RECORDING TV ON TAPE

RECENTLY DEMONSTRATED IN THE STUDIOS OF ASSOCIATED REDIFFUSION LTD.

(*Concluded from page 8, August issue*)

SINCE the recording is FM, and therefore recorded to saturation level at all times, no erase head is required.

Also on the control track are edit pulses spaced at one-field intervals at the bottom of the vertical synchronising lines. The edit pulses are recorded by the control track head and originate in the master control units as a derivative of the vertical synchronising lines.

Editing and Splicing

The latter part of the vertical synchronising signal represents a blanking time between television fields. The editing pulse marks where this blanking time appears. If the tape is cut and put back together during the blanking periods, there will be no roll-over on the television screen when the tape is played back. To make the editing pulses visible, a solution containing carbonyl iron is applied to the tape prior to making a cut. The iron particles adhere to the tape according to the magnetic pattern made by the recording, and clearly reveal the editing pulses. The tape is then put in a jig and the cut is made along the line in the video pattern which is marked by the editing pulse. Splicing tape is then applied to the back of the tape to hold the spiced ends together. After the splice has been made, the carbonyl iron particles wipe off easily.

Playback Switching

During replay, it is necessary to derive the amplified output signal from one head at a time, switching from one preamplifier to the next (at a moment in the transmission when minimum disturbance will be introduced into the reproduced picture), and later to demodulate the amplified r-f output of the playback heads. Electronic switching accomplishes this purpose.

A network of coincidence gates is employed with a "get-ready" signal sent to each gating tube in turn from the 240-cps photocell source; a "go" signal is delivered with precision to each gating tube from the television signal itself. Switching occurs only on the back porch of a horizontal pulse. Therefore it does not appear in the reproduced picture, even as a transient.

The multi-grid gating tubes pass the r-f signal to their plate circuits only when each of two grids is raised to a predetermined level of bias. Thus the coincidence of two positive bias signals is used to trigger each of the four gates consecutively.

The photocell output is delivered to the sequential switcher, as well as to the servo amplifier control system. This 240-cps signal, whose phase is directly related to the instantaneous position of the rotating head drum, is fed through a vernier phasing control to a 90-degree lag network that controls two related channels in conjunction with the other signals. The same signal is continuously fed to a frequency doubler and to an in-phase network.

The in-phase 240-cps signal is clipped and fed to a phase splitter, which produces two signals, one in-phase and one 180-degrees out-of-phase. These two signals are applied to the gating tubes, the in-phase signal to one of the grids of gate 1, the opposite phase to one of the grids of gate 3. These are the same grids to which the amplified r-f from heads one and three is fed.

The same 240-cps signal, after passing through a 90-degree lag network, is similarly clipped, fed to a phase splitter, and applied to the control grids of gates two and four. In the same way, these gates receive the amplified r-f output of heads two and four at intervals of 90 and 270 deg.

Present Development

Performance of the "Videotape" recorder, in the form in which it exists in 1958, has been considerably improved over that obtained from the experimental unit first displayed in 1956.

The development of special tape, with surface

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smoothness much finer than that normally provided (or needed) in audio tape, specially formulated oxides of particularly good short-wave length resolution capability and improved mechanical characteristics have all combined to make possible the routine realisation of signal-to-noise ratios of 34 to 36 db, with occasional attainment of ratios as high as 40 db.

Head manufacturing techniques have also been refined, reducing the abrasion effect, both on the tape and on the heads, to the point where a substantial number of heads have proved usable well beyond the 100 hours which were originally considered a practical norm. Tape, too, is proving capable, under these improved conditions, of being reproduced many more times without deterioration, and of being recorded and re-recorded for an aggregate of well over the 100 passes of the revolving heads which at first were thought to be the practical maximum.

Head Deterioration

Deterioration in heads, due to wear, does not produce deterioration either in resolution, or in the linearity of gray-scale transfer; in fact, resolution improves slightly as heads wear and only the eventual increase in noise tells of the approaching end of the useful life of the heads.

The same is true of tape. Neither resolution nor gray-scale linearity is affected by the gradual abrasion of the tape which occurs in use. Instead, the signal-to-noise ratio slowly begins to deteriorate, signifying the end of the useful life of the tape.

Linearity of gray-scale is an inherent advantage of the video-tape recording process due to the modulation system used. Differential gain measurements typically give readings of under 10 per cent.: this remains constant being quite independent of head or tape condition. The live appearance of the video-tape reproduction is as much due to linear gray-scale transfer characteristic as to any other operating characteristic of the machine.

Resolution of better than 300 lines, with high contrast ratio, is readily obtained.

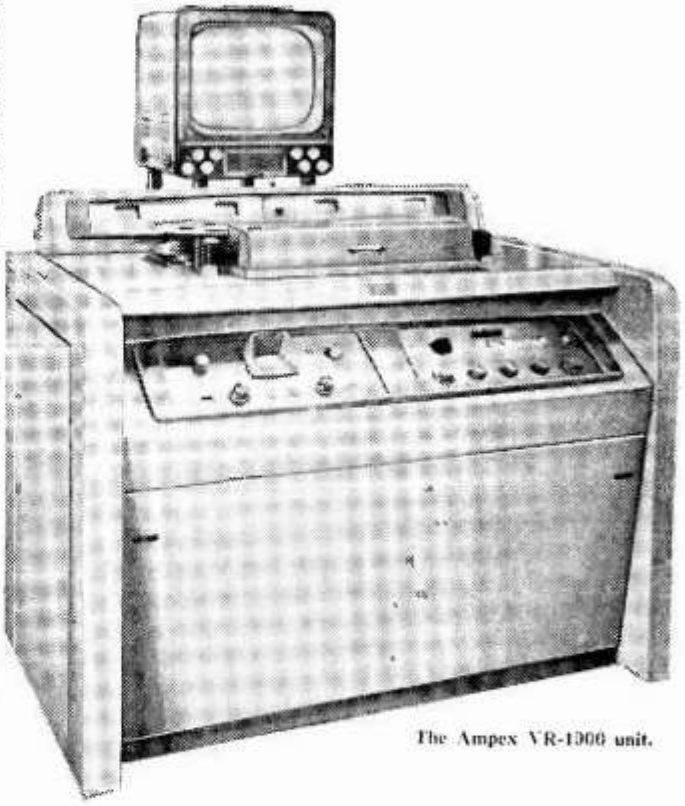
Tape Duplication

Experience with the recorder in daily network and station operation has established the practicality of making duplicate tapes from an original. While there is no method of making copies except by connecting one or more videotape units as recorders, while another is used as a replay machine, the number of copies which may be made in this manner is substantially unlimited.

First-generation copies of an original videotape recording are deteriorated in hardly any visible way, resolution and gray-scale linearity being substantially identical to the original. (A slight rise in noise occurs, but if this is already well below visibility in the original the copy will appear virtually the same as the original.)

Adapting the Colour Accessory Unit

In developing the VR-1000 colour accessory, Ampex engineers made its attachment to the black and white machine as simple as possible. In the console, aside from a few minor resistor changes, no other modifications are necessary.



The Ampex VR-1000 unit.

In the existing second rack a new switcher unit and processing amplifier will replace the original equipment. Additional components in the new third rack will include two power supplies, a burst separator and gate delay unit, a modulator-demodulator unit, burst lock oscillator, single channel generator, and a side-band converter. The customer must supply a 3.58 Mc/s signal at standard level and stability.

Output will be standard composite NTSC colour signal at standard level. Interlace of frequency components between Y and the L and Q signals will not be maintained.

After the colour accessory has been installed, the VR-1000 will record and reproduce either black and white or colour signals.