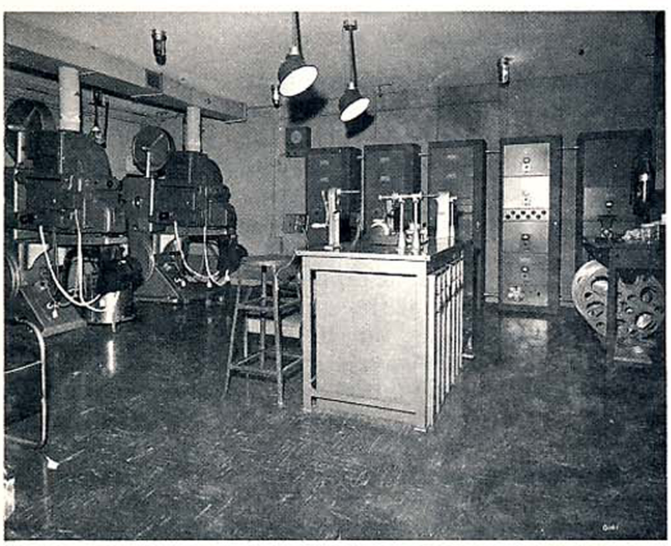
In magnetic recording such differentiation is important. Certain losses — such as amplifier response, self-resonance of head windings, eddy current losses in head cores, etc. — are frequency-dependent losses. Others — reproduce gap losses, head-to-tape spacing losses, tape thickness losses, etc. — are wavelength-dependent losses.

Erasing

Our major purposes in erasing are to obliterate any prior recording and to leave the tape quiet, so that it may be used again and again for different programs. Permanent magnets will do the erasing job, but it is difficult to prevent these devices from magnetizing the tape in one direction — a single pole on the magnet would magnetize the tape to saturation, and a high noise level would result in the subsequent recording. The common practice, therefore, is to subject the tape to an a-c field which gradually increases to a maximum magnitude, then gradually decreases to zero.

The erase head functions exactly the same as the record head, but it is constructed with a relatively large gap — which allows the flux to leak out over a relatively large longitudinal area in the tape path We send a high frequency a-c signal to the head. As a point on the tape approaches the gap, the alternating magnetic field gets stronger and stronger until a maximum magnitude is reached directly at the gap. Then as the point recedes from the gap, toward the record head, the field grows weaker and weaker until it disappears. Remember here that we are talking of relative distances, and the erasing field will disappear before our point on the tape approaches the record head.



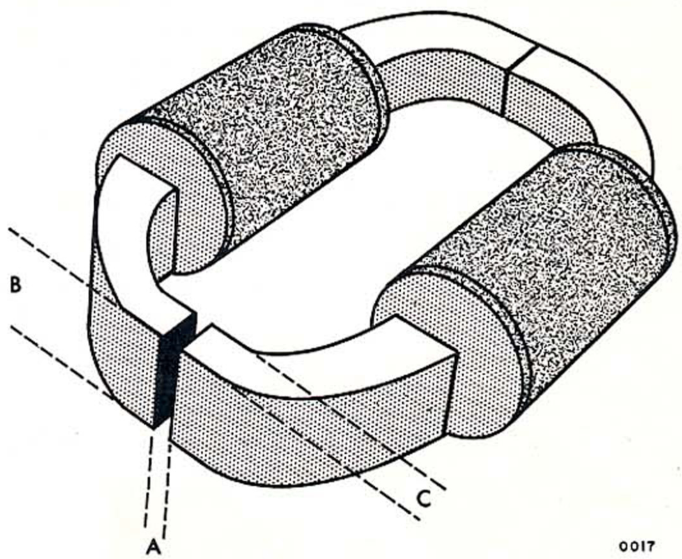
Magnetic reproducing equipment in the motion picture theater. Ampex installation along the far wall (at Warner Theater, New York City) provides six channel stereophonic sound.

Reproducing

Although the reproduce head is constructed almost the same as the record head, it functions more like an electric generator. When we move a conductor through a magnetic field, as we do in a generator, we induce in that conductor a voltage whose amplitude and polarity are functions of the magnitude and direction of the magnetic field. We can, of course, achieve the same results by passing the magnetic field across a stationary conductor, as the only requisite is that the conductor must cut the lines of force. (Note here that, assuming a constant field, the amplitude of the induced voltage is dependent upon the speed with which the conductor cuts the lines of force.)

Similarly, when we move the recorded tape past the gap in a reproduce head, the magnetic flux on the moving tape will induce a voltage in the head coil. This induced voltage will be proportional to the number of turns of wire on the head coil, the permeability of the core material, *and the time rate of change of the magnetic flux.*

Assuming a constant tape speed across the head, the last factor means that the output of a given reproduce head will increase directly with frequency (as frequency rises there is a greater rate of change of flux across the head gap for a given tape speed).



Head gap terminology used in this discussion (A) gap length (B) gap with (C) gap depth.

In reproducing information from a recorded tape, one important factor is the dimension of the reproduce head gap. We have seen that the magnetic flux on the moving tape induces a voltage in the head coil; but what actually occurs here is a little more complex than that simple statement implies.

Actually, the flux must travel to the coil through each branch of the head core (forced into that path by the high reluctance of the gap) and must result in a voltage differential across the coil if a current is to be created. Therefore, an instantaneous *difference* in the magnitude of the moving flux must exist across