Typical two channel electronic assembly. Ampex Model PR-10-2 professional recorder/reproducer.

circuits, except for certain minor modifications made necessary by the special application. (Note here that such necessary items as line amplifiers, power amplifiers, loudspeakers, microphones, mixers, etc., are not considered part of the magnetic recorder.)

Record Amplifier

The function of the record amplifier is to present to the record head a signal current of proper amplitude for the recording process. The record head is essentially an inductance whose impedance will vary directly with frequency. The magnetizing force is directly related to the amount of current which flows in the head coil, so high frequencies would suffer if the rising impedance of the head coil at the higher freguency were allowed to decrease the current flow appreciably. Therefore, the output circuit of the amplifier will present a relatively high resistance in respect to the head coil, which will now have a minor effect on the complete circuit; a virtually constant current condition is thus maintained regardless of the frequency involved.

In order to further ensure proper recording of high frequencies, the record amplifier also contains a pre-emphasis circuit which essentially provides more amplification as frequency rises. Because the reproduce curve has been standardized, the pre-emphasis circuit is adjustable to reproduce a flat overall response when the reproduce amplifier is set on the standard curve.

A-C Bias

The normal magnetization curve of any ferromagnetic material is extremely non-linear, with the slope near the point of origin practically zero. Theoretically we should be able to record in this region with no correction (it is sufficiently linear) by maintaining signal amplitude at a sufficiently low level. However, such a recorded signal would be so small that the signal-to-noise ratio would be unacceptable.

By using carefully chosen values of d-c bias we can utilize the approximately linear portion of the curve in recording a limited range of alternating signal amplitudes. But lower basic noise and more linear results over a greater range of signal levels can be accomplished by using an a-c bias voltage. The frequency of this a-c bias is not critical, but it should be several times that of the highest signal frequency (in AMPEX audio equipment the bias frequency is normally 100 kc).

Fundamentally, biasing with an a-c field is similar to a long-known method of achieving an "ideal" (or "anhysteretic") magnetization. In this method, an alternating field of high amplitude is superimposed on an unidirectional field, then the amplitude of the alternating field is gradually reduced to zero. The result is a remnant magnetization that is a linear function of the unidirectional field. The maximum amplitude of the alternating field is unimportant as long as it exceeds a certain level, and the final state of magnetization will depend only on the value of the unidirectional field when the alternating field strength falls below a certain level.

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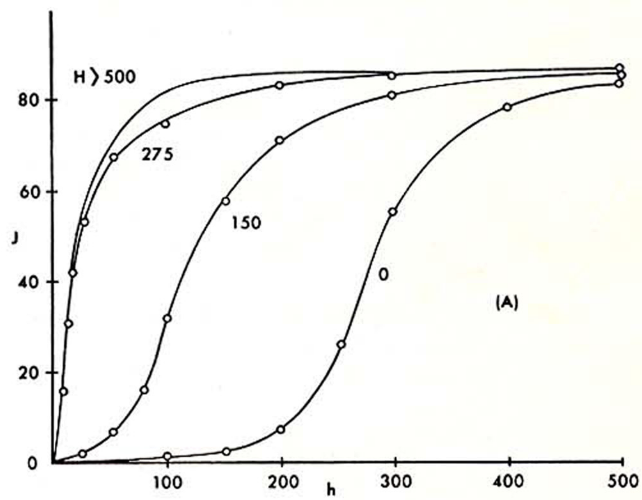

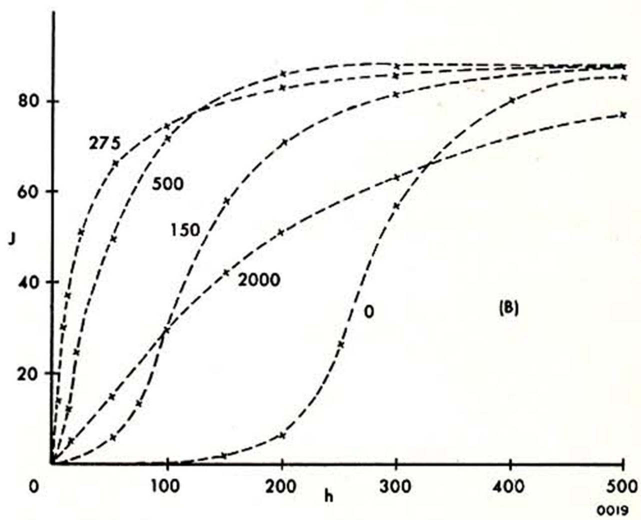

Anhysteretic intensity of magnetization (J) is plotted against the unidirectional field strength (h) for various amplitudes of a-c bias in this chart. In (A) the bias field was reduced while holding the unidirectional field constant. In (B) both fields were reduced simultaneously. Note in (B) that increasing the bias field beyond a certain value decreases the intensity of magnetization.