APRIL, 1962

BROADCAST ENGINEERING®

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

In this issue . . .

COMING . . . Next Issue . . .

NAB CONVENTION NUMBER

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

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

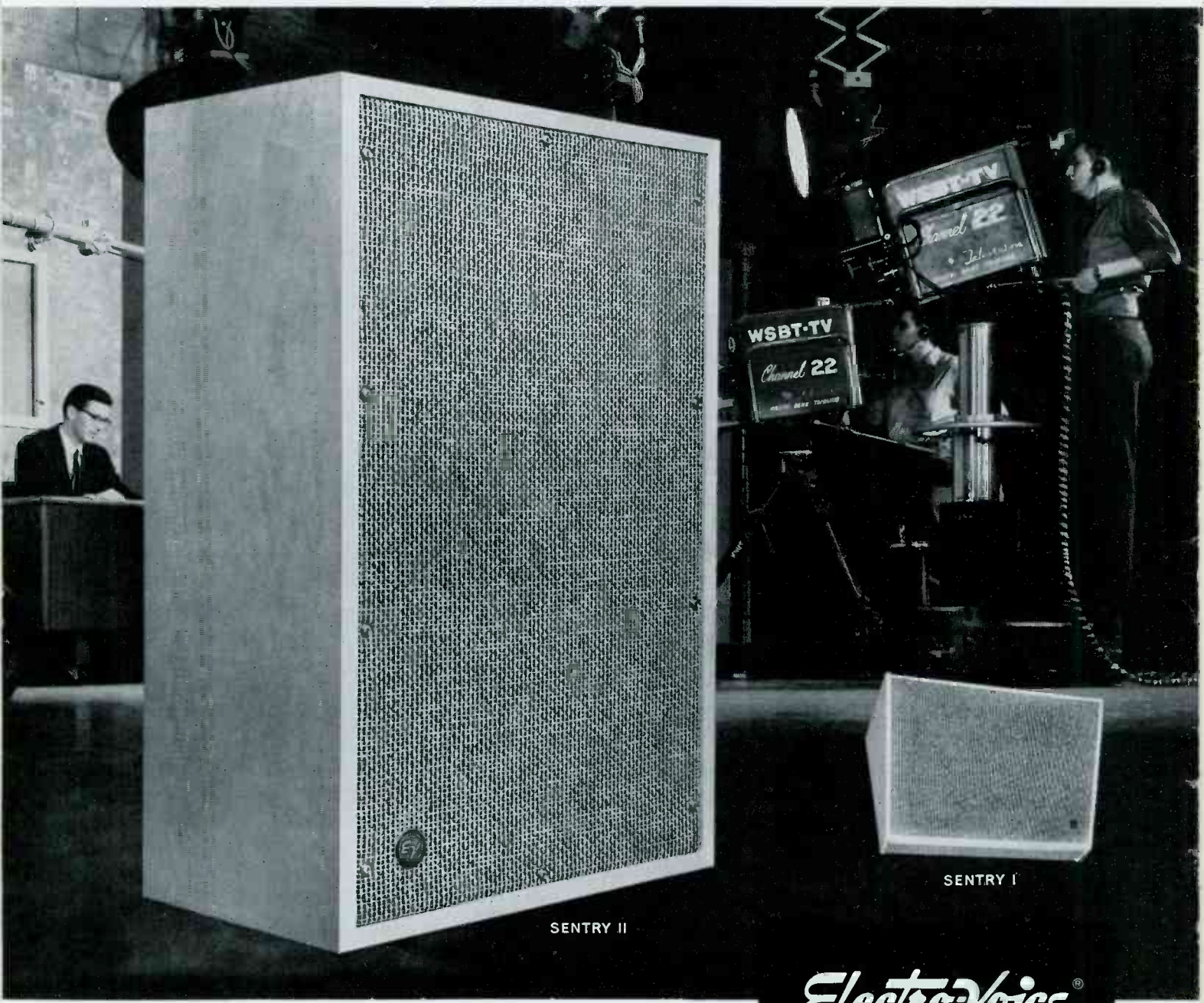
Gone are "balance" switches or knobs that vary response... each Sentry is adjusted flat at the E-V laboratories before you ever see or hear it! And because of this simplicity, the E-V Sentry Series speakers are modest in size and price.

NEW VOICE OF AUTHORITY!

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

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

Sentry II Floor Model. 32" H, 20" W, 13" D. List Price $248.33. Sentry I Wall or Ceiling Model, 17" H, 37" W, 21¾" D. List Price $231.67. (Normal trade discounts apply.)



Electro-Voice®

ELECTRO-VOICE, INC., *Commercial Products Div., Dept. 421V, Buchanan, Michigan*

NEW! IMPROVED!

Sylvania GB-1252/6U8A

provices unusual longevity
—genuine interchangeability

Problem was the popular 6U8A, as good as it is, was not specifically designed to fill the stiff requirements of broadcasters.

Sylvania, working with station engineers, analyzed 6U8A field performance and developed a superior replacement...Gold Brand GB-1252/6U8A. Now, broadcasters can expect and get vastly improved life expectancy, high stability throughout useful life. Electrical uniformity from tube to tube is improved, too, providing superior interchangeability, optimum performance from the moment of replacement.

Here are some of the improved features of GB-1252/6U8A: tighter specifications on Gm and plate current spread; stringent controls on grid emission; longer life tests; severe interface life tests; and gold-plated pins for improved electrical contact.

GB-1252/6U8A—a specific design for a specific job—is typical of the Sylvania Gold Brand Tube program. Ask your Sylvania Industrial Tube Distributor about Gold Brand types for broadcasting such as: GB-5814A and GB-6189, medium-mu double triodes; GB-5725, dual-control pentode; GB-6201, high-mu double triode.

For technical data on a specific type, write Electronic Tubes Division, Sylvania Electric Products Inc., 1100 Main Street, Buffalo 9, New York.

Available from your Sylvania Industrial Tube Distributor

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY ®

VOLUME 4 APRIL, 1962 NUMBER 4

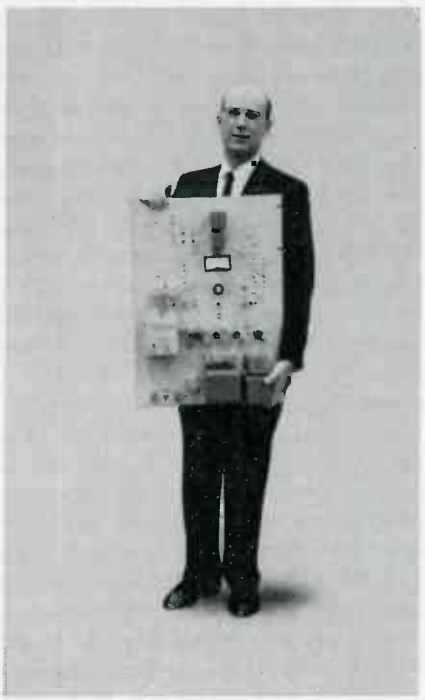
Contents

Departments

1 KW OF FM STEREO

as simple as A, B, C!

A. Take the brand-new Collins 786M-1 FM Stereo Generator. *Features:* both stereo channels produced as a composite signal . . . stereo separation greatly exceeding FCC requirements . . . no on-the-air adjusting or readjusting.



B. Match the generator with the Collins 830A-2 Exciter. *Features:* accepts FM stereo directly so that no auxiliary modulators are necessary . . . eliminates undesirable multiplication of oscillator drift . . . provides monophonic and SCA audio inputs from 30 cps to 75 kc directly.

C. Mount the generator and exciter into the Collins 830D-1A FM Transmitter. *Features:* equipment designed specifically for both stereo and monaural transmission . . . simplicity and ease of operation . . . low distortion and high signal-to-noise ratio.

Result: a full kw of the finest FM stereo transmitting equipment on the market!

For more information,
contact your Collins Broadcast Sales Engineer
or write direct.

COLLINS

Collins Radio Company • Cedar Rapids • Dallas • Los Angeles • New York

The Editor's Cue Line

OH! THE PITY OF IT ALL . . . this phrase can sum up so easily the sad pass to which broadcasting is coming. With close to 4,000 AM stations, a good start on 1,000 FM stations and around 600 TV outlets, not to mention nearly 1,750,000 operator licenses of one kind or another, this basic industry has to be picked out by its masters for the imposition of a fee for its own regimentation. The fee proposal of the FCC recently announced is not excessive in terms of fees for applications, etc. But what is so surprising is that there is neither rhyme nor reason in the ratio of proposed charges. And perhaps the most productive fees from a cash point of view will be the impost on operators. Not many observers appear to have noticed that maximum revenue will derive from the 1,750,000 operator license fees.

Why should broadcasting alone of the various bureaux be selected for revenue purposes? Is it because of the glamour surrounding television and the (*sic*) stupendous cash revenues derived therefrom? Is it because there are so many radio stations that the licensing fees look like an easy touch? Or is it because broadcasting has grown fat and lazy and not interested in sticking up for itself?

THE MOVING FINGER HAVING WRIT MOVES ON—and leaves clearly on the wall the doom for all to see. As we write this, the Commission has just announced the license revocation of two stations, with more on the waiting list! One station in Los Angeles had a long list of violations which the FCC found proven and well justified revocation. The case will be well publicized so there is no need to go into details here. In the other station there were technical violations and falsifications. Much of the evidence and grounds for revocation centered around the lack of a proper first class operator, and failure to comply with the FCC's Rules regarding the need for these operators. Since the relaxation in the early 'fifties of the rigid first class license operator requirements many stations have proceeded to get around even the relaxed Rules by various subterfuges. So far very few, if any, licensed operators have been involved —or should we say—caught? The ruse of hanging up a license in the control room *may* be all right, depending on circumstances, but when the tightening up on license holders and the call to operate according to the Rules is enforced rigidly, some of you readers had better be ready with a good story—or have changed some of the circumstances surrounding the display of your licenses! Otherwise we may see operator's licenses being revoked also!

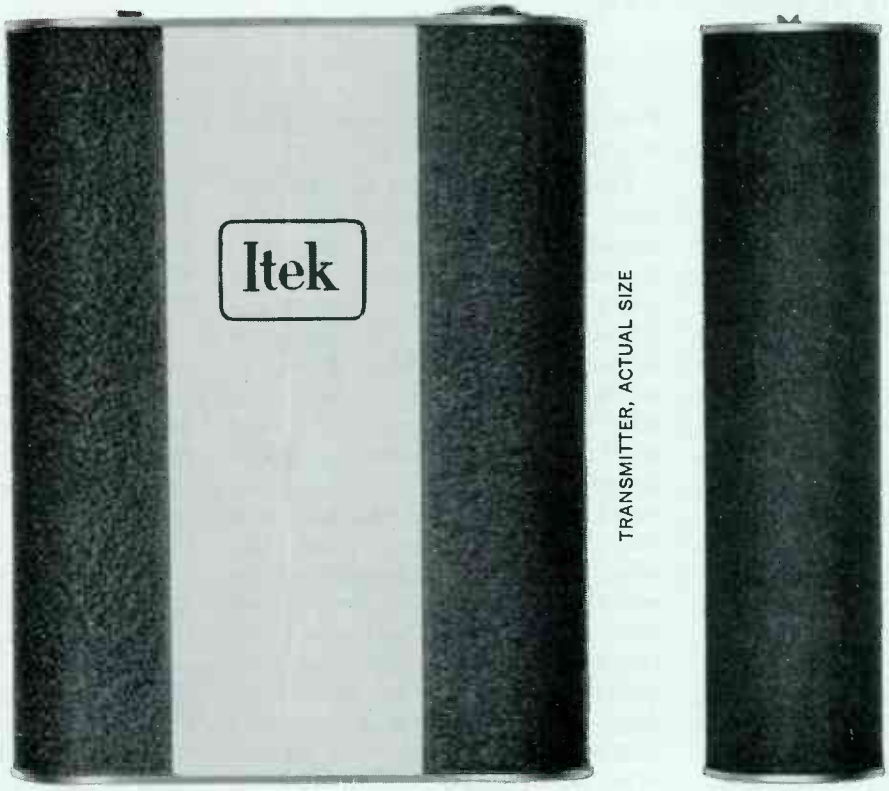
THIS ALL LEADS US INTO our major point that the call for a slowdown in the rate of issuing new station construction permits may be built around a tightening of technical requirements and more rigid enforcement of the technical standards. This in turn may lead to the return of more rigid operator requirements, and a higher standard of operator license proficiency . . . which is what all qualified first 'phone men would welcome. Today's installations do not need a genius, nor a degree, to operate, but *to avoid* technical violations and licenses in jeopardy once the guarantee period is run out, there should be technical ability to cope with the relatively simple technical standards.

OUR THOUGHT FOR THE ISSUE is that one reason why broadcasters do not always seem to achieve the success that other media do in influencing legislation is because they do not act in concert, or in many cases do not act in the right places, or timing appears to be faulty. At the recent West Virginia Broadcasters Assn. Spring Meeting Governor Collins, President of NAB, made an interesting off-the-cuff speech. After he was through the guests consisting of the honorable Senators and Congressmen (and woman) from West Virginia were invited to say a few words. All echoed the sentiments of Senator Jennings Randolph who clearly invited broadcasters to place their case before the House and the Senate committees *well in advance* of the time that action is expected!! Their well-made points . . . "Don't wait until the bill is on the floor, it is too hard to make sensible changes then . . . tell us your thoughts early in its life!" Maybe it is time broadcasters woke up!

KEEP YOUR COMMENTS COMING ON THE INSTITUTE OF BROADCAST ENGINEERS!

Itek INTRODUCES

THE WORLD'S FINEST WIRELESS MICROPHONE SYSTEM



Designed especially for exacting broadcast industry use in or out of the studio . . . dead spots eliminated by simple, effective diversity reception and high power (400 milliwatts) . . . fidelity surpasses quality of today's finest miniature microphones . . . an Itek crystal filter and crystal control in each Receiver give you up to six channels simultaneously . . . from Itek, world's largest producer of crystal filters. Write today for brochure. You saw it at the NAB Show.

Itek Electro-Products Company

75 CAMBRIDGE PARKWAY, CAMBRIDGE 42, MASS. A DIVISION OF Itek

AUTOMATIC CONTROL FOR THE VIKING CARTRIDGE TAPE MACHINE

"On hand" parts and ingenuity make remote control for tape machine at minimum cost.

By Hampton C. Clark, Jr.
CE, KMRC, Morgan City, La.

RECENTLY the task arose of building an automatic control unit for a Viking cartridge type tape machine. Not having the circuit diagram available and being limited in finances made it necessary to design a unit using all "on hand" parts where possible, and keeping the cost to a minimum.

The foil-on-tape and electrical contact type of control were discarded immediately, as such controls had been observed in operation in the past and proven rather unsatisfactory as far as convenience was concerned.

Design Problems

Experiments were begun to determine if the erase head on the Viking would operate as a record-playback head for an oscillator type control. Although lacking the high frequency response that the regular record playback head possessed, it was determined that the erase head had an impedance of approximately 500 ohms at about 1,000 cycles. When a 1,000-cycle tone was recorded on this head and played back through a Gates MO-3638 line amplifier and rectified, a no-load voltage of about 25 volts was obtained with the amplifier at full gain.

Relays were needed, and a search was made through various catalogs to find some economical relays that would be usable and, if possible, require very low current, especially in the case of the relay to be operated by the taped tone. The unit was built around four of these relays. Five milliamps are required (about 25 volts dc) to close the relay.

Further experiments showed that when the rectified output from the amplifier was applied to the relay, the relay loaded the output down so much that only about 15 volts was obtained under load. This was insufficient to trip the relay. Then the regular record playback head was tried. The output when played back on this head was greater, and a sufficient voltage to trip the relay could be obtained if the tone was *recorded* on the *erase* head. But when the tone was recorded on the record playback head, and played back on the record playback head, the output was only about 15 volts under load and hence inadequate. Any arrangement using a record playback head would have necessitated purchasing an additional head, so this plan was dropped and further experiments in this vein discontinued.

Sensitivity Controls

At this point, it became apparent that with the relays on hand, it would be necessary to apply a fixed voltage to the relay controlled by the tone, capable of control to adjust the sensitivity of the device. Because about 30 volts dc were used to power the other relays in the equipment, a 5,000-ohm, wire-bound, two-watt potentiometer was connected across this 30 volts in series with the amplifier output, and a condenser connected across the two voltages in series. This method proved workable and satisfactory. Another method tried and discarded was to cascade two line amplifiers. This method was workable, but required the use of two amplifiers which was undesirable from an economic viewpoint.

However, the series voltage method had a drawback. The tone controlled relay closed when the tone from the tape was applied, but the close voltage and the release voltage of a relay are not the same. The relay closed, but the adjusted booster voltage held the relay down, even when the tone had ceased. To eliminate this, the booster voltage was run through the contacts of another relay which opened when the tone-operated relay tripped, so that this voltage was removed when the tone-operated relay tripped, thus removing this voltage. This worked, but the relay which removed the booster voltage would sometimes buzz. It was found that by passing this voltage through yet another relay, contacts eliminated the buzzing.

Installation and Operation

During installation there was still some doubt as to the quality of the reproduction from the regular record playback head, because the erase head could no longer be in use as an erase head. Thus there was a possibility that even after using a magnetic tape eraser on all the tapes a 60-cycle hum would be present on the completed tapes. However, it was found that if a good

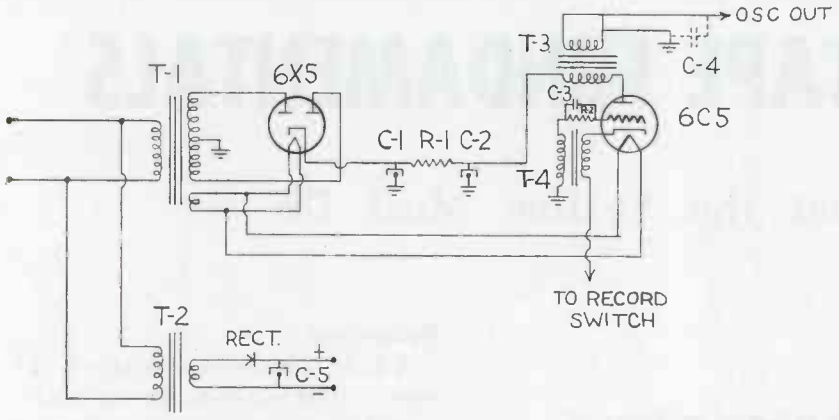


Figure 1
Power supply and oscillator.

Table 1
Parts for Rectifier

C-1, C-2	40-30 MFD, Dry Electrolytic
C-3	.002, 400 volt
C-4	Optional. May vary from .002 to .01 or omitted. Controls OSC pitch.
C-5	50 MFD (50 to 150 volt)
T-1	Quality 6-K-49VG and HB (Power xformer 230-0-230 @ 50 ma, and 6.3 V.)
T-2	Quality 6-K-48 HF (Filament xformer 26.5 volts @ .6 amps.)
T-3	Merit A-3023. (Tube to line 20,000 Ω, 10,000 Ω primary. Secondary 500 Ω line.)
T-4	Interstage xformer
R-1	2200 Ω, 2w
R-2	100,000 ohms ½ μ

Rectifier—500 mil. 150-volt Top Hat type silicon.

recording level was used, the small amount of hum present on the tape was completely blanked out, and reproduction was satisfactory.

With the type of relays used, it was necessary to mount all four relays on a sheet of insulating plastic, mounted on stand-offs from the chassis. All hardware was mounted first, including transformers, relays and terminal strips. Then wiring began.

Operation of this equipment is as follows:

To record, the amplifier for the recorder is set in the "record" position and a signal of the proper level applied. Record switch (S-2) is depressed momentarily, also start switch (S-1). S-1 is held down while material is being recorded to prevent any strong signal inputs to the regular record head from leaking over to the erase head feeding the automatic equipment and stopping the tape machine motor during recording.

When switch S-2 is depressed, 30 volts dc is applied to coil of relay E-1, closing contacts of E-1 and connecting the erase head to oscillator output. At the same time, S-2, which is a double-pole, single-throw switch, grounds one side of the primary of transformer T-4 in Figure 1, causing the 6C5 to oscillate. This signal is fed through transformer T-3 to the oscillator output through contacts of relay E-1 to the erase head, thus recording the tone on tape.

Figure 2 shows the playback operation. During playback, tone is picked up by the erase head, fed through the contacts of relay E-1 to the amplifier, rectified, filtered, added to booster voltage taken off R-1, and fed to the coil of relay E-2. R-1 is adjusted so that the desired amount of signal voltage will trip relay E-2. When the erase head picks up tone, relay E-2 closes, breaking contact momentarily. This causes relays E-3 and E-4 to break contact. When E-4 breaks, the recorder motor stops. If the solenoid-type Viking unit is used, the contacts of E-4 can control the solenoid instead of motor. When E-3 breaks, E-4 cannot close again until equipment has been re-cycled by pressing the start switch. Since booster voltage to E-2 is fed through contacts of E-3, booster voltage is removed until equipment has been re-cycled by depression of start switch. This removes all voltage from coil of E-2, allowing E-2 contact to return to

(Continued on page 12)

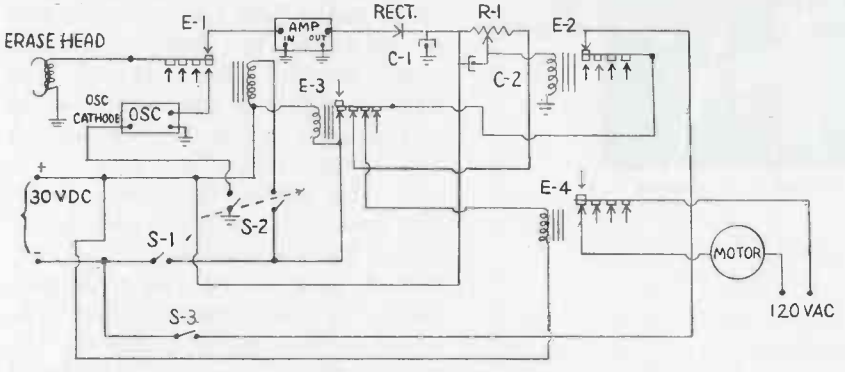


Figure 2
Amplifier. Any amplifier may be used. Gates MO 3638 line amplifier was used in the KMRC equipment.

Table 2
Parts for Amplifier

C-1, C-2	50 MFD, 150 volt
E-1, E-2, E-3, E-4	2500 Ω, 5-500 MA Plate Relay Olson SW 196
R-1	5000 Ω wire sound, 2w
S-1	Start Switch, pushbutton SPST, Normal Open
S-2	Record Switch, Pushbutton DPST, Normal Open
S-3	Stop Switch, Pushbutton SPST, Normal closed

Rectifier 500 mil, 150 volt Top Hat Type Silicon OSC as shown in Figure 1.

TELEVISION TAPE FUNDAMENTALS

Part 3– What the System Must Do

By Harold E. Ennes
Maintenance Supervisor
WTAE
Pittsburgh, Pa.

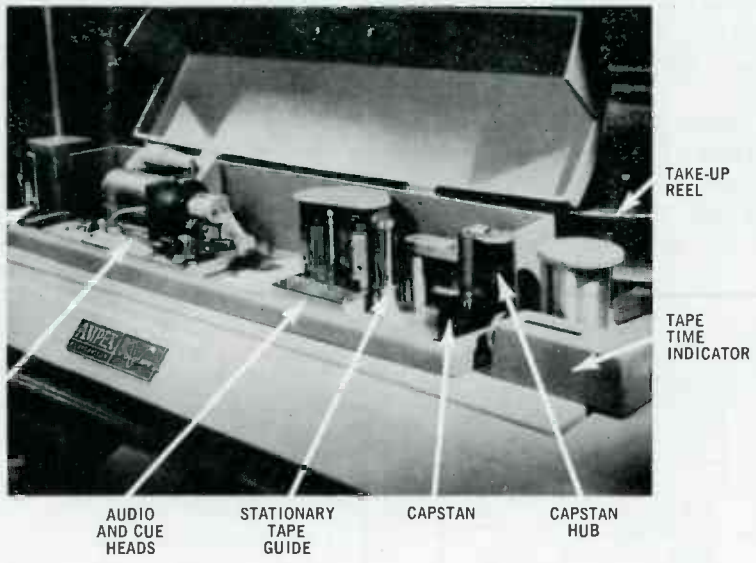


Figure 16*

Ampex 1000-B Tape Transport

*Editor's Note: Figure numbers follow in sequence throughout this series of articles.

Recording

A brief tabulation of what the TV tape system must do shows that:

1. The composite video signal is presented to the four rotating heads simultaneously in the form of an FM signal.

2. One revolution of the headwheel lays down four video tracks. The tape is pulled past the headwheel at 15″/sec and adjacent video tracks are spaced approximately 5 mils apart.

3. To recover the recorded information, video head outputs (FM) are first amplified, then fed to an electronic switcher which selects the signal from the head in contact with the tape. This selection occurs during horizontal retrace intervals so that switching transients are invisible.

4. The electronic switcher output (FM) is then demodulated to recover the video signal from the carrier RF. It is then processed to "clean up" sync and blanking intervals for distribution to the television system.

5. For proper synchronization, the tape velocity (15″/sec) must be locked to the headwheel rotation (240 rps). During recording, sync from incoming video to be recorded is used to obtain a 240 cps signal (four times field frequency) which is amplified to obtain sufficient power to drive the headwheel. This 240 cps signal is also converted to a sine-wave which is recorded on the control track of the tape.

6. Also during the record mode, the speed of the headwheel is obtained from a tachometer and converted back to 60 cps to supply power to the capstan motor. The speed of the capstan motor has absolute control over the velocity of the tape which is a nominal 15″/sec.

7. In the playback mode, the headwheel again rotates at a nominal 240 rps with the initial refer-

TABLE 2
TAPE REEL DATA

Feet	Minutes	Diameter (Inches)
1200	16	6
2400	32	8
4800	64	12½
7200	96	14

ence either the 60-cycle power line or pulses from the local sync generator. The 240 cps control track signal is compared in phase to the playback speed of the headwheel, and any phase-frequency error modifies the 60 cps nominal frequency applied to the capstan motor. Thus the tape velocity is continuously maintained so that the rotating heads sweep directly across the video tracks (in the form of FM) originally placed on the tape.

8. The audio signal is handled by conventional magnetic recording techniques longitudinally along the top of the tape. However, the axis of easy magnetization of the iron oxide particles is aligned transversely across the tape to favor video response. For this reason, the upper frequency limitation is about 10 kc to 11 kc, as compared to the 15 kc response for audio tape systems, and the signal-noise ratio is slightly lower.

It will also be noted that the audio record-play head follows the rotating heads in space along the tape transport. This space is 9 inches, which we know from previous articles is equivalent to 18 frames of picture. At 15"/sec speed, then $9/15 = 0.6$ second sound leading video. Note that this spacing provides correct lip-sync on playback since the same video-sound relationship is used, and is therefore important only in critical editing (and splicing) of tape.

The Tape Transport

The tape transport (Fig. 16) conveys the magnetic tape across the recording and pickup heads while maintaining proper tape velocity and tension.

Tape is threaded from the supply reel on the left (not shown in photo) across the components shown to the takeup reel on the right. The size of the reels depends upon tape footage as shown by Table 2.

In normal *play* and *record* modes, the reel motors supply power to hold back or take up the tape; the capstan maintains full control over tape speed. During rewind the supply reel motor is fully energized and the takeup reel motor is energized to rotate counterclockwise (although its direction of rotation is clockwise) to maintain tape tension and avoid spillage. During either "rewind" or "fast forward," the capstan hub is disengaged from the capstan.

The first component (left to right) contacted by the tape is the master erase head. This is energized in the *record* mode only to erase any previous signal.

The tape is then pulled between the vacuum guide and the rotating head drum as previously discussed.

The tape is held in intimate contact with the audio and cue heads, and properly positioned vertically by the stationary tape guide. As a tape guiding element this idler is precisely machined so that the tape will fit almost exactly between flanges at top and bottom of the inner surface.

The capstan idler arm assembly

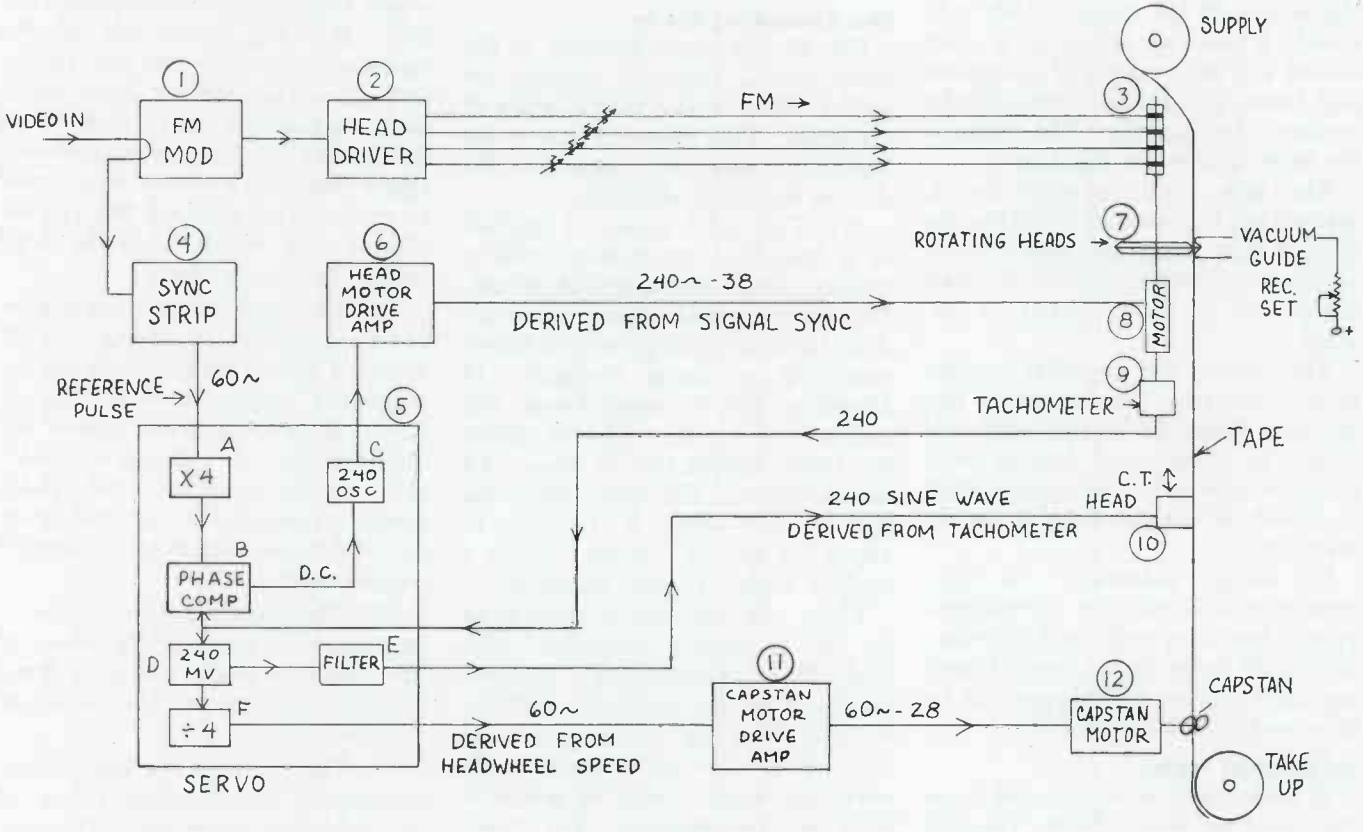


Figure 17

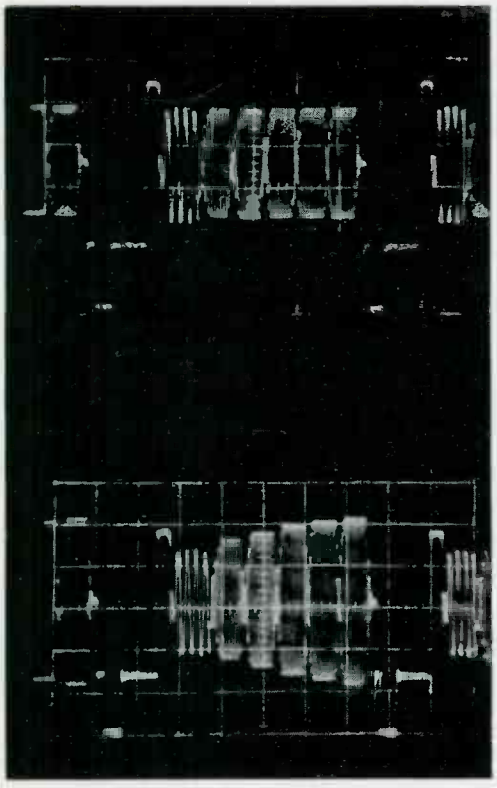


Figure 18A

Composite input keyed burst signal.

Figure 18B

Waveform of (a) at reactance tube grid showing pre-emphasis.

consists of a neoprene rubber-tired hub mounted on a U-shaped bracket (providing a certain amount of self-alignment), which is in turn mounted on an arm directly coupled to the pivoting housing shaft. The housing shaft pivots as dictated by the action of the capstan idler solenoid, which is actuated in the *record* and *play* modes of operation and forces the rubber tired hub to contact the capstan. This clamps the tape against the capstan.

The tape time indicator has a manual set to zero and indicates the elapsed time in minutes and seconds whether in normal *record* or *play* modes, or in fast forward or rewind.

The takeup reel provides storage of the tape after passing across the previous items. Stabilizing arms adjacent to supply and takeup reels dampen and take up excess tape in event of erratic motion as in starting.

Of major importance in tape transport systems are cleanliness, proper tensions, and de-magnetization of all items in the tape threading path. Proper techniques will be discussed in a later article.

Additional Notes

A blower system cleans and cools the rotating head drum, filtering trap dust, lint and iron-oxide particles from the tape and drum. The vacuum system for the tape guide is also filtered.

Spring actuated brakes are used for stopping. A brake release allows convenient threading, editing and splicing.

The Recording Mode

Fig. 17 is a block diagram of the basic system function (except for audio) when in the *record* mode of operation. The following notes are correlated with the numerical circles on the block diagram.

(1) The video signal is applied to a frequency modulator with a typical carrier frequency of 46 mc. The resulting FM signal is heterodyned with a fixed 51 mc oscillator, producing a carrier frequency of 51—46=5 mc. In monochrome operation the deviation of this carrier for 100% modulation is about 4.3 mc to 6.8 mc. For color operation this carrier swing is reduced to about 5.4 mc to 6.3 mc. (Uses a slightly higher carrier frequency).

Video pre-emphasis is used prior to the modulator reactance tube grid. For monochrome, approximately 4 db pre-emphasis at 4 mc is used (Fig. 18) which increases the signal/noise ratio about 3 db over that which would be achieved with no pre-emphasis. For color, since the deviation must be less (due to color subcarrier components), pre-emphasis is increased to about 9.5 db at 4 mc. This results in an increase of approximately 5 db signal/noise ratio over that obtainable from no pre-emphasis.

(2) The FM output from the modulator is amplified and split into four separate channels, one for each of the rotating video heads. The only reason that this is necessary in the *record* mode is that the FM amplitude to each head must be adjusted individually to obtain optimum results.

(3) The individually adjusted outputs from the driver amplifier drive all four video heads in parallel through a slip ring-brush assembly. No switching occurs during the *record* mode.

This completes the basic video function when recording. The remaining functions serve to identify the timing of the recorded signal.

(4) Sync pulses are stripped from the video signal being recorded and the field frequency (nominal 60 cps) provides the initiating power source for the rotating head motor. This is termed the reference pulse.

(5) (A) The 60 cps reference pulse is multiplied by 4 to 240 cps which feeds a phase comparison circuit (B). The other side of this comparator receives 240 cps (nominal) from the rotating head motor shaft tachometer. Any tendency of the motor to run at a different speed generates an error signal used to control the nominal 240 cps oscillator (C) which feeds the head motor drive amplifier.

(6) The head motor drive amplifier is capable of supplying over 70 watts of power to the head motor. (Nominal power consumption is about 50 watts.) Two phases are obtained by a capacitive phase shift circuit, and this two phase power is converted to a three phase circuit by means of Scott connected transformers.

(7) The rotating head drum is engaged with the tape by means of the vacuum guide which is fixed during recording to the standard "tip projection."

(8) The speed of the head motor determines the absolute values of the deflection frequencies, the con-

(Continued on page 20)

Planning STL or Intercity Relay? Send for Raytheon's Free Planning Kit!

Raytheon's Microwave System Planning Kit helps you engineer initial requirements, carry out preliminary terrain and tower surveys. It also explains topographic maps, path clearance pitfalls, profile plotting, FAA and FCC regulations.

In designing this Planning Kit for TV Station Chief Engineers, Raytheon experts drew on their extensive experience in servicing over 1000 microwave installations throughout the world.

Raytheon KTR — for Intercity Relay network pick-up — is available in both 1/10-Watt and 1-Watt systems to meet individual needs. These systems have proven their reliability, operating unattended over extended periods. Initial cost is low, and long-term financing is provided.

The world's largest manufacturer of microwave tubes and equipment, Raytheon also offers TV Stations complete, no-obligation System Engineering Service.

RAYTHEON

RAYTHEON COMPANY

EQUIPMENT DIVISION

Mail Today for Free Planning Kit

Raytheon Company, Dept. B-4
Lexington 73, Massachusetts
Attention: Mr. M. B. Curran

Please send free Microwave System Planning Kit

☐ Planning a system. ☐ For reference only.
☐ Have Engineer call.

Name .....

Title .....

Company .....

Address .....

City & State .....

Cartridge Tape

(Continued from page 7)

the normal up or closed position, ready for the next operate cycle. E-3 cannot close again until start switch is depressed.

When start switch is depressed, relay E-3 is drawn down and stays down because one side of E-3's coil is fed through its own contacts and through E-2's contacts to negative 30 volts. S-3, the stop switch, normally closed, is also in this line to stop machine manually if desired. Coil of relay E-4 is energized through contacts of E-3 and E-2, drawing contacts of E-4 down and starting motor on tape machine, or pulling in solenoid, depending on which type of tape machine is in use.

The erase head used in the automatic control gear is inverted so that it records the tone and plays back on the *lower* half of the tape. This prevents pick up of the tone by the regular playback head in case the operator does not turn his console fade down immediately after the recorded material has been played.

R-1 on Figure 2 may be adjusted to control the sensitivity of the automatic control equipment.

In the equipment described, bargain parts were used throughout; the rectifiers cost about 50 cents each, the four relays, $3.00, and some of the equipment was built from materials already in stock. T-2 on Figure 1 to provide the voltage for operation of the relays was the one most difficult component to locate. Special rectifier transformers could be used for this purpose, but their cost is fairly high. Since the relays in use draw such a small amount of current, it was found that a 26.5-volt, .6-amp filament transformer supplied all the power needed, at $2.50 cost.

Total cost of this entire equipment, less the amplifier, was about $20.00. Any good line amplifier can be used. The one used was chosen because it was on hand and not in use.

While not quite as compact as some of the commercial units, this unit has proven satisfactory for broadcast use, and does not overheat when left on all during the broadcast day.

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:

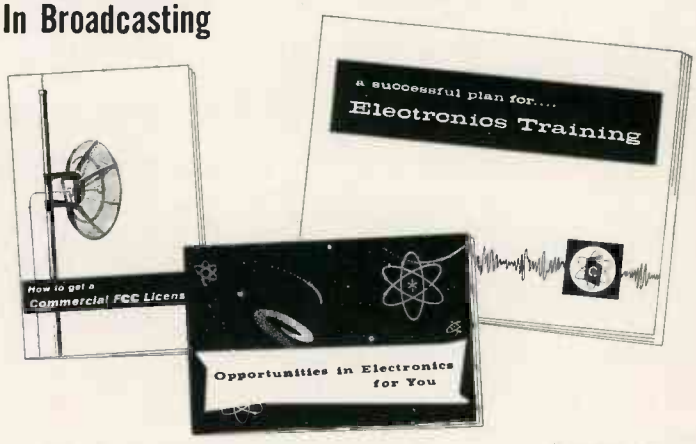
Perhaps you have men whom you'd like to move into more responsible positions but can't because they lack licenses. In their spare time, we can prepare these men for their FCC examinations and increase their value to your operations. If you'll write us on Company letterhead, we'll be happy to provide 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-4,
Cleveland 14, Ohio.

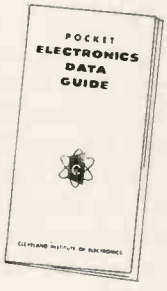
Accredited by the National Home Study Council

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-4, 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-4

PROGRAM GATED NOISE SUPPRESSION AMPLIFIER

New device reduces background noise by means of controlled gain

By Herbert P. Michels
Chief Engineer
Ron Electronics Corp.
Montclair, N. J.

As THE broadcasting industry achieves a higher state of sophistication, a need becomes apparent for technical equipment which performs certain auxiliary functions. One of these functions is accomplished by the new gate amplifier—specifically, audio background reduction by means of a controlled gain amplifier.

Design Objectives

In arriving at a possible design for the amplifier, a complete evaluation of existing design requirements was made. It was essential that the amplifier not degrade response, distortion and noise levels of the existing broadcasting system. Among circuits which showed promise for background noise reduction was the conventional linear expander; however, this produced results which did give some improvement, but unfortunately did not lend itself to broadcast program transmission because of its tendency to expand the dynamic range of the program material.

After a number of tests, it was determined that the circuit selected, if used for broadcast or recording, must function to reduce background noises (by expander action) without significantly changing the dynamic range of the program material. Fortunately, most background

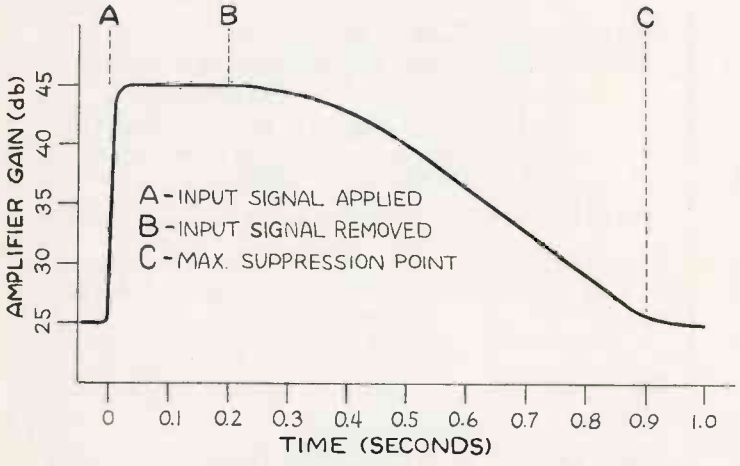


Figure 1. Gate Amplifier Gain Vs. Input Signal.

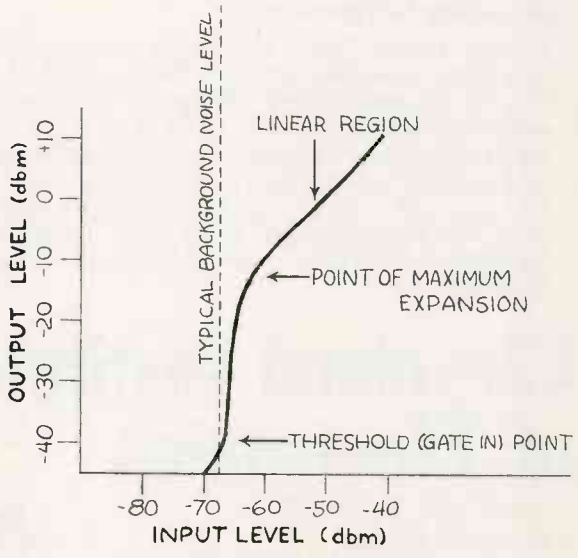


Figure 2. Amplitude Response.

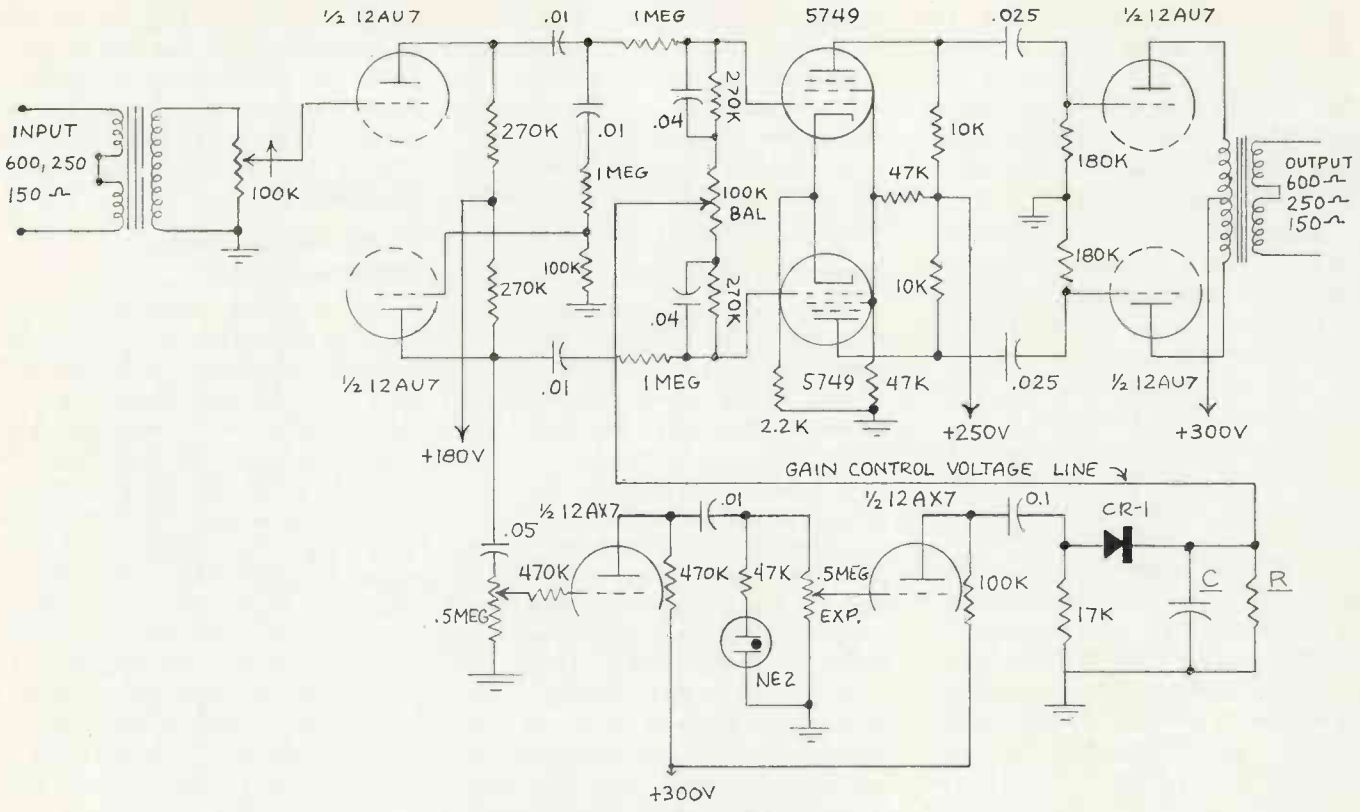


Figure 3. Simplified Schematic.

noises are at least 30 db below program level (such as background microphone pickup, film soundtrack or telephone-recorder line noise). These are high enough to be annoying to the listener but are generally separated by at least 10 db from useful program material peak level.

The design objective was to develop an amplifier which would expand the 10 db separation between program and noise by at least another 15 to 20 db without significant expansion of the program material. This expansion had to take place in the region between noise and program—otherwise the resulting program expansion could cause loss of low passages of program, or overmodulate on high levels.

Figure 1 shows the operation of the Gate Amplifier adjusted for a maximum gain of 45 db and an ungated (no signal present) gain of 25 db. Point A indicates the start of program material; point B indicates the completion of that particular program burst. Point C (600 milliseconds later) is the final ungated level.

Rapid gate-in is obviously required in any application; otherwise, serious loss of program intelligence can result. Generally, a gate-in speed of less than 10 milliseconds to .707 times the full program level is required for broadcast or other high quality transmission. Extensive listening tests with the gate amplifier resulted in a selection of a gate-in time between 3 and 8 milliseconds as most satisfactory. It should be noted that faster gate-in times (as low as 1 millisecond) are simple to obtain, but, however, are not designed into the amplifier since too rapid a gate-in time can result in "thump" causing current surges, particularly as tube aging causes slight unbalances in the push-pull circuits. The final design did not require the use of matched or selected tubes in the Gate Amplifier.

Best decay time, points B to C, was found to be between 0.1 and 0.8 seconds depending upon type of noise which was to be suppressed. Random but occasional noise such as background speech, movement of studio furniture, etc., were more satisfactorily eliminated by a choice of a rapid decay (0.1 to 0.3 seconds). Continuous noises such as film background were found to be better handled by a very long decay (0.8 seconds). The long decay time for steady and continuous noises tended to render the gating action less obvious to the listener.

Figure 2 indicates the type of amplitude response required for the Gate Amplifier. Note that the input vs. output level is linear above the expanded area, and that the expansion reaches maximum at a point 25 db below program peak level. This satisfies the requirement that the dynamic range of the normal program material remain unchanged; all expansion takes place in the region just above unwanted background levels.

Operation

A simplified version of the actual circuit used in the Gate Amplifier is illustrated in Figure 3. Here it can be seen that the signal path is first fed through the 12AU7 phase splitter, then into the push-pull 5749 variable mu pentodes where the gain control takes place.

The 5749 cathodes are operated at positive 12 volts dc with respect to the control grids, under zero signal conditions. The gain controlling voltage is applied to the 5749 grids through R6. This control voltage is developed in the control amplifier-limiter-rectifier section. Here a 12AX7 is used as a cascade control signal amplifier. Neon lamp NE-2,

connected in the 12AX7 plate circuit, will fire at its rated ac voltage to limit effectively the signal control voltage after the predetermined value has been reached. In practice, this value is adjusted to 15 to 20 db below peak program level.

When NE-2 fires, no further expansion can take place, hence, the amplifier passes all signals linearly. CR-1 provides dc rectification for the controlling signal. The values of R and C are selected for proper attack and recovery times.

Considering the rapid gate-in time of the 5749 amplifiers, it is apparent that some consideration must be given to the problem of "thump" due to the sudden plate current surge as the 5749 grid potentials are driven from —12 volts to near —1 volt dc in less than 8 milliseconds. Careful balancing of the push-pull 5749 stages tends to minimize this problem; however, since all tubes seem to age at different rates which would throw off the carefully balanced stages after a few months of operation, an additional safety factor is incorporated in the design. This is pre-emphasis of the low frequencies (30 to 500 cps) ahead of the controlled stages and de-emphasis of these frequencies in the output coupling of the controlled stages. The resulting program response of the complete amplifier is flat; however, the low frequency "thump" components are attenuated to a value which is negligible.

Since loop inverse feedback in a controlled amplifier is impractical, the complete amplifier had to be carefully designed to produce low distortion and flat overall response without the aid of the usual feedback correction. Careful selection of component values and correct operating conditions of the various stages were essential in obtaining response within 1 db from 30 to 15,000 cps, and total harmonic distortion below 1 per cent.

Typical Applications

Since the original design of the amplifier was completed, many applications were brought to our attention which we did not previously consider. Originally the Gate Amplifier had been developed to fill a need in broadcast systems for background noise reduction. Uses such as reduction of background pickup from TV studio boom microphones and TV film noise suppression were considered as the designed applications for the amplifier. Later, the Gate Amplifier has been used successfully to improve signal to noise ratios in beeperphone (telephone recording) systems; here the Gate Amplifier, adjusted for rapid recovery, provided suppression of telephone line buzz, cross-talk and tone beeps. Commercial point to point communications systems operation have also been improved by the amplifier by reducing background voices which might otherwise be picked up and transmitted.

A significant improvement was found in the overall efficiency of TV studio intercom systems by using the Gate Amplifier. Certain microphones such as the director's and floor manager's microphones must be left open at all times—thus feeding extraneous noises into the intercom system. The Gate Amplifier provides excellent results for this application. By closing off intercom microphones that are not in use, a great deal of the usual confusion of voices reaching the cameramen and others depending upon the intercom system for instructions, cues, etc., is eliminated.

Figure 4. Gate Amplifier 40A.

Compatability With Other Equipment

An extensive investigation was made to determine the best location in the broadcast system for the Gate Amplifier. It was found that for compatibility with existing AGC amplifiers, or limiter amplifiers, the Gate Amplifier should precede any compression device in the system. Therefore, the amplifier was designed to operate following the conventional microphone or projector pre-amplifier. The Gate Amplifier output may then be coupled (via a fixed 40 db attenuator) into a fader in the console mixer system—or the high level output may be used directly to feed a line, intercom system, etc.

Evaluation Tests

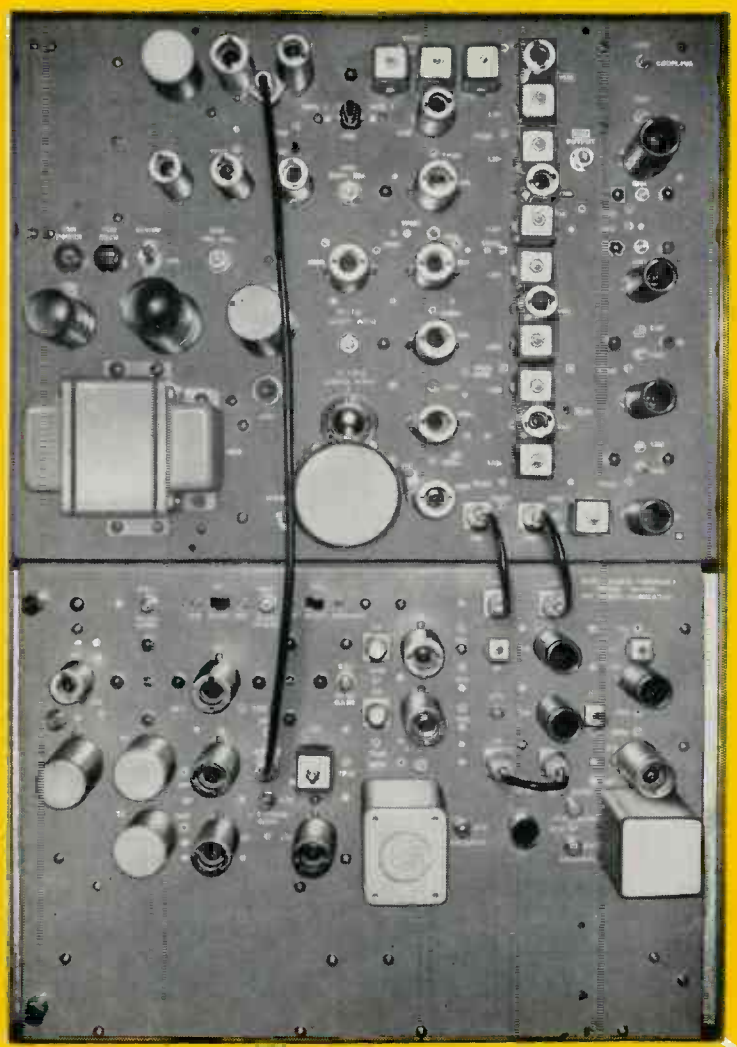
A general evaluation of the improvement obtainable in any given system may be made by comparison with test results in a typical application. Here undesired background noises averaged 25 db below program level. With the Gate Amplifier adjusted to give 18 db suppression, the background noises were reduced to: 25 plus 18 or 43 db.

Also, to be considered is the problem of the listener being able to distinguish the gating-in and out of the amplifier. For this situation, many listener tests were made, both in the lab and in actual broadcast studio operation. It was found that the ability of a listener to detect the presence of the Gate Amplifier depended upon the following factors: 1. Type of background noise present. 2. Amount of noise suppression used. 3. Decay time adjustment of the Gate Amplifier.

Steady state noises such as high level hiss from an old film sound track was best handled by very slow decay time (on the order of 0.5 to 0.8 seconds) and using no more than 14 db of suppression. Other types of noises, such as random background voices, were best suppressed by a rapid decay adjustment (0.2 seconds) and up to 20 db of suppression.

CREATING A WHOLE NEW WORLD OF STEREO

with the NEW GATES SMX-1 STEREO GENERATING SYSTEM



■ This entirely new Gates system was *built for stereo* – not just adapted to stereo. Here you have three dimensional quality . . . genuine stereo performance, reliability and serviceability unmatched in the FM radio industry.

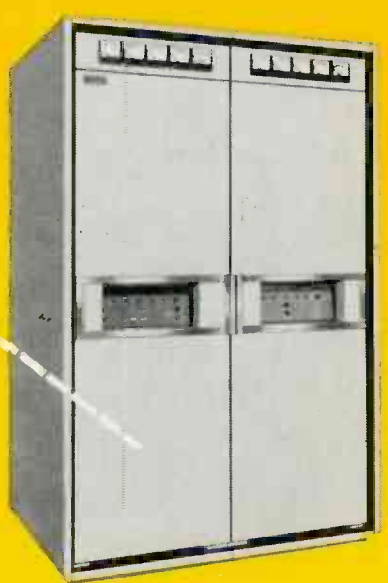
■ The basic equipment, which meets or exceeds all FCC requirements, includes an entirely new FM exciter and stereo generator.

■ FM exciters developed by Gates were selected by several manufacturers for original stereo research, with this equipment used in one of the two stereo systems initially approved by the FCC. Now, with this completely *new* FM exciter–included as standard equipment on all Gates FM transmitters from 10 watts to 40,000 watts – a whole new world of stereo has been created.

■ The stereo generator features built-in matrix and silicon power supply, and was designed along vertical construction lines for instant accessibility. Space is also provided for the optional sub-channel generators with automatic muting.

■ Gates stereo design objective, in addition to delivering the finest stereo performance, is also to provide space for 2-channel SCA* in the same unit without compromising the broadcasters' SCA multiplex performance requirements. This is a Gates performance exclusive and permits broadcasting FM stereo and 67Kc SCA simultaneously.

Let us tell you more about the technological advances of this new stereo generating system. Write today for Bulletin No. 95 – yours for the asking.



NEW GATES FM-5C 5 KW FM TRANSMITTER

*Subsidiary Communication Authorization

GATES

GATES RADIO COMPANY

Subsidiary of 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

HARRIS INTERTYPE CORPORATION

PRACTICAL FM ENGINEERING

Part III

Proof-of-performance is important, and noise in the transmitter and audio equipment can easily mar FM sound.

Editor's Note: Parts 1 and 2 contained references to broadcast equipment. It should be realized that these were included for illustrative purposes only and that the article was intended to apply equally to all modern broadcast equipment, and it was not intended to single out any special manufacturer.

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

Most program equipment is adequately filtered, but unique conditions may occur where FM interference will arise. It will be shown by problems such as buzz getting into the tape recorders and consoles. In anticipation of this, the transmitter frame should be connected to the station ground. Special RF filters can be placed in series with the ac power input to all of the critical units that manifest this FM buzz problem. These filters should take the form of .01 disc capacitors to ground, shunting the ac power line with series elements of sufficient capacity to handle the line current but with resonances in the FM band. A typical choke could be formed by 22 turns of No. 16 wire around a ½" form, and suitably insulated from ground.

Today's FM receivers are extremely sensitive and serve as the source for many high fidelity audio systems. Quality standards accepted in other broadcast media are not tolerated by FM listeners. It should also be noted that severe overmodulation will cause distortion of the FM program channel, and in the case of stereo, will contribute considerably to crosstalk.

In order to reduce the possibility of overmodulation, it is extremely important that some type of limiting amplifier be utilized in the program sources for FM equipment. This approach eliminates the human error and can assure of freedom from distortion due to overmodulation, and the transmission of the high quality of which FM is capable.

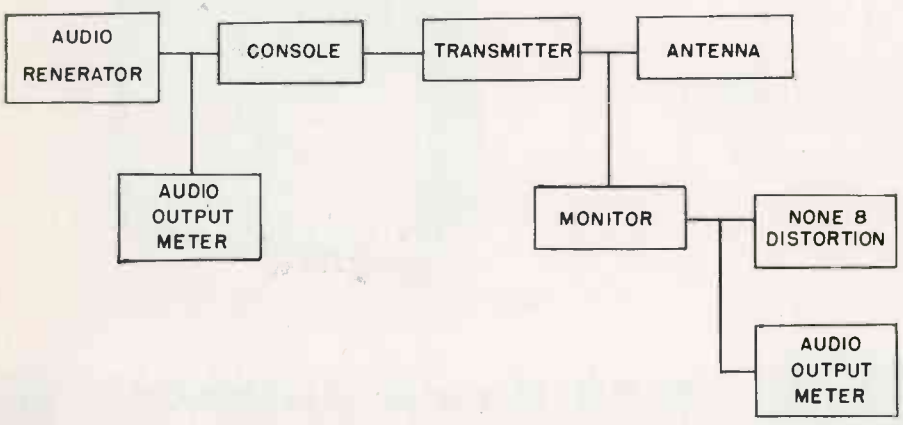


Figure 1. Block diagram of typical proof-of-performance equipment line-up.

FM Proof of Performance

In order to obtain a station license, a proof of performance must be filed. This requires the broadcaster to analyze the operation of his complete system from the console through the transmitter with respect to audio frequency response, noise and distortion. Figure 1 presents a typical arrangement of equipment for providing this series of measurements. It will be seen that the audio level required to achieve 100%, 50% and 25% modulation at the audio frequencies of 50, 100, 400, 1000, 7500, 10,000 and 15,000 cycles must be noted and recorded. The noise and distortion measurements at the output of the frequency monitor for these various levels and frequencies are also recorded.

Figure 2 shows a typical set of forms for making these reports, and the FCC's limits.

It is necessary at this point to refer to Figure 2A which shows the 75 microsecond pre-emphasis curve. By referring to this curve it may be noted that 17 db less audio signal is required at 15KC than was neces-

AUDIO FREQ.	V_1 100% MOD.	50%	25%	DISTORTION 100%	50%	25%
50						
400						
1000						
5000						
7500						
10000						
15000						

Figure 2A. Common way of showing measurement results.

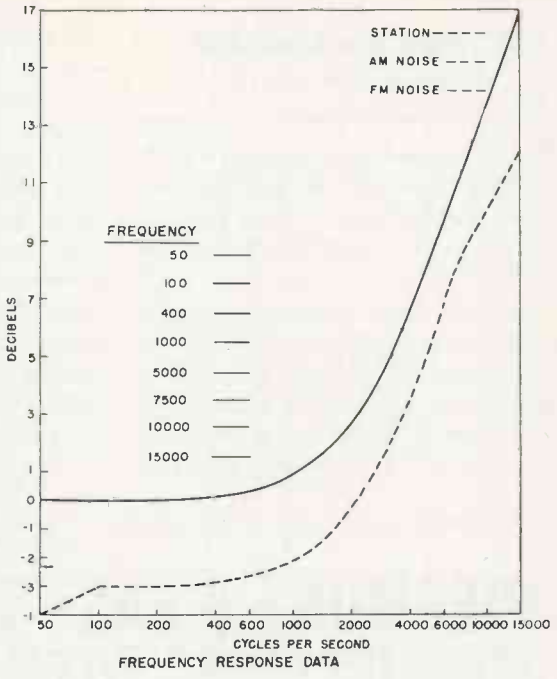
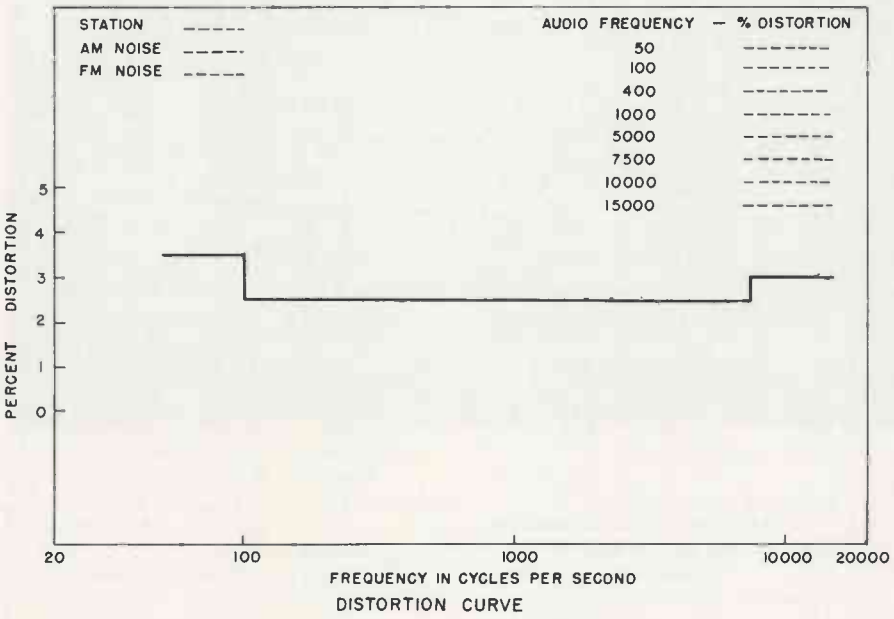


Figure 2B. One method of plotting frequency response data.

Figure 2C. Typical distortion curve.



sary at 400 cycles to produce 100% modulation of the carrier. Thus when the engineer completes his proof of performance, he should not be alarmed to find that less signal is required at higher frequencies than that which is required at the lower frequencies to achieve the same modulation. This pre-emphasis of the high frequencies has been incorporated as an FCC standard in FM broadcast systems to increase the signal-to-noise ratio in the transmission of higher frequencies, because it is considered that the average program represents an extremely low level of high frequency information. At the receiving end of an FM system the converse is true and a de-emphasis circuit is incorporated which returns the program material to its original proportions.

Two other items are required to complete the FM proof of performance. One is the determination of *FM* hum, while the other is determination of the *AM* hum. The former is achieved by modulating the carrier 100% at 400 cycles, and measuring the audio output from the monitor terminals. This tone is then removed, and the ratio of the remaining signal to the original 400 cycles is the FM noise. The FCC insists that this ratio be at least 60 db.

The AM noise is determined either by utilizing the technique described in the instruction book associated with your particular FM broadcast monitor, or by utilizing the circuit described in Figure 3. In any event, this measurement is a comparison of the AM modulation of the carrier with the RMS value of the carrier itself. The FCC requires that this ratio be at least 50 db. If stereo broadcasting is employed the proof of performance requirements are more complicated. This will form the basis for a subsequent article.

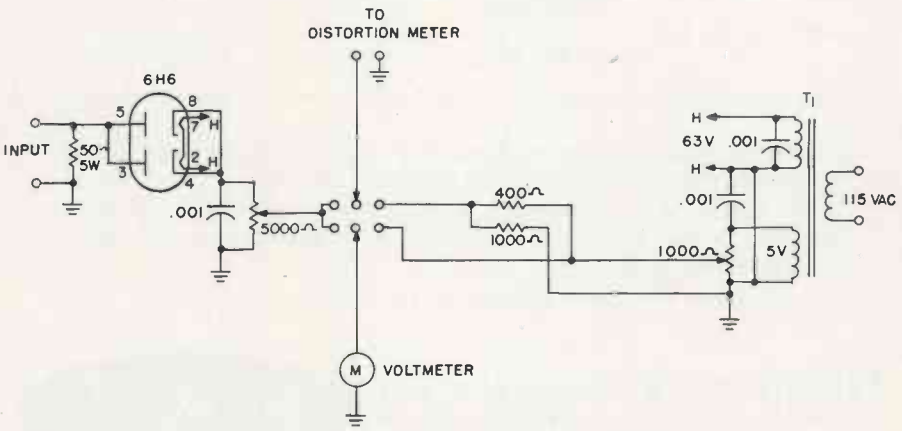


Figure 3. AM noise detector circuit.

TV Tape Fundamentals

(Continued from page 10)

trol track signal and capstan speed. It must, therefore, be tightly controlled. A 3-phase winding permits tighter phase control with less power.

(9) The head tachometer signal is used to generate the master control signal recorded on the control track of the tape, and to develop the initial power reference for the capstan motor. The signal indicates the relative position of the heads (controlled by the head motor), and the longitudinal position of the tape (controlled by the capstan motor). The Ampex tachometer employs a timing ring (painted black over 180 degrees and white for the other 180 degrees), in conjunction with an exciter lamp and photoelectric cell. The output of the P.E. cell corresponds in frequency to the nominal 240 rps of the motor. The leading edge of the square wave bears a direct time relationship to the head in contact with the tape.

The RCA method employs a "tone wheel" with a notch which breaks the magnetic path when passing across the tone wheel head. The resultant pulse is converted to a square wave by means of a multivibrator.

Since the 240 cps square wave derived from the headwheel speed is the servo phase comparison (5-B) with the 240 derived from vertical sync (reference pulse), the particular head in contact with the tape at the leading edge of this pulse is that which will be recording vertical sync. Thus the physical orientation of the timing ring (Ampex) or the tonewheel (RCA) notch relative to the head determines which of the four heads will record vertical sync. This servo action (see Note (5) above) also assures that each picture field occupies exactly 16 complete transverse tracks on the tape. (Each revolution produces 4 tracks. This is ¼ field, so 4 revolutions = 1 field = 16 tracks).

(10) The control track head records a sine wave derived from the headwheel speed. The filter (5-E) converts the 240 multivibrator signal (5-D) into a sine wave which is recorded as a control track to be used in playback timing information.

(11) The capstan motor drive amplifier receives 60 cps information derived from the headwheel speed (D and F of 5) and provides amplification to the 2-phase power necessary for the capstan motor. Thus the capstan is electronically coupled to the rotation of the video heads.

(12) The phase stability requirements for the capstan motor are not as severe as the head motor. Therefore, a 2-phase synchronous motor which is phase locked to the rotating heads is practical.

It should be understood at this point that the method of attack in system functions is, in some instances, quite different between Ampex and RCA practice. Except where noted, the discussions under *recording* as well as the following *playback* description are general in nature rather than specific. The practicing engineer in the field will readily recognize the basic system functions as they apply to his system.

Raytheon-Machlett Tube Reaches 19,800 Hours at WGAL, Lancaster

WGAL-TV has just logged in the longest tube life ever achieved in the visual modulated amplifier of its 50 KW transmitter. At 19,800 hours the Raytheon-Machlett 7007 tube has operated more than twice as long as any previous tube in this position.

WGAL-TV, maintaining the high average transmitter power required for color transmission, found the durable 7007 tube consistently easy to drive and broadband. This pioneer station began operations in March, 1949, and now telecasts on Channel 8 at 316,000 watts.

Available through your Raytheon distributor, Raytheon-Machlett tubes set new standards in superior performance for commercial telecasters.

DISTRIBUTOR PRODUCTS DIVISION

Westwood, Massachusetts

RAYTHEON

ALL-PURPOSE
SUPER UNIVERSAL ZOOMAR
Optically Improved 100%

Otis Freeman gets the First!

TELEVISION WPIX CHANNEL 11

WPIX inc · 220 East 42nd St., New York City 17

OTIS FREEMAN
VICE PRESIDENT IN CHARGE
OF ENGINEERING

Mr. Jack A. Pegler
Television Zoomar Company
500 Fifth Avenue, Room 2223
New York 36, New York

Dear Jack:

Congratulations are in order for your new lens creation - - the Super Universal Zoomar with improved optics.

Since we purchased the first one off the line it has performed in a very commendable manner for us. We used it with great success at the recent track meets in Madison Square Garden, and at the WPIX-11 pool feed origination of the reception and banquet at the Waldorf-Astoria Hotel for Marine Astronaut John Glenn. We believe it will serve us well when we start our exclusive coverage of the World Champion New York Yankee baseball telecasts within the next few weeks.

As one of the oldest television stations, in the most competitive market in the country, Channel 11 has pioneered in many facets of programming and engineering. Much of this success may well be attributable to the fact that early in television we saw the inherent value on using Zoomar lenses - - way back in 1948.

In this new lens, the improvement made by Dr. Bach is quite apparent, and we believe it adds a new dimension in broadcasting.

Sincerely,

Otis Freeman

OF/cm

JACK A. PEGLER BILL PEGLER

TELEVISION ZOOMAR COMPANY 500 Fifth Avenue, Room 5520 • New York 36, New York • BRyant 9-5835

Cable address PEGTELZOOM

Television Zoomar, the originator — 15 years of specialization in the manufacture of ZOOMAR LENSES for Television

OVER 600 ZOOMAR LENSES USED AT TELEVISION STATIONS AROUND THE WORLD

Engineer's Exchange

The Perfect Equipment Case

By Joseph D. Coons
President and General Manager
WOHI-WOHI FM, East Liverpool, Ohio

It's sad but true that station managers look at equipment from a different point of view than chief engineers; however, both objectives are satisfied with these simple boxes we have made here at WOHI and WOHI-FM. I wanted to cut down the rebuilding expenses for our microphones which, it seemed, always appeared and sounded as though they had been dropped from ten story buildings. George Kelly, our chief engineer, was anxious to keep our mikes sounding good, and provide some means by which our better equipment could be used for musical pickups without danger of damage. We have achieved the results desired with these cases, and are thoroughly satisfied.

Figure 1 shows the boxes as they look when packed for a job. Each complete kit consists of a top unit, which carries cables, phones, tools, hook-up wire, extension cords, etc. In addition, there are as many other units snapped on as there are microphones needed on the pickup. Two saltshaker mikes require one saltshaker box, while each of our much used 77-D or 44-BX mikes rates a container all its own. Since each box has its own feet, and has latches exactly matching all other cases, the interchangability is complete and useful.

The cases are cheap. We made two cable cases and seven microphone cases from one sheet of half inch plywood, four feet by eight feet. Hardware cost about as much as the plywood, bringing the total to about $15-18 for the works.

When buying hardware, get sturdy suitcase latches and use piano hinge for the top, as well as a king-size handle that will take the rough and tumble of remote pickup use. We slapped on only one coat of grey paint, figuring they'd need more soon, anyway. That was two months ago, and we were right. They need it again!

The inside of each microphone

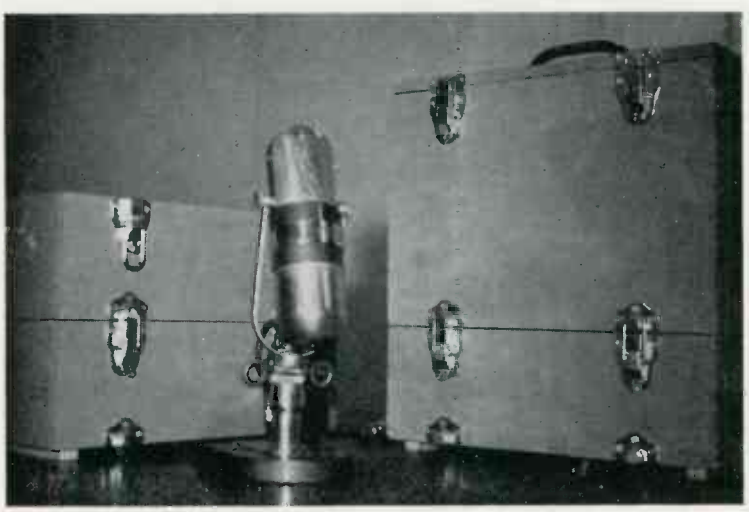


Figure 1

Figure 2

box is lined with one inch thick foam purchased at a fabric and sewing center. It is not glued in; each piece simply was cut a little oversize and squeezed in.

Incidentally, we cut all the bottoms at once, all the sides at once, etc., counting on mass production to keep the dimensions the same. It did. Sides and bottoms were nailed with finishing nails and glued, with the sides getting two 1½" x No. 6 flat head screws to boot just for an extra margin of safety. The length, width and height are all one inch longer than the respective dimensions of the microphones. The feet, which also help each box interlock with the next and protect tabletops from the latch tongues were cut from a piece of ½ x ¾-inch pine.

Construction of the boxes themselves took about four hours for the nine we made; mounting all those catches took another four hours. It was well worth the effort. Even I'm happy!

Nasal Troubleshooting

By Hampton C. Clark, Jr.,
CE, KMRC, Morgan City, La.

A few days ago, something kicked our 500 watt Gates transmitter off the air. Upon opening the back door of the transmitter, my first observation was the unmistakable scent of cooked mouse, including hide and all. The clue to the problem was the mouse scent.

Many transmitter troubles are caused by wasps or other flying insects clustering inside coils containing high RF potentials. Each insect has his unmistakable odor, especially when fried to a crisp! Some blown fuses are caused by various types of lizards. Each type of little creature has his own preferences as to what part of a transmitter he chooses to locate in, and by use of one's nose, repair time can frequently be cut in half, or even quartered. By identifying the type of creature that caused the difficulty, one immediately knows what portion of the transmitter should be checked for a charred carcass.

There may be some engineers who will take exception to this form of trouble shooting, but in support of this method, I would like to mention a few other common transmitter troubles which are frequently solved by the sense of smell. Consider the case of a burned up resistor—anyone who has ever worked on radios can easily detect the sharp scent of a burned resistor. Then what about a selenium rectifier which has gone bad? One can identify a bad selenium rectifier immediately by smell alone. If you have more than one selenium rectifier, all you have to do is to go around sniffing each one until a particularly pungent odor is detected, then replace that one. An ohm-meter is unnecessary.

A transformer which has been overloaded and burned has a characteristic odor. Sometimes a bad transformer can be located by visual inspection, where tar or sealing compound has melted and run out on the chassis. However, this method is not infallible, because frequently a temporary overload causes melting, and the transformer is good. However, the smell of a burned transformer is positive proof of a bad transformer.

In a transmitter, there are several types of insulation. Burned plastic has a different scent from burned rubber. Even burned copper from an arc has a scent which, while not lingering as long as some other scents, can be a valuable aid in location of the trouble if the trouble shooter wastes no time in getting on the trail.

"CONRAC Performs Perfectly...And Keeps On Performing."

Says LEE BERRYHILL, Chief Engineer KRON-TV, SAN FRANCISCO

Mr. Berryhill has been around the broadcasting industry a long time. His experience has led him to set high standards when it comes to the quality and reliability of precision engineered products. Because his station's monitoring equipment has to fill a vital role in the efficient functioning of KRON-TV's control studios day after day, he selects the best performing monitors. He selected CONRAC because – as he says – "With CONRAC I get a good balance of performance that is high in quality and uniformity and low in maintenance."

FROM 8" THROUGH 27", BROADCAST AND UTILITY, EVERY CONRAC MONITOR HAS A COMBINATION OF UNIQUE FEATURES.

- Video response flat to 10 megacycles
- DC restorer with "in-out" switch
- Selector switch for operation from external sync
- Video line terminating resistor and switch

CONRAC MONITORS ARE DISTRIBUTED BY RCA, GENERAL ELECTRIC, AMPEX, AND VISUAL ELECTRONICS.

CONRAC DIVISION GLENDORA, CALIFORNIA
GIANNINI CONTROLS CORPORATION

Makers of Fine Fleetwood Home Television Systems / Telephone: Covina, California, EDgewood 5-0541

Book Reviews

ABC's of Ultrasonics

By Alan Andrews. Catalog No. ULT-1. Published by Howard W. Sams & Co., Inc., Indianapolis, Ind. 96 pages. Price: $1.95.

ABC's of Ultrasonics, gives the reader an over-all look at ultrasonics, the science of putting sound to work. This truly amazing development — even in today's age of miracles — is performing jobs ranging from cleaning tiny watch movements to huge missile cases; from homogenizing milk to relieving lumbago; from measuring the thickness of material to locating schools of fish.

The first chapter introduces the reader to ultrasonics. It explains the frequency range of ultrasonics, the terminology, the two types of wave behavior (cavitation and echo ranging), plus applications such as cleaning, degassing, thickness and distance measurement, testing, machining, welding, and soldering. Also covered in this introductory chapter are medical uses for ultrasonics, and how sound waves above the normal audible range are employed in alarm systems and liquid-level indicators.

Thoroughly explained are how waves are produced, how transducers work, their two main categories (magnetostriction and piezoelectric), and the FCC regulations pertaining to ultrasonics. Subsequent chapters describe and amplify the topics — waves, transducers, electronic circuitry, cavitation applications, tests and measurements, and miscellaneous applications. Also included are descriptions and photos of specific commercial equipment used for various applications.

RCA Receiving Tube Manual

RC-21. Published by Electron Tube Div., Radio Corp. of America, Harrison, N. J., Nov., 1961. 480 pages.

A new RCA Receiving Tube Manual is now available. The latest edition, the RC-21, is the largest yet and continues as the most complete and authoritative reference in its field. With this printing, total sales since the introduction of this

well-known series will pass the four-million mark. Although this edition has grown to a record 480 pages, the price is still only one dollar.

This new edition has technical data on over 900 receiving tubes including nuvistor, novar, and other new tube types. Data are also here for more than 100 types of black-and-white and color picture tubes.

The Manual's text material on electron tube theory, installation, application, and interpretation of tube data has been augmented in coverage in its well-known, easy-to-understand style. A new receiving-tube chart has been added to aid in the selection of tube types for specific applications. The Picture-Tube Characteristics Chart is also completely new. Both charts have been designed to make them easier to read and more convenient to use.

The popular Circuits Section has been expanded and now includes 26 circuits. The section includes several broadcast receivers; a 144-Mc receiver and a 10-meter nuvistor preamplifier for amateur radio applications; two 2-channel stereo amplifiers; five amplifier circuits, several using novar types; preamplifier, mixer, and tone-control circuits; a code-practice oscillator; an intercom set; and an electronic volt-ohm meter.

Copies of the new RCA Receiving Tube Manual, RC-21, may be obtained from RCA tube distributors, or by sending $1.00 to Commercial Engineering, Electron Tube Div., Harrison, N. J.

Auto Radio Manual

Volume 13, Catalog No. AR-13. Published by Howard W. Sams & Co., Inc., Indianapolis, Ind. 160 pages. Price: $2.95.

Volume 13 of Howard W. Sams Auto Radio Manual Series covers 50 models used in late model cars, including foreign cars. Like previous manuals in the series, Volume 13 includes PHOTOFACT® Standard Notation Schematics, resistance charts, chassis photos, parts lists and replacement data, alignment information, push-button adjustments . . . plus much other time-saving material.

Industry News

Visual Appoints New Field Engineering Supervisor

Robert Bollen, formerly of Allen B. Du Mont Laboratories, has been appointed field engineering supervisor for Visual Electronics Corp., New York, N. Y.

The announcement by James B. Tharpe, Visual president, explained that Bollen will supervise application engineering and field engineering of installations by the firm. He will additionally coordinate the specialized technical systems for AM, FM, and TV studio and transmitter installations in the field. Assisting him will be Visual's field engineering staff, Tharpe stated.

Two New Appointments Announced by Amperex

Two new appointments have been announced by Amperex Electronic Corp., New York, N. Y., according to Irwin Rudich, manager, semiconductors and special purpose tubes.

Larry May was appointed to the position of product specialist, entertainment, semiconductor and special purpose tubes. He will be responsible for the introduction, preparation of specs and sales of electron tubes and semi-conductors to TV, radio and the hi-fi industries.

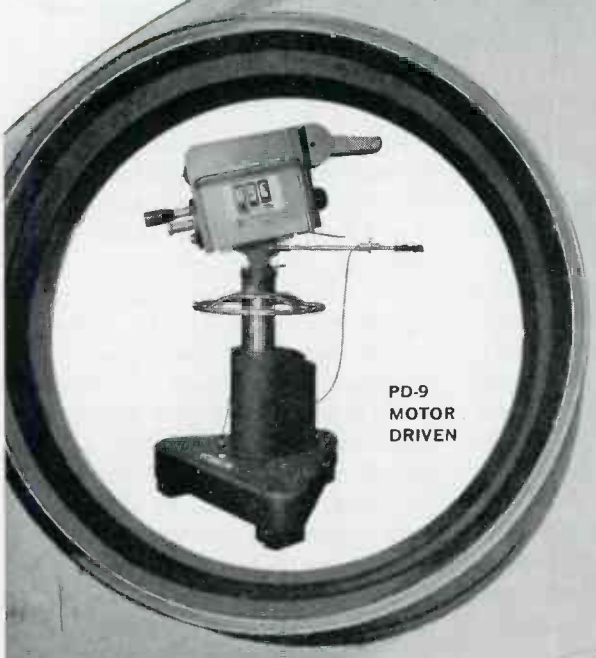
The second appointment is that of Martin Wolpert as commercial engineer, semiconductors. He will be responsible for product specifications, liaison with manufacturing, engineering and field sales, and will operate from the company's semiconductor plant in Slatersville, R. I.

Bogen-Presto Appoints Sales Representative

Bogen-Presto Div., Siegler Corp., Paramus, N. J., has appointed Pat Aylward & Co., Minneapolis, Minn., as factory sales representative for all Bogen products in Minnesota, North Dakota, South Dakota and western Wisconsin, according to an announcement made by M. S. Sumberg, director of sales for sound and high fidelity products.

Aylward will handle Bogen hi-fi tuners, amplifiers, receivers, transcription players, turntables, intercoms, public address and school systems.

3 NEW WAYS TO AUTOMATE YOUR STUDIO



PD-9
MOTOR
DRIVEN

PD-7 ELK
ELECTRO-LIFT
KIT

MCH-6
REMOTE
CONTROL

PD-9 Silent maneuverability... up, down and dolly shots ...with the cameraman in complete control every instant. Raise or lower (19" travel) electrically while dollying and without stooping. Lets the cameraman concentrate on the big picture. For color or monochrome cameras.

PD-7 ELK Transform your easy-glide PD-7 pedestal to full automatic up-down control with the new Electro-Lift Kit. Installs as quickly as you can tighten four bolts, with no machining or drilling. A real low-budget improvement to every studio's operation.

MCH-6 This fully automatic remote-control camera head operates pan and tilt. Control panel is planned for remote operation of lift, diaphragm setting, zoom-lense and focus...all done as if you were behind the camera! Three years in development under commercial studio conditions. Adds a new dimension to closed-circuit TV.

Westwood Division / Houston Fearless Corp.
11851 West Olympic Blvd., Los Angeles 64, California

Give me a fast dissolve to the commercial.

☐ PD-9 ☐ PD-ELK ☐ MCH-6 ☐ FILM PROCESSORS

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

WESTWOOD DIVISION HOUSTON FEARLESS CORPORATION, LOS ANGELES 64, CALIFORNIA

Industry News

Realignment of Ampex Field Organization

Realignment of the nationwide field organization, including appointment of seven new regional managers, has been announced by John Jipp, vice-president, sales and service, Ampex Corp., Redwood City, Calif. The realignment places all company products under the regional managers, each of whom will report to the national sales manager, C. Kenneth Sulger, and is responsible for all sales and service activities, including regional staff, manufacturers representatives, dealers and distributors, in his respective region.

The new regions and regional managers are:

Northwestern (northern California, Oregon, Washington, Nevada, Idaho, Montana, Wyoming, Utah), Charles H. Wirth. Southwestern (southern California, Arizona, Hawaii), A. A. Stroka. South Central (Colorado, New Mexico, southern Kansas, Oklahoma, Texas, Arkansas, Louisiana), Charles E. Norton. Midwestern (North Dakota, South Dakota, Nebraska, northern Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Michigan, Indiana, Ohio, Kentucky), George S. Shoaf. Southeastern (Tennessee, North Carolina, Mississippi, Alabama, Georgia, South Carolina, Florida), William Craig. Mid-Atlantic (Virginia, West Virginia, Maryland, District of Columbia, Delaware), William W. Follin. Northeastern (New York, New Jersey, Connecticut, Pennsylvania, New Hampshire, Vermont, Maine), John R. North.

Half-Speed Operation of TV Tape Recorders

A new engineering advance that enables television tape recorders to operate at half the conventional speed, thereby doubling the amount of information that can be recorded on a given length of magnetic tape, has been announced by Radio Corp. of America, New York, N. Y.

The lower tape speed of 7½ inches per second will reduce tape usage and cost by 50 per cent and should bring video recording within the economic means of a wider group of users, according to C. H. Colledge, a division vice-president. RCA TV tape recorders converted to the slower speed also will continue to be capable of operating at the conventional tape speed of 15 inches per second, Colledge pointed out.

It was further stated that development of a new headwheel assembly, the recording/playback heart of a TV tape recorder, made it possible to reduce operating speed while retaining the high level of reproduction quality. In video recording, revolving heads place video information on tracks running laterally across the tape's width. The new recording head covers a track only 5 mils wide, as compared with the present 10 mils, to deposit the same volume of information at half the former tape speed. Colledge reported that RCA has protected the interchangeability feature wherein tapes recorded on one quarduplex machine may be played back on any other.

Beginning in May, RCA will make deliveries of the accessories required to convert two types of its TV recorder line to the new operating mode—the TRT-1B, a standard broadcast model, and the TR-11, a compact version popular among closed circuit TV users.

Allied Electronics Names Three New Product Managers

Three executives of Allied Electronics Corp., Chicago, Ill., industrial sales subsidiary of Allied Radio Corp., have been named product managers with responsibility for selected electronic components. A. D. Davis, Allied president, said the appointments of George Seykoski, Herman Baron and Ronald Kramer to the newly-created positions are part of the company's program of further concentration on industrial electronics as distinct from consumer market distribution.

Seykoski formerly was product merchandiser and has been with Allied 15 years. He becomes product manager for connectors, electronic hardware, test equipment, transformers, wires and resistors. Herman Baron, who joined the company a year ago as merchandise controller of industrial components, will serve as product manager for capacitors, relays and switches.

Kramer, with Allied for five years and formerly a product merchandiser, will handle semiconductors, special purpose tubes, and cooling devices.

Harold Ross and Melvin Bransky have been appointed assistants to Seykoski; Merrill Rosenbaum, assistant to Baron; and Richard Goldstein, assistant to Kramer.

Marketing Manager Post To William L. Cara

Stancil-Hoffman Corp., Hollywood, Calif., has named William L. Cara as marketing manager for the entire line of the corporation's production. Cara, who has been active in magnetic recorder merchandising for 14 years, recently resigned from Ampex Corp., where he had served seven years. He was an executive in Ampex International for the past four years.

In addition to marketing of the company's standard lines, Cara will also coordinate the military sales activity to service the missile and satellite programs which require the company's miniature and subminiature magnetic recording equipment.

Fred R. Green Named as Sterling Chief Engineer

Fred R. Green has been appointed chief engineer of Sterling Information Services, Ltd., according to an announcement by Charles F. Dolan, president.

Green will supervise the installation of a closed circuit television system to hotels in New York City, which will link studios at 43 W. 61 St. to mid-Manhattan hotels via a half-inch coaxial cable in the existing ducts of the Empire City Subway Co.

Sterling Information Services was granted a franchise recently to provide a televised guide to entertainment and shopping attractions to New York hotel guests.

Adler Electronics Expands Facilities

Adler Electronics, Inc., New Rochelle, N. Y., a producer of transportable and fixed communications systems, has expanded its production plant in Pelham, N. Y., by 45,000 square feet. The new facilities will enable the company to keep pace with its growing volume of business.

Industry News

FM Station Uses New RCA Transmitter

Station WJEF-FM, Grand Rapids, Mich., is using the new high-power FM transmitter developed by Radio Corp. of America, New York, N. Y., to cast its 500,000-watt voice across a broad listener area in the midwest.

On the air with increased power since early fall, Fetzer Broadcasting Co.'s newly-equipped outlet teams the 50-kilowatt transmitter with an RCA 12-bay, high-gain antenna to give it a half-megawatt of effective radiated power, according to Carl E. Lee, Fetzer executive vice-president. The FM antenna is mounted at the 800-ft. level of the 1,000-ft. tower used by Fetzer television station WKZO-TV, and located midway between Kalamazoo and Grand Rapids.

C. H. Colledge, RCA division vice-president and general manager, said the WJEF-FM installation marked the first commercial use of RCA's new high-power transmitter for FM broadcasting. He also pointed out that all FM transmitters produced by RCA since 1948 have built-in capability for transmitting stereo and can be readily converted with the addition of a sub-carrier generator. WJEF-FM is presently installing equipment to adapt its transmitter to provide listeners with the new stereo broadcast service.

Visual Announces Two New Appointments

The appointment of George H. Wagner to the newly-created position of marketing manager for Visual Electronics Corp., New York, N. Y., has been announced by James B. Tharpe, president. Wagner, formerly sales manager for the instrument division of Allen B. Du Mont Laboratories, joins Visual after serving 15 years in various sales and engineering capacities in the broadcast and communications fields. In the new position he will be responsible for the overall marketing program, the sales and the services of the company's regional and branch offices across the country. His headquarters will be in the firm's executive offices in New York City, and he will be assisted by the headquarters staff for advertising promotion and order service, in addition to the various regional and branch managers.

Announcement was also made of the appointment of Charles E. Spicer as general manager for the TV automation systems division, in which capacity he will supervise the design, installation and servicing of all Visual automation programming systems for TV, AM and FM stations throughout the country. He will be assisted by the design engineering staff of automation systems specialists, and newly established automation application engineering group. Spicer will also be responsible for the coordination of system requirements to assure that all technical facilities provided for automatic operation integrate directly with the operation of traffic, accounting, and sales departments.

Two Fellows Scholarships For 1962-63 School Year

The Board of Directors of the Assn. for Professional Broadcasting Education has voted to award two Harold E. Fellows scholarships of $1,000 each during the 1962-63 school term.

The APBE administers the scholarships established by the National Assn. of Broadcasters in memory of its 16th president who died in office in March, 1960.

Employees or the children of employees of radio or television stations or networks which are members of the NAB are eligible for the scholarships. They may be used for courses of study in radio and television at any of the 60 colleges and universities that belong to the APBE.

Vitro Awarded Sugar Plant Engineering Contract

Vitro Engineering Co., a division of Vitro Corp. of America, New York, N. Y., has been awarded a contract for preliminary design and engineering of a large beet sugar factory for Red Valley Sugar Co., Drayton, N. D. The contract also includes cost, feasibility and marketing studies. The plant, to be located in the Drayton area, will be sized to process approximately 300,000 tons of beets yearly.

RCA 50-KW IN NEW YORK CITY UHF-TV TESTS

For its UHF tests in New York City the FCC is using a high-power transmitter designed and built by RCA. The most powerful of its kind, this 50-KW UHF transmitter consists of two TTU-25's in parallel. It operates on channel 31 and is installed on the 80th floor of the Empire State Building, where seven other channels serving the metropolitan area are located.

The work was performed under a contract awarded RCA by the FCC on March 1, 1961. The award was made based on considerations of power consumption, tube replacement and experience in equipment installation, as well as general performance and cost.

RCA also supplied the studio equipment to WNYC (the New York City-owned station) which will handle programming for the FCC outlet. This includes four TK-12 4½ inch I.O. Cameras, a film system with TK-21 Film Camera, TP-11 Multiplexer, TP-6 Film Projectors, TP-7 Slide Projector, and a TRT-1B Television Tape Recorder.

This same RCA experience and equipment are available to all those who seek for leadership in the field of television broadcasting.

RCA BROADCAST AND TELEVISION EQUIPMENT
CAMDEN, N.J.

RCA®

The Most Trusted Name in Television

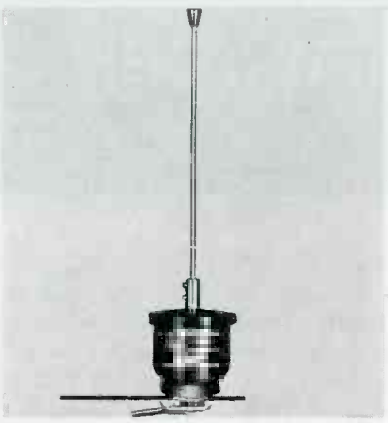
Product News

IMAGE INTENSIFIER ORTHICON TUBE

Radio Corp. of America, 30 Rockefeller Plaza, New York 20, N. Y., has announced the development of an image intensifier orthicon tube that will permit the operation of television cameras in the dark.

According to the manufacturer, the new tube is a combination of an image tube and an image orthicon tube; the image tube section is similar to the image tube used in the infrared sniperscope (night vision weapon sight), but is made sensitive to visible light instead of infrared; the image orthicon section is similar to the standard camera tube used in commercial TV systems.

An optical image of the scene to be viewed is formed by a lens system on a semi-transparent photosensitive surface on the front end of an image tube. The photons impinging on this surface cause it to emit electrons. These photo-electrons are then focused and are at the same time accelerated at a very high voltage onto a phosphor screen at the other end of the image tube. The impact of the photo-electrons causes the phosphor to radiate visible light. Thus a picture is formed on the phosphor screen which is a reproduction of the image projected on the photo-sensitive surface but up to a hundred times brighter. The light from this phosphor screen of the image tube then energizes the photocathode of the image orthicon tube. The image tube and the image orthicon are all enclosed in one glass envelope thus constituting the image intensifier orthicon tube. The electronic output from the image orthicon part of the tube is used in the same way as in standard television and the intensifier image is displayed on a conventional television picture tube.



NEW ROOF TOP ANTENNA

GAM Electronics, Inc., Manchester, N. H., has specifically designed a mobile antenna for the top of any car or in places where space is at a minimum.

The miniaturized TG-2-R features a mount that enters the roof only ⅜-inch, and is said to eliminate old-fashioned upholstery removal techniques for antenna installation. The unit utilizes a half-wave radiator with matching transformer which is an integral part of the system. According to the manufacturer, it will get marginal signal, eliminate dead spots, cut down on picket-fence effect, and yield 6 db gain (co-axial as a reference antenna), and any type of roof mounting structure (wood, plastic, metal, etc.) will not affect the performance.

MIKE-CASTER WIRELESS MICROPHONE

Federal Mfg. & Engineering Corp., 1055 Stewart Ave., Garden City, N. Y., has introduced the new Victoreen wireless microphone system, model 421D, which is said to represent a major breakthrough in miniaturized FM equipment. The system is based on the Victoreen method of operating crystal-controlled oscillators at high frequencies and directly frequency-modulating them. The same principle is used in the companion, miniature receiver, using crystal control of dual conversion oscillators.

The transmitter weighs 10 oz. including mercury batteries good for 30 hours continuous use, and requires only short, soft antenna wire which may be carried in the clothing. The omni-directional, high-quality dynamic button-mike leaves the user's hands free; the unit works equally well with any low-impedance hand-held or lavalier mike.

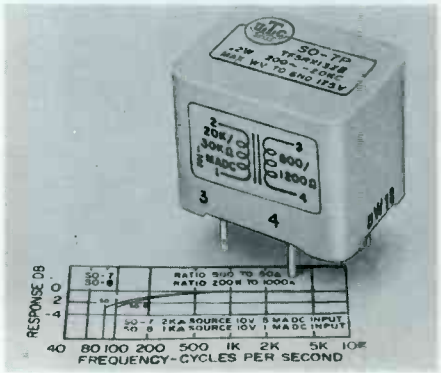
Model 421 has F.C.C. type acceptance for licensed use in specific commercial applications, and also is certified under Part 15 of F.C.C. rules for operation without a license. Another unit, model 421A, has F.C.C. type acceptance for use on public safety frequencies and operates within the new, narrow-band regulations. Both transmitter and receiver are said to be easily serviced with readily available standard replacement parts.

LOW-NOISE, SOLID-STATE PREAMPLIFIER

The Nems Clarke SSP-101, a new low-noise, solid-state preamplifier for telemetry applications, has been developed by Vitro Electronics Div., Vitro Corp. of America, 919 Jesup-Blair Dr., Silver Springs, Md.

The unit weighs 19 oz., has a maximum noise figure of 4.5 db, a gain of 25 db minimum, and is flat across the band at 3 db. Completely solid-state, it is designed for the 225-260 megacycle telemetry range, but can be made to cover bands anywhere between 55 and 300 megacycles.

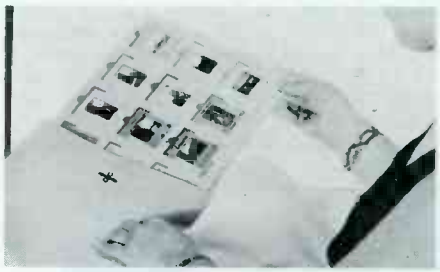
The SSP-101 can be used in any environment and is mounted at the antenna or directly at the coax cable. It operates from its own external 12-volt dc power supply, with a low current drain of 12 milliamperes. The power supply is available for rack mounting and other convenient means.



MINIATURE MOLDED AUDIO TRANSFORMER

United Transformer Corp., 150 Varick St., New York 13, N. Y., has introduced the SO#P and SSO#P miniaturized components featuring high efficiency and wide frequency response.

Designed for both transistor and tube applications, the units are vacuum molded to MIL grade 5, class R, life X specifications, and employ 40 mil deeply anchored pin terminals suited for printed circuit designs. The terminals are said to be strong enough to support the lightweight (approximately .04 lb.) units, and the physical design employs moisture barrier offset construction. Special nickel iron core materials and winding methods are used to provide exceptional performance and reliability, the manufacturer states. Power levels range from 5 to 250 mw, and impedances range from 200 K to 3.2 ohms.

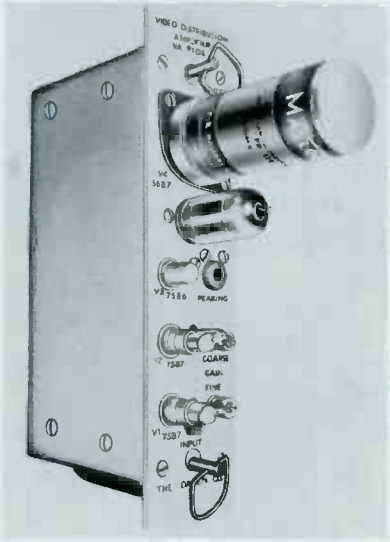


NOTEBOOK STYLE SLIDE FILE

The Vue-File triple purpose slide file, which can be used as a notebook file card, a drawer file card and a slide mailer, is now supplied to fit 2¼ x 2¼-inch slides in 2¾ x 2¾-inch mounts, according to Burke & James, Inc., 321 S. Wabash Ave., Chicago 4, Ill. This is in addition to the 2 x 2-inch for 35mm.

The 2 x 2-inch style holds 12 mounts, and the 2¼ x 2¼-inch style holds six. Either style fits in standard three-ring binders, 8¼ x 11-inch or larger file cabinets, and 9 x 12-inch manila envelopes. Slides can be instantly selected and easily removed and replaced.

Product News



NEW PLUG-IN PRE-AMPLIFIER

A new plug-in pre-amplifier is being offered by Daven Co., a subsidiary of General Mills, Inc., Livingston, N. J. The design employs three RCA Nuvistors, reducing the size of the pre-amplifier to a minimum. Eight amplifier modules plug into one VA-S-101 shelf, using 8¾ inches of vertical panel space. Coarse and fine gain controls on the front panel adjust to full gain. Gain may be varied from one extreme to the other with negligible change in frequency response, the manufacturer states.

Nominal gain is variable from +14 to +26 db and the bandwidth is a flat ±2 per cent to at least 8 mc. Differential gain at one volt out is 0.7 per cent maximum; differential phase at one volt out is 0.35-deg. maximum. The unit has one input and one output, and 60 cps square wave tilt is less than 1.5 per cent. Nominal input level will not exceed one volt out at any gain. The approximate B+ drain is 70 MA or 560 MA per shelf of eight.

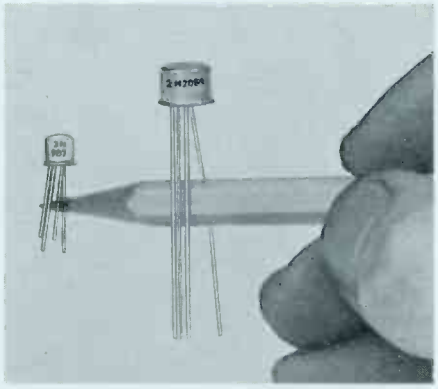
NEW MODEL 750 TURNTABLE

Fairchild Recording Equipment Corp., 10-40 45th Ave., Long Island City 1, N. Y., has developed a new model 750 turntable designed to correct rumble problems in playback facilities.

The 750 is said to be the first 16-inch, three-speed, belt-driven turntable offered to the broadcast industry. The manufacturer states that a new low in rumble of —65 below a 1 kc signal at 5 cm/sec. virtually makes rumble non-existent, and that all the advantages of a belt drive are available with wow and flutter below .03 per cent.

A belt drive system employing a two-speed hysteresis synchronous motor is designed to eliminate belt stretching problems. Speed switching can be accomplished while the turntable is revolving. Speed change and overall turntable operation are quiet, allowing operation very close to open studio mikes, and the unit is said to be ideal for remote control.

Additional features include a 35-lb. aluminum-filled turntable, and front dress plate for mounting controls. Semi-automatic operation is available with the use of the new Third Hand, an automatic attenuator.



AMPEREX UNIVERSAL COMMUNICATIONS TRANSISTORS

Amperex Electronic Corp., Semiconductor and Special Purpose Tube Div., 230 Duffy Ave., Hicksville, Long Island, New York, has announced the 2N987 universal communications transistor, mounted in a subminiature four-pin, TO-18 case. The same transistor, packaged in a TO-33 case, is available as type 2N2084.

PADT Germanium alloy-mesa transistors, both models are said to provide the best characteristics of RF front end and IF types, and feature the combination of high breakdown voltage, high beta and high frequency. They are recommended for use in RF and IF amplifiers in the HF and VHF bands in mobile and airborne communications, instrumentation and radar IF applications. The subminiature 2N987 is particularly suited for portable paging systems, airborne, mobile communications and other miniature equipment where size, weight and space are important.

Both units provide a typical power gain of 14 db at 100 mc, typical beta (h[fe]) of 140, breakdown voltage (BV[cbo]) of 40 V, and an output capacitance (C[ob]) of 2 uuf, are suitable for printed circuits and will replace such types as the 2N499, 2N1224, 2N1225, 2N1395, 2N1396, 2N1745 and 2N1866.

KNIGHT-KIT LAB OSCILLOSCOPE

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., has announced production of the Knight-Kit 10 mc dc laboratory oscilloscope.

The new unit features interchangeable vertical preamplifiers. A dual trace and a high gain preamplifier are optional, and a blank, slide-in chassis is available for those wishing to design their own custom preamplifier. The lab scope kit utilizes steel girder construction, printed circuitry and modular construction.

Technical features include calibrated vertical amplifiers and calibrated horizontal sweep circuits designed to permit quantitative and amplitude measurements to the smallest waveform details. Trigger and amplifier circuits also are dc coupled throughout so that very low frequencies can be displayed. Studs are provided for mounting a camera in front of the screen.

Pulses of fast rise time (40 nanoseconds) can be displayed due to the wide frequency response of the vertical amplifier to 10 mc. Using the dual-trace preamplifier, sensitivity of this vertical system ranges from 50 mv/cm to 20 v/cm. The horizontal amplifier has a frequency response from dc to 2.5 mc with 3 db down, and a sensitivity of approximately 0.1 volt/cm to 1 volt/cm depending on attenuator setting. The attenuator has 10:1 multiplier vernier control.

MODEL 955 CAPACITOR TESTER

The model 955 capacitor tester, designed to check capacitors in or out of circuit, including very sensitive checks for shorts or opens, has been announced by Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City, N. Y. The tester includes a Wien Bridge with a balancing circuit to allow in-circuit capacitor measurements even when shunt resistances are comparatively low.

The 955 measures 0.1 mf to 50 mf capacities at ±10 per cent accuracy at any point on the dial, in or out of circuit. Capacity is read from a 4-inch lucite dial after it has been adjusted to null, in conjunction with the RC balance control, which is calibrated in RC product (equivalent shunt resistance in kilohms × capacitance in microfarads) in two ranges: 0.6 - 10.5, and 7.0 - infinity. Ranges are selected by the RC range switch. The manufacturer states that the wide RC product range provided allows easy setting to any value and is the key to the instrument's accurate capacitance measurements; further, the RC product obtained for out-of-circuit capacitors can be translated into dissipation or power factor by means of conversion charts in the manual. Test frequency is 60 cps. Indications are seen as sharp, bright bar patterns on an electron ray tube.

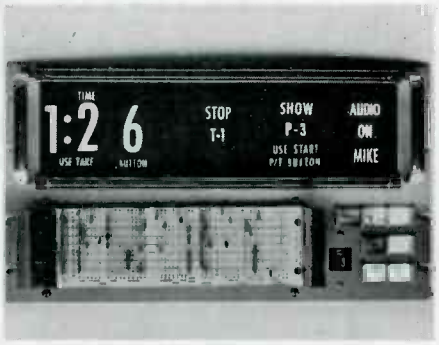
Short tests: In or out of circuit with shunt resistance as low as 1 ohm, short indicated by closed bar on indicator tube; reliable up to 2,000 mf. Test frequency is 60 cps; maximum test voltage is 6.3 volts (open leads), decreasing as impedance decreases. Open tests: Capacitors as small as 15 mmf, in or out of circuit. Shunt resistance in circuits may be as low as 35 ohms for capacitors over 250 mmf, or a minimum of 7,000 ohms for 15 mmf. Opens shown by closed indicator bars. Test frequency is approximately 19 megacycles at very low voltage.

The 955 will operate on ac line voltages from 105 to 130, 60 cps, consuming 8 watts. A line adjust control is designed to permit adjustment to maximum sensitivity for available voltage. Unit is transformer-operated and fuse-protected. Tube complement is one 6C4 and one EM84/6FG6.

FM ANTENNA CATALOG

Andrew Corp., P. O. Box 807, Chicago 42, Ill., has published Catalog B, on its Multi-V FM antenna system. When used in conjunction with Heliax, flexible coaxial cable, the Multi-V provides a matched system with minimum VSWR across the entire channel. The system offers complete flexibility for multiplexing. All electrical specifications shown in the catalog are based on measured data.

Product News

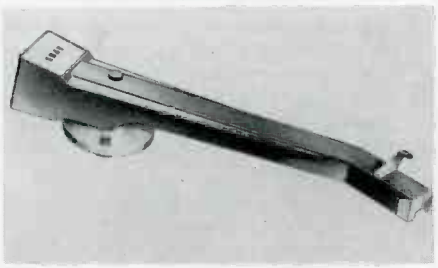


AUTOMATIC PROGRAM-SWITCHING CONTROLLER

An automatic program-switching controller has been introduced by Chrono-log Corp., 2583 W. Chester Pike, Broomall, Pa. Known as STEP (Sequential Television Equipment Programmer), the system is designed to automate the panic period switching during station breaks.

The required switching sequence is set up on a detachable pinboard unit which is then plugged into the STEP console-mounted panel prior to running the break. STEP is said to control video and audio switching of up to eight video tape or film projectors, three slide projectors, three studios, a remote crew or return to network. The unit will also preroll projectors and tape units at the proper time, and stop tape units and projectors. Eleven audio sources can be selected by the controller at the same time as switching video, or independent of the video switching, it was further stated.

Program switching is programmed in STEP in time increments; the minimum increment is one second, the maximum per event is one minute, 59 seconds. A visual display provides indication of what the next event will be as well as the time to go for that event; warning messages are provided when necessary for the operator when on manual control. The unit is said to make possible the programming of an entire day's breaks in advance.



NEW GRAY PROFESSIONAL STEREO TONE ARM

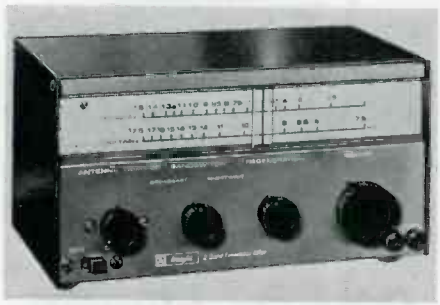
A new professional stereo tone arm, model 208-S, has been announced by Gray Mfg. Co., 16 Arbor St., Hartford, Conn., which is said to incorporate major advances in tracking error theory and features the automatic adjustment of all operating parameters.

According to the manufacturer, the secret of the 208-S's success is its simplicity and the almost unmeasurable friction of its pivot which makes it possible to operate ultra-high compliance cartridges at tracking pressures as low as 7/10 of a gram. The use of

silicone damping fluid offers stability of operation, as well as clean audio response. The unit has only one moving part and the operating tension on the single hardened steel needle bearing is controlled by gravity, so that all operating characteristics remain the same indefinitely.

The cartridge assembly is designed to automatically adjust lateral balance, vertical balance, stylus overhang, and impedance for each cartridge when it is plugged into the arm.

A special model, the 208-S/G, is also offered to allow broadcast turn-around cartridges to be instantaneously interchanged with standard monophonic or stereophonic cartridges. The manufacturer further states that both the 208-S and 208-S/G are calibrated so that cartridges may be quickly exchanged between arms without affecting system performance.



BATTERY-POWERED ALL-TRANSISTOR RADIO KIT

A battery-powered all-transistor AM-shortwave radio receiver for the kit builder has been introduced by Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

The new Knight-Kit, called the DX'er, is designed for the hobbyist and the shortwave listening fan, and a major feature is said to be its adaptability as a fallout shelter receiver. The unit is powered by four 3-oz. penlight batteries, and receives both the standard AM broadcast band from 550 to 1500 kc. and shortwave signals from 7.5 to 17.5 megacycles. The radio is independent of outside power and intended for use with an outside antenna, provisions recommended for shelter receivers by civil defense authorities.

Conelrad frequencies, 640 and 1240 kc., are marked on the AM scale for easy reference. The second scale is designed to permit tuning of international shortwave and amateur radio broadcasts on the 20 meter band—both sources of vital information in case of national emergency.

UPCOMING PROFESSIONAL MEETINGS

BROADCAST ENGINEERING will be glad to publish all notices of technical meetings if sent to the editor at least six weeks ahead of time.

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.

Sept. 28-29: 12th Annual Broadcast Symposium (IRE-PGB), Willard Hotel, Washington, D. C.

Advertisers' Index

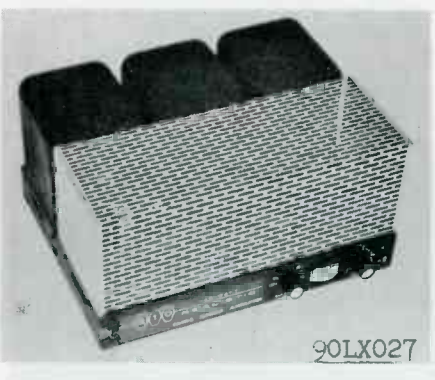
Product News

VIKING 86 STEREO-COMPACT TAPE RECORDER

Viking of Minneapolis, Inc., 9600 Aldrich Ave, South, Minneapolis 20, Minn., is offering the new model 86 stereo-compact tape recorder which features new recording and playback electronics to give it a range of 25-18,000 cps, plus a special heterodyne filter designed to permit distortion-free FM stereo recordings.

The unit uses the Viking transport mechanism; the electronics are totally new. The recording amplifiers and playback preamps are combined in the same package. Independent stereo VU meters are operative in either recording or playback modes. Playback preamplification permits the new model to be used with even the most marginal music system amplifiers, the manufacturer states. Automatic equalization of both recording and playback at either 7½ or 3¾ ips is provided. It is accomplished as the tape speed control is set for either speed, and no further adjustments are required, it was further stated.

Three models are available: ERQ—half-track stereo or monaural recording; half or quarter-track stereo or monaural playback. RMQ — quarter-track recording, stereo or monaural; quarter or half-track playback, stereo or monaural. ESM—half-track only recording and playback, stereo or monaural.



REALISTIC BA-210 POWER AMPLIFIER

Radio Shack Corp., 730 Commonwealth Ave., Boston 17, Mass., has introduced the Realistic BA-210 power amplifier.

The 140-watt, basic stereophonic amplifier is designed to have sufficient power to drive the least efficient commercial system. The unit features a silicon diode full wave voltage doubler power supply, with filter choke and thermal time delay for protection of filters and tube filaments.

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. Eidson Electronic Company, Box 31, Temple, Texas. 9-61 tf

One used model 518-DL, 10,000 watt FM broadcast transmitter including: 1,000 watt driver, interconnecting wiring; complete remote control system; frequency and modulation monitor. Immediate delivery. Capitol Broadcasting Company, Inc., Virgil D. Duncan, Chief Engineer, 2619 Western Blvd., Raleigh, North Carolina. Telephone 919 828-2511. 3-62 4t

10 CM. WEATHER RADAR SYSTEM Raytheon, 275 KW peak output S band. Rotating yoke P.P.I. Weather Band 4, 20 and 80 mile range. Price $975 complete. Has picked up clouds at 50 miles. Weight 488 lbs. Radio Research Instrument Co., 550 Fifth Avenue, New York, N. Y. 4-62 1t

Two used model 450 Ampex tape playback units 3¾ ips half track both direction at $400 each. Two late model 450 Ampex tape units as above. $600 each. One changeover panel silence sensing for item one, $50. Five Magnecorder playback units 3¾ ips half track fast rewind, $125 each. Twenty-five slightly used Browning multiplex tuner receivers $75 each. Several used Harkins and Hershfield multiplex receivers, POR. Several used Seeburg Automatic record players 78 rpm and 45 rpm models with 100 record capacity, POR. Capitol Broadcasting Company, Inc., Woody Hayes Music Division, Woody Hayes Manager, 3207 Clark Avenue, Raleigh, North Carolina. Telephone 919, 834-8474. 3-62 4t

MICROWAVE ANTENNAS — 6′ spun aluminum dish, parabolic, Andrews No. 2006 W/T 4 mounting bracket, de-icer and dipole radiator. New crated for export. $100 complete. One Hundred available. Also rigid line, hangers and fittings. SIERRA WESTERN ELECTRIC, 1401 Middle Harbor Rd., Oakland 20, Calif. TE 2-3527. 4-62 1t

UNUSED TRANSMISSION EQUIPMENT— 1⅝" Andrews, 51.5 OHM Rigid Line, $40 for 20′ length; ⅞" ditto 90¢ foot; 6 foot Dishes with hardware, $150 each. Also Elbows, Reducers, Dehydrators, Hangars, etc., at surplus prices. Write for Stock List. S-W Electric Cable Company, 1401 Middle Harbor Road, Oakland 20, Calif. 4-62 1t

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. 4-62 6t

WANTED: Two Harrison Video Equalizers. Contact Bradley Kemp, Precision Film Recording Services, 5746 Sunset Blvd., Hollywood 28, California. 4-62 1t

We have just converted our two Ampex Videotape recorders from Model 1000-A to Model 1000-C. As a result we now have a number of used, left-over units which were removed in the process. These could be of use as spares to a station still operating the Model "A" machines. We have priced them at approximately one-third of the cost of similar new units. I am listing the ones that we have available, with our price, F.O.B. Chicago, per unit.

Item	Ampex No.	Our Price
Power Supply	50148-01	$150.00
Pre-Amp	13612-01	45.00
Pre-Amp Housing	13690-01	75.00
Record Driver Amp.	13841-01	135.00
Mod-Demod Chassis	13625-01	830.00
Channel Switcher Chassis	50152-01	765.00
Blanking Switcher Chassis	50142-01	350.00
P.E. & Switch Chassis	13617-01	25.00

L. A. PIERCE, WBBM-TV
630 North McClurg Court, Chicago 11, Ill.

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

Technician Class Amateurs: Now a monthly publication for and by technicians. Latest issue. 25¢. The Technician, Box 465, Billings, Montana. 4-62 1t

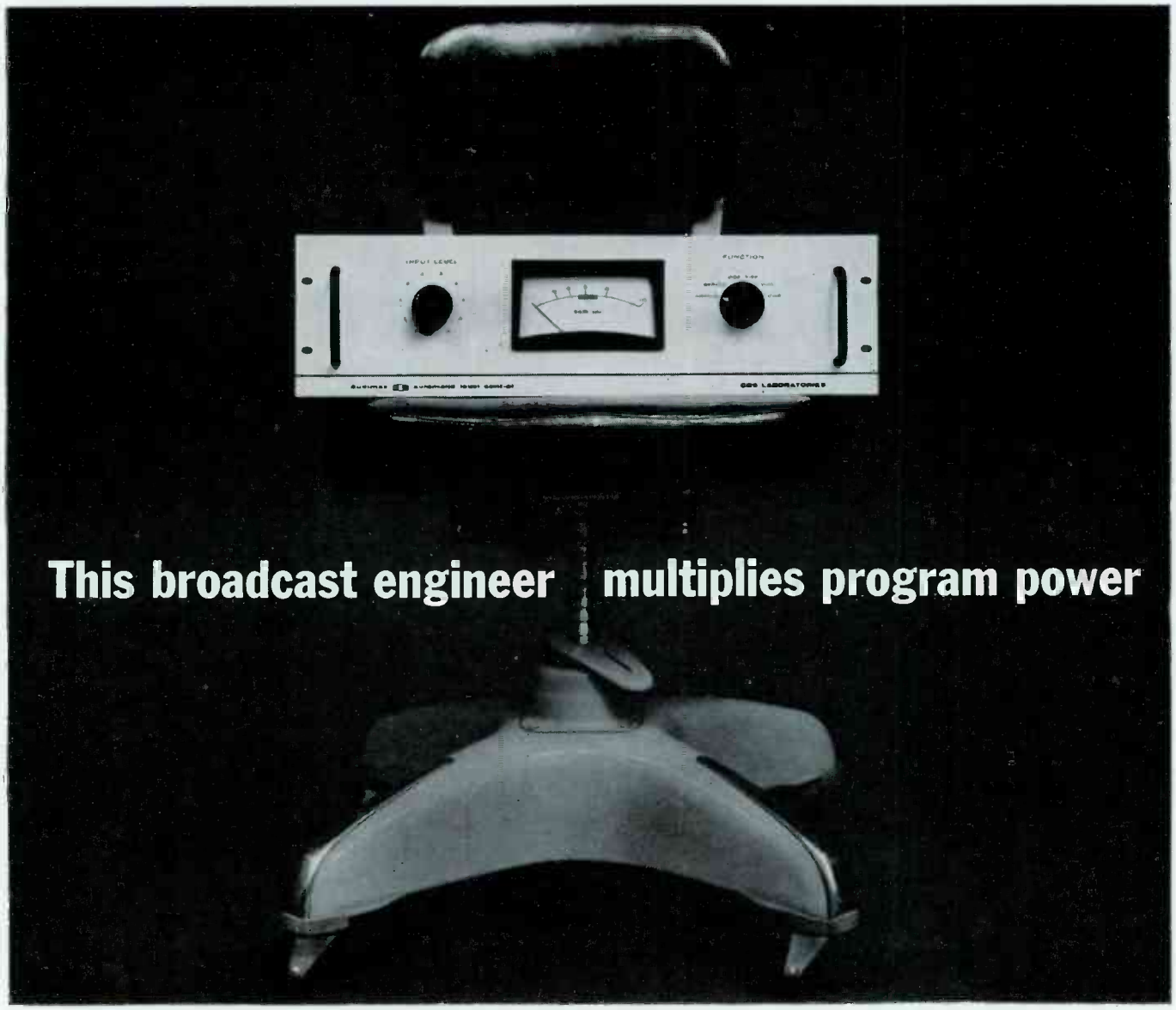
Professional Services

VIR N. JAMES
Specialty
Directional Antennas
232 S. JASMINE DExter 3-5562
DENVER 22, COLORADO
Member AFCCE

CHARLES E. BRENNAN
(Member AFCCE)
DONALD A. WELLER
Consulting Radio Engineers
405 E. Lincoln Ave. • Milwaukee 7, Wis.
Humboldt 3-3370 Humboldt 3-3371

JOHN H. BATTISON & ASSOCIATES
CONSULTING RADIO ENGINEERS
Specializing in AM-FM-TV Applications and measurements.
934-5 Munsey Building
1329 E. St., N.W. Washington 4, D. C.
DI 7-2330
Member Association of Federal Communications Consulting Engineers

A Classified Ad In
BROADCAST ENGINEERING
Gets Results!
Send Yours Today!



This broadcast engineer multiplies program power

(without degrading signal 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".

Most TV Camera and Microphone Cables Are Made by Belden

Belden offers a full range of application-designed wire and cable for TV and radio broadcasting, recording studios, remote control circuits, and related applications. Available from your Belden electronics 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

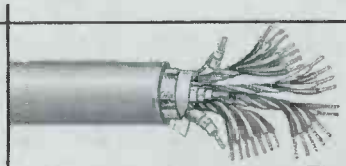
Plastic Microphone and
Shielded Power Supply Cables

Rubber Microphone and
Shielded Power Supply Cables

Broadcast Audio Cables

FREE: Write for copy of 7-page technical paper "Choosing a Microphone Cable."

75-Ohm Video Cable



TV Camera Cables

8-6-1