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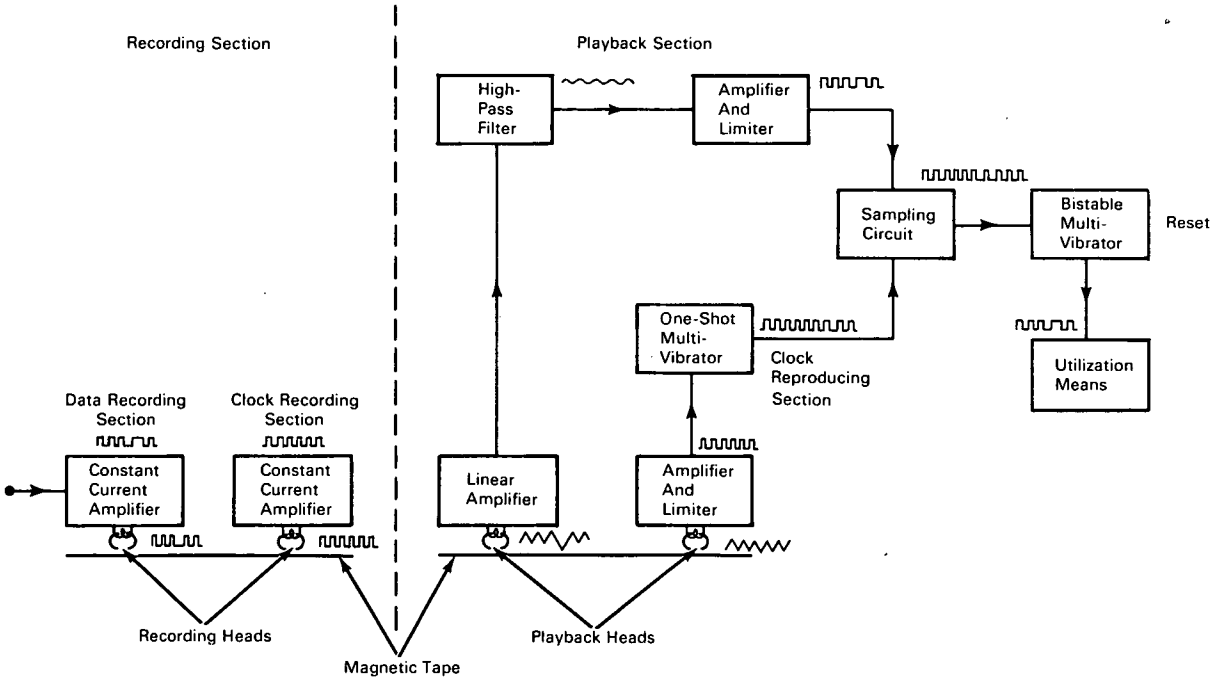
NASA TECH BRIEF

PCM Magnetic Tape System Efficiently Records and Reproduces Data



The problem: To design a reliable, precision PCM (pulse code modulated) magnetic tape recording and reproducing system that achieves a high packing density on the tape and provides a symmetrical reproduction of the recorded signal.

The solution: Utilizing the split-phase PCM technique, the gap width of the playback head is matched to approximately one half the wavelength of the prf (pulse repetition frequency). The playback head then has the characteristics of a low-pass filter and accordingly provides an output signal that is an integral of the recorded square waveform. When the playback head gap width equals one half the recorded wavelength, maximum head output voltage is obtained. This is also the condition for reliable reproduction of the recorded signal near the upper frequency limit of the playback head. Clock signal circuitry is used to provide high pulse symmetry.

How it's done: The recording system consists of a data recording section and a clock signal recording section. Both data and clock signals are fed into constant-current amplifiers (which are essentially insensitive to frequency variations). The outputs from these

(continued overleaf)

amplifiers are coupled to recording heads which induce the magnetic patterns (a data track and a clock track) on the tape.

The playback system also has two sections, one for data reproduction and one for clock signal reproduction. Upon playback, the magnetic data and clock tracks generate voltages in their respective playback heads. The output voltage from the data playback head is amplified by a linear amplifier, and the resultant signal is fed to a high-pass filter whose low-frequency cutoff point is approximately equal to the prf. The output signal from this filter is a derivative of the signal from the data playback head. The amplifier-limiter amplifies the filtered signal and clips it to form a square wave of substantially the same shape as that of the originally recorded PCM signal. The clock reproducing section, by means of an amplifier-limiter and a one-shot multivibrator, generates a unidirectional signal at a phase difference of 90° with respect to the amplifier-limiter signal. The sampling circuit receives these signals and triggers the multivibrator to produce an output signal that, except for a 90° phase difference, is an exact duplicate of the originally recorded PCM data.

Notes:

1. The clock circuitry may be omitted in situations where symmetry and high timing accuracy are not required.
2. The clock track can be eliminated by synchronizing an oscillator to the playback data repetition frequency to derive the sampling pulses.
3. The basic system (with or without clock sections) may be modified to record and reproduce more than one data track by incorporating a data recording section and a data playback section for each additional track to be accommodated.
4. A single head, constructed in the manner described for the playback head, can be used to perform the recording and playback functions.
5. Should it become desirable to compensate for any phase shift that may result in the system, a phase shifting network can be inserted between the one-shot multivibrator and each sampling circuit.
6. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B65-10311

Patent status: NASA encourages the immediate commercial use of this invention. It is owned by NASA, and a patent application has been filed. When patented, royalty-free nonexclusive licenses for its commercial use will be available. Inquiries concerning license rights should be made to NASA, Code AGP, Washington, D.C., 20546.

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