December 1967

Brief 67-10676

NASA TECH BRIEF

Scan Rate Converter for Tape Recording and Playback of TV Pictures

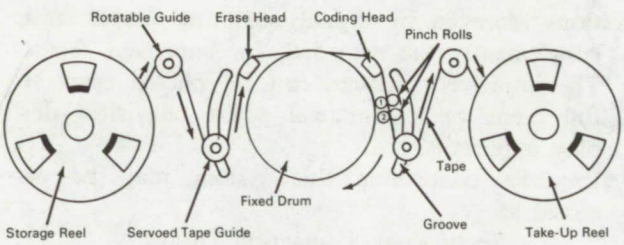

FIGURE 1.

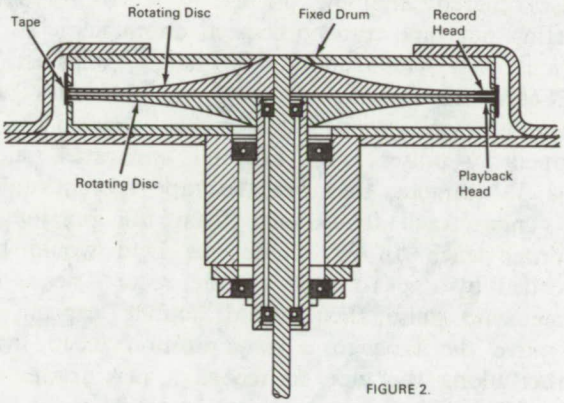

FIGURE 2.

Equipment has been designed for magnetic tape recording and playback that is adaptable to conversion of television pictures, both black and white and color, from one scan rate to another. The equipment can accurately index color picture frames for retrieval electronically and can be used as a document storage and retrieval medium that is compatible with hard-copy printout machines. In this respect, it has the advantage of being able to store 300,000 pictures or documents, any one of which may be retrieved within 3 minutes and made into a copy. The system is usable for scan conversion of television pictures wherein a slow-scan picture may be played back at commercial scan rates. Thus, programs at European scan rates may be recorded and played back at commercial U.S. scan rates. Conventional slow-scan converters of the storage-tube type have several functional disadvantages; the most serious being the decay time of the phosphor screen. Commercial disc-type video recorders and playback units do not have the frequency response necessary for color pictures on a single track.

This system uses the frequency modulation method of recording in which the video input information is amplified in a video amplifier and applied to a voltage-regulated reactance tube modulator. The output from a power amplifier drives a spherical recording head. The playback circuit is also a conventional fm system which accepts the signal from the playback head.

The tape transport mechanism is shown schematically in Figure 1. The motor of the take-up reel is associated with a torque servo which moves a rotatable tape guide along a groove so as to maintain a constant tension on the magnetic recording tape. Similarly, a servoed rotatable tape guide moves in a groove to maintain a constant tension on the tape from the storage reel. The tape from the storage reel threads through the two rotatable guides (on the left), the erase head, and helically 370 degrees around the fixed

(continued overleaf)

drum, which is coated with a solid lubricant to avoid excessive friction. Rotating discs, on which the special recording heads are mounted, spin at specific rates inside the fixed drum. The heads extend through a circumferential opening in the drum so as to record a track diagonally across the tape over a span of 360 degrees. After a track is recorded, the tape moves in the direction toward the coding head which can be utilized to encode the recorded track with binary, audio, or gray scale indicia and can be used in automatic retrieval of the diagonal track. The coding head is a three-track head, i.e., two audio and one control track recorded linearly along the tape edge. One of the audio tracks is used as a binary code track for retrieval by binary comparator. The control track is used for a sync signal to keep the recorded data in alignment with clocking pulses, thereby enabling the use of servos for subtracting out tape transport speed anomalies.

In a first video mode, capstan 1 steps at a RETMA rate moving the tape at 15 inches per second. In a second video mode, capstan 2 is stepped by pulses from external apparatus, such as a TV camera, to move the tape incrementally to a new track 0.005 inch from the previously recorded track. In this mode one field would be recorded by one rotation of the record head. A frame sync pulse then would actuate capstan 2 to move the tape to a new position 0.015 inch further along the tape to record a new frame of video. This takes into account a track width of 0.010 inch and a track spacing of 0.005 inch.

The cross-sectional view (Fig. 2) shows the interior detail of the fixed drum. The record/playback heads are mounted on the two concentric, noncontiguous rotating discs. These discs can scan a concentric peripherally located magnetic tape cylinder at one rate and playback at another. The rates are determined by the relative rotational speeds of the concentric discs, which may be set merely by shifting the axial position of the magnetic tape cylinder so that the recorded track is aligned with the playback head. This is done by helically winding the tape on the fixed drum coaxially located about the rotating discs whereby the tape is in magnetic coupling communication with the rotating magnetic record/playback heads.

Notes:

1. Scan rate conversion, as in recording a slow-scan television picture from a spacecraft (10 frames per second) and replaying the picture at commercial television rates (30 frames per second) 1800 rpm playback speed, can be accomplished directly by this system.
2. In the newly developing areas of contrast enhancement and display of electron microscope fields, a 1000 line/frame television system is used. By means of a standard television pickup system, the picture data can be recorded on the scan rate converting recorder in full color. The contrast can then be enhanced and distortions removed by digital computer means and, subsequently, re-recorded in improved form. The improved pictures can be played back in full color on commercial color television display apparatus.
3. Inquiries concerning this system may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B67-10676

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Norman I. Holt
Jet Propulsion Laboratory
(NPO-10166)