FEBRUARY, 1962

BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

S-5018—replaces 5AU4, 5AW4, 5AZ4, 5T4, 5U4, 5V4 5W4, 5Y3, 5Z4, 5931, 6087, 6106

S-5207
replaces 6X4

S-5130—replaces 866, 866A, 3B28

S-5367—replaces 8020

S-5343—replaces 816, 836, or 3B28 and 866 at reduced voltage

S-5033—replaces 6AU4, 6AX4, 6BL4, 6W4, 12AX4, 17AX4, 25W4, 6U4
S-5019—replaces 5R4

S-5011A—replaces 80, 82, 83, 83V, 5Z3
S-5017—replaces 0Z4, 5X4, 5Y4, 6AX5, 6X5

S-5251—replaces 5U4, 5AU4, 5AW4, 5AZ4, 5T4, 5V4, 5W4, 5Y3, 5Z4

Illustrations approximately ½ size

S-5347
replaces
12BW4, 6BW4

New low prices
Now $75.55
in 1 to 9 quantity

S-5344
replaces 872A

New low prices
Now $75.55
in 1 to 9 quantity

S-5373
replaces 8008

Sarkes Tarzian Tube Replacement Silicon Rectifiers improve circuit performance

Send for revised price list

These standard Tarzian tube replacement rectifiers are directly interchangeable with over 95% of all popular vacuum tube rectifiers. Although they are generally smaller and more compact than the tubes they replace, their dc current ratings are as much as three times as high.

In addition, they offer the inherent advantages of solid state rectification:

1. Greater electrical stability
2. Compact, rugged construction
3. Instant operation; no warmup; no filament supply
4. Cooler operation

For applications requiring high efficiency, wide temperature range, and long-period, maintenance-free operation, these compact units are unmatched. They are available in production quantities, at realistic prices. Special designs and modifications engineered on request. Special tube replacement units designed by Tarzian engineers include rectifiers with peak inverse voltages to 19,000.

Write for specifications and prices of tube replacement silicon rectifiers. Application engineering service is available on request.

Quality in volume

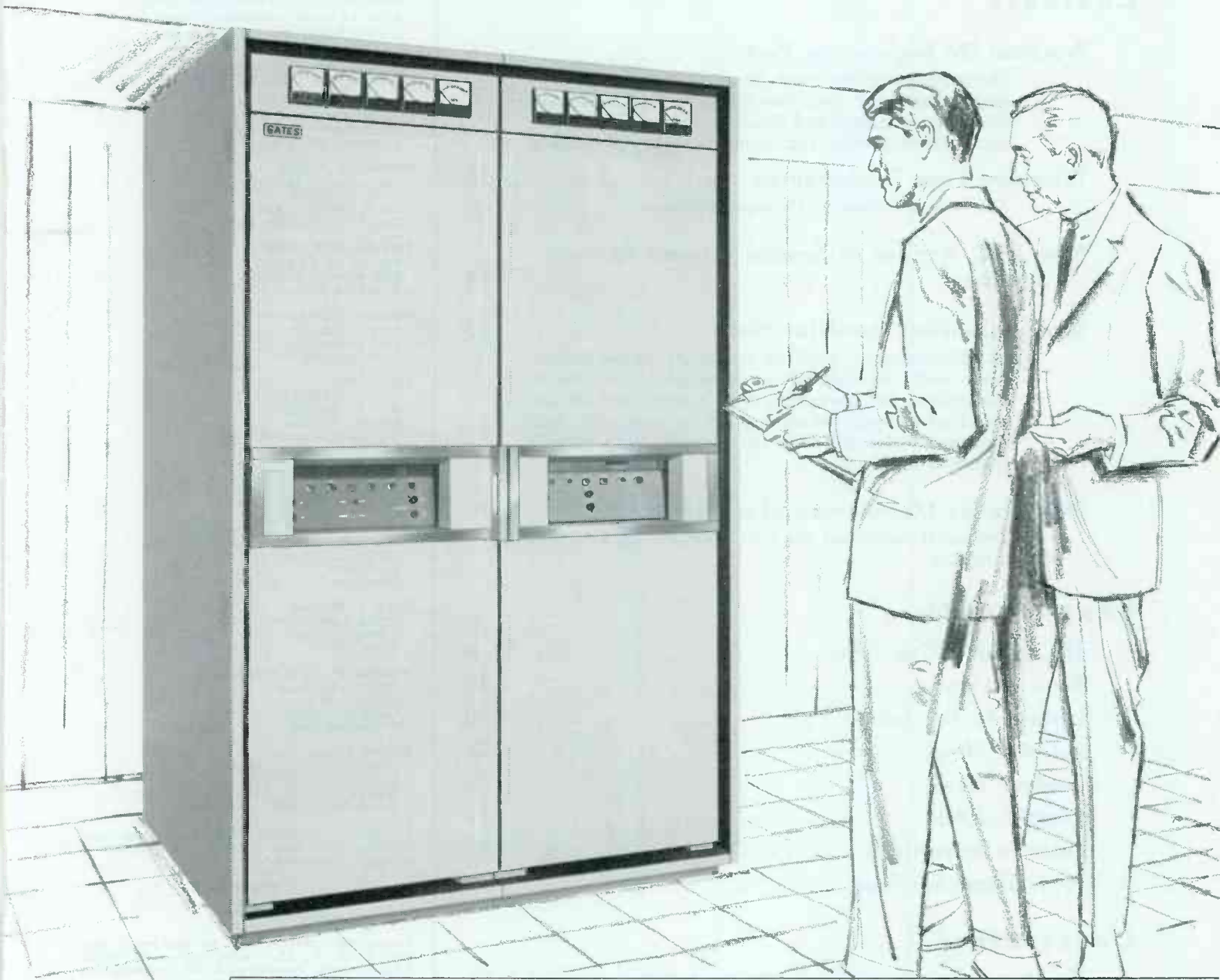
SARKES TARZIAN, INC.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

SEMICONDUCTOR DIVISION • BLOOMINGTON, INDIANA

In Canada: 700 Weston Rd., Toronto 9 • Export: Ad Auriema, Inc., New York

ENTIRELY NEW GATES FM-5C 5 KW FM TRANSMITTER—*with new advanced shadow-mold styling, new cooling system, longer tube life, silicon rectifiers throughout and built-in remote control. Just a few of the outstanding features of this entirely new FM transmitter.* ■ The FM-5C is a picture of conservative simplicity, with clean vertical lines accented by an array of controls protectively enclosed in a horizontal three-dimensional setting. Basic cabinet is medium dark glossgray, outlining the soft tones of recessed twin doors and meter panel, further distinguished by brushed aluminum door handles and trim. ■ Inside is an engineer's dream. A new cooling system reduces blower noise to an extremely low level – a low whispering hum is the sound of the FM-5C at work. One type 4CX5000 power tetrode, conservatively rated for long tube life, is used in the final amplifier. Silicon rectifiers are used in all power supplies, and all remote control accessories are included as part of the transmitter. ■ There are many other exceptional features that tell an exciting story of engineering excellence in FM. Write today for complete technical information – yours for the asking.



GATES **GATES RADIO COMPANY**

Subsidiary of Harris-Intertype Corporation

HARRIS INTERTYPE CORPORATION

QUINCY, ILLINOIS

Offices in: HOUSTON, WASHINGTON, D.C. In Canada. CANADIAN MARCONI COMPANY
Export Sales: ROCKE INTERNATIONAL CORP., 13 EAST 40th STREET, NEW YORK 16, N.Y., U.S.A., Cables: ARLAB

BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY ®

VOLUME 4 FEBRUARY, 1962 NUMBER 2

Contents

Departments

Cover Story

The cover shows a closed circuit television system in operation in the First National City Bank of New York for holding conferences and committee meetings jointly at the uptown and downtown offices simultaneously. Provided by General Precision Laboratories of Pleasantville, N. Y., the equipment saves hours of commuting between the two offices. At the same time the bank has been able to consolidate most of its operating departments under one roof.

Subscription Price: U. S. $6, one year; Outside U. S. A., $7. Single copies, 75 cents. Adjustments necessitated by subscription termination at single copy price.

Broadcast Engineering is published monthly by Technical Publications, Inc., 1014 Wyandotte St., Kansas City 5, Missouri, U. S. A.

Corporate Personnel: Robert E. Hertel, President; Frank D. Smalley, Executive Vice-President; E. P. Langan, Vice-President; Kenneth Long, Vice-President.

The Popular Choice of Broadcasters for High Power TV Applications

For Ease of Installation
Better Protection
Uniform Patterns
Low VSWR

RCA "TRAVELING WAVE" ANTENNA

Combines Improved Electrical Characteristics with Mechanical Simplicity and Economy

Here is a VHF high-band antenna that has inherently low VSWR and produces smoother patterns. The design, based on slot radiators, results in improved circularity. This new antenna is strongly resistant to high winds and offers better weather protection.

INHERENTLY LOW VSWR

The traveling wave nature of the feed results in a low VSWR along the antenna. This characteristic gives the antenna an inherently good input VSWR without compensating or matching devices. The input has been broad-banded to provide a smooth transition from the transmission line to the antenna.

EXCELLENT VERTICAL PATTERN

The null-less vertical pattern is extremely smooth. This provides uniform illumination of the desired service areas. Gains from 9 to 18 can be obtained.

IMPROVED CIRCULARITY

The individual patterns produced by slot radiators when added in phase quadrature result in an overall pattern with improved circularity. This design combines radiating elements, feed system and antenna structure in one unit, giving excellent horizontal circularity.

LOW WIND RESISTANCE

The smooth cylindrical shape of the antenna is ideal for reducing wind load and has high structural strength. It is designed to withstand a wind pressure of 50 psf of flats, or 33⅓ on cylindrical surfaces. In addition, the absence of protruding elements minimizes the danger of ice damage.

The steel outer conductor is hot-dip galvanized for better conductivity and protection. The inner conductor of the antenna is rigidly supported at the bottom end without relying on any insulator type of support to carry the dead weight. Polyethylene slot covers are fastened to the pole over every slot for better weather protection.

SIMPLIFIED FEED SYSTEM

The feed system is completely self-contained with only one point of connection. Simplified feed system consists of a large coax line and coupling probes. Completely enclosed by heavy-wall steel shell, thereby minimizing possibility of damage and off-air time due to "lightning discharges."

HOW THE "TRAVELING WAVE" ANTENNA WORKS

Essentially, the RCA "Traveling Wave" Antenna is a transmission line with slots cut into the outer conductor. These slots are arranged to guide the energy radiated by the center conductor into the needed radiation pattern. It fills the need for a VHF High-Band Antenna which combines mechanical simplicity and economy, especially in high-gain, high-power applications.

Your RCA Broadcast Representative will gladly help with TV antenna planning. See him for details on this new antenna. Or write to RCA, Dept. E-367, Building 15-5, Camden, N. J.

RCA

The Most Trusted Name in Television

The Editor's Cue Line

The Institute of Broadcast Engineers

When we commented in December BROADCAST ENGINEERING that there seemed to be a need for an Institute of Broadcast Engineers, we did not expect the response that the opinion aroused. Printed on the opposite page are four representative letters of the many that we have received. The actual ratio of pros and cons is exactly the same as those printed — three pros for every one con!

Mr. Harry Dennis' letter makes a very good point, or series of points, for the IRE and its professional groups, and his attitude is that of an enthusiastic member who participates in professional group activities. But for the majority of our readers such activities are out for one reason or another. Similarly he refers to Kahn's article on CSSB in the October *Proceedings*. This has been the only one for a long time; and how many broadcast engineers still pay $15 annually for membership plus extra dues for professional group membership? And how many feel that the monthly journal that they *have* to buy contains anything of real interest and value to them?

Audio Engineering and Audio Engineering Society were born more or less in an upsurge of enthusiasm, and to get more of what the members wanted because no other group offered it. Now the time is long overdue for the same thing to happen for broadcast engineers!

Mr. Frederick Hervey has suggested that BROADCAST ENGINEERING be adopted as the official organ for the proposed new society. We must make it clear that BROADCAST ENGINEERING is not in the business of arousing internecine strife, nor of forming new engineering groups. However, we are aware of our responsibility to our readers. Therefore, for the present B-E will be happy to act as a clearing house for all correspondence on this subject.

If the correspondence continues to flow in as it has done, we will help to campaign with the foundation members to canvas for a show of interest. We feel that if the interest is there on the part of the broadcast engineers the necessary backing and support will be found.

It has been ever thus in America!

Licenses in Jeopardy!

As is their right, responsibility and prerogative, the Federal Communications Commission is tightening up on technical operations. In many ways this is the best Commission that we have had for some time. BROADCAST ENGINEERING is concerned only with the technical side of station operation, and our readers are all responsible men who try to do a good job under what are sometimes very trying conditions. The field inspections that the FCC inspectors make are planned only with the object in view of ensuring that equipment is operated in accordance with the regulations of the Commission. Sometimes the inspector's visits are a blessing to the chief who is trying to bring his operation up to standard but is prevented from doing so by an avaricious owner.

This thought leads us to the condition in which a chief, or operating engineer, finds himself in a situation where pressure is put on him to operate, or certify, sub-standard equipment. There is only one answer to this kind of pressure—don't certify anything that you know is not true!

So far, the Commission has not cracked down very heavily on engineers who are involved in, for want of a better term, sub-legal engineering operations. This is probably because in the cases in question the engineers were not to blame, and management was at fault. However, this is not to say that engineers will not be increasingly observed in their operations. So *Caveat Engineer!* Let the engineer beware! It is easier for a man to lose a First Class License than it is for a corporation to lose a station license! By sticking up for legal and technically correct operation you will have the FCC behind you—and you will not jeopardize your license!

Editor, BROADCAST ENGINEERING

Dear Sir:

Apropo of your Editorial comment on the IRE and in view of the fact that the IRE and the AIEE are well on the way towards consolidation, I too believe that the time is ripe for the formation of an Association of, by, and for Broadcast Engineers. I am a Member of the Audio Engineering Society, as it was once interested primarily in the broadcast aspects of the audio field. The AES has seemingly gone more and more towards the "High Fidelity" angle, merchandising, manufacturing, and standards.

I suggest, as a basis for discussion at least, the following requirements for membership in the proposed IBE:

All members be actively employed in the broadcast industry or immediately related industries: i.e. BC equipment mfrs. and reps.

Voting Membership be restricted to those Members in possession of the usual Fone First ticket. Let's not let the unlicensed rabble in here.

Honorary Membership be conferred on the FCC Field men. They are our allies—only the boobs and incompetents fear them.

Membership be in the following grades: Student, Associate, Member, Fellow, and Honorary. There should be the usual Officers and an elected Board of Governors.

I herewith offer my help in getting this thing rolling—we have long needed an Engineering Society for the BC people. I can come up with a draft of a Constitution and By-laws. And while I think of it, why not adopt Broadcast Engineering as the official publication, at least as a start?

Sincerely,

FREDERICK C. HERVEY
Radio Stations WHKW WLFM
Chilton, Wisconsin

Editor, BROADCAST ENGINEERING

Dear Sir:

I have just read your most welcome editorial in the December issue of Broadcast Engineering. It is a heartening feeling to know that others have realized the lack of interest in standard broadcast engineering displayed by the IRE and the professional publications. In recent years, I have stopped subscribing to several such periodicals because I have little interest (so far as my job is concerned) in esoteric computer circuitry and competing advertisements for sub-miniature linear potentiometers.

On behalf of the many who, like myself, are committed for the remainder of their useful years to trying to keep a reasonably clean AM signal on the air while increasing efficiency to meet often smothering competition, I raise my hat to you for your sentiments. Furthermore, I offer what little I can contribute toward the formation of such a professional group.

Please let me know what I can do to help.

Sincerely,

DEAN H. ELLIOTT
Chief Engineer, KINS
Eureka, California

Editor, BROADCAST ENGINEERING

Dear Sir:

I concur whole heartedly with your editorial for an institute of Broadcast Engineers. I will be most happy to be first in signing up for such an organization.

Let's get behind this!

Cordially,

JAMES E. GRAY,
Chief Engineer, WYDE
Birmingham, Alabama

Editor, BROADCAST ENGINEERING

Dear Sir:

I am forced to take exception to your lead editorial in the December issue of your magazine.

I can agree with you on one point, IRE was originally a technical society composed of mainly broadcasters per se.

I am a broadcaster and am currently serving as Vice Chairman of the Cleveland section of IRE. I have been a past Chairman of the Professional Group, Broadcasting.

We have a very active broadcast group in Cleveland which holds at least six meetings per year. The broadcast group is the host to the entire section for one meeting annually. Our list of speakers are leading members of the radio-TV broadcast industry.

If someone belongs to an inactive broadcast group perhaps the fault lies with the individual. It does take a little work to activate any society.

You suggest forming a new group. I wonder if you realize what a tremendous burden this undertaking means. Who would administer this group? Where would the necessary funds come from to make this a vital voice for the broadcast industry?

You also take the Proceedings to task. I would like to call to your attention the October, 1961, issue of the Proceedings in which Leonard Kahn wrote a very detailed explanation to a CSSB System which might be applied to a conventional AM broadcast transmitter.

The national office of PGB regularly issues papers related to our own industry.

Your editorial is just so much sour grapes to me. Let's get some active broadcast groups around the country. IRE is a recognized world-wide technical society of which each member can be justly proud to be a member. The strength of any organization lies with the individual members.

Sincerely yours,

HARRY DENNIS
Vice-President, Engineering
Radio Station WERE
Cleveland, Ohio

PRACTICAL FM ENGINEERING

Part 1 – Fundamentals

By Jack Alexander
International Television
Consultants Inc.
Washington 15, D. C.

The author, who has much practical experience in FM installation work, describes the pitfalls of haphazard frequency selection and details considerations of antenna and transmitter combinations as they affect ERP.

WITHIN the past few months the FCC has announced some proposed FM rule changes — the first for many years. As is to be expected there has been support and argument over them. Nevertheless, whatever the outcome, certain FM fundamentals will remain. In this two-part article, the general basic FM engineering practice will be discussed without regard to future possible changes.

Planning an FM Operation

As in any other job the first thing is to find a frequency. Sometimes this is easy—in the West for example; in the East it is impossible in some cities. Let us suppose in this case that we live in the West, or a part of the East like West Virginia, where the choice is almost wide open.

If your proposed station is to be in a television fringe area, pay particular attention to the channels received either directly, or on a CATV system.

If channel 6 is your only or major channel, select an FM frequency around 100 MC to avoid the possibility of FM interference to television. Channel 6 is 82-86 Mc, and the bottom FM channel is only a few Mc's away. Due to the necessarily broad band input of the TV tuner, and the high gain—especially in a fringe area receiver—it is very easy to cause interference to picture reception. Nothing is calculated to diminish interest in a new FM station more than ruined TV reception — especially in a small town.

When considering channel 6, also remember to watch channels 8 through 13. These are the high band channels from 174-216 MC. The second harmonic of an FM transmitter working on the band 88.1 MC to 107.9 MC can easily fall right on a distant, or even local, TV signal. All modern transmitters such as those produced by ITA, have second harmonic, and total harmonic attenuation in excess of 80 db. But even a very weak harmonic can play havoc with a very much attenuated fringe video signal.

Sometimes the FM receiver IF is overlooked. This is generally 10.7 MC and for this reason it is advisable to select a frequency that is not 10.6 or 10.8 MC removed from an adjacent FM station. In fact it is likely that the FCC will not approve such an application, or at the very least will demand that the applicant agree to correct all interference problems arising from it, and this could prove impossible.

At the same time that you are observing the 10.7 MC IF rule you should watch out for 4.5 and 21 MC beats. These standard IF frequencies fall in ranges of aeronautical, government and broadcast services. It doesn't take many microvolts to cause interference.

Finally, in making your determination of a suitable frequency, consider the FCC's own table of acceptable adjacent channels, and interference ratios. For a co-channel station the ratio is 10:1 desired to undesired signal. That means your

ERP**	TRANSMITTER	ANTENNA	EQUIPMENT* COST
1KW	250W	4	5,100
	1KW	1	5,400
5KW	250	20	13,100
	1KW	5	7,400
20KW	1KW	20	14,900
	5KW	4	13,000
50KW	5KW	10	16,000
	10KW	5	15,500
	5	20	21,000
100KW	10KW	10	18,500

* ANTENNA COST AROUND $500/BAY
** ASSUME 0 LINE LOSS

EQUIPMENT COST VS. TRANSMITTER COMBINATION

Figure 1—Table of comparative transmitter/antenna combination costs, based on ITA equipment.

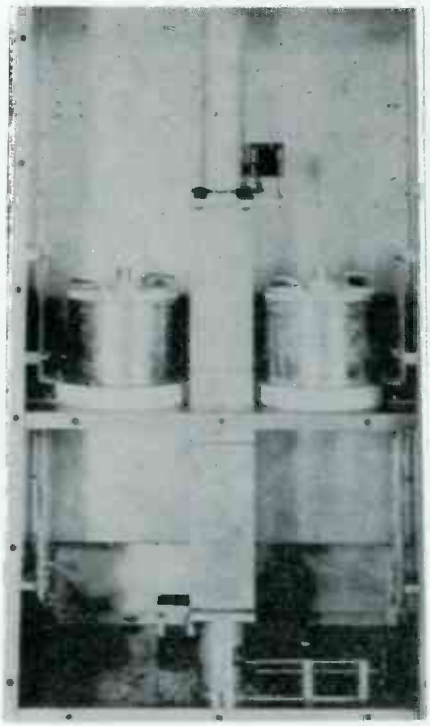


Figure 2—Two 3CX10,000A7 tubes operating grounded grid in an ITA 35 KW power amplifier form a good example of modern ceramic tube usage.

1 MV/M signals must be ten times as strong as the undesired; or 1 MV/M (1,000 microvolts) to 0.1 MV/M (100 microvolts). The average distance to the 1 MV/M contour of a class B FM station is 31 miles, and to avoid interference there should be no co-channel signals stronger than 100 microvolts at that contour.

For adjacent channels the ratios change as far as 1:100 desired to undesired signal. That means that for the third adjacent channel which is 600 KC removed from your desired signal, the interfering signal can be as much as 100 MV/M before interference occurs. Often this is taken advantage of in allocation work to accept a tiny "plug" of interference around an adjacent channel transmitter in order to get an allocation.

Antenna Considerations

Obviously every broadcaster wants maximum power. Class B stations in Zone 1 are limited to the equivalent of 20 kw ERP from 500 ft. above average terrain. This means that whatever combination of power and height is used, the coverage obtained will not exceed that obtained by the reference figures, or approximately 31 miles to the 1 MV/M contour. In Zone 11 these limits do not apply.

The FCC publishes a set of curves which are used to determine the distances to the various contours with differing heights and powers. There is no purpose to be gained in trying to work out your own curves because unless there is some very good reason why they should be used, the FCC will not accept them. The only time that non-FCC curves will be accepted is when due to some unusual local topographical conditions, such as excessively high mountains surrounding the site, normal curves will not apply. Then the FCC demands that you arrive at your coverage figures on a method based on the conditions.

Because FM propagation is like that of TV and the signal normally travels only in a line of sight, height is more essential than power, and atmospheric refraction plays a very small part in FM propagation.

It is far better to have a high tower and low ERP (Effective Radiated Power) than high power and a low tower. Of course the high tower can consist of a short tower on a high building and this is generally the cheapest way to obtain height. One station in Wyoming actually has its antenna mounted only five feet above ground, on a peak of the Rockies, and yet has and average height above ground of thousands of feet.

Another factor that must be considered in siting your antenna is the need to place 3-5 MV/M over the major city served, 5 MV/M over the studio, and 1 MV/M in all urban areas. In this regard, the FCC's rules require that in counting population only those people in urban areas of 10,000 or more, who receive better than 1 MV/M can be counted. Fifty microvolts is the

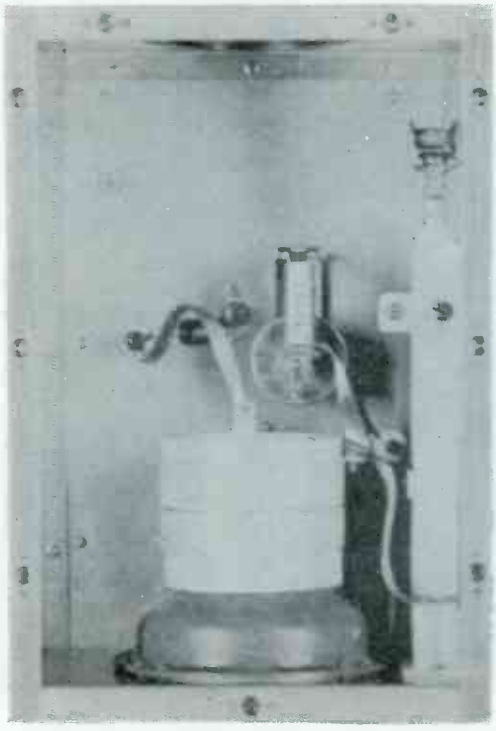
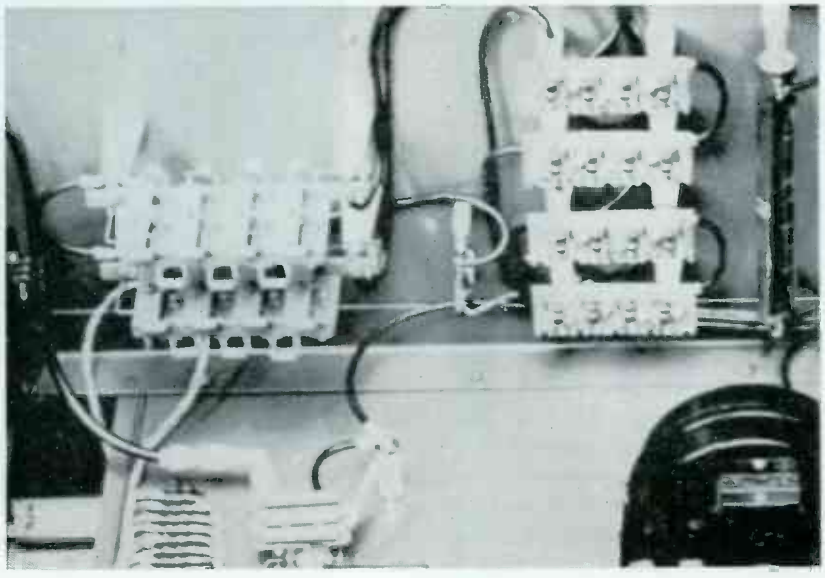


Figure 3—A ceramic 4CX1000A tube forms the power amplifier stage of the ITA FM-1000C 1 KW amplifier. Note simplicity of layout.

Figure 4—A typical silicon rectifier installation in modern ITA transmitter.



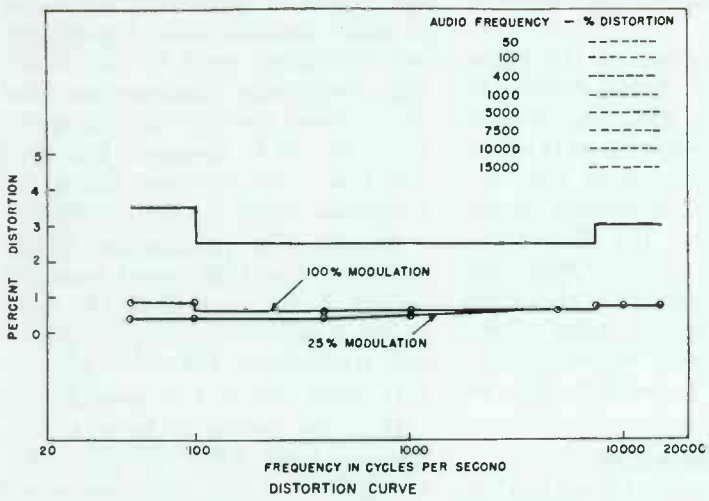


Figure 5A—Typical modulation/distortion curves for an ITA phase modulated FM exciter.

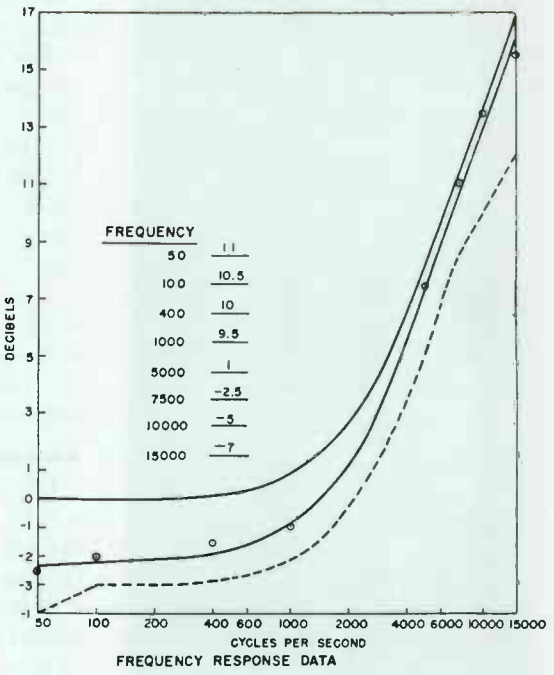


Figure 5B—Frequency response obtained from phase-modulated exciter.

minimum figure for suburban areas.

After deciding on the antenna height above ground, and calculating the height above average terrain by drawing eight radials each ten miles long from the site, and averaging the elevations from two to ten miles, and then averaging these eight averages and determining the antenna's height above *this* average, the Effective Radiated Power must be decided. ERP is found by multiplying the gain of the antenna by the actual power into the antenna from the transmission line. For example: if a transmitter has a power output of 10 kw into the line and the line has a loss of 3% at the operating frequency (this point is important —some lines fall off very badly as the frequency increases even slightly) and the antenna gain is 7, the ERP will be: 97% of 10 KW times 7 equals 9.7 KW times 7, or 67.9 KW ERP. A goodly figure!

In deciding what combination of power, height and antenna to use, consideration must be given to initial installation cost as well as operating costs. At first, the reaction is "let us use a low power transmitter, high antenna and high gain, because then power and tube costs will be lower." This is true, but sometimes the *apparent* signal strength in the immediate vicinity of the transmitter is not reached when a low power-high gain combination is used and a high power-low gain combination gives a better signal in the metropolitan area. Thus, as in almost every area of broadcasting the solution is not as simple as at first it seems, and due consideration must be given to all the facets.

Figure 1 is a chart showing representative combinations of ERP and Cost arrived at in various ways. It is based on figures produced by ITA.

Transmitter Selection

Since FM first became a commercial accomplishment there have been many good transmitters on the market. And today there are many to choose from. The choice often becomes difficult when competing rates engineers present their claims of fantastic efficiency and low price. As a general rule if the equipment complies with the following suggestions you will not regret its purchase.

Tube Costs: Some FM transmitters use final tubes that are costly to replace and have comparatively short lives. This can nullify any immediate cost cutting. The best choice is the modern ceramic tube

(Continued on page 24)

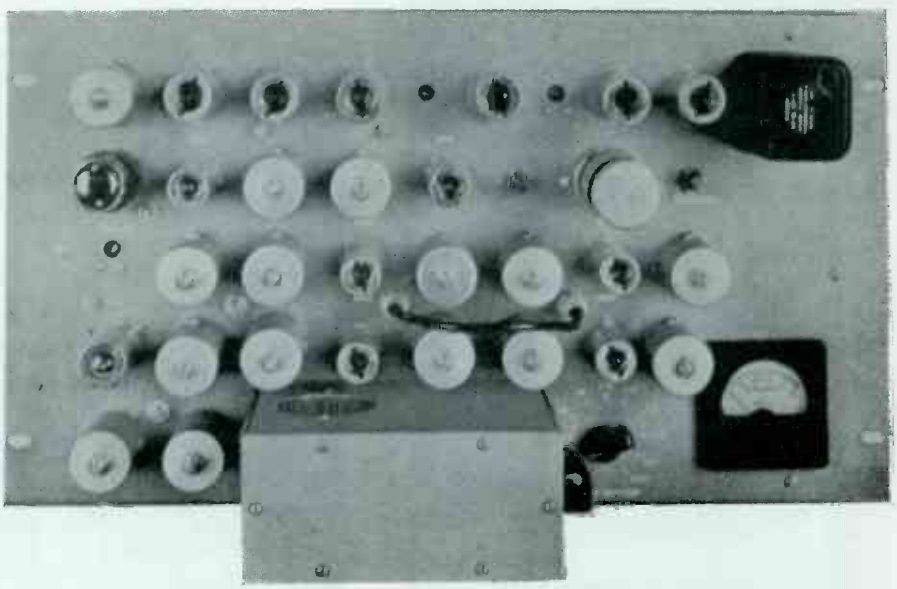


Figure 6—Phase modulated exciter made by ITA. All adjustments are made from the front panel.

"Sylvania GB-5749 cuts costs 50%!"

Paul F. Rex, Chief Engineer, WISR, Butler, Penna., says—"Sylvania Gold Brand 5749 has solved our limiter amplifier problem. Proper operating curve adjustments are now routine—with unselected tubes—*at less than one-half our former cost.*

"Now we enjoy excellent fidelity—no thumps—with 15 to 17db of compression. This means good high level audio at the receiver. We recommend Sylvania Gold Brand Tubes for those tough problems." If, like WISR, you have a critical tube job—replace with Sylvania Gold Brand Tubes.

AVAILABLE FROM YOUR SYLVANIA INDUSTRIAL TUBE DISTRIBUTOR

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

TELEVISION TAPE FUNDAMENTALS

I—The Basic Solutions to TV Tape Problems (Part 1)

By Harold E. Ennes

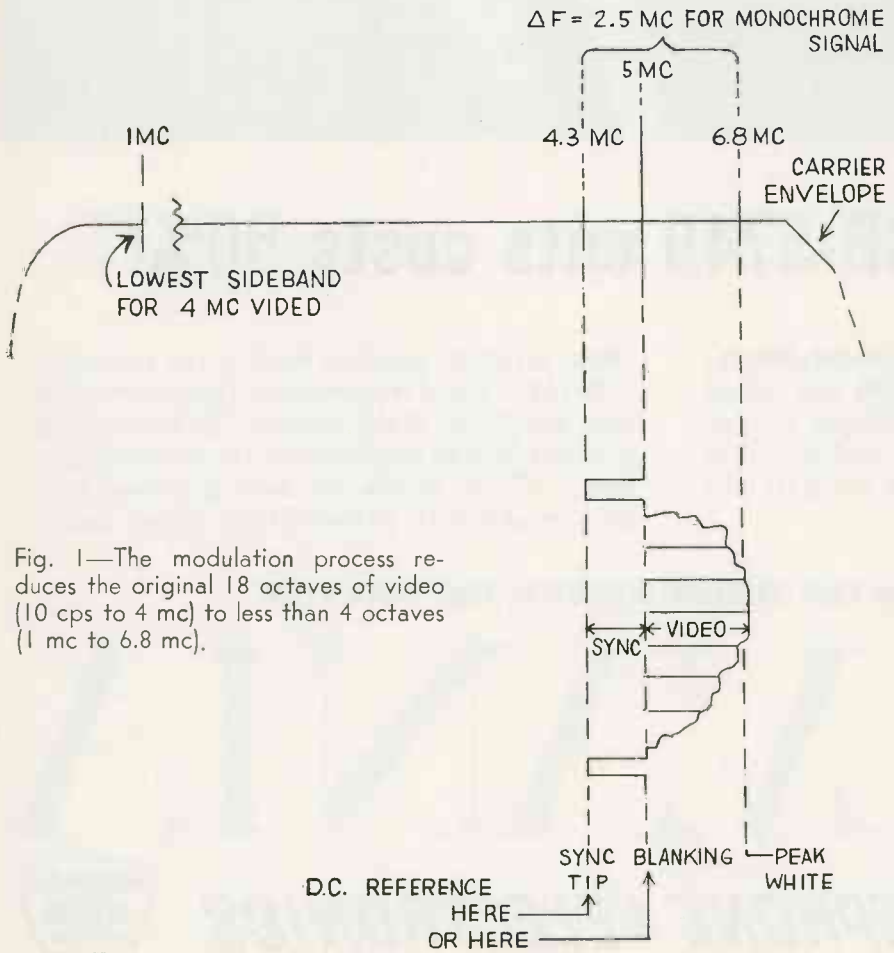


Fig. 1—The modulation process reduces the original 18 octaves of video (10 cps to 4 mc) to less than 4 octaves (1 mc to 6.8 mc).

THE PURPOSE of this material is to provide a fundamental theoretical training in TV tape systems. It is aimed at the goal of meeting the needs for initial introduction to the novice as well as for the practicing engineer who feels the need for a better understanding of his equipment.

Specific circuitry will change rapidly in the immediate years ahead. This coverage is therefore general in nature and applicable to any standard broadcast video magnetic tape system, using the "quadruplex" (four rotating heads) method. The scope of coverage is from basic theory to testing and maintenance of complete systems.

The Time-Space Relationship Fundamentals

Although the time-space relationship is important to all communication theory, television tape techniques are such as to exaggerate this interdependence.

Wavelength = Velocity/fcps

This recalls the familiar conversion which is a fundamental time-space relationship.

The velocity of sound waves, although influenced by temperature, humidity and height above sea level, may be taken as approximately 1088 ft./sec. Since the wavelength is equal to velocity divided by the frequency in cycles-per-second, a 1000 cycle tone (in air) will have a wavelength of 1088/1000 or 1.08 feet. Doubling the frequency to 2000 cycles results in a wavelength just one-half as long.

But as the frequency is increased still further into the radio-frequency

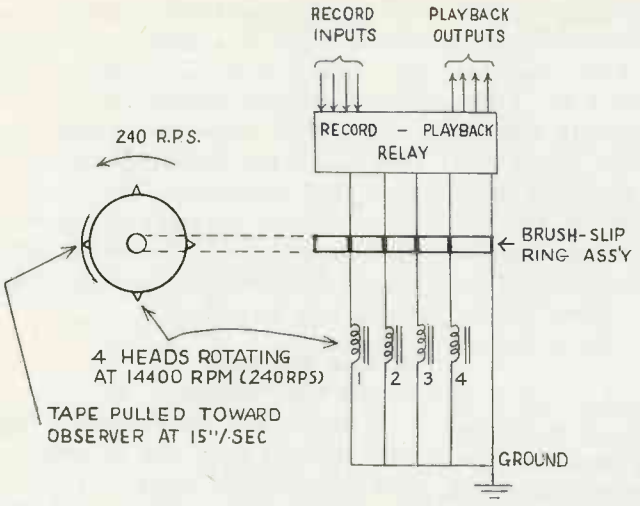


Fig. 2—Fundamentals of rotating head assembly.

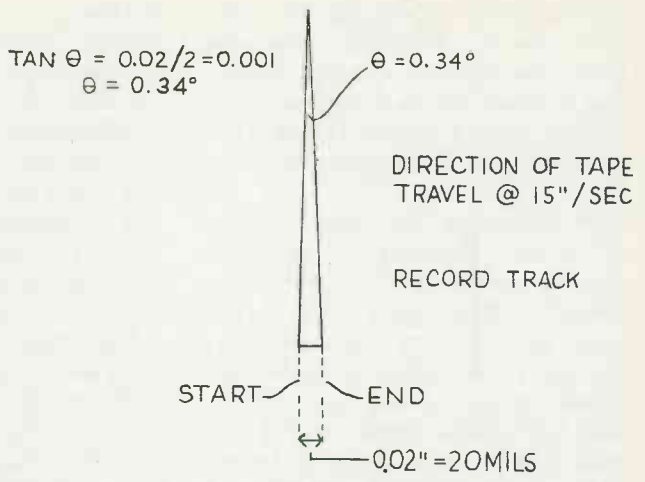


Fig. 3—Angle of recorded track as pole tip sweeps across 2-inch tape with tape velocity of 15"/sec.

spectrum, the velocity of propagation in air also increases to practically the speed of light, or 186,000 miles (300,000,000 meters) per second. Thus increasing the 1000 cycle tone 1000 times (1 megacycle) results in a wavelength of approximately 984 feet. The higher the velocity, the longer the wavelength for a given frequency.*

Broadcast type audio tape recorders use a tape velocity of either 7½ or 15 inches/sec. At 7½"/sec, the recorded wavelength of a 1000 cycle tone is $7.5/1000 = 0.0075$ inches or 7.5 mils. (One mil is 1/1000 inch). At a tape speed of 15"/sec, the recorded wavelength of a 1000 cycle tone is 15/100-0.015 inches or 15 mils.

The strength of the magnetic field is determined not only by the amplitude of the signal fed to the head, but also by the rate of change of the magnetic field. For a given amplitude, as the frequency is increased (increased rate of change) the magnetic field is increased in intensity.

As the frequency is doubled (increased by one octave) the voltage is doubled. This voltage increase measured in decibels is 6 db. Therefore a 6 db/octave rise occurs in magnetic recording with increasing frequency.

Conversely as the frequency decreases from a given high frequency limit, a 6 db/octave falloff of amplitude response occurs. At a certain lower frequency limit, the rate of change of the magnetic field is so low compared to the gap size that very little output exists. When the signal output falls to an objectionable signal-to-noise ratio, the lower frequency limitations of the system have been exceeded.

The frequency limitation of direct magnetic recording is about 10 *octaves, or* 30 *to* 15,000 *cps in the audio range.*

If it is desired to increase the upper frequency limit to 30,000 cps, then the lower frequency limit must also be doubled to maintain adequate signal-to-noise ratio at the lower frequency again resulting in a 10 octave range of 60 to 30,000 cps.

Required Frequency Range for Television Tape

The gamut of frequencies required in a video signal must extend into very low frequency regions for good picture shading, and comparatively high regions for satisfactory picture detail.

System requirements at the extreme low frequency end approaching zero frequency (dc) are aided by line-to-line clampers and dc restorers, but the low frequency ac response must also be very good. As a reference for this discussion, we will arbitrarily state that 10 cps is the low frequency ac response requirement. Response in this region is directly related to the proper operation of clamps and dc restorers when these circuits are employed.

To avoid accumulative effects, modern studio equipment normally has a bandwidth to at least 8 mc. The picture transmitter however is limited to approximately 4 mc by FCC engineering regulations. Therefore the horizontal resolution is restricted to about 320 lines in the home receiver. The complexity of the problems encountered in recording pictures on magnetic tape warranted a compromise in this particular studio equipment gear. Modern television tape recorders specify a bandwidth at least to 4 mc (320 lines horizontal resolution) with a signal-to-noise ratio of at least 35 db. In addition, sync pulse stability must meet minimum FCC requirements.

The video signal frequency range for television tape extends from very low frequencies (actually dc) to a practical upper limit of 4 mc. If we consider the range to be 10 cps to 4 mc, a scale of 18 octaves is required.

Solving the Low Frequency Problem

The dc component in a standard video signal is "inserted" by means of line-to-line clampers. Essentially, the clamper charges or discharges a coupling capacitor to a dc reference which is usually that representing signal blanking level. This assures that each active line scan starts from the same reference immediately following horizontal blanking.

The extreme low frequency requirements are met for the magnetic tape medium by employing an RF carrier which is frequency modulated by the video signal. FM was chosen over AM to allow amplitude limiting to be employed for attenuation of extraneous noise.

The carrier frequency can now

*Wave composition is longitudinal for sound waves, transverse for radio waves.

represent the dc component, either sync tip or blanking, depending upon the system clamp reference. Fig. 1 shows the modulation characteristic with a carrier frequency of 5 mc clamped to the signal blanking level.

With carrier frequency clamped at video blanking level, it is standard monochrome practice to adjust picture signal gain so that peak white deviates upward in frequency 1.8 mc. Thus the peak white signal occurs at 6.8 mc. With a standard video input of 0.3 volt sync to 0.7 volt video, sync tips deviate the carrier 0.7 mc lower in frequency to 4.3 mc. A total deviation of 2.5 mc is used currently as the 100 per cent modulation reference for monochrome signals.

Sidebands occur at the carrier frequency plus and minus the instantaneous video frequency. The maximum video frequency in the system passband determines the sideband limits. For 4 mc, the lowest sideband occurs at 5-4 = 1 mc.

The upper sideband only extends far enough to provide a "shelf" for the upper frequency deviation. Sidebands beyond this limit are not used. The conventional assumption that the carrier frequency must be at least 10 times the highest modulating frequency is discarded in television tape.

When the modulation index is less than 0.5 (frequency deviation less than half the modulating frequency), sideband energies above a single pair are practically nonexistent and approach AM characteristics in this respect. (Ref: Charles E. Anderson: Signal Translation Through the Ampex Videotape Recorder; Journal of the SMPTE, Nov. 1958).

The only practical result of these compromises is a slight zig-zagging of vertical lines apparent at 300 lines resolution and above.

The total frequency range now becomes 1 mc to approximately 7 mc. This constitutes less than 4 octaves, and provides a practical solution if the high frequency problem of handling a 7 mc maximum signal can be met.

Solving the High Frequency Problem

A good audio tape recorder may have a head gap size as small as 0.25 mil. (0.00025 inches). Then for the upper audio range of 15,000 cps and a tape speed of 7½ inches/sec:

Recorded wavelength = 7.5/15,000 = 0.0005 inches = 0.5 mil.

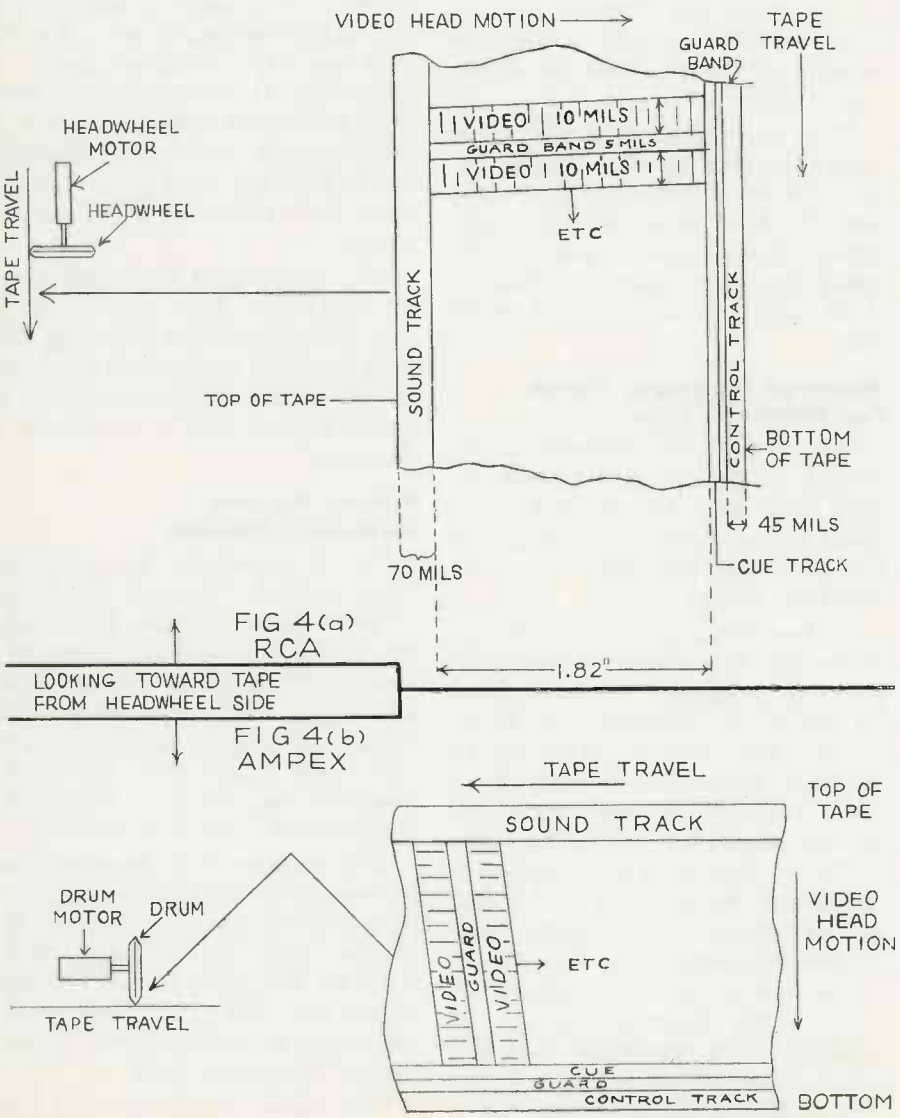
The recorded wavelength is twice as long as the gap width. This wavelength/gap size is the lowest practical limit which can be adequately pre-emphasized for good reproduction and signal-noise ratio. The signal begins to decrease before this point due to losses in the magnetic core structure and pre-emphasis is required.

The smallest practical magnetic gap that can be used is approximately 100 micro-inches, or 0.1 mil.

Then the minimum wavelength that will represent 7 mc must be twice as long as 100 μ in., or 200 μ inches.

Knowing the gap size, and the minimum required recorded wavelength at the upper frequency limit, we can now visualize the required tape velocity.

To find the necessary tape speed:



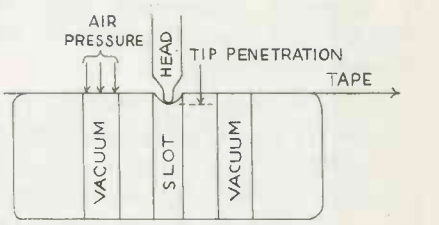
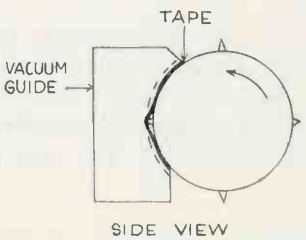


FIG 4(c)

FIG 4(d)



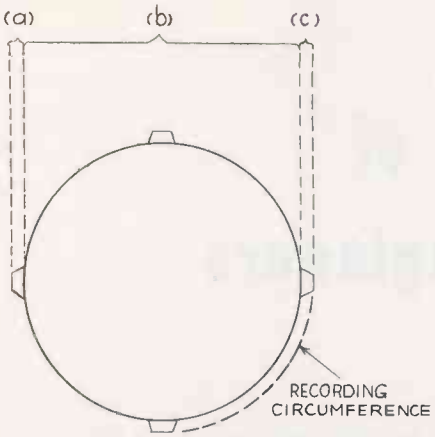


Fig. 5—Tip projection (a) and (c) = 3.7 mils max. 1.0 mil min. Reference Diameter (b) = 2.064".

Since Wavelength = Velocity/Frequency, then Velocity = Wavelength × Frequency = (0.0002)(7,000,000) = 1400 inches/sec.

If the tape was actually pulled across the head at this speed, it would require 420,000 feet of tape on a reel over 80 feet in diameter to record one hour of material. Try to visualize the required tape transport mechanism! Obviously this is an impractical solution.

The problem is solved by pulling the tape at a practical speed of 15"/sec past a rotating video head. Insofar as the video signal is concerned, the resultant velocity is more accurately termed "head-to-tape velocity." The rotating head (Fig. 2) gives an effective head/tape velocity slightly in excess of 1500"/sec, and the head gap size is very slightly under 0.1 mil. The width of the video track laid down transversely across the tape is approximately 10 mils.

The FM video signal is fed to the individual heads on the rotating drum via a slip-ring and brush assembly. Video tracks are laid down transversely (across) the 2" wide magnetic tape. Audio is recorded longitudinally along the top of the tape at the conventional 15"/sec rate. A control track which indicates the precise position of the rotating head drum relative to recorded video information is recorded along the bottom of the tape. (240 cps signal).

A Close Look at the Rotating Head Theory

The circular mounting which contains the four video heads is termed the "headwheel" by RCA, and the "drum" by Ampex. Ampex employs a horizontal tape transport while RCA uses a vertical tap transport.

A rotating head contacts the tape for approximately 120° arc. The tape is pulled past the head at a velocity of 15"/sec. The head rotates at 240 rps so it takes 1/240 sec for 360° and ⅓ this time to traverse the 2" tape (120°) which is 1/720 sec.

Since the tape travels 15" in one second, it will go 15/720 = 0.02" or 20 mils while the head describes its arc across the tape. Therefore the bottom of each video track will be ended 20 mils later than the start, thus resulting in an angle of 0.34° (Fig. 3).

Fig. 4(a) shows the orientation of recorded information on the RCA vertical tape transport. The video heads contact the entire 2-inch surface of the tape but a 70 mil wide track across the top is erased for audio information, which is recorded by a conventional audio head longitudinally to tape travel. The video tracks actually are not erased along the bottom of the tape containing the control track, but only that portion which is used as video information is shown by the illustration.

Tapes recorded on either system are entirely compatible and may be played back on either system. The track orientation on the tape is that viewed looking toward the coated side from the rotating heads. Fig. 4(b) is the Ampex version with exactly the same track dimensions.

Fig. 4(c) shows the method of holding the tape concentric to the rotating heads. The center slot provides clearance for tape "stretch" under head penetration. Fig. 4(d) is the side view.

The wheel which contains the four video heads has a reference diameter of 2.064 inches. The tip projection of a new head is about 3.7 mils maximum. The tip projection of a worn head is about 1.0 mil minimum. (Fig. 5).

The maximum recording diameter (tip projection of 3.7 mils) is:

(a) + (b) + (c) = 0.0037
2.054
0.0037
2.0714 inches

Circumference = π D
= 3.14 × 2.0714
= 6.504 inches

Since the head revolves at 240 rps:

Head/tape velocity = 6.504 × 240 = 1561"/sec. at maximum tip projection of 3.7 mils.

The minimum recording diameter (tip projection of 1.0 mil) is again:

(a) + (b) + (c) = 0.001
2.064
0.001
2.066 inches

(Continued on page 24)

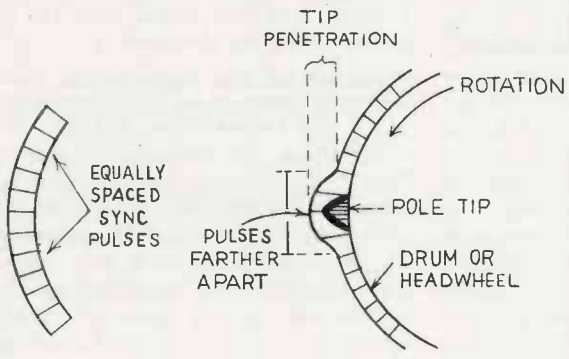


Fig. 6—Effect of tip penetration on spacing (hence timing) of television lines.

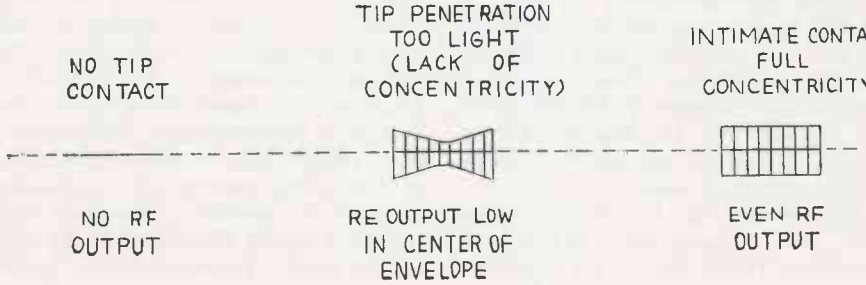


Fig. 7—Effect of RF envelope output from various tip penetrations.

New FCC Actions of Special Interest to Engineers

PART 1

BROADCAST ACTIONS

The Commission en banc, by Commissioners Minow (Chairman), Lee, Craven, Ford and Cross, took the following actions on December 6:

INTERIM PROCEDURE ADOPTED FOR PROCESSING FM APPLICATIONS

By Memorandum Opinion and Order, the Commission denied certain petitions to suspend action on all FM broadcast applications which would conflict with its proposals to revise the FM rules (Docket 14185 and RM-94) pending the outcome of that proceeding. It held that a total "freeze" is not warranted at this time but recognized that an interim procedure for processing FM applications is desirable.

Accordingly, by separate Order, the Commission adopted a temporary procedure, effective today, for processing FM applications.

Basically, applications for new FM broadcast stations or for modification of existing FM broadcast facilities will be acted upon where the station operating as proposed will not receive or cause interference within its 1 mv/m contour or cause interference within the 1 mv/m contour of another proposed or existing station. Also, coverage of the proposed facility may not be more than the equivalent of that of an FM broadcast station operating with 20 kw effective radiated power and an antenna height of 500 feet above average terrain, provided the effective radiated power specified is not more than 20 kw. Directional antenna systems, if any, may not radiate more than 20 kw effective radiated power in any direction.

Service and interference contours for all FM applications will be determined by use of F (50, 50) and F (50, 10) curves, respectively. These curves are the same as proposed in Docket 13440 for TV channels 2-6, also for FM in Docket 14185, and are attached to the interim procedure order.

Educational FM broadcast applications are exempted from the interim procedures except that in the computation of service and interference the applicant will be required to use the curves mentioned.

Applications pending before the Commission, including those in hearing status, will be reviewed to determine whether their proposals are consistent with the interim criteria. If so, appropriate action will be taken on an application, but where the proposal is inconsistent with the interim criteria the applicant will be notified and its application placed in the pending file. Applications tendered for filing which do not comply will be returned as not acceptable for filing. The way is left open for pending applications to be amended to bring them into compliance.

Commissioner Cross dissented to the interim procedure order.

BROADCAST ACTION

The Commission en banc, by Commissioners Minow (Chairman), Lee, Craven, Ford and Cross, took the following action on December 6:

PROVISION FOR CONDITIONAL TV INTERIM OPERATION INCORPORATED IN PROCEDURAL RULES

By Order, the Commission amended Part 1 of its rules of practice and procedure to incorporate in Sect. 1.362 governing conditional grant of applications for broadcast facilities a new subpart (i) to provide that, when two or more applications for the same TV assignment have been designated for hearing, the Commission may, if the public interest will be served thereby, make a conditional grant to a group composed of any two or more of the competing applicants, such grant to terminate when the successful applicant commences operation under the terms of a regular authorization. No conditional grant will be made unless all of the competing applicants have been afforded a reasonable opportunity to participate in the group seeking the conditional grant. In its application, the group shall include a special showing as to the need for the service pending operation by the successful applicant under the terms of a regular authorization; the effect, if any, of a grant on the position of any applicant which is not a member of the group; and any other factors which are deemed pertinent to the public interest judgment. The amendment is effective December 18, 1961.

PROPOSED RULES CONCERN PRE-SUNRISE AM REGIONAL (CLASS III) OPERATION

The Commission invites comments to proposed rule making looking toward amending Section 3.87 of the AM rules concerning pre-sunrise operation by stations on regional (Class III) channels. It would provide that all such stations operating with their daytime facilities during pre-sunrise hours shall give advance notice of such operation to the Commission, that the determination of whether objectionable interference results from such operation shall be made on the basis of the standard broadcast technical standards, and a cut-off date would be established beyond which new Class III stations would be precluded from engaging in pre-sunrise operation under Section 3.87 (a) and would be limited to licensed hours of operation. The effect of the amendment would be to terminate Section 3.87 except as it may apply to regional assignments made previous to the effective date of the amended rules. Chairman Minow and Commissioner Cross concurred, the former with a statement.

BROADCAST ACTION

The Commission en banc, by Commissioners Minow (Chairman), Lee, Craven, Ford and Cross, took the following actions on December 6:

WCUY(FM), CLEVELAND HEIGHTS, LIABLE FOR $8,000 FORFEITURE

The Commission addressed the following letter to the Friendly B/cg Co., licensee of FM station WCUY, Cleveland Heights, Ohio:

"This letter constitutes a notice of apparent liability for forfeiture under Section 503 (b) (2) of the Communications Act of 1934, as amended.

"On July 8, 1959, Friendly Broad-

casting Company was granted a construction permit (BPH-2644) to change the frequency of Station WCUY (FM) (then WJMO-FM) from 95.3 megacycles to 92.3 megacycles and to change the ERP, type of transmitter, and transmitter site. Subsequent amendment to BPH-2644 was granted on January 4, 1961 (BMPH-6522) to operate on 92.3 megacycles but at the existing transmitter site with continued use of the existing tower and antenna. On March 8, 1961, an extension of completion date was granted to April 28, 1961 (BMPH-6608).

"On the morning of March 18, 1961, WCUY's new transmitter was turned on for test purposes without any notification to the Engineer in Charge or the Washington office of the Commission as required by Section 3.216 of the Rules. In the afternoon of the same date, the station broadcast its regular programming on the new frequency of 92.3 megacycles in violation of Section 3.217 of the Rules since no license application had been filed and no request for program test authorization had been made. Similarly, on March 20, 21 and 22, 1961, the new transmitter was turned on in the morning for testing purposes and from approximately noon to midnight regular programming was broadcast. Such operations, in addition to violating Sections 3.216 and 3.217 of the Rules, were in violation of Section 301 of the Communications Act of 1934, as amended.

"You are advised, therefore, that since WCUY's new transmitter was tested and operated on March 18, 20, 21 and 22, 1961, on the frequency of 92.3 megacycles in violation of Section 3.216 and Section 3.217 of the Rules, which violations also constitute violations of Section 301 of the Act, you are subject to a forfeiture pursuant to Section 503 (b) (1) (B) of the Communications Act of 1934, as amended, for willfully or repeatedly failing to observe the provisions of the Act and the Rules of the Commission prescribed thereunder.

"Consequently, the Commission has determined that you have incurred an apparent liability of eight thousand dollars ($8,000.00) for willful or repeated failure to observe the Act and the Rules thereunder, said amount to be forfeited to the United States. In making this determination, the Commission has considered your explanatory letter of May 17, 1961, but does not consider the facts stated therein as a valid excuse for violating the Act and the Rules."

PART 2

Although the following announcements were made in November and December, 1961, we are reprinting them because of their importance to the broadcast engineer. There appears to be a considerable amount of misunderstanding on the part of many operating engineers regarding the proper times to use DA's, as well as failure, in many cases, to make the necessary regular field intensity measurements at the monitoring points as called for by the license.

In another section of this issue there appears an article by a leading Washington attorney on the subject of keeping your engineering operations legal. We strongly urge all our readers to read both this article and the following FCC release reprint.

BROADCAST ACTIONS

The Commission en banc, by Commissioners Minow (Chairman), Hyde, Lee, Craven, Ford and Cross, took the following actions on November 21:

KOMA, OKLAHOMA CITY, LIABLE FOR FORFEITURE

The Commission addressed the following letter to the Storz B/cg Co., licensee of station KOMA, Oklahoma City, Okla.:

"This letter constitutes a notice of apparent liability for forfeiture under Section 503 (b) (2) of the Communications Act of 1934, as amended.

"Station KOMA is licensed by the Commission for operation at Oklahoma City, Oklahoma, on the frequency 1520 kilocycles with operating power of 50 kilowatts unlimited time using a directional antenna pattern at nighttime. The license for Station KOMA specifies for each month of the year the hours during which the station may be operated with its daytime facilities.

"On January 19 and 20, 1961, Station KOMA was inspected by an engineer of the Field Engineering and Monitoring Bureau of the Federal Communications Commission. As a result of such inspection, there was issued on January 31, 1961, an Official Notice of Violation (FCC Form 793) which specified seven instances of KOMA's non-compliance with Commission Rules and Regulations and two instances of non-compliance with the terms of KOMA's authorization in that the operating logs showed that the transmitter was operated using the daytime non-directional antenna prior to 4:00 a.m., and the field strength

(Continued on page 25)

Television Tape

(Continued from page 13)

Circumference = π D
= 3.14 × 2.066
= 6.487 inches
Head/tape velocity = 6.487 × 240 = 1557"/sec. at minimum tip projection of 1.0 mil. Therefore:
Head to tape velocity at 3.7 mil tip projection = 1531"/sec.
Head to tape velocity at 1.0 mil tip projection = 1557"/sec.

The foregoing relationship of tip velocities has a direct bearing on proper timing to avoid space errors in television tape playback.

The angular velocity remains the same regardless of tip projection. But to avoid time-space errors in the reproduced picture, the spacing of the horizontal sync pulses across the entire video track must remain the same. This is to say that the space occupied by a TV line must be the same at the middle and end of the video track as that which occurs at the beginning of the track. (Fig. 6a).

Fig. 6a is the tape with the head disengaged. As the vacuum guide is moved toward the head, the pole-pieces contact the tape and a stretch occurs as in Fig. 6b. The greater the tip penetration, the greater the stretch and the wider the space between sync pulses.

The effective spacing in time between pulses is determined by the tip velocity. If a recording is made with 3 mils tip penetration, the same recording can be played back with a worn head where the tips have been reduced to 1 mil projection. This is true because the reduced tip velocity of the worn head means it will take a longer time to scan a given length of the video track. Therefore, *less tape stretch* is required to maintain the correct space-in-time relationship.

From the foregoing analysis it is evident that reduced velocity due to worn tips is complementary to the resulting reduction in tape stretch.

Therefore, assuming that the video tape stock neither shrinks nor stretches during its life, the vacuum guide position relative to the head-wheel remains the same as tip projection decreases with head wear.

The position of the vacuum guide which cups the tape around the rotating heads determines the amount of pole-tip penetration into the tape.

When the guide is sufficiently far enough away from the pole tips, a positive clearance between tape and heads occurs and no contact exists. Under this condition, no recording would be laid down on the tape, and no playback of recorded information could occur. (Fig. 7a).

As the vacuum guide is brought closer to the head, RF output from recorded information begins to occur. A negative clearance now occurs between the pole tips and the tape in the slotted guide. The amount of this negative clearance is the tip penetration. When the tip penetration is extremely light, concentricity between the tape and head does not exist. Under this condition, tip penetration is less at the center of the tape than at either end, resulting in a dip in the RF envelope of the head output. (Fig. 7b).

As tip penetration is further increased, intimate contact is gained with full concentricity, and an even RF output results from the head. (Fig. 7c).

An adequate magnetic contact must prevail at the low values of tip penetration which exist near the end of head life. Since the guide position relative to the head is a constant value, new heads with high tip projection will exhibit relatively high values of tip penetration.

High values of tip penetration increase both head and tape wear, as well as the load on the head motor drive amplifiers. If excessive loading occurs, head servo instability can occur, particularly when marginal tubes are in service.

A tip penetration of less than 1 mil aggravates drop-outs and possible head clogging. "Drop-outs" are white flashes in the reproduced picture caused by microscopic irregularities in the magnetic coating of the tape. Head clogging results from iron oxide particles loosened from the tape coating being lodged in the head gap. At heavier tip penetrations, a "self-cleaning" action occurs which helps to minimize clogging of the pole tips.

The "standard" tip penetration must be a compromise between the above conflicting requirements. It is prevailing practice at the time of this writing to use from 2.5 to 3 mils tip penetration for a new head.

(Continued Next Month)

FIRST...IN STEREO/MONO CARTRIDGE TAPE

Now . . . ITA offers stereo and monophonic cartridge tape recorders that will play and record up to 31 minute programs. Convenient plug-in, modular construction features all transistor circuitry. Fully compatible with existing machines. With separate record and play heads, the ITA recorders give uniform high fidelity frequency response . . . even when full half-hour cartridges are used. Plug-in remote control—sequence triggering—unique idler wheel! ITA cartridge tape recorders are your *best* buy. For a free demonstration of the ITA cartridge tape recorder call your nearest ITA sales office listed below.

ITA ELECTRONICS CORPORATION

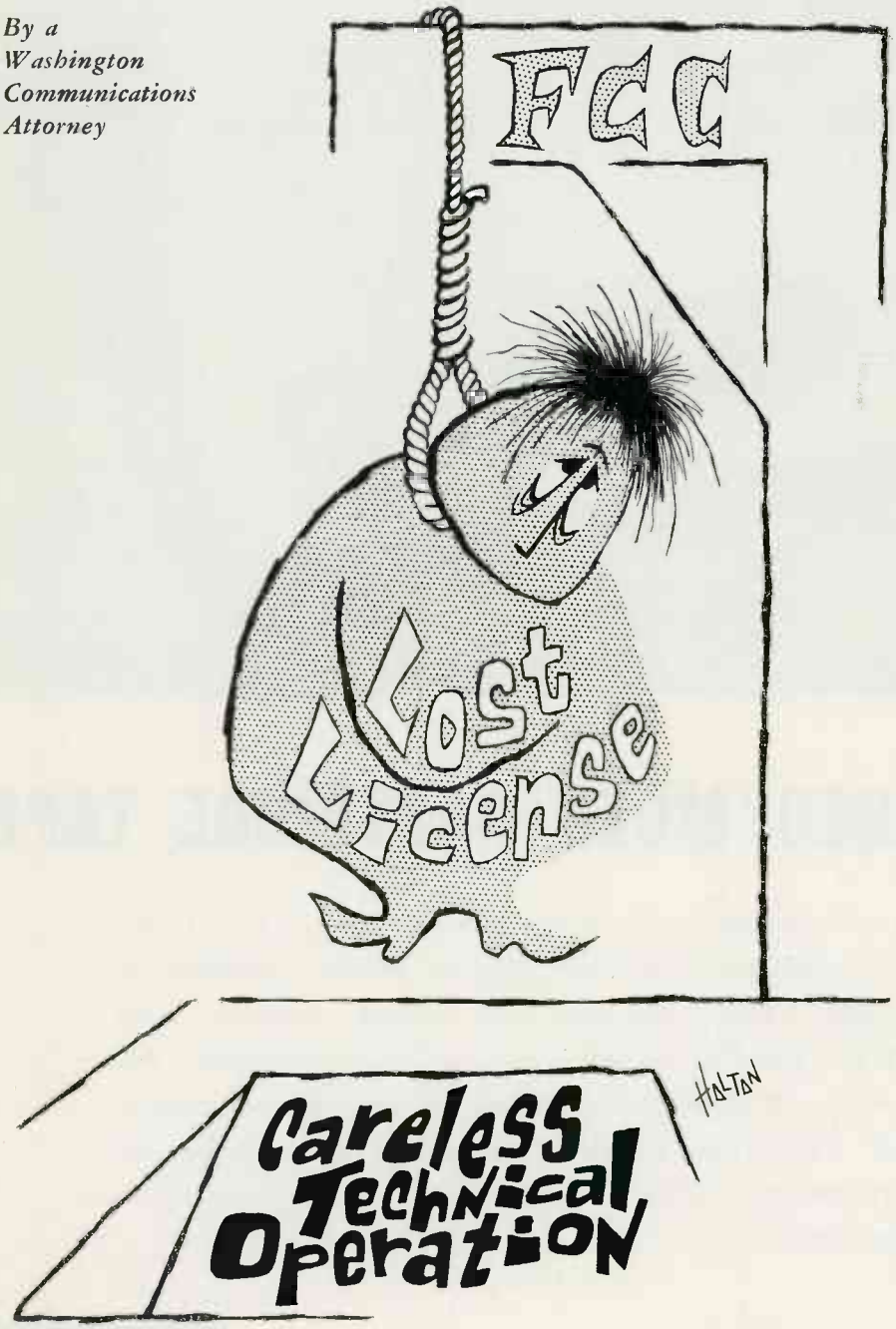
BROADCAST DIVISION • LANSDOWNE, PENNSYLVANIA

ITA

Chicago, Ill. AN 3-3797
Cincinnati, Ohio CH 1-6386
Dallas, Texas FL 7-9607
Jacksonville, Fla. EL 6-0121
Kansas City, Mo. GR 1-2838
Lansdowne, Pa. CL 9-8200
Los Angeles, Cal. MA 2-8552
New York City, N.Y. CH 2-1999
Portland, Ore. CA 2-2651
Washington, D.C. 337-2884

Preventative Maintenance of a Different Kind

By a Washington Communications Attorney



Technical violations can cost time, money and even a license.

No one doubts the value of preventive maintenance in insuring the smooth, uninterrupted operation of any equipment, whether it be the family automobile or the broadcast transmitter. The hours spent in the surveillance of the station's technical equipment pay off well in minimizing costly off-air time. However, it would appear that not enough attention is being given by some station operators to the matter of compliance with the Federal Communications Commission's technical regulations. But this is preventive maintenance of the most important kind—maintaining the station's license itself.

At the latest tally, there were more than 500 applications for renewal of broadcast station licenses which had been pending for more than three months. Of the several reasons for withholding action on the applications, technical violations accounted for the greatest number. There may be justifications for irregularities in ownership reports, balance sheets and genuine differences of opinion between the FCC and the broadcast licensee in the programming area, but there is absolutely no justification for not complying completely with all of the Commission's technical rules.

Until recently, a broadcast licensee would consider an application for renewal of license just as a routine procedure which he had to go through every three years. And he never doubted but that in due course his license would be renewed for another three years. Not so any longer. He is now well aware that his application for renewal will be scrutinized most carefully by the FCC and if all is not well, he has problems.

Penalties

One of the reasons for this new approach is that the Congress recently gave the Commission two very useful punishment tools—the short-term renewal and the authority to fine stations. Before the availability of these devices, the FCC could either renew a license or designate the application for hearing. The hearing process is a cum-

bersome, time-consuming process which nearly always resulted in the renewal of the license after the licensee showed penance. Under the new procedures, the Commission can invoke fines—up to $10,000—or put an offender on a short-term license. The short-term renewal puts the licensee on probation, usually for a year, and if at the end of the year the licensee has not mended his way, he is in for real trouble.

Of course there are due process safeguards against the possible abuse of this new authority of the Commission, but the best way to avoid having the wrath of the FCC invoked is to abide strictly with the Commission's Rules. This in no way suggests succumbing to FCC pressure on programming, but what can't be done directly sometimes is done indirectly. Our purpose is to urge perfect technical compliance so that technical violations are not available to the Commission as a device for imposing otherwise unsupportable sanctions.

Now, the Commission can, and does, hit where it hurts most—the pocketbook. You may be assured that the FCC is not "out to get" anyone, but it will not hesitate to use its authority to impose substantial fines directly upon violators of its Rules.

Technical Violations

Recently there was a great deal of publicity given to the notification to a licensee of the licensee's apparent liability for a $10,000 fine because it had used its daytime directional antenna outside of daylight hours and had failed to maintain proper adjustment of its antenna array.

This incident forcefully points out the folly (and apparently a costly one) of not complying with the Commission's Rules. Another example of costly oversight, or carelessness, is the recent notification to a licensee of its apparent liability for an $8,000 fine for failure to obtain authority from the Commission before conducting program tests. The Rules are explicit and unambiguous as to the procedures to be

(Continued on page 26)

Book Reviews

Sound in the Theatre

By Harold Burris-Meyer and Vincent Mallory. Price: $10.00. Pages, 95, including index. Published by Radio Magazines, Inc., Mineole, N. Y.

This is an interesting book for the sound man, or engineer who is interested in sound reinforcement on the stage or in open air. It is not particularly technical, nor does it give a strong indication of having been too carefully written; however, this may be due more to the printing style, which looks like offset, rather than laxity on the part of the authors. Nevertheless, it is this reviewer's opinion that the price is somewhat steep for so few pages. This is undoubtedly (as the dust cover says) the first book to set forth in authoritative detail what can be done with sound by means of electronic reinforcement. Many types of sound source are considered, and specific problems, 32 in number, are described to give the reader an idea of what is required.

If the reader does a lot of sound work on a *high* professional level then he might find $10.00 well spent; otherwise, it is merely interesting reading for the engineer.

Transistor Substitution Handbook, Revised

Catalog No. SSH-2. Published by Howard W. Sams & Co., Inc., Indianapolis, Ind. 112 pages. Price: $1.50.

As in the first edition of this invaluable working guide, basing diagrams, polarity identifications, and manufacturers for over 3,000 transistor types are included. Related text material tells why substitution is feasible, when to use a substitute, how to choose the most suitable replacement, and what precautions to observe.

Also included are separate sections listing 800 American substitutes for Japanese transistors, and 630 semiconductor-diode substitutes —the latter accompanied by a diode color-code guide.

This handy volume is indispensable for anyone concerned with transistor replacement — whether for home entertainment, industrial-commercial, or military applications.

Electronic Games and Toys

By Len Buckwalter. Price: $2.50. 128 pages. Published by Howard W. Sams and Co., Inc. The Bobbs-Merrill Co., Inc., New York.

This is a book for the offspring of the broadcast engineer. It gives theoretical and constructional details of 15 different toys and games of skill that can be built by the reader. Although we say that it is for the offspring of the radio engineer—it would be more correct to say perhaps that the engineer himself may find things of interest to make "for his offspring."

The projects range from a simple test of nerves in holding one contact away from another while sliding a loop along a bare wire, to a treasure hunt and a musical instrument. All in all, an interesting book.

Letters to the Editor

Dear Sir:

I was amazed and interested to read your editorial in the December issue in which you dared take the almighty IRE to task for its neglect of the *true* radio broadcast engineer. I have felt for a long time that what this country needed—as well as a good 5¢ seegar—was a good technical body that paid attention only to broadcast engineers.

Of course the engineers unions demand technical proficiency in addition to the necessary First Class License, but these are not professional bodies in the sense of existing only for engineering reasons.

Your suggestion of an Institute of Broadcast Engineers is well made, and I for one would be glad to join it—if it is ever formed. However, because I am a member of IRE, although I can't understand a word of the *Proceedings* since they dropped the comic strip—I prefer to remain anonymous until such time as the actual formation of the I B E is announced. When I read about it in BROADCAST ENGINEERING I will send in my subscription and unveil myself.

Until then may I sign myself,

Cordially,
ANEN GINEER

This is WGN's new Mid-America Broadcast Center . . . one of the world's largest and most modern studios for radio and TV transmission. Dedicated in June, 1961, it has more than 100,000 square feet of floor space, including three 72′ x 48′ TV sound stages, and two 30′ x 18′ radio studios.

Carl J. Meyers, center, Vice President and Manager of Operations and Engineering; and Woody Crane, left, Chief Engineer of Television, discuss WGN's wire and cable needs with Belden sales engineers, who, on behalf of Belden distributors, have just toured the new facilities.

90% of WGN TV-camera, Microphone, and Audio Cables made by Belden

Belden manufactures a complete line of wire and cable for TV and radio broadcasting, recording studios, remote control circuits and similar applications. Call your Belden electronic distributor.

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902 — CHICAGO

power supply cords • cord sets and portable cordage • electrical household cords • magnet wire • lead wire • automotive wire and cable • aircraft wires • welding cable

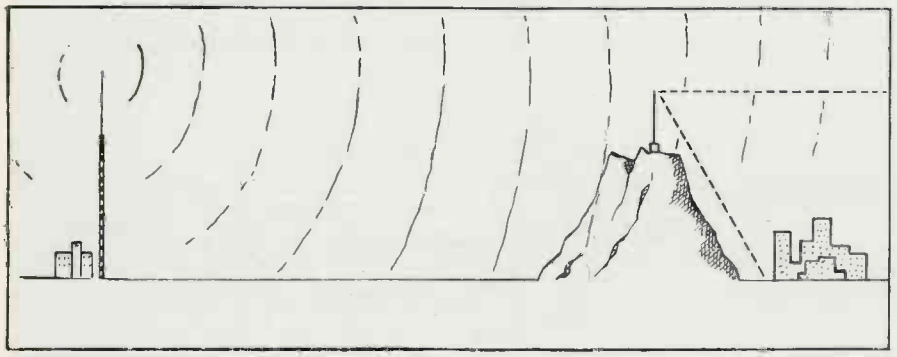
8-12-1

Some Television Translator Notes

Translators offer possible secondary operation for many radio stations, either from point of view of installation and operation, or as a secondary service, provided competitive aspects can be overcome. Subsequent articles will deal more deeply with specific equipment technical problems.

In many parts of the United States the only manner in which TV programs can be received is through use of an UHF-TV translator. Most of these installations are in the west and southwestern areas where the mountainous terrain makes normal reception using VHF-TV propagation very "spotty." In effect, each poor or zero reception area has its own small UHF-TV transmitter which fills in only the particular area that it is intended to serve.

A typical translator installation consists of a high-gain receiving antenna mounted sufficiently high so that an adequately reusable VHF signal is received, low loss transmission line to the receiver/transmitter, (or translator) itself, a transmission line back to a high gain UHF antenna mounted on the same tower, or support, as the VHF antenna. Additional equipment included will be an adequate power source with standby power if necessary, test equipment, a suitable building (although some installations using small low power transmitters can be built using merely a small weather-proof steel box to house the electronic equipment), and in some cases if more power is needed, a translator amplifier to boost the output of the translator.



Typical VHF—UHF-TV pickup problem. Exaggerated picture of mountain cuts-off city to east from VHF signals. Translator on mountain peak rebroadcasts UHF-TV to shadow area. Similar operation is used to provide coverage at edge of flatter area where VHF signal is attenuated and full of static. Sometimes a series of UHF translators is used with off-the-air pickups to extend reception.

Popular Operations

Close to 300 translator stations are in use in the U. S., and more are being added every day. This increasing use of translators is an excellent example of government moving rapidly to legalize something that the public needed, wanted, and was determined to have. The movement first started in the Rocky Mountain areas and eventually there were so many unlicensed UHF-TV transmitters—in effect translators—operating in Colorado that the FCC made a special investigation, and was pressed by the Governor of Colorado to legalize translator operation. Realizing very quickly that public opinion was determined to continue the use of translators, the FCC at once issued rules to cover their operation, and established standards of technical operation that eliminated the completely "hay wire" rigs that in many cases caused interference to the very stations they were trying to rebroadcast, and even more serious, to aircraft navigation systems.

The heart of the unit is the receiver/transmitter which does the job of converting the incoming VHF signal to UHF without degradation,

and rebroadcasting without attenuation or distortion. This is particularly important in the case of color rebroadcasts because any phase shift or distortion will interfere with the transmission of the color subcarrier. A typical translator receiver, the Adler UST-20, will accept any VHF-TV signal and without demodulating convert it to the 806 to 890 MC band; that is, any UHF channel 70 through 83 for rebroadcasting. Also UHF signals can be picked up and rebroadcast on other models.

Technical Data

This unit includes a Morse-code identification keyer that is used to meet the FCC's requirements of half-hourly identification of the translator station itself. This is necessary because every rf transmission must carry identification of some kind, so that it can be identified in case of interference, or other need. Generally this takes the form of a small motor driving a keying wheel to put a coded tone on the audio system. At this stage in the operation the FCC does not require visual carrier identification.

Because these translators are generally planned to operate in areas where signal strength is very low and fluctuates due to aircraft, or other conditions, AGC is essential and it must also be fast acting and adequate. In the equipment mentioned AGC is applied to the head end of the receiver, and can handle signal input variations of ± 15 db with less than ± 1 db variation in rf output. The same circuit is also used to turn off the transmitter when the originating station goes off the air, and to turn it on again when the first VHF signals are again received. It is against the FCC Regulations to leave the UHF carrier on and unmodulated, when the main VHF transmitter is not operating.

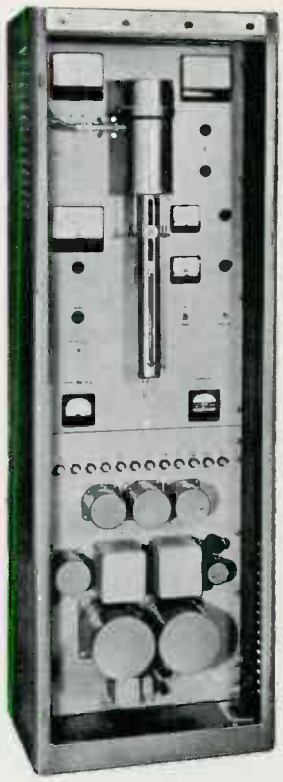
A temperature controlled crystal oscillator generates the injection signal which is mixed at high level to obtain freedom from noise problems in the conversion stage. Because of this its stage is very free from intermodulation and instability problems. Linear output stages raise the output to 20 watts video and 10 watts audio. A directional coupler feeds into the line, or a 100 watt amplifier may be added. Shielding is complete and any number of translators may be operated side-by-side in the same building. These translators will operate satisfactorily at relatively great distances from an originating VHF station. The actual distance, of course, depends on the terrain, power, and local static conditions. However, satisfactory operation is obtained at distances of 88 miles in relatively flat areas, and much more than can be expected if the area is mountainous so that long line of sight paths are obtained. As far as reception of the converted UHF signals is concerned, this has been achieved at 75 miles with a 10-watt translator, and even greater coverage can be obtained from a 100-watt translator. About 20 miles is a good average figure for a 20-watt unit. Here again the topography and antenna height control reception, and also the sensitivity of the UHF-TV converter. In general UHF receivers are better than convertors.

Operating costs are low because a licensed operator is not required and normal service can be performed by any trained TV technician or serviceman, although all critical and frequency determining circuits must be worked by a licensed operator. Locally originated programming is not authorized by the FCC, and the only local signal allowed is the required half-hourly identification on the audio channel. There is nothing to stop one from originating a video identification, but the cost of producing and modulating such a signal would be far too high to warrant its use.

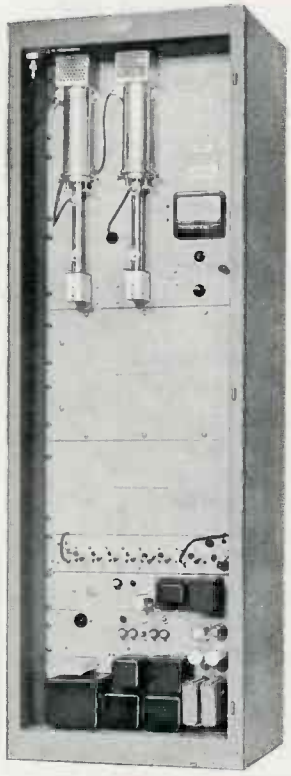
VHF Translators

The main objective of translators is to fill in "holes" in normal TV service areas, and thus provide service to people who normally would not be able to obtain service. However, in a good many parts of the country small communities far removed from a main VHF or UHF-TV signal install their own units to serve isolated towns, and thus obtain their only TV signal. The FCC not long ago authorized the use of VHF translators in an effort to provide better service facilities for communities. Some VHF stations have taken advantage of this apparent loophole to try to extend their VHF coverage area by using

(Continued on page 27)



Typical Adler 100 watt UHF translator amplifier, the RA-7.



A typical Adler VHF-UHF-TV Translator, the UST-20, designed for 20 watt operation on channels 2-13 input and 70-83 output.

Practical FM

(Continued from page 8)

that has low loss, low power requirements and comparatively low cost.

Plate dissipation should not be less than 50% of the RF power output—between 60 and 70% efficiency is good for FM. In general, stages and tubes that require neutralization should be avoided. This means that older type tubes with high internal inductances are out, or at least most be operated grounded grid to remove need for neutralizing—this factor will be covered in the next paragraph.

Neutralization: From the beginning of radio amplification, as tubes became more complex, and as power and efficiencies increased, the problem of instability became more troublesome. Screen grid tubes controlled the problem for awhile, but as frequencies went up so did instability. Today, the average transmitter is stable when used under normal conditions and for single channel transmission. However, when stereo or multiplexing is added to the modulation, troubles can pile up if there is any instability or even in cases where neutralizing is used. Even a slight lack of neutralizing, or changes as tubes age, can cause cross-talk when used in multiplex operations. Examples of modern transmitter output stages such as those used in two representative ITA transmitters are shown in Figures 2 and 3.

Power Supplies

Dating back from the days of banks of storage cells and motor generators, to vacuum rectifiers and electrolytic rectifiers and mercury tubes (did you ever stop to think that the early wet-electrolytic condensors could be used as rectifiers?) the pendulum has swung to solid state devices. Today a transmitter that does not use solid state rectifiers should be considered very carefully, in this writer's opinion. How many readers have had trouble with an 8006 that had to be cleared before use and it always seemed that when a rectifier blew there was never a "clean" tube replacement available and hot?

The advantages of next to no replacements, minute quantities of heat, and small cabinet space make solid state rectifiers almost a must today. The earlier versions were inclined to be troublesome, but today's diodes can be fitted and forgotten. Even lightning surges can be taken care of with adequate resistors and fast acting relays. Use of this type rectifier reduces the number of spares that need to be kept on hand. Figure 4 shows a typical rectifier installation in a 1 KW transmitter.

The Oscillator/Exciter

The last part of the transmitter to be analyzed this month is the exciter. It is really the heart of the transmitter, and for this reason deserves the greatest care in selection and design. Most manufacturers today use the phase modulated exciter because of its stability and freedom from distortion and extended frequency response. Figures 5A & 5B show typical frequency response and distortion curves for the exciter pictured in Figure 6. This ITA exciter has two jacks inputs for sub-carrier injection for multiplexing or stereo operation.

FCC Actions

(Continued from page 15)

at several monitoring points far exceeded the licensed maximum values.

"In your reply, dated April 7, 1961, you stated the corrective measures taken, but you also acknowledged that Station KOMA for some time prior to the inspection was operating on the daytime non-directional antenna prior to 4:00 a.m. and that your difficulty in maintaining the licensed values of field strength at monitoring points continued uncorrected except for temporary remedial measures. It appears from an examination of the operating logs that KOMA's transmitter was operated using the daytime non-directional antenna prior to 4:00 a.m. for at least ten days immediately prior to January 20, 1961. It further appears that since January 20, 1961, and continuing until the present time, Station KOMA has been operated so that the field strength exceeds the licensed maximum values at several monitoring points. It is apparent, therefore, that since Station KOMA has been so operated in excess of ten days, you are, in accordance with Subsection 503 (b) (1) (A) of the said Act, subject to the maximum forfeiture established by subsections (1) and (3) of Section 503 (b) of the Communications Act of 1934, as amended, for willfully or repeatedly failing to operate Station KOMA as set forth in its license.

"Consequently, the Commission has determined that you have incurred an apparent liability of ten thousand dollars ($10,000) for willful or repeated failure to operate Station KOMA substantially as set forth in its license, said amount to be forfeited to the United States. In making this determination the Commission has considered your response to the Notice of Violation, but does not consider the facts therein as a valid excuse for non-compliance with the terms of the station license in view of the definition of 'daytime' in Section 3.6 of the Commission's Rules, the specification in your license of the daytime hours during each month of the year, and the exception made by Section 3.87 of the Rules for operation of KOMA with daytime facilities after 4:00 a.m. on certain conditions, which section clearly negates any authority to operate with daytime facilities prior to 4:00 a.m. The Commission has also considered the extensive correspondence submitted pertaining to the second item of non-compliance with the terms of KOMA's authorization for exceeding the licensed maximum values of field strength at several monitoring points, but does not consider your responses on this issue as a valid excuse for continued unauthorized operation of KOMA in view of an excessive period of approximately nine months after issuance of the Notice of Violation which you permitted to elapse prior to your submission of recommended procedures to correct this serious problem, and in view of your apparent unawareness of the problem until called to your attention by the Commission.

$ $ MONEY FOR MANUSCRIPTS $ $

BROADCAST ENGINEERING actively solicits readers' written material. If you have ideas for equipment that you have built, or have designed but not yet built, or any installations you may have made, etc., sit down and write a story about it. Be sure to send plenty of photographs and drawings to illustrate it. We can use from one magazine page to three, or even four if the story is of sufficient interest. Our regular rates will be paid promptly on acceptance by the editor.

Preventative Maintenance

(Continued from page 19)

followed before putting into operation new or changed equipment pursuant to a construction permit. The failure to follow those procedures can be a most expensive oversight.

Both of the above situations could have been avoided. Aside from the particularities of the violations, the sanctions imposed should impress all with the necessity of insuring that your operation is strictly "by the book." For example, if you are operating a DA, are you regularly ascertaining compliance with the field intensity values at the monitoring points specified in your license? Simple matters, such as the keeping of the operating log, should be checked against the Commission's Rules. There is no excuse for imperfection and the FCC will settle for nothing less.

Station Inspection

The Commission conducts on-the-spot inspections of stations coming up for renewal some months in advance of the renewal date. Just when the inspector will show up is anyone's guess, but if your operation is impeccable, it really doesn't matter. You may be sure that when he does show up, he will be well informed on your operation—he will even have taped some of your programming.

If the inspection should reveal any technical violations, an immediate citation will be issued. And, of course, the deficiency should be immediately remedied. The inspection report will be sent to Washington for consideration in connection with the review and processing of the renewal application.

In the event that the violation is of a serious nature, for example, an improperly adjusted antenna array, the matter will be referred to the Commission's Complaints and Compliance Division for such action as may be appropriate.

It is imperative that all features of the station's technical operation be checked against the Commission's Rules to determine compliance therewith. It is not enough to rely upon what might have been acceptable in the past. The next inspector may be a different one and it is certain that he is going to be a tougher one.

Translator Notes

(Continued from page 23)

a chain of such VHF translators employing off-the-air techniques and serving a chain of small VHF service areas. However, the FCC has ruled that such an operation is not within the meaning of their regulations and they were not intended to allow a station to encroach into other areas, or expand by this means.

Obtaining a C. P.

Any responsible citizens group can start a translator station. The only requirements are good character and citizenship. FCC Form 346 is filed with the Commission to obtain a Construction Permit and after construction is completed within six months of issue, Form 347 is filed to obtain a station license. Licenses are renewed yearly. As a matter of fact the installation and operation of a translator station is often a "natural" for a local radio station. Of course it is often said that TV is the enemy of radio as far as local revenue is concerned, but in many remote towns the local radio station is often a daytimer so that the main competitive times at night are not affected. Certainly the high tower of a radio station, and the availability of technical help makes the proposition attractive; also the licensee is in a good position to provide maintenance.

One drawback to translator operation is the fact that anyone can pick up the signals without contributing a penny to the cost of the installation or operating costs. So far, no one has found a way to overcome this. It might be that here is an ideal way to implement pay TV; after all the case for such authorization seems suitable in this instance. However, there are close to 300 translator stations operating today and their success points to the fact that ways can be found to pay for such operations!

One final point: although practically anyone can install a translator it is advisable to employ a properly qualified consulting engineer to determine the needs of the community and the best way of meeting them technically. Many times a rough first guess is not the best answer.

Industry News

Peterson and Gagnon to Gates Radio Co. Staff

Gates Radio Co., subsidiary of Harris-Intertype Corp., Quincy, Ill., has announced the appointment of Norman A. Peterson as manager of audio sales. He will be located at the Gates headquarters in Quincy. Peterson was formerly the chief recording engineer for Western Cine Service in Denver, Colo. Prior to this, he was chief engineer of radio station KTLN, Denver, holding this position for nine years.

Edward S. Gagnon has been named as manager of special projects, and will report directly to L. J. Cervone, vice-president of sales. Gagnon was formerly the broadcast product line manager of Collins Radio Co. He has been associated with the broadcast industry since 1939.

Allied Radio Names Friedman to New Position

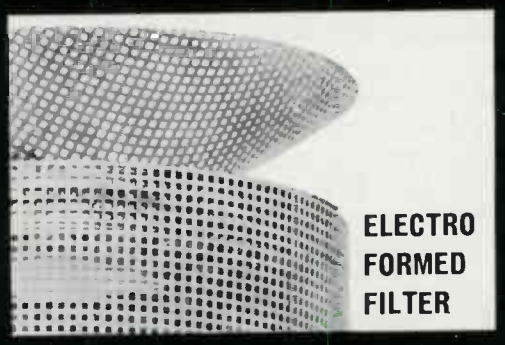
Allied Radio Corp., Chicago, Ill., has announced the appointment of Myron S. Friedman to the new position of assistant to the vice-president-general manager, Alfred W. Preskill. Friedman formerly was vice-president for marketing of Radio Shack Corp., Boston.

The company said the move is prompted by Allied's continuing expansion in industrial electronics, and is a step in a planned growth program. Prior to his association with Radio Shack Corp., Friedman held management positions with two industrial distributors of Admiral Corp.: Dale-Connecticut, Inc., New Haven, and Dale-New Jersey, Inc., Dale, Conn. He is a graduate of City College of New York.

R. M. Soria Elected to Board of Directors

Rodolfo M. Soria, vice-president, research and engineering, Amphenol-Borg Electronics Corp., Broadview, Ill., has been elected a director of the company, according to an announcement by Arthur J. Schmitt, chairman of the board. His election increases the membership of the board to 13.

A graduate of Massachusetts Institute of Technology and Illinois Institute of Technology, where he received his B.S. and Ph.D. degrees in electrical engineering in 1939 and 1947, respectively, Dr. Soria is a fellow of the Institute of Radio Engineers and has served as consultant to the Department of Defense, Office of Defense Research and Engineering. In 1959 he served as a delegate from the United States to the International Electrotechnical Commission. He is a member of the national IRE administrative committee on engineering management and on component parts, and is a past president of the National Electronics Conference.



ELECTRO FORMED FILTER

EXCLUSIVE UNILAR† DIAPHRAGM

GOLD PLATED CONNECTOR POINTS

INTEGRAL SHOCK MOUNTING

EXCLUSIVE FEATURES

Found only on University MODULAR MICROPHONES†

Features that make a University microphone better than most. Better in quality and utility for applications requiring the ultimate in pickup. Better to answer every exacting need with unswerving performance, flexibility and durability.

Let's see why.

Electro-formed Filter: Actually, **two** screens are used, one of silk, the other of electromesh–a type of metal screening so fine that it can be formed only by a selective plating process—ensuring positive deterrence against airborne particles. The unique mating of the two screens is also most effective in preventing annoying wind noise and breath pops.

Exclusive Unilar† Diaphragm: Why Unilar? Because it possesses conflicting properties—lightness **and** great rigidity—which permit the microphone diaphragm to mirror perfectly every subtlety of the original performance. And Unilar has astonishing immunity to both high and low temperature extremes, humidity and many corrosive elements. Beyond this, Unilar can withstand extreme physical stress. For example, if deformed by extreme high intensity sound pressures, it springs right back to its original shape! Thus Unilar is your assurance of constancy of performance.

†TRADEMARK

Gold Plated Connector Points: University has made certain—to the nth degree—that no obscure malfunctions shall be permitted to mar the final performance of any microphone. To this end, gold plated push-on connectors and pins are employed on all modules and adapters. The mechanical integrity of the push-on connectors is such as to assure **perfect** electrical contact without annoying crackle noises due to corrosion.

Shock Mounting: University's unique integral shock mounting gives more widespread benefits than ordinary shock mountings, which are limited to the isolation of the microphone from vibrations transmitted through the stand. University actually 'floats' the cartridge element in a specially-designed foam rubber bed, thus isolating it not only from floor vibrations, but **also** from spurious sounds **originating at the microphone case itself**—such as when a performer handles the microphone or when it is being passed around.

For **more** exclusive features, and descriptions of the entire line of University **modular microphones,** write: Desk N-2, University Loudspeakers, Inc., White Plains, N.Y.

UNIVERSITY

A Division of Ling-Temco-Vought, Inc.

Names Sales Manager at Technical Appliance Corp.

Jerrold Electronics Corp., Philadelphia, Pa., has announced the appointment of Daniel T. O'Connell as sales manager of the consumer products division of Technical Appliance Corp. According to Sidney Harman, Jerrold president, the appointment is in line with recent national expansion of the division's activities. O'Connell will direct the marketing of Taco antennas for consumer use, through an extensive organization of distributors.

He has had more than 13 years experience in marketing products of the electronics industry. Prior to association with Taco, he was director of sales of GC electronics division of Textron Electronics, Inc., Rockford, Ill., where he supervised the sale of a line of thousands of catalogued products. For more than 11 years he was vice-president of Radion Corp., Crystal Lake, Ill. O'Connell will be based at the Jerrold facility in Philadelphia, where Taco's national distributor sales office will be located.

New Representatives Named at Fairchild

Fairchild Record NG Equipment Corp., 10-40 45th Ave., Long Island City, N. Y., has announced the following appointments to its field sales structure:

Paul Kurtz Co., 18212 James Couzens Highway, Detroit, Mich., covering the state of Michigan; and William Tauber, 151 Fayette Blvd., Syracuse, N. Y., covering upper New York State.

Carl Carlson, formerly with Fisher Radio, recently joined the company as factory sales representative.

Smith Appointed G-E Marketing Manager

Harry E. Smith has been appointed manager-marketing for General Electric's technical products operation in Syracuse, N. Y., and will be responsible for all marketing functions within the operation, according to Robert L. Casselberry, technical products general manager.

Smith comes to the new post from Schenectady, N. Y., where he was industrial sales manager of the company's medium ac motor department. A veteran of 11 years with the firm, he has held a number of assignments in sales, advertising and sales promotion and marketing personnel development.

Testing equipment and procedures similar to those illustrated in this scene at Electric Valve Co. headquarters in England have been set up by Visual Electronics Corp., New York, to provide a complete customer service for sales of English Electric Valve Image Orthican Tubes by Visual.

ALL YOU NEED FOR RESPONSE ADJUSTMENT

A TURN OF THE SCREW AND A TURNER 400 SERIES MICROPHONE

That's right, these new high quality, broadcast type microphones from Turner feature adjustable impedance and adjustable response – all accomplished by a turn of the screw. It's simple, it's time-saving. And, because Turner manufactures only microphones, you know you're buying the quality that specialization produces. The four 400 Series microphones are wide response, pressure operated, moving coil dynamics, and essentially non-directional; recommended for motion picture, studio, TV, broadcast and high fidelity recording applications. The 400 Series microphones move smoothly through a full 180°, can be mounted on desk or floor stand, and inserted or removed without disconnecting.

THE TURNER 400 SERIES

	401	402	403	404
Impedance	150 or Hi (Screwdriver Adjustment at Mike)	150 or Hi (Screwdriver Adjustment at Mike)	150 or Hi (Solder Connection at End of Cable)	150 or Hi (Solder Connection at End of Cable)
Basic Frequency Response	40 cps to 20,000 cps	40 cps to 20,000 cps	50 cps to 13,000 cps	50 cps to 13,000 cps
Low Frequency Response Adjustment	Screwdriver Adjust for 40, 80 or 160 cps Cutoff	Screwdriver Adjust for 40, 80 or 160 cps Cutoff	None	None
Hi-Frequency Response Adjustment	Screwdriver Adjust for 10 kc or 20 kc cutoff	Screwdriver Adjust for 10 kc or 20 kc cutoff	None	None
Output Level	—60 db at High Impedance	—60 db at High Impedance	—60 db at High Impedance	—60 db at High Impedance

For more information, complete specifications and prices, write:

THE TURNER MICROPHONE COMPANY
907 17th Street, N.E., Cedar Rapids, Iowa

IN CANADA: Tri-Tel Associates, Ltd.
81 Shepard Avenue West
Willowdale, Ontario

EXPORT: Ad Auriema, Inc.
85 Broad Street
New York 4, N. Y.

IRE Honor Conferred Upon Benjamin Adler

Benjamin Adler, president, Adler Electronics, Inc., New Rochelle, N. Y., was among the engineers and scientists named Fellow of the Institute of Radio Engineers by the Institute's board of directors.

The honor was conferred for his "contributions toward effective utilization of the UHF spectrum." The development of UHF translators to bring TV into areas deprived of direct reception, and the growing use of low power UHF stations for educational television, are a direct result of his activities in the field of ultra high frequency broadcasting.

Blonder-Tongue Converters Available from Almo Radio

Almo Radio Co., Philadelphia, Pa., is presently supplying its dealers and servicemen with two new Blonder-Tongue all-channel UHF converters.

Morris Green, Almo president, said the demand for these converters has gained momentum since the opening of WHYY (Channel 35), the Delaware Valley's first noncommercial, all-educational and cultural television station. He further stated that this offers the alert dealer and serviceman an opportunity for plus business, and that he expects the interest on Blonder-Tongue to continue as WHYY is making extensive program plans for the coming season, including the appearance of full symphony orchestras.

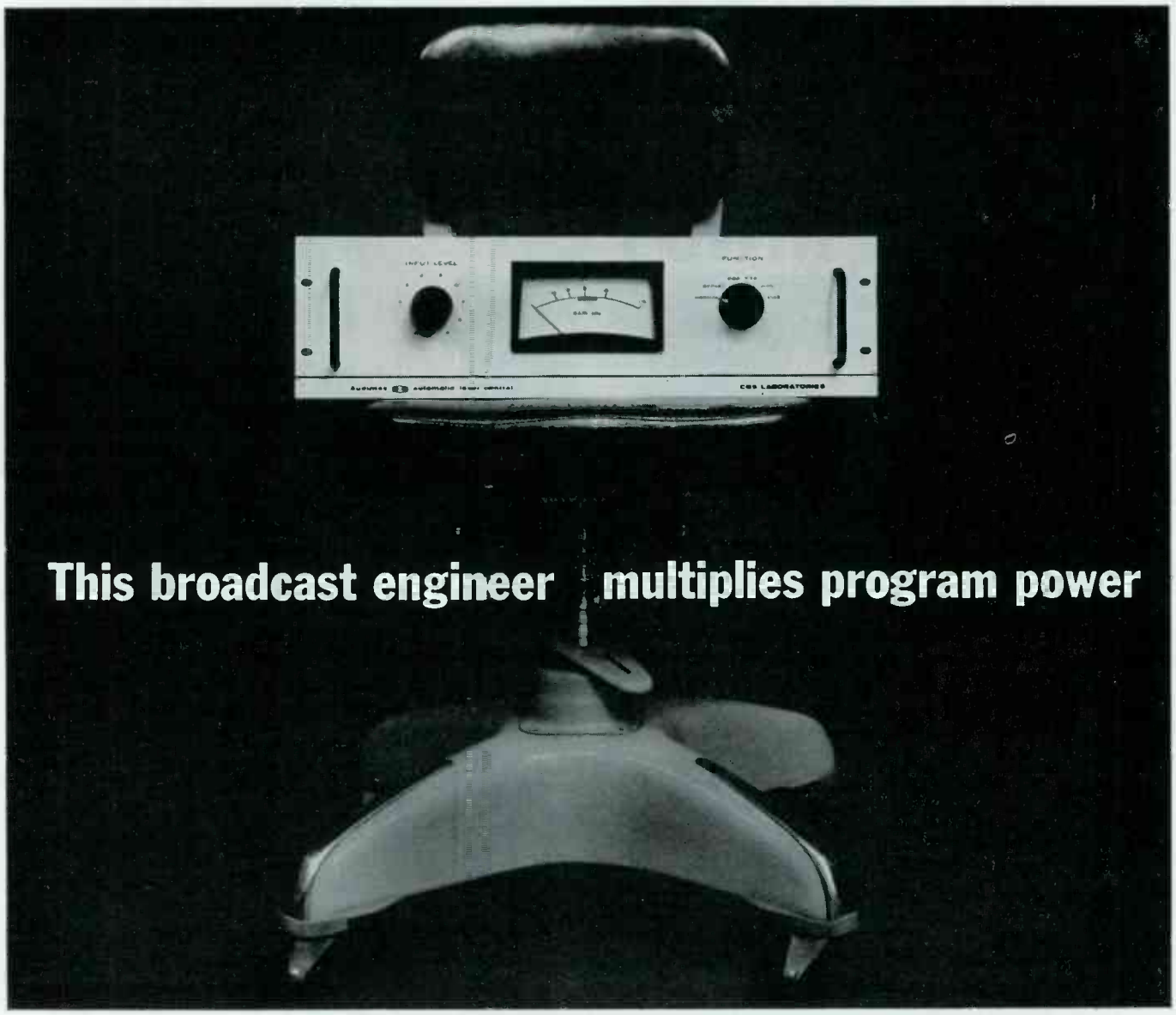
Names Sales Manager For New Division

The appointment of Martin Christman as sales manager of the Solid Bearing Slide Div., Grant Pulley & Hardware Corp., West Nyack, N. Y., was announced recently by Nathan A. Gussack, president of the firm.

Christman, former president of Christman Industries, Inc., precision metal fabricators, comes to Grant with an extensive background in the fields of industrial hardware and marketing. Prior to his forming Christman Industries, he was founder and general manager of a leading industrial sliding hardware manufacturing company. In addition, he has been a member of the board of directors of the Indiana division of the American Marketing Assn., and chairman of the board of the Indiana Industrial Division of Marketing.

In his new post at Grant, Christman will head all sales activities for the solid bearing slide division, working closely with the Military Electronic Field.

The first Videotape cruiser sold by Ampex Corp. outside the U. S. has been purchased by Telesistema Mexicano, Mexico's major television network. The 35-ft. long coach is fully equipped with modern television broadcast equipment for on-the-spot news coverage, commercials and background scenes.



This broadcast engineer multiplies program power

(without degrading program quality)

CBS Laboratories' new AUDIMAX automatic level control is already helping more than fifty stations multiply their station coverage. Extensive field tests have shown that AUDIMAX increases average modulation by 6 db with a corresponding 300% increase in radiated program power.

AUDIMAX is not just another limiter, compressor or AGC amplifier—it is an electronic device which controls gain as competently as the most alert engineer. No other device acts with such speed and intelligence. While the staff engineer pursues more important duties, AUDIMAX sits in for him, maintaining maximum modulation or recording level. With AUDIMAX there is no need to compromise signal quality for high level of modulation.

This unique sound level control device is available in two models: AUDIMAX I ($495) for broadcasting and recording, and AUDIMAX II ($595) for television, motion picture and video tape production. A special Gated Gain Stabilizer in AUDIMAX II automatically determines whether gain should be turned up during prolonged lapses in the program. This eliminates the need for continuous manual monitoring of TV films and prevents noticeable level changes during pauses in live telecasts. A stereophonic adapter ($150) is also available to enable two AUDIMAX units to adjust gain on both channels simultaneously, thus assuring perfect balance in stereo broadcasts.

For complete information on how AUDIMAX can improve your broadcast efficiency write or call our Audio Products Department.

CBS LABORATORIES
STAMFORD, CONNECTICUT
A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

For export sales, write CBS International, 46 East 52nd St., N.Y. 22, N.Y., Cable address "Columbine".

Howe Appointed to New Post at Allied Radio

Allied Radio Corp., Chicago, Ill., has named William J. Howe to the new post of director of industrial relations.

Howe had been personnel manager since joining Allied in 1956. He

Howe

Repke

is succeeded in that position by Jack B. Repke, who has been associated with Brunswick Corp. in personnel and industrial relations capacities for the past three years.

In making the announcement, Allied President A. D. Davis noted that the company recently expanded its operations with the formation of Allied Electronics Corp., a new nation-wide sales subsidiary serving the industrial market.

Enters FM and Multiplex Manufacturing Field

Fugle-Miller Laboratories, Inc., Clark, N. J., has entered the FM and multiplex manufacturing field, according to an announcement by Frank L. Fugle, Jr., president.

A complete line of receivers and tuners is anticipated, and initial production is already under way. The company has been a producer, for many years, of precision coils, filters, delay lines and specialty broadcast items.

W. H. Collins has joined Fugle-Miller Laboratories as director of the new FM and multiplex receiver division, and will be responsible for the design, manufacture and sale of these products.

Harmon Receives NAB Engineering Award

The National Assn. of Broadcasters has announced that its Engineering Achievement Award will be presented to Ralph N. Harmon, vice-president for engineering of the Westinghouse Broadcasting Co., New York. The presentation will

be made at a Broadcast Engineering Conference luncheon during NAB's 40th annual convention in Chicago April 4.

Mr. Harmon, a veteran of 34 years in the broadcasting industry, has been an outstanding leader in fostering the technical art of broadcasting. He joined Westinghouse as a radio engineer in 1928 shortly after his graduation from Carnegie Institute of Technology with a B.S. in electrical engineering. In 1941 he became section engineer at Westinghouse and two years later was promoted to manager of engineering of the company's electronics division. He was transferred to Westinghouse Radio Stations, Inc. (now the Westinghouse Broadcasting Co.) in 1948. He is a Fellow in the Institute of Radio Engineers and is a member of the Society of Motion Picture and Television Engineers and the American Institute of Electrical Engineers.

He was selected for the honor by an awards subcommittee of NAB's Broadcast Engineering Conference Committee. Jack Petrik, chief engineer of station KETV, Omaha, Neb., is Conference Committee Chairman, while George W. Bartlett, NAB manager of engineering, heads the awards subcommittee. Other subcommittee members are Mr. Petrik; William S. Duttera, NBC's director of allocations engineering, and William B. Honeycutt, chief engineer, KRLD, Dallas, Tex.

UPCOMING PROFESSIONAL MEETINGS

Feb. 7-9: National Winter Military Electronics Convention, Los Angeles.

March 26-29: Annual National IRE Convention.

April 1-4: National Assn. of Broadcasters National Convention, Chicago.

April 29-May 4: SMPTE Semi-Annual Convention, Los Angeles.

March 20-25: High Fidelity Music Show, Los Angeles, Calif.

April 11-13: Southwestern IRE Conference and Show, SWIRECO, Houston, Texas.

April 23-May 5: 2nd International Television Symposium and Exhibition, Montreux, Switzerland.

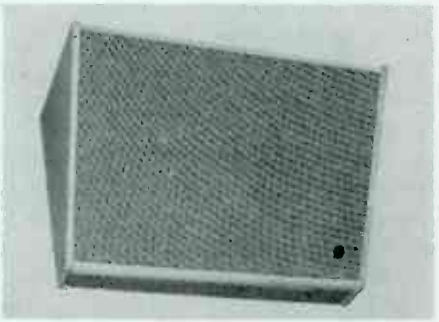
May 1-3: Cleveland Electronics Conference, Cleveland, Ohio.

May 21-24: Electronic Parts Distributors Show, Chicago, Ill.

May 24-26: IRE Seventh Region Conference, Seattle, Wash.

Sept. 19-20: Eleventh Annual Industrial Electronics Symposium, Chicago, Ill.

Product News

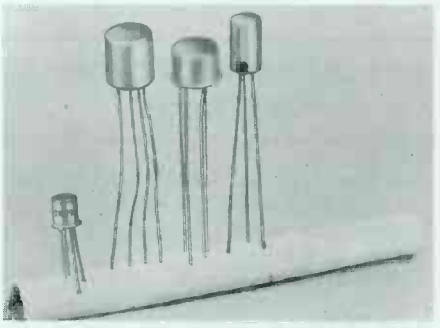


STUDIO MONITOR SPEAKER SYSTEMS

Electro-Voice, Inc., Buchanan, Mich., has announced the addition of studio monitor speaker systems to its line of broadcast and recording equipment. The units have been designed specifically to meet the rigid requirements of the audio engineer.

The Sentry I model is designed for wall or ceiling mounting, while the Sentry II is a floor model of the same basic system. The cabinets have been sanded and sealed, ready to finish to harmonize with the studio decor. The manufacturer states that both models employ specially-designed 12-inch co-axial loudspeakers with unusually flat response and very-high-frequency drivers with E-V developed diffraction horns to extend the high end to 20,000 cps, providing response beyond audible limits. Impedance connections for 16, 50 and 600 ohms are available.

Another E-V development was announced recently. A new microphone windscreen material called Acoustifoam is said to eliminate practically all microphone pickup of wind screen surface noise with no effect on the frequency or polar response of the microphone. Now being used in producing the windscreen models 324, 326, 327 and 355, it is also available in bulk for those who wish to construct their own microphone windscreens.



SUBMINIATURE TRANSISTORS FOR ENTERTAINMENT PURPOSES

Amperex Electronic Corp., Semiconductor and Special Purpose Tube Div., 230 Duffy Ave., Hicksville, Long Island, N. Y., has announced subminiature transistors for entertainment purposes. Mounted in 4-lead TO-18 cases, the units comprise a group of four PADT germanium alloy-mesa RF transistor types for FM and AM pocket portable radios.

Three of the group constitute a high frequency FM kit: the 2N990, 2N991 and 2N992 are respectively an RF amplifier, oscillator-mixer and an IF amplifier. The fourth, the 2N993, is a universal type for use in the standard broadcast and short wave bands up to 6 mc in all stages from RF through IF.

All four types are held to tight specs and feature low collector leakage current (avg. 1.2 ua), high current gain (hfe) of 150, and high collector-base breakdown voltage (min. of 20 volts). In addition, these types are said to maintain performance at supply voltages as low as 3 volts.

The 2N990 is controlled for low noise and high power gain at 100 mc; the 2N991 features high conversion gain up to 100 mc; and the 2N992 has low output capacitance and conductance at 10.7 mc.

BEAVER LIQUI-TAPE

Liqui-Tape, a liquid insulating compound designed to solve difficult electrical and moisture insulation problems, has been developed by Beaver Laboratories, Inc., 469 Jericho Turnpike, Mineola, N. Y.

According to the manufacturer, the new product is pliable yet hard, and will not crack, chip or peel. Electrical insulating properties of 700 volts-per-mil-per-application can be expected. Additional applications can be used to increase the amount of insulation and resistance to corona and arcing.

SPOTMASTER EQUALIZED TURNTABLE PREAMPLIFIER

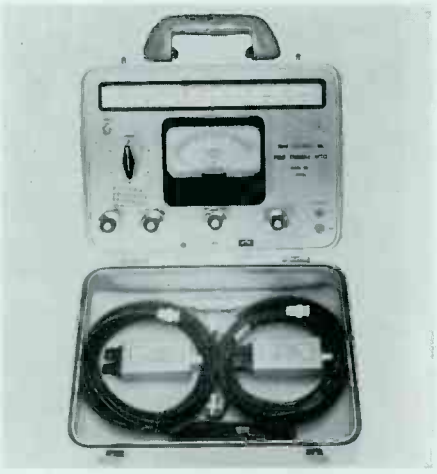
Broadcast Electronics, Inc., 8800 Brookville Rd., Silver Spring, Md., has introduced the model TT-20 Spotmaster equalized turntable preamplifier.

The unit is a transistorized preamplifier with built-in RIAA-NAB equalizer circuits. Noise level is said to be better than —65 db and less than one per cent distortion. Output is —20 VU.

NEW MICROWAVE CATALOG

Mark Products Co., 5439 W. Fargo Ave., Skokie, Ill., has released a 12-page brochure, Bulletin 620, covering microwave antennas ranging from 400 mc through 12,700 mc, with design data and tables showing gain, beamwidth, side lob characteristics, etc. In addition, the brochure shows pictures of the firm's design and manufacturing facilities.

Product News

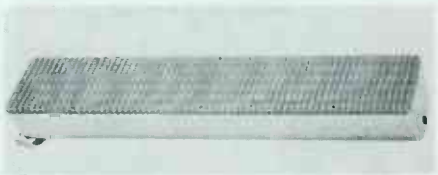


FIELD STRENGTH METER

Smith Electronics, Inc., 8200 Snowville Rd., Cleveland 41, Ohio, has introduced the new model SM-1 field strength meter, a portable, self-contained, gain-stabilized radio receiver.

The unit is said to tune continuously over a VHF range from 52 to 220 mc and a UHF range from 450 to 900 mc. It contains no calibrating source, but can be calibrated by an external signal generator. A small tunnel diode calibrating oscillator can be made available. By switch control the meter will measure visual peak, aural rms or battery condition. The attenuator range, including the meter scale, is 120 db. As a tuned r-f voltmeter with 50 ohms input, the voltage sensitivity range is from 10 microvolts to one volt.

Cables, baluns and a matching network are supplied to connect 50 or 75-ohm unbalanced transmission lines, or 300-ohm balanced transmission lines. Optional equipment includes an antenna kit consisting of VHF dipoles, a UHF log periodic antenna and a tripod support. The power supply is a single, self-contained, 12-volt, nickel cadmium rechargeable battery. Additional features include a built-in charger; a 110-volt ac power cord; and a small loud speaker with volume control to monitor the f-m signal. The instrument is housed in an aluminum case, 9 x 12 x 9 inches, fitted with a carrying handle and a removable front cover which contains all of the accessories, and weighs 17 lb.



NEW COLUMN SPEAKERS

Atlas Sound Corp., Div. American Trading & Production Corp., 1419-51 39th St., Brooklyn 18, N. Y., has announced a new line of sound columns, called Columair, which enclose a vertical stack of six adjusted-range cone speakers that produce a fan-shaped, broad horizontal, narrow vertical pattern, to cover areas where adverse conditions of reverberation and acoustic feedback exist.

Two models are available: a 20-watt unit measuring 5 x 5 x 28 inches; and a 40-watt

model measuring 8 x 6 x 42 inches. The units may be rear, side or corner mounted, using an all-purpose bracket which is supplied. The enclosure is of heavy-gage steel, lined with Tufflex acoustic padding to prevent resonance. Facilities are also provided for concealing the transformer within the enclosure.

TECHNICAL DATA SHEET ON COLORTRAN MARK II CONVERTERS

Natural Lighting Corp., 630 S. Flower St., Burbank, Calif., has announced the release of a technical data sheet describing the new ColorTran Senior and Junior Mark II converters.

The units are designed to supply boosted voltages to tungsten filament lamps to produce high intensity illumination of proper quality for photographic and TV studio or location use. Description and illustrations point out the new split-load input feature of the Senior converter to permit operation of the unit from two individual inputs of 15 amps each, or from one input of 30-amp capacity. The Junior converter for lower capacity is also detailed.

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

Transmission line, styroflex, heliax, rigid with hardware and fittings. New at surplus prices. Write for stock list. Sierra Western Electric Cable Co., 1401 Middle Harbor Road, Oakland 20, California. 6-61 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 A. M. monitor service. Nationwide unsolicited testimonials praise our products and fast service. Eldson Electronic Company, Box 31, Temple, Texas. 9-61 tf

Magnecords—Several different professional models. Newly reconditioned. Send for list. Audio Specialties, Dept. B, P. O. Box 12203, San Antonio 12, Texas. 2-62 2t

POSITION WANTED

First class phone, now chief engineer seeking permanent position in New Jersey, engineering only, AM FM station. Broadcast Engineering, Dept. BE 7, Kansas City 5, Mo. 2-62 2t

BUY, SELL OR TRADE

Will buy or trade used tape and disc recording equipment — Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 10 BE Pennsylvania, Tuckahoe, N. Y. 10-61 6t

MISCELLANEOUS

Train now in New York City for FCC first phone license. Proven methods, proven results. Day and evening classes. Placement assistance. Announcer Training Studios, 25 W. 43 New York—OX 5-9245. 2-62 3t

Product News

BROAD-BAND DUAL-CHANNEL CO-AXIAL ROTARY JOINTS

Two compact, dual-channel, co-axial rotary joint assemblies with broad-band frequency characteristics have been made available by General Electronic Laboratories, Inc., 18 Ames St., Cambridge, Mass. The new couplers feature low VSWR's and minimal insertion losses with negligible wow (variation of insertion loss with joint rotation).

The inner channel of each coupler uses direct contact to allow performance over the frequency range from dc to 11 KMC. The outer channel is non-contacting and designed to cover approximately an octave band in the S and C frequency ranges. Both channels may be used for such applications as scanning and slewing. Small outside diameters are said to make the couplers compatible with space-sharing requirements of slip-ring assemblies, and other through-the-mast rotatable equipment. Structurally, the rotary joints are adaptations of concentric co-axial transmission lines using improved transformations and coupling techniques to achieve the low VSWR's and insertion losses.

NEW COMPACTRON RECTIFIER

A new Compactron device for high-voltage rectifier service in television receivers has been developed by General Electric Corp.'s receiving tube department, Owensboro, Ky.

Designated type 2AH2, the new 12-pin unit is designed to supply power to the anode of the picture tube. Features include lower seated height, and a 2.5-volt cathode-type heater which is designed to enable the rectifier to handle substantially higher voltages than other rectifiers with filament-type heaters. Maximum peak inverse plate voltage rating of the 2AH2 is 30,000 volts for total dc and peak; 24,000 volts in the dc component. Maximum steady-state peak plate current is 80 milliamperes, and maximum dc output current is 1.5 milliamperes.

FM-35000C TRANSMITTER

A new 35,000-watt FM transmitter has been developed by ITA Electronics Corp., Broadcast Div., 130 E. Baltimore Ave., Lansdowne, Pa.

The model FM-35000C, requiring only 11 sq. ft. of floor space, features the use of silicon rectifiers throughout; complete overload protection with automatic recycling; and modern ceramic power tubes. According to the manufacturer, the new unit is perfect for stereo and multiplex, and is easy to operate.

Professional Services

Advertisers' Index

The FCC First Class Commercial License . . .

Your Ticket To An Unlimited Future In Broadcasting . . .

What's your career goal in broadcasting? Whatever it is, your chances of reaching it are a whole lot better with an FCC First Class Commercial License . . . and here's why: According to FCC regulations, a great majority of the important and high-paying jobs in broadcasting can be filled *only* by men with FCC First Class Licenses. What's more, even where there's no *legal* requirement, most top stations far prefer licensed men for practically any studio, transmitter, or remote assignment. Talk to anyone who's been in broadcasting a few years. They'll invariably tell you the same thing . . . "The FCC License is a virtual necessity if you want to take advantage of every opportunity for success in broadcasting".

Cleveland Institute Guarantees A First Class Commercial License . . . Or Refunds Your Tuition

Of all Electronics home study schools, only Cleveland Institute makes this exclusive guarantee:

Completion of our Master Course prepares you for a First Class Commercial Radio Telephone License with a Radar Endorsement. If you fail the FCC examination for this license after successfully completing the Master Course, you will receive a full refund of all tuition payments. This guarantee is valid for the entire duration of your enrollment period.

Read the guarantee again. It means exactly what it says. You complete our training and get your FCC License . . . or we send you a check for your full tuition costs. You can't lose.

Special Note to Supervisors:

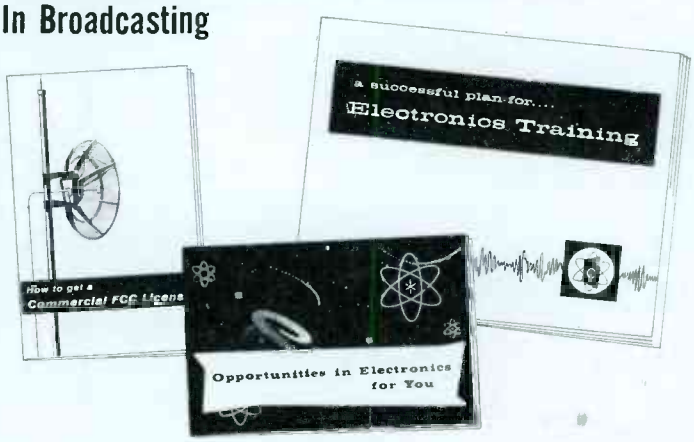
Perhaps you have men whom you'd like to move into more responsible positions but can't because they lack licenses. In their spare time, we can prepare these men for their FCC examinations and increase their value to your operations. If you'll write us on Company letterhead, we'll be happy to provide you with complete details on our new Participating Education Plan. Write: PEP, Cleveland Institute of Electronics, 1776 E. 17th St., Cleveland 14, Ohio.

Cleveland Institute of Electronics

1776 E. 17th St., Desk BE-2,
Cleveland 14, Ohio.

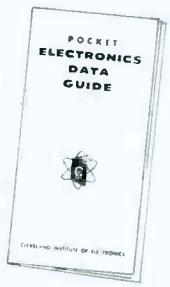
Accredited by the National Home Study Council

Three Free Booklets Tell How CIE Home Study Prepares You For An Unlimited Future In Broadcasting



And, This Handy Pocket Electronics Data Guide FREE . . .

Conversion factors, formulas, tables and color codes at your fingertips. Yours without obligation, simply for responding NOW to this opportunity to improve your future.



I want to know more about your electronics home study training program. Please send me your free booklets described above plus your handy pocket Electronics Data Guide. I understand there is no obligation. I have had training or experience in electronics as indicated.

Clip Here and Mail Coupon To

Cleveland Institute of Electronics
1776 E. 17th St., Desk BE-2, Cleveland 14, Ohio

- ☐ Military
- ☐ Broadcasting
- ☐ Radio-TV Servicing
- ☐ Home Experimenting
- ☐ Manufacturing
- ☐ Communications
- ☐ Amateur Radio
- ☐ Other

I'm now working in_____

I want to know about the following area of electronics

_____

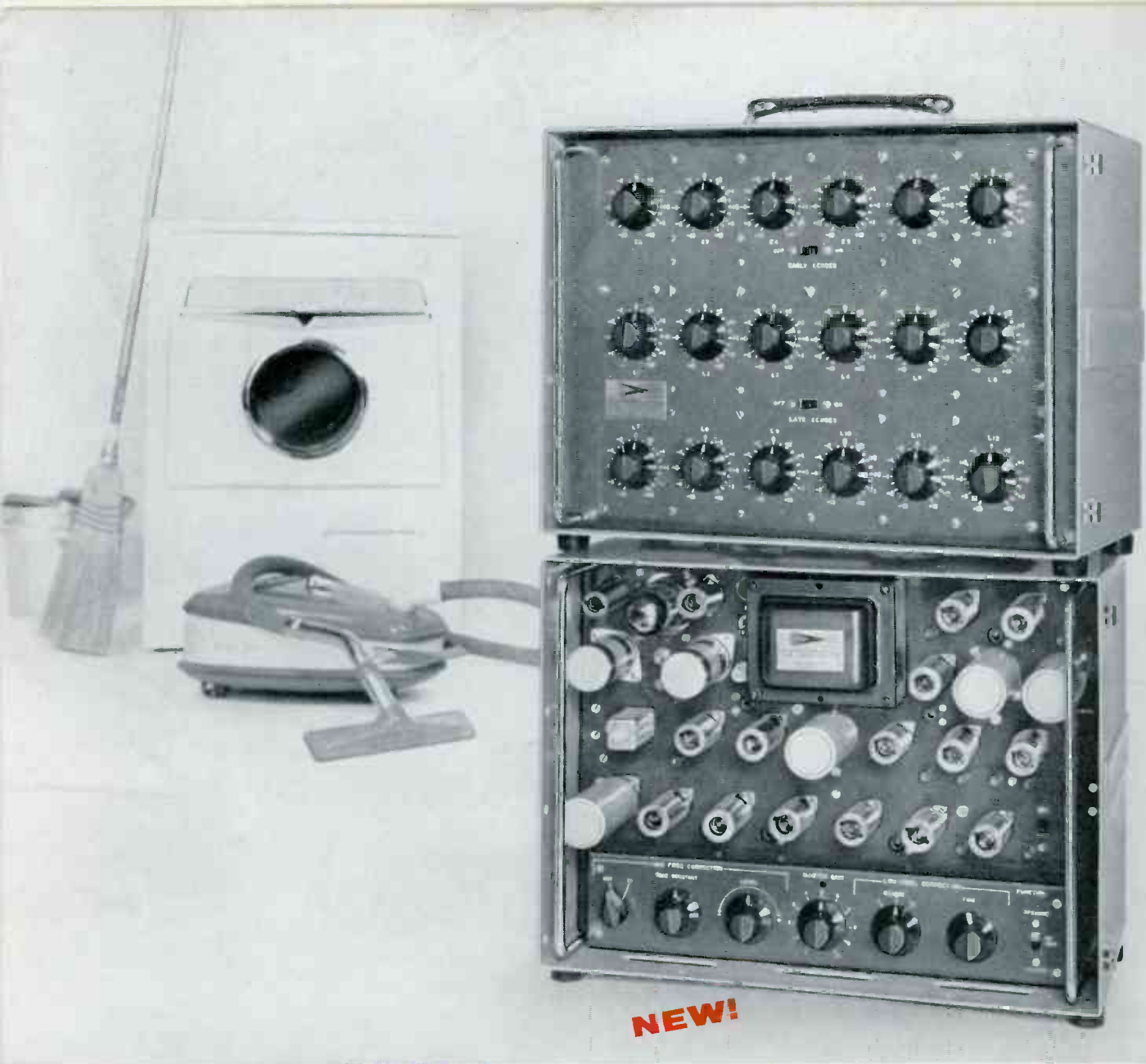
(please print)

Name_____ Age____

Address_____

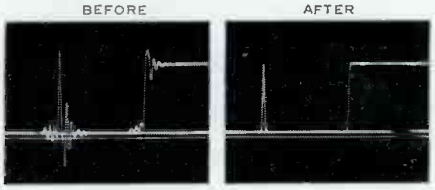
City_____ Zone____ State_____

BE-2



...clean-up video distortions easily

Photos, taken a few seconds apart, show how the Model 20/20 cleans up smears, overshoots, ringing and other waveform defects.



Waveform correction is illustrated by before-and-after photos of an expanded portion of Sine²-test signal. The Model 20/20 can be used with any desired test signal for pre-broadcast, or on-the-air correction.

At the recent NAB show, Telechrome demonstrated a remarkable new device, the Model 20/20 Time Domain Equalizer. If you saw it in operation at the show, you were, no doubt, amazed at the ease with which it corrected streaking, smearing, ringing and overshoots. If you have antenna mismatch problems due to icing, etc., inadequate transmitter phase correction, video tape degradation, distortions on remotes or STL links, or, in short, almost any video distortion problem, let us demonstrate the 20/20 to you and your staff.

Prove the value of the 20/20 at your own facilities for on-the-air or pre-broadcast signal corrections.

The 20/20 requires no special signals or set up, so a few minutes of your time is all that is necessary to produce the picture that is worth the proverbial thousand words. For your demonstration contact H. Charles Riker, Vice President Marketing. No obligation of course.

TELECHROME

AT THE FRONTIERS OF ELECTRONICS

ELECTRONICS DIVISION

TELECHROME MANUFACTURING CORP., AMITYVILLE, L.I., NEW YORK • LINCOLN 1-3600

Division Offices: Lombard, Illinois • Van Nuys, California • Washington, D.C.