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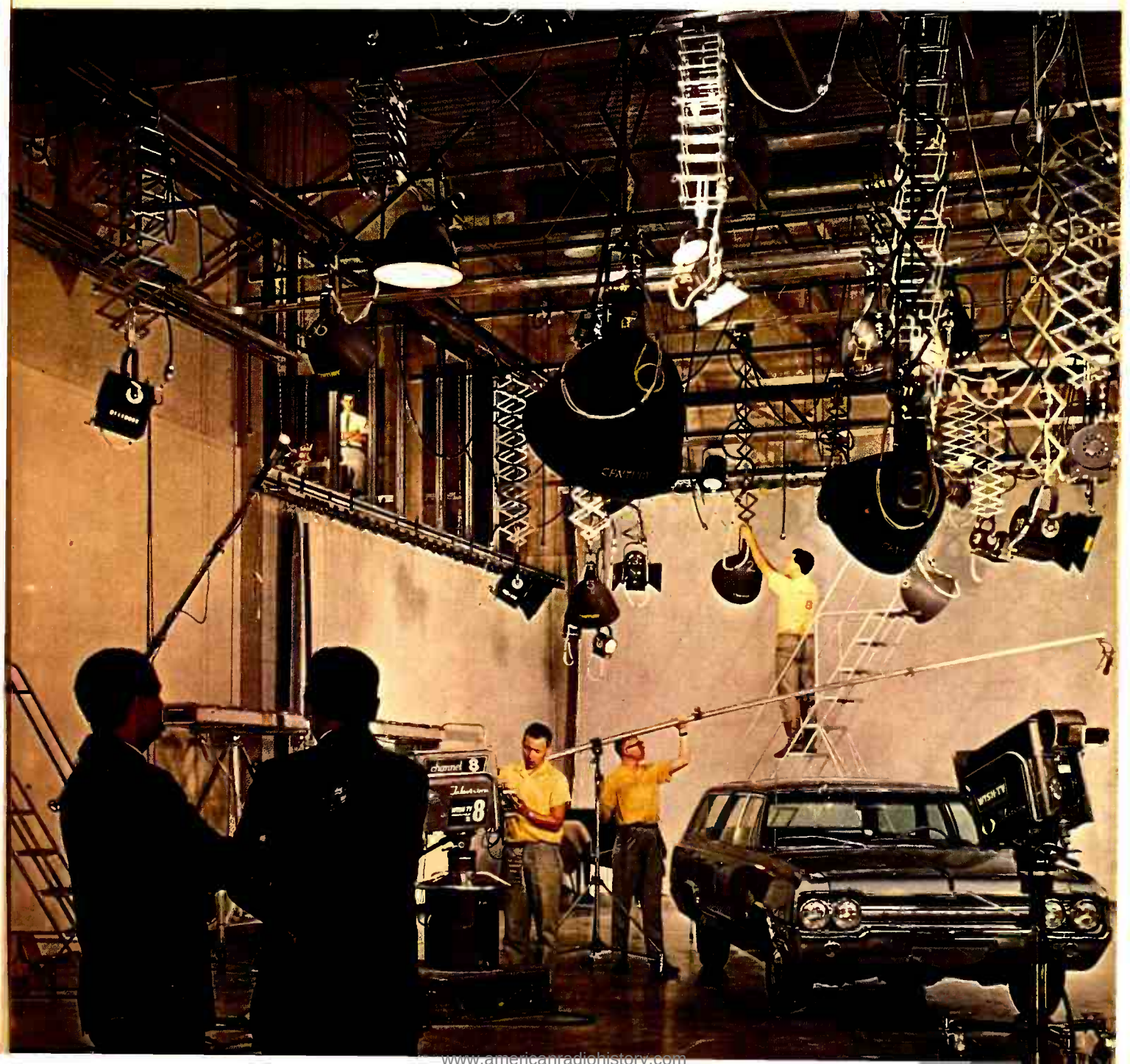
Broadcast Engineering

the technical journal of the broadcast-communications industry



COLOR COLOR COLOR COLOR COLOR

RIKER RIKER RIKER RIKER RIKER

NOW COLOR WITHOUT A COLOR CAMERA OR ENCODER

INTRODUCING THE RIKER COLORIZER

The RIKER COLORIZER allows even the smallest station to swing to color. Now for the first time, broadcasters can produce color station breaks, color commercials and network color inserts using existing monochrome cameras.

A RIKER COLORIZER consists of two all-transistor modules. A 6 position switch selects the following modes of operation:

. . . Any 3 pre-selected colors
. . . Manual selection of color
. . . Automatic cycling through the color spectrum at a selectable rate
. . . Color added to a monochrome camera output

This unique production tool is designed for economy, speed and simplicity of operation. For example: black and white film may be developed normally to generate color. Color inserts may be varied without changing luminance.

So many color effects are possible. Here are a few:

. . . Fade to any color
. . . Insert any color
. . . Color monochrome slides (even the U.S. flag in color)
. . . Color ID's and titles

FOR THE COLOR STATION—another color video source.
FOR THE MONOCHROME FACILITY—color station breaks, color commercials and color inserts—all possible with the RIKER COLORIZER.

Partial Listing of Additional Color Equipment from Riker:

- Encoded Color Bar Generator
- Color Bar Generator
- Color Sync Generator
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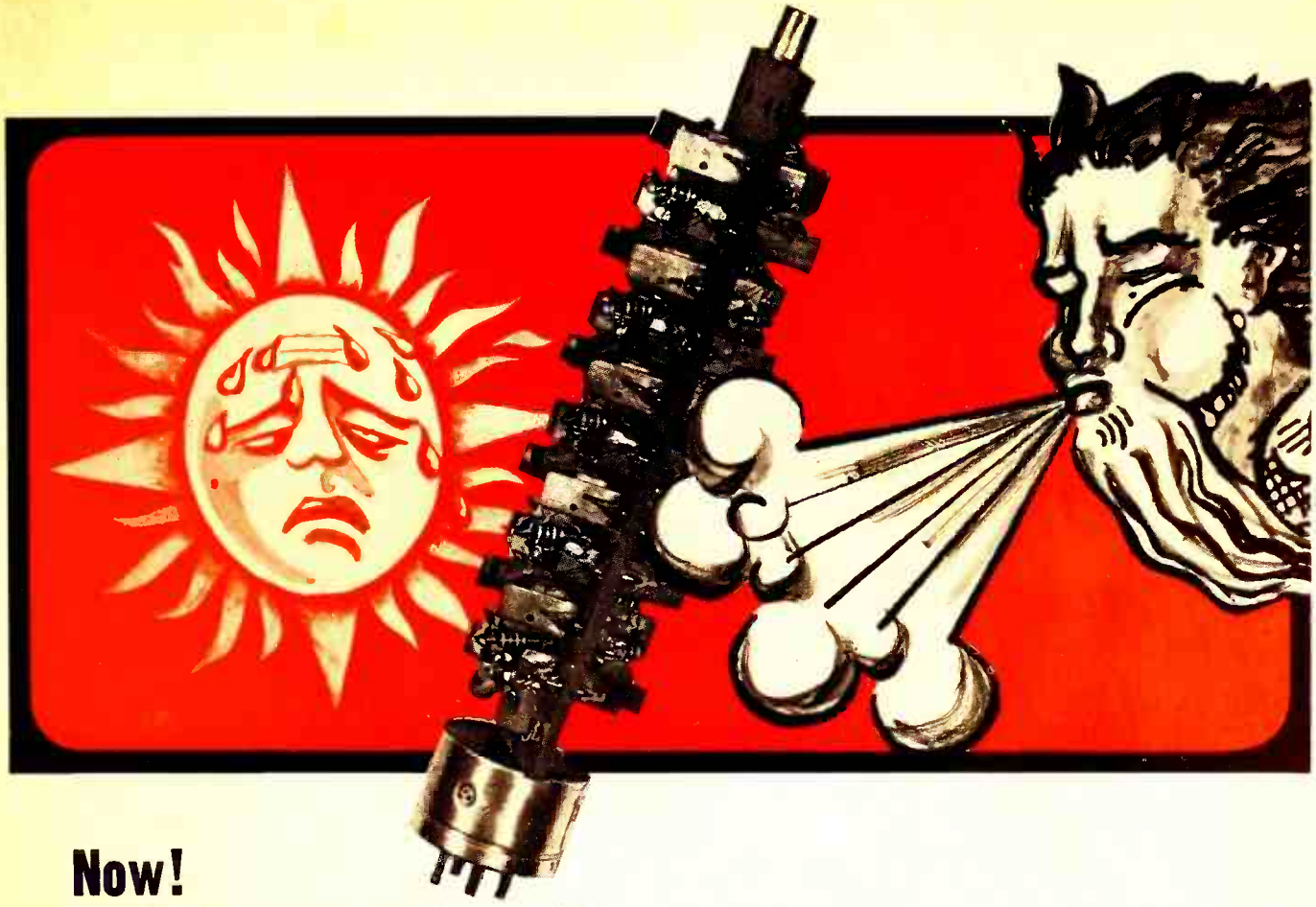
- Bar & Dot Generator
- Color Video Switching Systems
- Additive/Non Additive Mixer
- Black Burst Generator
- Burst Flag Generator
- Color Special Effects Generator
- Test Signal Generators
- Color Processing Amplifier
- 3.58 MC Phase Shifter
- Plus Many Others

Call or write today for complete details.

RIKER INDUSTRIES, INC. ...thinking always of tomorrow

Norden Lane, Huntington Station, New York Phone 516 HA 1 3444 Atlanta Los Angeles, Detroit, Washington, D.C.

Circle Item 1 on Tech Data Card



Now!
End "Off-Air" Panic and Eliminate Temperature Worries Forever, with... WILKINSON SILICON RECTIFIERS

No more finicky temperature sensitive mercury vapor rectifiers . . . Go on cold mornings! Forget heating and air conditioning! . . . Wilkinson Silicon Replacement Rectifiers produce no filament heat and function below −60° C.

No longer high priced! Wilkinson Silicon Rectifiers cost less than others and can be repaired in seconds with low-cost replacement diodes. No encapsulation used! No more guesswork or costly test time! You know at a glance the exact status of your complete power supply because a "GO, NO GO" indicator warns when the reverse leakage of any diode is in excess of 50 microamps. Wilkinson Rectifiers virtually last forever!

Now it's easy and economical to solid state the power supplies in high power equipment. With Wilkinson Rectifiers no rewiring is necessary. Just plug them into your present mercury vapor tube socket. Filament transformers as well as other components are left in place.

Modernize your equipment today! Consult the Tube Replacement Chart shown here and order now!

FEATURES: Light indicator on each diode warns of any difficulty or high voltage ON. • Easily replaceable low-cost diodes. • Reduces heat — power cost — hash. • Operates from −65° C to +70° C Free Convection. • Eliminates warm-up time.

TUBE REPLACEMENT CHART

WE TYPE	REPLACES TUBE TYPE			P.R.V.	AMPS	UNIT PRICE
SR-3-1	866A	816		3KV	1	10.95
SR-10-6	872	8008		10KV	6	50.00
SR-10-12	872	8008	575	10KV	12	60.00
SR-14-6	872	8008	575	14KV	6	72.00
SR-14-12	872	8008	575	14KV	12	84.00
SR-20-6	6894	6895	673	20KV	6	100.00
SR-20-12	6894	6895	673	20KV	12	120.00
SR-24-15	869B			24KV	15	225.00
SR-32-25	857B			32KV	25	475.00

FOR COMPLETE DETAILS WRITE:

WILKINSON ELECTRONICS, INC. 1937 MACDADE BLVD. • WOODLYN, PA. 19094
TELEPHONE (AREA CODE 215) 874-5236 874-5237

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advertising sales offices
Hugh Wallace, Sales Manager

eastern
Gregory C. Masefield
Howard W. Sams & Co., Inc.,
3 West 57th Street
New York, N. Y., MU8 6350

midwestern
Paul N. Houston
Howard W. Sams & Co., Inc.,
4300 West 62nd Street,
Indianapolis, Indiana 46206, 291 3100

southwestern
C. H. Stockwell Co.,
4916 West 64th Street,
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foreign
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Leicester Square, London W.C. 2,
England, WHitehall 0525
International Media Representatives,
Ltd., Kisha Kurabu 14, 2-chrome
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the technical journal of the broadcast-communications industry

Broadcast Engineering

Volume 7, No. 12 **December, 1965**

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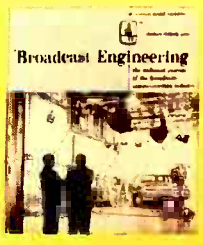

SCR-controlled lighting and the large conference-room window are two features of studio A at WISH-TV, Indianapolis. For more details, turn to page 13.

We'll do a month's work for you free!

Just send this page to CBS Laboratories. We will send Audimax and Volumax to your station. If you want to send them home after 30 days, we will pay the freight. But if you want to make your station their permanent home, all you do is pay $665 each.

At the end of that period, chances are you will be so sold on Audimax and Volumax you will want to buy them.

And you should. After all, they can increase your program power 8 times.

Solid state Audimax is an automatic level control years ahead of the ordinary AGC. By automatically controlling audio levels, it frees engineers, cuts costs and boosts your signal.

Volumax, also solid state, outmodes conventional peak limiters by controlling peaks automatically without side effects. By expanding effective range and improving reception, it brings in extra advertising revenue.

We can afford to give Audimax and Volumax away free. Because we know they're so good, most people can't afford to give them back.

CBS LABORATORIES
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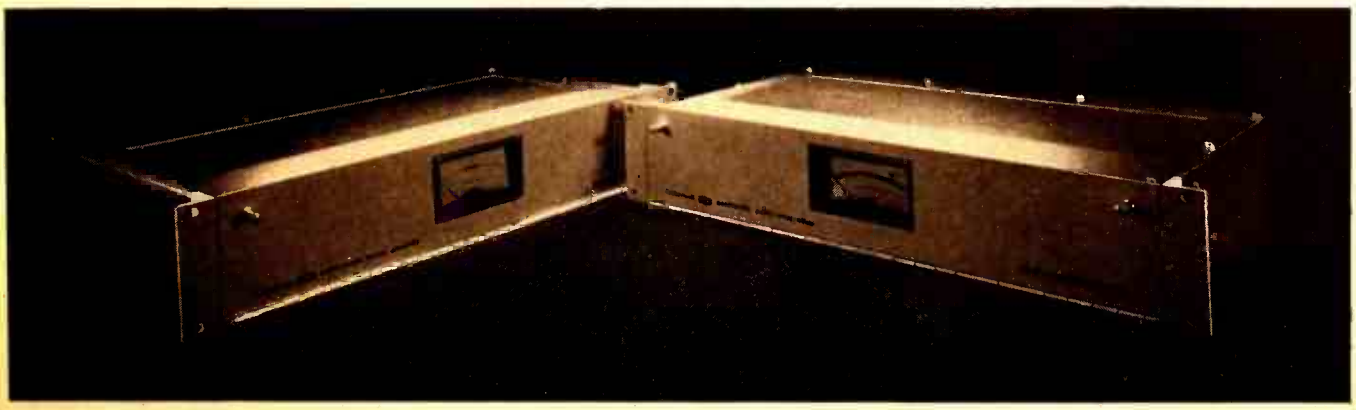

Circle Item 3 on Tech Data Card

LETTERS
to the editor

DEAR EDITOR:

Your article on line services in the September issue of BE was most interesting. As a user of several schedule AAA and AA lines, I hope that you will be able to pursue the subject in greater detail in the near future.

Having been in the broadcasting field for nearly twenty years, I find that the amount of misunderstanding between the broadcaster and local telephone personnel, especially in smaller communities, is sometimes astonishing. Most of these men certainly mean well, but they do only a limited amount of program-line installation and have little opportunity to learn about many of the problems involved.

On occasion it has been necessary for us to wait as long as four months for schedule AAA lines, only to be presented with facilities which are unable to meet noise requirements. When frequency and noise measurements are within limits, we often find that the lines are 20 or 30 db down and are told that this is to be expected when equalization requirements are so exacting. It is often difficult to duplicate the telephone company's measurement figures.

It seems that our industry is badly in need of a set of procedures that will be compatible with those of the telephone industry and will provide us with figures closer to those they give us.

GEORGE S. WOODS

WRUN AM-FM
Utica, New York

Thanks for your comments, George; we'll be looking at the subject of remote lines again before too many moons have passed. We try to give our readers the information they want and need, and letters such as yours help us to know what those wants and needs are.—Ed.

DEAR EDITOR:

Especially in view of the much-appreciated courtesy accorded me by Microwave Associates' representatives during the Fourth International Exposition at Montreux, Switzerland, please permit me to apologize for an error in my report on the company's new microwave link for outside broadcasts (September 1965 BE, page 42). The equipment does not use klystrons as was stated; it is completely solid-state. I also noticed two errors in the printing of the article: On page 23, figures 2 and 3 are interchanged; on page 44, the name "Diemens and Halske" should read "Siemens and Halske."

ELLIOTT P. FAGERBERG

Geneva, Switzerland

New, from Electro-Voice! Sentry Series Professional Monitor Loudspeakers . . . guaranteed flat ± 3 db from 40 to 20,000 cps!

No longer must you improvise with theatre or home-type hi-fi speakers designed for some other purpose. Gone is the guesswork when equalizing . . . you know you'll get *exactly* what you hear through an E-V Sentry Monitor. That's because each Sentry is simple, reliable and as flat in response as modern science can make it!

Gone are "balance" switches or knobs that vary response . . . each Sentry is adjusted flat at the E-V laboratories before you ever see or hear it! And because of this simplicity, the E-V Sentry Series speakers are modest in size and price.

NEW VOICE OF AUTHORITY!

The natural-finish hardwood cabinets are available in a sloping-front style for wall or ceiling mounting . . . or in an upright floor model for fixed or portable applications. They are all identical in sound. Built-in transformer matches studio output impedance of 8, 16 and 600 ohms.

If you want to end equalization guesswork . . . if you want to know that the sound you hear is an exact duplication of the original . . . the E-V Sentry Series Professional Monitors were designed for you. Write for complete specifications, or see your E-V Professional Products Distributor, today!

Sentry II Floor Model, 32" H, 20" W, 13 D. List Price $248.33. Sentry I Wall or Ceiling Model, 17" H, 37" W, 21¾" D. List Price $265.00. (Normal trade discounts apply.)

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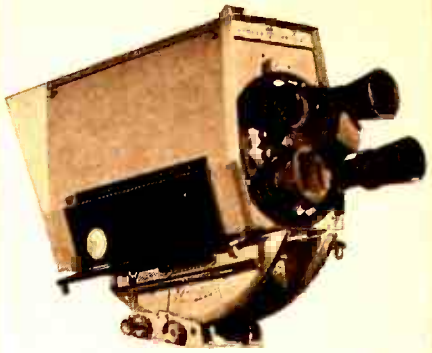
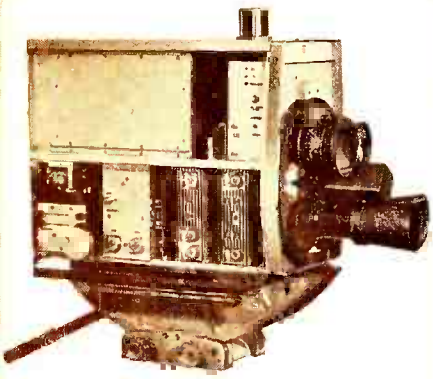
Circle Item 6 on Tech Data Card

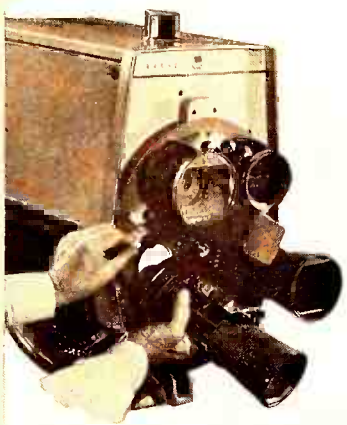
A FEW REASONS WHY YOU CAN'T BUY A FINER TELEVISION CAMERA ...AT ANY PRICE



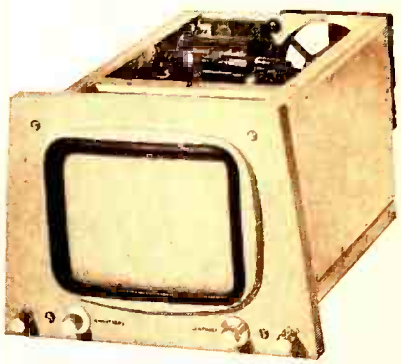
Impressive, designer-styled exterior. Clean lines, ultra-compact package houses field-proven Tarzian 3" Image Orthicon camera system. Highly portable. Easy to handle. Uses conventional camera cable.



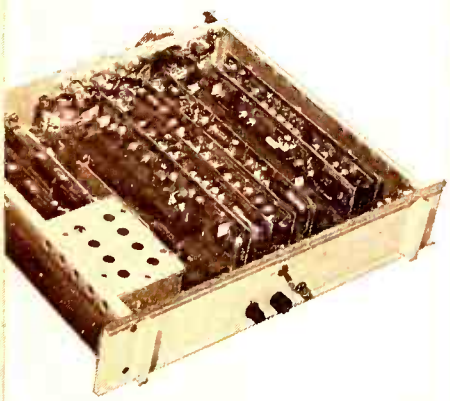
100% transistorized plug-in electronics for reliability and fast, convenient troubleshooting. Hinge out yoke assembly allows rapid change of IO tube.



Built-in remote iris control. Quick-change lens insert system accepts variety of lenses, fixed focus and zoom.



Plug-in, self-contained 8-inch viewfinder assembly, interchangeable with other Tarzian live cameras. All circuits accessible without removing viewfinder.



Modular proc amp completes camera system. (Also interchangeable between cameras.) Totally transistorized electronics on plug-in circuit cards. Compact, highly portable.

SPECIFICATIONS

Scanning rate	525 lines, 30 frames, 60 fields, 2:1 interlaced
Line repetition rate	15,750 cycles per second
Resolution (horizontal)	600 lines picture center 500 lines picture corners
Signal-noise ratio	Limited only by image orthicon
Remote iris control	Time for full range, 3 seconds accuracy of setting ± 0.25 lens stop
Output signals	Horizontal drive, 4 volts ± 0.5 volts; Vertical drive, 4 volts ± 0.5 volts; Sync, 4 volts ± 0.5 volts; Blanking, 4 volts ± 0.5 volts. Viewfinder video (external) 0.7 volts intercom audio.
Viewfinder size	8" tube
Intercom	Dual transistorized

These are but a few reasons. For all the rest, call, or write, for 8-page brochure, "3000L 3" Image Orthicon Camera System."

SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION — BLOOMINGTON, INDIANA

Circle Item 7 on Tech Data Card

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FAST DELIVERY

Prompt, helpful service is the rule with your Sylvania Distributor. Same-day service wherever possible from his complete inventory of rugged, dependable industrial and commercial tubes in any quantity.

Next time you need electronic tubes in a hurry, try him first. You'll be glad you did.

Electronic Tube Division, Sylvania Electronic Components Group.

SYLVANIA

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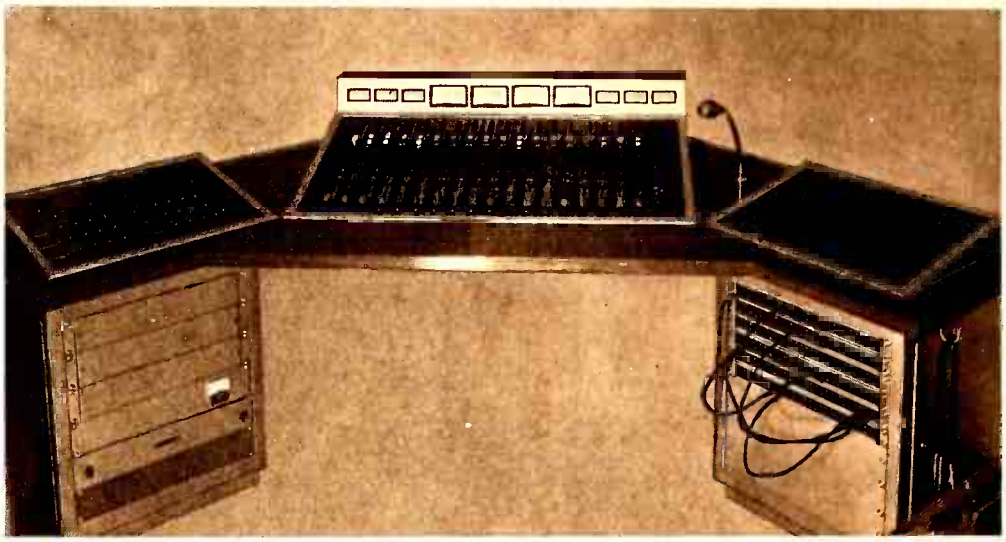
NEW CAPABILITIES IN: ELECTRONIC TUBES • SEMICONDUCTORS • MICROWAVE DEVICES • SPECIAL COMPONENTS • DISPLAY DEVICES

Circle Item 8 on Tech Data Card

To audio engineers happiness is:



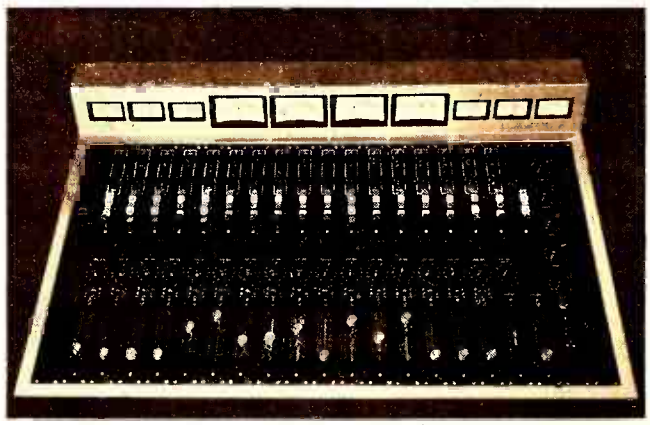
This console designed and engineered for International Recording, Inc., Dallas, Tex.

a custom console built by Audio Acoustics.

Happiness is: a four channel recording console built in module form.

It's 16 microphone channels, two echo channels and one master control module.

It's 16 Langevin MX113 slide faders, plus four color coded channel selector push buttons for instant switching, and a fifth button for reset which disengages the microphone from the system.



Close-up of modular strip design.

Happiness is more: it's a level control and selector switch on each microphone that allows the echo to be fed either before or after the mixer.

It's 16 Universal Audio equalizers that give individual microphone equalization—a necessity in modern recording techniques.

And it's four A.P.I. illuminated VU meters and six Weston VU's that show gain/reduction, echo send level, and composite output.

We can build a console for you . . . to meet your requirements. Call or write today. (It would make us both happy.)

AUDIO ACOUSTICS EQUIPMENT CO.

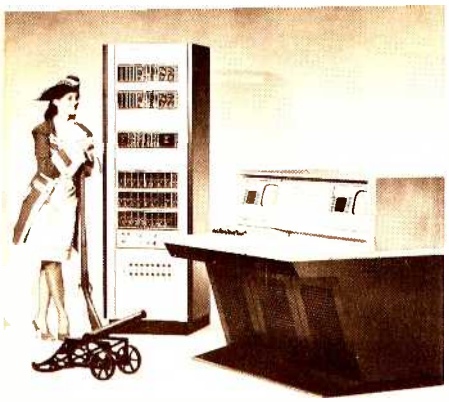
P. O. Box 444
Arlington, Texas
Area Code 214
AN 4-2437

Distributor for: A.D.C. / A.P.I. / A.T.C. / Ampex / Atlas / Beyer / Cannon / Cinema / Dyna / Electro-Voice / E.M.T. / Fairchild / Gotham / Langevin / Marantz / Metal Works / Miratel / Nagra / Neuman / Pultec / Rek-O-Kut / Sony / Universal Audio / Vega / Weston

Circle Item 9 on Tech Data Card

REVOLUTION... IN THE TV CONTROL ROOM!

→



New Studio Console and Rack Equipment

Revolution in the control room affords savings and opens new operating possibilities

. . . to improve television program quality

SPACE SAVINGS

Use of RCA "New Look" equipments, such as transistorized sync generators, power supplies, and distribution amplifiers greatly reduces the amount of rack space required by a television station. It is possible to install the few racks required in the control area, eliminating need for a separate equipment room. Moreover, use of transistorized monitors and simplified camera controls can greatly reduce space required for control consoles.

OPERATION LESS COMPLEX

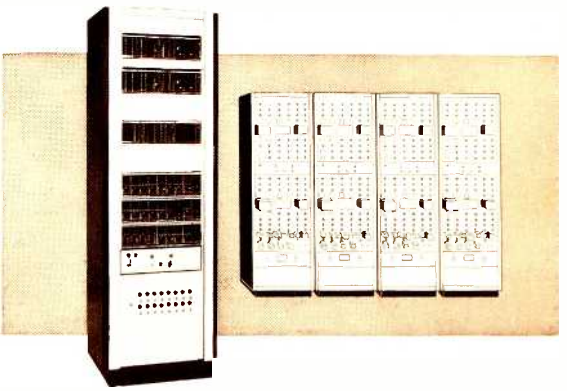
In many cases only one control position is required using the "New Look" system. Since cameras are stabilized and self-adjusting, the second position normally used for the "shading" operation can be eliminated. Using this new method, there are fewer demands for human hands to "ride controls" and, more importantly there is better control of program quality.

NEW OPERATING POSSIBILITIES

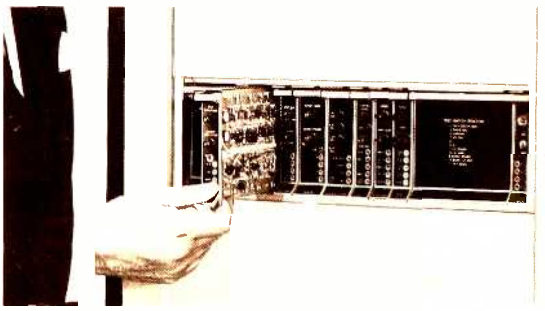
"New Look" tape recorders and film projectors are as stable and self-sufficient in operation as the "New Look" self-adjusting cameras. No longer is it necessary to isolate these machines in separate tape and film areas. They may be installed in one large master control area. And, since they are designed for remote operation, they may be started and stopped from the control console. Other new possibilities include preset station-break switching, preset program switching, and full time automation.

DOLLAR ADVANTAGES

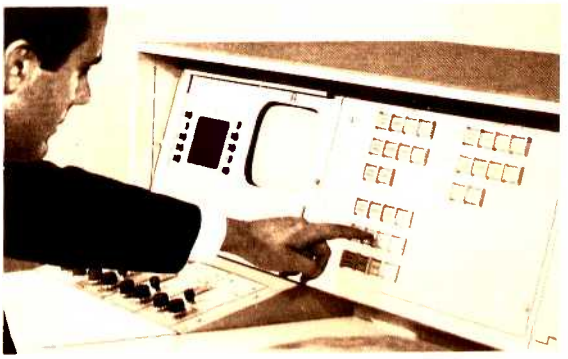
"New Look" equipments cost less to install and less to operate. Long life of transistors and speed of module change lead to a new high in reliability, and a cut in maintenance costs. Reduction of controls reduces possibility for errors; hence fewer rebates. Overall the revolutionary "New Look" approach to equipment operation makes picture quality more uniform (more pleasing) through use of stabilized self-adjusting circuitry, focusing human attention on control of creative facilities for improving production of programs and commercials.



The sync and distribution equipment mounted in this one rack formerly took as many as four.



Standard transistorized modules improve performance, cut maintenance costs.



Revolutionary "New Look" compact design console showing machine control from one position.

For further information about using RCA "New Look" equipments in a system, write RCA Broadcast and Television Equipment, Building 15-5, Camden, N.J. Or call your RCA Broadcast Representative.

The Most Trusted Name in Television

TRENDS IN TV STUDIOS

by David I. King — Solid-state dominates the equipment picture at this modern studio facility.

In the ten years since its first broadcast in July 1954, WISH-TV had outgrown its original home on Indianapolis' North Meridian Street. As a result, management decided to move to a new home, built especially for the station, five blocks north of the original location. Contractors began the construction in April 1964, and in June 1965, WISH-TV, a Corinthian Broadcasting Corporation station, originated the first live telecast from its new studio facilities.

The Building

Maximum use of glass and contemporary decor characterize the entire building. White, sculptured columns surround the glass-enclosed two-story structure. Total area exceeds 30,000 square feet.

On the lower floor, spaces for the program, production, news, and film departments wrap around the engineering and studio spaces. Managerial offices, accounting offices, conference rooms, and an employees' lounge make up the top floor.

The south wall of conference room Number 1 is a large window which overlooks studio A; clients are thus given an impressive view of studio operation. The cover photo, which was taken inside studio A, shows the conference-room window—it's above and left of center. Rear-view film projectors and CCTV sets in the conference rooms and offices are installed behind sliding wood panels. Off-the-air TV, CCTV, and film-viewing facilities provide a most impressive internal communications system.

A large carpentry shop for prop construction is included in the basement. Storage rooms, the heating plant, and a 105-ton air conditioner take up the rest of the basement.

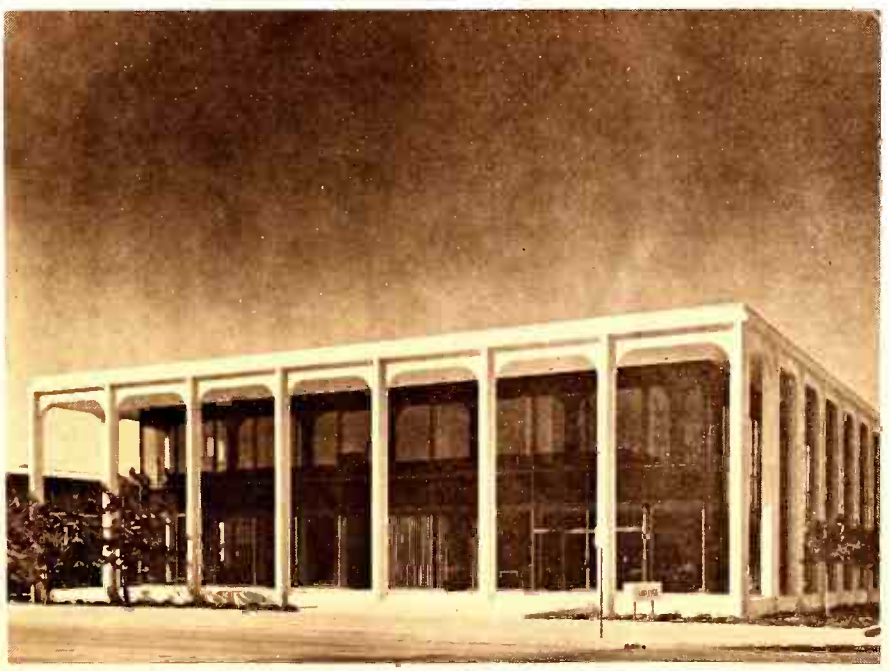
The Studios

At present, two image-orthicon cameras are used in each of the two studios. These cameras soon will be supplemented by color units. Lighting in both studios is quite flexible. Pantograph mounting devices (lazy-boys) allow the height and direction of each light to be easily adjusted.

Studio A

The large studio, studio A (Fig. 1), measures 47′ x 60′; its ceiling is 28′ high. The door between the prop room and this studio is large enough to allow an automobile to enter—the overhead door, which opens to the outside, and the ramp in the prop room are designed for this purpose.

Maximum viewing area of the



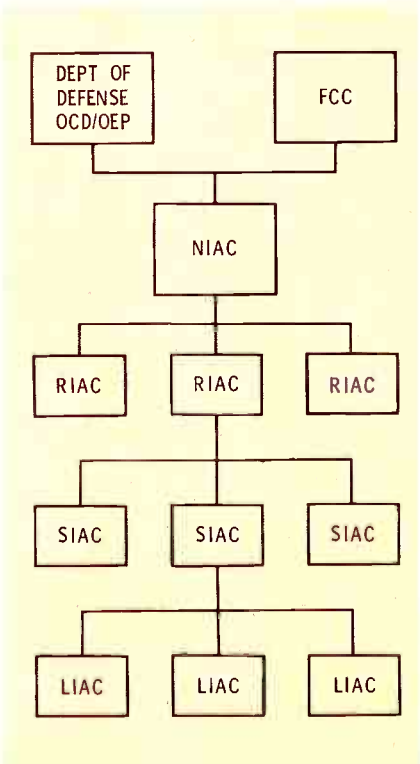
This modern building houses program-origination and business functions of WISH-TV.

on a voluntary basis. Standard broadcast stations in the system provide the direct outlet to the public. Network interconnection is provided by local telephone companies, A. T. & T. land lines, commercial networks, and newswire teleptype services. The EBS is a network of great depth, with many echelons of backup facilities provided by common-carrier and private microwave systems, state FM defense networks, and numerous similar communications facilities which will automatically complete any link of the connecting system that may be destroyed in an attack.

Besides the national network, there are various networks at regional, state, and local levels working within the overall structure to provide service both to their own areas and to the national network when needed. These are made up of a variety of facilities, such as FM stations, TV aural channels, STL's, private microwave links, remote-pickup stations, and local telephone companies.

The EBS Plan

Operation of the network follows the procedures outlined in a document called the EBS Plan. All participating stations must adhere to the procedures of the Plan. The Plan is revised continually as methods, routings, authenticating procedures, and techniques are added or improved. Although complete coverage of the Plan is impossible in one article, a few points will be brought out to indicate its scope.



EBS organization includes industry committees at all levels from national to local.

Priority of messages—what may be recorded for later playback and what must be broadcast live—is spelled out. Specific alerting and operating procedures for use during and after an attack, along with the correct authentication procedures, are given. Also included are network routings from various seats of government (national and local) with alternate routings from alternate sites. Key stations, regional areas, current FCC field supervisors and their addresses, and current members of the various industry advisory groups are listed.

Each participating station is provided with a copy of the EBS Plan. Additional copies may be obtained from the FCC field supervisor or the Defense Commissioner at the FCC in Washington.

Participation

As was mentioned earlier, participation is strictly on a voluntary basis. Even though a licensee desires to have his facility participate in the system, certain technical and other criteria must be met, and the facility must be accepted into the EBS. As with any well organized system, each facility must be capable of effectively meeting a need and of being integrated into the system. Operation in the EBS and any modification of the facilities which may be required are at the expense of the individual licensee.

A participating station may withdraw from the system if it desires. There are some requirements to be met, however. The licensee must inform the FCC field supervisor **in writing** 30 days prior to withdrawal and must submit his National Defense Emergency Authorization for cancellation. This is required because the function his facility fulfilled in the system will have to be replaced by another means.

For those stations not belonging to the EBS, a few requirements of the regular FCC Rules must still be met. Whenever the Emergency Action Notification is sounded, the EBS goes into operation, and **all** stations are required to transmit the alert **immediately**—without apology to their listeners and without delay. (Transmission of the alert on every station reaches the greatest number of people.) After transmitting the prescribed alert message, non-EBS stations must immediately remove their carriers from the air and remain silent until the Emergency Action Termination signal (all clear) is given. The only stations permitted on the air during an Emergency Action Condition (the period between the alert and the all clear) are regular government communication channels and those stations participating in the EBS.

Organization

Security of our nation is the responsibility of the Department of Defense. Through its office of Civil Defense (CD) and Office of Emergency Planning (OEP), in cooperation with the FCC, the EBS is controlled and directed.

All the participating facilities of the EBS are nongovernment, so industry groups are represented at various levels in the organization by the National (NIAC), Regional (RIAC), State (SIAC), and Local (LIAC) Industry Advisory Committees. Each of these committees is composed of members of industry groups in the area involved. It is the responsibility of these groups to work toward a continually more effective system.

These industry groups are familiar with their own areas and the capabilities of their facilities; they can develop many possible local routings, intercity connections, and operating procedures. The state FM defense networks and the remote-pickup communications networks are two of the developments of these committees. Any plan developed by a committee must be offered as a proposal to the next higher committee so that local, state, or regional plans can be integrated into the system. All such proposals must get approval from the FCC before final inclusion in the EBS Plan.

The Rules

There are not many EBS rules. They are found in Part 73, subpart G of the FCC Rules and Regulations. Some of them pertain to all

stations, and others pertain to EBS stations only. Implementation and elaborations of the EBS rules are sent out as Annexes to the Plan.

Every standard, FM, or TV station, commercial and noncommercial, must interrupt its programing and broadcast the alert in the manner prescribed. This requirement applies also to those stations operating with program or equipment test authority.

To insure receiving the alert, every station is required to have in operation at its control point a receiver tuned to a key EBS station. This is required even though the station is connected to one of the news-wire teletype services.

EBS tests are conducted so that, when an alert is sent out, station personnel will be able to perform the required functions without delay. Key EBS stations send out a test once each week, at a different time and day each week. The news-wire services send out a test on weekends. Every broadcast station is required to transmit a test once a week. Times and days are varied so that the test does not become a routine event and so that all personnel have an opportunity to perform the required functions. Over-the-air tests are to be made between 8:30 AM and local sunset. The time and source (key station, news wire, or the station itself) of each test, whether received or transmitted, must be entered in the log.

The over-the-air tests are the well known carrier interruptions, 1-kc tone, and appropriate message (prescribed in the EBS Rules).

Any licensee may apply to the FCC field supervisor, in writing, if he desires his facility to participate in the EBS. To determine whether a station meets certain technical and other criteria for acceptance into the system, an application must be filled out. The application is not elaborate or complicated, but it does cover points such as station day and night coverage, hours of operation, adequacy of staff, and similar points.

When a station is approved for participation in the EBS, it is sent a National Defense Emergency Authorization (NDEA). This is a certificate similar in size and appearance to the regular station license; it is to be posted along with the station license.

It is not the intent of this article to imply that only a select group of stations is desired in the EBS. On the contrary, the FCC and Department of Defense would like to have as many facilities participate as possible. At the same time, however, simple numbers do not make an effective network. A station joining the EBS must be willing to accept some obligations and possibly some expenses along with whatever prestige may be gained from being a member. Such obligations include participation in the local, state, or national committees if called upon; promotion of the EBS; education of listeners; and a willingness to make whatever modifications may be required to technical equipment or facilities.

FM stations and some television aural transmitters are used to form state or regional FM defense networks. These networks are backup facilities and not intended for direct broadcast to the public. (Of course, the public can listen if they tune in the FM station. All stations, whether AM, FM, TV, remote pick-up, etc. operate in the EBS with their normal frequencies and powers.) FM licensees wishing to participate must apply to the chairman of the SIAC in their state. When such a station is approved for operation in the FM defense network, the FCC issues an NDEA for this purpose.

There are some cases, depending on location and circumstances, in which an FM station not part of the state FM defense network may be permitted to broadcast directly to the public just as an AM EBS station would do. Application must be made to the chairman of the state IAC so that it can be determined whether such use of the FM station would cause interference to the FM defense network. If such transmissions are approved, the station will receive an NDEA for this operation. Such situations, however, are not common.

Stations operating in the FM defense networks are still obligated by the regular FCC Rules to obtain permission and give permission for programs rebroadcast from another station. There is a simple, acceptable solution to this problem. The SIAC chairman will provide the FM

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Date_____

Federal Communications Commission
Washington, D.C. 20554

Secretary:

The undersigned licensee grants to any standard, FM, or television broadcast station authority to rebroadcast the Defense Network (FM) programs transmitted by this station.

_____
Name of Licensee

_____
Call Letters of Station

_____
Station Location

_____
Signed by Licensee

Sample of a letter for use by a station participating in a state FM network.

A PRIMER ON DIRECTIONAL ANTENNAS

by J. G. Rountree, Consulting Engineer, Austin, Texas—An introduction to and review of the basic principles and terminology of directional antennas.

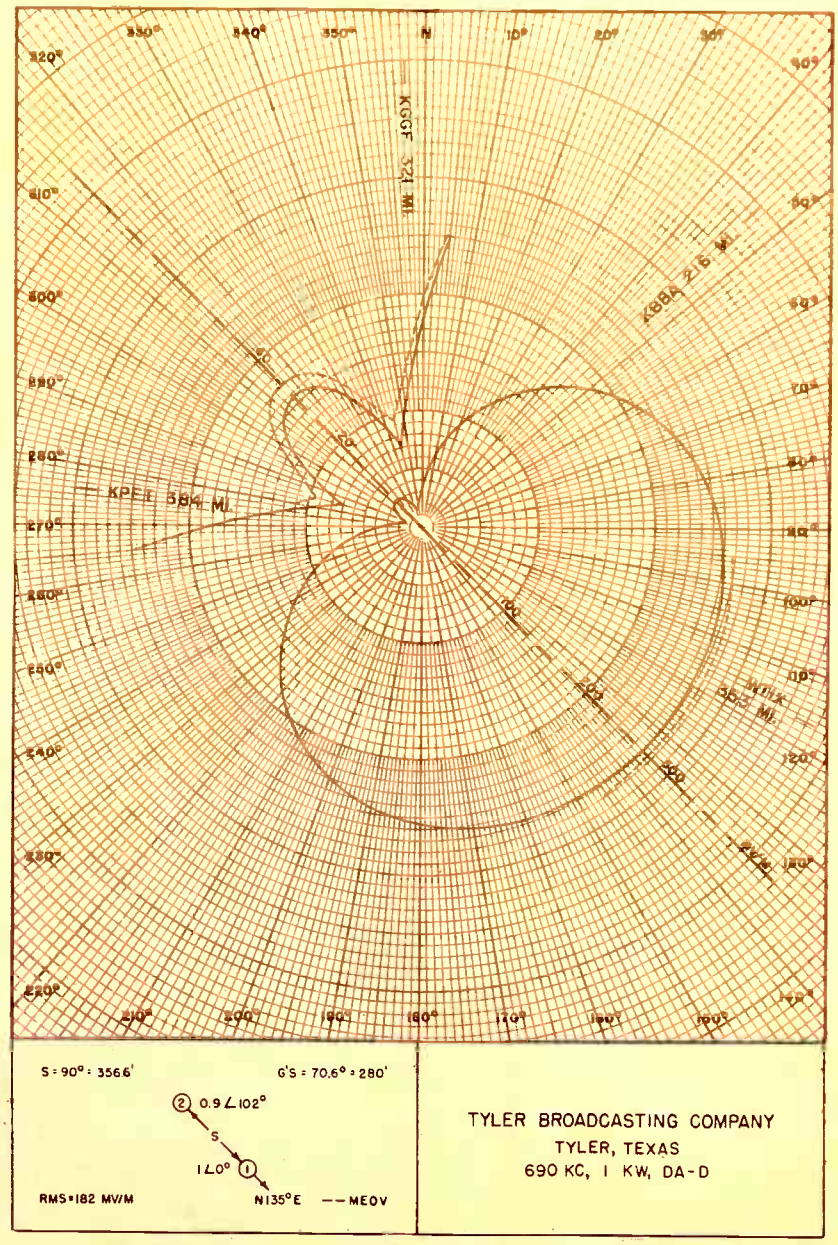

Fig. 1. Pattern is polar graph of unattenuated field at one mile, not a coverage map.

The operator accustomed to single-tower operation enters an often-confusing field when faced with the care and feeding of a multielement directional antenna. This article will discuss directional antennas for standard broadcast stations, with the hope of eliminating some sources of confusion.

The Why of Directional Antennas

Basically, the purpose of a directional antenna is to shape the radiation pattern of the antenna system in a desired manner. In almost every instance, the desire is to reduce radiation toward other stations and thereby minimize interference to these stations. In a few instances, a directional antenna at a coastal location is used to restrict the signal over the sea while increasing it over land.

A directional-antenna pattern is a polar graph showing the amount of radiation in each direction in terms of the unattenuated field intensity in millivolts per meter at one mile (Fig. 1). (In countries using the metric system entirely, this is sometimes given in terms of the unattenuated field intensity at one kilometer.) Unattenuated field intensity at one mile is the field intensity which would exist at that distance if the signal were not attenuated in passing over the ground.

It is usually found that a station using a directional antenna system is so located that the major lobe of the pattern extends in the direction of the city with which the station is associated (Fig. 2). From this fact it is often incorrectly assumed that the antenna pattern was designed to place the major lobe over the city when operating from the station site. The fact is that first the an-

tenna pattern was designed to provide the required protection, and then the site was selected so that the required coverage contours include the city. It must be emphasized that the directional antenna pattern itself is not a coverage map. This is a frequent misunderstanding among nontechnical persons.

Directional Antenna Data

When a directional antenna is being designed, the value of unattenuated field intensity which will be radiated in a given direction is determined from the design formulas. Such formulas can be quite complex, and computers are frequently used for their solution. After the antenna is built, the actual unattenuated field intensity radiated in a given direction must be measured. For this purpose, field-intensity measurements are made in a manner prescribed by FCC Rules. The measurements, made along a radial extending in the specified direction[1], are plotted on a log-log graph paper (Fig. 3) and analyzed by comparison with the appropriate graph of field intensity versus distance appearing in the FCC Technical Standards[2].

A complete report on the adjustment of the directional antenna system is filed with the Federal Communications Commission in connection with the application for station license. This proof-of-performance report normally includes data on field-intensity measurements, including graphs of measurements along each radial, maps of the points at which measurements are made, values of field intensity measured, and distance from the center of the antenna system to each point of measurement. Also included are all pertinent meter readings; the measured directional pattern; data on antenna or common-point impedance measurements; description, map, and photographs of the monitoring points; and any additional information deemed pertinent. A copy of this report must be retained at the station and made available on request to authorized FCC personnel.

The Directional Antenna System

The directional antenna itself consists of two or more towers with the currents in each tower carefully controlled as to relative amplitude and phase. Power from the transmitter is fed into a phasor, which divides the power and introduces the desired phase shifts in the resulting currents fed to the towers. Usually, the phasor is a single unit located near the transmitter, although occasionally its elements are distributed among the towers. In the usual installation, each output from the phasor is fed through a transmission line to one tower base, where a line-termination unit matches the line impedance to the operating base impedance of the tower. Each line-termination unit has an RF ammeter which indicates the current at the antenna base. Frequently, another meter or a jack is provided so that the transmission-line current into the unit can be measured.

A large single-turn loop of wire or tubing is suspended from the tower to sample the field radiated by the tower. This sampling loop may be either a shielded loop insulated from the tower or an unshielded loop in which a leg of the tower forms one side. In either case, a small-diameter transmission line, called a sampling line, carries the sample of RF energy to the phase monitor. In the case of the unshielded loop, a portion of the sampling line is coiled to make an inductor, called an isolation coil, which is placed at the tower base to prevent the sampling line from acting as an RF short across the base insulator. The isolation coil is adjusted by means of tapped turns or a variable capacitor.

On a tower which is a quarter-wavelength or less in electrical height, the sampling loop is placed near the bottom of the tower, far enough above ground (20′ or so) to minimize ground effects. On a tower more than a quarter-wavelength in electrical height, the sampling loop is usually placed at the point of maximum current (Fig. 4).

In some installations, the sample current is taken from an RF trans-

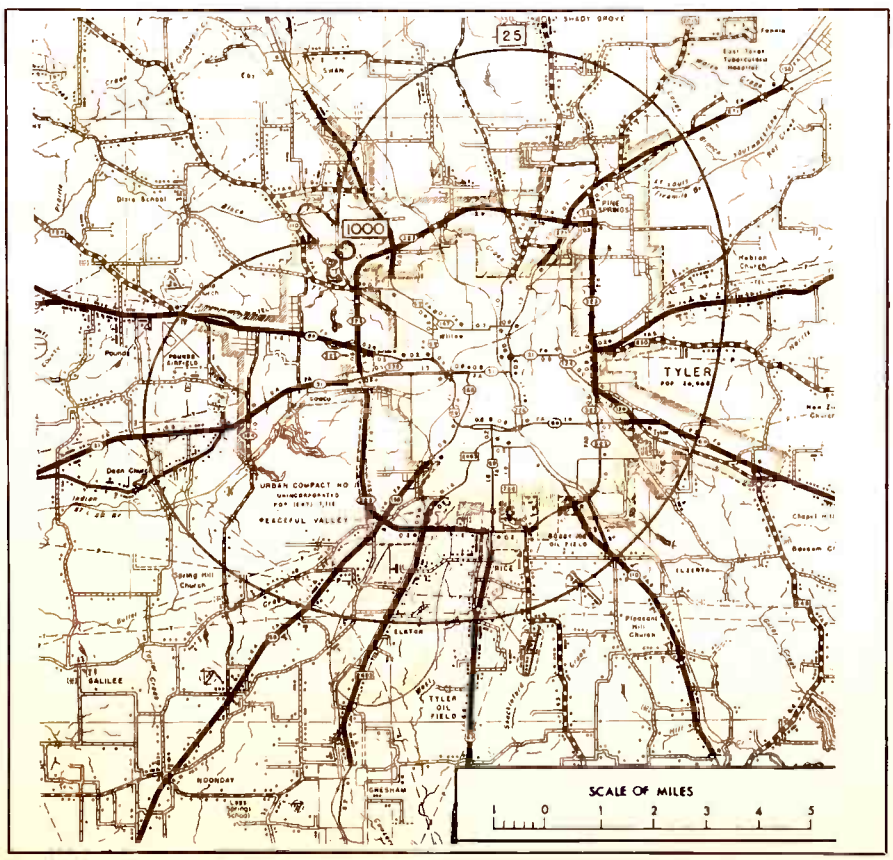

Fig. 2. Map shows 1000-, 25-mv/m contours for station whose pattern is shown in Fig. 1.

[1] "Running the Radial," by Elton B. Chick, June 1965 BROADCAST ENGINEERING, page 21; and "Understanding and Using the Field Intensity Meter," by Thomas R. Haskett, November 1965 BROADCAST ENGINEERING, page 10, and December 1965 BROADCAST ENGINEERING, page 23.

[2] "Checking the Pattern," by Elton B. Chick, July 1965 BROADCAST ENGINEERING, page 20.

former located in series with the base ammeter. However, such transformers usually use a tuned secondary, and this introduces an element of possible instability in the monitoring system.

Regardless of how the sample current is obtained, it is fed to a phase monitor which provides an indication of relative phase and current amplitudes. The indications of the phase monitor are of primary importance in maintaining proper operation of the directional antenna.

In designing a directional antenna system, the engineer has chosen current ratios and phase relationships which will produce the desired radiation pattern. These are the theoretical specifications shown in the station license. In the actual tune-up, the parameters usually depart somewhat from the theoretical specifications. The actual values are listed as the operating specifications in the station license. It is these values which should be observed in order to maintain the directional-antenna pattern. FCC Rules require that the ratios of base currents and of sampling-loop currents be maintained within 5% of the values specified in the license. No tolerance for phase relationship is specified in the Rules, although it has been held that deviation beyond 4° is considered to be excessive. It should be noted that some critical antenna systems require operation within closer tolerances than these in order to provide required protection. In such instances, the closer tolerances are spelled out in the station license.

Common Point of Input

In a single-tower antenna, the actual value of antenna base current is used to determine radiated power. In maintaining a directional antenna system, however, the actual values of base currents are less important than the ratios between tower currents. Power is determined at the point of common input to the phasor, and the current read at that point is called the common-point current. After the antenna system has been finally adjusted for the required pattern, the resistance at the common point is adjusted to the desired value, and the common-point reactance is made as close to zero as possible.

Because power is lost in the tuning equipment of a directional antenna, the transmitter actually supplies more than the rated power to the common point. For a station of 5000 watts or less which uses a directional antenna, FCC rules provide that the license will specify the common-point resistance as 92.5% of that actually measured. Thus, a 1000-watt station will actually deliver 1081 watts to the common point, and a 5000-watt station will deliver 5405 watts.

For stations of over 5 kw, the license value of common-point resistance is specified at 95% of that actually measured, since such stations usually use lower-loss tuning equipment. Thus, a 10,000-watt station will actually deliver 10,526 watts to the common point, and a 50,000-watt station will deliver 52,632 watts.

Monitoring Points

The license for a station which uses a directional antenna describes certain monitoring points and specifies values of field intensity which must not be exceeded at these points. Monitoring points are designated by the engineer carrying out the directional-antenna proof of performance and are chosen to comply with terms of the construction permit. Those terms require that a monitoring point be selected in each of certain directions from the antenna and that the points be in the clear and located not less than one nor more than four miles from the antenna. The engineer tries to locate monitoring points that are readily accessible, available over all-weather roads, and located in areas where new construction is not likely. Thus, cemeteries, public parks, golf courses, and school playgrounds are highly regarded as monitoring-point locations. Occasionally, a suitable point cannot be found within the one- to four-mile section of a radial; then a point elsewhere along the radial is used.

The directional-antenna proof-of-performance report must include the value of field intensity measured at each monitoring point after final adjustment of the antenna system. In issuing a station license, the FCC applies a multiplying factor to

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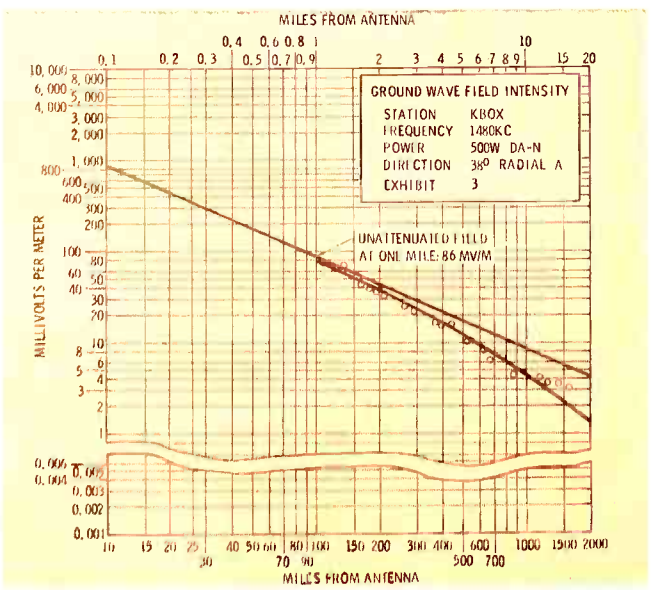

Fig. 3. Unattenuated field is determined from measured values.

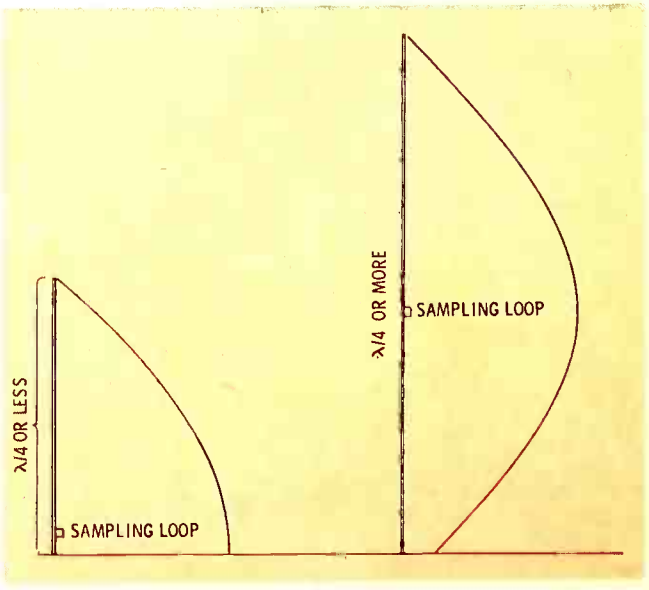

Fig. 4. Loop placement depends on electrical height of tower.

RADIO PIERCES THE GREAT BLACKOUT

by George C. Sitts, Eastern Regional Editor

When the power died in the Northeast the evening of November 9, 1965, radio stations in the affected area either made or lost their reputations as reliable news sources in a crisis. It was a difficult test, and those stations that passed did so because their engineers were prepared.

We chose the New York City area for a closer look at the engineer's role in that crisis principally because more people and stations there were affected for more hours than in any other area.

As the power dip occurred, stations found themselves in a variety of situations—power at the transmitter but none at the studio, no power at either transmitter or studio, loss of STL lines, loss of remote control, a multitude of engineers, or no engineer around. All affected stations were off the air briefly, leaving the broadcast band rather quiet; then they gradually came to life again. Within one minute, carriers that were off began to return, and those stations equipped with automatic switchover began to program. Within five minutes, other stations popped on, and within the hour most of the stations that were going to make it at all were in operation.

WCBS was a prime example of preparedness. With studios on the 16th floor of a new building and a remotely controlled transmitter, the station had auxiliary diesel generators with automatic switchover to produce operating power for two studios, control rooms, input equipment, newsroom, and some lights. In addition, there was a second generator to power elevators. The transmitter was equipped with a diesel generator to switch over automatically and operate the auxiliary 10-kw transmitter; besides this, WCBS had recently installed a 175-kw generator capable of operating the 50-kw main transmitter, but without automatic operation. As power lines died, the auxiliary generators kicked on at the studio, and the 10-kw rig came on at the transmitter site. The engineers checked the STL phone line, found it okay (they had a standby STL ready), and turned the operation over to the programing people.

A transmitter engineer on his way home saw the lights go out, realized the problem, and immediately returned to the transmitter. By 10 PM, the 50-kw rig was operating on the new generator. Chief Engineer Robert Mayberry told BROADCAST ENGINEERING the station remained on auxiliary power until 6:15 the following evening, long after power had been restored, to ease the starting load on the Consolidated Edison system.

Chief embarrassment of WCBS was that the station's two mobile cruisers were stranded on the upper level of a storage garage with electrically operated elevators; they were useless during the blackout.

WABC, according to chief engineer Julius Barnathan, was off the air for 15 minutes, the time it took to get the emergency generator going at the transmitter site. This station utilized another gasoline generator to power the radio studio. The STL phone line was dead, but engineers discovered the business phone to the transmitter worked. A call was made from studio to transmitter to open the line; then the console and transmitter input equipment were connected to the phone terminals, putting the station back in operation.

WINS, the city's all-news outlet, lost studio facilities for two minutes as lights went out. An engineer at the transmitter in New Jersey, where power held, played prerecorded fill tape until contact was reestablished. At the studios, engineers connected a battery-operated remote amplifier to the STL phone line, only to discover the line was out of service. However, before an alternate line could be established, the original line returned and held through the evening.

WINS, being an all-news operation, had more reporters on the street when the problem occurred than other stations. As soon as programing began, chief engineer Hal Brokaw reports, his engineers turned to the problem of coupling battery-operated tape recorders to incoming phone lines for beeper reports. This alleviated the necessity for reporters to return to the studio and climb 19 floors to air their reports.

WOR Radio was typical of the nonnetwork metro-

Control room B at WCBS shows operations during emergency.

WCBS newsmen report on the blackout as engineers look on.

politan stations partially affected by the power drop. With a transmitter in Carteret, New Jersey (an unaffected area), a studio in Manhattan, and a remote-control point in the Empire State Building manned by WOR-TV engineers, the station was off for a quarter-hour. According to WOR director of engineering Orville J. Sather, as soon as the power went off, engineers at the remote-control point hooked two batteries to a small inverter to power the remote-control unit.

At the studio, a gasoline generator failed to start. A battery-operated remote-broadcast amplifier was put into service, but the STL phone line to the transmitter was out of service (a telephone-company booster amplifier had lost power). After some hurried patching and connecting, engineers managed to get a line to the transmitter via DC intercom lines to the Empire State control point and then to the transmitter via a spare set of lines in the remote-control circuitry.

Broadcasting began with the announcing staff using candles and flashlights in the studio. WOR was blessed with a traffic-report helicopter in the air and a mobile unit on the street at the time. The receivers for these remote units were located at the Empire State Building, and because the shortage of power at that site prevented use of the cue transmitter, it was necessary to give on-the-air cues to the units, at which times the Empire State engineers would patch them directly to the transmitter.

Shortly, the gasoline generator at the studio was repaired and activated, restoring lights and limited studio power. This luxury lasted until about midnight when it became apparent the unit would soon be out of gas. With gas-pump and elevator service out (WOR studios are on 24th floor), the problem could have been serious; but a businessman in New Jersey, hearing of their plight on the air, drove in with seven gallons of gas and carried the fuel up all 24 flights.

WNEW was more fortunate. Chief engineer Max Weiner reports two of his maintenance men were about to leave the transmitter when the failure occurred. Again the transmitter was in a safe area, but the fail-safe feature of the remote-control unit kicked the carrier off the air. The men immediately restored the carrier locally and programed music from a turntable at the transmitter. The station was again fortunate because the STL phone line held up. Thus, getting back in business for the night was only a matter of getting one of their battery-operated remote-broadcast amplifiers connected to the line, and gathering candles and flashlights.

Personnel of WMCA, seeing the lights begin to dim and hearing the turnables change speed, threw the remote-control equipment to an emergency supply, preventing any carrier break. Engineers then switched their operation to a standby studio equipped with a battery-operated console and two turntables powered by an inverter. The staff began operation with three 75-watt lamps, but reduced illumination to one lamp to save battery power when it became apparent the power outage would continue.

The station remained on emergency power for 12 hours. Teletype service was out—as it was in all stations—but news was brought in by telephone reports and by roving reporters with portable tape recorders. Many of the staff members stayed through the night, subsisting on sandwiches, coffee, soft drinks, and cakes brought up to the 13th-floor studio by faithful listeners.

Among the city's other stations:

WLIB and other daytimers were approaching scheduled sign-off time and thus remained dark for the duration of the failure.

WHOM, a principally Spanish-language operation, used battery equipment to operate studio facilities until their 2 AM sign-off.

WQXR, with no emergency power provisions, spent the night silent—the station's first power failure in 25 years.

The morning after the blackout was a time for station managers and engineers to analyze the night's operations. As a result, some studios and transmitters are now being equipped with improved power-generating equipment and backup STL relays. But in most cases, relatively smooth emergency measures illustrated the careful planning by a handful of engineers for just such a night. ▲

Emergency news broadcast originates from the WMCA studios.

CARE OF MAGNETIC TAPE HEADS

by Larry J. Gardner, BE Consulting Author, Chief Engineer, WKIX, Raleigh, North Carolina—Broadcast-quality tapes require properly adjusted machines.

A magnetic tape head is simply a ring of magnetic material having one or more air gaps and upon which is wound a coil of wire—a simple device, but one which must be designed to very close tolerances. Before looking at the things which can go wrong with a tape head, let's investigate its construction and how it varies with different applications.

Head Construction

First, a head core may be either a solid piece of magnetic material or a stack of laminations separated by a varnish coating to reduce eddy-current losses. It may have a single air gap, or it may be of symmetrical construction with two air gaps (Fig. 1). The symmetrical configuration reduces hum pickup, but also reduces output level. In every case, the tape contacts the head at the air gap and serves to complete the magnetic circuit of the core.

For the most part, the windings determine the electrical characteristics of the head. For vacuum-tube circuits, high-impedance heads are used, and the windings consist of a great many turns of very fine enameled wire. Generally, high-impedance heads have an inductance of about 500 mh and are used for playback. Record-only heads and playback heads for transistor circuits usually have an inductance of from 50 to 100 mh, whereas the inductance of erase heads is in the neighborhood of from 10 to 50 mh.

Physically, playback heads must have the shortest possible gap width consistent with sufficient output level—usually in the area of .0002". The record-head gap is longer, about .001" to .002", and the erase-head gap is about .002" to .01". The three basic gap configurations are shown in Fig. 2. The triangular gap produces the greatest output level but has a very short life. It can be seen easily that a small amount of wear on a head of this type will begin to affect the gap width. The straight-line gap has the longest life, but, unfortunately, it has a very low output level and is seldom used in practice. A good compromise is the trapezoidal gap geometry, which is used in most heads and provides good life and moderate output level.

The same basic construction is used on record, playback, and erase heads, the only differences being in inductance and gap length. The playback head, however, requires more shielding to prevent undesired hum pickup. Of course the con-

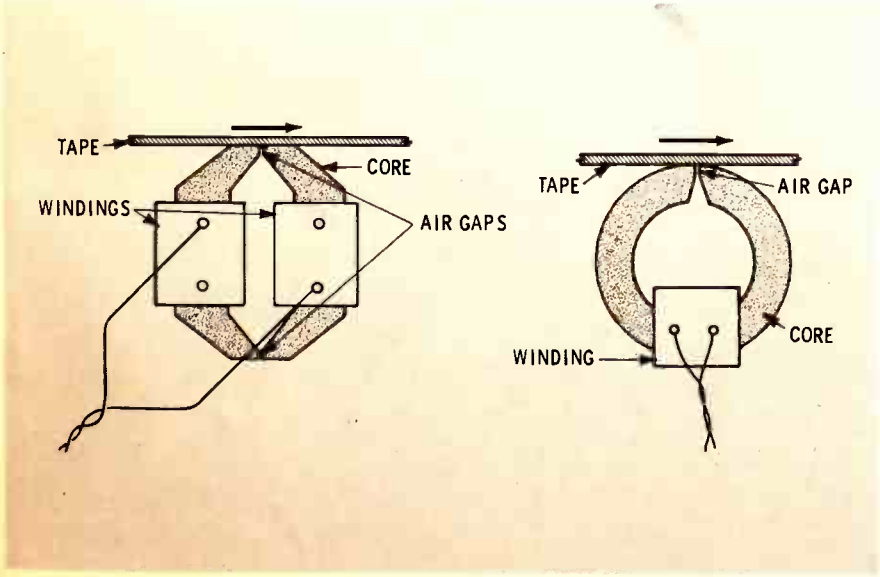

Fig. 1. A magnetic tape head is usually constructed in one of two basic arrangements.

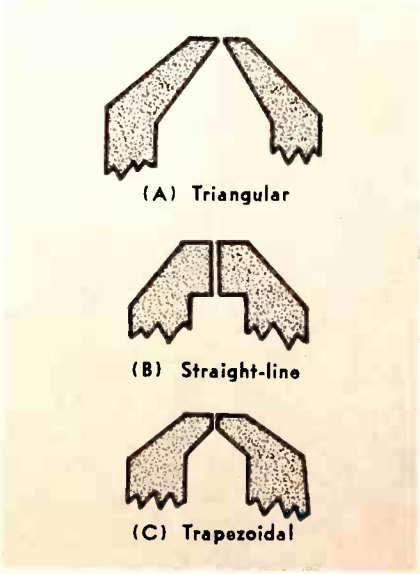

Fig. 2. Basic head-gap configurations.

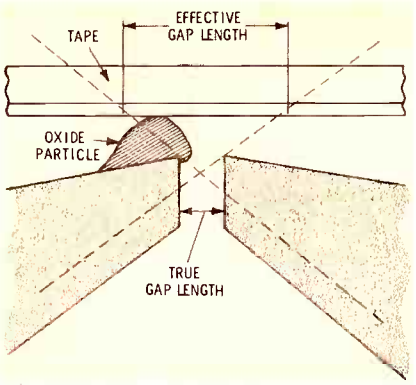

Fig. 4. Oxide accumulation on head lifts tape and increases effective gap width.

struction varies in size depending on whether the head is intended for full-track, two-track, or four-track operation. Fig. 3 shows the head dimensions which conform to the NAB standards.[1]

Head Wear

The most important cause of head failure is wear. The performance of the head becomes unacceptable as soon as the width of the gap begins to increase. Of course, the oxide coating on the tape is abrasive, and eventually any head can wear out. In addition, because of variations in the stacking of the head laminations, the gap tends to drift back and forth relative to the tape as the head wears. This means that occasional touching-up of head alignment is necessary to maintain best performance. Because of its shorter gap width and depth, the playback head is most subject to wear and generally becomes excessively worn somewhat before its companion record head and long before the erase head.

The usual symptom of wear in a playback head is a gradual deterioration of high-frequency response. The reason for this is that the output level is zero when the gap length is equal to the recorded wavelength. For example, if a worn head has a gap width of .001" and the tape speed is 7½ ips, it can be seen that the response will be zero at 7500 cps:

$$\text{frequency} = \frac{\text{velocity}}{\text{wavelength}}$$

$$7500 = \frac{7.5}{.001}$$

There is no practical way to reduce head wear other than taking the precaution not to rewind or fast-forward the tape over the heads. Generally, the condition of the head gap may be determined by inspection of the head surface with a magnifying glass. In a good playback head, the gap should be barely visible through the glass. The record-head gap should be easily visible and in a good head will be uniform in width across the entire head surface. The same holds true for an erase head. Since head wear is almost never completely uniform across the entire head surface, a good check on the condition of a full-track record head is playing a tape made with it on a stereo machine. If the record head is excessively worn, there will usually be a large difference in the levels of the two channels of the stereo playback, due to the difference in level recorded by the long and short portions of the recording-head gap.

For good performance, it is absolutely necessary that the heads be kept clean. Dirty heads show exactly the same symptoms as worn heads: loss of high-frequency response, poor recorded level, or poor erasure. Oxide build-up on the head surface tends to lift the tape off the head, increasing the gap width by an amount equal to more than twice the distance between the pole pieces and the tape, as shown in Fig. 4. For example, a head with a .0005" gap and .001" of oxide on its surface will have an effective gap greater than .0025", and at 7½ ips its output will drop to zero at 3000 cps. Also, since the oxide from the tape is a magnetic material, it can tend to cause a magnetic short-circuit across the head gap, bypassing the surface induction of the tape and causing a still greater loss in output level. And if this isn't enough, since the oxide build-up is always uneven and tends to shift the angle at which the tape contacts the head, still more high-frequency loss will occur.

Heads should be cleaned with ethyl alcohol, commercial head cleaner, or common rubbing alcohol. Many manufacturers do not recommend carbon tetrachloride be-

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[1] See also "NAB Reel-to-Reel Tape Standard," September 1965 BROADCAST ENGINEERING, page 16.

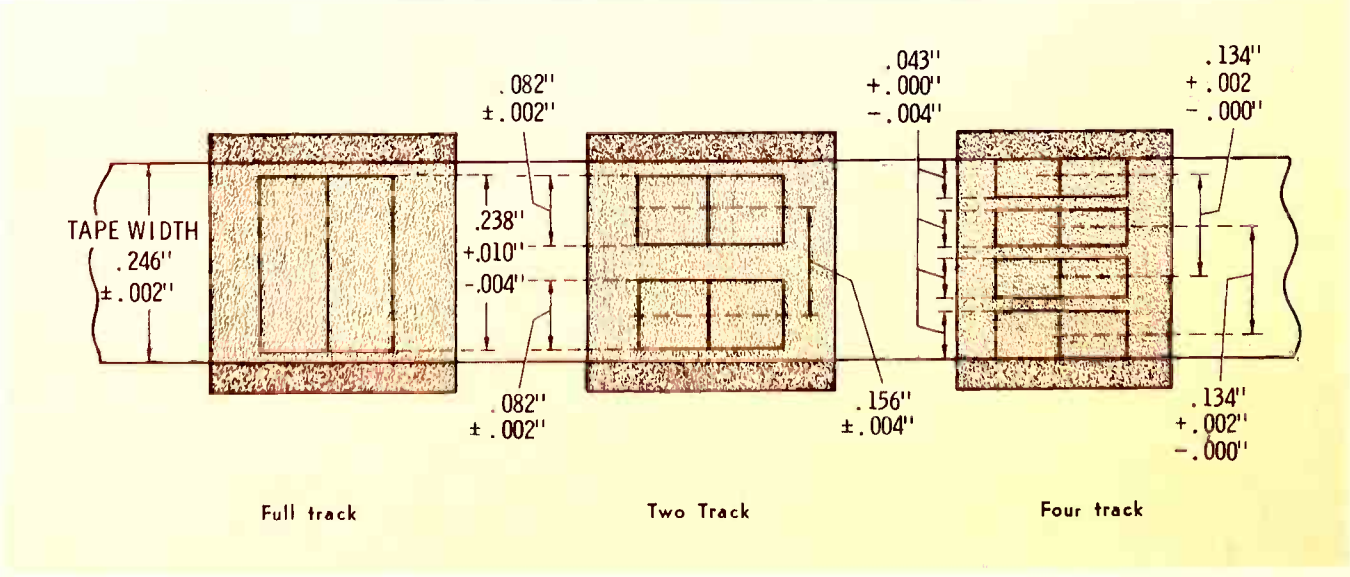


Fig. 3. For proper tracking and interchangeability of tapes, heads should be adjusted to conform to these NAB standard dimensions.

UNDERSTANDING AND USING THE FIELD-INTENSITY METER

by Thomas R. Haskett, Central Regional Editor, Cincinnati, Ohio—Part 2.
The value of the measurements obtained with this instrument depends on how it is used.

The first part of this series described the operation of the field-intensity meter and the way it is calibrated and read. This, the concluding part of the series, outlines the methods to use to insure validity of the results of the measurements.

Validity of Readings

A properly calibrated FIM can accurately indicate the intensity of the field in which it is placed. However, the technique of putting the meter in the field properly must be learned through experience. You must take a series of measurements, log them, plot them on groundwave paper, and see if they look right. A single reading by itself is practically useless.

To begin with, it's best to use headphones to be sure you are tuned to the desired station. If you are operating out of a car, tune the car radio to the station when beginning the trip. Listen for a station ID to verify the call. When you stop at the first measuring point, turn up the volume on the car radio, put headphones in the FIM, and take it outside. Tune the field meter to the same station you hear on the car radio. If you forget the headphones, put the field meter near the car antenna and turn on the calibration oscillator. If you are tuned to the proper station, you'll hear a heterodyne on the car radio. You should also look for a reasonable reading on the meter. Working within a couple of miles of a 1000-watt station, you would normally expect a reading in the vicinity of 10 to 100 millivolts, depending on whether the station is directional or nondirectional, and in the case of a DA whether you are in a lobe or a null. However, if you find a reading of 1.5 mv/m, something is probably wrong. If you find several readings that don't seem proper, it might be worthwhile to stop and call the transmitter. Perhaps the station is operating at low power or has switched patterns. It's important that the mode of operation be the same during all field measurements, and to verify this it's wise to talk with the operator on duty and have him check his operating logs for the times and days that you took the measurements.

Fig. 1. Overhead wires are almost sure to result in false intensity readings.

One of the most common mistakes made by a newcomer is taking a reading at a poor point—usually one where there's an obstruction. Some of the common ones are overhead wires (Fig. 1), trees (Fig. 2), buildings (Fig. 3), hills and creek beds (Fig. 4), and buried pipes. Such obstructions cause reradiation and shielding; they make readings useless or misleading. It's best to stay away from an obstruction by at least three times its height. Avoid high-voltage transmission lines and radio/TV transmitting or receiving towers by at least a tenth of a mile. Fig. 5 illustrates a pitfall for the inexperienced or careless field man. While a construction site is invitingly clear and may offer a choice spot in an otherwise heavily urbanized area, it lacks one important criterion for a measuring point—permanence. You can take the reading easily now, but when you come back in six months to recheck the array, you find a six-story apartment building on the spot, and you can't use that point anymore!

There are several techniques which can indicate reradiation and a poor point. Note the direction of the approaching wavefront—it should be in the general direction of the transmitter location. If you aren't sure what that direction is, use a compass to check. Note also the depth of the null when rotating the FIM—it should be deep enough for you to switch downrange a couple of steps before coming to the bottom. If you can't you probably have a bad point. Except when working extremely close to the antenna, say within a couple of miles, you can also check for reradiation by pacing off a small square, 10 or 20 paces on a side, while observing field intensity on the meter. There should be little or no variation in

Fig. 2. A tree is another obstruction to be avoided when selecting a point.

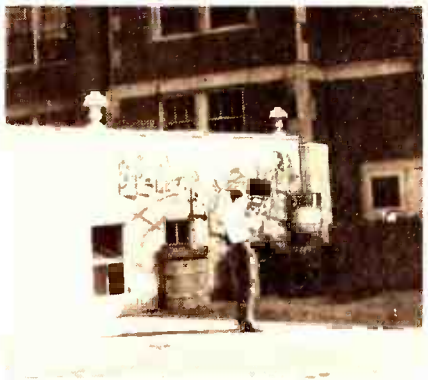


Fig. 3. To be valid, a reading must not be taken at a point too near a building.

the reading, and if there is you've probably got a bad point.

Choosing and Plotting Points

Points are usually tentatively chosen from a topographic map published by the Coast and Geodetic Survey. Radial lines will have been drawn from the transmitter site, and line-of-sight distances along each radial marked. Once you have chosen a point, you will drive there and inspect it. If the point is clear and accessible, the reading is then taken and an arbitrary point number assigned. It's important to mark the map and describe the point carefully so it can be located again. A typical log description might read: ".3 mi. S of Beavertown on US ±25, 20 pcs W of road, in cornfield." Beware of tying points down solely on seasonal plant growth. It's okay to give the distance from a permanent landmark and note that the point is in an apple orchard or by a walnut tree, but the orchard or the tree itself might be gone next year.

Cemeteries are probably the most desirable places for choosing field points. They don't have obstructions or wires, they are easily accessible during the day, they are almost eternally permanent and reliable, and they permit precise location, i.e., "10 pcs in front of headstone John R. Smith." Public parks are also desirable for measurement points, as are pasture land, cultivated fields, and interstate expressways. While most roads have overhead wires, and you have to walk out into the adjacent field to take the reading, expressways usually don't have wires, and the median strip is easily accessible.

Fig. 4. Hills and creek beds can act as obstructions, result in false readings.

Measurement points are plotted on log-log graph paper (Fig. 7). The distance between points varies with the distance from the antenna. Two points a tenth of a mile apart at the .2-mile distance will be well spaced on the graph; to get an equal spacing at the 2-mile distance requires that the points be a mile apart. FCC rule 73.186 requires that you take points every tenth of a mile out of 2 miles, every half mile from 2 to 6 miles, and every two miles out to 15 or 20 miles. Beyond this, the usual practice is every 5 or 10 miles out to 100 miles, and 10 to 15 miles apart beyond 100 miles.

Close-in work (out to 2 miles) has its own requirements. It's essential to get these points exactly on the radial and as close as possible to the tenth-of-a-mile distance. Since roads cannot be depended on to furnish precise points at the desired distances, close-in work usually involves what are known as walk-in points. Simple pacing is usually inaccurate and should not be used for determining tenth-of-a-mile distances. One fairly accurate method involves two men and a length of rope that is some submultiple of one-tenth of a mile—say 132′. The men stretch the rope between them until they have measured off a tenth of a mile. Another method is to use a steel tape in the same manner. To make sure you're still on the radial, use a magnetic compass to measure the angle between the antenna and North. Remember to use the correction factor for magnetic error, for topographic maps are oriented to True North.

If you have to work alone on walk-in points where there are almost no landmarks on the radial, you can use a magnetic compass and the FIM itself to locate the tenth-of-a-mile points. On the map, measure off the required points and locate large landmarks (farmhouses, road intersections, etc.). Then measure the directions from the points to the landmarks. To locate the actual points on the ground, take bearings on the landmarks. Also, you can use the FIM as a direction finder by nulling out the station signal and sighting across the loop antenna. (There is a small slit on top of the loop for this purpose.) Using the compass, the FIM, the map, and a protractor, you can find the walk-in points by triangulation.

Fig. 5. Construction site may seem like a good point, but it lacks permanence.

Calibrating the meter at a close-in point can be confusing, because the station signal may be greater than 500 mv/m (one-half volt per meter), and you may not be able to null it down far enough to avoid a heterodyne with the calibrating oscillator. In this case, a fairly reliable method is as follows. Null the station signal in the usual fashion by rotating the loop; then detune the RECEIVER control **up-band,** while switching the FULL SCALE RANGE switch down-range, until the signal is near the bottom of the 100 uv/m range. Then calibrate the meter as usual. Note that you are calibrating the meter **off** the station frequency. When you have calibrated, readjust the RECEIVER control to the station signal, orient the FIM for maximum signal, and take the reading. Then repeat the procedure, except detune the RECEIVER control **down-band.** You will then have measurements calibrated on either side of the station frequency. Record the average of these readings as a close approximation of the actual value.

Some engineers prefer not to take measurements closer to the antenna than 1 wavelength or 10 times the spacing of a directional array, while others read the meter as close in as possible without exceeding the

measuring range of the instrument. If you want to take very close readings, you must contend with the induction field and the fact that a DA is not a point source. These effects are known as proximity effects, and correction factors have been determined for application to close-in measurements. The factors are found on pages 9-22 and 9-23 of the 1960 edition of the **NAB Engineering Handbook.** The advantage of these close-in measurements is that soil conductivity has almost no effect on the readings, and a true indication of the array's inverse field is obtained.

It is always important to take more measurements than will be necessary for the final plot. No matter how careful you are in choosing clear points, there are always a few readings that don't plot out nicely, and these you usually throw away. Beyond two or three miles, it's not of prime importance to get points at exact distances. It's much more important to stay on the radial, especially when the station is operating DA. Even so, points that lie within one degree of the radial are usually acceptable. Such off-radial points should be marked as such, of course. Occasionally you will find a lake or a trackless wilderness inside which it's almost impossible to get points. If this forbidden area isn't too big, you simply skip it and take a few extra points on either side of it to compensate for the hole. However, if a lake exists for five miles close-in on an important null radial in a DA, you will have to hire a boat or an airplane and make the readings. Techniques of nautical and aeronautical measurements are beyond the scope of this article. (See Bibliography)

Extra Hints

With almost no exceptions, field measurements **must** be made during daylight, because skywave signals render nighttime measurements useless. This means that you can work only during certain hours that depend on local sunrise and sunset. These items can be found on the license of a daytime station or a station with different day and night patterns and/or powers. If necessary, you can call another station in the area for this information, which is standardized by the FCC for each community. If you are

Fig. 6. Satisfactory measuring points, accessible and free from obstructions.

measuring fields of 50 mv/m or stronger, it's usually safe to work within 1 hour of local sunrise or sunset. For fields between about 5 and 50 mv/m, the general limitation is 2 hours away from sunrise and sunset. With fields of less than 5 mv/m, you may not be able to work within 3 hours of sunrise and sunset. These limitations apply in general from late spring, through summer, to early fall. During winter, skywave activity is stronger during daylight, and, to cite an extreme, sometimes in January you can only work a couple of hours each day when measuring very low field intensities. Actually, none of these are hard-and-fast rules, and your own judgment as you take readings is the final criterion. If the reading is not steady over a period of a minute or more, skywave interference may be present, and you may not be able to use the reading.

The type of log you keep as you take readings will depend on your chief engineer, consulting engineer, or other authority. Typical entries include the station measured, operating frequency, power, mode (DA-D, DA-1, ND, etc.), weather conditions, meter type and serial number, engineer's name, date, time, point number, distance to antenna, description of point, and the reading of field intensity. This last column will usually be headed "E mv/m," and readings should always

• Please turn to page 48

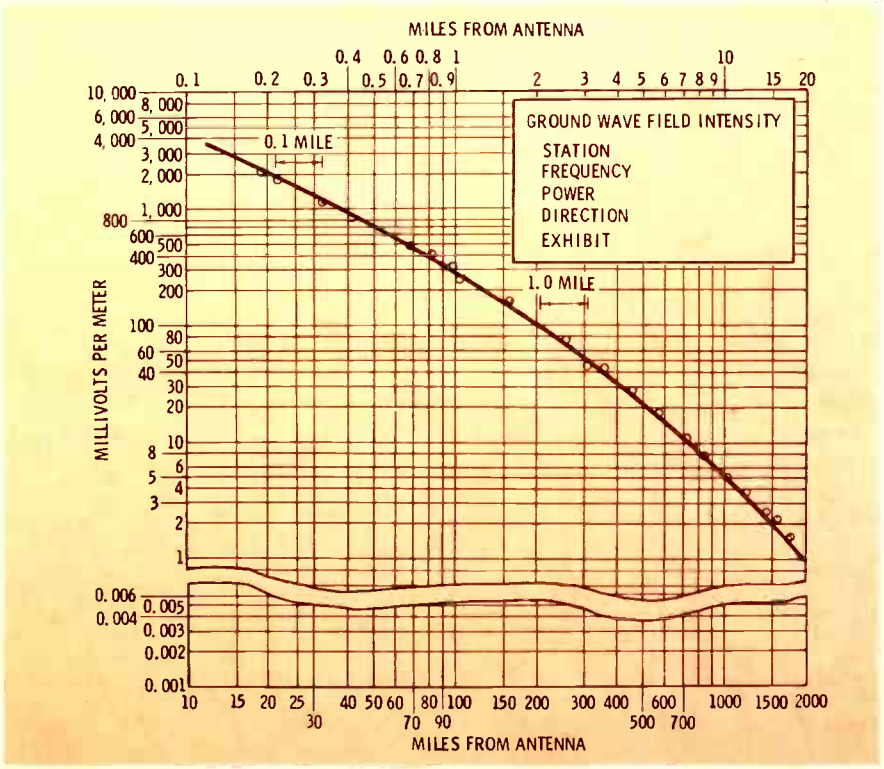


Fig. 7. Field-intensity curve is plotted in this manner; distance affects spacing.

1965 SUBJECT-REFERENCE INDEX

BOOK REVIEW

Handbook for Electronic Engineers and Technicians: Harry E. Thomas; Prentice-Hall, Inc., Englewood Cliffs, N. J., 1965; 427 pages, 7" x 9¾", hard cover, $15.

Although much of the information given in this reference handbook is slanted toward military hardware and its applications, it should still be of value for use in nonmilitary applications. EIA, U.L., and NEMA standards are included; for example, the component-parts section and many of the circuits and measurement techniques given are useful for both civilian and military applications.

Mechanical-construction considerations are covered in the first six chapters. Chapters one and two describe tools and techniques used for drafting; chapters three and four list methods and tools used for chassis construction. These first four chapters should be a particularly useful reference for those who, although they have little contact with construction processes, must be familiar with all mechanical requirements and standards. The fifth chapter describes electronic components and their characteristics. Photos, tables, graphs, and drawings provide handy reference data on markings, tolerances, temperature characteristics, and applications. Chassis assembly and wiring procedure is covered in the sixth chapter.

A brief summary of math is given in the seventh chapter; slide-rule use, algebra, standard scientific notation, trigonometry, vectors, and binary numbers are all discussed. The eighth chapter introduces methods of laboratory organization.

Chapters nine through nineteen describe various techniques for measuring individual component characteristics, frequency, waveforms, vacuum-tube and semiconductor characteristics, microwave-equipment parameters, transmitter and receiver characteristics, and radar-system characteristics. The twentieth chapter concerns synchro- and servo-system applications and testing. The last chapter describes power-supply design methods and applications.

There are six appendices at the back of the book which supplement data contained in the text. Included are schematic symbols, a glossary of electronic terms and abbreviations, receiving-tube characteristics and basing diagrams, a list of JEDEC registered semiconductor characteristics, fuse data, and much other reference information. ▲

December 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

Changes in Public Inspection Rules

The Commission has made minor modifications in the Rules that require all broadcast stations to have reference copies of all major applications available for local public inspection (June 1965 Bulletin). Under the changed Rules, television translator station applications are exempt from the public inspection requirement. The Commission has also made it plain that network-affiliation contracts or financial records not otherwise made public are not covered under the public inspection Rule. Further, in the case of petitions to deny applications, only a statement identifying the name and address of the petitioner need be made publicly available, instead of a copy of the entire petition as originally required.

In their first approach to modifying the public-inspection Rules, the Commission decided which engineering information must be made available. Only maps showing service contours and information concerning transmitter and studio location would be necessary. This meant, however, that all stations must have coverage maps available. It soon became apparent that not all stations had such maps except with their applications at the Commission, and preparation of them would involve considerable expense. As a result, the Commission hastily rescinded this part of the changes.

Coverage maps are now required to be made available for public inspection only when they are part of new applications.

Microwave Service Exclusively for CATV

The Commission has created a new class of microwave service to be known as the Community Antenna Relay (CAR) Service, to provide relay facilities servicing Community Antenna Television (CATV) systems. The new service is in the lower 250 mc of the 12.7 gc to 13.2 gc band. On an interim basis, the CAR service will employ the same technical standards as those for television remote pickup and intercity microwave stations. All applications filed after November 22, 1965, must be in compliance with the new Rules, and no renewal authorizations for existing facilities will be granted to extend beyond February 1, 1971.

Under the new Rules, CATV systems are permitted to own their own CAR systems, and are encouraged to conserve spectrum space by using these microwave facilities jointly with other CATV systems. The Commission has also asked for comments on the question of the desirability of CAR licensees and television broadcast licensees sharing common relay facilities.

"Double Billing" Officially Outlawed

The Commission has adopted new Rules for AM, FM, and television stations to prohibit "double billing" practices by broadcast stations. The new Rules were adopted, with some modifications, in response to a proposal issued in March 1964.

Under the new Rules, the practices which are outlawed include not only the actual submission of separate bills in two amounts but also the providing of assistance to advertising agencies which might mislead the agencies' clients as to the amounts charged by the station for advertising. The Commission has issued a Notice giving its interpretation of several questions which might be likely to arise under the new Rules. A copy of this Notice may be obtained from the Commission (Mimeo No. 74223), or we'll be glad to obtain a copy for you.

Relaxed Station Identification for Auxiliaries Proposed

The Commission proposes to relax its Rules requiring station identification for television remote pickup and studio-transmitter link stations. The proposal would require only the call sign of the television broadcast station as a means of identifying the remote pickup or STL. Under present regulations, the call sign of the auxiliary station must be transmitted at the beginning and end of each period of operation. Also being considered is a relaxation of identification requirements on intercity relay stations, which would be exempted from any identification.

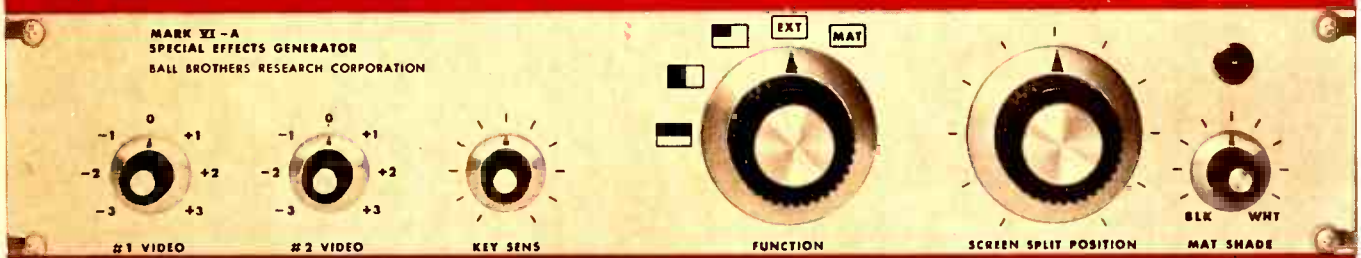
The Electronic Industries Association (EIA) has also petitioned the Commission to permit unattended operation of stations in the auxiliary services. Under the present requirements, these stations must be under the control of a licensed first-class operator, although remote-control operation is permitted and usually undertaken.

Short Circuits

Applications for 7 VHF translators at Cumberland, Maryland, have been set for hearing to determine whether they might retard UHF development in the area . . . A CATV system in the eastern part of Pennsylvania has been cited for excessive radiation from its cables; the radiation was almost ten times that permitted by the Commission's Rules . . . The Commission has proposed to modify its Rules governing calculations of interference from AM directional antennas to specify the use of calculated rather than measured values; predetermined tolerance is to be applied so as to permit the use of high-speed electronic calculators . . . Two FM stations in the Philadelphia area have been authorized to carry 4 SCA channels for "educasting" to be used for home instruction . . . 32 additional FM stations have been exempted from the AM-FM nonduplication requirements (September 1965 Bulletin) until December 31, 1965 . . . Emergency Broadcasting Service (EBS) operational plans have been approved for 49 states (all except New Hampshire) and the territories and possessions except for Guam, the Virgin Islands, and the District of Columbia; more than half of the country's broadcast stations are participating.

Howard T. Head...in Washington

THE MARK VI-A SPECIAL EFFECTS GENERATOR



ADD NETWORK-TYPE CAPABILITIES TO YOUR STUDIO OPERATION AT MODERATE COST WITH THE MARK VI MONOCHROME SPECIAL EFFECTS GENERATOR

Two models of the BBRC Mark VI are now available: the Mark VI-A self-contained unit (above) and the Mark VI-AR remote control unit (at right). Both units are capable of the following special effects: Horizontal, vertical and corner wipes. External video key for keyed inserts. Independent, selective matting* (or lettering) in the range of grey from black to white.

Studio Applications: Local stations can offer advertisers a variety of special effects. Educational TV stations, university TV workshops, or closed circuit TV systems can greatly expand studio capabilities. The Mark VI is an ideal standby generator, an auxillary unit for a second studio, or can be used in mobile van operation.

Compact, reliable construction: All solid state circuitry. Price: From $1375.00

Optional console panels are available for remote unit installation with the...

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BBRC

Circle Item 12 on Tech Data Card

Directional Antennas

(Continued from page 20)

each such value and specifies for each monitoring point a maximum value of field intensity which should not be exceeded. This is the maximum permissible value of field intensity—no further multiplying factor is to be applied.

Not infrequently, a monitoring point "goes sour" because of new construction in the vicinity and no longer gives a true indication of the state of adjustment of the antenna system. In such a case, a new monitoring point must be selected, preferably one of the points at which measurements were made in the original proof of performance. Complete data must be furnished to the FCC on the substitute monitoring point, including a description of the point, directions for getting there, a photograph of the point showing the field-intensity meter in place and as many landmarks as possible, and the value of field intensity measured at the point in the original proof of performance.

Conclusion

It is beyond the scope of this article to develop directional-antenna theory. For those who wish to study the subject further, a number of books and articles are available, such as "Standard Broadcast Antenna Systems" by Carl E. Smith and Daniel B. Hutton in the fifth edition of the **NAB Engineering Handbook.** It is hoped that the basic information presented here will serve as a foundation for such study. ▲

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Circle Item 14 on Tech Data Card

Tape Heads

(Continued from page 22)

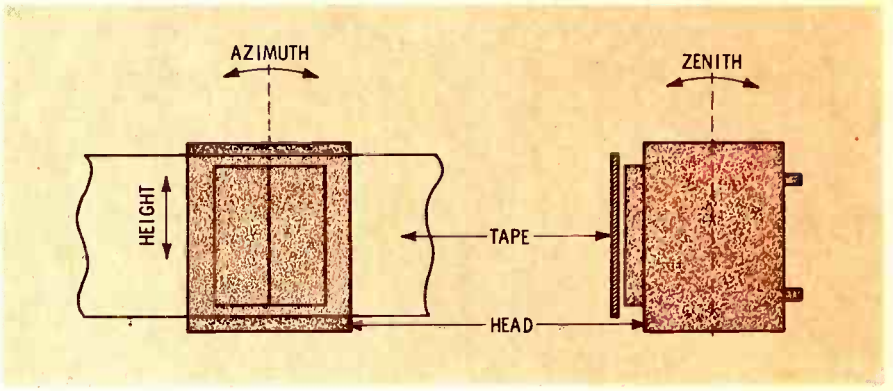

Fig. 5. For best performance, each tape head must be aligned in three directions.

cause it may dissolve the varnish which separates the laminations; it can be dangerous to the operator as well. The best cleaning tool is a small cotton swab. Also, cloth cleaning tapes may be used, but they should not be run across the heads at high speed because of the heat of friction.

Demagnetization

Although the head cores are made of a "soft" magnetic material, they can pick up a degree of residual magnetism from surges through the windings, exposure to strong fields, or contact with magnetized objects. If a head is magnetized, it can raise the noise level of a recording, whether the machine is in the record mode or not. It can also partially erase the high recorded frequencies and damage valuable tapes. To avoid magnetizing the heads, the following precautions should be taken:

1. Do not allow the heads to come in contact with magnetized objects, such as scissors or screwdrivers.
2. Do not record at excessively high levels, or even apply excessive signal levels to the record amplifier.
3. Do not remove tubes in either the record or playback amplifier while the machine is on.
4. Do not operate a bulk tape eraser near the heads.
5. Do not subject the heads to mechanical shock, such as allowing the gate to slam shut.
6. Do not turn the power off while the machine is recording.

The heads should be demagnetized at regular intervals. How often this is done depends on how much the machine is used and the quality standards which must be maintained. Many major recording studios demagnetize the heads each time the machine is used. Other users demagnetize them only when the machine gets its regular routine maintenance. For most conditions, the latter should be sufficient.

Alignment

In addition to being kept clean and demagnetized, the heads must be properly positioned, or aligned. As can be seen from Fig. 5, there are three position adjustments: height, azimuth, and zenith. On some machines, only one or two of these adjustments can be made; the others are fixed during manufacture. Head height positions the tape so that it is properly scanned. This adjustment is especially important on two-track and four-track machines to be sure the head is properly centered on the correct track and only the correct track. The best way to set the height is to use a piece of tape from which the oxide coating has been removed with acetone. A full-track head should be centered on the tape; a two-track or four-track head should be set so that the edge of the pole pieces coincides with the edge of the tape. A check on positioning of the tracks can be made using one of the colloidal suspensions of magnetic particles which are available

for the purpose. These suspensions, when applied to the tape and allowed to dry, permit the recorded tracks to be seen readily. Any variations in track spacing or positioning can then be corrected easily. This procedure applies only to record heads, but playback heads may be adjusted easily by changing the height to secure maximum output from a recording of a low-frequency tone (around 100 cps) made with a head that is known to be properly positioned.

The zenith adjustment merely positions the head face so that the tape has no tendency to slide off the head, or skew. It is often fixed in manufacture and usually is correct when the head surface is perpendicular to the deck surface.

The most important mechanical adjustment of the heads is the azimuth adjustment. This is set so that the head gap is precisely at a 90° angle to the edge of the tape. It may be checked very quickly by recording a 10,000-cps tone on a tape, playing it back, and observing the output level. Then the reels are interchanged, the tape is run through the machine in the opposite direction, and the level is checked again. If the difference in level for the two directions is less than one decibel, the azimuth alignment is satisfactory. To adjust the azimuth, a standard alignment tape should be used. Adjust the playback-head azimuth for a maximum reading while playing the standard tape. Then adjust the record-head azimuth for maximum playback level of a recorded 10,000- or 15,000-cps tone.

Conclusion

A good head should give many thousands of hours of service if it is kept clean, demagnetized, and properly aligned. Most head troubles may be cleared up by the procedures outlined above. Just remember, heads always wear out, but seldom burn out. ▲

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Cabinet Model also available. Same features as RM Model and designed for side-by-side mounting with a picture monitor in standard racks. Takes only 8¾" of rack space. Field case offered as an optional accessory for Type 529.

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Circle Item 20 on Tech Data Card

Trends in TV

(Continued from page 14)

white film island with one slide and one film projector.

At present, there are two video-tape record-playback units (one is a solid-state type) and one video-tape playback unit. Each unit can be remotely controlled from the video-control room.

Fig. 2. Custom solid-state audio-control console was built by station personnel.

The station has ample film- and tape-editing facilities, which it uses in conjunction with its mobile unit. Addition of a color video-tape record-playback unit and color cameras will allow local programs to be taped in color.

Audio Equipment

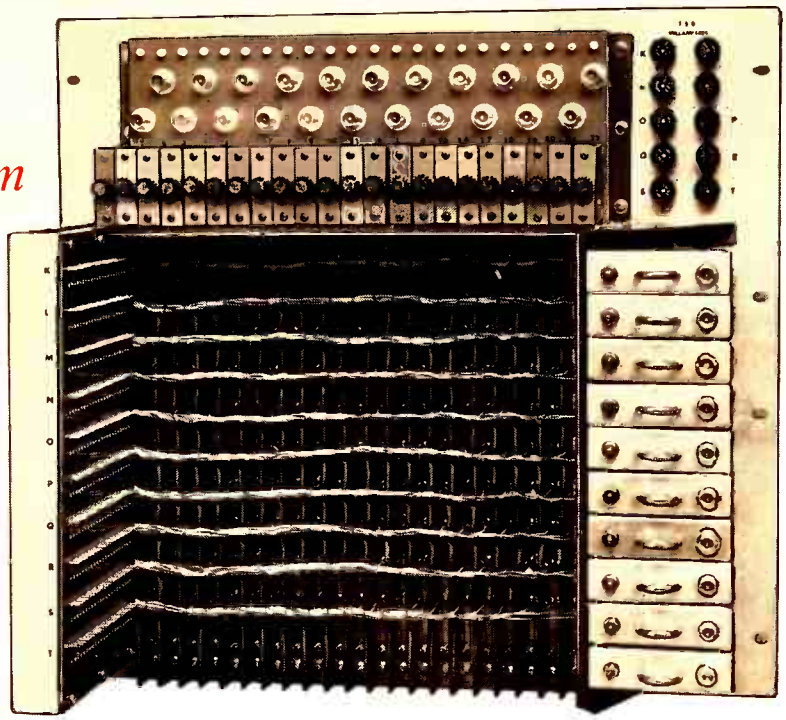
Fig. 2 shows the audio console; 30 inputs can be handled by this solid-state unit. Since a commercially built console meeting the station's requirements was not available and a custom-built unit would involve high cost and a long delay, WISH-TV elected to build its own.

The console is built around plug-in cards with solid-state components. All faders use solid-state photo-sensitive relays. The lamps in these units are run slightly under rated voltage for long life, and the lamp current is controlled by transistor amplifiers to minimize the required power rating of the control potentiometers.

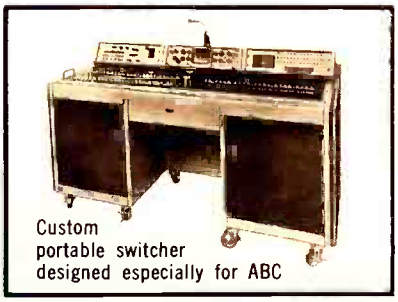
Originally, printed-circuit boards were considered for the design, but the perforated phenolic boards shown in Fig. 3 were easier to use. Also, this design permits modifications, which would be difficult to make on a printed-circuit board. Components mounted on top of the boards are connected to the underside wiring by means of terminals pushed through the perforations. Parts cost for the entire audio-control console was about $4400; total cost, including labor, was about $6500.

Fig. 3. Front and back views of plug-in circuit boards built at WISH-TV.

Terminal boards in the audio racks have solderless connectors similar to those used by the local telephone company. Each connector consists of two knife-edged bars between which the insulated hookup wire is forced with a special tool. Any wire can be rapidly



We can custom make your switcher. If you have special switcher requirements that demand custom manufacture, then International Nuclear can be of service to you. An International Nuclear audio and video crossbar switcher can be assembled to house any number of inputs or outputs. Each input line is a printed circuit. All amplifiers and power supplies are completely solid state. A single standard type transistor is used throughout the circuitry. All components are readily accessible and operate well within their rating. Custom switchers handle double re-entry switching as well as composite or noncomposite switching. *We can custom make your switcher.* The new reed-type relays which we use are metal contacts operating in a glass sealed atmosphere. Control of these relays is accomplished by an external push-button and tally light console. Telephone companies and space programs have proven that this type of relay is the only reliable method of switching video. *Yes sir, we can custom make your switcher.*



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Circle Item 22 on Tech Data Card

pulled and placed at another terminal—good electrical contact is always assured by the terminal design. These terminal boards have already saved much installation time and will make future modifications much easier.

Video Equipment

Video-equipment racks separate the video-control room from the space containing the film chains and tape units. In the video-control console, the special-effects equipment and picture monitors are of solid-state design. The microwave-control unit, vertical-interval switching units, video patch panel, pulse-distribution amplifiers, and the camera control units are in the rack bay behind the video-control console.

Both the pulse-distribution amplifiers and the camera-control unit were built by staff personnel. Pulse-distribution amplifier plug-in boards are similar in construction to the boards used in the audio control unit; the video units have 4 inputs and 16 outputs. Rack mounted beside the pulse-distribution amplifiers are their two power supplies,

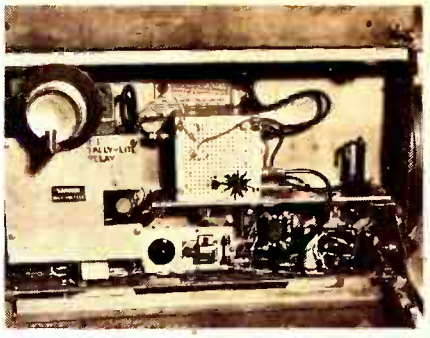


Fig. 4. Solid-state camera preamp was built to replace original tube unit.

one in use, the other a spare. A toggle switch on the panel is used for switchover if the unit in use should fail.

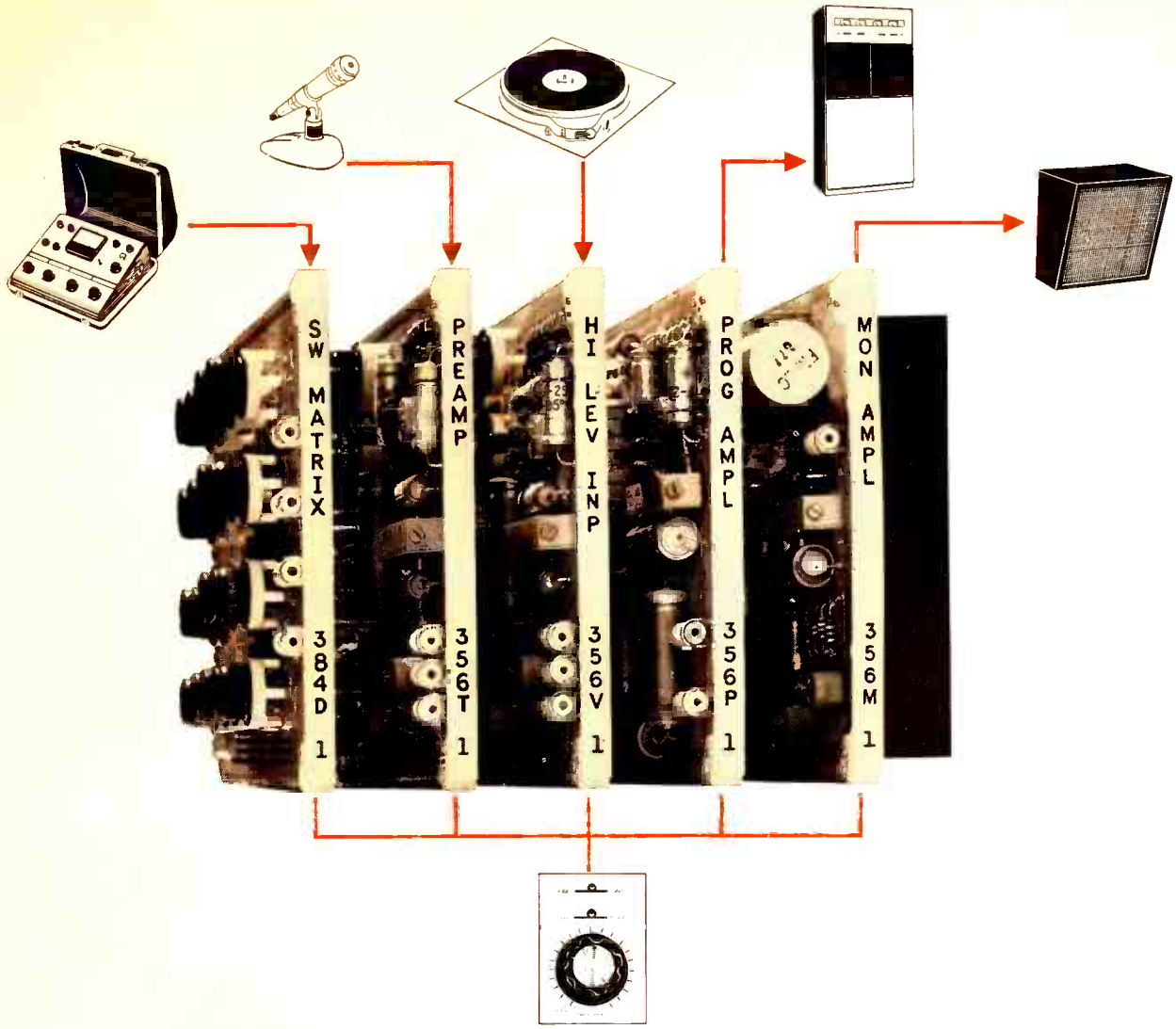
The camera-control units also use plug-in boards built by station personnel; a processor board, a shader board, and a pulse-amplifier board are used. Power-supply units are mounted on the main chassis.

Other solid-state additions are the camera preamplifiers (Fig. 4). These three-transistor units replace the original six-tube preamplifiers. Again, these boards were built by the staff, and construction is similar to that of the boards used in the audio-control console and pulse-distribution units. Here, however, cable connectors are used instead of plug-in connectors. Major advantage of the solid-state preamplifier is reduced maintenance; also, the reduction in heat lowers the failure rate of other camera components.

Conclusion

WISH-TV is an example of a station which is expanding its studio, engineering, management, and public-relations facilities to meet the trends in modern communications. Improved studio lighting techniques are one facet of these trends; increased reliance on solid-state equipment—even if it must be built by station personnel—is another.

Our sincere thanks go to Ray Reisinger, William Gruenert, Chief Engineer C. E. Wallace, Jr., and Hal Szalay of the WISH-TV staff for their help in making this article possible. ▲



Actual size of card 6⅜" x 4½"

Now, Collins photoconductive controls can be custom designed for your studio!

Eliminate pops, clicks and hums by replacing mechanical contacts with Collins' new photoconductive modules.

Arrange cards (solid state modules with integral switching) in any configuration you want.

Concentrate all your sensitive wiring within card cage, away from all interference.

Remote your amplifiers with a simple 4-volt, dc wire (instead of shielded cable).

Eliminate your biggest maintenance problem: worn or dirty mechanical contacts. With photoconductive cells instead of relays and switches, you won't have a mechanical contact in your program circuits.

Simplify troubleshooting. Replace attenuator, input switches, and amplifier output switches with one quick shuffle of cards.

For the finest audio available, let Collins' specialists custom design your studio. Contact your Collins Sales Representative, or send a block diagram of your requirements to Collins Radio Company, Broadcast Communication Division, Dallas, Texas 75207.

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Circle Item 26 on Tech Data Card

Emergency Broadcast

(Continued from page 17)

station with a letter which gives blanket permission to all EBS stations to rebroadcast FM defense network programs carried on the particular station. Only two copies of this need be filed with the FCC in Washington.

Auxiliary facilities can also be used as local communication links, intercity links, or even state communications networks. Such facilities as remote-broadcast pickup transmitters, private microwaves, and STL's are used in this manner. They must be approved for use in the system, and when so approved each receives an NDEA for this operation.

All NDEA's are in effect, unless cancelled, as long as the current station license is valid. When the major station license is renewed, the NDEA must be renewed at the same time. This holds for each NDEA held by the licensee, whether for the main station, remote pickup, or microwave. If one fails to renew his NDEA, his facility will be dropped from the system. Only stations holding a valid NDEA may operate during an emergency action period.

On the Local Scene

In each area, stations holding NDEA's are required to form an LIAC. This is made up of representatives of the EBS stations, Civil Defense, and local government. It is the responsibility of the local people to develop plans for the defense and safety of the public in their designated area. It is the obligation of the EBS station to provide the means of communication between these officials and the public. Most if not all local CD directors have worked out plans for evacuation of the population, designated fallout shelters, etc. The EBS station can assist in the education of the public concerning such parts of these plans as are desired by the local officials.

Whenever the network goes into an Emergency Action Condition, no

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The numerical markings are permanently printed in white at two-foot intervals on the cable jacket. . . . and one-foot increments are designated by a white horizontal line midway between each numerical marking.

To simplify installation, handling and inventory procedures, order SUPERIOR Sequentially Foot-Marked Coaxial Trunk Cable . . . at no extra cost! Every reel is 100% sweep-tested.

For detailed information and prices, write

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Circle Item 29 on Tech Data Card

EBS station is permitted to identify itself by call letters; it must use only the designation of the area to which it is providing service. This requirement is not a security measure. It was established so that an EBS station operating during an alert will not gain any competitive advantage over the non-EBS stations in the area.

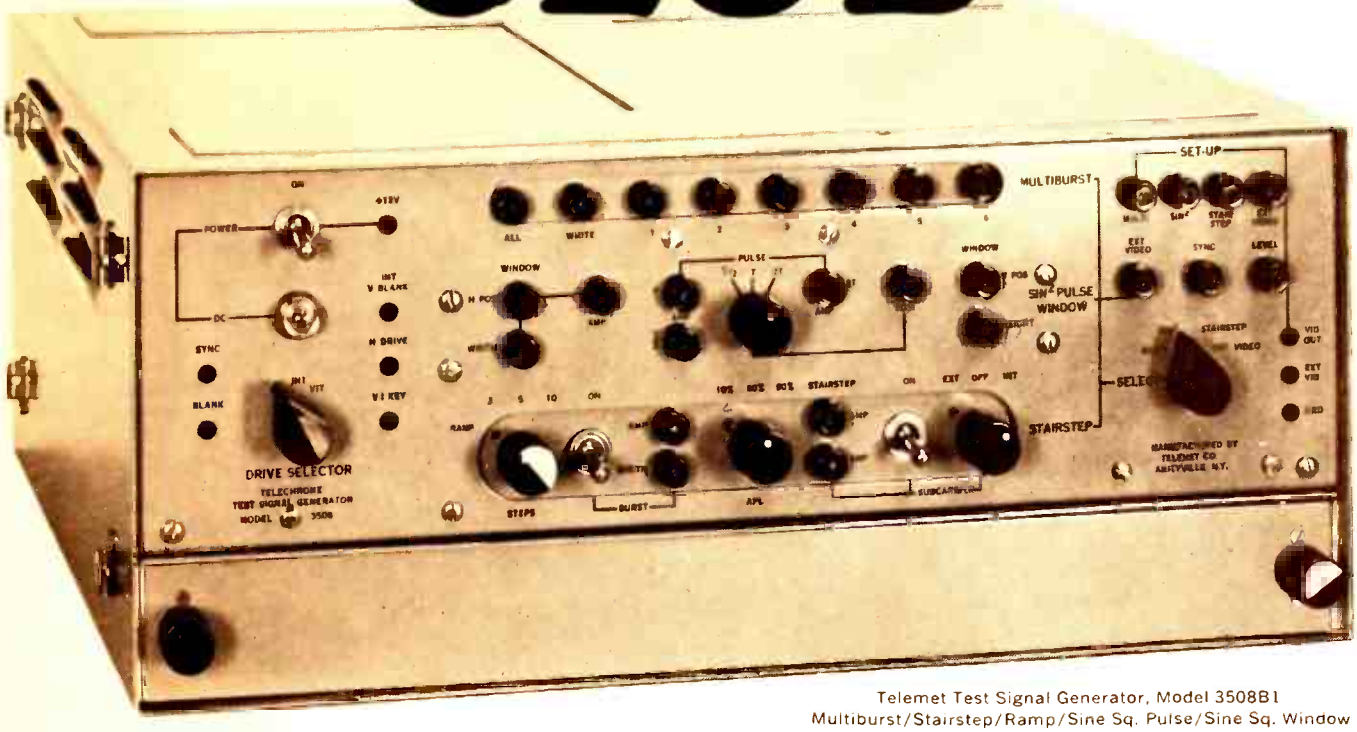
Most stations require periodic maintenance during the test period after midnight. The engineer should first check the EBS monitor to make certain that an Emergency Action Condition does not exist before putting the carrier on the air.

Stations will regularly receive updated instructions, materials, and information on the workings and plan of EBS. To avoid confusion, the old material that is replaced by the new should be discarded and the files kept up to date.

To insure that the operator on duty at a station knows what to do during an alert, a simple set of operating procedures should be available near the operating position. This should tell the operator what to do and when, what staff members to call, and similar **simple** information. Remember—if an enemy attack is launched, it will reach us within a matter of minutes, and speed in preparing to meet the attack is vital. Because of this urgency, the instructions should be very, very simple. Practice will help, but even so, the operator may panic and become confused. If he must search through the whole EBS file to find out what to do, the system will fail at that station when it is needed most!

We all hope that an attack will never come, but we must be on the alert and prepared. Our present EBS system is a good mass-communications medium. Even so, by constant effort of those now in the system and the ever-increasing number of those participating, the system can become even more efficient and effective. ▲

JOIN THE CLUB



Telemet Test Signal Generator, Model 3508B1
Multiburst/Stairstep/Ramp/Sine Sq. Pulse/Sine Sq. Window

OVER 300 of these units are in daily use throughout the television industry—and this doesn't include the individual test signal generator modules (3501, 3502, 3503, etc.), of which hundreds have been sold.

This kind of popularity doesn't just happen...it's the combined result of awareness of customer requirements, capable engineering, quality production and continuing service.

If you're not already a member of the Model 3508 club, why not join now? It costs no more to go first class.

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Circle Item 32 on Tech Data Card

Field-Intensity

(Continued from page 25)

be logged in the same unit of measure—millivolts per meter. Never convert to microvolts or volts—it's too confusing.

While it's possible to get a reasonable amount of work done alone, there are delays if you must drive, read maps, choose and plot points, take readings, and make entries yourself. It's much more convenient to have a driver. If he isn't an engineer, then you must navigate, make entries, and take readings. The untrained driver must be taught to do exactly as told, to drive safely but not waste time, to be observant, and not talk too much. He must be able to read the odometer with one eye while watching the road with the other.

The best way to break in a field man is to teach him how to manipulate the FIM, then send him out as driver/engineer, accompanied by an experienced field man as passenger/navigator/recorder. The navigator is in charge, ordering the driver to the proper points. When they arrive, the driver hops out and takes the reading, which the navigator then records in the log. This is the most efficient system, for it divides work fairly evenly. Also, the men can switch duties to avoid monotony, although it's best not to switch more than once per day. Under such conditions, the navigator can plot graph points as he goes along, to make sure there are no holes in the curve.

One more point should be kept in mind. The field-intensity meter costs a cool thousand dollars, and you should treat it like a newborn baby—gently. **Never** get it wet; if you must take a fast point in a light drizzle, dry it off when you get back in the car. **Never** drop it, for then it must be sent back to the factory for recalibration. **Never** carry it on the seat of a car, where a sudden stop could cause it to fall off; always put it on the floor, usually between your legs and the seat. And when you stop for a meal or stay at a motel and leave the car, put the meter in the trunk or take it with you. If you have to take the meter with you on an airline flight, **don't** check it at the baggage counter. Put it on the floor between your feet. Finally, before you start out on a field trip, get a full set of spare batteries, a spare 1R5, and a spare 1T4.

Conclusion

In the two parts of this series, we have described the standard-broadcast-band field-intensity meter and how it is used. Additional information of the use of this instrument can be obtained from the sources listed below. ▲

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"Notes on Standard-Broadcast Field-Intensity Measurements," Elton B. Chick, January 1961

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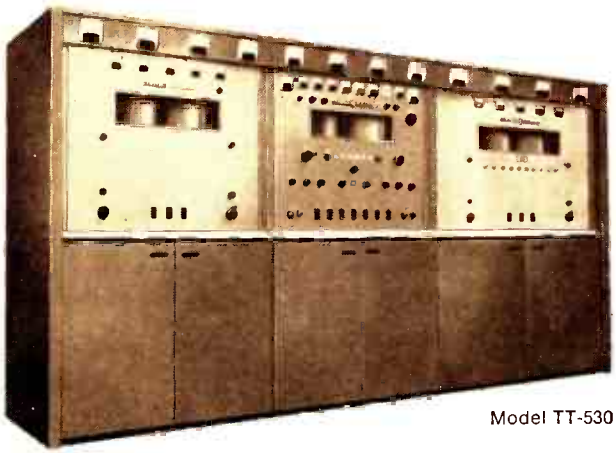
They don't make a smaller 30-KW VHF-TV transmitter



Model TT-530

They don't even make it this small... or as economical.

Only General Electric does... in three, accessible, self-contained modular cubicles... air-cooled. 5 KW more with less over-all floor space than competitive transmitters. Easy to install, more economical to operate and maintain. Designed to FCC and EIA specifications for color and monochrome operation... with remote control capability via external landline and/or microwave terminal equipment. The uncompromising quality of the Model TT-530 VHF transmitter assures optimum performance and makes it possible to attain maximum E.R.P. at 5 to 1 power ratio. General Electric also has VHF transmitter cubicle combinations for 1, 5, 10 and 60-KW with visual to aural power ratios from 5 to 1 to 10 to 1. For further information, contact your G-E Broadcast Equipment Representative or: General Electric Company, Visual Communications Products, #7-315, Electronics Park, Syracuse, N.Y. 13201.

GE-25

Visual Communications Products

GENERAL ELECTRIC

Electronics Park, Syracuse, N.Y.

Circle Item 36 on Tech Data Card

NEWS OF THE INDUSTRY

INTERNATIONAL

New TV Stations in Portugal

Two new television stations are to be opened at Muro in the north and Mendro in the south of Portugal by **Radio Televisao Portuguesa.** The Mendro station will broadcast in Band III and will use a 5-kw visual transmitter and a 1-kw aural transmitter. The station at Muro will broadcast in Band I with a 10-kw visual transmitter and a 2-kw aural transmitter. **Marconi** transmitters are being installed at both stations; this is believed to be the first time that British television transmitters have ever been sold in Portugal.

Radio Televisao Portuguesa (RTP) is now in its eighth year of broadcasting and already reaches 160,000 receivers. The opening of these two stations will bring RTP to over 95% of the area and 97% of the population of Portugal.

Two-Way Intercontinental Television Program

The first two-way commercial television program using the Early Bird satellite was transmitted October 26 by **RCA Communications, Inc.** for the **Columbia Broadcasting System's** "Town Meeting of the World." The two-way arrangement permitted students in Belgrade, London, Paris, and Mexico City to direct questions on world affairs to a panel in the Washington, D. C. studios of CBS. The program also marked the first time that multiple points on both sides of the Atlantic were linked via satellite. The program was transmitted live between 4:30 and 5:45 PM (EDT) and taped for rebroadcast over the network from 10 to 11 PM (EDT).

Panel members included Gen. Dwight D. Eisenhower, former President of the United States; Arthur J. Goldberg, U. S. Ambassador to the United Nations, and Thurgood Marshall, Solicitor General of the United States. They answered questions posed by students attending the London School of Economics, Belgrade University, University de Paris, and the University of Mexico City.

NATIONAL

RF TV Channel Superimposed on Millimeter-Wave Signal

The entire radio-frequency channel of a television station has been superimposed on a millimeter-wave signal by means of a semiconductor device called an injection modulator. The experiment was conducted by **General Telephone & Electronics Laboratories, Inc.** Development of the new semiconductor device was carried out by GT&E Laboratories under a series of contracts from the U. S. Army Electronics Command, Fort Monmouth, N. J. The injection-modulator concept originated at Fort Monmouth, and early development work also was carried out there.

In the GT&E demonstration, an 83-mc signal containing video and synchronizing pulses was applied to the device to modulate a 70-gc carrier. The resulting amplitude-modulated millimeter-wavelength signal was transmitted, detected, and displayed on a conventional television receiver (left in photo) used as a monitor. The signal prior to transmission is shown at the right in the photo.

Urges No Stereo for TV

A request for the FCC to drop or defer for an indefinite period its inquiry into the feasibility of adopting standards for stereophonic sound in television broadcasting has been submitted by the **Electronic Industries Association.** The association said there is not enough interest in the industry to warrant a further study of the question at this time. A report by the association's Broadcast Television Systems (BTS) Committee concluded that, based on past experience, a study to develop EIA recommendations would require that an estimated 100 industry engineers spend about 25% of their time on the project over a period of 18 months.

Since the FCC issued its notice of inquiry last November 12, an ad hoc subcommittee of the BTS Committee has

examined these problems: (1) compatibility of sound and picture with the potentialities of TV receivers now in the homes of viewers, (2) stereophonic reception characteristics, and (3) systems considerations. The ad hoc group's study indicated that a project to develop stereophonic sound standards for television would be greater than that assigned to the National Stereophonic Radio Committee, an industry committee established by EIA in 1958 under FCC sanctions to develop stereophonic sound standards for FM broadcasting. The difficulty is greater, the BTS Committee report said, because current television standards do not provide as much freedom in developing a stereophonic signal that is compatible with existing TV receivers for both sound and picture as was the case for FM broadcasting.

Call for Papers

The call has been sent out for technical papers for SWIEEECO, the 18th annual Southwestern IEEE Conference & Show to be held in Dallas April 20, 21, and 22, 1966. Authors of papers who would like to appear before this forum of engineers and technicians have been invited to submit 200-word abstracts to Technical Program Chairman Dr. Robert Carrel. Subjects which may be covered include research, component design, network design, and systems engineering in the fields of power generation, communication, computation, control, and the geosciences. The abstracts must be written exactly as they may appear in the SWIEEECO program, with title, author's company affiliation, city, and state. The 200-word abstract must clearly state the paper's purpose, content, and technical contribution. All abstracts and any additional information from the authors should be addressed as follows:

Dr. Robert Carrel
Collins Radio Company
Dallas, Texas 75207

The technical program, as well as the trade show and exposition, will be held in Dallas Memorial Auditorium. The Baker Hotel will serve as headquarters for the Conference & Show.

NAB Files CATV Comments, Plans and Holds Conferences

The Federal Communications Commission has been urged by the **National Association of Broadcasters** to prohibit Community Antenna Television systems from originating any kind of programing and from extending their signals by artificial means. It said that CATV systems, which charge a fee for their service, should be limited to the reception and retransmission of broadcast signals without any "insertions or deletions" of any kind. Such a policy, it said, would be consistent with CATV claims that the system is merely a "master antenna service" and with NAB's position that CATV systems should be a supplement to and not a substitute for free broadcasting service.

NAB also proposed that CATV's be permitted to retransmit distant signals into areas having three or more stations only if the distant signals were of sufficient strength to meet specified engineering standards.

On the FCC's request for comment on the possible impact of CATV on UHF television stations, NAB said the importation of a number of signals into single- or multiple-station markets will lead inevitably to a fractionalization of audiences. "The net result," it said, "must be a serious, if not fatal, deterrent to the development of independent VHF and UHF stations."

In NAB activity relating to conferences and conventions, the Convention Committee has approved a new format for the 44th annual convention and agreed to incorporate the annual Broadcast Pioneers Banquet into the formal agenda of the convention. The new convention format ends concurrent radio and television sessions on Tuesday and Wednesday mornings. Instead, a radio session will be held Tuesday morning and a television session Wednesday morning. The revision will enable television members on Tuesday morning, and radio members on Wednesday morning, to attend each other's sessions, to visit the exhibits, or to attend to other convention matters.

Registration for the 1966 convention will begin on Saturday, March 26. Exhibits will open at 10 AM Sunday, March 27, and Sunday afternoon will be devoted to FM radio.

The committee meeting was held at the Conrad Hilton Hotel in Chicago, which will be the site of the convention.

A group of 49 radio and television engineering executives attended the Association's first Engineering-Management Development Seminar held at Purdue University, Lafayette, Ind., from November 29 through December 3. The registrants included broadcasters from 23 states and from one foreign country—Venezuela.

The course was designed "to encourage and aid the individual engineer further to develop and refine his working philosophy of management so the objectives of his organization can be met with greater efficiency and effectiveness."

The instructions were under the overall supervision of Dr. Charles Lawshe, Dean of the College of Technology, and Dr. Gregory Barnes, Professor of Industrial Education. Special research material provided by the broadcasters themselves and specially tailored for the Seminar was also used in the instructions.

PERSONALITIES

Logan Z. (Mike) Edwards has been appointed chief engineer of **KPAT AM-FM**, San Francisco. Mr. Edwards, in the broadcasting field since 1949, has spent

the major portion of his career with various California stations, holding the title of chief engineer since 1954. Most recently, he has been associated with the McLendon Corporation as chief engineer at WYSL, Buffalo, New York, and at KLIF, Dallas, Texas.

Richard F. Yearick and **Duane W. Crist** have been appointed vice-presidents of **Ameco, Inc.**

Mr. Yearick was promoted from sales director of the CATV equipment division. As vice-president in charge of product sales, he will be responsible for the distribution and sale of CATV equipment to existing systems through a network of 6 warehouses and 22 field sales engineers.

Duane Crist joined the company as credit manager and later became assistant treasurer. In his new position, he will be responsible nationally for new community antenna television system sales, and for seven district sales managers and a group of Phoenix based specialists providing engineering services, financing, equipment, turnkey construction, and training of customer personnel.

Albert W. Malang has been appointed manager-broadcast product planning for **General Electric Visual Communications Products.** He will be responsible for establishment of all requirements, specifications, scheduling, and other phases

of new product introductions for G-E television broadcast equipment. Mr. Malang comes to G-E from the Gencom Division of the Whittaker Corp., where he was chief engineer for the past year. Prior to that position, he was associated with the American Broadcasting Company for ten years, serving successively as TV maintenance engineer, video facilities engineer, and, from 1960 to 1964, as chief video facilities engineer.

Also at G-E, a newly created position of district sales representative for the greater New York metropolitan area has been filled by **Vincent P. Marlin.** He will work with Lewis F. Page, district

sales manager, to increase customer contacts and market penetration for General Electric Visual Communications Products television and radio broadcast equipment and closed-circuit TV equipment. Mr. Marlin joined the company in early 1964, serving as a headquarters sales engineer for broadcast products. For the previous six years he was chief engineer at WFBL (radio), Syracuse.

PROPERTY TRANSACTIONS

Metromedia, Inc. has sold its Decatur, Ill. TV outlet, **WTVP**, to **LIN Broadcasting Corp.** subject to FCC approval. The sale price was $2 million.

The sale was made so that Metromedia could negotiate an option to purchase **KSAN-TV**, a San Francisco UHF station, and associated assets from S. H. Patterson. Total consideration involved in the KSAN-TV purchase was reported to be $1,000,000. Upon exercise of the option, the transaction will be subject to the approval of the FCC. Metromedia intends to exercise its option following resolution of the controversy that has existed in the past several years over the location of a joint-use tall television tower to serve all of the San Francisco television stations. During the interim, Metromedia's facilities and program planning will go forward.

The sale of Radio Station **KJAY**, Sacramento, California, by **Bobelrick, Inc.** to **Jack L. Powell** has been negotiated for $157,500. Bobelrick, Inc. is owned by Robert W. Dumm and his son, Rick Dumm. Robert W. Dumm formerly owned KROY, Sacramento. Mr. Powell formerly owned and operated KMSL, Ukiah, and KVON, Napa, both California. KJAY operates with 500 watts, daytime only, on 1430 kc.

Panax Corp., John P. McGoff, president, has sold three Michigan FM stations. **WABX-FM**, Detroit, was purchased for $100,000 by **Century Broadcasting Corp.**, Howard Grafman, president. Century owns Radio Stations KSHE-FM, St. Louis, Missouri and KMAP-FM, Dallas, Texas. **WGMZ-FM**, Flint, was purchased for $60,000 by Philip Munson, a vice-president of Panax Corporation. Mr. Munson will remain with Panax. **WQDC-FM**, Midland, was sold to **Habco, Inc.**, Ned S. Arbury, president. The total consideration for WQDC was $55,000.

Wheeling, West Virginia radio station **WHLL** has been sold, subject to FCC approval, by **Wheeling Broadcasting Company**, owned by Glenn A. and Kenneth H. Forney, who established the station in 1949. The purchaser is **Wheeling Radio, Inc.**, owned by William A. Kendrick, a Clarion, Pennsylvania merchant, and Walter G. Broadhurst, former manager of WWCH in Clarion. Sale price was $195,000. WHLL is a 5-kilowatt daytimer on 1600 kilocycles. ▲

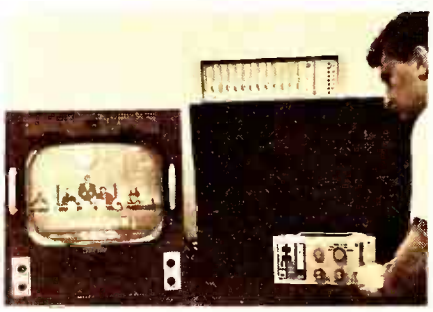
NEW PRODUCTS

Tape Duplicator

The 235 tape duplicator is available as a basic system of one master and one slave, and can be expanded to a total of ten slaves without additional electronics. The system is intended for use by schools, studios producing broadcasting jingles, producers of cartridge tapes for automotive tape players, and others who need to duplicate audio tapes. The units are of solid-state, modular plug-in construction.

Viking of Minneapolis prices the basic 235 tape-duplicating system at $1850 for full-track; $1800 for half-track, one-channel; $1995 for half-track, two-channel; $1995 for quarter-track, two-channel; and $2600 for quarter-track, four-channel. The complete ten-slave system in half-track, two-channel is $5600, and in quarter-track, four-channel the price is $6730.

Circle Item 59 on Tech Data Card



Color Special Effects

Special effects for stations broadcasting color are produced by the Mark VII color special effects generator manufactured by **Ball Brothers Research Corp.** This transistorized video system creates: artificially colored keyed inserts (any color in the range of the NTSC spectrum can be obtained by variations in the selection of control settings at the remote control panel, using a monochrome camera and the normal white-on-black background visuals); nonadditive lap dissolves (combinations are not dependent on video brightness information. Combining two video signals with color information on a variable time-sharing basis provides pattern effects when dissolving between video scenes); split-screen transition (as few as three or as many as fourteen wipe patterns may be obtained).

The system provides basic video switching circuitry to produce both internal and external keying effects with sync addition to one or two video output signals. The basic unit can handle a variety of monochrome or color signals of either composite or noncomposite format at the inputs.

The Mark VII consists entirely of plug-in modules (12 in all) which mount in a standard 5¼" x 19" relay-rack card housing. The remote-control unit dimensions are $5\frac{5}{16}$" x 11⅛" x 3". Systems are expandable on a building-block concept; prices start at $1810.

Circle Item 60 on Tech Data Card

All-Band CATV Amplifier

The Model B-2 solid-state amplifier is directly powered and covers channels 2 through 13 and the entire FM band.

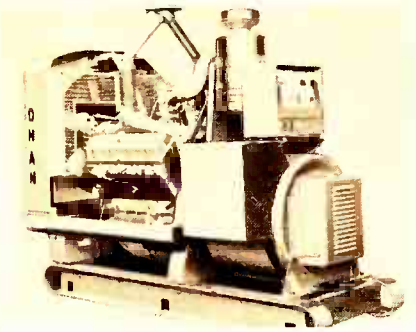
It features 30-db gain and has four fused distribution-line outputs. Insertion or omission of one of these fuses determines whether or not power is fed down a particular distribution line. The **Entron, Inc.** amplifier is designed for mounting in a pole equipment housing adjacent to a trunk-line amplifier; the amplifier section may be removed without disturbing the trunk-line signals. The Model B-2 includes seven transistors and a built-in 28-volt or 60-volt transformer for feeding power down the distribution cables. Circuitry also includes changeable pads and manual gain and tilt controls.

Circle Item 61 on Tech Data Card

Video Distribution Amplifiers

The Model 4454 video distribution amplifier features high output capability and total harmonic distortion less than 2%. The basic module has a self-contained power supply and is usable as an individual amplifier. In addition, up to four of the modules can be rack mounted in the **C-COR Electronics** Model VDR-1 rack adapter. Covering the frequency band of 5 cps to 3 mc, the Model 4454 has a single input and four isolated outputs, each capable of delivering 10 volts peak-to-peak into 75 ohms. Each channel has gain adjustable from 0 to 6 db. The basic module is priced at $450; the VDR-1 rack adapter is $150.

Circle Item 62 on Tech Data Card

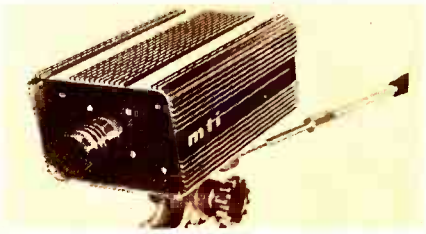


Standby Power

Both the 140- and 160-kw models of the "WE Series" electric generating plants are designed for installation in confined areas. The radiator-cooled "WE Series" is 1½' shorter than previous **Onan** models in this capacity range. Both models, whether used for intermittent standby duty or continuous operation, are powered by the 8-cylinder Roiline H884 engine which was specially designed and built for such applications. The two units carry certified ratings of 140 and 160 kw for emergency standby duty and 125 and 150 kw, respectively, for continuous operation. Factory-installed carburetion for gasoline or gaseous fuels may be ordered.

The plants are available in standard 60-cps 3-phase voltages up to 600 volts. The unit includes a static exciter and voltage regulator. Standard features include mounted control panel, voltage-adjusting rheostat, complete engine-starting controls, all necessary safety devices, run-stop remote switch, automatic over-speed shutdown, running-time meter, and high-water-temperature and low-oil-pressure cut-outs. The generators may be equipped with a load-transfer control for completely automatic power takeover when high-line power fails, and automatic return to commercial power when the emergency has been corrected.

Circle Item 63 on Tech Data Card



Vidicon Camera

The VC-1D Vidicon camera is designed to offer high resolution and sen-

sitivity. Produced by **Maryland Telecommunications, Inc.**, this self-contained single unit of modular construction weighs less than 18 lb.

Resolution of the VC-1D is specified as in excess of 800 horizontal TV lines at 3 x 10^{-1} footcandles and over 500 horizontal TV lines at 2 x 10^{-2} footcandles. The camera has plug-in solid-state circuitry and automatically regulated electrical focus and target adjustment for light-level changes. The unit features a cascode input, nuvistorized video preamplifier, nonmicrophonic solid-state sweep protection, linearity of both horizontal and vertical axis within 2%, and regulated solid-state power supply. The target potential is current-regulated and automatically adjusts to variations in light level. A minimum number of operating controls is incorporated for simplicity of operation. Off-the-shelf delivery is available at $2495.

Circle Item 64 on Tech Data Card

CATV Bridging Amplifier

This main-line all-band bridging amplifier, Model KBR-4, provides four 75-ohm high-level outputs with low trunk-line insertion loss. The **Kaiser CATV** amplifier is enclosed in a messenger-mounted, weather-proof, aluminum case designed with end-mounted fittings for all popular sizes of aluminum or corrugated copper cable. Specifications include 20 db maximum gain (at channel 13) and a line insertion loss of 1 db maximum.

Circle Item 65 on Tech Data Card

High-Power RF Diplexer

High-power hybrid bridge diplexers rated at 100 kw peak power for use on channels 2 through 13 are being manufactured by **Jampro Antenna Co.** The Type PK-100 diplexer is used with batwing turnstile antennas to provide 90° phase-quadrature feed. The unit shown, for operation on channel 6, is made of 6⅛" transmission line and weighs 195 lbs; isolation between visual and aural inputs is over 34 db for channel 6. Power division is within .02 db, and input VSWR values better than 1.04:1. ▲

Circle Item 66 on Tech Data Card

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

75. AMERICAN GELOSO—Literature details complete line of sound, public-address, and portable sound equipment.
76. CBS LABS—Literature on the "Volumax" automatic peak controller and the "Audimax III" solid-state automatic level control.
77. EUPHONICS—Eight-page bulletin No. 201 includes both installation instructions and a section titled "How to Design Your Own Circuit" for the Miniconic semiconductor cartridge.
78. LA CROSSE—Circular describes Model 200B portable solid-state tape-cartridge playback unit.
79. MARTEL—Flier sheets list features and specifications for line of imported and domestic tape recorders.
80. MINNEAPOLIS MAGNETICS—Literature covers replacement parts for rebuilding tape heads.
81. QRK—Brochure depicts professional turntables for mono and stereo reproduction.
82. SHURE—Data sheet supplies specifications and descriptions for Models SM5A and SM5B cardioid microphones.
83. SONY—Full-color catalog describes 1966 line of tape recorders and recording accessories.
84. SPARTA—Catalog sheet details new tape-cartridge system; new-product brochure is also available.

CATV EQUIPMENT

85. JERROLD—Eight-page brochure features "Starline" solid-state unitized CATV systems.
86. SKL—Folder lists and provides specifications for head-end, trunk, and distribution equipment; accessories; and special products for CATV use.

COMPONENTS & MATERIALS

87. HARVEY—500-page catalog lists line of broadcast and recording equipment and electronic components.
88. JENNINGS—12-page catalog No. 103 gives specifications and applications for vacuum coaxial relays.
89. QUICK-SET—Price schedule and 12-page brochure supply photos and mechanical specifications for *Gibraltar* tripods and pan heads.
90. TEXWIPE—Sheet details solvent cleaner for use on video and sound tape heads and film.

MICROWAVE DEVICES

91. MICRO-LINK—Planning guide covers 2500-mc ITV systems. Brochures and specification sheets provide data on Model 420A portable link and Model 600 fixed link.
92. MICROWAVE ASSOCIATES—Sixteen-page brochure, bulletins, and technical report detail applications and specifications for TV-broadcast solid-state microwave-relay equipment.

MOBILE RADIO & COMMUNICATIONS

93. MOSLEY ELECTRONICS—Catalog lists complete line of 1966 Citizens-band equipment.
94. SPRAGUE—Circular M-853 describes SK-1, SK-10, SK-20, and SK-30 "Suppressikits" for vehicles with alternators or DC generators.

POWER DEVICES

95. HEVI-DUTY—Bulletin 7-22 supplies data on line-voltage regulator using saturable-core reactor.
96. ONAN—"Gas Power for Standby Generators," an eight-page brochure, cites advantages of natural gas fuel for standby electric plants.

RADIO & CONTROL ROOM EQUIPMENT

97. BURDEN ASSOCIATES—Flier provides specifications and functional diagram for Model AC-8 stereo audio console.
98. IGM—Full-color eight-page illustrated brochure shows monitor unit, timer module, punch-card reader, automatic network switcher, and other control-system units.

REFERENCE MATERIAL & SCHOOLS

99. CLEVELAND INSTITUTE—Booklet outlines courses in electronics, including those for broadcast engineering and FCC-license preparation.
100. HOWARD W. SAMS—Literature describing popular and informative technical publications; includes latest catalog of technical books.

STUDIO & CAMERA EQUIPMENT

101. ACME FILM—Film transfers, tape duplicates, 16 mm developing and printing are catalogued and priced in a 10-page booklet. A footage-conversion chart and a detailed system for eliminating splice lines are also included.
102. CLEVELAND ELECTRONICS — Data concerns modifications using new yoke assembly to update 3" image-orthicon camera.
103. HARWALD—Film inspection, cleaning, and editing equipment is described by fliers.
104. LIGHTING & ELECTRONICS — "Studio Lighting for Monochrome and Color Television," a 32-page booklet, supplies detailed information on basic lighting principles.
105. NATIONAL CINE—Prices and services for 8 mm and 16 mm film are described in pamphlet.
106. TV ZOOMAR—New literature features Autocam programed remote control pan and tilt equipment; literature describes lenses for IO and vidicon use.

TELEVISION EQUIPMENT

107. COLORADO VIDEO—Sheet gives data for the Model 301 video analyzer which displays TV waveforms directly on picture monitors.
108. GENERAL TELEVISION — Circulars list specifications and applications for television projector, television stands, and scope carts.
109. VITAL—Data sheets give specifications of Model VI-500 stabilizing amplifier, Model VI-10A video distribution amplifier, and Model VI-20 pulse-distribution amplifier.

TEST EQUIPMENT & INSTRUMENTS

110. TEKTRONIX—Four-page circulars give complete specifications for dual-trace oscilloscopes: Type 442, AC or battery-powered, and Type 453, with calibrated sweep delay.

TOOLS

111. ENTERPRISE DEVELOPMENT—Bulletins feature Models 300 and 100A desoldering-resoldering iron for PC-board use.

TRANSMITTER & ANTENNA DEVICES

112. BARKER & WILLIAMSON—Proprietary equipment catalog contains design and application data, illustrations and specifications for transmitters, receivers, test equipment, antenna couplers, dummy loads, and coils.
113. GATES—Brochure depicts transcription turntables and accessories. Flier sheets give specifications for solid-state monitor amplifier and Model FM-1G 1,000-watt FM transmitter.
114. MARTI—Specification sheets, flier sheets, and brochures give full particulars on line of remote-pickup and STL equipment.
115. MOSELEY ASSOCIATES — Condensed catalog illustrates complete line of broadcast equipment. Both wire and STL remote-control systems are featured.
116. RUST—Data sheet describes transmitter automatic-logging equipment. ▲

Advertisers' Index

Professional Services

VIR JAMES
CONSULTING RADIO ENGINEERS
Applications and Field Engineering
345 Colorado Blvd.
Phone: (Area Code 303) 333-5562
DENVER, COLORADO 80206
Member AFCCE

JAMES C. McNARY
Consulting Engineer
National Press Bldg.
Washington 4, D. C.
Telephone District 7-1205
Member AFCCE

CARL E. SMITH
CONSULTING RADIO ENGINEERS
AM, FM, TV and CATV
8200 Snowville Road
Cleveland, Ohio 44141
Phone: 216-526-4386
Member AFCCE

CAMBRIDGE CRYSTALS
PRECISION FREQUENCY
MEASURING SERVICE
SPECIALISTS FOR AM-FM-TV
445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

AMPEX HEAD ASSEMBLY RECONDITIONING SERVICE for all Ampex professional model recorders. This professional service features precision relapping of all heads for maximum head life. Your assembly is thoroughly cleaned and guides are replaced as required. Price includes optical and electrical inspection and complete testing on Ampex equipment in our plant. Full track or half track assemblies . . . $35.00. One to two day service. "Loaner" assemblies available, if necessary. LIPPS, INC., 1630 Euclid St., Santa Monica, California 90404. (213) EX 3-0449. tf

Barnett F. Goldberg, P.E.
CONSULTING ELECTRONICS ENGINEER
AM, FM & TV
APPLICATIONS AND FIELD ENGINEERING
ACOUSTICS AND VALUATION-APPRAISAL WORK
803-253-8347
1138 BULL STREET, COLUMBIA, S.C. 29201

VIDEO TAPE RECORDER
AUDIO HEAD ASSEMBLY SERVICE
Precision relapping of all heads and supporting posts, including cleaning and testing. Ampex head assembly with "cue" tracks, $75.00 complete. RCA units also relapped. One to two day service. LIPPS, INC., 1630 Euclid St., Santa Monica, Calif. 90404. (213) EX 3-0449. tf

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

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

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

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

AMPEX 350 SERIES reconditioned capstan drive motors (BODINE NCH-33 only) $85.00 exchange. Send us your old one, or order for $100.00 and get $15.00 back after sending old one in. Ours have new bearings and rewound stator. Package motor well. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda California. 1-65 12t

Everything in used broadcast equipment. Write for complete listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 11-64 tf

New and Reconditioned Remote Pickup and 2-way radio equip., Fire and Police Receivers. All brands and models. Sales Manager, Box 238, Phone 817-594-5171, Weatherford, Texas. 5-65 12t

Audio Equipment — Ampex, Altec, Fairchild, Langevin, Neumann, etc. Trades. New and used. Get our list. Audio Distributors, Inc., 2342 S. Division, Grand Rapids, Michigan. 7-65 6t

Signs, Nameplates, Labels, Badges, Trophies and Plaques. Seton Corp., Dept. BREN, New Haven, Conn. 06505. 10-65 1t

Parabolic Antennas, 6' aluminum solid surface complete with dipole and mounting bracket. Now tuned for 1750 MC for $125 set. Tuned to 950 MC for $175 set. Sierra Western Electric Cable Co., 24th and Willow Streets, Oakland, California. Phone 415 832-3527. 12-65 tf

FOR SALE: Unsued Trompeter JS 48 RF and vidio patch panel, 48 jacks on 3½ inch panel, BNC fitting, WE spacing, $200. Delta Broadcasting System, 1004 N. Golden Dr., Santa Maria, Calif. 93454. 12-65 1t

EQUIPMENT WANTED

Wanted: Field Strength Meter, Nems-Clarke AM broadcast band only. LOW POWER BROADCAST EQUIPMENT CO., 248 Swedesford Road, Malvern, Penn. 19355. 12-65 1t

Employment

BROADCAST SALES
FM TRANSMITTERS
A leading Midwest broadcast and communications equipment manufacturer has an outstanding opportunity for a man familiar with FM broadcast transmitters and associated equipment. Currently employed in the FM field, either in broadcasting or manufacturing. Age 28 to 40, B.E. degree or comparable experience required. Opportunity for advancement in a growing company. Complete employee benefits. An equal opportunity employer. Send complete details and picture to Box 146. 12-65 1t

BROADCAST EQUIPMENT
SALES SPECIALIST
Live in Southeastern United States and sell technical equipment to AM, FM and TV stations. Must know broadcasters and have broadcasting experience. An equal opportunity employer. Send resume including education and experience to Box 144. 12-65 1t

BROADCAST EQUIPMENT
SALES SPECIALIST
Live in the San Francisco area and sell technical equipment to AM, FM and TV stations. Must know broadcasters and have broadcasting experience. An equal opportunity employer. Send resume including education and experience to Box 145. 12-65 1t

Business Opportunities

EXCLUSIVE FRANCHISE

Amazing new liquid plastic coating used on all types of surfaces interior or exterior. Eliminates waxing when applied on Asphalt Tile, Vinyl, Linoleum, Vinyl Asbestos, Hard Wood, and Furniture. Completely eliminates painting when applied to Wood, Metal, or Concrete surfaces. This finish is also recommended for boats and automobiles.

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As these are exclusive formulas in demand by all businesses, industry and homes. No franchise fee. Minimum investment—$300. Maximum investment—$7,000. Investment is secured by inventory. Factory trained personnel will help set up your business.
For complete details and descriptive literature write:
CHEM-PLASTICS & PAINT CORP.
1828 Locust, St. Louis 3, Mo.
6-65 14t

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No competition. To service and set up new accounts in exclusive territory. Investment secured by fast moving inventory of amazing plastic coating used on all types of surfaces interior or exterior. Eliminates waxing when applied to any type of floor. Eliminates all painting when applied to wood, metal or concrete surfaces.
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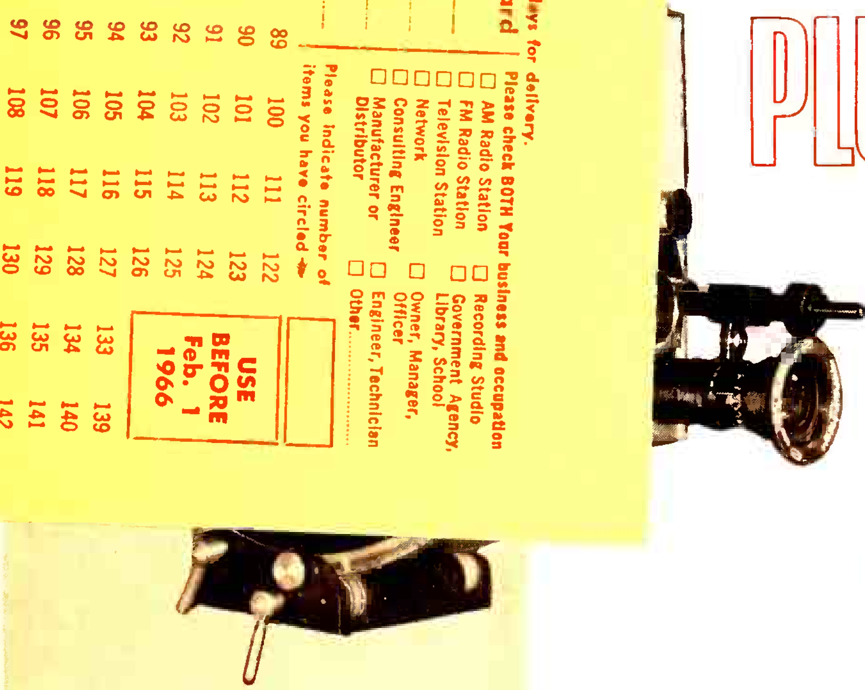

PLUMBICON

VIDICON

SEPARATE FIELD MESH

Dage engineering has developed the 520 solid state camera chain which outperforms any other vidicon equipment presently available for commercial or educational broadcasting and video taping. Check feature for feature and see why this is the system for your studio.

RELIABLE SOLID STATE CIRCUITRY • HIGH SIGNAL TO NOISE RATIO • MORE AVAILABLE OPERATOR FEATURES • TREMENDOUS DETAIL RESPONSE AND SENSITIVITY • HIGH RESOLUTION CAPABILITIES WITH NO DISTORTION • PLUMBICON PROVIDES PICTURE WITHOUT LAG

RAYTHEON

No matter what your equipment needs are, Dage has the **BIG** *answer for you with the new 520 Broadcast Camera Chain for use with* **PLUMBICON**, **VIDICON**, *or* **SEPARATE FIELD MESH**

Dage-Bell Corporation

A SUBSIDIARY OF RAYTHEON COMPANY

455 Sheridan Avenue, Michigan City, Indiana, Dept. 30-8

Circle Item 56 on Tech Data Card

Professional Services

VIR JAMES
CONSULTING RADIO ENGINEERS
Applications and Field Engineering
345 Colorado Blvd.
Phone: (Area Code 303) 333-5562
DENVER, COLORADO 80206
Member AFCCE

JAMES C. McNARY
Consulting Engineer
National Press Bldg.
Washington 4, D. C.
Telephone District 7-1205
Member AFCCE

CARL E. SMITH
CONSULTING RADIO ENGINEERS
AM, FM, TV and CATV
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Cleveland, Ohio 44141
Phone: 216-526-4386
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EQUIPMENT

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Audio Equipment b Ampex, Fairchild, Cr ing. F. T. C. Brew West Hayes Street, P

Television/Radio/com any type available. tube. Microwave, tra studio equipment, your needs—offers. Columbus Ave., NYC.

COMMERCIAL CRYS replacement crystals E., Bliley, and J-K repair, etc. BC-604 c on AM monitors and itors. Nationwide uns praise our products a son Electronic Compa Texas.

AMPEX 350 SERIES stan drive motors (BC $85.00 exchange. Sen or order for $100.00 after sending old one bearings and rewou motor well. TABER & ENGINEERING CO Alameda California.

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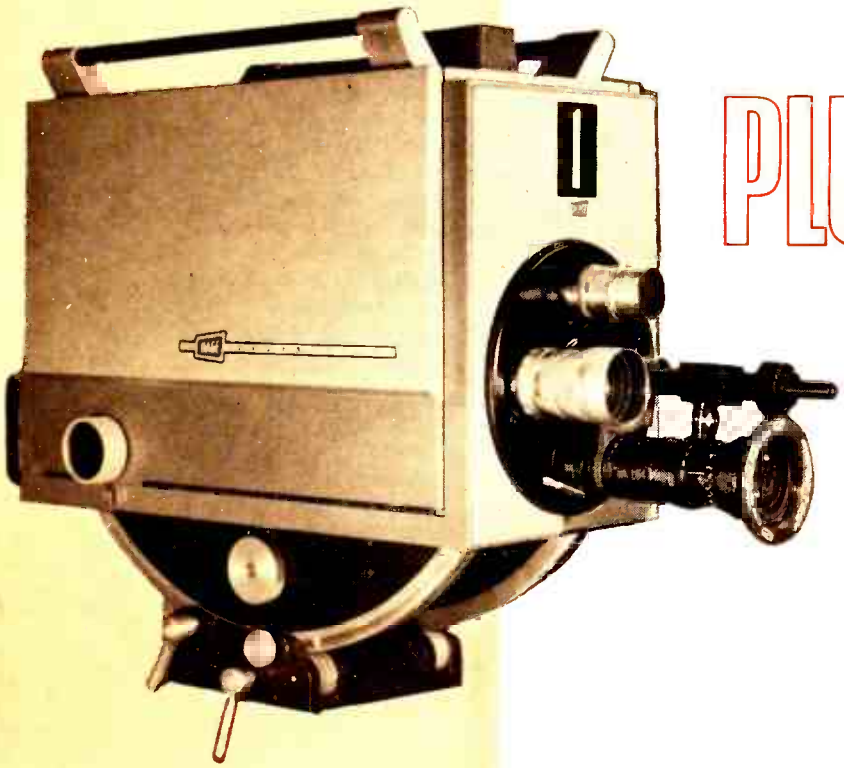

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Dage-Bell Corporation
A SUBSIDIARY OF RAYTHEON COMPANY
455 Sheridan Avenue, Michigan City, Indiana, Dept. 30-8

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it pays to use the best

Before RCA's new solid-state silicon rectifiers became commercially available as direct plug-in replacements for mercury vapor and gas rectifiers, they had to be the best. At stake was RCA's reputation with the broadcasters.

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2. INSTANT-ON—No warm-up time, no cool-down necessity.
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4. LESS TO MAINTAIN—Long life—replacements minimized.
5. LESS EQUIPMENT—No filament transformer required.
6. SAME-SOCKET REPLACEMENTS—Type numbers identical to those of your present mercury vapor and xenon rectifier types.

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RCA Electronic Components and Devices, Harrison, N.J.

The Most Trusted Name in Electronics

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