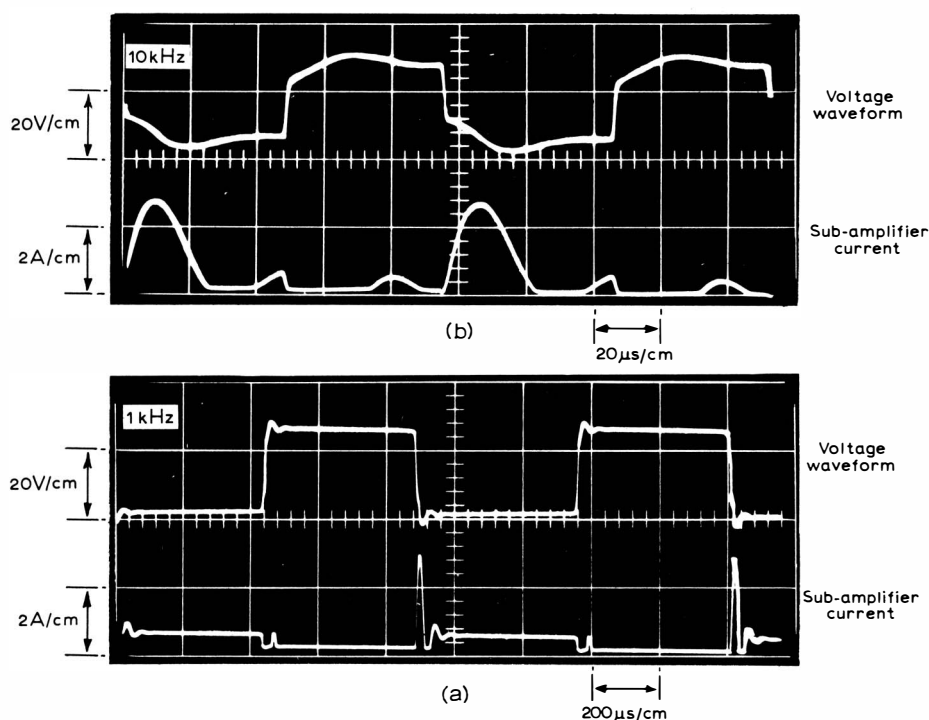


Fig. 10. Square-wave performance when driving electrostatic load at 1kHz (a) and 10kHz (b). Top traces are voltage and lower traces current out of sub-amplifier. Ringing is due to output impedance converting ringing current in  $L_2$  and  $C_2$  into ripples in the output.

production line can be guaranteed for operation in any climate and for any period of time.

### Possible applications

The performance of an amplifier of this calibre is, in my opinion, wasted in a conventional audio set-up. In most cases, the transducers will be the weakest link.

The approach used in the design of the output sub-amplifiers does not rely on complementary matched devices—in fact, in most cases n-p-n devices are preferred for their superior secondary breakdown characteristics. This represents considerable reduction in amplifier costs especially in the 100-watt region as presently available devices boast a  $V_{CEO}$  of 120V with

100 watts dissipation at a cost of less than 75p.

The ultimate use for this amplifier would appear to lie with the high-power professional market where the performance of cascaded amplifiers in a system would have to be excellent. Use in other fields would be mainly governed by the expected gain in performance or reduction in cost. A possible application would be as a portable standard oscillator, perhaps meter calibration amplifiers, or even high-frequency low-distortion class B transmitter amplifiers. However, these are only inspired guesses which may interest those working in these relevant fields.

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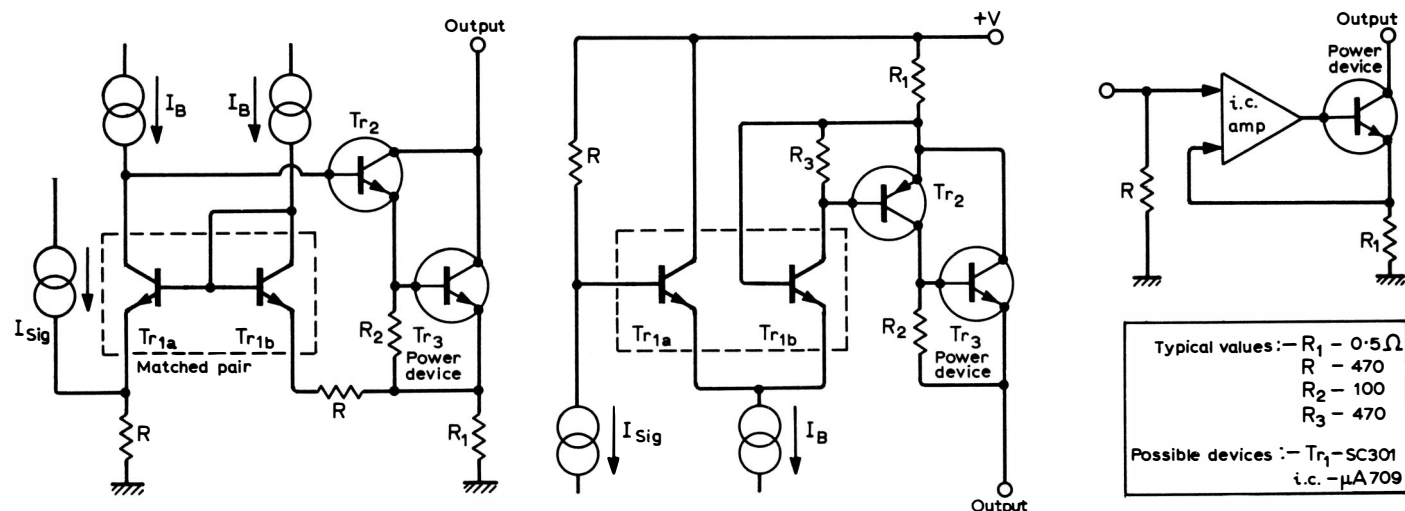


Fig. 11. Proposals for integrated components in output sub-amplifier.