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the technical journal of the broadcast-communications industry

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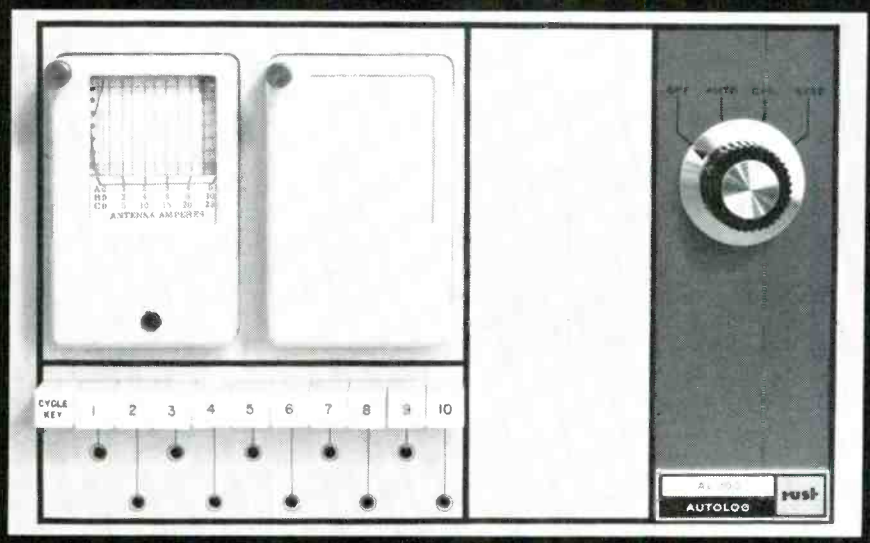

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Volume 6, No. 10 **October, 1964**

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BROADCAST ENGINEERING is published monthly by Technical Publications, Inc., an affiliate of Howard W. Sams & Company, Inc. Editorial, Circulation, and Advertising headquarters: 4300 West 62nd Street, Indianapolis 6, Ind.

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WOULD YOU INVEST $665 TO DOUBLE YOUR EFFECTIVE PROGRAM POWER?

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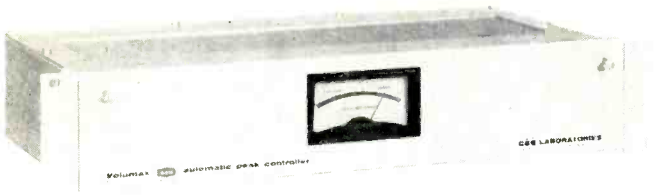
Expanded effective range, more reliable reception in fringe areas – both can add to your station's audience and both can be achieved by simply replacing your present peak limiter with a solid-state VOLUMAX.



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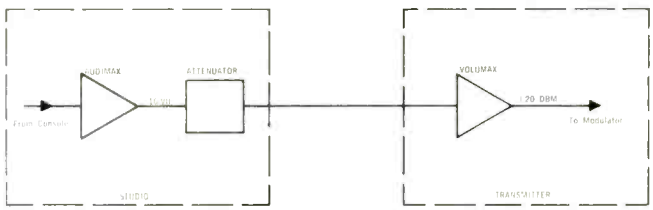

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LETTERS to the editor

DEAR EDITOR:

I would like to comment on Larry Gardner's letter (July Letters to the Editor) in reference to my May article, "Use of Audio Level Devices." Mr. Gardner is right as far as his suggestions with regard to the use of "Symmetra-Peak" are concerned, where such an audio configuration is possible. However, since we also have an audio console at the transmitter, which is used during nighttime hours, placing the "Symmetra-Peak" before the compressor would limit the device to use with daytime programming.

We find that operating our compressor with the suggested 15-db center-range compression allows us a substantial margin for handling whatever unbalance there is in the signal. Furthermore, we find that the "Symmetra-Peak" will operate satisfactorily at the lower levels present at the end of our equalized program line, even though these levels fall below the minimum suggested by the manufacturer.

Perhaps I should have included the transmitter audio console in the block diagram printed with my article and explained, at that time, the reason for our placement of the unit in question.

BRUCE L. MACKEY

Technical Supervisor,
WKRT Radio,
Cortland, N.Y.

DEAR EDITOR:

You really must have been short of material for your July issue; otherwise, I am sure you would have thought twice before printing the article entitled, "Standby Production Console."

Most of your articles, such as those by Bob Jones, are well written and informative to many engineers. However, those describing engineering methods and equipment use, that any engineer worth his "salt" is familiar with, we can do without.

RALPH E. EVANS

Vice President of Engineering,
WOKY, Milwaukee, Wisc.

While most vice presidents of engineering, directors of engineering, technical operations directors, technical supervisors, and others of equally high office may be quite familiar with engineering methods and equipment usage, there are board men and beginning technical personnel who are not. To a great extent, it is for these inexperienced people that the occasional basic articles are published in B-E—many of them aspire to gain the knowledge and experience possessed by advanced engineers. In time, today's novices could be tomorrow's chiefs and may then concentrate on the more theoretical subjects in the magazine. However, we hope they will never lose sight of the "nuts and bolts" practical side of station engineering.—Ed.

DEAR EDITOR:

I've read in the news about stations with towers down setting up "clothesline arrays" and other emergency-type antennas. How about an article on this kind of operation; we're curious as to how it's done and how it's tested.

I've always read B-E from cover to cover but never have seen an article on these emergency antennas.

DEAN LOUDY

Technical Director, WNNT,
Warsaw, Va.

An article on emergency antenna systems and procedures is scheduled for a future "Special Antenna Section." Meanwhile we would welcome any comments on the subject and would be interested in hearing of readers' experiences with antenna emergencies.—Ed.

DEAR EDITOR:

In my article, "Telephone Line Impedance Matching" (August, 1964), I noticed a printing error in column three of page 30. The formula for characteristic impedance of a line should read either:

$$Zc^2 = ZoZs$$

or,

$$Zc = \sqrt{ZoZs}$$

Would you please publish this correction in an upcoming issue? It might save someone the trouble of trying to figure out some rather weird results when first using this system.

Having completed construction of KSNO Radio, in Aspen, Colorado, the last in a long series of construction jobs, I have returned home for what I hope will be a year-long rest. Should anyone wish to write to me about the many facets of lower-cost line utilization, I'll be glad to receive their letters.

JOHN P. TUCKER

Clifton, Colo.

Thanks for pointing out the missing exponent, John; interest such as yours helps us maintain accuracy.

Readers who would like to comment further on lines and economical application should write directly to B-E; we'll forward the letters and publish the most interesting, with Mr. Tucker's notes, in this column.—Ed.

CORRECTING OUR GEOGRAPHY

Editor's Note: In our April issue, station CKAC was incorrectly listed as being located in Toronto. Both Len Spencer and the station reside in Montreal.

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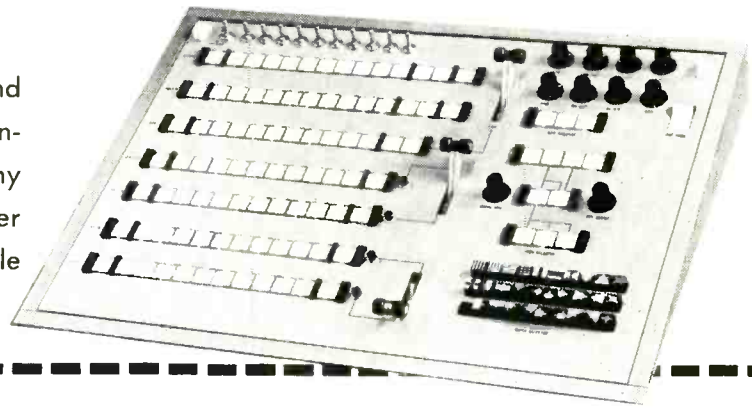

CDL Switchers can be supplied for mixing, fading, dissolving and wipes . . . *between composite and non-composite signals.* This is significant, since there is no need now to distinguish between composite and non-composite signals when setting up program feeds, and all signals become generally interchangeable in the station. A solid state Switcher Processing Amplifier, in the output of the program bus, sets proper levels for sync, set-up, white clip, and gain. For convenience, controls for these levels can be installed on the control panel. Facilities can be provided to fade any signal on the direct take bus to black, either manually or automatically, and fade up to the next signal.

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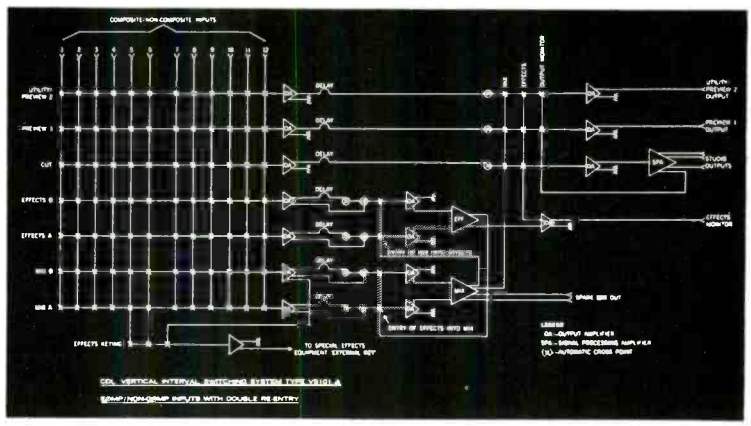

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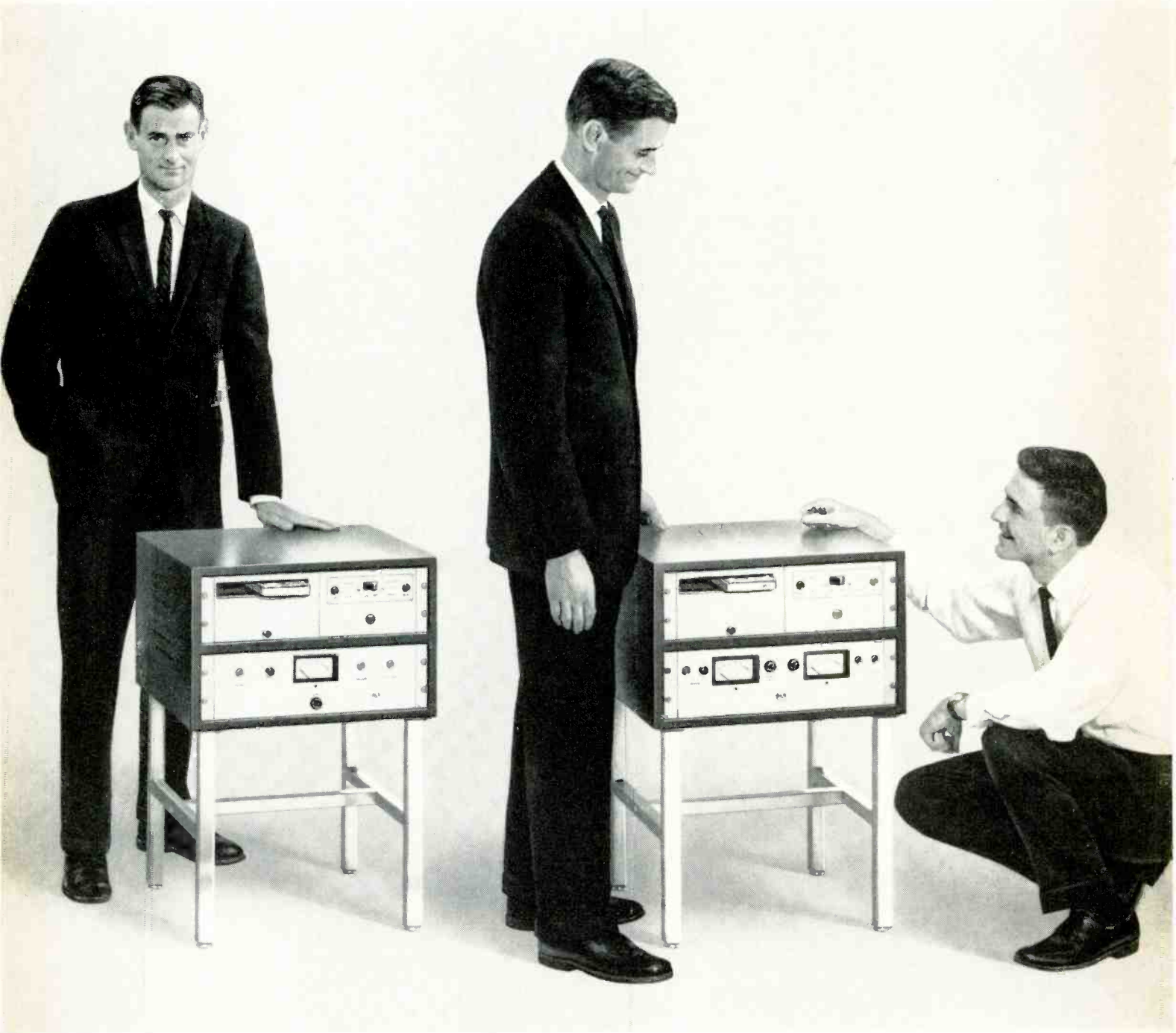

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Stereo Cartridge Tape System . . . RT-37

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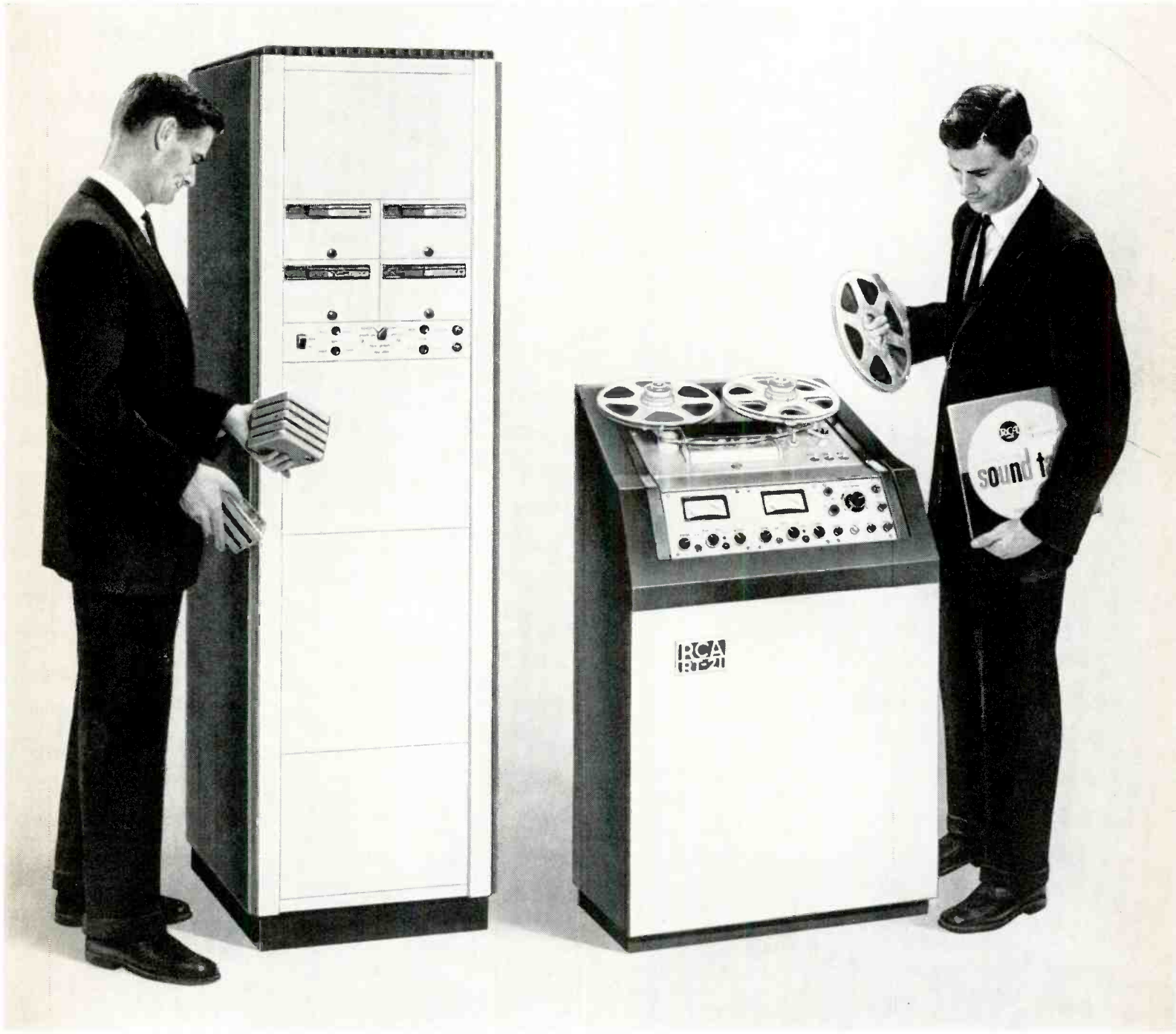

Multiple Cartridge Playback System . . . RT-8

For handling quantities of tapes. Can be operated manually, sequentially, or by pulses supplied from an automation system. Each unit houses four plug-in cartridge decks which can be stacked in systems of 8-12-16 or more units. A random trip cue feature is optional.

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Quality to meet the most critical requirements. Also simplified operating features. Variable speed control for quick cueing of tapes, an optional fourth head for special playback use, rugged construction for smooth reeling and braking. Console, portable, or rack mounting—stereo or monaural.

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AN INTRODUCTION TO TV CAMERA TECHNIQUES

by *Elmer Friman,* Staff Engineer, WFBM-TV, Indianapolis, Ind., and ***Allen B. Smith.*** — An examination of the creative use of television cameras through increased understanding of basic optical and mechanical functions of the instrument.

In the technical sense, a television camera is only one part of the complex electronic system used to generate and transmit video signals. It is no more—nor less—important than another system component in assuring development of a technically-correct transmission. As an instrument used to create images and action through selective vision and movement, however, it achieves a far greater stature; and this aspect of the camera is often overlooked by the cameraman.

While responsibility for the artistic excellence of a program is primarily in the hands of the director, he is helpless to exercise his ideas without a responsive and knowledgeable man at the camera.

The Camera's Selective Vision

No small amount of imagination is required for the cameraman to get the most from his camera, but the exercise of that freedom depends on a thorough understanding of the instrument. Much can be learned if we begin by examining a hypothetical camera mounted on a fixed platform, unable to move from its assigned position. Assume that the imaginary camera has a complement of six lenses varying in focal length from a 35 mm wide-angle lens to a 210 mm narrow-angle, or telephoto, lens. These lenses cover the viewing angles listed in Table 1. Therefore, simply through the interchange of lenses, the camera becomes selective in what it sees.

Table 1. Angle of View For Various Lenses.

Focal Length	Angle of View
35 mm	51 degrees
50 mm	34 degrees
75 mm	22 degrees
90 mm	19 degrees
135 mm	13 degrees
210 mm	8 degrees

Using the 35 mm wide-angle (51°) lens, for example, the camera might—from a distance of about 12′—view a standing group of eight or ten people (Fig. 1). With the 90 mm semitelephoto (19°) lens, it could examine two members of the group engaged in conversation and exclude the others from its view (Fig. 2). Using the 210 mm telephoto (8°) lens, it might examine the face of one group member as he lights a cigarette (Fig. 3). Without moving the camera, by simply changing lenses, the cameraman can exercise one facet of the camera's selective vision, the angle of acceptance, or how much it sees of a given scene from a fixed point. Table 2 lists commonly-used abbreviations for camera direction using a normal complement of lenses.

By using a lens of variable focal length (the zoom lens) the variety of usable acceptance angles is increased many times. A typical zoom lens may have a focal length that is continuously variable from 25 mm (very wide angle) to 250 mm (very narrow angle). The primary advantage of the zoom lens is that the acceptance angle may be altered through its entire range while the camera is live, a technique which imparts an illusion of motion to an otherwise static scene.

In addition to how much of a scene the camera sees, we are also interested in other characteristics of its vision that determine the relative importance of the elements included in the scene. These characteristics (focus, depth of field, and perspective) are intricately involved in optional theory beyond the intent of this article, but it is possible to make some useful observations about them within the context of television applications.

Focus

It is generally accepted that to be viewable a television picture must be in sharp focus. In fact, however, the entire picture is seldom sharp except in wide-angle shots (the reason for which will be seen later). What is important is that if the center of interest is in sharp focus, no one cares (or even notices, as a rule) that other parts of the scene may be soft or out of focus. The reason for that is that the eye remains fixed upon the center of interest (generally a person who is speaking or a central object) and disregards the rest.

An interesting use can be made of this situation, to shift the visual

Fig. 1. 35 mm lens covers entire group.

Fig. 2. 90 mm lens selects two persons.

Fig. 3. 210 mm lens examines a detail.

center of interest. For example, consider a camera which sees two people, one of whom stands nearer than the other, and focuses upon the person in the foreground as he speaks. If the point of critical focus is then shifted to the background figure, the visual center of interest immediately shifts to him. This selective-focus technique is often used in commercials to feature a product in the foreground before shifting to the announcer in the background; thus, the product goes soft as the camera moves into a closeup of the announcer.

Depth of Field

Depth of field is a term that confuses many cameramen and (in general terms) refers to the area within which objects seen by a given lens will appear to be sharply focused. The sharply-rendered area is greatest when the lens is focused just short of infinity (the hyperfocal distance) and decreases as the camera-to-subject distance decreases (see Fig. 4). Depth of field at a fixed distance depends primarily upon two factors: the focal length of the lens and the aperture of the diaphragm. Without examining the theory involved, cameramen can use this rule of thumb: The greater the focal length of a lens, the shallower is its depth of field; and the smaller the aperture, the greater is the depth of field. Scales engraved on each lens barrel indicate the approximate depth for each focusing distance, and detailed tables of computer-calculated depth-of-field figures for lenses of most focal lengths are available for precise determinations.

Perspective

Still another facet of the camera's selective ability exists in determining the relative size and position of varous picture elements through lens choice and camera height. In Fig. 5A, for example, the use of a wide-angle lens allows the subject to dominate the set, while the same subject—without changing his position—appears (in Fig. 5B) to be a part of the set when viewed by a narrow-angle (long focal length) lens at a decreased distance.

Table 2. TV Camera Shot Abbreviations.

LS	Long shot (cover)
MS	Medium shot
CU	Close up
ECU	Extreme close up
One S	One shot
Two S	Two shot

While camera elevation is only moderately variable (even when using a mobile pedestal mount or crane dolly), higher or lower camera angles used with lenses of varied focal length can produce highly interesting effects.

Positioning the Camera

All description of the camera's power of selectivity so far has excluded any camera movement. Little imagination is required to see that the combination of a camera's visual variety and well-directed movement can add pace and interest to any production. Table 3 lists ten camera make-ready and motion cues.

Pan-tilt Heads

Primary camera movement is achieved at the pan-tilt head through which the TV camera is mounted to its traveling support. The head allows the camera to be moved (usually by a handle of arm's length) in either of two axes.

Most camera heads are spring loaded and can be adjusted for a comfortable operating tension. Generally speaking, the least amount of restriction in camera movement, the better and smoother the movement will be. The first step toward smooth panning or tilting action is to assure correct placement of the camera on the tripod head. If heavy equipment (zoom lenses or prompter units, for example) is mounted on the front of the camera, placement should be made with this in mind. When the camera is secured to the head by means of a head bolt, the camera's mounting plate should have several holes to assure proper balance. This will give more usable latitude for the built-in balance control on the camera head. In some cases, counterweights must be attached to the head handle.

Once the camera is mounted, the cameraman may adjust the horizontal and vertical friction locks. It is best to adjust them with just enough drag to hold in any position without pressure from the cameraman. As a final test, a light touch on the handle should easily move the camera horizontally or vertically.

Traveling Supports

The two basic traveling supports are the standard studio tripod and the more complex mobile pedestal assembly, which has an elevating column. Each has its own advantages, and both are excellent production aids in the hands of skilled cameramen.

The tripod is usually a collapsible type that, when necessary, can be folded and moved for remote coverage. Its base can be a mobile dolly with castered rubber wheels or a fixed platform that firmly anchors the three spike-tipped legs. The tripod provides a substantial (and very mobile) camera platform for use wherever the production schedule calls for rapid repositioning of the camera. The ability to move a tripod-mounted camera quickly and precisely under direction is one of a good cameraman's outstanding assets. One of two methods of camera movement is

• Please turn to page 58

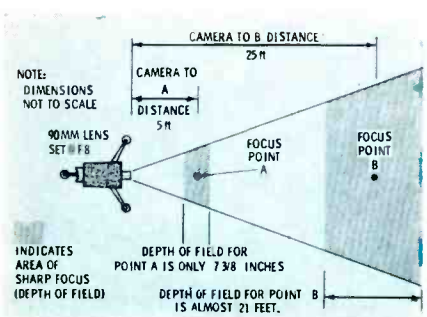

Fig. 4. Depth of field varies greatly.

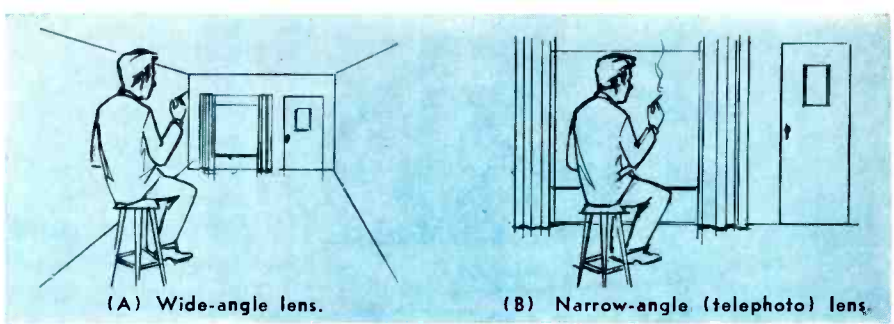

Fig. 5. The relative sizes of both subject and set vary with lenses of different lengths.

AN AUTOMATIC PROGRAM LOGGER

by *Edward Tong*, Consulting Author, Assistant Chief Engineer, WDSU-TV, New Orleans, La. — A complete program logging system utilizing 1/4" tape which provides quarter-hour I.D.'s, continuous monitoring, and a failure-sense alarm.

Many radio stations have, for several years, operated successfully with automatic programming. However, while the advantages to be gained by using a system of automatic program logging were evident, these systems were not available until recently. Written logs can only briefly note what was put on the air, but an automatically-recorded log remembers every spoken word and every note of music that was broadcast. This record fulfills the FCC requirements for a program log and is useful to verify commercial performance, while at the same time acting as a quality-control check for the station's on-the-air signal.

Logging Systems

The FCC amended the rules governing logging requirements for broadcast stations on October 3, 1962, and in a public notice about one month later clarified the fact that they did not endorse any specific system of automatic logging equipment by stating as follows: "The Commission's rules were simply amended to provide that the program-log function of broadcast licenses may be performed in whole or in part through the use of automation. The extent, if any, to which this is done is completely within the discretion of each licensee and it is the licensee who remains responsible for accurately supplying the Commission with any information required by the Rules."

Fig. 1. Automatic program logging system.

Several systems of slow-speed reference recording were available to stations at that time. One method embosses a plastic disc at a very low speed. Another method employs two rotating magnetic heads recording in a transverse mode on 2"-wide magnetic tape. Recently, new equipment was introduced on the market which uses standard ¼" audio tape and operates at a speed of about ⅓" per second.

To obtain a combination of the features our staff deemed desirable, we have assembled a system composed of commercially-available equipment and station-designed circuits which efficiently performs the functions of automatic program logging (Fig. 1). Its features include: simultaneous playback of the tape during recording; a failure sensing alarm circuit; automatic insertion of timing information; a duplicate recording unit for backup recording, for convenience in transcribing during the time the other unit is in use for logging, and for ease of system maintenance.

The Norelco Model 301 tape recorder was selected because it provides a speed of 15/16" per second; however, other machines could be used. In addition, the machine is completely transistorized and has a feature we consider important for this type of equipment — the mechanical parts can be completely exposed by removing the top trim plate. Thus, troubleshooting, always a physical problem, is greatly simplified.

When recording a quarter track at 15/16 ips, 2400' of ½-mil tape will record for a period of 8 hours and 16 minutes per track. We feel that the audio performance of the recording system at this speed is in excess of the requirements for program logging and have even experimented with slowing the tape travel to 15/32 ips by modifying the stepped motor pulley (Fig. 2).

Equipment Description

A block diagram of the complete WDSU logging system is shown in Fig. 3. The program audio source (which could be the audio output of a modulation monitor or off-air program monitor) is bridged with a transformer that delivers a –10 dbm signal to the logger. This signal is fed through attenuator networks to match the 500-ohm microphone inputs of the recorders. Input-selector switches are provided for each recorder, so that microphones may be used to record a voice identification at the beginning of each track.

Notice the separate playback channel that provides off-the-tape monitoring as well as a signal for equipment-failure sensing and activation of the alarm. The alarm-amplifier circuit (Fig. 4), adapted from commercial automatic programming equipment, was modified to include a simple audio output

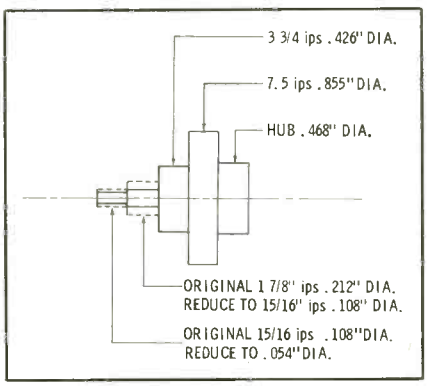

Fig. 2. Diagram of motor-speed pulley.

stage to drive a small monitor speaker mounted in the control box.

The design of the tape transport mechanism dictates installation of the extra playback head between the capstan and takeup reel. The resulting wow and flutter percentage is somewhat higher than that encountered when the tape is played back through the main record/playback head but is sufficiently low for our purpose. It may be necessary, however, to adjust the takeup-reel clutch and idler-wheel mechanism initially, as we did on one of our machines, to minimize these speed fluctuations; we found that once set this adjustment is quite stable. Fig. 5 shows a bottom view of the top trim plate on which we have mounted the playback head and switch. It is necessary to install the head-mounting assembly on the under surface of the plate to align head and guides to the normal tape path.

Easily identifiable three-second time announcements such as, "Central Standard Time 2:15 PM," are recorded on a cartridge tape for insertion each quarter hour. The cartridge player is activated by a 15-minute interval timer, and stops automatically at the beginning of the next announcement. The shortest contact-closure period obtainable by means of the adjustable cam furnished with the timer we purchased was six seconds. To reduce this time to less than one second, the circuit shown in Fig. 6 was devised. Stations that give time announcements frequently and with reasonable regularity in the normal course of programming could possibly dispense with this logger function.

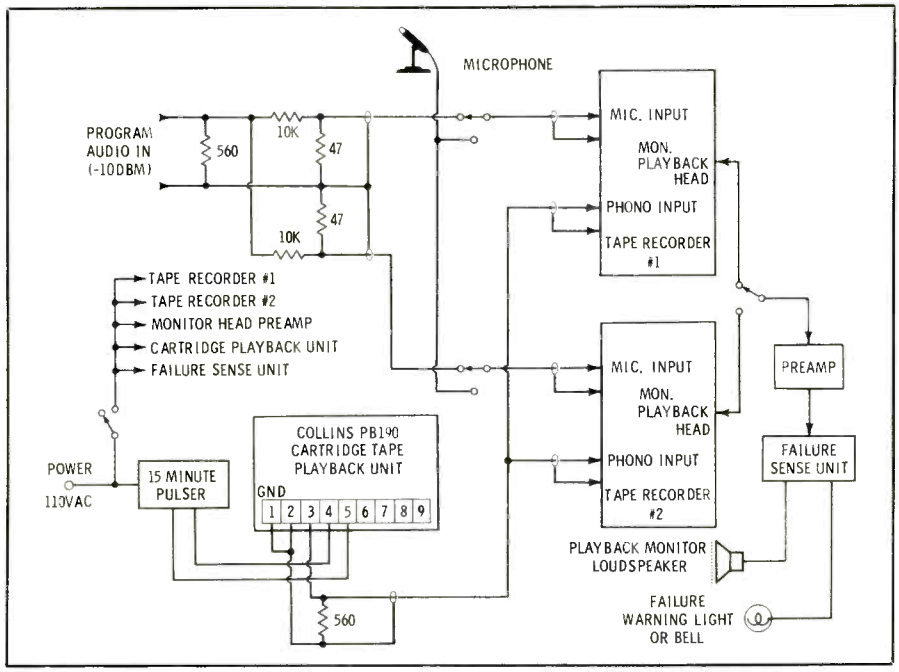

Fig. 3. Block diagram of automatic program logging system showing input switching.

The power to all units except the 15-minute interval timer is controlled by a master switch located on the control-unit panel. The interval timer is never turned off, thereby saving us the trouble of adjusting it each day.

Construction

The recorders are designed for horizontal operation only, precluding rack mounting. We found that the equipment was more accessible, and the overall system far more attractive, when assembled within a cabinet. The top of the enclosure was designed to accept the two tape machines; it is recessed a couple of inches for appearance and security. The control box (which contains the main power switch, power-on indicator, monitor head selector, and input switches) is mounted on a wooden upright fastened to the back of the cabinet.

Caution should be exercised in wiring the interval timer, since it

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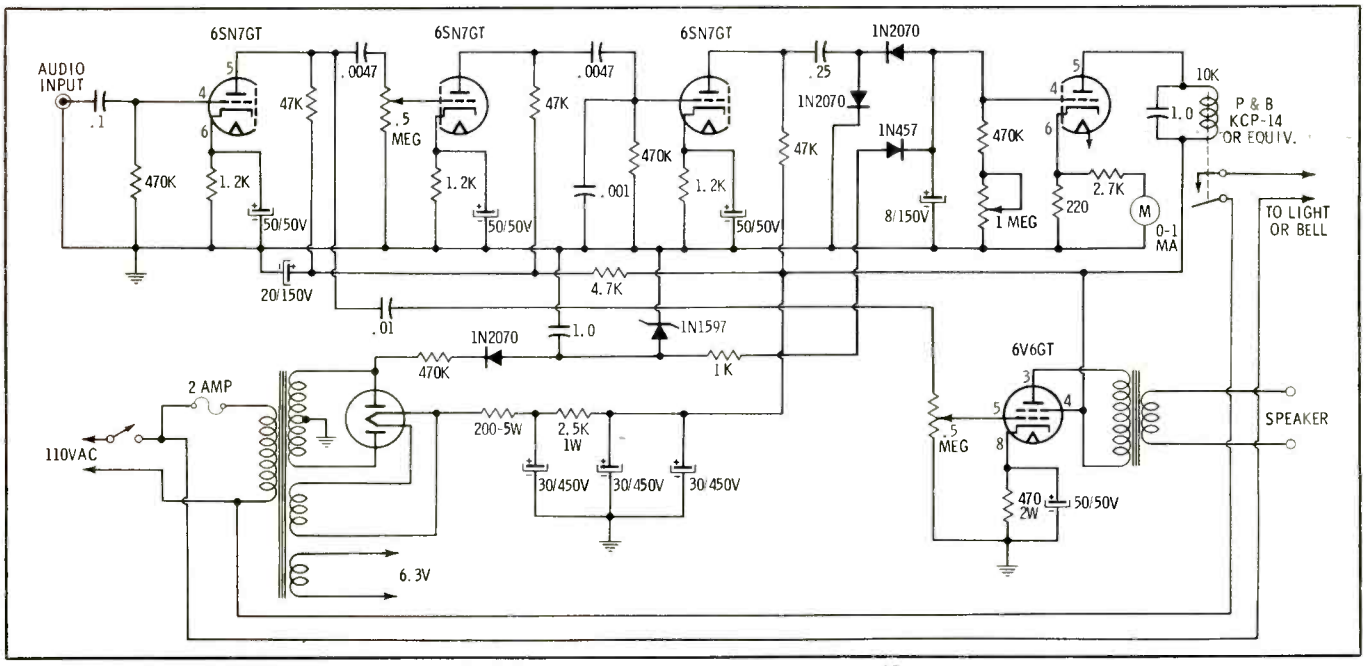

Fig. 4. Circuit of automatic audio-failure sensing alarm and monitor amplifier for program-logging system.

REAR-VIEW PROJECTION ON A LIMITED BUDGET

by *Charles F. Beach,* KTTS-TV, Springfield, Mo. — A no-nonsense approach to an efficient, low-cost system using a 35mm projector.

Fig. 1. High-quality image of low-cost, 35 mm RVP system.

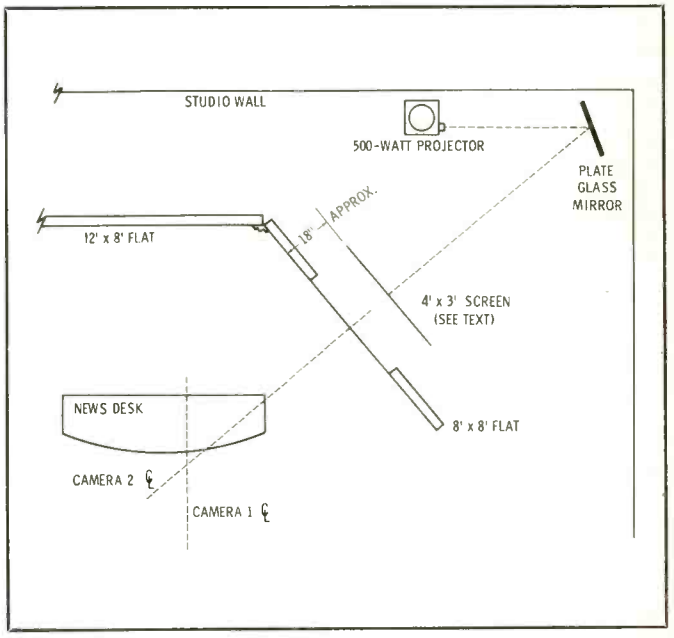

Fig. 2. Floor plan of the studio setup at KTTS-TV for RVP.

Rear-view projection can contribute much to the continuity and impact of news and sports programs; for that matter, to any program in which the combined presentation of a studio set and projected image is required. Unfortunately, large-screen RVP (rear-view projection) systems commonly used in television require a high-wattage projector, which usually entails an expenditure beyond the budget limits of many small stations.

It is quite feasible, however, to assemble a very acceptable small-screen RVP system from components totaling $300 or less. No difficult studio techniques are involved, but the news and program departments must understand and be ready to compensate for the in-

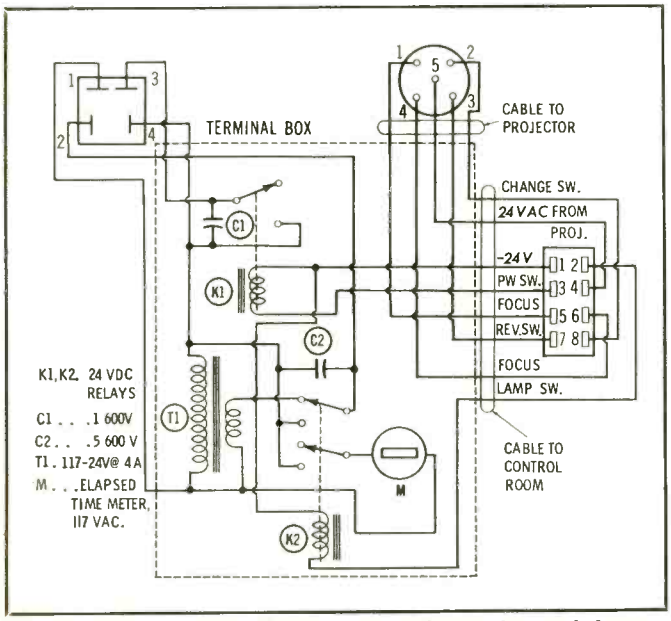

Fig. 3. Remote wiring diagram for projector fan and lamp.

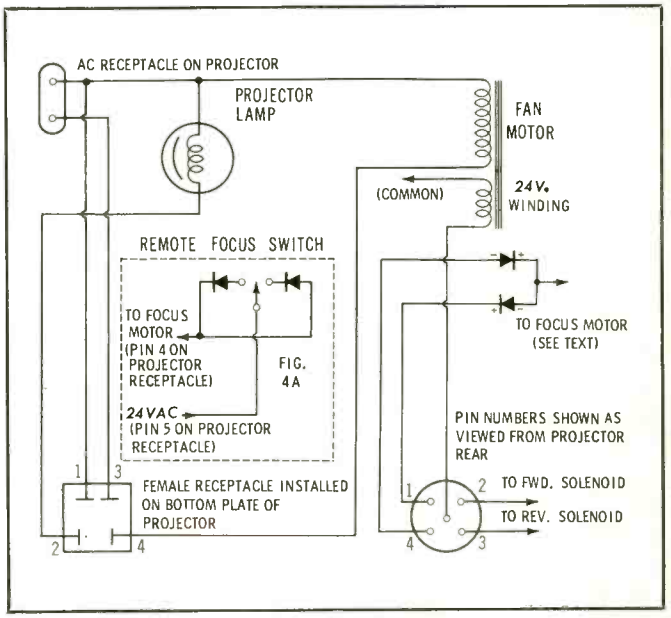

Fig. 4. Connections made to the projector for remote control.

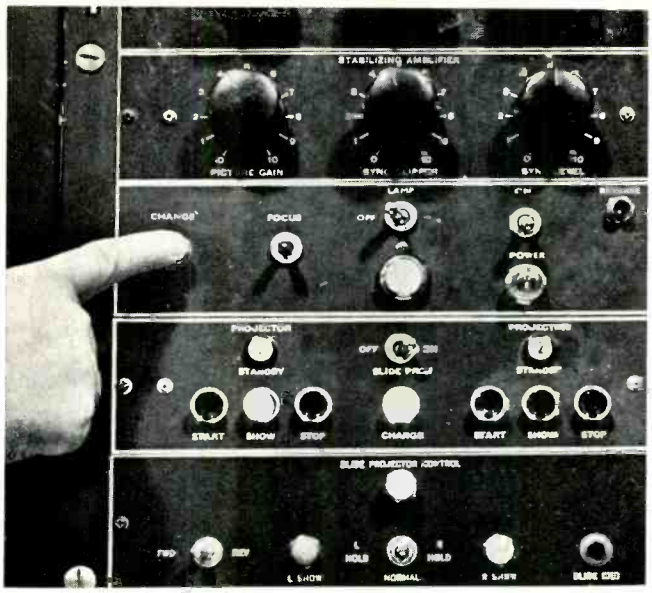

Fig. 5. The studio remote-control panel for the RVP system.

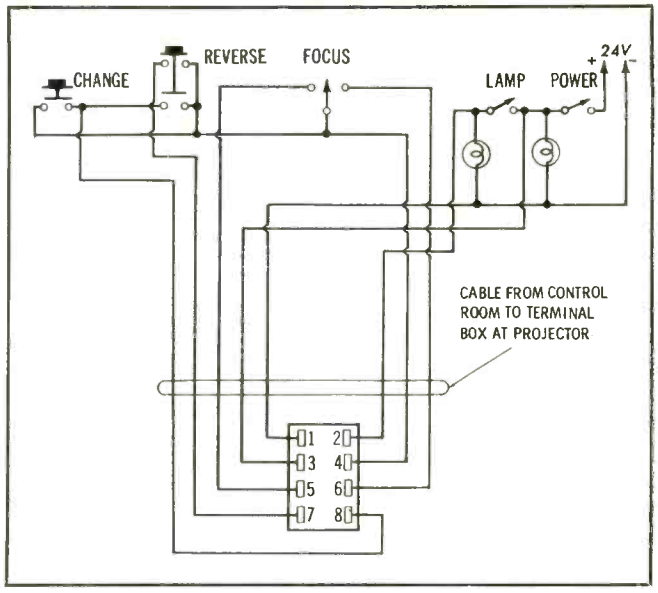

Fig. 6. Schematic diagram for the remote-control panel.

herent deficiencies of lower-wattage projection. While an RVP screen measuring only 3′ × 4′ may appear to offer limited utility, the one shown here (see Fig. 1) has proved to be entirely adequate during its two year tenure.

In the KTTS-TV installation, the screen is permanently mounted as an integral part of an 8′ × 8′ portable flat. The flat is positioned at an angle of 50° relative to the studio wall. An inexpensive ¼″ plate glass mirror permits "folding" the projector-to-screen distance for a more economical use of floor space (Fig. 2). The total projector-to-screen distance is approximately 12′ with a 4″ lens and 9′ with a 3″ lens. The screen material (of flexible translucent plastic) is available from Polacoat Incorporated, Blue Ash, Ohio.

It might be noted here that the standard 3:2 format of the 24 mm × 36 mm slide does not correspond with the 4:3 format of the television camera. It is also important to note that the lens-to-screen distance charts designed for the 24 mm × 36 mm image area will not be accurate for the slides of slightly reduced area commonly used for television projection. The ASA size customarily scanned by vidicon cameras is approximately 21 mm × 28 mm. Because of these variables, no exact projection data are given here. Such figures are easily determined after the projector and the slide format are chosen.

Lighting the RVP set requires more care than skill. In order to keep as much light as possible from the screen, the screen plane should be recessed about 18″ as illustrated in Fig. 2. A dark screen is an absolute necessity if good contrast is to be maintained. Stray light, direct or reflected, will "fog" the image and be detrimental to picture quality.

The Projector

The projector used at KTTS-TV lends itself to this project. It is designed for remote operation and has a reversible lens-focusing motor as well. The circular slide drum has more than ample capacity for most program situations and is noted for

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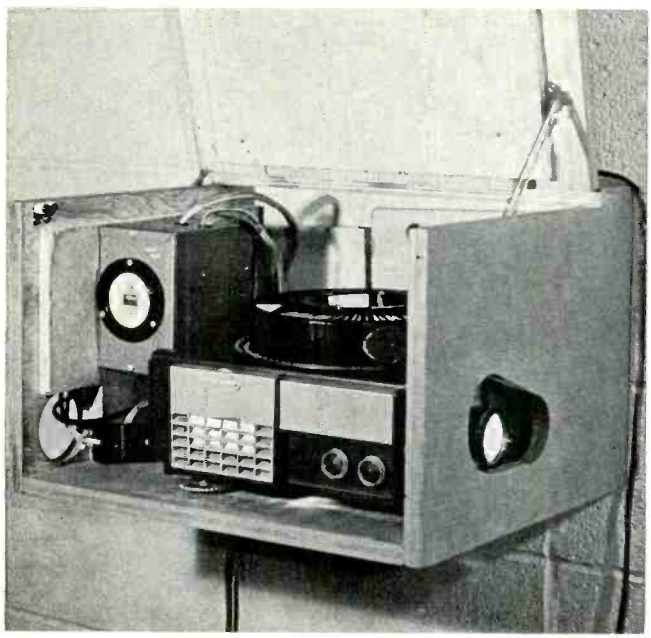

Fig. 7. The Carousel projector, elapsed-time meter, and case.

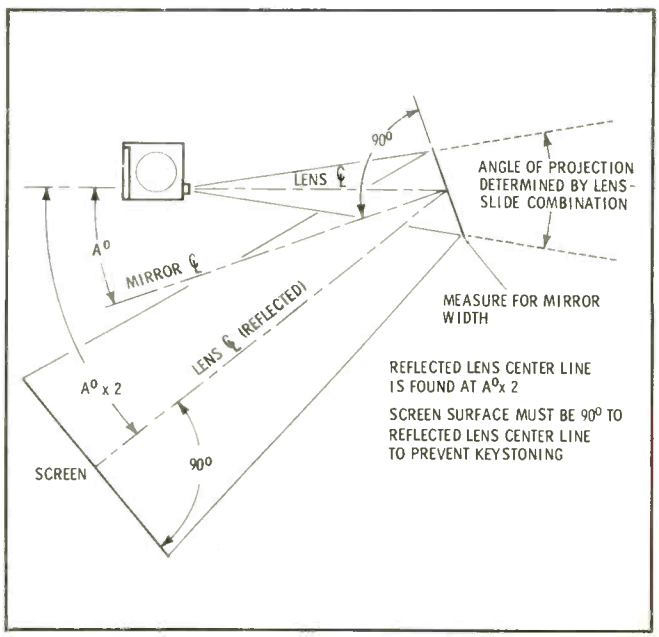

Fig. 8. Determining critical angles and center lines for RVP.

PORTABLE VIDEO TAPE RECORDERS

by Stuart N. Soll—

An examination of presently available portable VTR's with specifications, descriptions, and application notes.

As an outgrowth of the magnetic audio-recording industry, a television tape recording and playback system was first used successfully in a coast-to-coast telecast of a network news program, in November 1956. Quickly proved to be practical, the amazing medium spread rapidly through the broadcast industry, simplifying production and programming techniques at stations wherever its use was adopted.

While television recording was initially designed for, and introduced in, broadcasting, other applications immediately presented themselves. In addition to the use of VTR's in television stations for recording, immediate playback, and editing of programs, educators quickly recognized the vast potentials of educational television aided by video tape. Such uses were soon to be encouraged by the introduction of smaller, less expensive studio machines and more-or-less portable video recorders.

Today many mobile and portable VTR's are found in hospitals, industrial plants, schools, offices, recording companies, military installations, government agencies, TV networks, news services, and independent stations. The use of portable video recorders is constantly increasing in broadcasting, in both commercial and noncommercial applications, and in the various phases of closed-circuit and educational television.

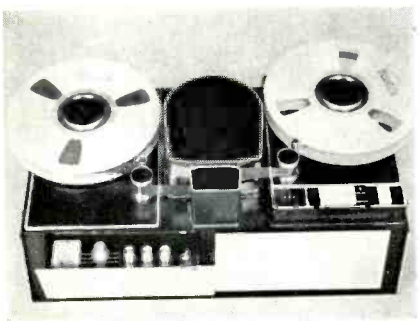

Fig. 1. Typical compact portable VTR.

Equipment

While the majority of video tape recorders considered "portable" are of the helical-scan type, both major VTR manufacturers currently offer fully transistorized transverse recording (or quadraplex) machines in relatively small packages. These compact versions of studio-style units are intended for primary and auxiliary studio use, for mobile installations, and for many other applications which call for smaller and less expensive recorders than are commonly used in commercial studios.

Transverse Recorders

RCA's TR-5 machine is labelled "transportable" and is just that. Capable of producing tapes for playback on any standard studio machine, this unit is a professional recorder designed to operate equally well in the studio or in the field. The TR-5 is housed in a relatively small case equipped with casters, allowing it to be moved easily from studio to van or station wagon; it weighs 275 lbs.

The playback facilities of the TR-5 are limited, being intended for cuing and preview in the field, but the recorder can be used successfully in closed-circuit systems. It has audio-playback preamps and a full-track erase head. An upright version, the TR-4, is a complete record/playback system meeting all broadcast specifications. Using a basic mechanism similar to the TR-5, the machine also has the necessary additional circuitry to provide a standard NAB playback signal. The unit is designed for studio and mobile van installation but does not offer the transportability of the TR-5. Cost of the TR-5 is about 1½ times that of the average helical-scan machine, while the TR-4 is priced considerably higher.

Fig. 2. Airborne VTR for sport events.

Ampex's VR-1100 is a fully transistorized video recorder/reproducer designed for studio and mobile van use. It can serve as the primary machine in smaller stations and as an auxiliary recorder in large studios, networks, and independent production centers. The machine is equipped with all the standard features required for program recordings; in addition, a full line of accessories is available for monitoring, special effects, control, and other purposes.

The VR-1100 is mounted in a 5′ high cabinet supplied with casters for ease in transportation; the entire system weighs 800 lbs. This fully compatible recorder is also supplied with a complete monitor assembly which mounts atop the console, increasing the overall height to 74″. A closed-circuit version, minus the broadcast-processing amplifier, is available at a slightly lower price. Both models use the same basic plug-in modules, tape transport, and simplified operating controls. The VR-1100 and the TR-4 are in the same approximate price range—just under three times the cost of the average helical-scan machine.

Helical-Scan Recorders

Not compatible with standard studio recorders (for that matter, incompatible with each other), the currently available helical-scan machines offer a high degree of portability. They can record and play

back good-quality tapes which usually may be interchanged between machines of the same manufacturer.

These portable recorders are quite popular for mobile and remote applications. Some are available specially mounted in vehicles and completely equipped with mobile power supplies, monitors, and cameras. While the machines vary so widely in configuration and specifications that no direct comparison can be readily made, one common property is their price; all machines fall in the $12,000 to $15,000 range. Some characteristic features of helical-scan recorders are given below:

Using a standard 2″ wide video tape on a NAB hub, the Ampex VR1500 transistorized portable recorder is designed for mobile and ETV applications. Maximum recording time is 256 minutes with 4800′ of tape in a 12½″ reel; tape speed is 3.7 ips.

Mechanical functions of this machine are controlled by a "joy stick" lever switch, located just in front of the record control panel. The electronics are completely transistorized and built on plug-in boards. Skew and tracking controls are provided to adjust the servo system to compensate for tape tension and track position changes that might occur between recording and playback functions, or between machines.

The guaranteed life of the VR-1500 heads is 250 hours. Overall video-frequency response of the recorder is ± 3 db from 10 cps to 3 mc, while audio response is ± 3 db from 90 cps to 9 kc; S/N is 38 db for video, 40 db for audio.

The VR-660 broadcast recorder incorporates the same basic design as the VR-1500, but is equipped with additional circuitry which enables it to produce video tapes that comply with FCC standards for television station use. An example is the tape-tension servo system which automatically and continuously compensates for tape-to-head contact variations; this is done manually in the VR-1500. The VR-660 is priced about 20% higher than the closed-circuit model.

A television adaption of Machtronics' earlier MVR-10 closed-circuit video recorder was introduced last year (See Fig. 1). (Precision Instrument Co. manufactures the PI-3V machine, an improved version of the original MVR-10, for ETV and other educational purposes.) All three machines employ 1″ wide tape on a standard NAB hub; maximum reel size is 10½″, accommodating 3600′ of tape, for 96 minutes of recording time. Tape speed is 7.5 ips, while the two-head drum rotates at 1800 rpm.

Fig. 3. Versatile mobile VTR vehicle.

The recorder is controlled from an illuminated pushbutton panel, and a remote-control panel is also available. Tension arms on the head guides stop all mechanical functions when released as the ends of the tape pass; while running, the arms compensate for variations in tape tension. A servo system maintains interchangeability between tapes made on these machines; additional circuitry in the broadcast model ensures compliance with the FCC regulations for television broadcast use.

Printed-circuit boards, with one for each operational circuit, are mounted plug-in fashion and are accessible from the front of the machine. Frequency response for all three machines is ± 3 db from 10 cps to 3 mc for video and ± 2 db from 60 cps to 10 kc for audio; S/N is 40 db for both modes. Guaranteed head life for this family of recorders is a conservative 250 hours.

The Sony BV-100 portable transistorized television broadcast recorder is larger and heavier than the other machines in this category but is very well constructed and easily handled by two persons. The machine uses 2″ wide tape and will accommodate a 7″ reel; a full 1800′ reel provides 63 minutes of recording time at 5.75 ips.

Completely modular in construction, the machine's transport mechanism can be operated with the covers in place to exclude dust and cut down noise. All functions are controlled from a well-grouped push-button panel, a duplicate of which is available for remote operation.

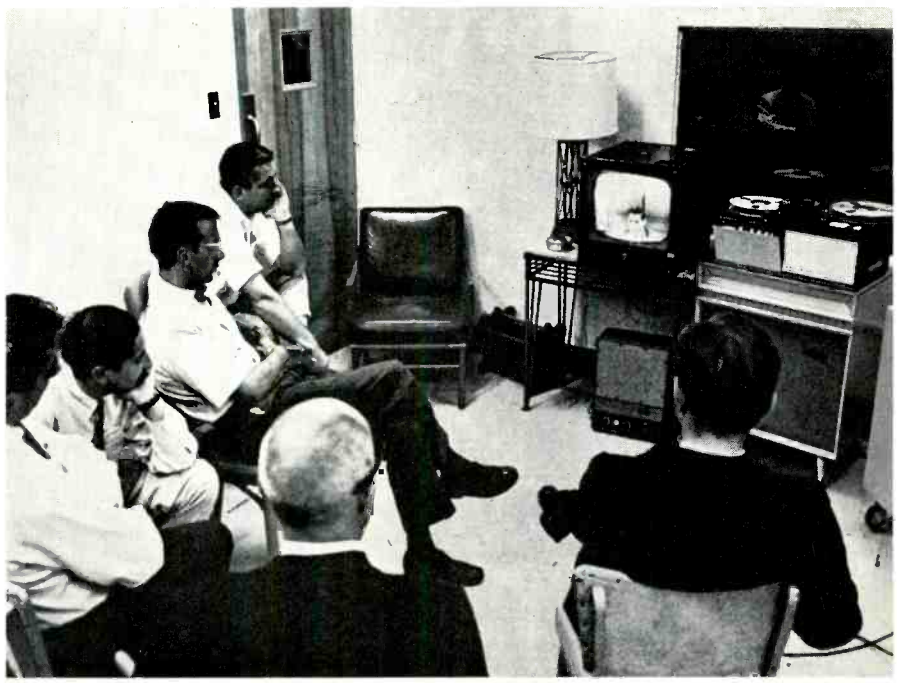

Fig. 4. Stanford selection committee views the video tape from East-Coast applicant.

A separate TV-signal stabilizer consisting of a waveform monitor, processing amplifier, master servo, automatic jitter control, power supply, and motor-power amplifier improves the time-base stability and waveform characteristics to produce a broadcast signal that meets all FCC requirements. The Model PV-100 recorder, supplied without the stabilizer, is available for closed-circuit use.

Guaranteed life of the video head (sync is recorded by a separate head) is 500 hours, although the manufacturer suggests that with normal routine maintenance life can be extended easily to 1000 hours. Video resolution is 330 lines. The audio-frequency response is ± 1 db from 100 cps to 7 kc, down 5 db at 50 cps and at 10 kc; S/N is 44 db for the video signal and 40 db for audio.

Typical Applications

Portable VTR's are found in a wide variety of applications ranging from mobile equipment vans to visual evaluation studies of job applicants. Their high degree of mobility suggests several uses for broadcast news and special-events coverage, for audition of taped commercial spots, and for acquisition of video information for later inclusion in ETV programming.

Mobile Recording

Fig. 2 shows a network installation of a portable VTR in a helicopter. The airborne VTR was used to provide coverage of the Daytona 400-mile stock-car race from Daytona Beach, providing race fans with an interesting aerial view of the action.

The more conventional mobile installation shown in Fig. 3 illustrates another approach to special events coverage. The portable VTR is mounted in a station wagon that has a sliding roof panel through which the camera and its operator may follow the action. The mobile recording center includes a CB communications system, a DC-to-AC inverter, a solid-state preview monitor, and a lavalier microphone for live commentary. The unit shown is an Ampex VR-660.

Educational Uses

The far more attractive price of the portable VTR's and the additional cost reductions possible when a broadcast stabilization unit is not required have brought the medium to the attention of educators across the country.

Perhaps the most unique educational program employing VTR is the Midwest Program on Airborne Television Instruction (MPATI). This system, engineered by the Westinghouse Electric Corp., uses airborne UHF-channel transmitters (fed by aircraft-carried studio VTR's) which broadcast educational programs in an area centered around Montpelier, Ind. The MPATI program is administered by Purdue University, in Lafayette, and covers a six-state (Illinois, Indiana, Kentucky, Michigan, Ohio, and Wisconsin) area.

Most major universities have many console-type VTR's supplemented by portable units, but even smaller schools—including some high schools—use lower-cost portables to prepare educational material for classwork and general administrative information. The Cupertino, Calif. school system, for example, employs a portable Precision Instrument PI-3V VTR to record and play back more than 25 hours of taped and pretaped programming a week.

Other VTR Uses

Dr. James H. Ryan, of Columbia University's Psychiatric Institute, used a VTR to record an interview with a young, married intern applying for a position with Stanford University. The intern outlined his course of study, his special aims, and his personal history, and also answered several questions prepared by Stanford's selection committee. The tape was then shipped to the West Coast where the young doctor's credentials were examined by the committee, using the taped video recording as shown in Fig. 4. The applicant was thus saved the expense of a trip to the coast for a personal interview.

Several manufacturers (Ampex, Motorola, and Sony, among others) have designed airborne entertainment systems for airlines use. These systems use compact VTR's to feed a series of monitors, viewable from each seating position, to provide in-flight motion-picture entertainment. Each passenger seat is equipped with an individual headset. Fig. 5 shows a typical installation.

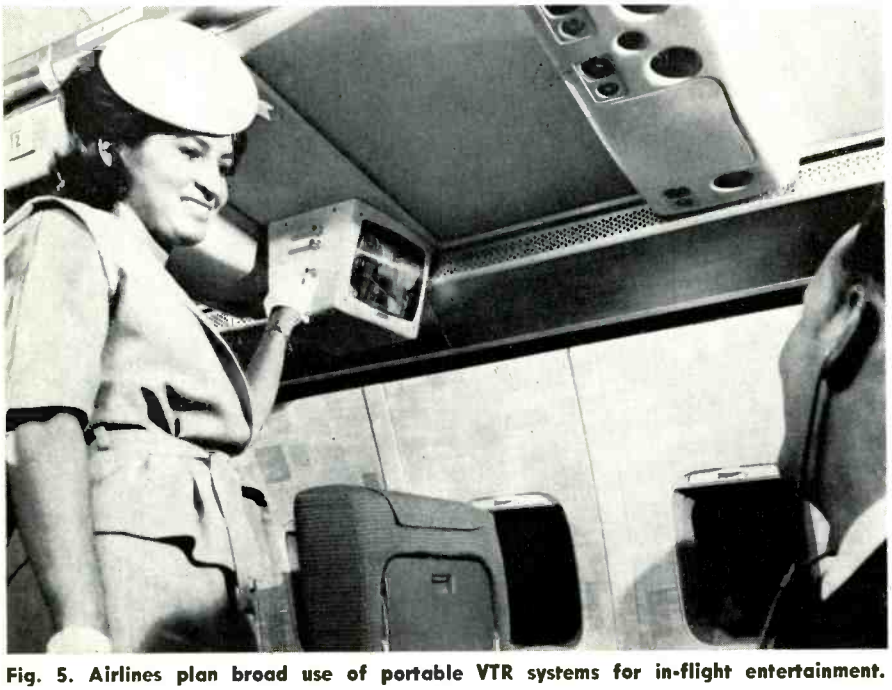

Fig. 5. Airlines plan broad use of portable VTR systems for in-flight entertainment.

Wide Application Ahead

Increased reductions in the size of VTR's and other improvements promise many uses from industrial surveillance to home entertainment, and from personal instruction to news coverage using hand-carried VTR's in much the same manner as today's newsmen use film-type cameras. Whatever does lie ahead for portable VTR's, you can bet we have just barely scratched the surface. ▲

We'd like to show you a picture of ATC's modular "building block" concept in Automatic Broadcasting systems. But we just can't do it. No two systems ever look the same. Each system is designed to the specific programming desires of management. This is why ATC systems are creating so much interest in the industry. Our building block concept tailors the system exactly to your needs.

We'd like to tell you just what you need in the way of an Automatic Broadcasting system. But we need your help. We need to know what it is you want to broadcast automatically. How long and why. To help you in this, ATC offers free a 35 page booklet entitled, "Planning for Automated Broadcasting." It helps you consider all aspects of Automatic Broadcasting without investing a penny. (There's a copy waiting for you now.)

We'd like to tell you just how much an Automatic Broadcasting system will cost. But we need to know exactly how you want your station to sound. ATC systems are priced on the basis of how many components are needed to do a specific job. You get no more than you need and certainly no less. Also, we need to know what equipment you now have which might be useable in the system. We work with you to get the price down, not up.

We'd like to tell you that switching over to Automatic Broadcasting is easy. But we can't unless the proper planning and preparation for Automatic Broadcasting is done beforehand. We *can* tell you, though, that the reward is well worth the effort. Your reward is better use of professional personnel. Your station is more dynamically effective seven days a week and night time, too. You enjoy complete error control over your program content. And, among other things, you maintain absolute control over your music policy.

We'd like to hear from you. Call or write us and tell us your thinking. Then we can show you the picture of what your Automatic Broadcasting system will look like. And cost.

AUTOMATIC ATC TAPE CONTROL
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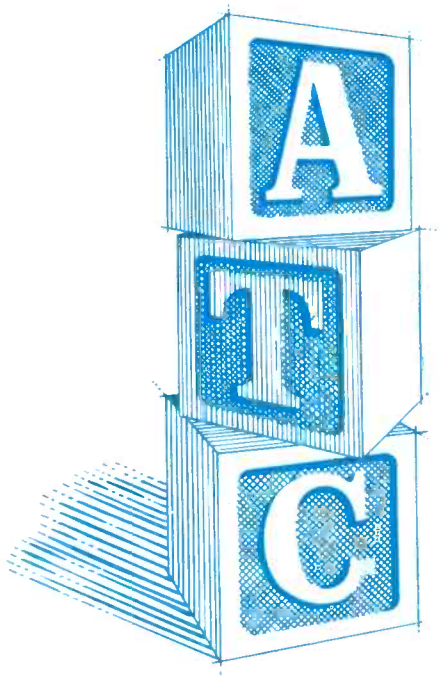

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Conference Notes

96th SMPTE TECHNICAL CONFERENCE
New York, September 27—October 2, 1964

The directors and program chairmen who put together the 96th SMPTE Technical Conference (held September 27 through October 2, 1964, in New York City) once again demonstrated the increasingly important position held by the Society within the broadcasting industry. While papers presented at the Conference ranged from instrumentation and high-speed photographic techniques to a description of the new CBS technical facilities, many topics of direct interest to television broadcasters were thoroughly covered.

The Tuesday program included two comprehensive sessions on 8 mm and 16 mm films and film techniques. Of particular interest to many TV news and studio cameramen, for instance, was the discussion of synchronous-sound systems using the increasingly popular portable ¼" tape machines. There were additional talks on films, developing, editing, splicing, special effects, and release-printing methods. Technically oriented topics included a discussion of a fiber-optic printer that greatly reduces negative defects compared to standard specular light printers, applications of 8 mm film for audio-visual systems, and an examination of a useful lens-aperture definition—the G number.

Wednesday morning was devoted to papers and demonstrations on equipment, allowing manufacturers to show new developments under actual operating conditions. Equipment included sound-recording units, new motion-picture cameras, tape-film systems, quartz lighting devices, and 35 mm still and instrumentation cameras.

Thursday was a real bonus day for television engineering and production people, with papers on the following topics being presented: Television Mobile-Unit Design; TV Facilities for the Political Conventions; Electronic Magnification for 3" Image Orthicons; Lighting for Television, a film; An Introduction to Separate-Luminance Color-Camera Systems; Video Tape Cutting and Splicing Techniques; Animation on TV Tape; An Operational Analysis of Electronic Editing Techniques; and a description and tour of the new CBS technical facilities.

Friday afternoon saw additional topics covered for those interested in another phase of TV—educational programming and films. These papers found interested acceptance: International Developments in 8 mm Film in Education; A case study in the Use of Film in Medical Education; Eight Years of Instructional TV in Washington County, Maryland Schools; The CBS Philosophy of Educational Television; and The Technological Revolution in Education.

We have covered only the items of particular interest to broadcasters, but there was much more of general interest to be seen at the conference.

Abstracts of the titles listed (and a complete listing of papers presented) are available from the SMPTE at a nominal charge.

20th NATIONAL ELECTRONICS CONFERENCE
Chicago, October 19-20-21, 1964

Practically speaking, there won't be much of specific interest to broadcasters presented at the 20th Annual National Electronics Conference, October 19, 20, and 21. And yet, to fail to remind our readers of the tremendous breadth and scope of this conference would be unthinkable. Seldom is there as good an opportunity to investigate many diverse topics related to the field of electronics—and they're all under one roof.

Just to illustrate the range of subject matter, there are three all-day refresher seminars on the following subjects: Topics in Modern Antenna Theory; Engineering Applications of Linear and Nonlinear Programming; and Electronic Thin-Film Technology. In addition, there are several industrially oriented seminars on these topics: Semiconductor Devices and Applications; Solid State Devices; Power Semiconductors; Applications of Unipolar Field-Effect Transistors; and an ERA/ESMA seminar—Marketing Sense Makes Dollars. Twelve panelists, representing a wide variety of backgrounds, will participate in two special panel discussions.

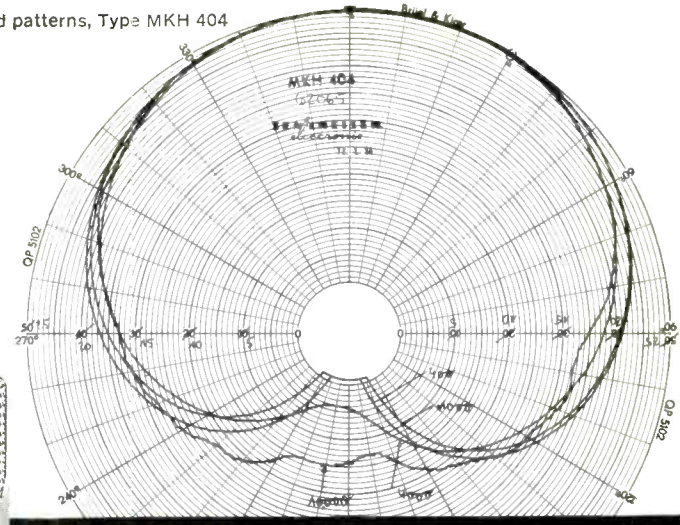
The foregoing lengthy seminars are only part, indeed a rather small part, of the entire NEC activity. Technical papers on 57 topics covering a bewildering variety of subjects will be presented over the three-day conference period. These papers, prepared by experts in many fields, encompass such diverse areas as: microelectronics, energy beams, control systems, space communications, consumer electronics, wire communication, antennas, nuclear science, education for engineers, ASW and oceanographic systems, microwave techniques, engineering writing, medical and biological electronics, PBX's, computers, safety, and information theory and coding. Several papers will be presented under most of the general headings noted above. Abstracts of all 57 papers will be available, and a complete publication containing all papers in full can be obtained for a nominal charge from the NEC headquarters.

While many—perhaps most—of the topics that comprise the program for a convention of this sort are rather remotely related to our professional interests and activities, the NEC offers an excellent opportunity to learn something new.

More than 25,000 engineers and scientists are expected to attend the show, and more than 450 electronic firms, agencies, and societies will exhibit their latest products and services.

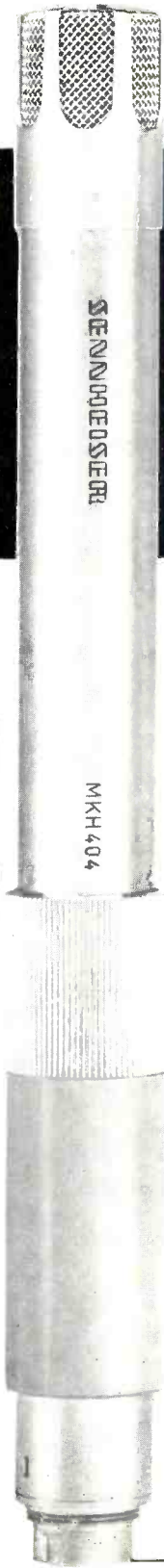
A distinguished list of speakers will add to the informative aspect of the show. James E. Webb, the administrator of NASA; Dr. Henry K. Puharcih, director of the Medical Research Interlectron Corp.; Dr. Albert V. Crewe, director of the Argonne National Laboratory; and Clarence H. Linder, President of the IEEE, are scheduled to speak at various activities.

Random-selected, individually drawn cardioid patterns, Type MKH 404



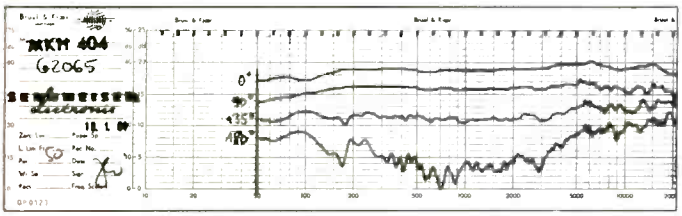
SENNHEISER PERFORMANCE HERE

ACOUSTIC BARRIER TO THE REAR



MKH 404 (actual size) Professional Net $230.

THE FIRST CARDIOID CONDENSER MICROPHONE WITH TRANSISTORIZED RF CIRCUITRY.



Random-selected, individually drawn curves, Type MKH 404

Between the introduction of the MKH 104 Condenser Microphone into this country and its establishment as a standard of comparison, very little time has passed. Where the requirement for the most exacting professional performance can be met with an omnidirectional microphone, it is an unhesitating choice. Now with the development of the MKH 404, a comparable instrument is available when conditions dictate directional pickup. Thus, a significant milestone has been reached.

Cardioid condenser microphones are not new. But the MKH 404 is the **first transistorized cardioid condenser microphone to employ integral RF circuitry successfully.** This type of circuitry offers unique advantages in performance and convenience. It enables the exceptionally flat, peak-free response above and below the audio range; the minimal distortion; and the unusually low noise level. It also renders the microphone impervious to temperature changes, humidity, shock, and stray magnetic and electric fields. It eliminates the power-supply problem. The slender, lightweight assembly shown here in full size includes the plug-on power pack, which holds the 6 mercury cells that energize the circuit. The performance of the MKH 404 attests the success of the engineering effort.

The cardioid patterns and frequency response curves showr here, taken in the laboratory from a random-selected MKH 404, show the excellent front-to-back rejection ratio at all frequencies and the outstanding uniformity of response at any angle, as well as on axis. In fact, the directional characteristics are exact and independent of frequency. The individually graphed frequency response curve you receive with any MKH 404 will adhere very closely to the one shown here. Response below 40 cps has been tailored to meet practical requirements in most applications.

Battery Adapter MZA 6 Professional Net $18.

TECHNICAL DATA

Acoustic system	pressure-gradient responsive
Directional characteristic	cardioid
Frequency range	40 to 20,000 cps
No-load transmission co-efficient at 1000 cps (Sensitivity measured in anechoic chamber)	1.8 mv/microbar (corresponding to −35 dbv referred to 10 microbars)
Impedance	800 ohms, unbalanced, ungrounded (accessory cable transformer matches to 200 ohms)
Weighted noise voltage (German Engineering Standard DIN 45 405)	10 microvolts
Unweighted noise voltage	25 microvolts (peak-to-peak)
Distortion at 10 microbars	0.35%
Overload level	150 microbars
Power-supply voltage	8 volts ±1 volt
Operating current	approx. 5 ma
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Circle Item 8 on Tech Data Card

THE 900-MC LINK

by *Philip Whitney,* Consulting Author, Director of Engineering, WINC, Winchester, Va. — A brief treatise describing a useful STL program service for remotely-located transmitters.

Many FM stations have learned that the only way to obtain satisfactory coverage of their primary service area is to install the transmitter on an isolated mountain top or other remote elevation that cannot be serviced by good telephone lines. A good line is one capable of meeting FCC specifications for FM stations, that is, one having a frequency response from 30 to 15,000 cps and a noise level at least 60 db below the peak program level. Even without going into mountainous areas, these telephone line specifications are hard to find. The solution that many broadcasters have adopted is the use of a 900-mc studio-to-transmitter link (STL).

Companies presently manufacturing links or who have done so in the past are Adler, General Electric, Raytheon, Jerrold, Microlink Corp., Miratel Electronic Laboratory, GPL, Moseley Associates, Sarkes Tarzian, and RCA. Philco, REL, and others have also made a few models, and there may also be other manufacturers which are not listed here.

When application is made to the FCC for a license to operate an STL in conjuction with an AM or FM station, use Form 313—"Application for Authorization in the Auxiliary Radio Broadcast Services." Two copies must be submitted in application for the Construction Permit, and two copies must be submitted for the License. Both may be tendered at the same time accompanied by the $30.00 filing fee. Be sure to fill out sections 1a, 1b, 1e, 2, 3a, 3b, 4, 5, 7, 8, and sign the application correctly before having it notarized.

The FCC provides STL licenses (to holders of AM or FM station licenses only) for 19 frequencies ranging from 942.5 mc to 951.5 mc in 500 kc increments. Channel bandwidth is 500 kc with a frequency tolerance of .005%. These 19 frequencies can also be licensed for intercity FM relay when the station can show that no other satisfactory service is available and that a common carrier cannot provide it. More than one STL will be licensed to a broadcast station only when it can be shown that one hop is too long (or the terrain is too rough) for a single hop.

An FM-station owner desiring to use two links on separate frequencies to transmit stereo program channels to the transmitter will be told that regulations stipulate that he cannot be assigned two channels. A standby link on his present frequency is permissible, but another way must be found to get both sides of the stereo program to the transmitter simultaneously. One way this can be done is by using a dual-channel link that will be described later. In a few cases, a second program subchannel has been multiplexed onto a normal STL carrier, but problems regarding frequency response, noise level, and crosstalk are many. Each STL is licensed for a fixed location and for a specific directional-antenna pattern.

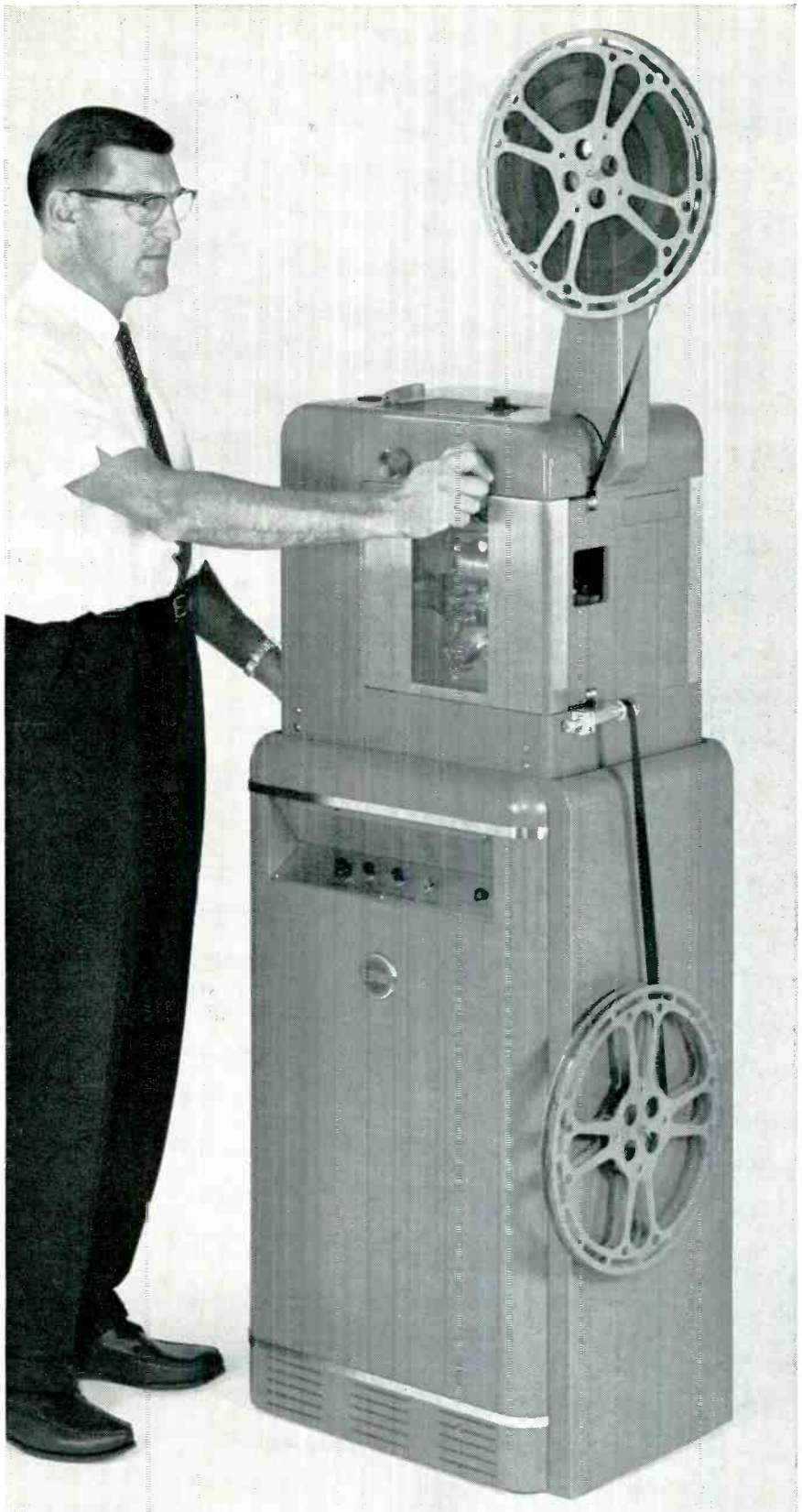
Requirements for Logging

Each station that operates an STL must announce its call letters at the beginning and close of each broadcast day. The FCC also stipulates hourly announcement of the station's call letters, but since an ID is announced at least every half hour during normal operation, that is considered sufficient. The rules also call for a log of STL activity, including hours of operation, programs transmitted, and date and time of frequency checks. Most engineers feel that a simple log notation of time the link is turned on and off, plus frequency-check information, when made, is sufficient. All programs transmitted through the link are also transmitted by the station it feeds and a log must be kept for this operation, anyway. The station must also provide assurance that the STL is operating within specified limits of operating frequency and modulation percentage. This means logging a set of measurements made by the engineering staff or by an outside service.

The FCC considers several frequency monitors on the market satisfactory for these measurements. Usual practice is to read one frequency in the multiplier chain accurately, then multiply the error in cycles by the number of frequency multiplications occurring beyond the sampling point. A wavemeter, such as the General Radio 1140A or equivalent, will be needed to check the transmitter output to be sure it is in the correct band. Other frequency meters as represented by the Lampkin type 105B (and the more sophisticated and expensive counter-type meters) are satisfactory for measurement of the link's frequency at some intermediate point.

Equipment Installation

Extra care is necessary when installing a microwave system in the vicinity of strong RF fields like those found at an AM or FM transmitter site. Good shielding and a good ground are both necessary. These will also help keep the link's harmonic and sub-harmonic frequencies from radiating into the FM transmitter or remote broadcast pickup receivers used for other program services. A well-built, en-



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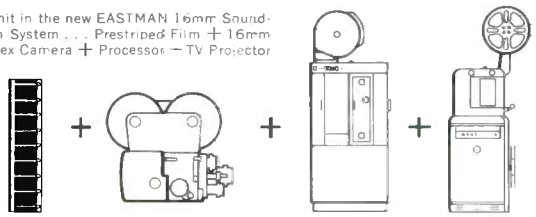

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Fig. 1. A pair of 900-mc dish antennas.

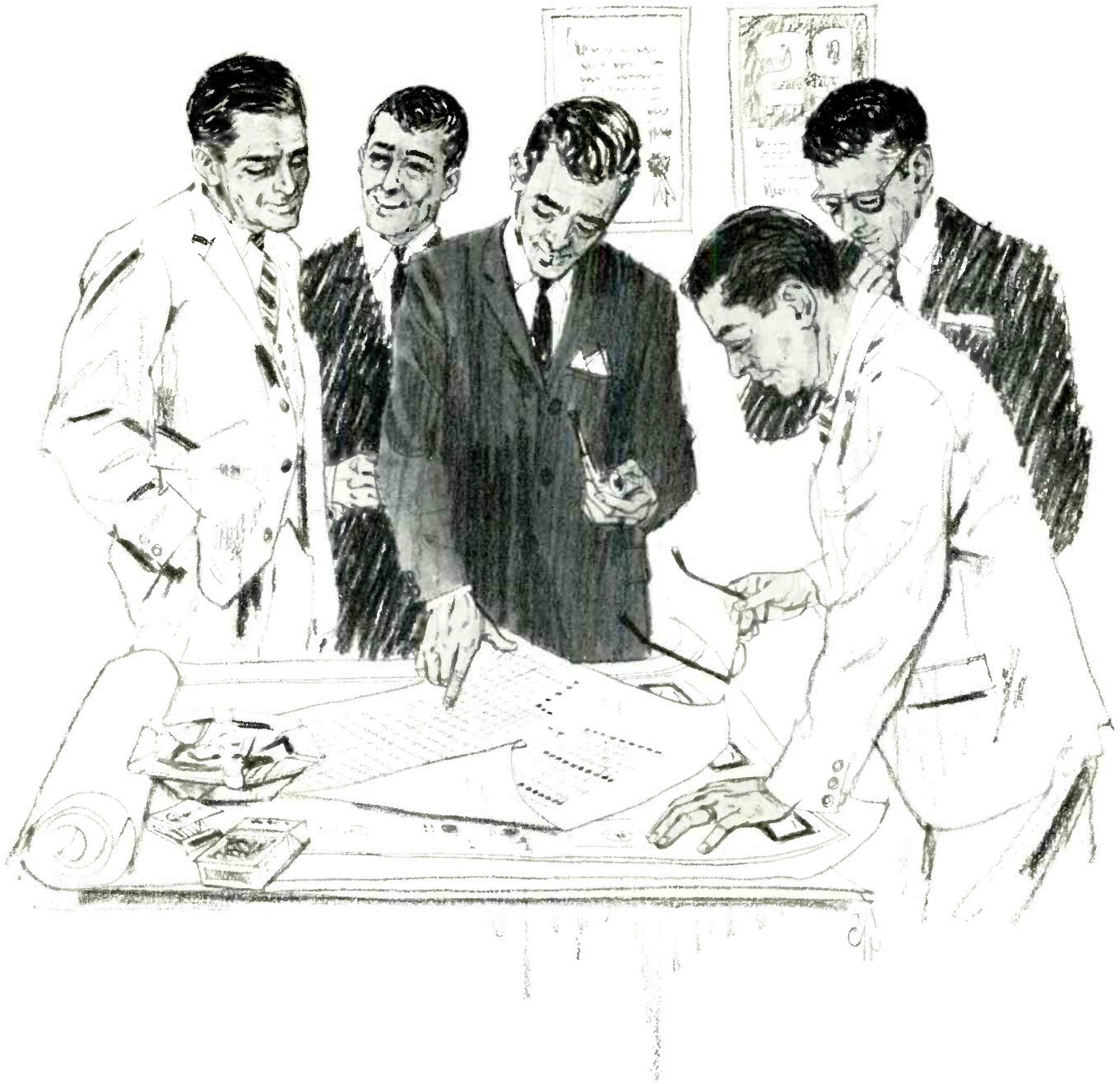
closed rack with good bonding between door and frame is a necessity. Because of the frequencies involved, a low-loss coaxial cable or waveguide is needed to connect the transmitter and antenna, or the receiver and antenna; RG18U is frequently used. Needless to say, the runs of RF line should be as short as possible.

Alignment

Generally, realignment of STL receivers requires rather sophisticated and expensive equipment; but, it is imperative that stages be aligned so that the sidebands are not clipped by a shifted IF skirt. Discriminator alignment is always critical for lowest noise and distortion figures. After alignment, it is a good idea to touch up the system using a distortion analyzer at the receiver output. Adjust critically for lowest distortion (in the area of one percent or less) throughout the entire system. Noise levels should be around —65 db. No spurious radiation should be detectable on a receiver at a reasonable distance from the transmitter. Consult the manufacturer's service data for alignment specifications and procedures.

STL Antennas

A typical antenna used with STL systems may have a gain of as much as 17.5 db over a standard dipole. This means that over the entire system, using identical antennas at transmitter and receiver, a gain of 35 db is realized. A quick calculation shows that as little as 5 watts output will give a signal approximately equivalent to that from a 15 kw transmitting system (minus certain inherent losses)! Such a



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narrow transmitted beam requires critical alignment of both transmitting and receiving antennas. It is also necessary to use a rigid mounting that will not sway in a high wind, causing misalignment. Coarse alignment during installation can usually be made by using field glasses or a spotting scope and a map and compass. Final alignment can be made by watching the signal-strength meter on the receiver (AVC voltage or first-limiter grid current) while in communication with the transmitting end of the system by radio or telephone. Fig. 1 shows two typical 900-mc parabolic antennas.

A Typical Single-Channel STL

The RCA BTL-1B transmitter and receiver are diagrammed in Figs. 2 and 3. This STL consists of an exciter unit, which RCA used in the sound section of their TV transmitters, followed by a doubler and two tripler stages. The exciter incorporates a Serrasoid modulator circuit and an overall frequency multiplication, from crystal to antenna, of 7776 times. This factor insures good low-frequency response. A communications model was also manufactured, using a small exciter with limited frequency response. It was used by pipelines and other industrial organizations.

The receiver's mixer diode is contained within the input cavity, to which the antenna and output hairpin of the local-oscillator-multiplier chain are coupled. The local oscillator is crystal controlled and followed by a tripler and two doublers. The last 6J6 multiplier output is between 115.8 mc and 123.5 mc below the incoming 900-mc carrier, so that the first and second

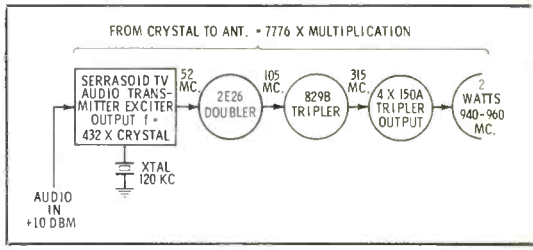

Fig. 2. Single-channel STL transmitter.

IF lines constitute a fixed-tuned FM receiver. Two audio stages bring the discriminator output up to the plus 10 db level necessary to modulate most transmitters. A 6AQ5 drives the monitor speaker in this unit.

A 12AU7, operated by the bias voltage generated at the first-limiter grid, acts as a Codan relay control. When no carrier is present, the audio output is removed from the transmitter line. Auxiliary contacts on this Codan relay can also be used to operate a remote-control system or "fail safe" to remove the FM or AM transmitter carrier from the air when the STL transmitter fails. Power output of the transmitter is two watts.

A Typical Dual-Channel STL

As was mentioned earlier, the FCC will not assign two frequen-

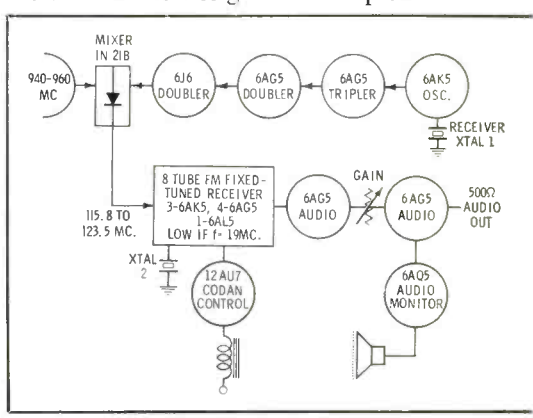

Fig. 3. A single-channel STL receiver.

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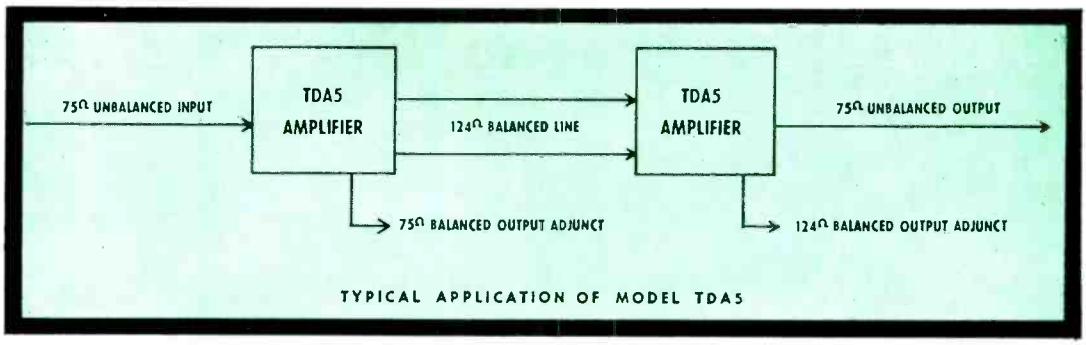
The TDA5 is designed for rack mounting. It requires only 1¾ inches of panel space. All signal connectors are standard 83-series, arranged across the rear chassis. Type 2N1143 transistors are used throughout. They are socket mounted on the front panel. Test points are provided and the regulated power supply is an integral part of of the amplifier.



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cies to a stereo-FM station to feed stereo programming to the transmitter. In many cases, of course, this poses a real problem. A solution to the problem is a dual-channel link like that developed by Moseley Associates. The Moseley system operates two separate STL transmitters within the 500-kc bandwidth allowed for each channel. Using 180F3 emission, the transmitter nominally generates 5 watts of RF power and has a maximum capability of 8 watts per channel. The FCC has set the maximum allowable noise figure for broadcast services at —60 db. This means that not only must the FM transmitter meet the FCC specification but that the entire system, from microphone to antenna, must also meet it. Experiments have demonstrated that it is extremely difficult to reach and maintain low noise and distortion figures using a multiplex system on a single-channel STL transmitter. (The reason is clear when it is understood that the main-channel modulation percentage must be cut back to accommodate the subcarrier, adversely affecting the main-channel signal-to-noise ratio. A poor modulation index for the subcarrier could result if the entire system is to be held well within the FCC's 500-kc bandwidth requirements.) It was therefore felt that a dual STL system was the best solution.

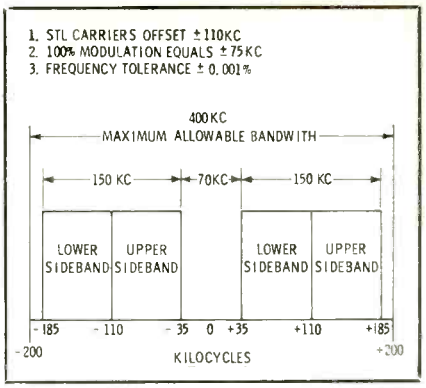


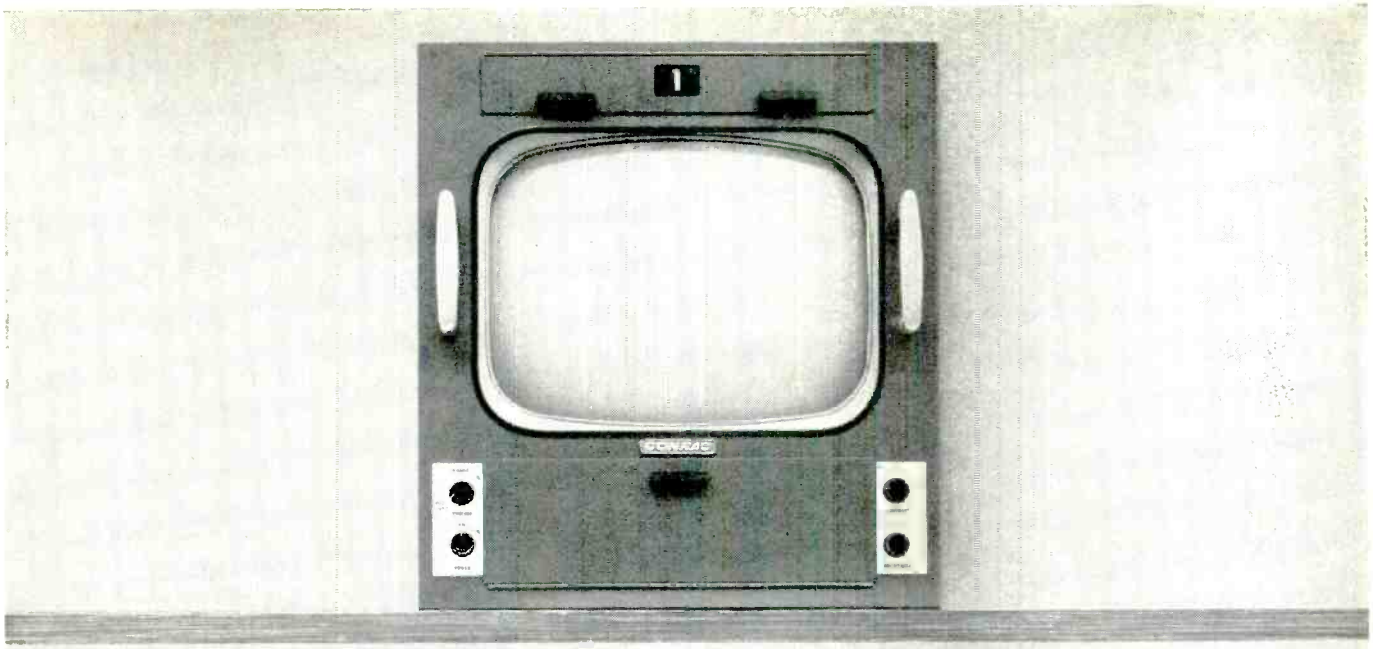
Fig. 4. Dual STL bandwidth distribution.

In most installations parabolic antennas are used, giving 17.5 db gain each. One antenna is polarized horizontally, the other vertically for extra separation of the two systems. Operating frequencies of the two transmitters are offset, one +110 kc, the other —110 kc as shown in Fig. 3. The subchannels are each restricted to a 150-kc bandwidth so that they do not interfere with one another, and a 70-kc guard channel is provided to reduce crosstalk to a minimum. Deviation is ±75 kc per unit for 100% modulation.

Each transmitter utilizes a 6AK6 oscillator, followed by two 6AN8's, two 6CM6's, one 2E26, and two 2C39's. The power supply uses silicon rectifiers. The receivers are double-conversion, crystal controlled superhets. Although a 3μv signal will produce 20 db quieting in the receiver, a 50 μv signal is usually considered minimum.

Summary

Remember that if your station is contemplating installation of a 900-mc STL, excellent results can be obtained if a few basics are given due consideration: The transmitter and receiver must both be tuned carefully to the manufacturer's specifications; transmission lines must be carefully chosen for mimimum loss; high-gain parabolic antennas must be rigidly mounted and precisely aligned. Follow these guides, and a 900-mc STL will provide a reliable program service. ▲



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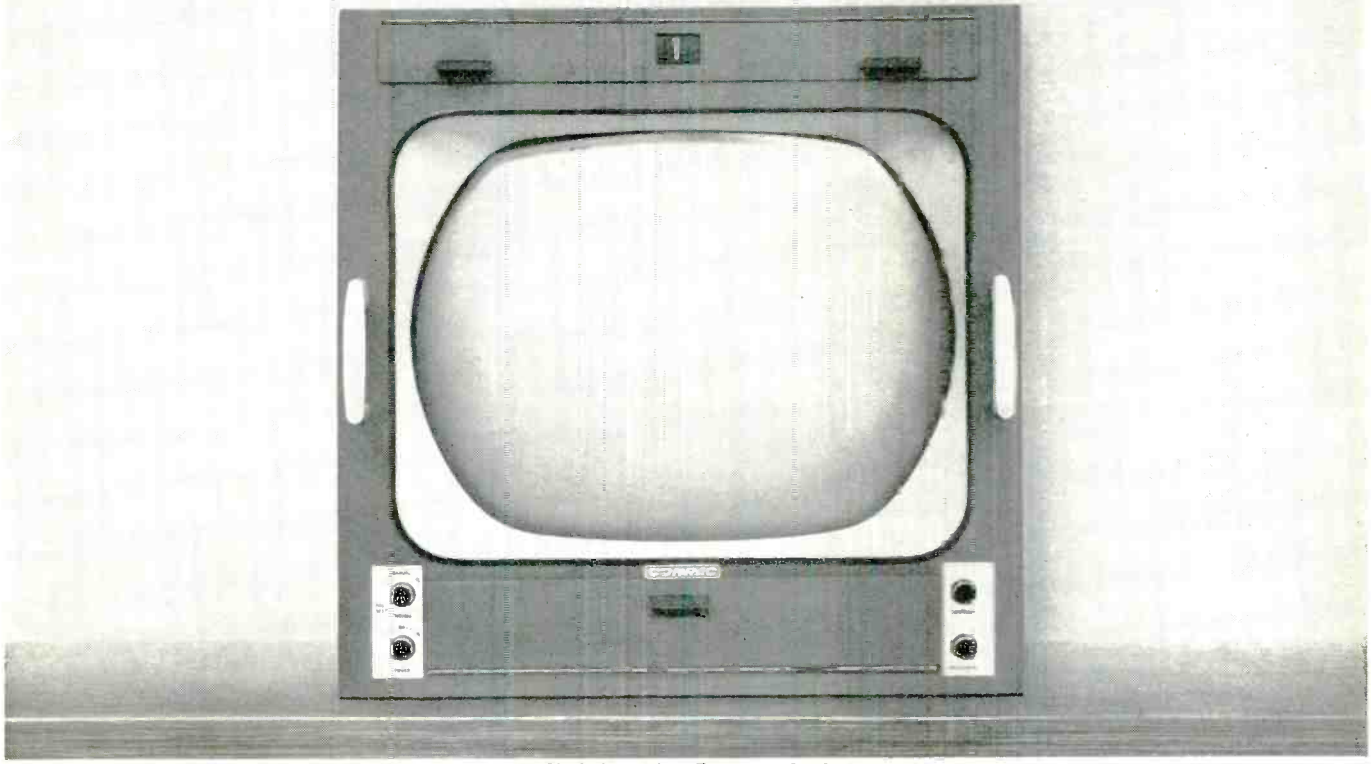


Circle Item 16 on Tech Data Card

VIDEO MICROWAVE SPECIFICATIONS FOR SYSTEM DESIGN

by ***Donald Kirk, Jr.,*** Microwave Engineer—Part 1. An evaluation of microwave system specifications used to select equipment for single-hop and multiple-hop video transmission.

When the broadcast engineer finds it necessary to prepare specifications for a video transportation link, he has three problem areas to consider. First, he must adopt an adequate set of electrical specifications. Then, he must describe the equipment he wants, in terms of adequate reliability and maintainability. Finally, equipment environment must be specified in terms of buildings, towers, roads, primary power, and standby power.

This article will discuss how individual electrical specifications of the system affect picture quality (the first area). We shall look first at those specifications which define how the system handles the desired signal in transmission.

Treatment of Desired Signal

One of the most important specifications in any television transmission system is frequency response. In order to transmit perfectly a standard 525-line television picture, a system must respond uniformly to signals in the range 30 cps to 4.2 mc. If television sound is also to be carried, the response must be increased to 4.5 mc; and, for each additional FM sound channel, a bandwidth increase of about .5 mc is necessary.

Bandwidth

A system that consists of cascaded hops should have an essentially flat bandpass. For example, if a single hop is 3 db down at 6 mc, a system of 5 such hops would be 15 db down. The question then becomes, "How much variation in flatness can be tolerated before the system becomes unusable?"

When reading frequency-response specifications, be cautious where a high variation is allowed in the response (e.g., flat to 7 mc ±1 db). Good single-hop performance dictates a response of ±.25 db to 8 mc. In looking at video response, be sure to check the IF flat bandpass. The IF system should have a flat bandpass at least equal to the peak-to-peak deviation plus twice the highest quoted video frequency. If it doesn't, the necessary video bandwidth can be obtained only by peaking the video, thus compensating for rounding of the IF response. However, this will result in poor differential phase and gain characteristics at the higher video frequencies.

Low Frequencies

Another important specification of a video system is its low-frequency response. This is usually given in terms of square-wave tilt. If a usable characteristic is to be obtained for multihop operation, the flat portion of video response must extend below 10 cps. By spiking up the low-frequency response and then letting it drop off rapidly, acceptable tilt may be obtained; the square wave will look slightly rounded. If the height of the rounded hump is too great (more than 1% or 2%) trouble may show up when units are cascaded, because excess low-frequency gain may be great enough to produce video bounce.

Differential Gain

The two specifications discussed so far describe how the system handles individual signals of different frequencies. Another specification describes how the system handles one signal in the presence of another—a characteristic that depends on **differential gain.**

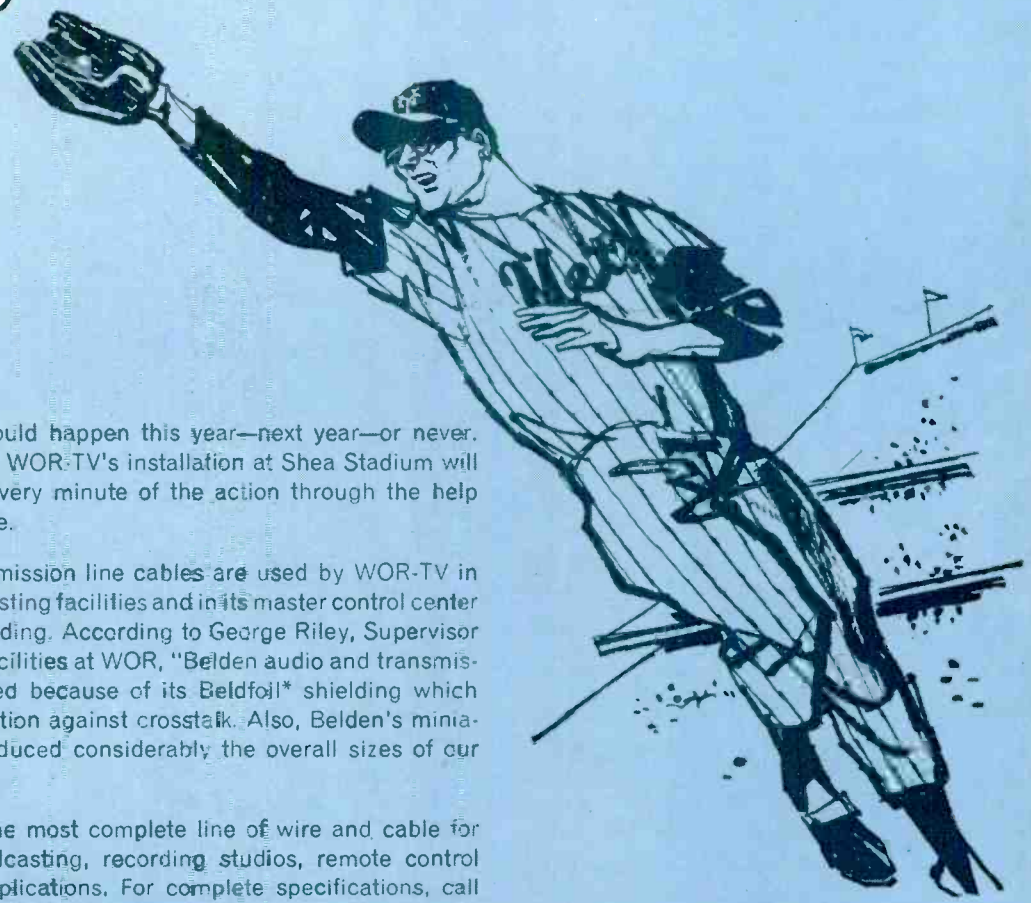
Assume that a 3-mc sine wave is being fed through a microwave system that has been adjusted for unity gain. If a second signal (a 60-cps sine wave, for example) is added to the system, the varying amplitude of the new sine wave changes the bias of the video amplifier tubes at a 60-cps rate, thus changing their gain at the same rate. On a positive peak of the 60-cps signal, one might find that the amplitude of the 3-mc signal had slightly increased; on a negative 60-cps peak, the amplitude of the 3-mc signal may have decreased. The gain of the system for the 3-mc signal, therefore, changes at a 60-cps rate. This characteristic is known as differential gain.

Differential gain can be produced by many elements of the system other than grid bias. Nonlinearity in the receiver's discriminator and nonlinear modulation of a klystron are two of the principal causes. To assure a usable differential-gain specification, look for a receiver whose discriminator has a frequency response at the high end greater than twice the highest video frequency plus the peak-to-peak deviation. In the transmitter, insist on good isolation in the stage immediately following the klystron. A specification for differential-gain of ±.25 db at full deviation will assure an acceptably low cross-modulation figure for color signals.

Phase Distortion

Just as the 60-cps signal in the above example was capable of changing the amplitude of the 3-mc signal, so is it also capable of altering the phase. For illustrative purposes, the microwave transmitter and receiver can be viewed as a bandpass filter. If a low-amplitude 3-mc signal is being sent through the system, there will be a carrier and two small sidebands present in the center of this filter's pass band. If a high-amplitude 60-cps signal is added, it acts as though it were moving this set of three

When the "Mets" capture the pennant... Belden will be there



Such a phenomenon could happen this year—next year—or never. But if and when it does, WOR-TV's installation at Shea Stadium will record and broadcast every minute of the action through the help of Belden wire and cable.

Belden audio and transmission line cables are used by WOR-TV in both its stadium broadcasting facilities and in its master control center in the Empire State Building. According to George Riley, Supervisor of TV Operations and Facilities at WOR, "Belden audio and transmission line cable was used because of its Beldfoil* shielding which provides superior insulation against crosstalk. Also, Belden's miniaturized audio cables reduced considerably the overall sizes of our panels and consoles."

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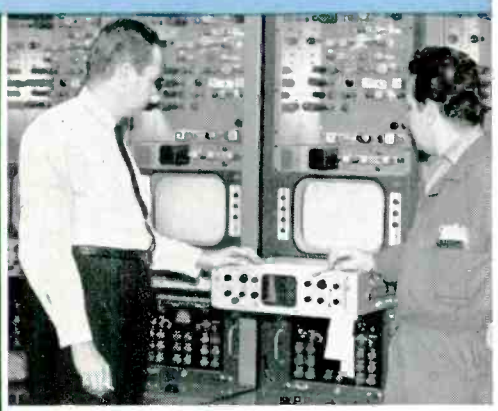
The control center of WOR-AM-FM is wired with Belden 8451 and 8700 miniature broadcast and audio cables. Explaining the complexity of the installation to George Kyros is Orville J. Sather, Director of Engineering for WOR-AM-FM.



In the control room, six monitor screens help the engineers transmit the play-by-play action. Looking over part of this installation are George Kyros, Belden Territory Salesman, and Earl Neely, Maintenance Supervisor of WOR-TV. The monitors are wired with Belden 8451, 8241, and 8281.

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signals back and forth across the pass band at a 60-cps rate.

Unfortunately, most bandpass filters look electrically longer at frequencies near the edge of their pass bands than they do at the center. Therefore, when the 60-cps signal moves the set of three signals to one side of the pass band, the phase of the 3-mc information is retarded. This system characteristic is known as differential phase.

When sound channels are put through a microwave system on FM subcarriers, the system must have a good differential-phase characteristic to prevent cross modulation between the video information and the sound carrier. For example, assume that the 15-kc component of the video signal produced a 1° phase shift of the sound subcarrier. The equivalent FM deviation is the product of the differential phase shift in radians (1° ÷ 57.3, or about 1/60) and the modulating frequency (about 15 kc). For our example this would result in a 250-cps FM deviation. If the FM subcarrier had a deviation of 25 kc for its peak audio signal, the 15-kc cross modulation would be 100 times or 40 db down from the peak signal. For lower video frequencies, the cross modulation would produce proportionally less spurious signal in the sound. When sound-channel trouble is encountered, it is usually in the form of sync buzz. This is caused by the differential-phase cross modulation produced by high-frequency components at the edges of the vertical blanking and sync pulses.

Treatment of Undesired Signals

At the terminus of a microwave system, the input signal (modified by the characteristics described above) is recovered. There are also, mixed in with the desired signal, some spurious contributions from the system that fall in the general category of noise.

Hum

In a microwave system of reasonable specifications, the low-frequency noise contributed by the path is negligible, and all of the noise below 10 or 20 kc consists of hum components at the first few harmonics of the power-supply frequency. The extent to which the hum interferes with the televised signal depends most critically upon whether or not the hum is synchronized with the picture information. Hum that is more than 45 db below picture levels is seldom bothersome. It is usually possible to keep the hum level on a single hop more than 50 db below the transmitted signal. Caution must be exercised when cascading equipment which uses hum-cancelling adjustments to get acceptable specifications. The chance is great that you may try to adjust one piece of equipment to overcome hum that is actually introduced by another unit. Using this procedure, if the phase or frequency of any independent power source changes, the maintenance man is lost.

Broadband Noise

By far the most critical deterioration of the desired signal occurs from broadband noise. The noise added by an FM microwave system is very low in amplitude at a low frequency, and the noise power added—per cycle of bandwidth—increases as the video frequency is increased. The signal-to-noise ratio of an FM microwave receiver can be shown to be:

$$S/N\,(db) = 206 + 10 \log Pc. - F + 20 \log fD - 30 \log f_1 - 10 \log \frac{(f_2)^3}{(f_1)} - 1$$

where Pc is received carrier power in watts,

F is receiver noise figure in db,

fD is peak deviation in cps,

f_1 is low end of pass band in cps,

f_2 is high end of pass band in cps.

For the typical video system where f_1 is very small compared to f_2 (30 cps to 4.2 mc), this equation reduces to:

$$S/N\,(db) = 206 + 10 \log Pc - F + 20 \log FD - 30 \log f_2$$

This equation gives an rms-signal-to-rms-noise ratio. If it is desired to express S/N in terms of peak-to-peak signal to rms noise, then the constant 206 should be changed to 215.

For the various terms in this equation, let us substitute some appropriate values that apply to our desired video-handling system:

For F, use 13 db as a conservative value for receiver noise figure.

For 20 log fD, use 129.5 (20 log

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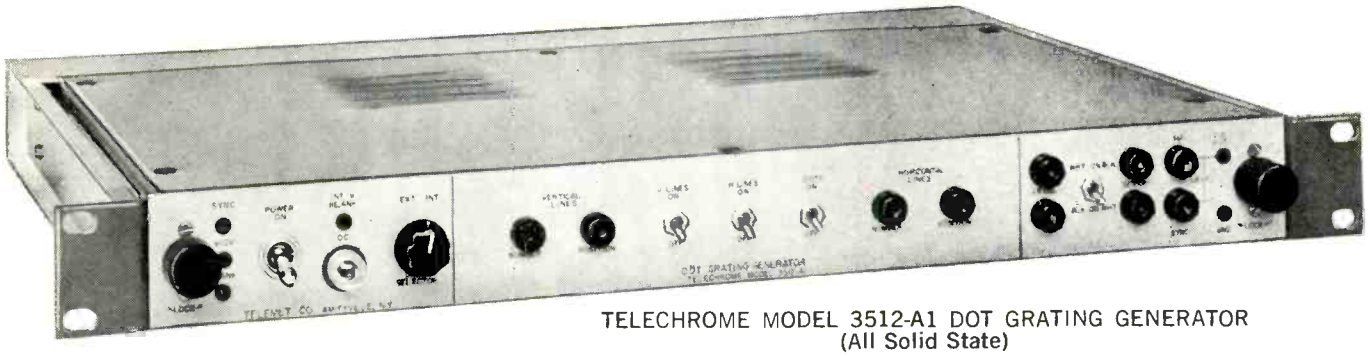

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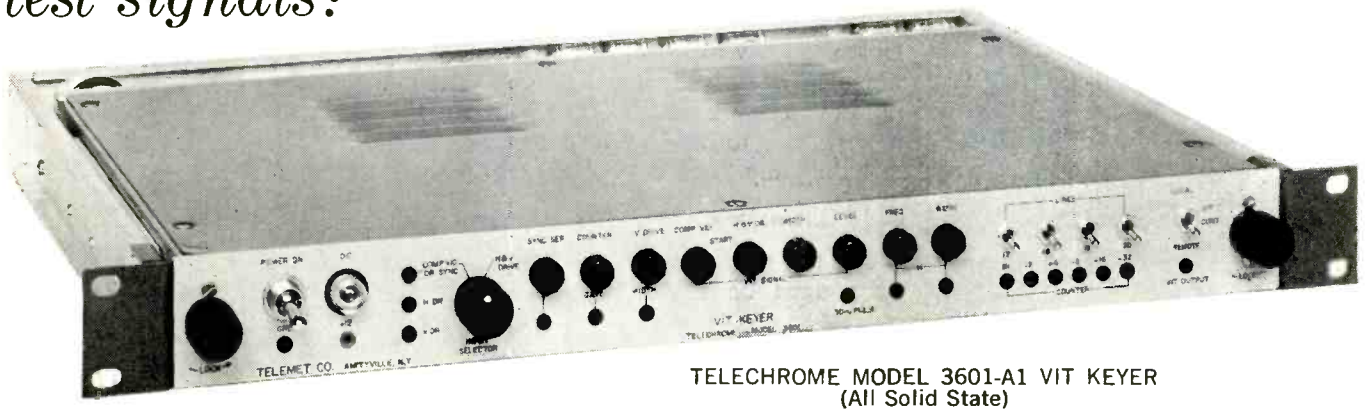

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Circle Item 19 on Tech Data Card

3,000,000) for a 3-mc peak deviation or 6 mc peak-to-peak.

For 30 log f_2, use 198.5 (30 log 4,200,000) for 4.2-mc video.

The equation then becomes:

$$S/N = 133 + 10 \log Pc$$

If the carrier power is —65 dbw, the S/N = 133 — 65 = 68 db, and it changes db for db with the received carrier level down to about 10-15 db above the FM-improvement threshold of —117 dbw.

Using the equation, we can make up a chart which relates the received carrier level to S/N. If other values of noise figure or deviation are used, S/N will change db for db. If the video bandwidth must be other than 4.2 mc, apply the following corrections:

5 mc	subtract	2.34 db	from	S/N
6 mc	"	4.68 db	"	"
7 mc	"	6.65 db	"	"
8 mc	"	8.39 db	"	"

It should now be apparent why a relatively high signal level must be used for FM sound channels added at the high end of the video band, even though the audio signal is relatively narrow. This triangular noise spectrum of an FM microwave system is really a help in video work, because a given amount of noise power degrades a picture less at a high frequency than it would at a low frequency. The most generally accepted measure of wideband noise is the signal-to-noise ratio expressed in terms of peak-to-peak signal to rms noise without including any "weighting factors."

Fade Characteristics

For any microwave path, calculations must be made of path attenuation, transmitter power, waveguide loss, and antenna gain to arrive at a received carrier level that will assure the desired signal-to-noise ratio. Having made these calculations, the broadcast engineer must approach the problem of specifying the desired fade margin. This must be done with great care since it will greatly affect both system performance and system cost.

Table 1. Fade Margin for Various Paths.

Path Length (Miles)	.1% Fade Margin[1]	1% Fade Margin[2]
5	6 db	0 db
10	12 db	3 db
20	19 db	7 db
30	23 db	11 db
40	26 db	15 db
80	35 db	25 db

1. *Will not be exceeded more than .1% of the time (3.6 seconds/hr)*
2. *Will not be exceeded more than 1% of the time (36 seconds/hr)*

The effect of path length on the amount of fade to be expected is shown in Table 1. The effects of propagation conditions and weather on the tower heights required to achieve the fade margins of Table 1 are shown in Table 2. The two tables are necessarily based on approximations. In specifying a fade margin for any given location, the engineer should make every effort to study existing systems in his vicinity to determine their fade characteristics.

This concludes the discussion of internal single-hop noise and the bandwidth considerations for microwave systems. In the second part of this article, multihop-system noise specifications and external noise interference will be discussed. ▲

Table 2. Tower Heights Required to Achieve Fade Margins of Table 1.

Propagation Condition	Perfect	Ideal	Average	Difficult	Very Difficult
Weather	Standard atmosphere	No surface layers of fog	Some sub-standard light fog	Surface layers, ground fog	Surface layers, fog over water or marsh
Locations found	———	Rocky Mountains	East and Great Plains	Coastal	Coastal waters Gulf of Mexico and lower Cal.
Tower heights for 30 mile path to achieve fades of Table 1.	159 ft.	190 ft.	201 ft.	248 ft.	300 ft.
Tower heights for 30 mile path to achieve 1% fades of Table 1 only 0.1% of time.	190 ft.	201 ft.	248 ft.	300 ft.	365 ft.

October 1964

We interrupt this magazine to bring you . . .

Late Bulletin from Washington

by Howard T. Head

AM Freeze Lifted

As predicted in the June Bulletin, the Commission has lifted the freeze on the acceptance of applications for new or improved AM facilities and has adopted technical regulations governing the processing of these applications. As anticipated, heavy emphasis is placed on providing AM service to areas which now receive little or no service. Also, new engineering requirements are far more strict than previous standards with respect to interference.

Notwithstanding the tighter engineering features of the new Rules, experience is showing that new stations and improved facilities are technically feasible at many locations, even cities of substantial size. However, relaxation of some restrictions provides incentive for establishing facilities where none now exist.

Restrictions are still imposed on the availability of several channels adjacent to the Class I-A clear channels. In these instances, the AM freeze continues in effect pending a Commission decision on the clear channels involved. Meanwhile, the Commission continues to seek a solution to the question of possible experimental authorizations for powers up to 750 kw for some of the Class I-A stations. The best bet is that a few of these experimental authorizations will be granted shortly.

Aeronautical Test Stations on 108 mc

The Commission has proposed that existing allocations in the Aircraft Service be changed to permit both the FAA and private licenses to construct and operate stations on 108 mc. These stations, known as very-high-frequency omnidirectional-range test stations (VOT), would transmit continuous test signals to permit checking VOR navigational receivers carried by aircraft. The lowest frequency now available for VOR purposes is 108.1 mc. The FAA has advised the Commission that no regular VOR frequencies are available for test purposes and has asked for the assignment of 108 mc.

This proposal is of particular interest to FM stations operating at the upper end of the FM band, especially those on FM channel 300. Most good FM receivers tuned to channel 300 respond readily to a 108-mc signal. The FCC has proposed that this frequency allocation be made only on the condition of noninterference to FM reception. However, several FM broadcasters using the high end of the band do not feel that sufficient safeguards have been proposed and have asked for stiffer restrictions.

Vertical Polarization for FM and TV

Mounting experience with the addition of a vertically polarized component to the standard horizontally polarized FM broadcast signal continues to reinforce the conclusion that worthwhile advantages can be gained. Almost without exception, field tests indicate improvement in reception with little or no increase in interference to other stations on the same or adjacent channels. Detailed reports of additional tests (see August issue of B-E) are expected in the near future.

These tests interest television broadcasters as well as FM licensees, since the results may indicate the possibility of improving television service by this means. The Commission made tests of circular polarization on channel 31 in the New York City area, but the use of circular or elliptical polarization for VHF television requires more thorough investigation.

Howard T. Head...in Washington

Fig. 1. Finished mixer unit connected to camera amplifier.

A TRANSISTORIZED DUAL-INPUT MIXER

by Edward Tong, Consulting Author, Assistant Chief Engineer, WDSU-TV, New Orleans, La. — An easy way to add microphone inputs to a sound-on-film camera.

Nearly every television station has an Auricon news-film camera. These excellent units, however, have a minor drawback—a tube-type amplifier with only one microphone input. Passive, resistance-type mixers are an unsatisfactory way to increase the number of inputs. Such networks reduce the available gain and are critical of the microphones used; matched microphones must be used for balanced performance. Battery-drain considerations and lack of space almost preclude additional tube-type amplifier stages in the existing amplifier case, and an outboard module of this type tends to be unwieldy to handle.

At the request of our news department, we put together the dual-input, transistorized mixer shown in Fig. 1. The new mixer works directly into the high-impedance, low-gain input of the amplifier unit.

The circuit (Fig. 2) is straightforward in all respects. Frequency response is within ±1 db from 20 to 10,000 cps. Clipping distortion appears at 1.6 volts output, which is far above the level required for full sound-track modulation. The amplifier noise is far below that contributed by the film system. Gain is more than adequate to match the existing microphone channel.

Since the existing amplifier (with the battery pack) is already quite bulky, every effort was made to keep the physical size of the auxiliary unit to a minimum. It was built into a Bud Minibox (CU-3003A), which measures 2¼" × 2¼" × 4". Inside views of the unit are shown in Fig. 3.

Battery drain is approximately 3 ma. Because it is readily available, we used the same type of 9-volt battery that is used in a great many transistor pocket radios. Mercury batteries of the same physical configuration are also available. An additional control was eliminated by arranging for power to be disconnected when the output plug is removed. Some operators may prefer that this function be associated with the removal of both microphones, and a circuit change to accomplish this is shown in Fig. 4. (The number 3 pins of both microphone jacks would be tied together.)

This unit has also been used successfully with other equipment, such as tape recorders and public-address systems, to expand microphone facilities with professional results. ▲

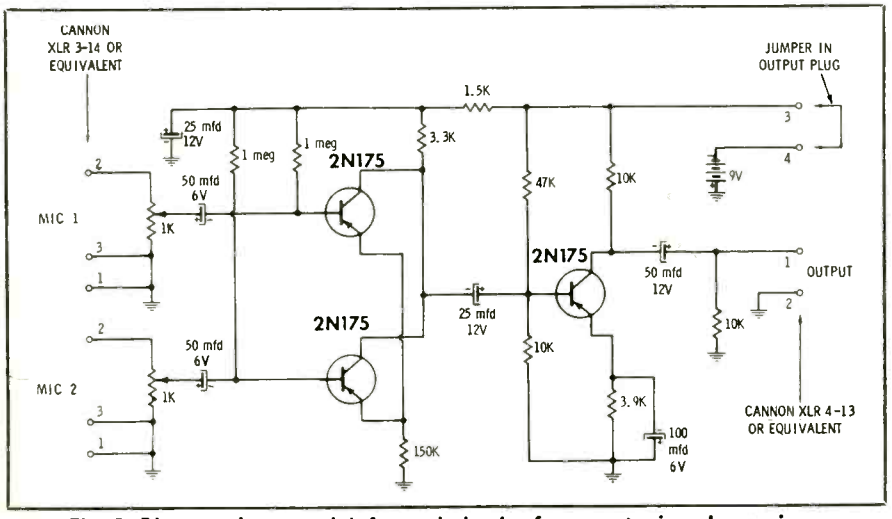
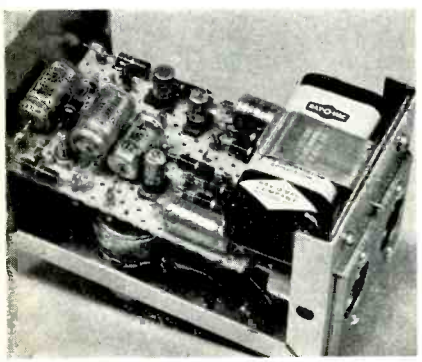


Fig. 2. Diagram shows straightforward circuit of compact microphone mixer.



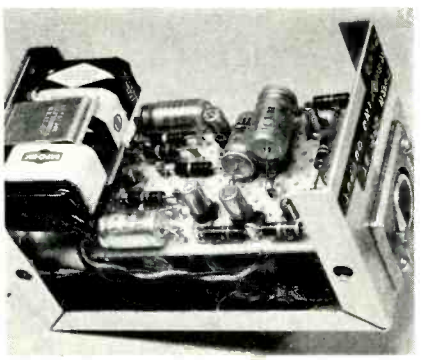


Fig. 3. Two bottom views show construction details of the circuit board and chassis.

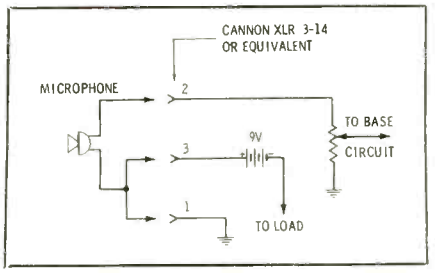
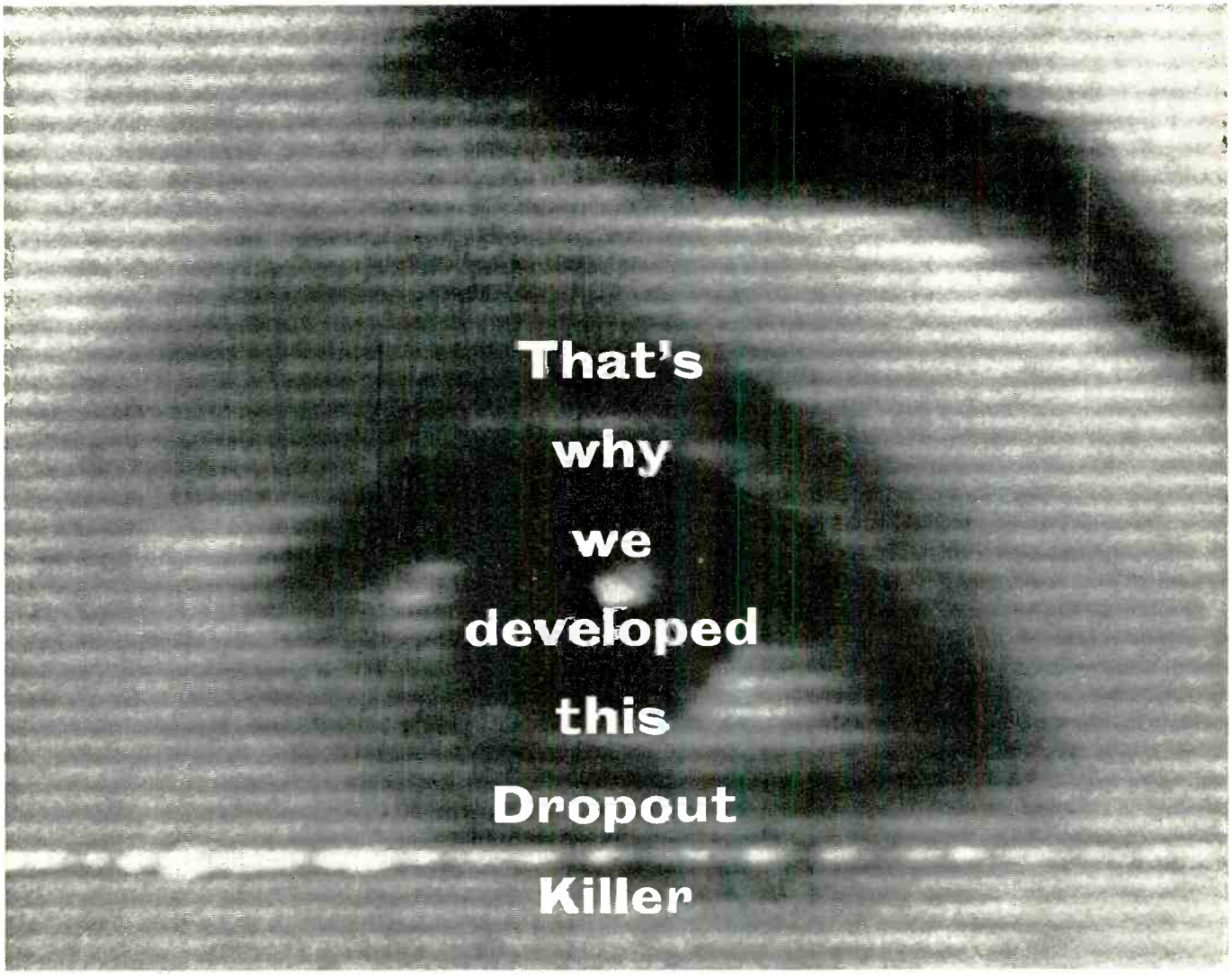


Fig. 4. Alternate wiring of mic. socket.

Been seeing any white flashes lately? Those are dropouts in your tape. They cost you money. They spoil your picture.



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DIMENSIONS: 5¼" x 19" x 11" Overall

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POWER: 120 Volts, 50-400 Cps, 16 Watts

OPERATING LEVELS: RF Loop-Thru: 0.25–2.0v Peak-to-Peak, Video Input/Output: Unity Gain 0-1.5v. 75 Ohms Impedance

FREQUENCY RESPONSE: ±1 db to 8 mc

3.58 mc DIFFERENTIAL PHASE: 1° Maximum

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THE WFIL AM-FM-TV BROADCAST CENTER

Description of the physical features and technical facilities incorporated in the ultramodern radio-TV center in Philadelphia, Pa.

Construction of a new WFIL AM-FM-TV broadcast center, as headquarters for the radio and television division of Triangle Publications, Inc., was recently completed in Philadelphia, Pa. Replacing facilities outdated by changes in broadcasting techniques and requirements, the unusual new building, with its dramatic design and attractive landscaping, houses some of the most modern broadcast systems in use today. The circular main structure is located on naturally sloping terrain that provides entry to the building on several levels (Fig. 1).

The complete WFIL facilities are arranged in two separate units within the four-story, 80,000-square-foot structure. All radio and television production activities are housed on the two upper floors, each of which covers the entire 178′ diameter of the building. Administrative facilities are located on the two lower floors, which are glass enclosed and set back 10′ from the perimeter of the upper floors.

Among the center's facilities are:

1. Four television studios equipped to originate black-and-white or color programs. The three main studios on the third floor are 3090, 2452, and 1744 square feet in area, respectively. A 347-square-foot interview studio is located on the fourth floor.
2. AM and FM studios and control rooms are arranged around a radio-operations center on the fourth-floor mezzanine.
3. Gas-fired heating boilers, air-conditioning and cooling equipment, and other physical-plant systems are centrally located in a circular penthouse on the roof.

Television Facilities

A large part of the building's third and fourth floors is occupied by the main television studios. Occupying wedge-shaped segments of the circular building, the studios each have two curved walls and 24′ ceilings (Fig. 2). Separate TV control rooms are located around the perimeter of the central core on the top (fourth floor) level, overlooking each studio (Fig. 3). The master-control position is situated in the center of the third floor and looks into the three main TV studios (Fig. 4).

Control Rooms

The three TV control rooms are equipped with identical systems, custom designed and built to the engineering staff's specifications. Of solid-state construction throughout, the video-control units provide lap dissolves and special visual effects as well as normal switching functions. The use of individual control rooms permits independent and simultaneous operation of all three studios and affords each operator an excellent view of the studio with which he is working.

The studios employ numerous transistorized vidicon cameras for live monochrome telecasts. In addition to these are the three 4½″ image-orthicon cameras used for more elaborate shows. The color cameras are in daily use during news and weather programs and other live

Fig. 1. The main entrance view of WFIL's new broadcast center.

Fig. 2. One of the three main wedge-shaped television studios.

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Fig. 3. Two individual TV control rooms.

studio productions. Some of the studio cameras are servo-operated by means of "joystick" levers, built into the video consoles, which control pan and tilt movements. The remote camera consoles contain video monitors that show the same picture as the viewfinder screens, and a set of controls duplicating the operating controls and adjustments at the camera.

Six video tape recorders, including three for use in mobile units with remote-controlled cameras, are part of the TV facilities.

Automation

The television master-control position is equipped with a custom-designed audio-video switcher that presets station breaks, automatically programming film, videotape, and slides. This system provides true- or elapsed-time operation and may be controlled either by the operator on duty or by automated control devices.

Six automatic memory panels display stored program information on "nixie" numerical-readout tubes. Punched cards feed the automation system as the preselected events are successively put on the air. The system performs the following automatic functions: stores an entire day's programming by use of punched cards; switches video and audio sources; previews next event; switches to film, video tape, or slides; starts audio tape; stops film projectors, video tape, or slides; indicates duration of on-the-air event; schedules and indicates next six upcoming events. In addition to the many automatic functions, the system allows overriding for manual control.

Fig. 4. Television master control, located adjacent to studios at third floor center.

Studio lighting systems are also controlled by automatic equipment that provides preprogrammed set-ups for all shows through the use of interchangeable plug-in cards.

Radio Facilities

WFIL radio broadcasting facilities consist of a master control room, two AM studio/control rooms and an FM studio/control room, plus associated announce booths. These are all situated in one segment of the fourth floor between the central core and the outer wall.

AM Master Control

The master console (Fig. 5) is the central control point of AM radio operations. This board handles all programming, whether originated in the master control room or obtained from other sources (live, disc, or tape) in the AM studios or their associated announce booths.

Program sources in the master control room include: two turntables, four reel-to-reel tape machines, and multiple-deck cartridge tape players. A cartridge tape recorder is provided for spot-announcement preparation. Also located in the room are the racks of program transmission equipment.

AM Studio No. 1

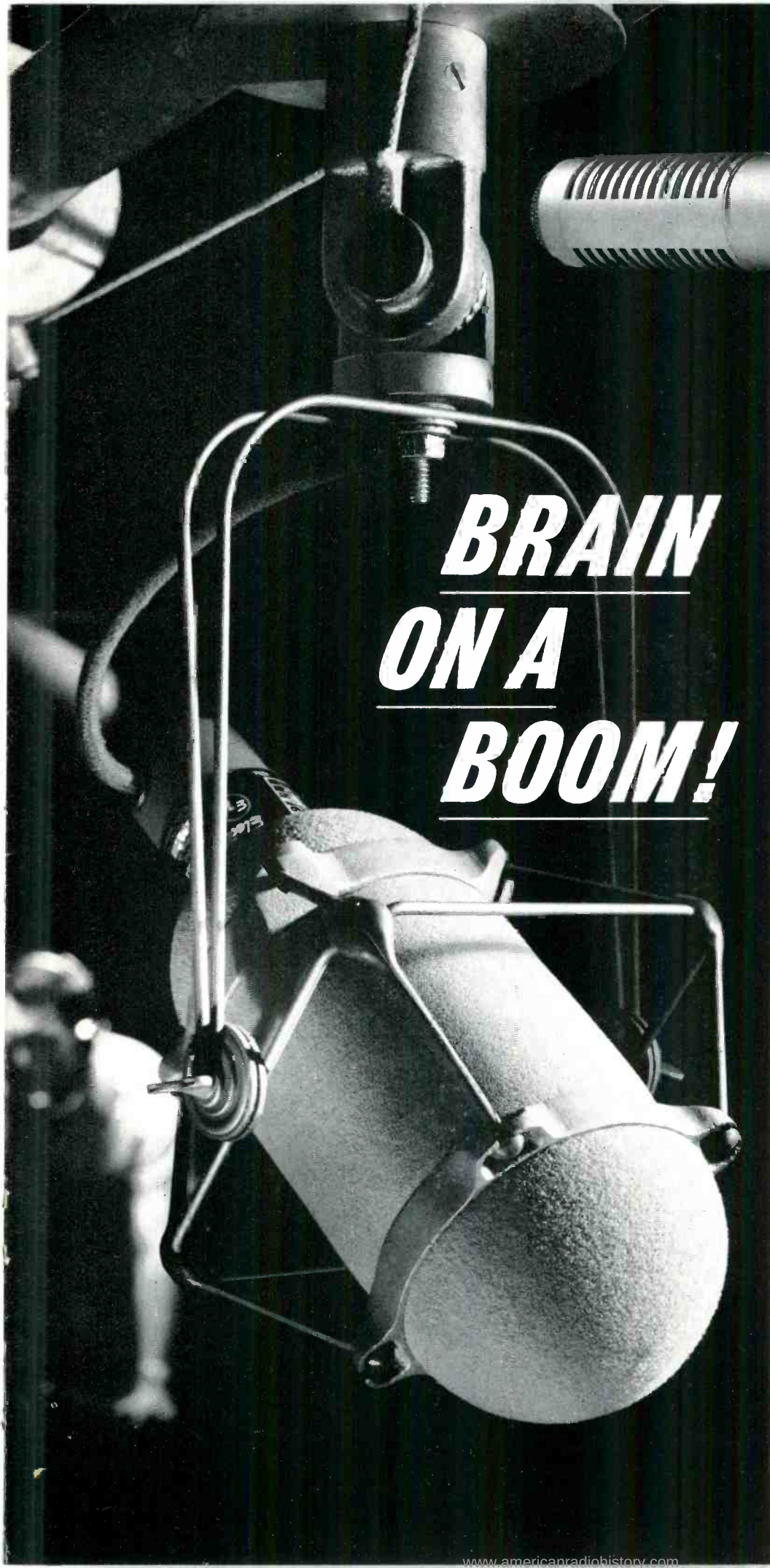
Studio/control room No. 1 contains a console, a six-deck cartridge player, one recorder, two turntables, and two reel-to-reel tape machines. Adjacent to the studio (and separated from it by two large windows) is an announce booth, the microphone outputs of which appear at the console. Also adjacent to AM control room No. 1 (and visually connected to it through another window) is the larger control room for FM programming.

AM Studio No. 2

Studio/control room No. 2 contains the same equipment as Studio No. 1 but excludes the reel-to-reel tape machines. This control room also overlooks an announce booth and, additionally, a larger radio studio from which live-interview and participation programs can be originated. Access to the AM studios is gained through a passageway which connects the rooms with master control.

FM Radio

The WFIL-FM facility comprises a complete broadcast-automation system capable of handling a full day's monophonic programming. High-fidelity material, consisting of newscasts, spot announcements, and station identifications, emanates from a variety of equipment. Controlled by the automation system, two 55-position cartridge machines automatically select tape-recorded cuts, in sequence without resetting or reloading any of the 110 cartridges, of spots, themes, and production sounds. The console equipment includes a dual-channel stereo console (four actual channels), two



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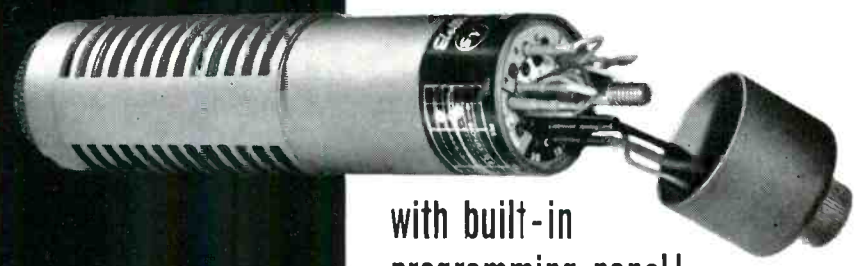

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It's just like having 36 microphones in one, at the end of your boom! Simply match the computer-style programming pins to the color-coded jack field inside the new E-V668. You'll get any combination of flat response (40 to 12,000 cps), bass and/or treble rolloff, treble rise, and 80 or 8,000 cps cutoff. The 668 built-in passive equalizer matches response to need precisely without loss in output level—mixes perfectly with any other microphone.

The 668 cardioid pattern is symmetrical in every plane with excellent rear cancellation at every program setting. Two independent Continuously Variable-D*systems provide this uniformity, yet permit high output (—51 dbm) for distant pickup without added equipment or special cables.

Light in weight and small in size, the 668 with integral Acoustifoam™ windscreen and shock mount minimizes shadow problems while allowing noise-free fast panning, indoors and out. Its 1 lb., 11 oz. weight eliminates "fishpole fatigue" and counterbalancing problems.

The 668 is guaranteed UNCONDITIONALLY against malfunction of any kind—even if caused by accident or abuse—for two years. And, like all E-V Professional microphones, it's guaranteed for life against failure of materials or workmanship.

The E-V 668 is the result of a three year intensive field testing program in movie and TV studios from coast to coast. It has proved itself superior to every other boom microphone available. Find out why with a no cost, no obligation trial in your studio. Call your E-V Professional microphone distributor today, or write us direct for complete specifications.

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Circle Item 27 on Tech Data Card

Fig. 5. The AM radio master control room.

turntables, and six reel-to-reel tape machines. Complete stereo recordings can be made from live sources by use of the adjacent music studio.

FM programming features light classical and classical music in quarter-hour segments. These musical programs are recorded from discs or tapes on reel-to-reel monophonic or stereo record/playback units. A 25-cps tone is recorded on the tape at the end of each segment of music to trigger the next program source. The duration of the tone is such that the music tape will be cued to the beginning of the next program segment when the 25-cps signal ceases.

Each program hour contains approximately 51 minutes of music, one four-minute newscast, four one-minute spot announcements, and four station ID's.

The four 12¾-minute segments of music are tape-recorded by the FM staff as a complete program. These music tapes are loaded onto as many reel-to-reel playback units as are necessary to provide the day's musical programming. The one-minute spot announcements are recorded on tape cartridges—one announcement for each cartridge—which are then loaded into the 55-position cartridge machine. Station identification announcements are recorded sequentially on one tape cartridge.

Fig. 6. WFIL's stereo-equipped FM studio.

EIMAC

4CX3000A powers new 1 KW single-tube AM broadcast transmitter

The Vanguard I is a new 1 KW AM broadcast transmitter from Gates Radio. It contains all solid state circuitry — except for one tube. That tube is Eimac's 4CX3000A. The result is a compact transmitter with extremely reliable performance and ease of maintenance. There were many reasons why Gates chose Eimac's 4CX3000A. It offers excellent gain with low drive requirements.

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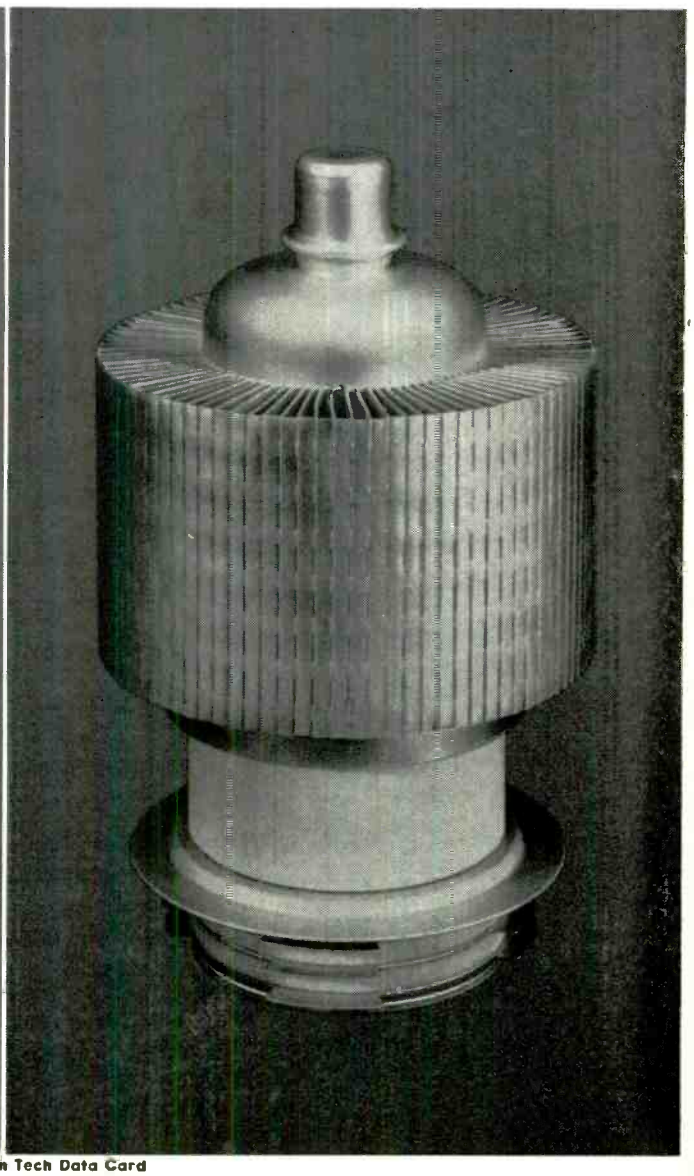


Circle Item 31 on Tech Data Card

Announcement and station ID recordings are cued by audio tones recorded at the beginning and end of each tape. A 1000-cps tone, which occupies the space on the tape loop between start and finish of an announcement, stops the unit, while a 3200-cps tone on the control track starts the next program element.

FM Program Service

Within the WFIL-FM facilities, stereo tape recordings are prepared for use by other Triangle stations and by stereo FM broadcasters who subscribe to the syndicated Triangle program service. A dual-channel stereo console, two turntables, four reel-to-reel stereo tape recorders, and four high-speed tape duplicators are employed in the production of these tapes.

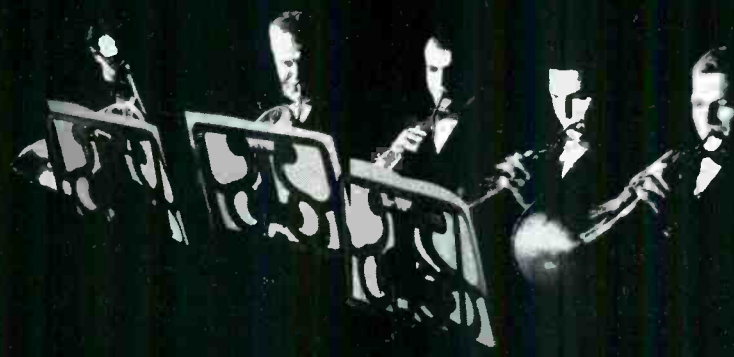
Located between the master control room and the FM studio/control room is a larger music studio used for live AM programs, live FM programs, recording, or rehearsal. This studio has its own control room, announce booth, and microphone facilities. Microphones and earphones are mounted on a centrally-located circular table; each position has an individual control panel on the table's central pedestal. (This unique unit can be seen in the right background of Fig. 5.)

This studio, the largest of the radio operating areas, is equipped with a piano and an organ and is visually coupled to the master control room, the FM control room, its own announce booth, and the No. 1 AM announce booth.

Conclusion

The modern building described in this article, and pictured in full color on the cover this month, houses complete facilities for a radio and television broadcasting complex and program service. Separation of administrative and production areas and proximity of associated operating departments produces an efficient situation and cuts wasted time and space to a minimum.

One of the first circularly-designed radio-television centers, Triangle headquarters is a prime example of pace-setting innovations which are shaping the technical philosophy in the broadcast industry. ▲



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Circle Item 35 on Tech Data Card

ENGINEERS' EXCHANGE

MV Tube Tester and Cooker

by James P. Rodgers, Sr. Engineer, WVAN, Pembroke, Ga.

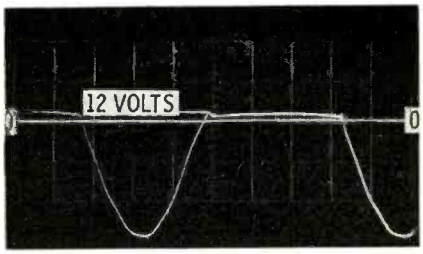


Fig. 1. A new tube fires at 12 volts.

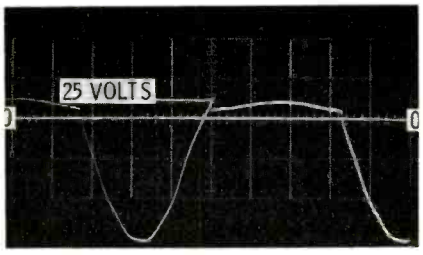


Fig. 2. A marginal 25-volt firing pt.

This unit serves the dual purpose of cooking mercury-vapor rectifier tubes and checking them for firing point, the firing point being a gauge of the tube's useful life. Since this unit uses an oscilloscope —rather than a meter—for firing point indication, some preliminary adjustments on the scope are first necessary.

Most important is that the DC balance be set properly to avoid axis shift and a resultant erroneous reading. The scope selector switch is set to DC and the sweep to 2000 μsec/cm. In the photographs, the scope was calibrated at 50 volts/cm.

Fig. 1 shows a new tube firing at about 12 volts, the normal voltage for tubes in good condition. Fig. 2 shows a used tube that had become unreliable in operation.

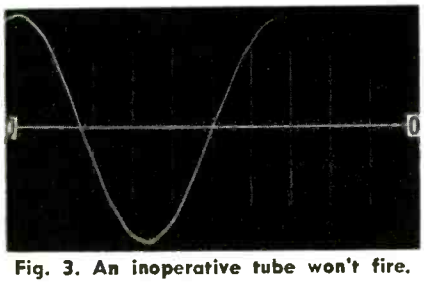
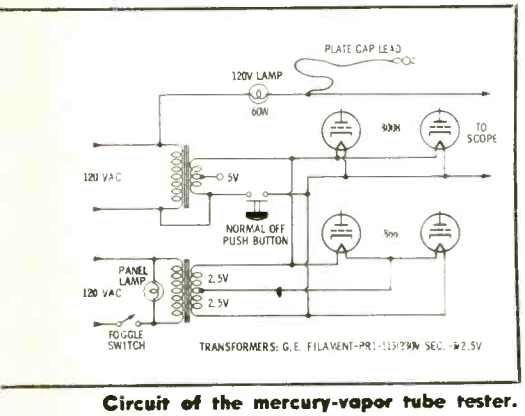


Fig. 3. An inoperative tube won't fire.



Circuit of the mercury-vapor tube tester.

Note that its firing point is 25 volts. Fig. 3 shows a totally inoperative tube whose filament is intact but which will not ionize at all.

Mercury-vapor tubes are frequently suspect in transmitter troubles and are often replaced unnecessarily. This cooker-tester will prevent discarding useful tubes and will also make it possible to anticipate rectifier tube troubles before they occur.

Meter Maintenance

by Robert E. Johnson.
Chief Engineer, WAXU, Lexington, Ky.

Shortly after installing a new RCA BTA 10H transmitter, we observed that about half of the 12 or so Westinghouse meters had become inoperative or sticky in operation. Initially, we assumed that tubes in the metered circuits were going bad because tube replacement appeared to correct the trouble—the meters would then indicate correctly. Later, we discovered that the meters themselves were at fault and would need repair or replacement.

When we learned that the replacement cost for each meter exceeded $50.00, we decided there was nothing to be lost in disassembling one for an interior inspection. (It should be pointed out that these meters all have internal shunts so that, regardless of the condition of the meter movement, the actual transmitter circuitry was unaffected). Disassembly revealed nothing amiss mechanically or electrically; the meter hand was perfectly free in movement. Finally, we discovered that two small nuts that held the dial plate in position also clamped one conductor of the internal shunt to the pointer coil—the nuts were loose. Examination of the other meters showed the same fault in every one of them. Tightening the two nuts restored normal operation and saved us a considerable sum of money.

Ordinarily, the disassembly of a meter is not recommended; this is one repair that is simple and worthwhile, however, and may apply to other makes of meters as well. If you try this procedure, be sure to select a clean place to work; the meter magnet is very powerful and will attract iron filings, etc. Be sure to use a delicate touch when returning the meter movement to the case and take care to engage the meter-adjust pin with the zeroing arm on the movement. Don't forget to replace the fiber seal in the meter case to keep dust out.

One of Those Days

. . . at a one-engineer, remote-controlled, stereo station.

by Harry Furkas, WGMZ, Flint, Mich.

3:00 AM Cat had kittens; cleaned up after her, went back back to bed.

6:30 AM Arrived at the station, turned on filaments.

6:45 AM Turned on plates. Mod montr reads out of tolerance. Try calibrating; won't calibrate, so transmitter probably okay; will try tubes after sign on.

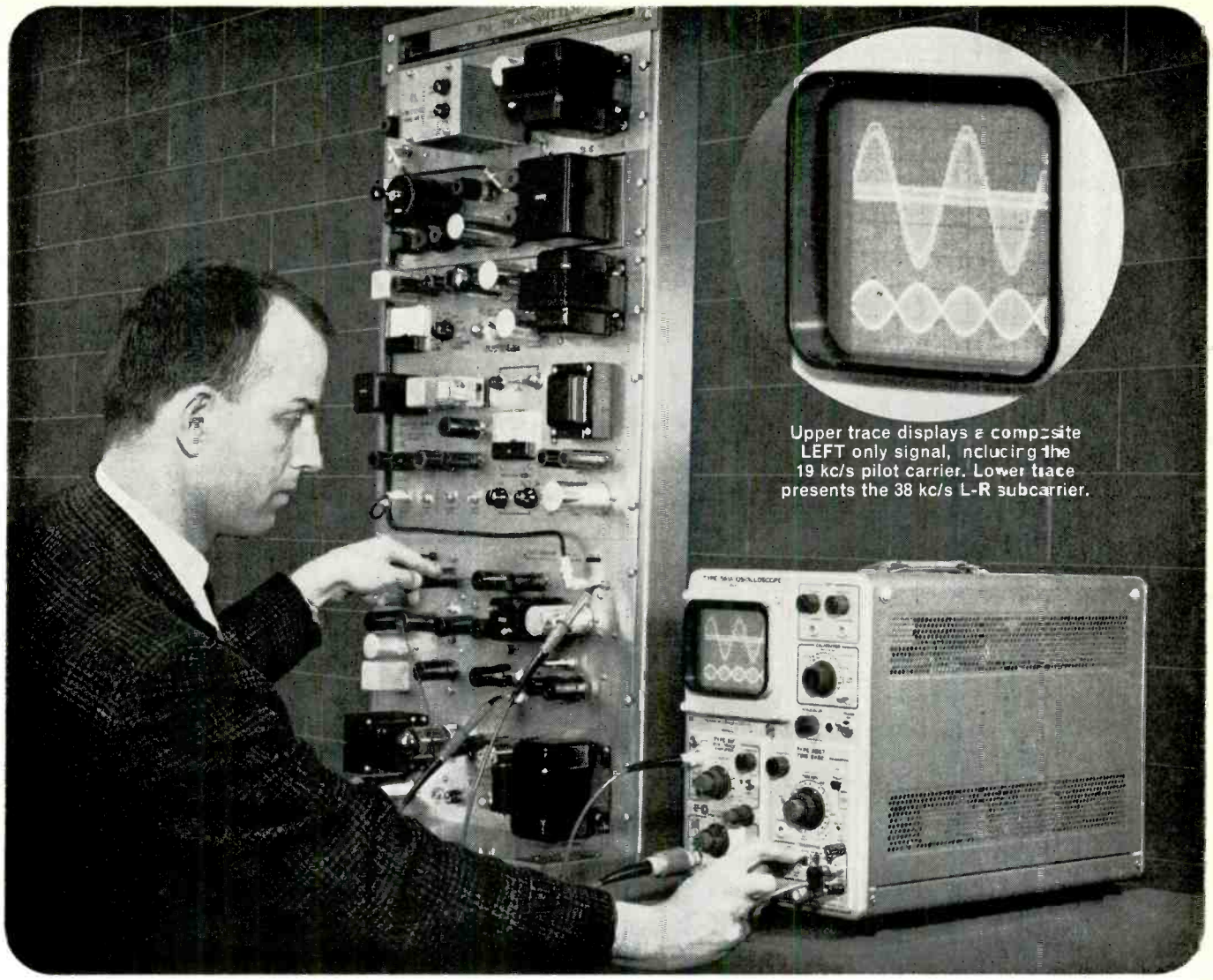
7:30 AM Found two tubes bad. All okay for now.

8:30 AM Relieved by P.D. so I could go to small town, 20 miles away, to check reception of remote xmtr and rcvr for best of basketball tournament at 7:30 tonight.

9:00 AM Arrived at remote site; checked rcvr; all okay. Take to xmtr for test. Static so bad, can't hear signal from remote.

9:15 AM Quick call to boss about ordering phone line (even though probably too late). Called phone co.

10:15 AM Checked new rcvr on trial (which is up today) for SCA reception from



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parent station 50 miles away. Nothing. Found later engineer at other station was adjusting SCA xmtr at the time. Checked again; sounded fair, but main channel was feeding thru and so was static.

11:00 AM Crated the two SCA rcvrs; forgot to enclose instruction book, so had to do it over.

11:30 AM Went home to clean up.

12:00 N Went back to studio as P.D. had luncheon meeting with big bosses in other town.

12:30 PM Asked the boss where sportscaster for tonight's game would be so I could check him out on remote equipment. Boss blew up; said to see the §&%$ P.D. about those little things. Told him P.D. was out of town; more §&%$)".

1:00 PM Went to drug store to buy cotton swabs for cleaning tape heads. Mfr says clean weekly; must be cleaned hourly or they get bassy. (We ran out of swabs last night.)

1:45 PM Had another run-in with boss; I still wanted to know about sports annor.

2:00 PM Went to school (taking course at local college). Odds are against anything going wrong with station during these two hours, out of about 120 hours a week.

2:20 PM Emergency call from studio. Annor turned off xmtr because sound was distorted and deviation meter out of limits.

2:25 PM Left class and called studio. Annor didn't know that on wet days (like today) antenna for mod montr and freq montr gets wet and there is not enough signal to operate fully; also we get our audio monitor from this source so distortion in studio spkr results. Xmtr back on air with 16 minutes lost (this means another report to boss).

2:40 PM Back to class till 3:00.

3:10 PM Went to REA to ship SCA rcvrs back. No petty cash at station; had to get $10 from wife to ship prepaid.

4:00 PM Called telco to see if line would be in. They said yes! (First good thing all day.)

5:30 PM Went to xmtr to pick up equipment for remote.

6:30 PM Arrived at gym and set up gear. Planned on someone else riding gain, but all had excuses. Still don't know where sports annor was. Left directions with wife in case he calls (we hired him just for games, resulting in loose ends).

6:45 PM Line ckd okay.

7:15 PM Annor arrives, then takes off for locker rooms; still haven't checked him out on format.

7:25 PM Game starts with National Anthem. (They used a phonograph and

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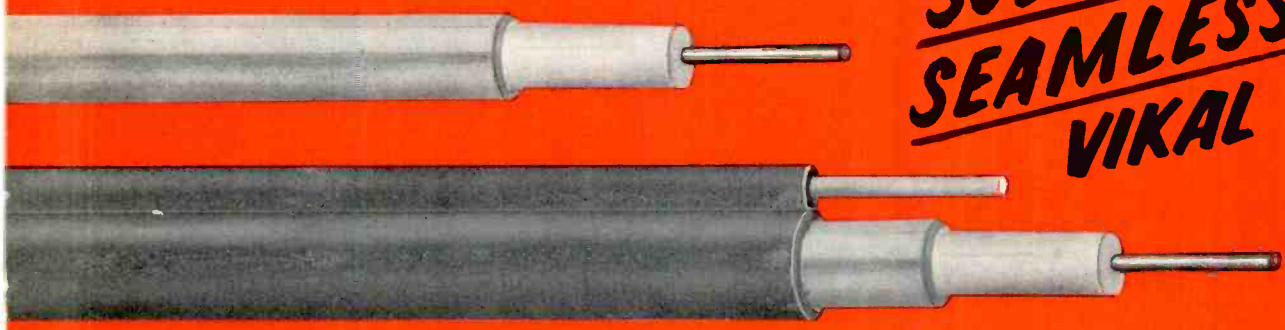
TECHNICAL BULLETIN and
ENGINEERING SPECIFICATIONS



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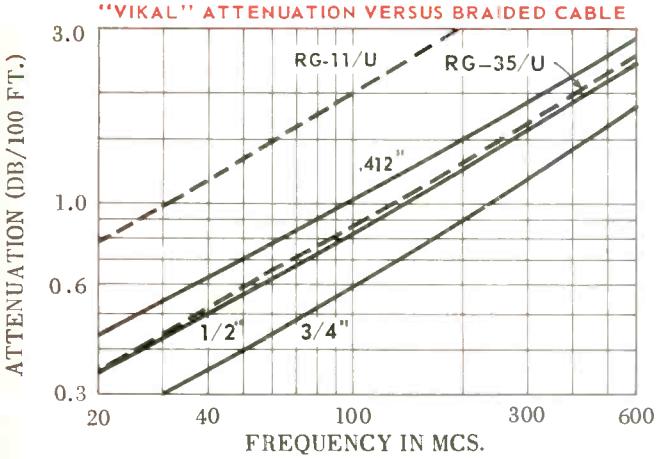

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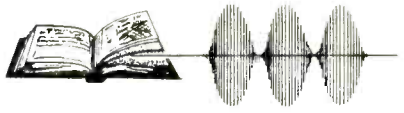
BOOK REVIEWS



Handbook of Electronic Tables and Formulas, Second Edition; Howard W. Sams Engineering Staff; Howard W. Sams and Co., Inc., Indianapolis, Ind.; 192 pages. $3.95. The title of this book might lead one to believe that the entire contents of the volume was in the form of formulas and mathematical tables. In fact, these useful aids comprise only a relatively small part of the reference information available in this revised and expanded edition. A complete listing of the comprehensive coverage this book gives to a broad range of electronic subjects would be nearly impossible, but an examination of the general areas covered should give one a good idea of the scope of the handbook.

The first section is devoted to a discussion of the basic laws and most commonly used formulas. Included are nomographs, conversion charts, and a table of decibel equivalents. The second section contains such highly diverse items as a detailed table of conversion factors (kilowatt hours to joules, kilometers to feet, etc.), an analysis of standard frequencies and time signals from WWV, the content of the composite television signal according to FCC specifications, and the requirements for various classes of FCC licenses. The remaining sections on Symbols and Codes, Service and Installation Data, Design Data, Mathematical Tables and Formulas, and Miscellaneous Data are equally varied and useful in content.

Communication Satellites, George E. Mueller and Eugene R. Spangler; John Wiley & Sons, Inc., New York, N. Y.; 280 pages, hardbound, $10.00. In modern global communications, orbiting satellites are becoming one of the more dependable, although expensive, means of relaying voice and television messages directly to any part of the world. Here's a book that tells about two important aspects of the subject—communications via satellites and the technology of placing a satellite in a communications-capable orbit. As outstanding engineers in the space program, both Dr. Mueller and his former assistant, Mr. Spangler, easily qualify as experts in both areas.

Chapters 1, 2, and 3 introduce problems and choices facing those who design satellite relay systems. Chapter 3 elaborates on the relative merits of passive satellites compared with active relay systems. Considering losses and other factors inherent in passive systems, it isn't difficult to conclude—as do the authors—that active repeaters are the more practical.

From here, the organization of the book seems a little indeterminate, but the information is all there. Chapters 4, 7, 8, and 10 treat of the satellites themselves, while chapters 5, 6, 9, and (part of) 10 are concerned with the communications systems and equipment—the payload and its functions. Chapters 11 and 12 deal with applications and reliability.

Concerning satellites, the reader is familiarized with the effects of, and interrelation among; altitude; micrometeorite activity; radiation such as cosmic, gamma, X-, and ultraviolet rays, plus other little-known radiation phenomena; and time delay in various orbits. Attention is given to problems of attitude and orbit control, and the systems now used for solving them. Satellite structure, methods of temperature (environmental) control, tracking provisions, and command (control) systems also receive their portion of discussion. Telemetry to and from satellites is necessarily associated with tracking and command.

Satellite communications systems require special frequency consideration, if they are to be effective. Also, as one much-publicized experience proved last year, their power supplies must be dependable and long-lived, as well as efficient in power/weight ratio; although nuclear energy systems are under study, present systems must rely on solar cells and storage-batteries. RF power levels are determined primarily by antenna gain, altitude, noise, receiver design, and bandwidth; higher power in a satellite beam means significant weight (payload) increase—to be avoided wherever possible. Modulation techniques are used that keep power requirements at a minimum.

Obviously, you'll not be operating satellites, at least not right away. However, you will be (or may already be) either handling programs that come to your station via satellite (plus network) or originating material (especially news) that will end up being sent to other continents via satellite. For the broadcast engineer whose curiosity about communications satellites is more than merely passive, this book offers a lot of information. The treatment contains just barely enough mathematics to interest those who understand math concepts, but not so much as to slow down the reader who wants only practical information; easily used charts and graphs take the place of unwieldy mathematical formulas.

dropped their needle about half way in and had to start over—HORRORS!) Sound was just barely audible, so we had dead air for that period.

7:59 PM Told anncr at studio we would do ID's from remote. Just heard spot end and cued sports anncr when I heard ID from station. Oh well, as I said before, it was one of those days.

9:30 PM Arrived home. Kittens doing fine. Watched TV for an hour and fell into bed so I would be fresh tomorrow for another routine, uneventful day at the station.

Focus Current Meter

by James W. Slate, Chief Engineer, William and Mary College CCTV, WCWM-FM, Williamsburg, Va.

To set focus current in the Sarkes-Tarzian VCC-4C camera control unit, a potentiometer on the chassis, which varies the grid bias of a 6AQ5 focus regulator, must be adjusted.

The 35-ma current can be measured with a meter brought in from the shop and plugged in to the focus-current jack; the current can also be approximately set by watching the video effects on a picture monitor screen. Needless to say, this can be a difficult procedure just before a show is about to begin.

We have simplified the adjustment by mounting a 50-ma panel meter in the equipment rack, and connecting it to the focus-current jack on either of our CCU's by means of a patch cord.

This assures an accurate adjustment, while eliminating extra trips to the maintenance shop.

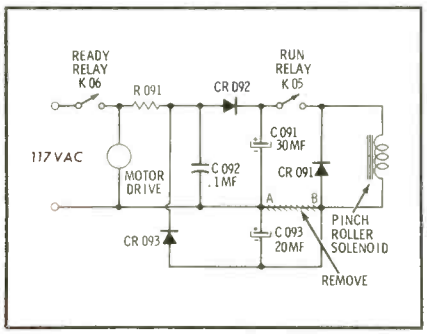
Displaying Licenses

Avoid an FCC citation when the inspector visits by making sure your station's and operators' licenses are posted in the room in which the transmitter or the remote control unit is housed. Do **not** post them in the workshop, control room, offices, or announce booths. If your station license consists of several pages, the pages must be posted separately, side by side. For a neat job, obtain a framed cork bulletin board from your local office-supply house.

Odes E. Robinson

Solving Cartridge Tape Transport Hold-In Problems

by Edgar C. Smith, Chief Engineer,
WFIN AM-FM, Findlay, Ohio



Modified solenoid power supply.

We have found a solution to hold-in problems experienced with RCA RT-7-A cartridge tape playback machines and hope our corrective measures will be helpful to other engineers.

Four of these machines developed considerable wow, accompanied with failure of pinch roller to pull cartridges in when starting. This was found to be caused by insufficient pinch-roller solenoid power. No setting of the pinch roller pressure was satisfactory for all cartridges, and any adjustment was quite critical. New coils with 10% more pull strength were tried, but very little improvement resulted.

We decided to modify the solenoid power supply to a voltage doubler by adding diode CR093 and capacitor C093 and removing the connection between points A and B, as shown on the diagram; this circuit provides 130 volts at 40 ma to the coil. The circuit was bench tested with power supplied to the solenoid coil continuously for more than an hour without serious heating.

One machine was then modified and operated for a month without any of the difficulties encountered previously, and the capstan pressure adjustment was not critical. All of our RT-7-A transports have now been converted and have been operating trouble-free for more than two months. ▲

TV Camera Techniques

(Continued from page 11)

practiced by most operators: Some leave the pan-head lock off and let the base freewheel as they move in, out, or sideways; others prefer to have the pan-head lock on and control the tripod movement with "body english" and a well-placed foot on the cross supports of the tripod base. Clearly, a smoothly-executed dolly movement requires strength and skill, but once mastered, tripod movements are much more flexible than those possible with the heavier pedestal support.

The mobile pedestal, while much larger and heavier, has certain advantages that make it more applicable to creative camera work. Manual control of wheel direction and counter-weighted vertical travel of the panhead make possible many smooth moves in direction, azimuth, and elevation. While the tripod and pedestal both have wheel locks, it is a good rule to leave the locks disengaged when rapid movement may be required. A quick call for movement from the director that finds a cameraman with his locks on may cause unfortunate delays or a lost shot. Directional locking of the pedestal's wheels is possible, but there is usually no need for it. If the cameraman has proper control of the rig, he has stable directional control. With locks off, he can change direction without delay. Using either the tripod or the pedestal, the cameraman can position the camera to capture the best shot using any focal length lens.

Table 3. Ten Basic TV Camera Cues.

1. *Uncap* — Put up a lens so that video can be seen.
2. *Rack focus* — Move the focus handle clockwise or counterclockwise to find focus.
3. *Go tight* — Put up a long focal length lens.
4. *Go wide* — Put up a short focal length lens.
5. *Pan left* or *right* — Point camera slowly left or right.
6. *Tilt up* or *down* — Point camera slowly up or down.
7. *One shot* — Show only one subject or object in frame.
8. *Split focus* — Change point of critical focus to shift center of interest.
9. *Ready camera* — Stand by; your shot will be next.
10. *Hold camera* — Your shot is being taken.

The Mobile Camera

To achieve the greatest variety and interest in television broadcasting, the artistic cameraman must combine his camera's selective vision, the camera's position, and his own imagination with movement while the camera is live. Table 4 lists the seven basic camera moves, all of which will normally be used only upon command from the program director who will also set the rate of the action; i.e., a fast dolly or a slow dolly. Consistently smooth movements are results of practice and experience; but, prepositioning the wheels, clearing cables from the intended path, and firm, even pressure on the camera support are extremely helpful.

In live-camera moves, director and cameraman must coordinate perfectly so that camera movement matches the pace of the dialog, action, and/or background musical theme of the shot. Smoothness and aptness are difficult to achieve but are necessary and rewarding.

When more than one camera is used for any production (and in most studios this is the rule rather

than the exception) each cameraman must know what the other is doing all the time. By a visual check of another camera's lens turret, a good cameraman can tell what the other camera is seeing, and he will not duplicate the composition. When not under specific direction, he will explore the action, trying for a shot that may complement the other camera's view, to offer the director a variety of coverage. He will also try to keep a usable shot at all times so that if, in the heat of control-room action, his camera is brought live by mistake, the error will not be obvious.

Cables from two or more cameras can offer a real navigational challenge, and if no floorman is available to clear paths, the cameraman must be sure that he charts a course to avoid them. During a fast dolly, striking a cable with a light tripod can upset the entire camera rig—a disturbing situation, at least.

Summary

While most of the suggestions made in this article are elementary, they warrant careful consideration by cameramen who may have been giving little thought to any except technical aspects of the television camera. Disregard of esthetics can cause the average quality of television production to suffer greatly —and when program quality suffers, the engineering and production staffs (and management, too) come up losers. A cameraman, because of the technical responsibility he has to the instrument, must be a good engineer; but, he must also demonstrate an extra degree of ability or interest. That "something extra" is what makes a camera operator a fine cameraman! ▲

Table 4. TV Camera Movement Cues.

Truck right — Move camera rig right, parallel to the action.
Truck left — Move camera rig left, parallel to the action.
Dolly in — Move camera rig closer to action.
Dolly out — Move camera rig farther from action.
Arc around — Move camera rig in a partial circle around the action.
Pedestal up — Elevate the camera on the pedestal column.
Pedestal down — Lower the camera on the pedestal column.

Rear-View Projection

(Continued from page 15)

being virtually jam proof, making it particularly useful for remote operation. For some installations, projector modification may be necessary. A remote-control panel with only forward, reverse, and focus controls would require no alteration of the projector. Nevertheless, for complete remote operation (and for greater lamp reliability) certain changes are recommended.

Fig. 3 illustrates the relay-switching circuitry used to supply 24 volts for preheating the projector lamp when the remote power switch is closed. Full line voltage is applied by K2, which is energized by the remote lamp switch on the remote-control panel. The elapsed-time meter runs only when the projection lamp is at full brilliance. In the interest of economy, the elapsed-time meter may be omitted; however, with no accurate record of lamp "on" time, a higher incidence of lamp failure while on the air may be expected, unless a conservative lamp-change schedule is established.

Before actual modification of the projector is begun, careful inspection of the remote-focus switch furnished with the projector is recommended. Recent models have a single diode—located inside the plastic remote-control housing—for the focus motor. The use of only one diode apparently supersedes the dual diodes previously used, which were located in the projector as shown in Fig. 4. If this proves to be the case, include two silicon diodes on the remote panel with polarities as shown in Fig. 4A. Check cable continuity with an ohmmeter to verify the connection between the focus motor and pin 4 on the remote receptacle.

Connections for the remote fan- and lamp-control switch are made by disconnecting the FAN, HIGH, and LOW buttons and extending the appropriate wires to a female, chassis-mounted connector that can be conveniently installed on the projector's bottom plate; use No. 18 stranded wire.

A 4″ × 5″ × 6″ aluminum box was used to house the elapsed time meter, the lamp-preheating transformer, and a terminal strip. The box is mounted near the projector.

Octal sockets (not shown) on the bottom of the terminal box receive standard 24-volt-DC plug-in relays. A larger box may be needed if relays other than plug-in types are used. A short four- or five-wire cable connects a terminal strip inside the aluminum box to the existing remote receptacle on the rear of the projector. Five wires are used only on the older models having two focus-motor diodes located inside the projector.

Wire size for the eight-wire cable from the terminal box to the control-room panel (shown in Fig. 5) should be large enough to prevent undue voltage drop in the "change" and "reverse" circuits. If cable resistance exceeds 10 ohms, unreliable reverse cycling may result.

The remote-control panel shown schematically in Fig. 6 requires little further explanation. Note, however, that the focus control should be a momentary-contact, center-off switch.

The housing seen in Fig. 7 serves the dual function of protection and sound suppression; ¾" plywood may be used. All inside surfaces except the bottom should be covered with a nondusting, sound-absorbing material. Position the ventilating holes carefully. A clearance well in the bottom will probably be needed for the plug. Ream the well oversize to facilitate later projector alignment.

Some paper work will be needed before choosing the mirror size. No decision should be made until the lens-slide combination is settled. Fig. 8 illustrates the constant and variable angles involved.

A protective housing should be built for the mirror. Leave one end of the mirror free until its exact position is determined. Needless to say, all optical components of the system must be mounted on a common plane to avoid keystoning the picture.

Conclusion

While the limited brilliance of the standard 35 mm projector used in this RVP system has held screen size to a modest dimension, the production value of the installation has been tremendous. Especially considering the cost of the entire project, KTTS-TV's RVP system is a complete success. ▲

Program Logger

(Continued from page 13)

is not isolated from the AC power line; grounding any part of the circuit to the metal cabinet may create a hazardous situation.

Operation

We use three methods to file and identify the program-log tapes. White plastic leaders attached to each end of the tapes carry legends such as "Track No. 1, WDSU-FM Program Log, Feb. 27, 1964, Operator John Doe." The operator's signature here also serves to authenticate the track. A legend is inscribed for each track of the tape, so that a completed reel will carry four notations, two at each end.

A voice announcement is recorded by the operator at the very beginning of each track, as follows: "This is track number one. The WDSU-FM Program Log for February 27, 1964. The time announcements inserted in each quarter hour are not part of the program transmitted and are inserted for time identification only. Program recording starts at 2:53 PM, Central Standard Time. The operator is John Doe."

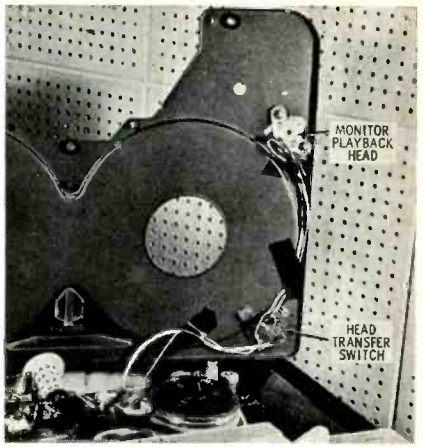


Fig. 5. Monitor head and switch mounting.

The third device we use for identification is a label, shown in Fig. 7, which folds over the edge of the box and is visible when the reels are stacked. The main area of the label, on the face of the box, is used for any comments the operator may find necessary to make.

This system was assembled at low total cost, primarily from components on hand. It has been operating satisfactorily for some time now since replacing a unit of commercial equipment that was purchased about a year ago to perform the same function. The logger is well accepted by our staff, which finds it easy to use and efficient in operation. We hope the general design of this system and this brief description will prove valuable to other stations that have a need for automatic program logging. ▲

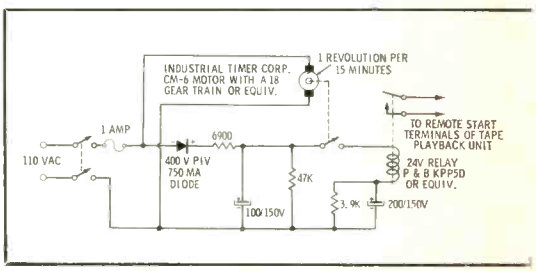


Fig. 6. The fifteen-minute interval timer.

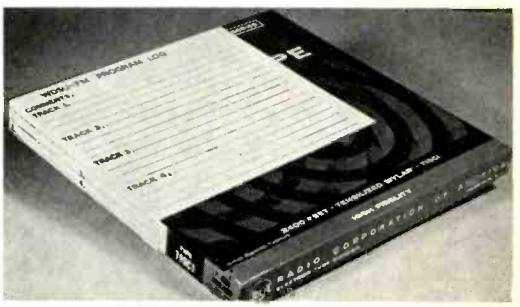
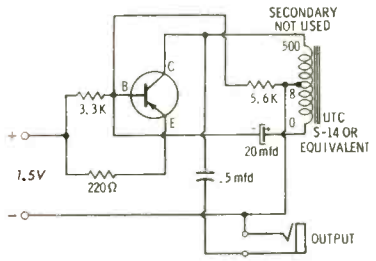


Fig. 7. Labelled logger-tape file box.

Miniature Transistorized Audio Oscillator



Circuit of audio oscillator.

We here a WIAM, like most station engineers, like to experiment. Sometimes we do this experimenting much to the dismay of our station management, as the bills don't often show the end results. Taking this into consideration, I won't pass on any of our larger "goofs" but will offer a simple and, we think, useful gadget.

If you've looked at the circuit, you are probably thinking right now, "So who needs another audio oscillator?" But consider that this one will operate 24 hours a day for more than six months powered by nothing more than an 18-cent flashlight cell.

The circuit is essentially self-explanatory; none of the parts values are particularly critical. Notice there is no on-off switch, as our units operate continuously. I might add that the output signal level remains fairly constant duirng the life of the cell; you could add a level control, though, if desired.

The little oscillator is built in a 1¾" x 2" x 4" aluminum box, with the transformer mounted on top. A phone jack serves as the output termination to permit, by use of various leads, feeding the signal to almost any equipment or circuit.

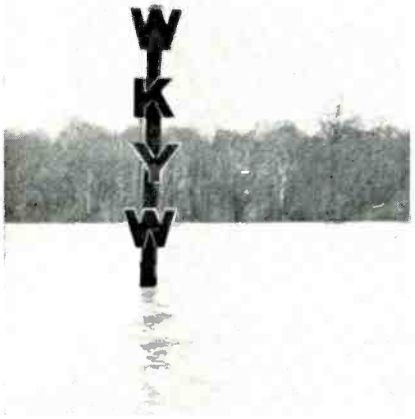
The oscillator operates between 700 and 800 cps; this frequency can be lowered by connecting an appropriate capacitor across the 500-ohm winding of the transformer. We've built two of these units, one using a G-E—1 transistor, the other a 2N1287, so I believe we can safely state that almost any audio transistor will do.

What about distortion? It sounds alright, but I wouldn't go to the trouble to check it. The little device is a handy gadget which provides good time tones and helps trace troubles in audio circuits. Some may laugh at my making such a big "to-do" over something so simple, but we find it useful, as do several neighboring stations.

Walter L. Johnson, WIAM
Williamston, North Carolina

NEWS OF THE INDUSTRY

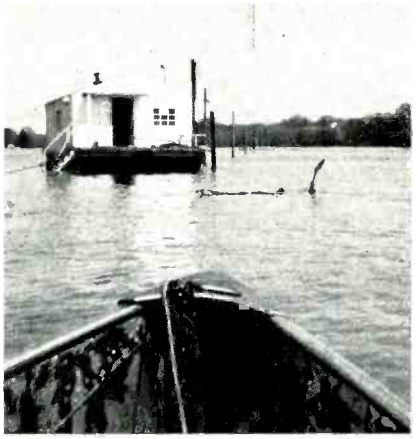
NATIONAL



WKYW Floats During Flood

William Neff, chief engineer of **WKYW,** Louisville, and his assistant **Davis Shouse** kept that station on the air while 21 feet of Ohio River swirled under the transmitter house during a flood earlier this year. Neff is not a stranger to the navigation of his unique floating transmitter house. The WKYW design employs war-surplus aluminum pontoons which support a wooden house about the size of a large single garage. This type of construction was decided upon when WKYW first went on the air in 1947 because the desired site, close to the Ohio River, was subject to high water. Excellent ground conductivity and proximity to the city of Louisville dictated the use of this site, even considering the danger of floods. The pontoons were elevated on concrete pillars to a height that was above all previous high-water levels except for that of 1937.

In two years previous to 1964, water rose high enough to float the transmitter house. When flooding occurs, lines are put out fore and aft, and as the structure floats off the concrete pillars, these lines help maintain the building's position and guide the pontoons as they



settle when the water drops.

During the 1964 flood, continually rising river water came pouring over the lowlands. Although the tuning unit at the base of the 376' guyed tower was mounted on an elevated pillar, it was soon covered. Anticipating this situation, Neff had rigged a shunt-fed, single-wire antenna which he attached to a point a quarter-wavelength up the tower. Number 6 soft copper wire was used, fastened to the tower with a cable clamp. The transmitter was retuned using a .005 variable capacitor in the feedline; taps on the output coil of the transmitter were changed to secure about 700 watts output. The modified installation was operated 12 hours daily for over a week until regular equipment was back in service after the waters had dropped.

WKYW engineers used an outboard skiff to reach the nearest dry land three blocks away and had many an anxious moment as debris was swept down the swift current in their path. Telephone and electric utilities were able to maintain service, but an emergency STL was rigged in case the phone lines went out.

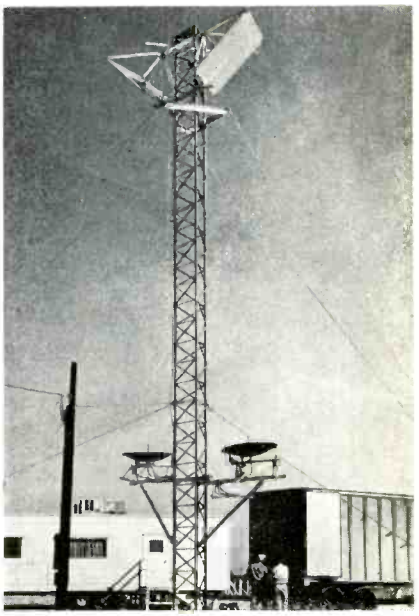
Top Power for ETV

The **General Electric** directional zig-zag panel antenna shown in the accompanying photo will make **KCET,** Los Angeles, the country's most powerful ETV station. KCET will use it with a G-E 25-kw UHF klystron transmitter for an effective radiated power of 1.2 megawatts. The antenna, with maximum gain in excess of 50, will provide a semicircular "butterfly" horizontal pattern from its site atop Mt. Wilson. Checking data at the company's test site near Syracuse

are Ronald E. Fisk, left, G-E antenna engineer, and James A. Mead, KCET special projects engineer. Greater Los Angeles has been the country's largest metropolitan area without a noncommercial TV broadcasting service. KCET will be operated by **Community Television of Southern California.**

RCA Prices Increase

Price increases ranging from 5% to 11% on most items of radio-TV broadcast equipment manufactured by RCA have been revealed by the **RCA Broadcast and Communications Products Division.** C. H. Colledge, Division Vice President and General Manager, attributed the increases to higher costs of labor and materials. Products affected by the increase and their new prices were announced on August 15, and the new price schedule will become effective October 1.



Towers Aid Army Operation

Shown in the accompanying photo is one of 12 passive microwave reflectors which moved 600 phone calls simultaneously over a 250-mile area during the Army's recent massive "Dessert Strike" operation in the California-Arizona desert. The reflectors, fabricated for **Rohn Mfg. Co.** by **Reynolds Metals Co.,** were installed and operated by the **Pacific Telephone and Telegraph Co.** The reflectors are for two directional 11-gc beams with the microwave "dishes" below. The trailer at the right houses the transmission equipment and all phone gear, while the one at the left serves as an office.

First All-Silicon CATV

Construction is now underway in Cocoa Beach, Fla., of the CATV industry's first all-silicon-transistorized system. In making this announcement, Dr. Byron S. Clair, president of **Westbury CATV Corp.,** pointed out that this system was selected because of the superior temperature stability provided by its silicon circuitry. The installation is being made under contract for **Cumnicable, Inc.**

New Transmitter Line

Visual Electronics Corp., a major systems supplier to the broadcast industry, will market a new line of AM-FM broadcast transmitters according to James B. Tharpe, president of the organization. The group will include FM transmitters of 250 watts, 1 kw, 5 kw, 10 kw, and 20 kw, while the AM transmitters will be 1, 5, 10, and 50 kw models. The FM transmitters are designed for operation with stereo and/or SCA subcarriers.

PROPERTY TRANSACTIONS

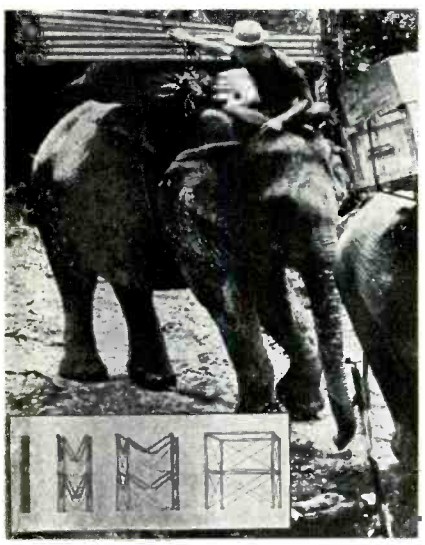
The sale of **KCOL** (1 kw, 1410 kc), Fort Collins, Colo., has been announced by Mr. and Mrs. Ellis Atteberry, to **Beef Empire Broadcasting Co.,** Mr. E. F. Huse, Jr., president. Beef Empire also owns WJAG, KVSH, and KCFR, all in Nebraska.

KRIG, fulltime 1 kw in Odessa, Texas, has been sold to **KRIG, Inc.,** by Bayard C. Auchinloss, who also owns KWCO in Chickasha, Okla. Joe Garrison, head of KRIG, Inc., also owns KVWC in Vernon, Texas.

KOBE, fulltime 250-watt station in Las Cruces, New Mexico, has ben sold by **Mesilla Valley Broadcasting, Inc.,** to **Las Cruces Broadcasting Co.**

KGBC, 1 kw daytime, 250 watts nights, on 1540 kc, has been sold by the **Galveston Broadcasting Co.** The buyers are **Harbor Broadcasting Co.,** E. B. Taylor, president.

INTERNATIONAL



Elephants Transport Towers

Portable aluminum towers are probably the lightest load elephants must carry for transporting major equipment to remote sites in Thailand for construction of microwave links of the U.S.-sponsored Thailand Communications Project. Radio relay represents the bulk of the 2300-mile communications system being constructed for the Thai government. Used for path-loss testing, the one-piece aluminum tower sections are unfolded at the site and erected one on top of the other to reach the desired height. Lifted by a davit attached to the top section, the sections lock into place without nuts, bolts, tools, or loose parts. The strong structure is stabilized by guy wires and supports test equipment at various heights on the tower. Since constant relocation is required, lightweight towers are the only practical equipment for the operation; the towers are manufactured by **Up-Right Scaffolds,** Berkeley, Calif.

American Dimmers to Japan Games TV

A contract to provide electronic dimmers for Station NET-TV, Tokyo, has just been awarded to **ColorTran Industries.** This marks the first time an American firm has been named to supply electronic dimming equipment to Japan's booming communication industry. Terms of the contract require the dimmers be installed in time for the 1964 Olympic Games in Tokyo. The dimmers will be used to control 600,000 watts of light on a giant TV stage now being built in Tokyo. The stage is expected to be one of the most modern in the world. The dimmers employ a new kind of solid-state controlling device known as Silicon Symmetrical Switches (SSS), and were accepted after a demonstration of prototypes satisfied NET-TV officials. The SSS's are manufactured by **Hunt Electronics.** Production of the entire NET-TV installation will be under the control of **Ryu-Den-Sha Co.,** of Tokyo, a lighting manufacturing firm with whom ColorTran has joint licensing arrangements.

PERSONALITIES

Franklin W. Butte, who joined **Northern Television, Inc.,** as chief engineer of KTVA and KNIK-FM on August 1, 1963, has been promoted to technical director of corporate engineering operations, it was announced by president **A. G. Hiebert.** Mr. Butte's responsibilities will include technical supervision of KTVA, KNIK-FM, and Muzak in Anchorage, as wel as KTVF in Fairbanks, and all seven of the company's translator operations.

John Andre has recently been appointed sales engineer of the Washington, D. C. area, for **Rust Corp. of America;** the announcement was made by **Sal Fulchino,** president. Mr. Andre will represent the complete line of Rust products, including transmitters, remote-control equipment, and automatic logging gear.

Organizational changes in the sales department were recently announced by **Gates Radio Co.,** a subsidiary of **Harris-Intertype Corp. Eugene O. Edwards** has been promoted to manager, Broadcast Sales. In this new post, Mr. Edwards will supervise domestic field sales activities from coast to coast. **Edward S. Gagnon** has been named to fill a new position as manager, product marketing, responsible for management and merchandising of commercial products. **George Yazell** has been named manager, customer services, with responsibility for administration of customer contracts and service functions.

Visual Electronics Corp. announced the appointment of **Dallas N. Barnard** as sales representative for the West Coast. Mr. Barnard will assist **Alfred M. Kallman,** Visual's Western Div. manager of Hollywood, California, to meet the needs of television stations in re-equipping facilities now over 10 years old.

C. Gus Grant, formerly vice president/general manager, video and instrumentation division of **Ampex Corp.,** has been appointed to the newly created position of vice president - operations, it has been announced by **William E. Roberts,** president and chief executive officer. In his new post, Grant assumes responsibility for three Ampex divisions —video and instrumentation, marketing (both headquartered in Redwood City, Califorina), plus consumer and educational products (Elk Grove Village, Illinois). **Robert Weismann,** formerly manager of engineering for the video and instrumentation division, succeeds Grant as general manager of the division.

Bruce Singleton, of Albany, Georgia, has been named director of engineering for the **Sarkes Tarzian broadcast stations.** The stations include WTTV, Bloomington - Indianapolis, WPTA - TV and WPTH-FM, Fort Wayne, and WFAM-TV, Lafayette. Simultaneously, Donald H. Morgan has been promoted from assistant to chief engineer of WTTV.

William J. Moreland and **Damon Van Utt** have been elected vice presidents of **Giannini Controls Corp.,** it was announced today by **Donald H. Putnam,** president. Moreland is general manager of the Conrac Division, manufacturer of broadcast and closed circuit television equipment. Van Utt manages the Cramer Division, producer of timing motors and interval and cycling timers.

CA and Pay TV

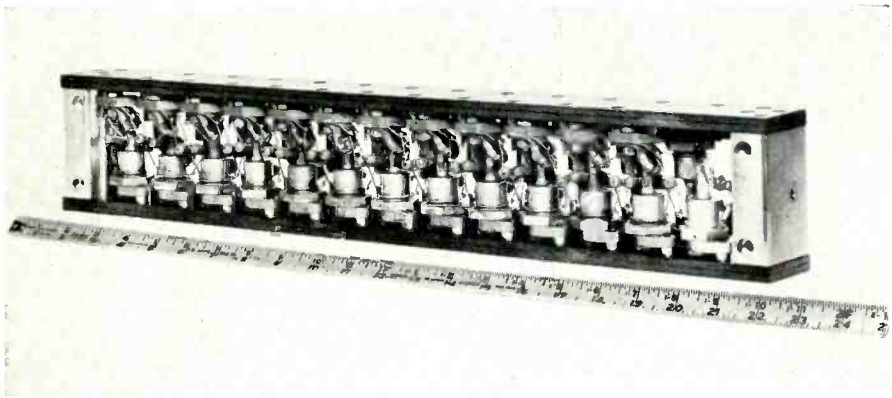
Several circumstances over the past few months have suggested that broadcasters in growing numbers feel that, where the CA and Pay TV dollar is, so should the broadcaster be.

At the July NCTA convention in Philadelphia, representatives of several broadcasting groups now actively involved in (or contemplating involvement in) CATV systems met to air their views. The general consensus was: Who is better equipped or prepared to offer the additional service, for which many viewers are willing to pay, than the established broadcasters—particularly, the telecaster? Attendance at the convention by many broadcast attorneys, manufacturers, and broadcasters not now affiliated with CATV reflects an increasing interest in the whole picture.

On August 3 and 4, in Atlanta, the Georgia Association of Broadcasters held a seminar to which both proponents and opponents of CATV and Pay TV were invited to state their positions. Broadcasters, the NAB, the FCC, and media executives (with some notable exceptions) seemingly accept CATV systems as "having arrived" in the competitive marketplace. About Pay TV, they are less certain as to what cultural or economic position it may take, but are prepared to admit that at least part of the viewing public will pay for commercial-free programming of a specialized nature, and that Pay TV will become increasingly active in the field of entertainment. Many at the GAB seminar felt that CATV and, to a lesser extent, Pay TV offer a real opportunity for increasing the broadcaster's slice of the entertainment dollar.

The matter of regulation of CATV activities, however, remains a thorny problem—one that must be resolved before all elements of the controversy are sifted into their final place in the entertainment market.

NEW PRODUCTS



High-Power Rectifier Columns

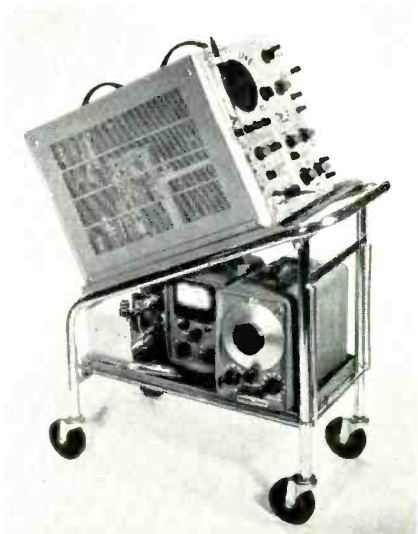
A high-voltage rectifier column has been announced by **International Rectifier Corp.**, who claims that in relation to volume vs function the new assembly is one-half the size of units previously produced. Its operating specifications indicate greater performance capability than those embodied in previous rectifier columns. The column was developed for use in long-range radar installations, high-power electrochemical precipitators, and high-power radio transmitters. Designated the 4HW, the device is available in ratings up to 25 kv peak reverse voltage; continuous average current up to 70 amps; surge-current capacity of 2000 amps peak for 8 milliseconds; and continuous power ratings up to 400 kw per column (when voltage is applied in a three-phase bridge and working PRV equals approximately 50% of rated PRV). All diodes are shunted by appropriate resistance-capacitance networks to insure equal voltage division and damping of commutation transient spikes along the series string. The operating temperature range is from −65° C to +120° C. Cooling may be accomplished by oil, forced air, or free air convection.

Circle Item 60 on Tech Data Card

Cylindrical TV Camera

A miniaturized television camera with integral camera control circuitry and zoom lens all contained within a sealed 3" diameter cylindrical housing is being offered by **Cohu Electronics, Inc.** The control unit attaches directly behind the camera head. The 2000-series camera has all solid-state circuitry and is of modular construction. The camera may be used in applications requiring continuous-duty televising from fixed or moving camera positions, where space and weight are critical considerations. Output video and DC power can be conducted on a single triax cable. Optional accessories include a video line-driver amplifier or RF modulator and a selection of fixed-focal-length and zoom lenses. The camera may be operated from a 24-volt DC source, permitting mobile or "back-pack" operation.

Circle Item 61 on Tech Data Card



Sturdy Scope Carts

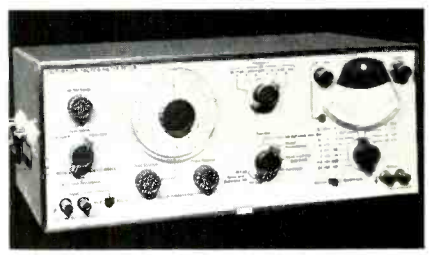
Two low-cost scope carts are available from **Atlantis Electronics.** They feature 25° scope tilt for comfortable observation, long-life construction, a convenient 8′ three-wire cord, and three cart-mounted receptacles. Four-inch swivel wheels provide easy transport of scopes wherever needed. Both models are collapsible for easy storage. Frame construction is of 1" steel tubing, while the top tray is of 20-gauge steel with nickel-chrome-plated tubing throughout; the lower tray of 24-gauge steel provides easy-access storage. Model C, 29" x 15" x 27", with wiring receptacles, is priced at $47.95. Model D, 42" x 15" x 27", with wiring receptacles, is $49.95.

Circle Item 62 on Tech Data Card

Utility Recording Microphone

Special Product Division of LTV University recently announced a new microphone, the Model 8000 Shock Mounted Cardioid Dynamic. Primarily designed for utility recording, it is also ideally suited for location broadcasting of AM, FM, and television, and for school applications. A special feature is the new warranty which guarantees the microphone against defects in material and workmanship for a period of five years. The dynamic element produces a wide frequency response from 70 to 15,000 cps. The diaphragm will, under normal operating conditions, retain its original level of performance throughout the life of the microphone. The price is $29.95.

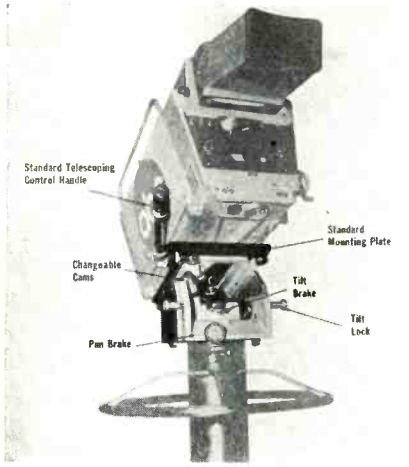
Circle Item 63 on Tech Data Card



Solid-State Analyzer

A fully transistorized Distortion Analyzer, Model 2331, which covers fundamentals from 20 cps to 20 kc (80 db suppression) and has two switched bandwidths of 100 kc or 20 kc, has been developed by **Marconi Instruments.** Distortion measurements can be made down to .05% from 200 cps to 6 kc and .07% over the remainder of the band. The analyzer can also be used for noise measurement relative to signal level; instrument noise is less than .01% (100 μv) with 20 kc bandwidth. The mean level voltmeter is calibrated in rms volts from 1 mv to 10 volts full scale and has 3% accuracy over the band 20 cps to 100 kc. Instrument distortion is less than .025% from 200 cps to 6 kc and less than .04% elsewhere. An optional LF cut eliminates hum components while a broadcast weighting network can be provided for noise measurement.

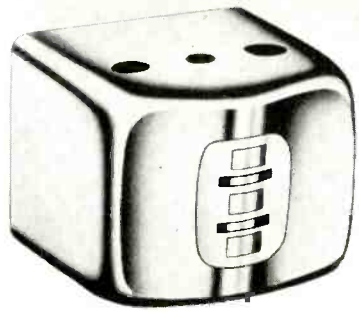
Circle Item 64 on Tech Data Card



Cam Operated Camera Head

Houston Fearless Corp. has designed a camera mount to hold all types of black and white or color television cameras. The new head uses a cam to provide a balance of the load and its resultant forces providing very smooth operation. Interchangeable cams are available to meet the requirements of each particular camera. The head has a 500 lb. capacity and retains all of the operational features of standard Houston Fearless heads, including pan and tilt brake, pan and tilt friction, central positive tilt lock, and the standard telescoping control handle. The assembly weighs 46 lb.

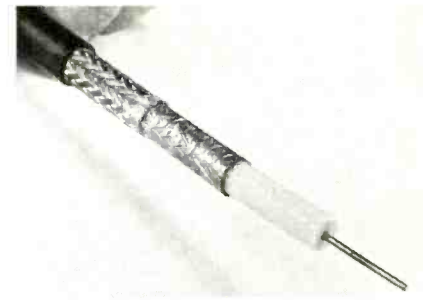
Circle Item 65 on Tech Data Card



Three-Channel Head for ¼" Tape

The **Nortronics** Model B3Q (5700 Series) is an all-metal laminated core head with hyperbolic contour which meets NAB standards for tape cartridge players in stereo applications. Designed for three-channel record and playback, the head has three .043" tracks located on .100" centers, deposited quartz gaps, and low-loss core structures. It is available in rear-mount, base-mount, side-mount, and no-mount styles. Applications include stereo spot announcements with two stereo channels and one cue channel, and three-channel stereo. Model 5701 (a no-mount playback head with 360 mhy inductance) and Model 5702 (a no-mount record head with 100 mhy inductance) are recommended for direct replacement on broadcast cartridge players.

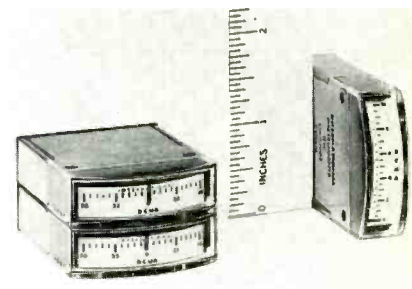
Circle Item 66 on Tech Data Card



CATV Cable

A double-shield cable designed to replace present solid- and braid-shielded television transmission cable has been introduced by **Amphenol Cable,** a division of the Amphenol-Borg Electronics Corp. The new cable, designated 621-149, is designed primarily for community-cable services and transmission of subscriber-paid television programming. It has a solid-copper center conductor insulated with a polyethylene-foam dielectric, over which a thin copper foil has been longitudinally wrapped. A standard copper-wire braid layer covers the foil, and the entire cable is jacketed in black polyethylene. The new cable is said to be more flexible than solid aluminum- and copper-shielded cable, yet possesses a better attenuation factor than braided cable.

Circle Item 67 on Tech Data Card



Stackable Miniature Panel Meter

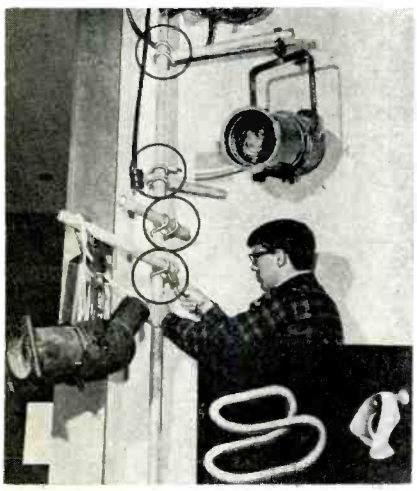
International Instruments, Inc., has developed a completely "flat" miniature edgewise-reading panel meter. Overall thickness is little more than half that of the previously available Model 1120. The barrel-less Model 1122's can be stacked one on top of another (for horizontal-scale models) or side-by-side (for vertical-scale models) without limit. There is no interaction, according to the company, between adjacent meters on either magnetic or nonmagnetic panels; the meter incorporates a self-shielded, permanent-magnet, moving-coil meter movement to eliminate such effects. Sapphire jeweled pivots and Alnico-5 magnets are used. The meter measures 1.6" wide (or high), 0.515" thick, and 2.35" deep. It weighs approximately 4 oz. Initial accuracy for DC meters is ±3% of full scale; for AC, ±5%. Available models include 20 DC ranges from 0-100 microamp to 0-15 amp, 11 DC voltage ranges 0-50 mv to 0-500 volts, and six rectifier-type AC voltmeter ranges. List price is approximately $19.00 for standard models.

Circle Item 68 on Tech Data Card

Dual-Legend Pilot Light

Broadcast equipment designers are offered a dual-legend "Line-O-Lite" manufactured by **Industrial Devices, Inc.** The pilot light measures 7/16" x 1⅜" and houses two lamps which can be illuminated either individually or simultaneously and can be supplied with three or four leads. Contrasting-color lenses (e.g., red and green) can be fitted in order to achieve maximum attention. Other available lens colors include amber, translucent white, or clear. Bezel can be supplied in bright chrome, black, gold, or brass finishes.

Circle Item 69 on Tech Data Card



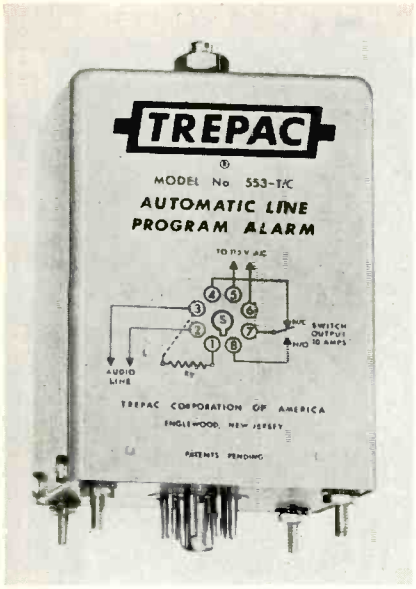
Adjustable Lighting Clamp

Complete flexibility in positioning theatrical or studio lighting is accomplished by a new locking device manufactured by **Up-Right Scaffolds, Inc.** Consisting of an open loop and a saddle, the device locks pipe at right angles to the main boom by means of a single set screw. Quickly installed, it can be moved along the pipe and locked at any position. Because of its open-loop design, the device can be added to permanent pipe fixtures or hand railings even when the end of the pipe is not exposed. To support the torsion loads of suspended instruments, the lock has twice the strength and 5 times the rigidity of conventional fittings.

Circle Item 70 on Tech Data Card

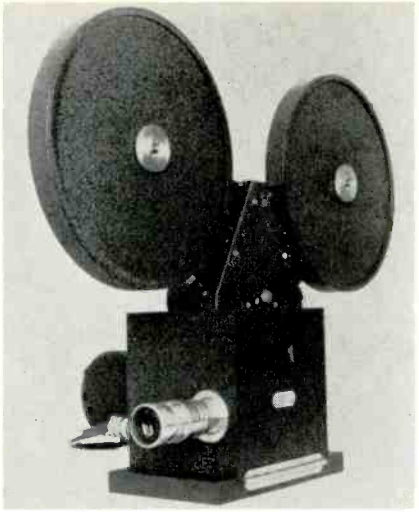
Automatic Program Alarm

Trepac Corp. of America has announced the availability of a compact automatic line-program device that monitors audio program levels. Model 553 T/C is said to eliminate the need for continuous personal supervision and provide for automatic switchover of accessory equipment. It features a variable threshold



adjustment that can be set to sense the allowable limit of audio-signal deterioration. The time duration for which a condition may be allowed to continue without being acted upon may be adjusted over a wide range. The unit may also be used as a sensitive voice-operated switch with adjustable time delay. The unit is a transistorized plug-in module, providing continuous duty over 10 million operations. It is potted in a steel case with gray enamel finish and measures 2¼" x 3¼" x 4¼".

Circle Item 71 on Tech Data Card



Kinescope Camera

A 16mm motion-picture camera that eliminates the major technical problems of TV kinescope recording has been developed and is being manufactured by **D. B. Milliken Co.** Foremost among the problems solved is "shutter bar," the dark horizontal line or grouping of lines that frequently appears in action filmed from a television screen. The Milliken camera eliminates this effect and its resultant image-shear through an improved intermittent drive which advances and stabilizes each frame in one 1/1000 second, permitting absolute synchronization of the camera with the desired video information. The camera also compensates automatically for the difference in frame rate between TV transmissions and motion-picture photography, converting the TV screening rate of 30 frames per second to the standard motion-picture speed of 24 frames per second. The equipment is said to offer special advantages in European countries, where 50-cps electrical systems normally cause substantial loss of video information in kinescope recording.

Circle Item 72 on Tech Data Card

Communication Tower Catalog

A comprenhensive catalog of communication towers and tower accessories may be obtained from **Rohn Manufacturing Co.** The catalog provides information on wind loading, guying methods, recommended mounts and bases, and lighting equipment. The volume is available **only** from Rohn Manufacturing Co., Peoria, Illinois and is priced at $1.50. ▲

Circle Item 73 on Tech Data Card

THE CHIEF ENGINEER

. . . Helps Solve Your Technical Problems

Readers are invited to send their questions to the "Chief Engineer"; those of most general interest will be published.

Now that this country no longer maintains diplomatic relations with Cuba, is it necessary to be concerned about whether radio stations in the United States protect Cuban stations?

Notwithstanding the strained relations between the United States and Cuba, the North American Regional Broadcasting Agreement (NARBA, which establishes radio technical standards) is still in effect, and both the State Department and the FCC insist that United States stations abide by the letter of the agreement. There is some reason to believe that numerous Cuban stations are operating in a manner inconsistent with NARBA, but U.S. stations will be required to observe the treaty until it is changed.

The present NARBA does not have an established expiration date, but will continue in effect indefinitely until it is renegotiated. Our AM allocation treaty with Mexico, on the other hand, expires in 1966, and plans are already being made for a renegotiation of the agreement. This renegotiation may very well open up the matter of the requirements governing 1-kw power for Class IV stations on local channels near the United States-Mexican border, as well as the present restrictions prohibiting nighttime operation in either country on clear channels assigned to the other.

There is still another separate agreement governing AM broadcast allocations between the United States and Canada. Generally speaking, the technical requirements of this agreement (as well as the NARBA and Mexican agreements) establish interference protection closely parallel to that provided among U.S. stations.

I am Chief Engineer for an AM station having a rather complex directional antenna. I find that the field strength at the monitor points exceeds the permissible limits at times, particularly during periods of heavy rain. Is this normal or is my antenna at fault?

From your brief description, without any history of your array, I cannot be certain, but this condition certainly may be entirely normal. Variations in the field strength at monitor points may be a function not only of radiation from the directional antenna but also of soil conductivity in the area. Thus, if soil conditions change, conductivity may vary, resulting in higher or lower field-strength readings. This phenomenon has been noticed in some areas where radical seasonal weather changes occur.

A single instance of a monitor-point field-strength reading only slightly out of tolerance is not necessarily cause for alarm. An occasional minor excursion above the licensed values can be tolerated. If, on the other hand, the monitor-point values are substantially out of tolerance, or remain above the permissible limits for a prolonged period, a readjustment of the directional antenna may be required. Any decision as to whether or not to readjust the antenna should be left to your consulting engineer, and measured data should be accumulated to permit him to render a proper judgment as to whether a readjustment is necessary or desirable.

I hear a lot of talk about "white areas" in connection with broadcast applications. What is a "white area"?

"White area" refers to an area unserved by broadcast stations. The field-strength contour used to denote "service" for a particular class of station is defined by section 3.182 of the Commission's Rules. This is ordinarily considered to be the .5 mv/m groundwave contour of an AM station, the 1 mv/m contour of an FM station, and the Grade B contour of a television station. A further extension of this terminology is a "gray area," a region which receives service from only one broadcast station.

These areas have become increasingly important in recent years, since the Commission's policies have been directed toward encouraging new AM applications, particularly in the Western states, where large "white" and "gray" areas exist. Even during the AM "freeze," a special exception permitted the acceptance of applications where at least 25% of the population or area within the proposed interference-free contour is in a "white area." ▲

Pulsing Relay Irregularity

When a metering pair of a remote-control system (such as the Gates RDC-10) exceeds 10 miles, or the loop resistance becomes greater than 2200 ohms, considerable irregularity in transmitter-pulsing relay operation may occur. This "out of step" condition usually results in erroneous meter readings at the control point. Greatly improved stability and "precise following" can be attained in most such instances by simply shunting a .5-mfd, 400-volt paper capacitor across the solenoid coil of the relay.

Phil Ross, WBNX

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

75. AKG—Brochures give technical specifications of capacitor and dynamic microphones.
76. ALTEC—Booklet is titled "Playback and Speech-Input Equipment for Recording and Broadcast Studios."
77. AMERICAN ELITE—Data sheet lists specifications of Telefunken battery-powered, broadcast-quality tape recorder.
78. ASTATIC—Catalog No. 111 describes microphones, accessories, and phonograph cartridges, pickups, and needles.
79. ATLAS—Catalog No. 564 contains illustrations and specifications on PA speakers, microphone stands for commercial and industrial installations, and other products.
80. AUDIO ACCESSORIES—Four-page catalog has information on jack panels and telephone jacks for two- and three-conductor plugs.
81. BROADCAST ELECTRONICS—Packet contains specifications and prices for "Spotmaster" tape cartridge systems.
82. CINE SONIC—Data sheet describes rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape or in cartridges.
83. CONCERTONE—Four-page brochure gives information on Series 800 "Reverse-O-Matic" stereo tape recorder.
84. CROWN INTERNATIONAL—Literature tells about solid-state 700 Series recorders.
85. EASTMAN KODAK—Information sheet lists availability of various types of magnetic tape for sound recording.
86. GATES—Information is available on audio mixer for production requirements, one-tube, 1-kw AM transmitter, and solid-state plug-in audio amplifiers.
87. HARVEY RADIO—Engineering bulletin offers specifications of Ampex MR-70 Series master recorders.
88. MAGNASYNC—Catalog covers magnetic film and tape recorders and accessories.
89. MILES REPRODUCER—Literature describes automatic logging recorder.
90. QUAM-NICHOLS—General catalog has listings of speakers for general replacement, public-address, and sound-system use.
91. REEVES SOUNDCRAFT—Illustrated six-page brochure, RS-64-18, gives magnetic and physical properties of sound-recording tapes.
92. SCULLY—Data concerns Model 270 transistorized professional tape playback unit.
93. SENNHEISER—Pamphlet presents information on Model MD421 directional studio microphone.
94. SHURE—Sheet gives technical data on Model 576 omnidirectional studio microphone.
95. SPARTA—Data sheet describes Model CD-15 cartridge time delay.
96. TURNER—List of specifications is given for Model 510 broadcast cardioid microphone.
97. UNIVERSITY—Catalog describes public-address speakers; "Technilog" gives information on selecting speaker systems.
98. WALLACH ASSOCIATES—Brochure lists and discusses variety of record and tape-reel cabinets, and tape storage containers.
99. WINSTON RESEARCH—Brochures describe wide-band and video tape recorders and AGC amplifier.

COMPONENTS & MATERIALS

100. BIRD—Catalog CF-65 provides information on electrical and mechanical specifications of RF coaxial filters.
101. BRADY—Product data sheet No. 600-A describes line of wire markers.
102. COLLINS RADIO—Broadcast catalog covers entire product line and includes reference material for broadcast engineers.
103. CORNELL-DUBILIER—Manufacturer offers 56-page "Replacement Component Selector," 20-page TV-FM reception booklet, and brochures covering antenna rotors and tantalum capacitors.
104. INTERNATIONAL ELECTRONIC RESEARCH—Literature describes heat-dissipating tube shields that fit obsolete JAN types.
105. SPRAGUE—Short-form catalog CN-116F lists transistors.

106. SWITCRAFT—Product Bulletin No. 144 describes molded coil cord assemblies; catalog C-502 gives data on audio and RF connectors; catalog J-103 covers telephone jacks and jack panels.

POWER DEVICES

107. HEVI-DUTY—Bulletin No. T-12 describes static line-voltage regulator that uses saturable-core reactor.
108. TERADO—Information sheet shows Model 50-191 and Model 50-202 transistorized DC to AC inverters.

REFERENCE MATERIAL & SCHOOLS

109. CLEVELAND INSTITUTE—Booklet discusses courses in electronics for broadcast and communications.

STUDIO & CAMERA EQUIPMENT

110. CLEVELAND ELECTRONICS—Data concerns deflection yoke and alignment coil for 3" image orthicons.
111. COHU—Four-page data sheet 6-322 serves as guide to selection of lenses for television cameras.
112. DAGE—Literature describes transistorized studio cameras for broadcast or closed-circuit use.
113. UNIVERSAL AUDIO—Fact sheets give information on Model 960 "Digital Metronome" and Model 120 "Electrostatic Reverberation Simulator."
114. ZOOMAR—Bulletins contain descriptions of zoom lenses and remote-control systems for television cameras.

TELEVISION EQUIPMENT

115. CONRAC—Data is available concerning CZB "Professional Monitor" series and CYA21 color monitor.
116. VITAL—Data sheets list features of Model VI-10A video distribution amplifier and Model VI-20 pulse distribution amplifier.
117. WARD ELECTRONIC—Data is offered on video and pulse distribution amplifiers and solid-state video mixing amplifier.

TEST EQUIPMENT & INSTRUMENTS

118. ENTRON—Specifications of Model LT-1 line tester are given in two-color catalog sheet.
119. GENERAL MICROWAVE—Folder includes information on reaction/transmission coaxial frequency meters, thermoelectric power meter, universal power leveler, and solid-state automatic noise-figure meter.
120. MARCONI—Booklet, "The Q Meter in Theory and Practice," discusses use of instrument to measure Q, inductance, RF resistance, capacitance, etc., also describes Model TF1245 Q meter.
121. SECO—Color folder includes data on color-bar generators, tube testers, and semiconductor testers.
122. SIMPSON—Bulletin No. 2066 lists test equipment for servicing and industrial applications.
123. TEKTRONIX—Group of catalog sheets gives descriptions of Type 524AD television oscilloscope, Type 525 television-waveform monitor, Type 526 color-television "vectorscope," and Types 527 and RM527 television-waveform monitor.

TOOLS & ACCESSORIES

124. ENGINEERING DEVELOPMENT—Bulletin features Model 300 desoldering-resoldering iron for use on printed circuit boards.
125. GREENLEE—Catalog E236 describes socket punches for making holes of various shapes and sizes.

TRANSMITTER & ANTENNA DEVICES

126. BAUER—Brochure describes Model 607 1-kw FM transmitter.
127. FINNEY—Catalog 20-307 lists models in the "Color-VE-Log" series of VHF-TV-FM receiving antennas.
128. McMARTIN—Data sheet covers Model AM-25 AM noise limiter.
129. RUST—Descriptive literature gives details of transmitter automatic logging systems. Stereo data sheet and data sheet on 24"-wide automated 1-kw FM transmitter are also available.
130. STANDARD ELECTRONICS—Two catalogs contain listings of TV and FM transmitters, amplifiers, and associated equipment.
131. WINEGARD—"Factfinder 239" describes transistor antenna preamplifier; "Factfinder 226" describes coupler for feeding outputs of several yagis into one transmission line.

Professional Services

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Classified

Advertising rates in the Classified Section are ten cents per word. Minimum charge is $2.00. Blind box number is 50 cents extra. Check or money order must be enclosed with ad.

The classified columns are not open to the advertising of any broadcast equipment or supplies regularly produced by manufacturers unless the equipment is used and no longer owned by the manufacturer. Display advertising must be purchased in such cases.

EQUIPMENT FOR SALE

Ampex Head Assemblies for 300 and 400 series recorders reconditioned. Service includes lapping and polishing all three head stacks, cleaning entire assembly, readjusting and replacement of guides, and realignment of stacks as to azimuth and zenith. Full track assemblies—$60.00. Taber Manufacturing & Engineering Co., 2619 Lincoln Ave., Alameda, California. 5-64 tf

Will buy or trade used tape and disc recording equipment—Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 295 Main St., Tuckahoe, N. Y. 1-64 tf

Laboratory Test Equipment, microwave components, all frequency and makes at real low prices. Write or call for information. Jericho Electronic Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N. Y. (516) WA 1-7580. 8-64 3t

COMMERCIAL CRYSTALS and new or replacement crystals for RCA, Gates, W. E. Bliley, and J-K holders; regrinding, repair, etc. BC-604 crystals; also service on AM monitors and H-P 335B FM monitors. Nationwide unsolicited testimonials praise our products and fast service. Eidson Electronic Company, Box 96, Temple, Texas. 5-64 tf

GOVERNMENT SURPLUS, NEW 10 CM WEATHER RADAR SYSTEM—Raytheon, 275 KW peak output S band. Rotating yoke P.P.I. Weather Band 4, 20, and 80 mi. range. Price $975 complete. Has picked up clouds at 50 mi. Wt. 488 lbs. Radio Research Inst. Co., 550 5th Ave., New York, New York. 5-64 tf

New Gates Model M-5309A 5KW broadcast antenna coupler units, $295.00; Trimm 504 audio patch cords, $4.00; audio jack panels 19" rack mounting, 12 pair $9.95, 10 pairs $8.95; repeat coils 500-500 ohm flat, $4.00; racks, cabinets, transformers, etc. Write for free list. Gulf Electro-Sales, 7031 Burkett, Houston, Texas. 8-64-3t

Audio Equipment bought, sold, traded. Ampex, Fairchild, Crown, McIntosh, Viking. F. T. C. Brewer Company, 2400 West Hayes Street, Pensacola, Florida. 3-64 tf

Television/Radio/communications gear of any type available. From a tower to a tube. Microwave, transmitters, cameras, studio equipment, mikes, etc. Advise your needs—offers. Electrofind Co., 440 Columbus Ave., NYC. 212-EN-25680. 8-64 tf

Brand new surplus BC-645 Transceiver, 435 to 500mc, complete in original cartons with PE-101C dynamotor, 12/24V input, UHF antenna, control box, plugs. Limited supply, price $32.50. Slep Electronics Company, P. O. Box 178BE, Ellenton, Florida. 8-64 3t

TV antenna system—RCA 12 layer batwing and filterplexer for channel 10. Can operate as bi-directional antenna with max. power gain of 25 and circularity better than 10 db. Cost over $50,000. Make offer. Hammett & Edison, Box 68, International Airport, San Francisco 28, California 415-342-5208. 10-64 3t

VHF TV 500 Watt Transmitters Used, Channel 3 excellent condition, Channel 12 good condition. Also, Vidicon cameras, 16 mm projectors, 35 mm slide projectors, sync generators, etc. Dept. 116, Broadcast Engineering. 10-64-1t

LABORATORY quality Test Equipment bought and sold—commercial and military; large stock, what do you need? We need Counters, HP608 (TS510) Signal Generators, instruments, special tubes. ENGINEERING ASSOCIATES 434 Patterson Road, Dayton, Ohio 45419. 10-64 1t

Bird R.F. Wattmeter, TS-118A/AP, Model 693, 50 ohms, 20-1400 Mc., 2 to 500 Watts in four ranges, like new. Write for details and price. G. Richie, Box 26, Salem, Virginia. 10-64 1t

Parabolic antennas, six foot dia., new, solid surface with hardware, dipole, etc. $100.00 each. S-W Electric Cable Company, Willow & Twenty-Fourth Streets, Oakland, California. 832-3527. 10-64 1f

Personnel

Chief Engineer for new AM 2-DA. Maintenance, operation, light announcing, work with people. Building small, professional staff. $500. Sam Elliott, Box 1114, Ulysses, Kansas 67880. 9-64 2t

Michigan 5 kw—need experienced chief engineer—some announcing, emphasis on engineering. WION, Ionia, Michigan. Phone area code 616-527-4400. 10-64 1t

REMOTE THERMOMETER
(Electronic)

Outside temperature from mike position. Installed in less than 1 hour. Over 300 stations now use the Electra Temp. Increased sales allow a new price to TV and Radio Stations. The New Mark II is reduced from $95 to $75. Offer good until Oct. 1964. Send for brochure.

Electra Met Inc., P.O. Box 6111
1246 Shafter Ave. San Diego 6, Calif.

- SYNCHRONOUS MAGNETIC FILM RECORDER/REPRODUCER
- MAGNETIC TAPE RECORDERS
- NEW—THE portable MINITAPE synchronous 13 lb., battery operated magnetic tape recorder for field recording.

THE STANCIL-HOFFMAN CORP.
921 N. Highland, Hollywood 38, Calif.
Dept. B HO 4-7461

Advertisers' Index

now read this

A well informed individual usually makes the wiser decision

INFORMATION:

Shown below is the rear of the rack mounting frame used with our video and pulse distribution amplifiers and other plug-in units. You will appreciate the easy accessibility afforded by the connector configuration. Note that no connector is closely surrounded by several other connectors, as is the case with many other frames. As a result, cables may be plugged or unplugged with greater ease and speed.

The pulse distribution amplifier, model VI-20, pictured above, offers superior performance with many desirable features. A few of these features are:

- **Self-contained, regulated power supply in each amplifier.**
- **Four plug-in amplifiers mount in a 1¾" rack frame providing a total of 16 outputs.**
- **High isolation between outputs during and between pulses.**
- **Maintains constant output levels.**
- **Indicator lamp shows presence or absence of output pulses.**

Clean and precisely controlled pulses assure stability of camera sweeps and improved tapes. Pulse defects such as ringing, overshoots, rounding, poor rise time, tilt and line reflections are overcome by the pulse reforming action of this unit. The VI-20 pulse D.A. is wired to operate in the same standard rack frame as the VI-10A video D.A.

Price: One complete frame with 4 pulse amplifiers..... $1100.00

Write for complete information and specifications

VITAL INDUSTRIES 3614 SOUTHWEST ARCHER ROAD GAINESVILLE, FLORIDA—PHONE 372-7254

Circle Item 59 on Tech Data Card

Created by the hand of experience

RCA-7295B 4½-INCH IMAGE ORTHICON

Unmatched picture quality in black-and-white pickup

- NEW MICRODAMP CONSTRUCTION. Reduces microphonic noise in the output signal by isolating the target-to-mesh assembly from the effects of external acoustical noise and camera vibration, and by damping out internally induced vibration on the target.
- REDUCED CHANCE OF "WASHED OUT" PICTURES. Opaque black coating on lower part of tube prevents "washed out" pictures due to extraneous light.
- HIGH AMPLITUDE RESPONSE FOR SHARP RESOLUTION (800 TV lines).
- HIGH SIGNAL-TO-NOISE RATIO (75:1 at 4.5 Mc)
- IMPROVED BACKGROUND UNIFORMITY, with very good half-tone signal reproduction.
- FIELD-MESH CONSTRUCTION. Produces uniform signal output and focus. Reduces unwanted bright edges and geometric distortion.
- HIGHER SIGNAL OUTPUT LEVELS with lower microphonics.
- MORE STABLE SENSITIVITY CHARACTERISTICS.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics

AVAILABLE THROUGH YOUR AUTHORIZED RCA BROADCAST TUBE DISTRIBUTOR

FOR NAME AND ADDRESS OF YOUR LOCAL DISTRIBUTOR WRITE OR CALL YOUR NEAREST RCA DISTRIBUTOR PRODUCTS SALES OFFICE—NEW YORK, NEW YORK: 36 W. 49th St., (212) MU 9-7200; NEEDHAM HEIGHTS 94, MASSACHUSETTS: 80 "A" St., (617) HI 4-8480; WASHINGTON 6, D. C.: 1725 "K" St., N.W., (202) FE 7-8500; ATLANTA, GA.: 134 Peachtree St., N.W., (404) JA 4-7703; CLEVELAND, OHIO: 1621 Euclid Ave., (216) CH 1-3450; CHICAGO, ILL.: Merchandise Mart, (312) 467-5900; DALLAS 7, TEXAS: 7901 Carpenter Freeway, (214) ME 1-3050; KANSAS CITY 14, MO.: 7711 State Line, (816) EM 1-6462; HOLLYWOOD, CALIFORNIA: 6363 Sunset Boulevard, (213) 461-9171; SAN FRANCISCO 2, CALIFORNIA: 420 Taylor St., (415) PR 5-5135-6-7.

Created by the hand of experience

RCA-7295B 4½-INCH IMAGE ORTHICON

Unmatched picture quality in black-and-white pickup

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