reaches a peak of 7 times E_S when the capacitor resonates with the head, at a value of C_{cr}. (A very low value of E_S must be used to run such a curve to keep the head voltage from reaching saturation.)

It is important to stay out of the unstable region, where a transient can flip the head into saturation, thereby lowering its inductance and holding it in the saturation mode. C_C should be chosen to be either **less** than the resonating value, C_{cr}, or greater than 5 times C_{cr}, thereby permitting the head voltage to be adjusted to a value somewhere between the supply voltage and 4 times supply. The voltage regulation of the driver will, of course, have an effect on E_h as C_C is varied. Often E_S will drop sharply as the head current increases near resonance, causing an apparent flattening of the peak on the curve.

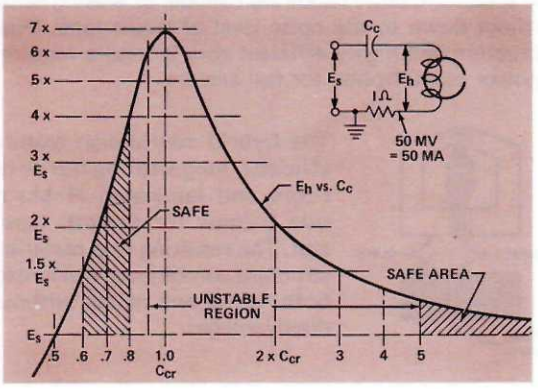

Fig. 13

C. Z COMBO® HEADS

"Z-Combo" heads have combination erase and R/P elements in the same housing. They are sometimes called "Three-in-one" heads. Erase and R/P functions are combined in one core structure with closely spaced erase and R/P gaps. They are available in a number of different track widths, in single or two-channels, and different case sizes. Types are Z-R1LC, Z-W1LC, Z-W1R, Z-W2RK, Z-J2L, and Z-J2H.

Z-Combo heads are particularly suited for use with "extended tip" poles for use against hard surfaces such as film, cards or drums. The close spacing of erase and R/P gaps makes practical the combined functions, where conventional combo or separate heads would not work. It also reduces the time delay or distance between erase and record.

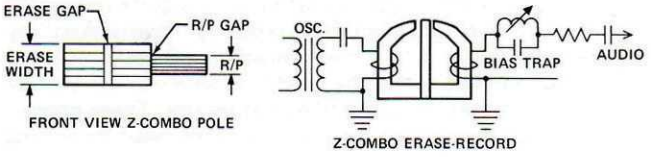

Fig. 14

Construction differs from conventional R/P heads with the addition of a center "I" core which is common to both the erase and R/P functions. The Erase C-core and R/P C-core each have their own coil. When the erase coil is energized with high frequency power from the erase/bias oscillator, enough leakage flux flows to the record side of the head to provide high frequency bias. Erase current is usually adjusted to the value which gives optimum (peak) bias at 1 kHz recording. The single-gap erase head is not as effective as the double-gap heads, limiting the degree of erasure to about 50 dB.

It is sometimes helpful to place a bias trap in the audio driver circuit to cause the R/P coil to look into a high impedance at the bias frequency. This will prevent bias voltages induced in the record coil by the erase coil from causing circulating currents which increase the effective bias flux at the record gap, necessitating a reduction in erase current to prevent overbiasing. In other words, we wish to maintain maximum erase current for good erasure without overbiasing. (D.C. can be used for erase and bias on Z-Combo heads—see section on D.C. BIAS).

Erase/bias voltage may be varied by adjusting the D.C. supply voltage to the oscillator, or by the size of the coupling capacitor to the erase coil. Tuning of the bias trap, if used, will also affect the bias.

D. HIGH SPEED DUPLICATORS

In duplication of tapes at high speeds all of the frequencies on the Master playback tapes and the Slave recorded tapes are increased by exactly the ratio of the duplicator to normal speeds. Equalization of both play and record amplifiers must be shifted up the spectrum in frequency in the same fashion. Fig. 15 below shows the Master Play equalization and the Slave Record equalization for 1 x (100-10,000 Hz), 2 x (200-20,000 Hz), and 4 x (400-40,000 Hz). Response curves are the same, but are changed in location to follow the new frequencies. The shaded areas show the range of adjustment for the equalization controls to compensate for variations in tape, master speed, master quality, etc.

Head Impedances must be scaled down to ease record driving at the higher frequencies, and to keep play head resonance out beyond the highest operating frequency. (See section on **Self Resonant Frequency** for measuring play head resonance.) Record head inductances can be 2, 5, or 10 mhy, and Play head inductances can run 5, 10, or 20 mhy.

Bias Frequency for the duplicator slaves should be at least five times the highest recorded frequency, and typically run 250, 500, or 1000 Hz. T70 series bias oscillator transformers are available for these frequencies.

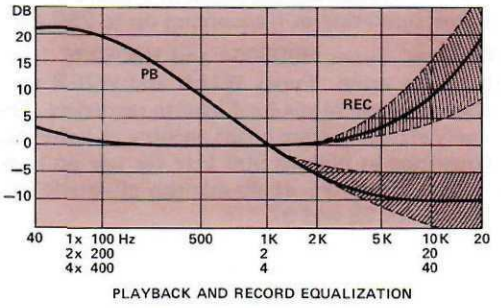

Fig. 15

Basically a duplicator consists of the same units as a conventional recorder, as shown in Fig. 16. The Master Play head feeds an equalized play amplifier which is connected to the recording amplifier. An additional power record driver may be used to drive 10 or more slave heads. The bias oscillator must supply enough power to the common bias buss to drive all the record heads. Sometimes erase heads are also used, placing additional demand on the oscillator.

Individual bias adjustments are recommended to compensate for head differences. Record currents may be individually adjusted also by replacing the fixed series 10K resistor with a variable one.