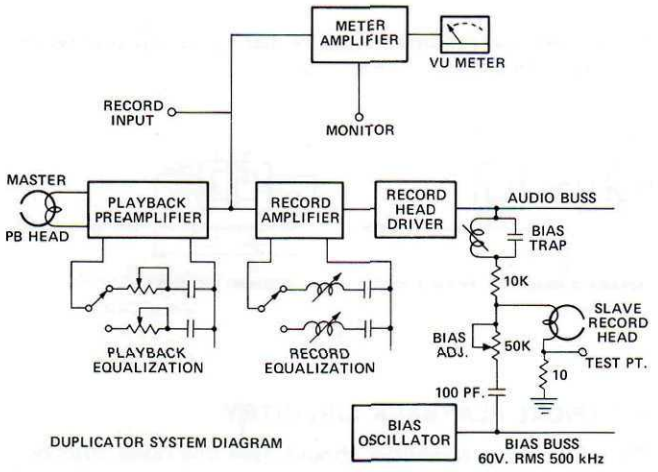

DUPLICATOR SYSTEM DIAGRAM

Fig. 16

II. RECORD & PLAYBACK CIRCUIT CONSIDERATIONS

A. TYPICAL RECORD CIRCUITRY

Recording consists of applying the audio signal, intermixed with the high frequency 50 to 100 kHz bias current, to the coil of the record head. Bias current is about ten times the audio current which places a zero-level signal (12 dB below sat.) on the tape. Bias level is adjusted to give maximum record sensitivity for a 1 kHz audio signal.

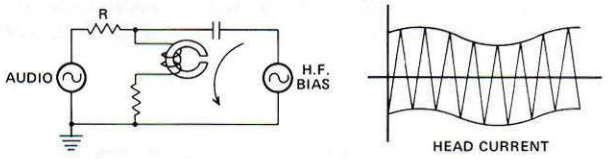

Fig. 17

Typical Record Circuitry is shown in Fig. 18. R1 controls the level of audio current fed to the record head and is adjusted to give a recorded level of zero reference when the VU meter reads zero-VU. Partial high frequency boost is created by C1 shunting R2 loaded by R3. C2 is a short circuit at the high frequencies, but below 100 Hz begins to add impedance to R3 to give a small low frequency boost. C3 and R4 give a degree of adjustment to the amount of high frequency pre-emphasis. C5 shunting R7 helps again to increase the rate of rise on the curve above 10 kHz. Alternately, instead of C5, we can shunt R7 with a series resonant circuit, C10 and L1 to give a greater amount of pre-emphasis and sharper rise. Resonant frequency of C10/L1 can be adjusted by L1 to fall between 10 and 20 kHz. R12 is selected to reduce the Q, if necessary. Tape speeds other than 7.5 ips will require changes in value for C1, C3, C5 and C10. For example, slower speeds need more capacitance.

The output of the transistor amplifier is fed to the record head thru R9 and the bias trap, which keeps the bias from the transistor. C8 serves to bypass the bias, and also to filter out audio frequencies above 20 kHz which might intermodulate with the bias. Bias is coupled to the record head thru the adjustment potentiometer, R10, and C9. R11 in series with the record head permits voltage readings across it to measure the bias and recording currents.

Q1 should be able to deliver at least four times the zero level recording current without distortion. This is not a problem with record heads of 2 to 50 mhy inductance. High impedance R/P heads of 200 or 400 mhy are more difficult to drive because of limited A.C. voltage swing from Q1, especially at the highest frequencies which may be boosted from 15 to 20 dB. A higher d.c. supply voltage may be required, plus holding down the inductance of the R/P head to 100 mhy.

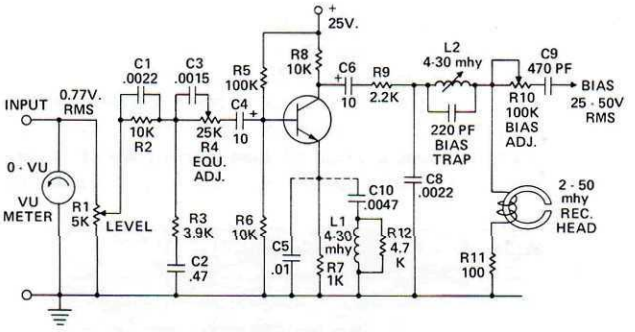

Fig. 18 – Record Equalization and Driver

IC Operational Amplifiers may be used as record head drivers, but are more critical to set up because of stability, gain, feedback, frequency response, power supply and noise considerations. Two references on IC record and play circuits include:

- LM381 Low Noise Dual Preamplifier, NATIONAL SEMICONDUCTOR CORP., AN-64 May, 1972, Byerly & Long. Gives tape head record and playback amplifier circuits.
- PIT FALLS OF THE GENERAL PURPOSE IC OPERATIONAL AMPLIFIER AS APPLIED TO AUDIO SIGNAL PROCESSING. Walter G. Jung, 1972, A.E.S. Preprint No. 893 (F-4), Audio Engineering Society, N.Y.

1. RECORDING LEVEL

The record current values given in the specifications in this catalog will place a 1 kHz signal on the tape 12 dB below tape saturation. This is also the level of the 1 kHz playback signal given in the specifications. To determine these figures follow this procedure:

1. Adjust for peak bias. A separate monitor play head is helpful.
2. Increase record current until playback signal saturates and refuses to increase further.
3. Reduce record current until play signal drops 12 dB from its maximum level. This value of record current is very close to "Zero Reference" and should cause the VU meter to read Zero-VU.

Alignment or Test Tapes have a Zero Reference Level which may be specified as "NAB Standard Reference Level" (150 NanoWebers/Meter), as "Reference Fluxivity" (200 NanoWebers/Meter), "Ampex Operating Level" (185 NanoWebers/Meter), or as "DIN Reference Level" (250 NanoWebers/M for Cassette 1.875 ips).

The above absolute tape levels can be related to each other as dB differences. Depending upon the particular test tape the VU-meter calibration will indicate the record level to produce a playback signal equal to the reference level.

Cassette recorder calibration for Zero-VU is best done at 200 nW/M as this is a safer level for distortion and is also the basis for calibration of the Dolby noise reduction system.

2. BIAS ADJUSTMENT

The bias current of a record or record/play head is normally "peaked" or adjusted to give maximum playback output from a 1 kHz recorded signal. This gives close to minimum distortion, with good high frequency response. **Overbiasing** slightly may substantially reduce the high frequencies while giving a small reduction in distortion. **Underbiasing** will