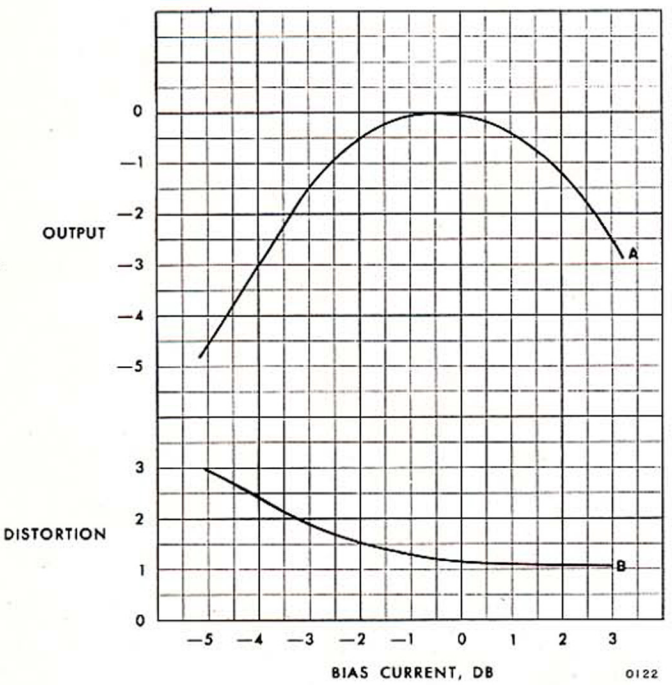
tape is within the gap of the record head it is subjected to a high frequency alternating field that is maximum at the center of the gap and decreases smoothly to zero on either side, plus a signal field that looks like an unidirectional field for that instant, we can see the degree of similarity that exists between the ideal magnetization method and an a-c biased magnetic recording.

As usual, however, there is one major area of difference. In the ideal method, the unidirectional field strength is held constant while the alternating field decreases to zero. In magnetic recording both fields reduce at the same rate as the point on the tape leaves the record gap, and the remnant magnetization on the tape will be determined by the signal strength when the bias reduces to the critical level. As a consequence, the remanent magnetization in recording, while linear, is always less than could be achieved by the ideal method. Another result is that the amplitude of the bias signal becomes important, because we find that the recorded level falls as the bias is increased beyond a certain value. This is explained by the fact that an excessive bias current can place the critical bias field strength well beyond the trailing edge of the gap, where the signal field strength is low. (Remember here that the only effective signal field is that which exists where the critical bias field is located.)

Using a-c bias, the output of the system can be peaked at any given frequency by the proper adjustment of the bias current. A complication arises in that the bias current necessary to achieve maximum output at low frequencies will result in a decreased output at high frequencies. We therefore adjust the bias at a given wavelength of the signal on the tape (see Record Bias Adjustment).



Typical output (A) and distortion (B) vs. bias current. Readings taken at 1000 cps at 15 ips.

Reproduce Amplifier

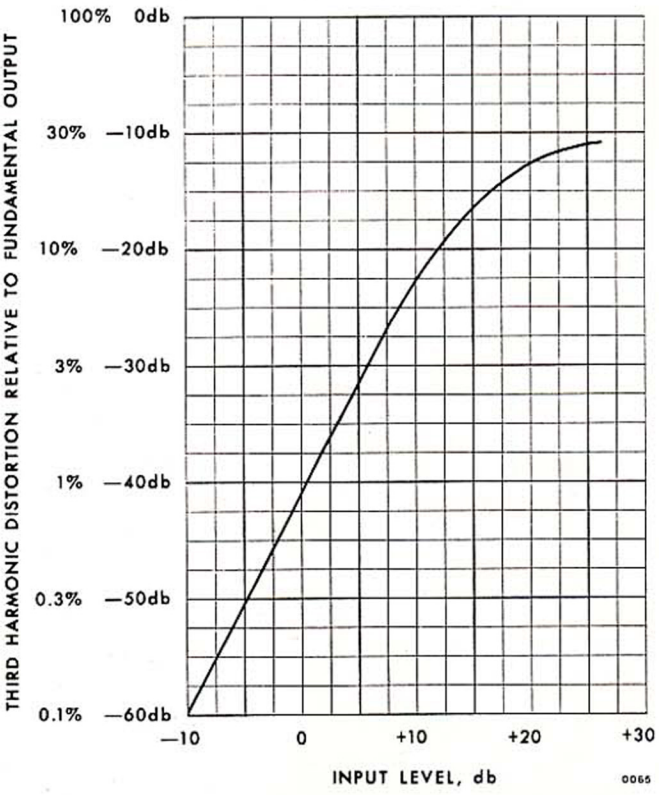
Preliminary amplification of the signal induced in the reproduce head is accomplished in the reproduce (or "playback") preamplifier. You will recall that the output of a reproduce head rises directly with frequency. This increasing output is at an approximate six db per octave rate (a very technical way of saying that the voltage output doubles each time the frequency doubles) so an opposite characteristic is required to obtain a flat overall frequency response.

An integrating amplifier, which attenuates rising frequencies at a 6 db per octave rate, is thus necessary for the reproduce function. The NAB standard curve incorporates this integrating amplifier modified by a rising frequency characteristic (or "post emphasis"). This post emphasis is achieved by an r-c circuit with a time constant dictated by tape speed and set by standards — for example, NAB standards for 7½ or 15 ips calls for a 50 microsecond time constant, which places the +3 db point at 3,180 cycles.

FACTORS IN DETERMINING IMPORTANT OPERATING CHARACTERISTICS

General

The most important operating characteristic in any sound storage device are low distortion, high signal-to-noise, good frequency response, and low flutter and wow. The last was thoroughly covered in



Typical third harmonic distortion vs. input level at 400 cps, measured at 15 ips. Distortion is plotted on a db scale to obtain a logarithmic function in linear steps.