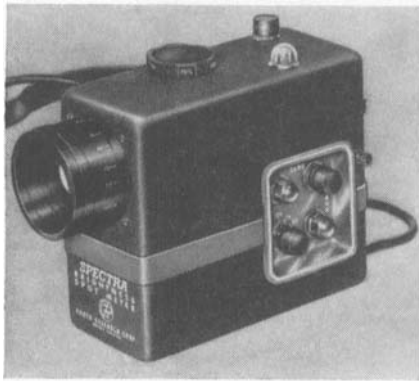




SPECTRA

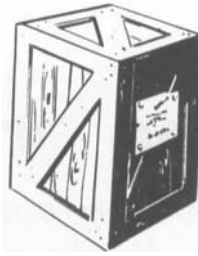
Brightness Spot Meter



- Checks uniformity of blue backing for matte shots directly from camera position
- Checks brightness of selected areas on set to determine brightness range
- Checks color temperature of light sources to maintain uniform color quality
- Shows footcandle output of individual light units without interference from other sources
- Measures uniformity of illumination and discoloration of projection screens for any distance or angle
- Maintains standard brightness and COLOR TEMPERATURE of printer lights

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Further information about these items can be obtained direct from the addresses given. As in the case of technical papers, the Society is not responsible for manufacturers' statements, and publication of these items does not constitute endorsement of the products or services.

A New Magnetic Video Recording System

BY CHARLES P. GINSBURG

[This paper presents a brief history of the project, a description of the equipment and a discussion of the applications for which it was designed. A full engineering report, with display and demonstrations, has been promised for the Fall Convention in Hollywood. The following is abstracted from the presentation made on May 2, 1956, at the Society's Convention in New York by Ross H. Snyder, Ampex Corp., Redwood City, Calif., for the author. An earlier report appeared in this column in the April 1954 Journal, pp. 323-4.]

In the fall of 1951, three members of Ampex management, all engineers, decided to commit a part of the company's capital to a research and development project aimed at the production of a practical magnetic tape recorder of video electrical signals. These were Alexander M. Poniatoff, now Board Chairman, Walter Selsted and Myron Stolaroff, now assistants to Ampex' President, George I. Long. Their interest had been aroused by the rotary head approach to the problem of wideband recording, the geometry indicating a possibility that a practical machine might by this means operate at high tracing velocity, yet at comparatively low tape speed. In December of that year, Charles P. Ginsburg, a broadcast television engineer of San Francisco, was brought to the company's Redwood City Laboratory with this specific project in view. Ampex was, at that time, a company of less than two hundred employees.

It was not until four years later that we knew our approach was workable, and that practical machinery positively could come out of it. The problems which arose, one after the other, each seemed insurmountable, and each was solved by one or another of the six-man engineering team, working in a locked laboratory. As an example of the rate at which development is still going on, the whole size of the machine now may be reduced by the success of experiments with one-mil-base Mylar magnetic tape, with which 64 min of program material can be contained on a 12-in. reel rather than the 14-in. reels contemplated earlier.

The console of the VR-1000 Videotape

Recorder is entirely self-contained. There are two input connections — one for video and one for audio — connections for audio and video monitors, two program output connectors, and a 117-v single-phase 60-cycle power cable, which draws no more than 3½ kw. There are no special requirements for its installation or operation. The entire equipment weighs approximately 900 lb, and can be moved through a 3-ft door.

The operation of the machine is in every way like that of an Ampex audio tape recorder. Threading requires less than 30 sec. There are the familiar pushbutton controls for "Play," "Record," "Stop," "Rewind" and "Fast Forward." Provision is made for remote pushbutton control. The buttons even feel the same as the controls on an Ampex Model 350, the professional audio recorder which gave its transport and control apparatus to the VR-1000 Videotape Recorder. Other controls are for purposes familiar to video operators anywhere. All internal circuitry will be immediately familiar to any qualified video engineer, and there is no requirement for special service facilities.

The machine which was shown at Chicago in April 1956 would play or record without interruption for 64 min, using 4800 ft of magnetic tape 2 in. wide on a 14-in. diameter reel. The 64-min recording or playing time is a basic specification of future production equipment. The tape moves at the standard audio speed of 15 in./sec, while four heads revolve transverse to the tape motion at high velocity. A soundtrack is laid down along one edge of the tape in the normal manner, using the usual Ampex bias and equalization circuitry. Tape entirely suitable for use with the machine is available from each of the four major suppliers.

Stability of operation meets video broadcast standards. The relative timing of any two scanning lines in any group of 20 adjacent lines is reproduced on any machine to an accuracy of 1 part in 600. No evidence of horizontal instability is detectable on a studio monitor of RCA 630TS synchronizing circuitry. Field-to-field stability is held to a degree equivalent to no more than 10% error of interlace on the reproduced picture. Video-level changes between record input and playback output, due to differences in output among the four revolving heads, are in every case more than 40 db below the peak-to-peak video level. The playback level of 15.75 kc pulses will not vary more than 1 db in any half-hour, nor more than 0.1 db in periods of 1/60 of a sec to 5 sec. There is no measurable difference whatever in the playback signals, whether they are reproduced immediately, or delayed a month or more. This depends much more upon the tape than on the machine, and the indications are that storage problems will not be substantially different with Videotape than with audio tape recordings.

Much of the operational stability of the machine derives from a refined version of the powerline lock-in drive described in 1950 to the SMPTE by Walter Selsted (September 1950 *Journal*). A control track is continuously recorded on the tape at a frequency which corresponds to that of the power line. Small variations are thus recorded for future reference. During play-

back, an electronic servo compares power-line frequency recorded with that being supplied, and issues a correction signal to the tape-drive mechanism, resulting in a steadiness which gives the specified video stability.

Other operating parameters of the Videotape Recorder include:

(1) The machine comes to full, stable operating speed in 4 sec from dead stop, and is automatically blanked out until stable speed is reached.

(2) A rewind time of approximately 1 min 40 sec for the full hour recording is provided. You might expect this, since the machine uses the same tape transport as that on a standard professional audio recorder.

(3) A horizontal resolution of 320 lines.

(4) Video bandwidth of 4 mc.

(5) Video peak-to-peak signal-to-noise ratio of 30 db or more.

(6) Audio soundtrack with frequency response beyond 10,000 cycles, signal-to-noise ratio of more than 50 db.

An audio cue track of limited quality is also included. This is a second and separate soundtrack from the program channel, and is recorded along the same tape in synchronism with the picture. Its purpose is the verbal recording of routine directions or notes to accompany the playback. It may be used, for example, to cue upcoming programs or spots, to direct editing, or to give warning before the end of the tape. Its response is limited to the band of 50 to 3000 cycles.

The machine was designed specifically for

the purpose of program delay, and it is for this purpose only that it will be first employed by CBS and NBC, to overcome the 3-hour East-West time difference. In this service the equipment will make possible both improved quality of picture and sound, and reduced annual operating costs. Usefulness of the Videotape apparatus for other purposes awaits exploration *after* experience is gained with the equipment in actual operation by NBC and CBS. A word of caution is entirely in order here. The VR-1000 is a wideband magnetic recorder, capable of continuous presentation of previously recorded electrical intelligence with a bandwidth of 4 mc and signal-to-noise ratio of 30 db or more. There is no multiplexing or other division of the video signals, and there is nothing in the circuitry which is unfamiliar to the video industry. It is obvious, then, that the uses of the equipment in applications entirely outside television are many, indeed. But even inside the TV industry we may be tempted to assume too much too soon. As a substitute for the "Hot Kinc" process, Videotape has immediate advantages both in quality improvement and cost reduction. But in the studio, whether station or production lot, there are many problems, some of them inherent in the process, to overcome. Videotape will be capable of editing and splicing like audio tape recordings. Tapes will be interchangeable from machine to machine. Within broad limits, tape stretch and shrink will not alter either program timing or quality. Tapes can be erased and new material then recorded, many many

times. Tapes can be copied from one machine to another.

However, so much of the machinery and electronics is common to both record and playback functions that no substantial cost reduction is in sight for a playback-only machine, and, indeed, no production is planned for equipment solely for playback purposes. This means the tie-up of a comparatively costly machine for editing purposes only — a machine which might otherwise be earning its cost in time-delay service. The Videotape recorder provides 320-line resolution with completely imperceptible gray-scale distortion, and gives, therefore, reproduction on the TV screen which is virtually indistinguishable from live TV. This is also true of the long-neglected soundtrack. It will do so immediately after recording and without any processing whatever. This makes it ideal for time delay of whole programs, unedited. The relatively small size of the one-hour tape reel also makes the machine potentially of great usefulness in rushing special-events broadcasts from points out of direct video contact with the studio — but even this use must await experience in the studio this Fall, and the construction of such special truck facilities as may be needed to house and power the machine. After the Fall tests in the broadcast studios, we will know far better how to exploit the special capabilities of Videotape. During these months we have been invited by both NBC and CBS to participate in the applications experiments.

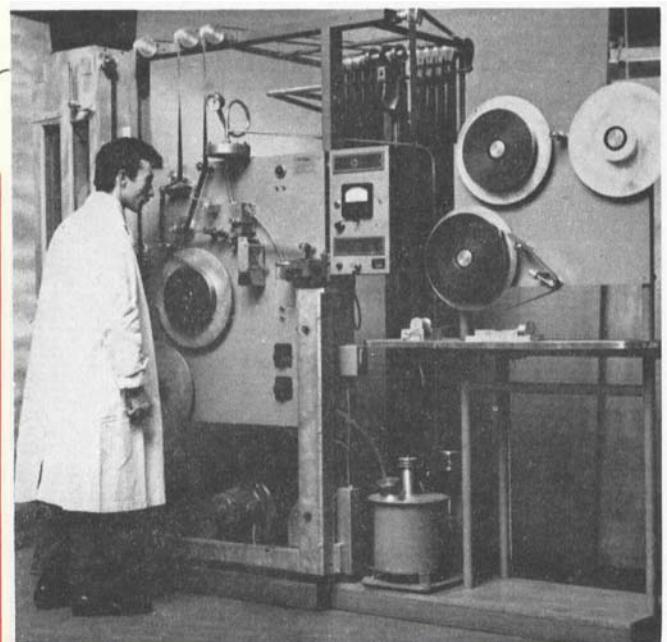
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⑤ Equipment for 35 mm
⑤ Equipment for substandard films



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machines to benefit greatly from the factory-studio engineering program this Fall, and we know that many of the standards which we are now deliberately leaving *open*, will be ready for resolution then. We recognize, of course, that standards are set by practice. We also recognize the danger of freezing practice too early, and thus of establishing standards which we may all regret at a later time. That is why all of us expect production VTR machines to differ considerably from the prototypes, and why we so welcome the networks' willingness to give us their experience in actual operation as a guide to the design we eventually freeze, at least as to operational standards.

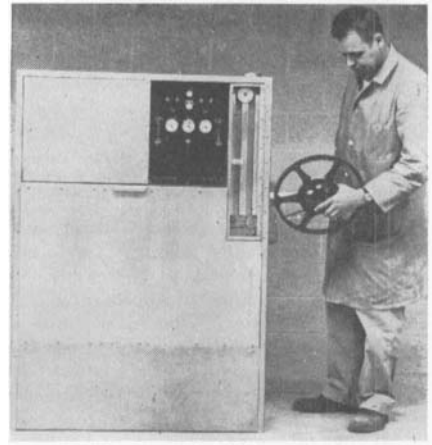
There is, for instance, placement of sound versus picture on the tape. It may be possible, as a result of the cooperation of the networks, to approach very closely, even perhaps to reach perfect dead sync. Experience with the prototypes now being made will tell the tale.

Inevitably there arises the question of motion-picture uses for the apparatus. Frankly, we see no immediate application here, and probably very little even in the future. At its very best, video quality is simply not comparable with ordinarily good original film, and not even remotely comparable to the new larger-negative film processes. VTR has come a long way in reaching good video standards. We do not expect it to make the big jump to match high-quality film. Videotape has perhaps one potential application to motion-picture production, however, as a time-

saving tool. Shooting a scene with high-quality film, the director must wait for processing to know if the camera got what he wished. He may do a scene over and over, in the hope one take may turn out right. After the processing delay, he still may find no take with which he is satisfied, and then must expensively reassemble cast and set. It might be possible to shoot simultaneously in film and in Videotape, then review immediately the tape recording. Among many other problems, those of assuring identical lens and picture registration would have to be solved. This procedure could reduce production time and costs in motion pictures — but any speculation on the replacement of the 35 mm camera by Videotape is, in our belief, foolish at this time.


There is, finally, the question of color. The machines which now exist will not satisfactorily record and reproduce color transmissions, despite their frequency response. There is, however, *no limitation whatever* in the operating principles of the VR-1000 which will prevent their use for color. As already stated, development has not stopped even on the prototype machines which the networks will have this fall. A large part of our current program is the realization of color recording in hardware — that realization exists now in principle.

A new rapid processor for TV news films has been announced by the E.D.L. Co., 5929 East Dunes Hwy., Gary, Ind. This D.M. 12-1 was recently described at the



Society's Spring Convention. Film processing time is 40 sec dry to dry at a rate of 36 ft/min, using either Eastman or Du Pont pre-hardened film. Capable of conversion to continuous operation for video recording purposes, it has a synchronous motor drive pacing the machine to an exact speed of 36 ft/min. It may be used with storage elevators. Overall dimensions of the equipment are 56½ in. high, 38½ in. long and 15 in. deep. Weight is approximately 500 lb.

A dead-sync magnetic sound editor has been announced by the E. W. D'Arcy & Assoc., Box 1103, Ogden Dunes, Gary, Ind. The device is a self-contained, picture viewer, sound reader and amplifier in the same en-



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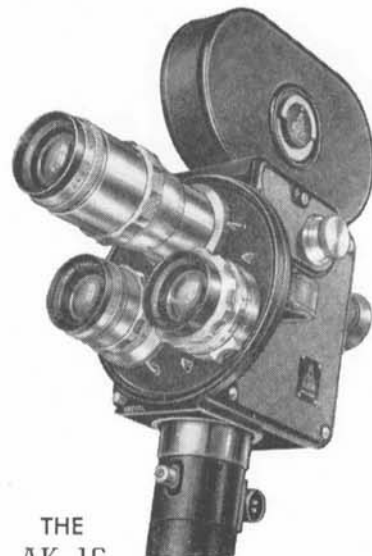
For the First Time, the "YEARS AHEAD" AK 16 and SIEMENS "2000"

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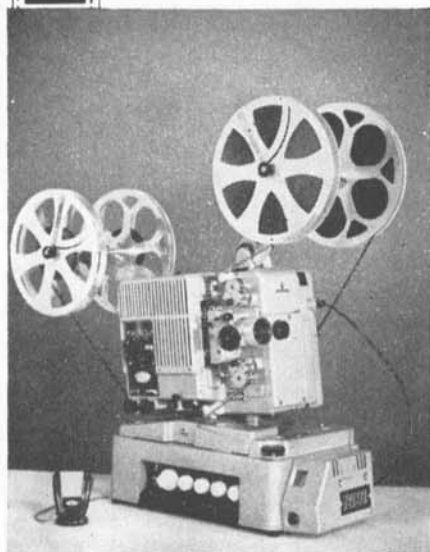
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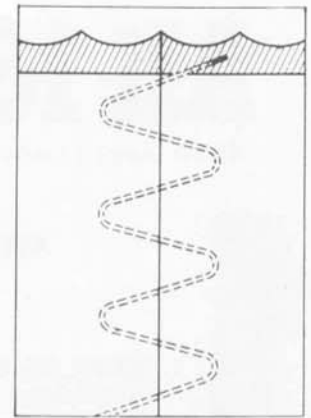
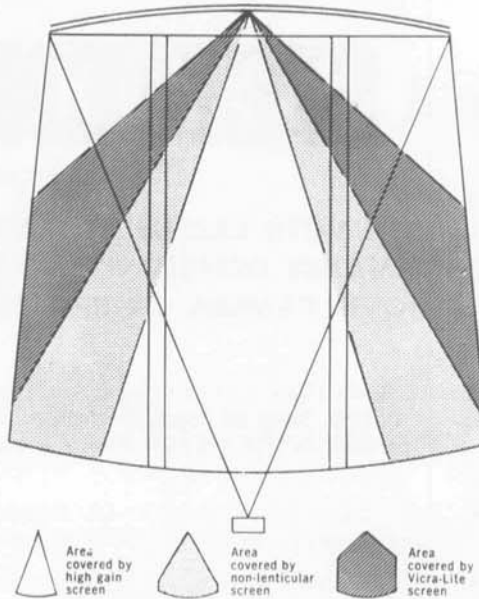
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closure. Facilities are provided for either loudspeaker or headset monitoring. This is reported to be the first in a series of such devices. This unit is priced at \$300.

An orbital magnetic head mount is now produced by E. W. D'Arcy & Assoc., Box 1103, Odgen Dunes, Gary, Ind., for the conversion of cameras and projectors to magnetic sound. The mount was described at the Spring Convention of the SMPTE. It is reported to make possible all of the critical alignment adjustments without affecting magnetic head film contact.

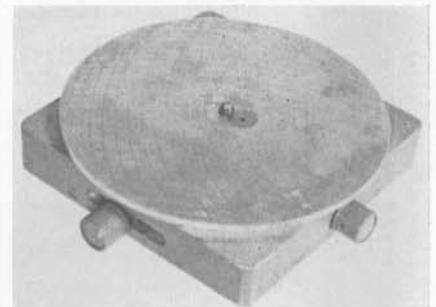
Typical seating plan showing comparison of optimum light distribution of non-lenticular, high-gain and Vicra-lite screens



SEAM

The Vicra-Lite Screen has been announced by L. E. Carpenter & Co., Empire State Bldg., New York 1, N.Y. Designed according to the principles depicted above, this embossed screen is made wholly of vinyl fabric chosen to provide a screen of great strength and durability and one of minimum susceptibility to damage in cleaning and handling. The lenticulated surface is designed for optimum light dis-

tribution and reflection. The seams are accomplished by a patented process called Nichro-Weld which is reported to make seams invisible to any part of the audience.



The X-Y Mount is a product of Photographic Analysis Co., 100 Rock Hill Rd., Clifton, N.J. When placed between tripod and camera the mount enables the photographer to move the camera left or right or backwards or forwards by turning a knob. It is possible to move the camera as little as 0.0078 in. per quarter turn, or it can be moved a full inch from the central starting point. The X-Y Mount will fit all tripods and cameras, but has been especially designed for use with the Eastman Kodak High-Speed camera, and the Wollensack Fastax camera. There are three models for varying camera holes and tripod mount screws.

The Hollywood Camera Company is a new firm specializing in all types of photographic equipment. Sales are both retail and by direct mail. The firm handles U.S. government surplus cameras, film and paper and other photographic items. It is located at 10615 Chandler Blvd., North Hollywood, Calif.

Westrex Corp., New York, recently announced its new line of Standard multi-channel and single-channel sound systems for motion-picture theaters. The Standard line uses the same R10 stereophonic magnetic reproducer and R6 photographic

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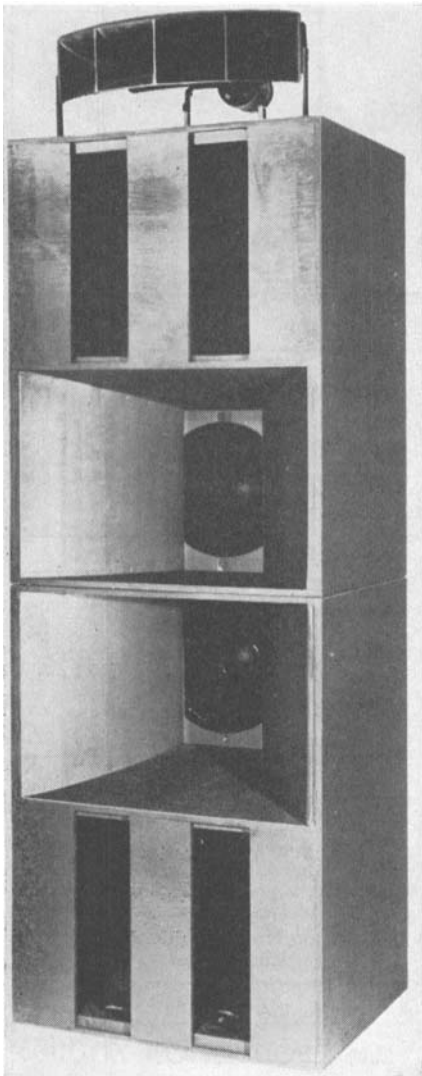
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reproducer as the Westrex line of sound systems described in the *March Journal* (p. 190). The preamplifier cabinet (51B) and control cabinet (52A) for multichannel systems are also the same in both lines. Where the Westrex line amplifier cabinets housed up to four 27-type 60-w power amplifiers, however, the Standard line uses a similar number of 26-type 30-w amplifiers. In the single-channel systems the same control cabinet (48A) is used, but the transmission cabinet in the Standard line is type 47 (instead of 49 as in the Westrex line). This type 47 cabinet is 20 in. high and may be wall or table mounted. The booth monitoring loudspeaker is located inside it and is large enough to permit operation at a relatively low level to be audible in the booth. The Westrex 26-type 30-w amplifier is mounted in the base of this cabinet and is easily removable. Space is provided for an additional 26-type amplifier.

The Standard line uses a type 15 loudspeaker assembly (shown above) featuring the Westrex 713B high-frequency unit and the type 803A low-frequency speaker. The 713B can handle the full output of the Standard multichannel and single-channel systems in the frequency range of 800 to 10,000 cycles and is used with either a 50° or 80° multicellular horn. It has a duralumin diaphragm in an oversized permanent magnet.

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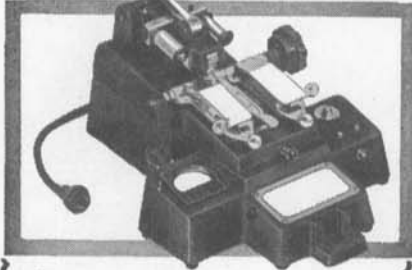


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