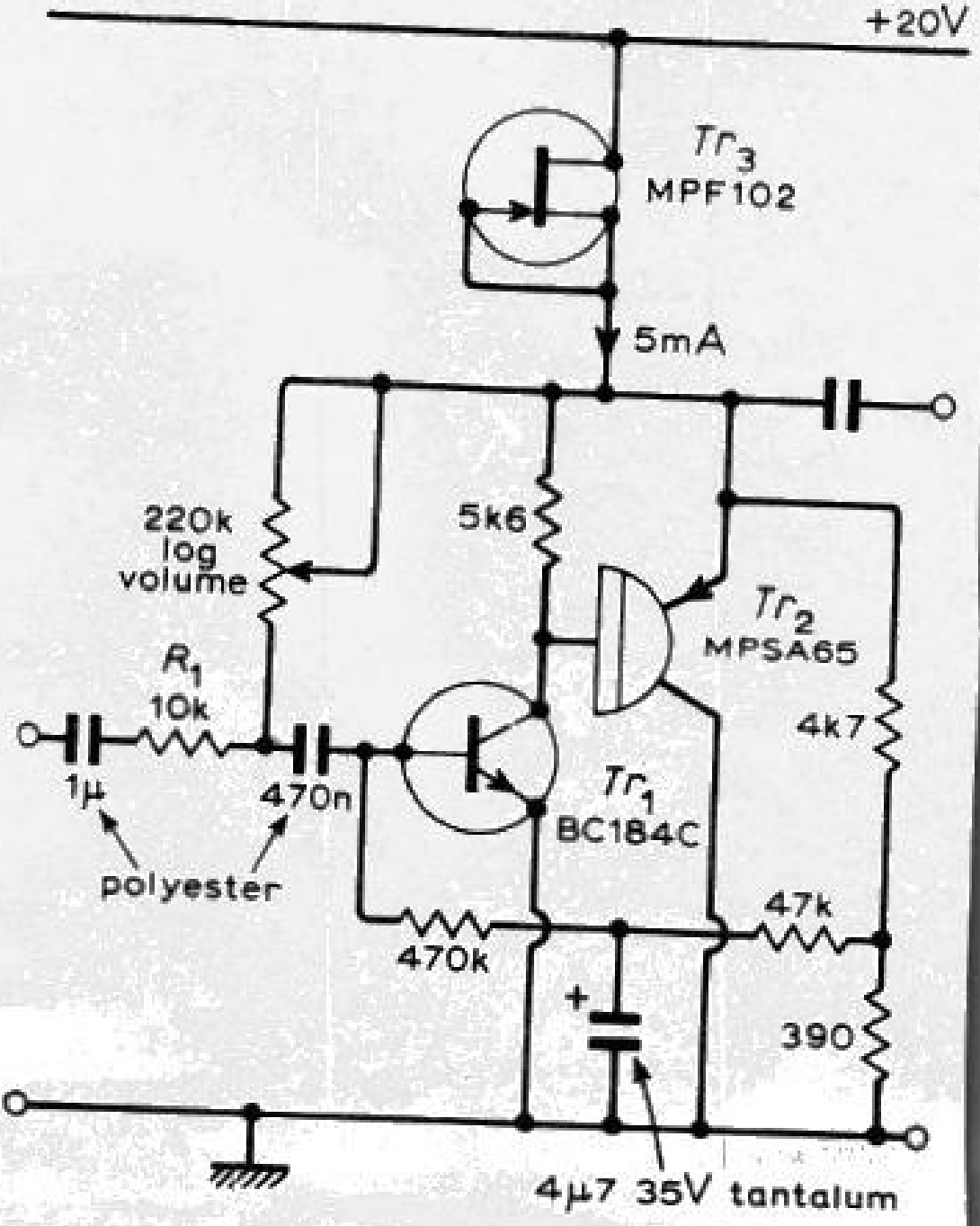
Variable-gain volume control

Large overload capability is not often provided by commercial amplifiers, but can easily be obtained by using a variable-gain volume-control stage at the input of the pre-amplifier. Inverting



amplifier circuits can easily be designed which will give overload factors of greater than 40dB at normal listening levels. The circuit shown has a maximum voltage gain of $\times 22$ but this is reduced to nearly zero at the minimum setting of the potentiometer. Sensitivity may be altered by increasing the value of R_1 — e.g. 22kΩ gives a gain of $\times$ 10. The inverting amplifier basically has one stage which provides a high open-loop gain ($\approx \times$ 2000) by employing a d.c. bootstrap circuit, and applied negative feedback reduces stage distortion to a very low level. Signal-to-noise ratio for the circuit shown is greater than 73dB on a 10mV input. For low noise and distortion the BC184C should be selected to have a current gain of greater than 400, and the field effect transistor (MPF102) should have an *I*DSS of 5mA or greater. The circuit is tolerant of hum and noise on the supply line and so may be run from a poorly stabilized supply. Total harmonic distortion at a gain of $\times 22$ and 1V r.m.s. output measured 0.025% at 1kHz and 0.05% at 10kHz. Equivalent input noise is less than 2μV, in the bandwidth 20kHz with input shorted to earth; and upper break frequency (-3dB) above 100kHz, with gain $\times 22$.

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(The symbol shown for Tr_2—the Motorola Darlington transistor type MPSA65 — was originally suggested by J. L. Linsley Hood in his article 'The Liniac', published in *Wireless World* in September 1971. Ed.)