

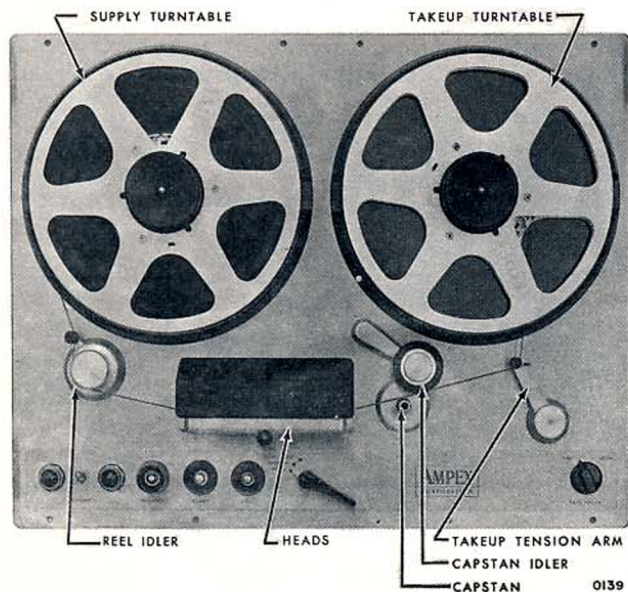
the head gap. This means that the gap must always intercept less than one complete wavelength of the signal recorded on the tape (see High Frequency Response). However, if the gap is too small the flux will not be forced through the core to the coil, and signal level will be reduced. An optimum design, tailored to specific requirements of frequency response and level is thus necessary.

Tape Transport — General

The function of the tape transport is to move the tape accurately across the heads at a precisely constant rate of speed. We can consider that all tape transports consist basically of three major divisions — first a tape supply system, then a tape drive system, and finally a tape takeup system. These divisions can be likened to two reservoirs with a pumping station between them that removes material from one reservoir and adds it to the other. Most professional quality equipment employs three motors (or their equivalents), one each for the supply system, drive system, and takeup system; however, if weight or volume is important (such as in portable machines) high quality results can be obtained by using one motor to drive the tape and employing mechanical coupling to the supply and takeup turntables.

Supply and Takeup Systems

Usually, the tape supply and tape takeup systems can be considered as identical assemblies, with the only probable differences being in the brake configuration and the connection to the power source. Torque motors (or their equivalent) are used to drive the turntables directly. These motors are connected to rotate in opposite directions when power is applied — the supply motor opposing and the takeup motor supporting the normal direction of tape motion.



Typical professional quality tape transport showing the top components on an Ampex Model 300.

In the record and reproduce modes these motors act simply to maintain proper tape tension and have no influence on tape motion, which is controlled entirely by the drive system. During this operation the supply motor imparts tension by opposing tape motion, while the takeup motor attempts to turn slightly faster than necessary to wind in the tape from the drive system.

In the fast winding modes of tape travel, the reel motors *do* control the tape motion. Here one motor is operated under full power and the other with reduced power; the greater torque of the motor under full power overcomes the lesser opposing torque and tape is simply pulled from one reel to the other, again under correct tension.

The Drive System

The drive system utilizes a synchronous motor coupled either directly or through a pulley arrangement to the capstan. The circumference of the capstan and its rotational velocity determine the speed of the tape in the record and reproduce modes.

While tape *speed* is a function only of the capstan, tape *motion* in record and reproduce is instigated when a capstan idler (sometimes called a pressure roller) clamps the tape between the capstan and itself, thus providing a surface against which the capstan can drive the tape. The capstan idler is normally coupled to a solenoid, which in turn is actuated by the play switch. This arrangement allows a "fast start" condition in which the capstan motor is operating whenever power is applied to the equipment, and tape can be quickly brought to full speed whenever the play switch is pressed.

Head-to-Tape Contact

Good head-to-tape contact and proper placement of the tape on the heads is extremely important. An inherent characteristic of magnetic tape recording is that the effective recording or reproducing of a signal on magnetic tape deteriorates with any spacing between the tape and heads. Thus, any loss in good head-to-tape contact will result in impaired performance — in recording there will be signal drop outs, in reproducing there will be a loss in frequency response.

Tape Tracking

If the tape does not track correctly across the heads, frequency response, phasing, and level will be affected. Two guides will thus bridge the head assembly. In professional quality equipment the positioning of the guides will ensure good head-to-tape contact and the accurate placement of the tape.

Tape Transport — Detailed Discussion*

Flutter and Wow

Flutter (or wow) is the amount of deviation from a mean frequency, caused by anything in the system that will affect tape motion.

*From "Multichannel Recording For Mastering Purposes", Journal of the A.E.S., October 1960.