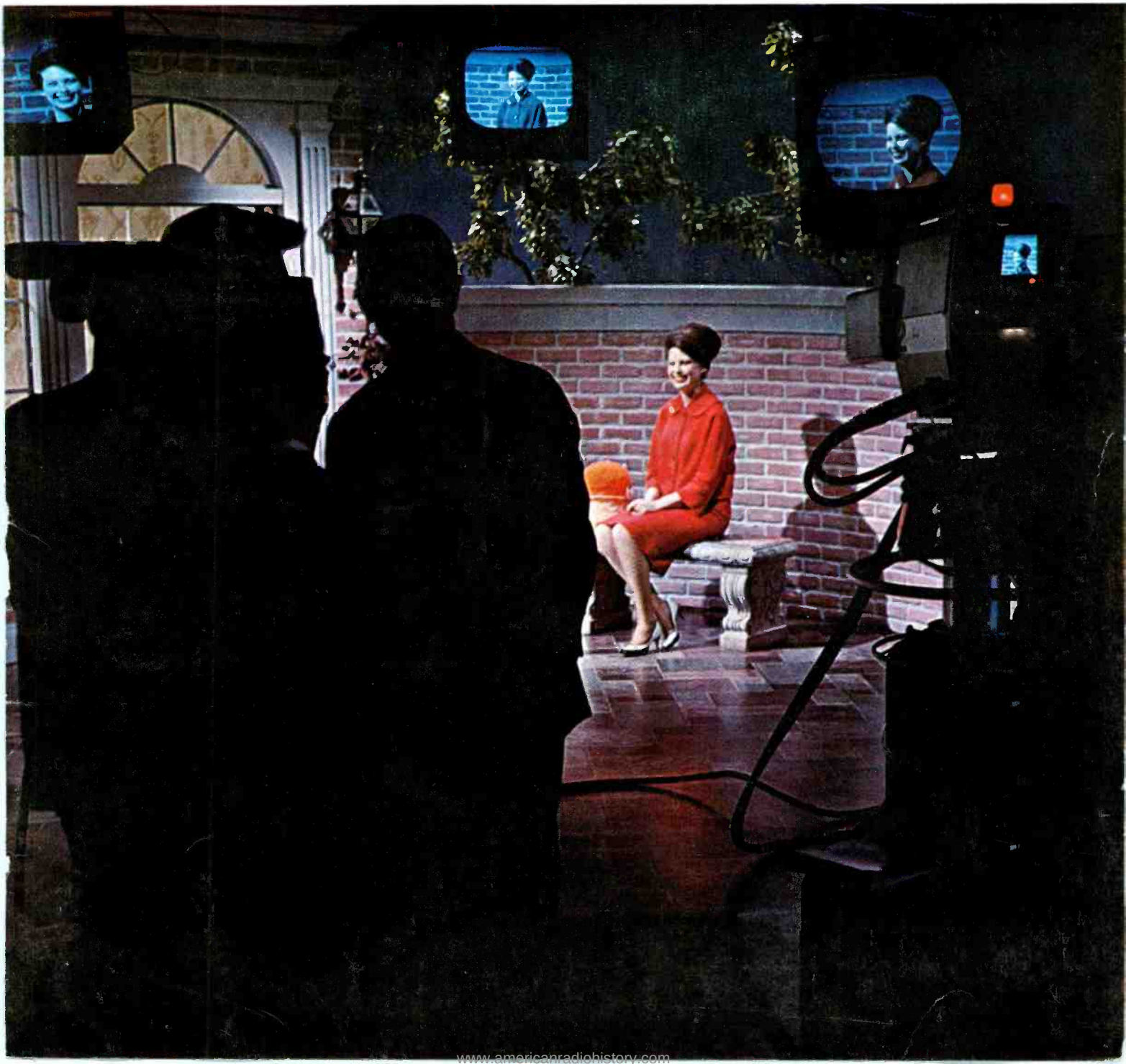
A HOWARD W. SAMS PUBLICATION

MAY 1965/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry



1962 Engineering Dept.

1963 Engineering Dept.

1964 Engineering Dept.

1965 Engineering Dept.

VIDEO SWITCHERS

WE DON'T CRITICIZE OTHER PEOPLE'S SWITCHERS

(after all, it took us 24,000 man-hours to develop one that's better!)

AND THE RIKER SWITCHER IS ACTUALLY MUCH BETTER IN SO MANY WAYS BECAUSE YOU MAY HAVE ALL THE FEATURES YOU NEED: ADDITIVE/NON-ADDITIVE MIXING.

Any number of Cross Points, Comp and Non-Comp · Plug-in Automation · Special Effects · New fully automatic foolproof double re-entry system (patent applied for) · Picture transition in nano-seconds during the vertical interval · Excellent interchannel crosstalk isolation · Excellent phase characteristics in color operation · Any number of inputs and outputs · System completely assembled, wired and tested at factory · Plug-in modular construction, completely interchangeable units · Easily serviced · Replaceable circuit cards · Modular design for complete system flexibility allows for future expansion very economically · Ultimate stability · Minimum rack space-rugged construction

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

NORDEN LANE, HUNTINGTON STATION, NEW YORK: PHONE 516 HA 1-3444 • MIAMI • LOS ANGELES • DETROIT

Circle Item 1 on Tech Data Card

publisher
Howard W. Sams

editor
Forest H. Belt

managing editor
James M. Moore

associate editor
Allen B. Smith

regional editors
George M. Frese, Northwest
Thomas R. Haskett, Central
Howard T. Head, Wash., D.C.
Robert A. Jones, Midwest
George C. Sitts, East

research librarian
M. D. Bishop

production
Esther M. Rainey, Manager
Robert W. Pool, Art
Paul A. Cornelius, Jr., Photography

circulation
Patt Tidd, Manager
Katherine Krise, Ass't
Cora La Von Willard, Ass't

advertising and editorial assistants
Hazel Boyer
Rebecca Clingerman

advertising sales offices
Hugh Wallace, Sales Manager

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

midwestern
Robert N. Rippy
Howard W. Sams & Co., Inc.,
4300 West 62nd Street,
Indianapolis 6, Indiana, AX1 3100

southwestern
C. H. Stockwell Co.,
4916 West 64th Street,
Mission, Kansas, RA2 4417

western
The Maurice A. Kimball Co., Inc.,
2008 West Carson Street,
Suites 203-204, Torrance, California
320-2204; and 580 Market St.,
Room 400, San Francisco 4,
California, EX 2-3365

foreign
John Ashcraft, 9 Rue Lagrange,
Paris 5, France, ODeon 20-87
John Ashcraft, 12 Bear Street,
Leicester Square, London W.C. 2,
England, WHitehall 0525
International Media Representatives,
Ltd., Kisha Kurabu 14, 2-chrome
Marunouchi, (502) 0656

BROADCAST ENGINEERING is published monthly by Technical Publications, Inc., an affiliate of Howard W. Sams & Co., Inc. Editorial, Circulation, and Advertising headquarters: 4300 West 62nd Street, Indianapolis 6, Indiana. SUBSCRIPTION PRICES: U.S.A. $6.00, one year; $10.00, two years; $13.00, three years. Outside the U.S.A., add $1.00 per year for postage. Single copies are 75 cents, back issues are $1.00.

the technical journal of the broadcast-communications industry

®Broadcast Engineering

Volume 7, No. 5 **May, 1965**

CONTENTS

Features

Departments

The NAB Convention, held this year in the nation's capital, provided a wide expanse of displays ranging from modest presentations of small products to elaborate (and costly) exhibits designed to capture the eye of the broadcaster. Our cover shows one of the sets constructed by a major manufacturer to demonstrate a new line of Plumbicon color cameras.

FOR NEWS PICKUP — INDUSTRIAL — EDUCATIONAL — MEDICAL — ADVERTISING AGENCY TV SYSTEMS...

THE VME 600
Video Tape Recorder
IS THE ONE BEST BUY!...

Because

VME 600 is the only VTR you can buy for less than $10,000 that...

1. Uses a broad tape that permits a band width of better than 3 mc. (i.e. that gives a picture so clear that it will not be fuzzy when demonstrated on a 21" monitor instead of a 9" monitor.)
2. Consumes tape at less than 80" per second (VME 600 consumes tape at less than 8" per second.)
3. Can be stopped and single-framed or run in slow motion in either direction.
4. Runs continuously for more than an hour... and without reversing at that.
5. Operates with a single plug-in head that precludes any and all alignment problems. The head is guaranteed for 500 hours and can be replaced for $25.00.
6. Pushes the tape into the head instead of pulling the tape around the head drum under tension (which can cause stretch and distortion.)
7. Permits a sound track in half a dozen languages (or a bilingual training tape.)

VME 600 is the only truly portable VTR.
No other weighs less than 80 pounds.
VME 600 weighs only 40 pounds.

The VME 600 can assure tape interchangeability if it is operated at 7.5" per second or it can be slowed down to 5.1" per second by just turning a switch (for maximum tape economy where interchangeability is not needed.)

And the price is only $2995!

Circle Item 3 on Tech Data Card

Write today on your company letterhead for complete details.

VIDEO-MEDICAL ELECTRONICS CORP.
TIME & LIFE BUILDING
ROCKEFELLER CENTER
NEW YORK, N. Y. 10020 Telephone: 245-2400 Cable: VIDMEDCO, NEWYORK / Telex 224573

Exclusive distributors for:
Fernseh Wireless (26 lbs.) Monochrome Camera with Remote Sync. Used by networks at political conventions.

LETTERS
to the editor

DEAR EDITOR:

In the November 1964 issue of BROADCAST ENGINEERING, there appeared an article entitled "Protective Maintenance at the Studio," in which the author offers a cure for the problem of announcers who work too close to the microphone. I feel there is an important point to be considered if anyone desires to try this idea.

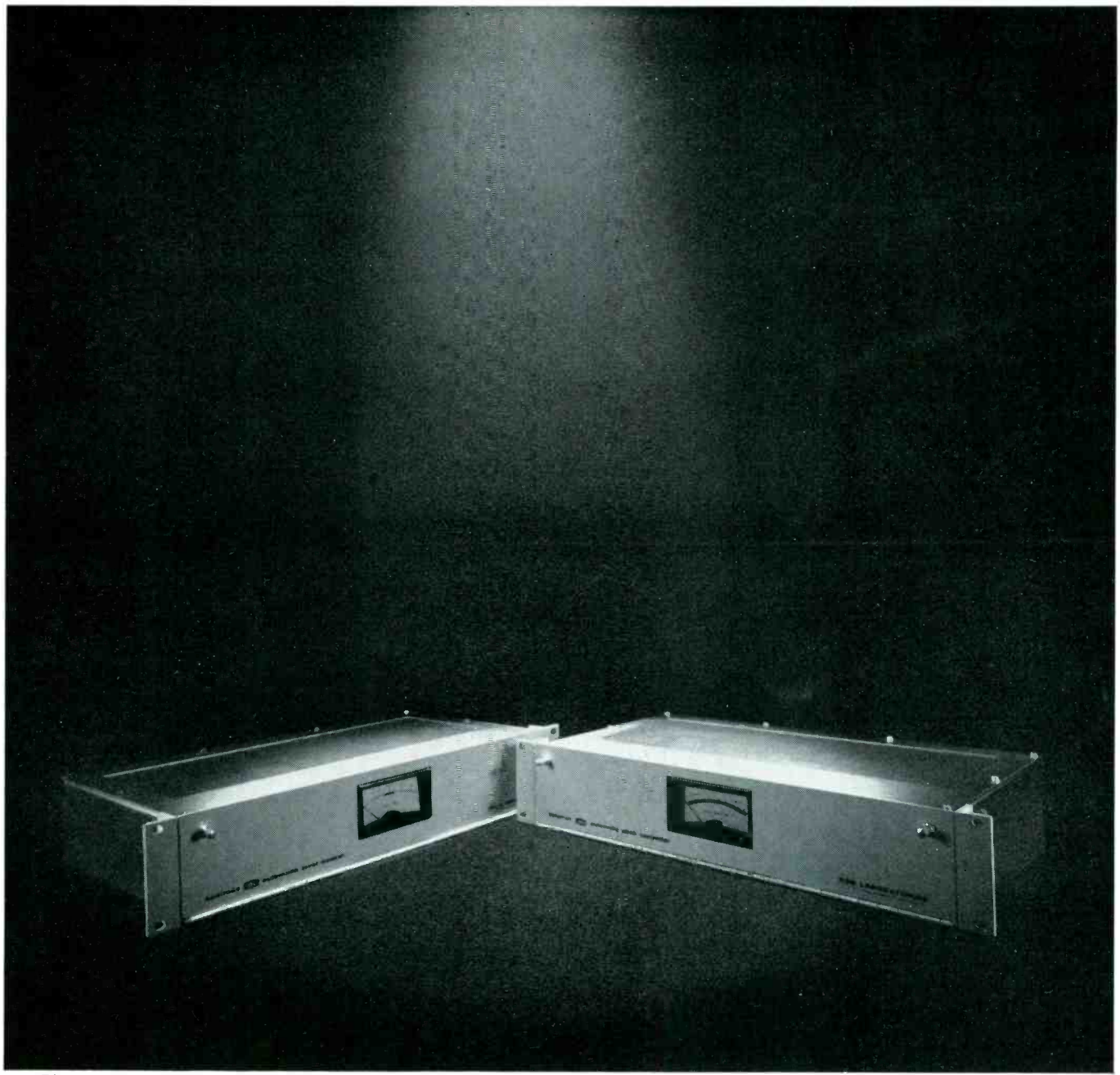
Mr. Williams advocates replacing the coupling and/or cathode-bypass capacitors with lower values to provide bass attenuation in the microphone preamplifier. It must be remembered that the annual FCC-required audio proof of performance will be unacceptable when taken on a console with this modification for the very reason that the bass attenuation will be obvious. I note that some console manufacturers even "hand-pick" certain values for each console preamplifier in order to provide audio response as nearly "flat" as possible.

Since the audio proof must include the entire audio chain of the station, from the input of the microphone preamplifier to the transmitter output, perhaps it would be wiser to leave the preamplifier as designed and simply use a filter between the microphone and the preamplifier. This would allow easy removal of the attenuating device when taking the audio proof and would simultaneously reflect the true operating characteristic of the station's audio console and system, which is a goal of the audio proof.

WILLIAM A. KINGMAN

Chief Engineer,
KOWL, Lake Tahoe

Mr. Kingman has brought up an important point that should be kept in mind by all station engineers: No equipment modifications should be made that adversely affect the required technical performance of the station. In this case, the problem may not be as serious as it sounds, at least in the case of AM stations. The limits for audio response for these stations are specified only for the range between 100 cps and 5000 cps. Thus, strictly speaking, the response below 100 cps could fall off considerably without resulting in noncompliance with the Rules. However, as this letter brings out, the philosophy of not correcting one wrong thing with another "wrong thing" is a good one.—Ed.



See the Max Brothers increase your program power up to 8-fold!

(That's the new solid state Audimax on the left . . . and the Volumax on the right)

Hear this unique combo perform free in your studio for 30 days! Now CBS Laboratories *gives* you the famous Max Brothers (Audimax and Volumax) both solid state for the first time. They'll perform *free* in your studio for 30 days. Then, if you're not convinced that solid state Audimax can "ride" gain to increase program power up to 4-1, and solid state Volumax can control modulation peaks for as much as an additional 2-1 increase, you can cancel the Max Brothers, with no obligation.

See why the Max Brothers are broadcasting's new money-making stars! Audimax is an automatic level controller that outmodes the ordinary AGC. A brilliant studio technician without human shortcomings. By automatically controlling audio levels, it frees engineers, cuts costs and boosts your signal.

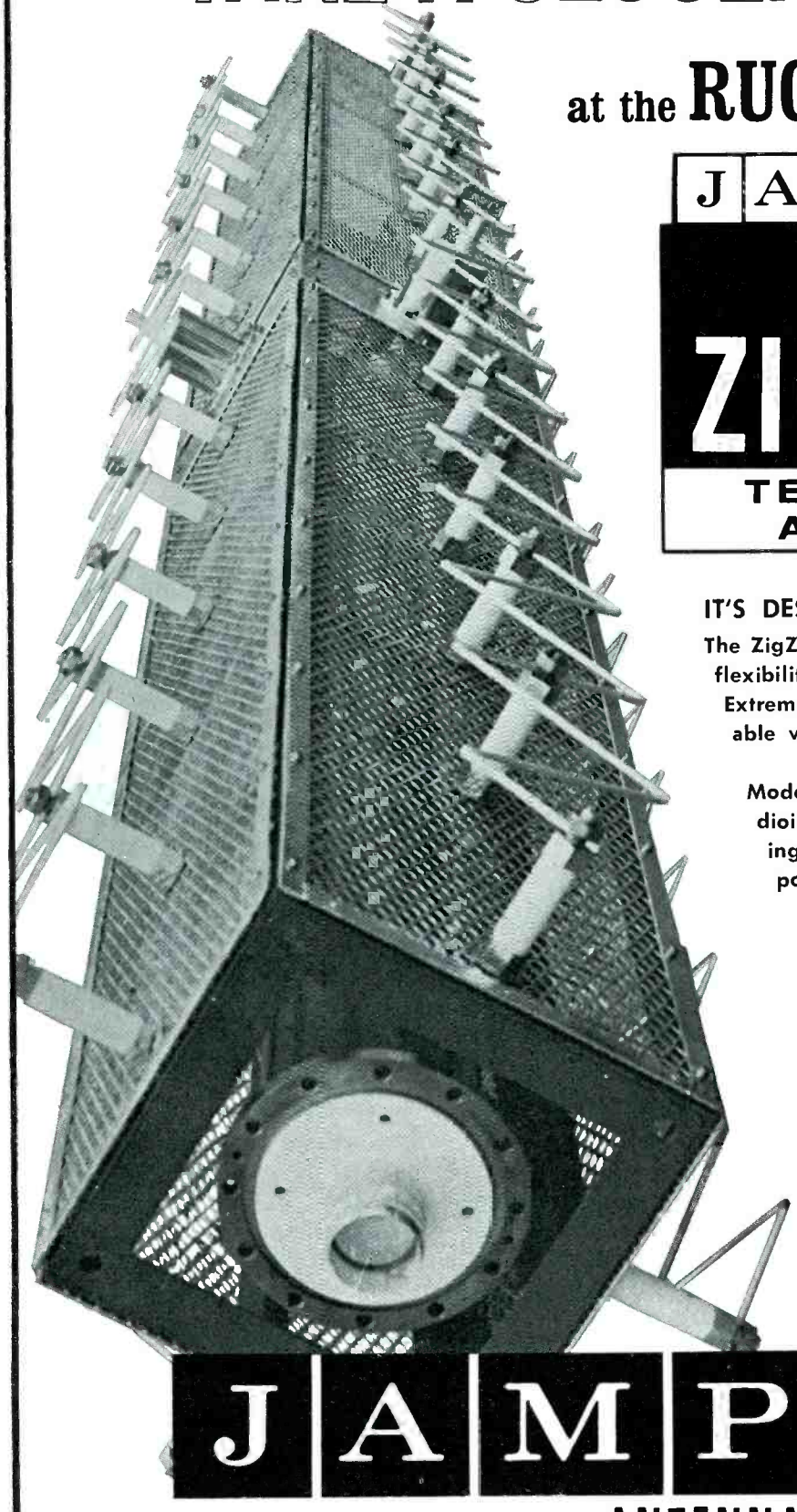
Volumax has a few specialties of its own. It outmodes conventional peak limiters by controlling peaks automatically without side effects. By expanding effective range and improving reception in fringe areas, it brings in extra advertising revenues. Call or write CBS Laboratories for a bulletin with complete details on Audimax and Volumax.

REMEMBER! Together, the Max Brothers can increase your program power up to 8-fold. Decrease operating costs. Bring in more advertising. For just $665 each. Can you afford *not* to ask for a FREE 30-day trial?

CBS LABORATORIES
Stamford, Connecticut. A Division of Columbia Broadcasting System, Inc.

Circle Item 5 on Tech Data Card

TAKE A CLOSER LOOK



at the RUGGED NEW

JAMPRO

UHF ZIG ZAG

TELEVISION ANTENNA

IT'S DESIGNED FOR FLEXIBILITY

The ZigZag offers more pattern and gain flexibility than any other UHF antenna. Extremely high power gains are available with contoured vertical patterns.

Models with omni-directional and cardioid patterns are available providing power gains from 10 to 53 and power capabilities of up to 50 KW!

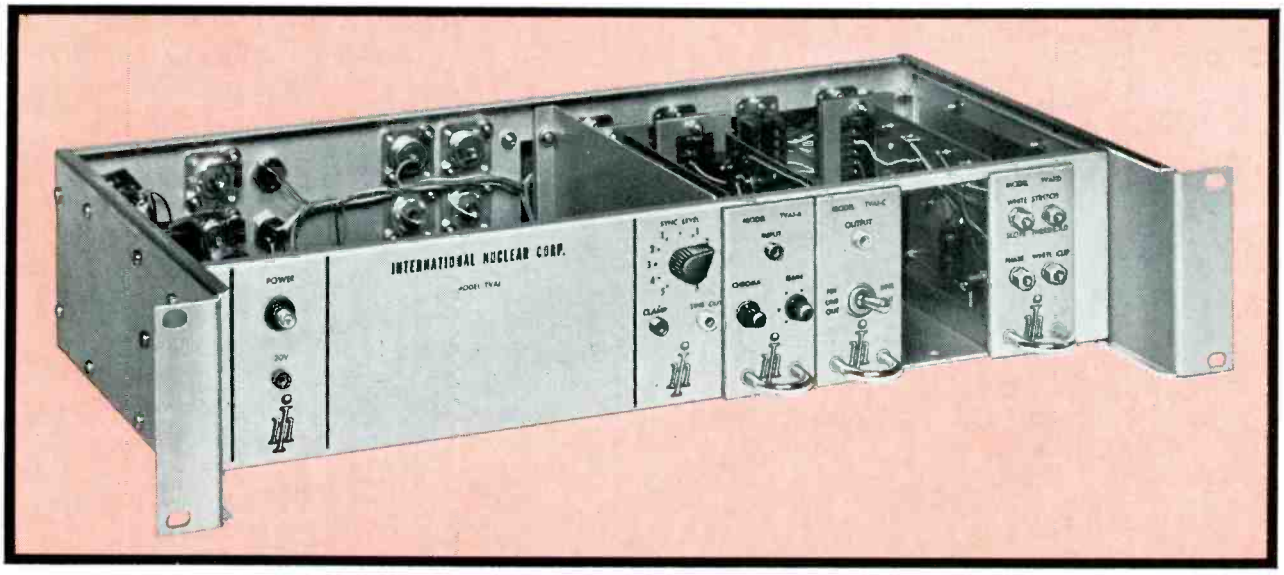
This low cost antenna contains a self supporting internal tower, and is capable of withstanding the most severe weather conditions. The heavy duty construction features hot dipped galvanized steel, stainless steel hardware and the time proven balun feed system.

FOR DETAILS WRITE:

JAMPRO ANTENNA COMPANY

6939 POWER INN ROAD | SACRAMENTO, CALIFORNIA

Circle Item 6 on Tech Data Card



TVA1 TRANSISTORIZED VIDEO STABILIZING AMPLIFIER
AND ASSOCIATED PLUG-IN UNITS

International Nuclear's Model TVA1 Video Stabilizing Amplifier, with its associated series of plug-in units offers high level performance and versatility for studio or transmitter use. It removes all low frequency disturbances such as hum, bounce and tilt by sync-tip clamping. The back porch level is precisely stabilized without affecting color signals in any way. Sync is stretched after back porch stabilization and then clipped accurately to desired level. This level may be set by means of a front panel control which can be extended to a remote location. Stripped sync is provided at one 75 ohm internally terminated output connector, at a 4 volt level. The TVA1 chassis contains a plug-in compartment which accepts up to 4 plug-in units. Among these plug-in units is the TVA1-E, providing a stripped color video channel, and the TVA1-D which provides the means of adjusting peak-white clipping, white stretch and differential phase. Other plug-in units are listed below.

PRICES F.O.B. NASHVILLE, TENNESSEE

Model TVA1 Stabilizing Amplifier (less plug-ins)	$1,380.00
Model TVA1-A, Manually operated input amplifier unit	$ 310.00
Model TVA1-B, input amplifier unit, with provision for remote master gain and chroma	$ 425.00
Model TVA1-C Monitor Amplifier unit	$ 265.00
Model TVA1-D White stretch and clip unit	$ 240.00
Model TVA1-E Stripped Video unit	$ 450.00

for more complete information write Department VA

INTERNATIONAL NUCLEAR CORP.

INTERNATIONAL NUCLEAR CORPORATION

608 NORRIS AVENUE — NASHVILLE 4, TENN. — PHONE 615 — 254-3366

Circle Item 7 on Tech Data Card

BUILDING A TRANSISTORIZED SYNCHRONIZING GENERATOR

by Lawrence P. Segar, Assistant Professor of Electrical Engineering, University of North Dakota — Part 2.
Circuit descriptions and construction considerations for the unit described in general terms in Part 1.

Last month, the overall design and operation of the synchronizing generator were described. In this, the concluding installment, specific circuits will be discussed briefly, and some construction considerations will be given.

Circuits

There are several types of circuits used in the synchronizing generator, including an astable multivibrator, two types of monostable multivibrators, bistable flip-flops, inverting OR circuits, a phase-comparing circuit, several common-emitter amplifiers, and four emitter-follower output circuits. Except in the final stages of the output amplifiers, all transistors are driven from saturation to cutoff. This type of operation is used for several reasons. First, it allows direct coupling of all common-emitter stages; second, it allows the pulse amplitudes to be independent of the transistors; and third, it allows a larger choice of transistors to be used in construction of the generator. This is true since only two points on the collector characteristics—the saturation voltage and the cutoff leakage current—are necessary for correct operation.

Direct coupling presents a problem in choosing a transistor for use in the common-emitter stages of the circuit. When two of these stages are coupled, the collector saturation voltage of the first stage must be less than the base-to-emitter breakdown voltage of the second stage in order to insure cut-off in the second stage. The 2N706A transistor, which is used extensively in this generator, meets this requirement as well as the requirement for saturated switching speed.

Multivibrators and Flip-Flops

A collector-coupled astable multivibrator[1] is used to generate the 31,500 cps signal (Fig. 1A). Simplicity of design and a minimum number of components necessary for construction make this type of circuit a good choice.

The multivibrators used in generating the equalizing and vertical-synchronizing pulses (Fig. 1C); horizontal-synchronizing, horizontal-blanking, and horizontal-drive pulses (Fig. 1D); and the vertical-blanking, vertical-driving, and 9H pulses (Fig. 1E) are also collector-coupled multivibrators.[2] These are monostable multivibrators which have a reasonably stable timing period and are well suited for determining the pulse widths of all the output pulses from the generator.

All frequency-dividing multivibrators are monostable circuits designed by A. I. Aronson and C. F. Chong[3] specifically for frequency-dividing systems. Complimentary transistors are used to achieve a timing period largely independent of the transistor and, therefore, independent of temperature as well. Four such circuits are used in the timing section of the generator, and one is used to obtain the line frequency in the pulse-forming section of the generator.

Several pairs of transistors can be used in this circuit. The selection depends primarily on the temperature stability required and the cost of the unit. If low cost is required, a 2N170 for X1 and a 2N711 for X2 can be used. However, for extreme temperature stability, a 2N706A and a 2N2411 should be used. These transistors are silicon, and therefore the leakage will not alter the timing of the multivibrators. The generator can then be used over a larger temperature range.

Two bistable counting flip-flops[4] are used in the pulse-forming section to obtain symmetrical pulses 3H long. The collector-coupled design is used for simplicity. Common-emitter OR circuits are used throughout the pulse-shaping section of the generator.

Comparator

The comparator circuit is designed to compare the phase of the 60-cps line voltage to the 60-cps pulses from the timing section. The comparator consists of a bistable multivibrator which is triggered on by the timing pulse and triggered off, after a time interval corresponding to the phase difference, by the line pulse. The line pulse is obtained by clipping a 60-volt sine wave at zero and at six volts positive. Slight changes in phase difference between the two waveforms alter the on time of the multivibrator and thus alter the DC value of the multivibrator output waveform. This output is amplified and then integrated using a 500-mfd capacitor and a 390-ohm charging resistor. The resulting DC voltage is then applied to the base return of the 31,500-cps multivibrator. The closed loop thus formed maintains a frequency stability very close to the stability of the power-line frequency.

Output Stages

Four identical output stages are used in the generator. Two common-emitter stages are used for amplifiers and inverters. A switch connection allows the use of either one or both of the inverters to obtain signal-F polarity reversal. Type 2N696 transistors are used in an emitter-follower configuration in the output stages. The requirements for good high-frequency response and medium power dissipation made the use of this type of transistor necessary.

Power-Supply Requirements

In order for the timing section of the generator to function properly, two well regulated supply voltages must be provided. Both voltages, +6 volts at about 100 ma and —6 volts at about 70 ma, must be maintained within +3%. The —1½-volt supply is obtained from a potential-divider network connected to the —6-volt tap. Approximately 25 ma flows in this branch.

The output stages are supplied from a separate source having its negative terminal connected to the —6-volt tap. From 12 to 16 volts at 500 ma is required. This supply need not be well regulated, but it should have low ripple. Variations in output amplitude can be made by varying this supply voltage.

The power supply must be transformer isolated from the power lines to protect the low-voltage transistors used in the generator.

Construction Considerations

This generator allows a large choice in circuit layout, and the builder can thus fit the unit into the type of cabinet most useful for his application. However, it is necessary that the individual units and multivibrators be constructed as separate circuits. A printed-circuit or perforated plug-in board for each multivibrator may be used, or the generator can be laid out on four larger boards, each one containing a major section of the generator (tuning unit, etc.). These are two reasonable layouts; others are possible. If a complete section is constructed on one board, each multivibrator must be placed in a separate area on that board.

The separation of individual circuits and the low-impedance, saturation-to-cutoff design of the generator help reduce stray coupling and noise effects on the generator.

Sequential building of the generator is suggested. The timing unit, starting with the 31,500-cps multivibrator, should be completed and tested before the pulse-forming unit is started. Each frequency-dividing multivibrator in the timing unit should be tested for correct operation by disconnecting the input trigger and noting any stray triggering or astable operation. If such operation is noted, the circuit should be checked for a construction error. If this is not the cause of the difficulty, the power supplies should be investigated. It is necessary that these supplies have a very low output impedance to prevent coupling and triggering from preceding multivibrators. To reduce the supply impedance, 1000-mfd, 6-WVDC capacitors may be connected from ground to each of the supply leads.

If 2N2411 and 2N706A transistors are used in the frequency-dividing multivibrators, it may be necessary to reduce the value of the 1K resistor connecting the base of X1 to the collector of X2. 1N-3604 switching diodes should also be used instead of the 1N461 diodes shown for X3 an X4.

When proper operation of each multivibrator is established, the entire timing unit can be calibrated and synchronized using the following procedure:

Calibrate the 31,500-cps multivibrator by shorting the collector of X2 in the comparator multivibrator circuit to ground. Connect an oscilloscope to the collector of transistor X2 of the 31,500-cps multivibrator. Adjust the potentiometer in this circuit to obtain a square wave having a period of 34 usec. After this step has been completed, the frequency-dividing multivibrator chain may be calibrated using the following steps:

1. Remove the shorting lead from the X2 collector of the comparator multivibrator. Disconnect the base return lead connecting the 31,500 - cps multivibrator to the comparator amplifier. Connect an external 0 to +6-volt source to the base return of the 31,500-cps multivibrator. Adjust the supply to obtain from the collector of transistor X2 an output square wave having a 31.5-usec period.
2. Connect an oscilloscope to the base of transistor X2 of the 10,500-cps multivibrator. Adjust the potentiometer of this multivibrator to obtain a waveform which has a period equal to three times that of the 31,-500-cps multivibrator. When this division of frequency is obtained, adjust the horizontal-gain control on the oscilloscope until the waveform is three major divisions wide on the face of the oscilloscope. Adjust the potentiometer of the multivibrator to obtain a waveform similar to the one shown in Fig. 2.
3. Follow a similar procedure for the other frequency dividers. The 2100-cps and 420-cps multivibrators both divide by five, so adjust the potentiometers of each these multivibrators to obtain waveforms which have a period five times that of the previous stage, and then adjust the oscilloscope horizontal-gain control to obtain five major divisions per period on the oscilloscope. Again adjust the potentiometer for seven-tenths of a division between t1 and t2. The 60-cps multivibrator divides by seven.
4. Remove the external power supply and replace the base return lead to the 31,500 cps multivibrator. Recheck each multivibrator for correct frequency division. Also check for synchronization with the 60-cps line frequency by placing an oscilloscope on either transistor of the comparator multivibrator. If synchronization has occurred, a steady rectangular waveform will be present.

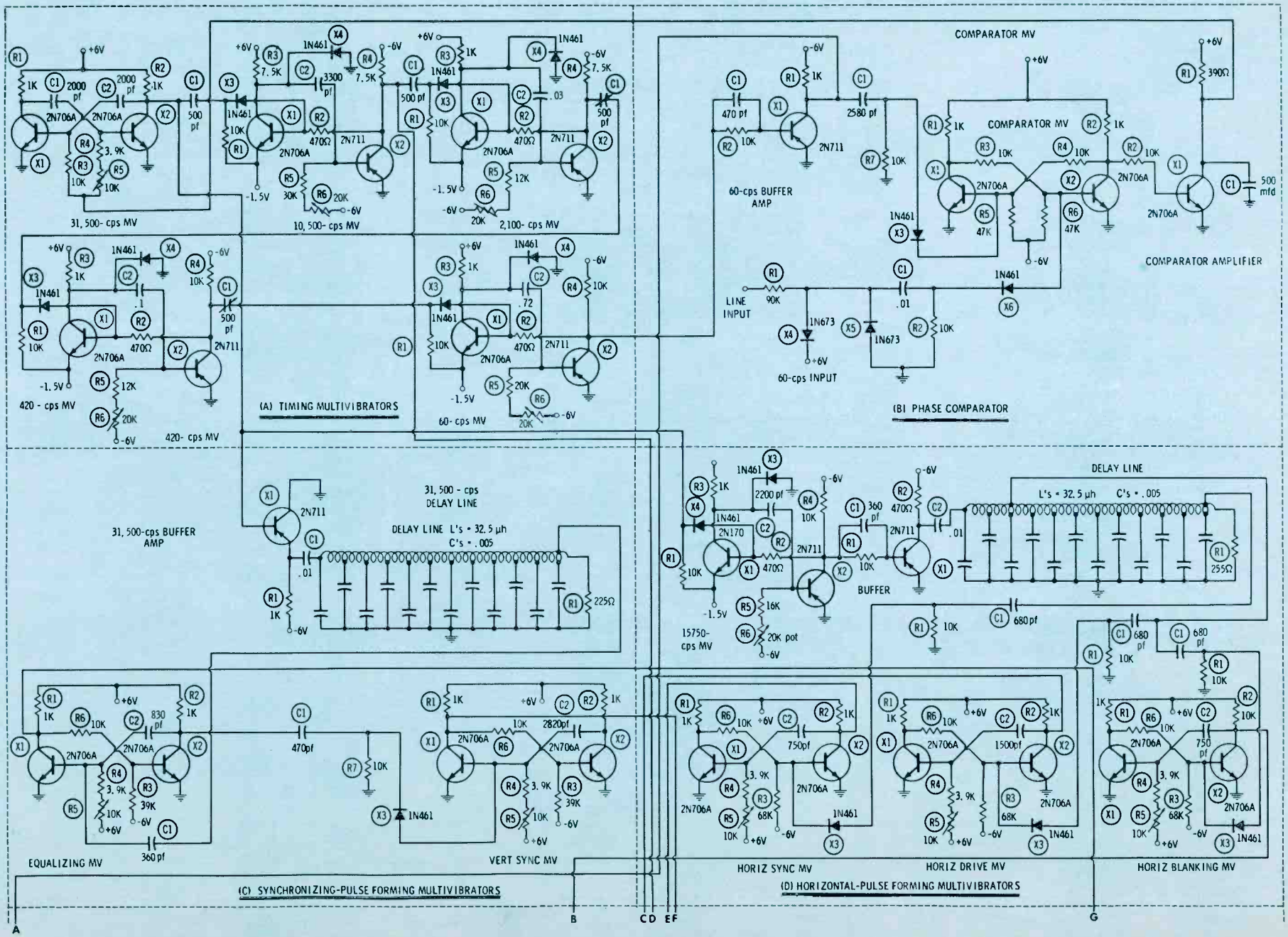
Table 1. Multivibrator Pulse Widths

Multivibrator	Width
Equalizing	2.54 usec
Vertical Synchronizing	4.45 usec
Horizontal Driving	11 usec adjustable
Horizontal Blanking	11 usec adjustable
Horizontal Synchronizing	5.1 usec
Vertical Driving	1.15 msec adjustable
Vertical Blanking	1.15 msec adjustable
9H	571 usec

The pulse-forming section should be constructed in the following sequence: (1) the synchronizing-pulse delay line and multivibrators, (2) the 15,750-cps multivibrator and delay line, (3) the horizontal-pulse-forming multivibrators, (4) the vertical-drive multivibrator, (5) the remaining vertical - pulse - forming multivibrators, and (6) the bistable counters. Each multivibrator should be tested for correct operation.

When proper operation of the multivibrators in this unit is obtained, the calibration procedure can be continued. Adjust the 15,-750-cps multivibrator for frequency halving using the procedure outlined for the timing-unit calibration.

• Please turn to pages 12, 13, and 46



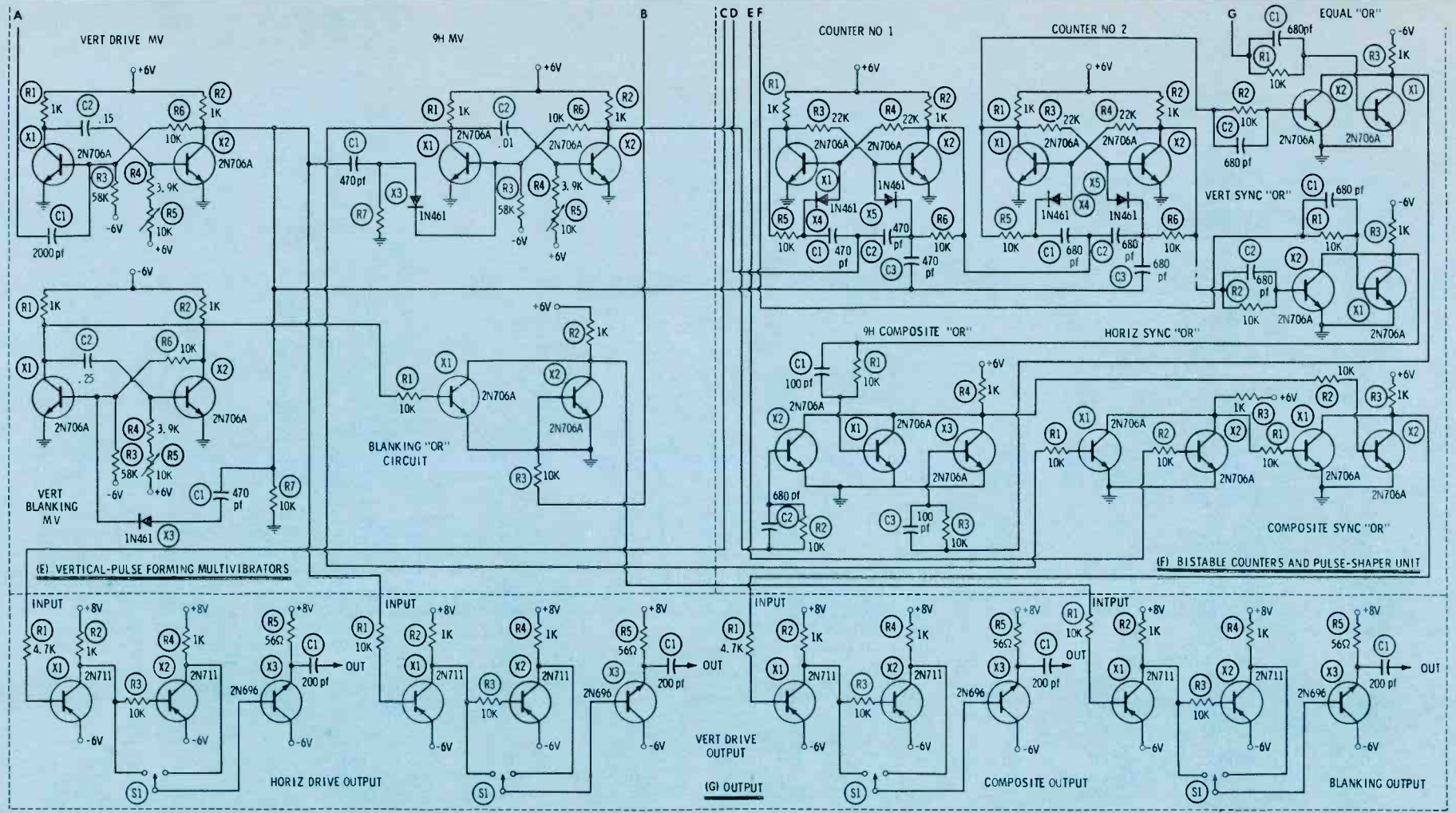


Fig. 1. Overall schematic diagram of transistorized signal generator shows individual circuits and interconnections between them.

COMPONENT TOLERANCES

1. All resistors are ½-watt, carbon, 5% tolerance, with the exception of R5 in each of the four output amplifiers. These resistors are 1-watt, carbon, 5% tolerance.
2. Potentiometers are 17-turn Bourns, E-Z Trim type 3068 ½-watt, carbon potentiometers.
3. C2 in each multivibrator is a 5% tolerance Mylar or mica capacitor.
4. The delay-line capacitors are 5% tolerance, mica.
5. All other capacitors are standard tolerance. Electrolytic capacitors are 15 WVDC.
6. Delay-line inductors are 32.5 microhenry, high-Q, ferrite toroids. They consist of 17 turns of No. 28 enameled wire wrapped on a toroid .25" in diameter, having a .125" center hole, and .25" long.

UPDATING YOUR RECORDING FACILITIES

by Larry J. Gardner, Chief Engineer, WCKY, Cincinnati, Ohio

— Two approaches to improving systems without expending any more funds than are necessary.

We are all aware of the many changes which have taken place in audio recording in the past few years, both in the equipment and in the ways it is used. Because of these changes and the speed with which they have come upon us, many of us have been faced with the problem of having to use equipment which was not designed for our purposes, or which has become obsolete. There are two ways to update your recording facilities for today's recording needs: use existing equipment to the fullest advantage, or replace the old gear with more modern units.

More From Present Units

Before deciding to make drastic changes and large expenditures to improve things, take a brief survey of the equipment you have on hand. Look at the instruction books and compare specifications with new equipment. You may find that most of your old equipment will come very close to modern performance standards when it is placed in "like new" condition.

Consider ways to swap equipment around to improve the overall versatility. It is always a good idea to use your best equipment in the recording studio, since even the best recorders can't help degrading the original input signal somewhat. Perhaps you are using a relatively new but small console for on-air service, but a more elaborate older one for production. If the older console is serviceable, you may produce a better signal for the listener if you use the newer console for your all-important recordings.

Vintage consoles sometimes outperform new ones if the controls are cleaned and some of the old capacitors are changed. Some of the parts may be impossible to replace, but some modern part can almost always be substituted. A few new tube sockets can often make the difference between a "dog" and a solid, reliable unit.

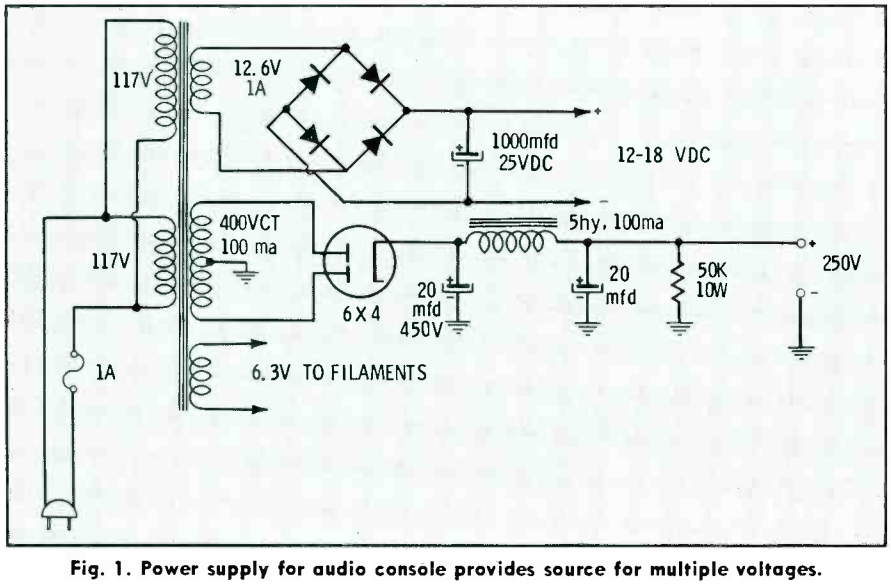


Fig. 1. Power supply for audio console provides source for multiple voltages.

If the amplifiers in the console are beyond improvement, try connecting the console mixer bus directly to the microphone input of your recorder. A couple of new microphone preamps in the front end, a homebrew power supply for them, and an ordinary hi-fi amplifier for the monitor have given new life to many tired consoles. Fig. 1 gives you an idea of what you can use for a power supply that provides filament voltage, B+, and 12 volts for speaker-muting relays.

A great deal can be done to rejuvenate aging recorders, too. Start with the transport mechanism, take it apart, and clean it up. Clean all the rubber drive wheels with deglazing solution (available from printing supply houses) or just plain alcohol. Rubber wheels that are cracked or have flat spots should be replaced. Also replace any belts that do not appear in good condition. Worn motor bearings can often be repaired by local motor-repair companies. Check the felt clutch and brake pads for they may have absorbed oil, and replace them if necessary. If the felt surfaces have become matted, they can sometimes be restored by rubbing them lightly with coarse sandpaper. Be sure to lubricate the transport mechanism as recommended in the instructions, and be careful not to get oil on rubber or felt parts.

Some machines use latching pushbuttons to control tape motion, and these sometimes wear out with hard use. They may be replaced with original equipment, or with the relay circut shown in Fig. 2. Most machines have a 110-volt DC supply from which power for the relays may be taken. Be sure you have the correct contact configuration on your relays, even if you have to

use two for one function, with the coils in parallel. Any single-pole momentary switch will do; but to make the machine look new, you can use illuminated switches with their lamps in parallel with the relay coils.

While you're working on the transport, check for poorly positioned or bent tape guides and test tape tension. Use the method outlined in the instruction book to set the tension, and don't cheat. Many manufacturers recommend the use of a spring balance to measure the tension; these are inexpensive and are available at most hardware or sporting-goods stores.

You can probably tell by careful inspection whether the heads need attention. Look at the surface of the playback head with a magnifying glass. The surface should be smooth, and the gap should be almost invisible and uniform all the way across. If high-frequency response is satisfactory, the playback is in good condition—and so is the record head, probably, since playback heads almost always wear out first. If you need a new head, check with some of the independent head manufacturers as well as the recorder manufacturer; some replacement heads may be better than original equipment.

Old records have a nasty habit of developing a high noise level, and the quickest cure is replacement of all resistors and capacitors in the input stages of both the recording and playback amplifiers. If the recorder has a high hum level, it would be wise to change the power-supply filter capacitors as well. An extra-low noise level can often be obtained by replacing composition resistors with deposited-carbon types. Select tubes for the input stages by trying six or eight new ones and choosing those with the lowest noise levels.

Of course, after making any changes or adjustments, the head alignment, bias, and equalization should all be checked according to the instruction manual.

Problems in cartridge recorders usually lurk in either the drive mechanism or the heads. Most manufacturers offer conversion kits for improving the drive system in older machines. These kits usually furnish hysteresis synchronous motors to replace induction types, or else provide direct capstan drive. Mechanical adjustments vary greatly among different machines but can be checked rather quickly by engaging the pressure roller with no cartridge in the machine. The roller should contact the capstan with enough pressure that it is difficult to stop with your finger, but not so tightly that it slows the motor down.

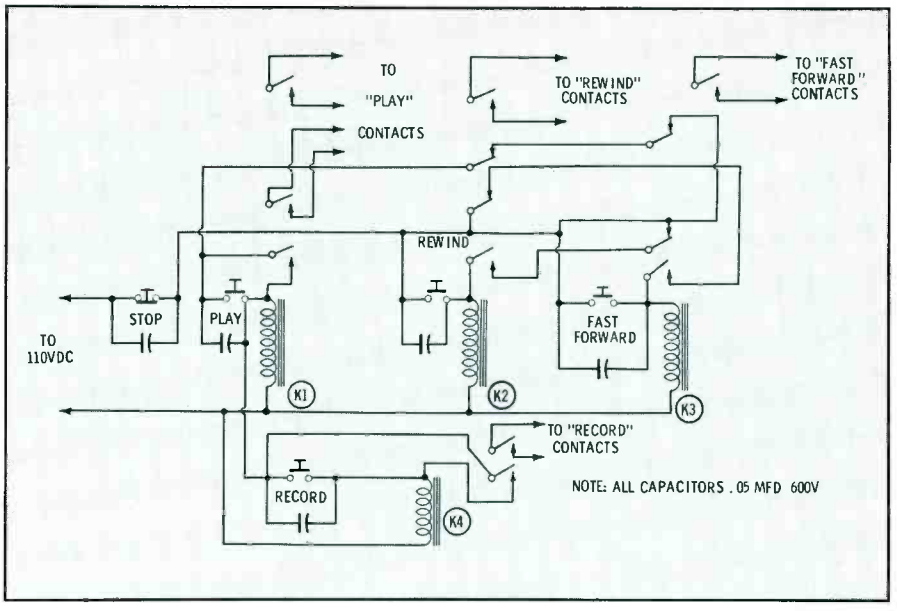


Fig. 2. Latching relay circuits that can be used to replace recorder bank of pushbuttons.

The frequency response of older cartridge recorders can be greatly improved by installing the newer laminated, hyperbolic-contour heads, which may be mounted on the same bracket as the old heads or on special adjustable mounts made by the head manufacturers. Because of shield structure, and the way the tape wraps around the head surfaces, you may find a rise in low-frequency response of about 3 db at 50 cps. Should you find this objectionable, the effect may be reduced by positioning the heads so they do not penetrate the cartridge so deeply, as shown in Fig. 3. This must be a compromise adjustment between best low-frequency response and good tape contact.

The new NAB head-positioning standards may be met by using separate two-track stereo heads for recording and playback. This change also has the advantage that it permits monitoring the tape with the playback system as it is recorded. When choosing heads, remember to use high-impedance types with vacuum-tube amplifiers and low-impedance ones with transistors. Also, be sure to check the bias level when changing heads.

Where only the small-size cartridges are used, a guide rail of angle aluminum, positioned along the left edge of the cartridge, will prevent improper insertion and make it impossible for the heads to be knocked accidentally out of alignment.

Check your microphones carefully, too. If you are in doubt about their performance, compare them with other similar mikes. Age and an occasional accident can bring about a slow deterioration of quality. One microphone that had begun

• Please turn to page 48

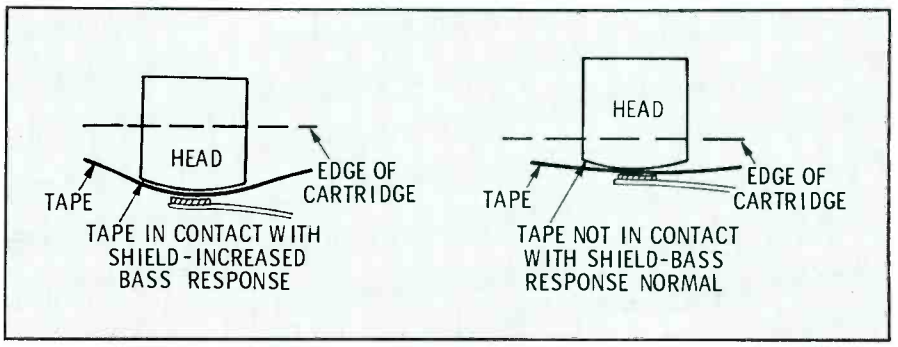


Fig. 3. Relative position of both tape and head affects bass response of the machine.

AUTOMATE TO MAKE, NOT SAVE, MONEY

by J. Nelson Rupard, KIND, Independence, Kansas — A slightly different viewpoint of what the broadcaster can achieve by automating.

Broadcast automation seems something like Mark Twain's weather; everyone talks about it, but no one really does anything about it. To be sure, manufacturers have developed some ingenious equipment. A few broadcasters have "gone automation" with varied results. More have combined conventional tape equipment to achieve one-man operation over a holiday, and most broadcasters have gone push button to handle spot announcements.

Nearly always, the approach to automation has been economic. What station owner wouldn't be willing to invest X number of dollars in equipment, cut the staff enough to recover the investment in a reasonable period, and bank untold savings thereafter? Theoretically, it may seem that simple, but the owner frequently runs into a stone wall of resistance from the very people he is dependent upon to make automation work. The chief engineer puts in for additional maintenance time because he has more (and unfamiliar) equipment to keep up to peak performance. The program director sees little use for his talents in programing a juke box, so he looks for another job. The sales manager has already been crying for more "personality" to sell, and the owner himself has doubts about spending five or ten thousand dollars for equipment that will be largely useless if the move to automation doesn't work out.

Yet, the time appears near when many broadcasters will need to give their personnel an extra challenge and broader opportunities to produce in order to earn more money in a given market. Automation may not be the only answer to that need, but it is the most promising. Automation may never mean cheaper radio, but it can serve the industry and its wage-earners well by creating better radio. And, realistically, if automation isn't going to save money, the type and cost of equipment will have to be seen in a new light.

The chief engineer can be swayed in favor of automation with simple, straightforward equipment of a type with which he is already familiar. The argument there can be cinched with proof that announcers will handle the equipment less often than they do in conventional operation. (Any chief knows that 90% of his troubles are caused by "announcer/operator failures.")

The program director can be challenged to get out of the rut called "good music," "top 40," or what-have-you, and program for automation. He may not come up with industry-shattering new ideas, but there are a few proven old-time ideas that lend themselves to an automated operation. More about that later.

The sales manager can have commercials with more personality, more voices, more sound effects, and better production. He can still sell radio's famous flexibility (the ability to change a product advertisement with a change in the weather) and at the same time create a "deadline" situation for top production that will make his clients glad to plan radio further in advance — and commit radio dollars right along with other media.

Less than $1000 worth of equipment will put a broadcaster in business to experiment with automated programing during off-air hours. In fact, the cost will be much less than that figure if the station happens already to be well equipped with automatic tape equipment and solenoid-operated reel-to-reel tape transports. Since our object is to approach automation from the standpoint of better radio, programing and production should be considered before specific equipment. After all, there is equipment on the market today for the most sophisticated form of automation, at a most sophisticated price; or, the broadcaster who wants to "poor-boy" it can find a tinkerer who will provide equipment to alternate records and announcements on loose cues for $300 and a little construction time, starting from scratch.

Ideally, a broadcast operation should be able to achieve, through automation, a sound which gives the illusion of an announcer on-mike at all times. That illusion provides presence, personality, and flexibility in presenting the music, news, weather, time, humidity, and other features that create the characteristic "sounds" of different stations.

Automation offers **plus** features. Let's take a typical "music and news" station as an example and automate it from 9:00 AM until noon and from 1:00 AM to 4:00 PM. A prerequisite is that the music be selected and prepared for automatic reproduction on either a record player or magnetic tape. An automatic record player is more flexible, but tapes offer tighter production and, on the whole, better quality. Pretaped music is available to fit any format, but the broadcaster who can pretape his own music immediately achieves two of the **plus** features of automation.

First, he can build and control the musical image of his station by selecting all music at a higher management level. No longer will the mood of the music depend upon the disposition of the announcer on duty. If the station's policy is a "bright music sound," the pretaped music will be bright (but paced) even if the man who announces it had a fight with his wife before leaving home.

The second **plus** feature is a real goodwill audience builder. Remem-

ber when even local radio was "live" — a studio orchestra, the organist, soloists, and even the kids who came up from the local high school for talent auditions? Those were the programs that built local radio, but similar live programs aren't economically possible for most local stations today. Even when a station carries a performance by the high-school glee club, as a community service, another station that wasn't on the air 20 years ago steals the mass audience with a civil-defense program featuring top-talent artists.

The automated broadcaster can have his cake and eat it too by including in his pretaped music format limited selections by the best local talent, such as school bands, vocal and instrumental groups (numbers are magic), soloists, church choirs, organists, music clubs, etc. This music can be recorded "live" with little trouble at concerts, school music contests, and choir practices. Use local talent to "pace" the featured music of the station. This will help to develop local talent, give the station conversational value, and no one will tune out knowing that Ray Coniff or Peggy Lee might follow a number by the high-school band.

One way to keep presence and personality in the automated voice of the announcer is to have the musical introductions and DJ patter taped for an hour at a time within an hour of broadcast time. The announcer's patter will then be adjusted automatically to nearly any event or mood that would affect live programing; the weather, news developments, etc. Musical introductions will be improved when the announcer has before him complete information on the selection, tempo, origin, descriptive phrases, etc., such as can be cataloged as the music is prerecorded. For the average station's programing, it will take an announcer about 10 minutes to set up and record the musical introductions for 55 minutes on the air. (Remember—5 minutes of news on the hour.)

The typical station that can best be automated probably doesn't have a fully staffed, full-time news department, and automation presents one way the announcer on duty can be profitably occupied during the 45 minutes he has been relieved from spinning records: he can augment

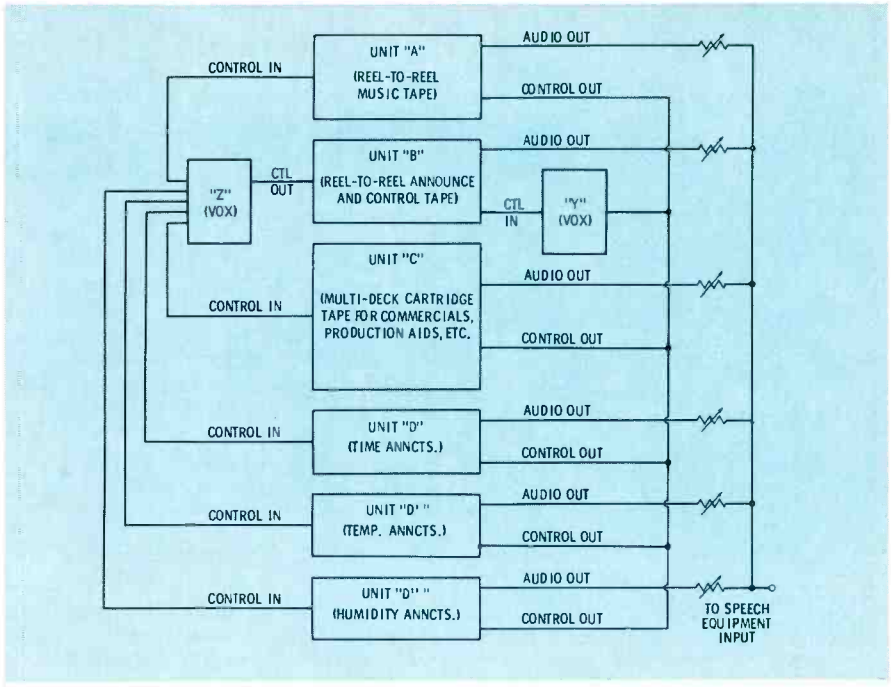


Fig. 1. Automated station uses readily available equipment for an improved sound.

the one-man, overworked news department. The "news man" can become a news director, in fact, with more free time to follow up news leads, write and pretape editorials, record man-on-the-street opinions and interviews, etc. The announcer on duty can give his program more authority by serving as the newscaster. With 45 minutes of every hour virtually free (someone has to keep the log) he can handle routine news beats and rewrite "phone-in" news.

Or, if a given announcer's talents run more to production, he would have most of 45 minutes out of each hour to execute new ideas for the sales department. New ideas and better production means bigger contracts, longer runs, less detail in the traffic department, and a happier sales manager. Automation presents the announcer with an opportunity to do creative work instead of daydreaming while a record spins. It's an opportunity to make himself worth a good salary even to the smallest operation.

Equipment

The flexibility of automation depends largely upon the equipment used. It is possible to secure some of the benefits of automation through the use of a single record/play cartridge tape machine and a good hi-fi automatic record player. Sophisticated, prepackaged equipment, with benefits limited only by the imagination of the broadcaster, is readily available at a price.

A middle-ground system, which any broadcaster should be able to assemble for less than $3000, is shown in the block diagram of Fig. 1. Nearly all units indicated are available as production-line components or as finished products. Some, not yet available, must be improvised or substituted for until factory production is available.

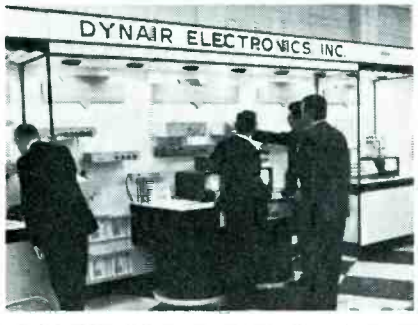
Unit A is a conventional reel-to-reel tape transport with half-track playback head (or heads) and playback amplifier to be used in programing music. Many production models are equipped with photoelectric cells, relays, and brakes to stop and start the tape transport instantly. The photoelectric-cell relay may be used to inaugurate the sequence following a musical selection, or a second-track playback head may be added for control by a tone (or tones) as is done in conventional cartridge tape machines. In any modification, the station engineer must bear in mind the need to use fast-make slow-break relays to trigger sequential operations.

Unit B handles the tape which is made up for each hour-long program segment and control tones for the complete operation. It is identical to unit A except that it must be modified for tone-signal operation (in the manner of cartridge tapes)

• Please turn to page 51

HIGHLIGHTS OF THE 1965 NAB CONVENTION

by George C. Sitts — The Engineering Conference and equipment exhibits as seen by BE's Eastern Regional Editor.



Even in four days it was impossible for any one engineer to attend all the sessions or to visit all the booths at the NAB Convention and Broadcast Engineering Conference. For those who did not see everything or who were not able to attend at all, we will try to recap some of the highlights of the Conference and the equipment exhibits.

Automation

Dan Coulthurst, engineering director of International Good Music, predicted that radio and television stations of the future will use small computers and that each time a contract is sold, contract and program-schedule information will be fed to the computer which, in turn, will completely schedule all elements of the broadcast day, put them on the air, and do all the logging and billing. For the engineer interested in immediate rather than future delivery of such a system, Sarkes Tarzian, Inc. displayed a production model and took orders on the spot. Mr. Coulthurst did stay one step ahead of the state of the art by predicting a program recording and playback device with random access but with no moving parts.

Arthur Freilich, vice-president of the Chrono-Log Corp., described the results of ten years of operating his company's STEP (Sequential Television Equipment Programmer) system of automated switching. He said this experience has shown that automated switching equipment is a profitable investment and can pay for itself in one to three years through reduction or elimination of losses due to switching errors and "make-goods," plus the better utilization of manpower.

Mr. Freilich emphasized to the group that automated switching equipment requires operating-personnel training, careful timing of all material, and the use of crossbar switchers. He said that the cost of interface equipment installed between automation and existing equipment averages $2000 and that for a small station cost may be as little as $500.

An opposing view of automation was given by James Higgins, general manager of WCNY-TV, Watertown, New York, who said, "We have not progressed to an automated state. Our judgment so far has been that more-or-less automated stations have no fewer operating errors than we do. Likewise, we are fearful of becoming a 'television factory,' or 'video jukebox,' so we prefer to have a small number of operating people around rather than to run the station with a 'fail-safe' mechanism."

Color

Interest in color equipment was emphasized by standing room only at Tuesday's color-camera panel discussion. The panel members were R. T. Cavanagh, general manager of studio equipment, North American Philips Co.; H. N. Kozanowski, manager of TV advanced development, RCA; Albert W. Malang, chief engineer of Whittaker Corp.; and R. E. Putman, manager of audio/video development engineering, General Electric Co. The moderator was Frank Marx, president of ABC Engineers.

In the area of film pickup, the panel discussion and questions from the floor centered around the relative advantages of the three-vidicon and four-vidicon systems, with some discussion on a comeback of the flying-spot-scanner system. Comparison of the image-orthicon, the three-vidicon-one-image-orthicon-system, and the Plumbicon dominated the studio-camera side of the discussion. Questions from the floor indicated that a good many engineers are trying to buy color equipment that will not become obsolete in a few years. The choice between the vidicon and IO with their well known characteristics, and the Plumbicons with their promised long life and superb pictures is not a simple one for the conscientious engineer to make.

Prices on the Plumbicon color cameras are around $53,000; the black-and-white prices start around $11,000. The cost of the Plumbicon tube itself is presently $1150 for the black-and-white model and $1250 each for matched color models. The demonstration people were optimistic that the long life of the Plumbicon would mean that a station buying a Plumbicon chain now will find tube prices in the $600 range when replacement time comes around.

Video Tape

A number of video tape systems were on display: RCA had their little TR-4 standard quadrature recorder on the floor ($34,900); Ampex had their new VR-2000 machine on display; and Visual Electronics showed the Allenized Ampex, which combines the Ampex transport and chassis with Allen Electronic Corp. solid-state equipment.

Steve Allen, president of Allen Electronic Corp., presented a paper to the Engineering Conference. In it, he described the components of the Allen solid-state system, which includes a modulator-demodulator and switcher, a new sync-lock servo system, and a set of transistorized accessories to complete the VTR. The design is intended to provide improved performance with simpler op-

eration, less adjustment, less maintenance, less complicated equipment, and less cost.

A technical paper submitted by Paul Welcome and Joseph Roizen, video consultants to Ampex, stated, "Recent improvements in the inherent signal-to-noise of the video-recording tape itself, combined with improved signal-to-noise of the recorder with interference-free recordings, make a third-generation copy which rivals the 'original' recordings of yesterday." The specific recorder improvements covered in the paper were included in the Ampex VR-2000.

Dage demonstrated a helical-scan broadcast recorder which sells for $15,000.

In the field of closed-circuit videotape machines, Ampex showed their stationary-head VTR, model VR-303, selling for $3950 and aimed at the closed-circuit educational market. The machine uses a ¼" tape running at 100 ips and giving 25 min. of recording time per track. The tape is automatically reversed to give a total recording or playback time of 50 min. per reel. The bandwidth, slightly better than 1.5 mc, gives a resolution of about 120 lines. The machine has the advantages of tape monitoring during recording and excellent audio quality due to the high tape speed.

The lowest-priced VTR that we saw was the VME model 600. Priced at $2995, it uses 1" tape at a rate of 5.1 or 7.5 ips. Picture quality seemed satisfactory for many applications, but was not of broadcast quality.

Solid-State Video Equipment

In a continuation of last year's trend toward solid-state circuitry, a number of new concepts were introduced this year. Vernon Duke, senior project engineer at NBC, discussed NBC-developed video AGC and gamma-control amplifiers. Automatic gain control is accomplished by a Raysistor circuit. The gamma amplifier incorporates circuits that retain high-frequency response, thus preventing the loss of white detail, a characteristic of many gamma-correction circuits. Mr. Duke showed films of various waveforms as they passed through these amplifiers, and the results were very impressive.

Meanwhile, on the exhibit floor, Vital Industries was demonstrating a solid-state video clamper and stabilizer amplifier capable of maintaining constant video- and sync-output level despite large input variation and the addition of up to ten volts of hum. The amplifier features re-formed sync, cable equalization, and switchable white stretch. The unit, called the VI-500, sells for $1390 complete with remote controls. The company is planning a Model VI-1000 featuring pulse-width control and chroma circuits for about $4000 by next year.

For the engineer looking for an available solid-state color-processing amplifier, Telemet showed their Model 3209, which sells for $4000.

A number of small companies are featuring new solid-state equipment. The Grass Valley Group, Inc., showed us their solid-state 750-1 sync generator priced at $1500. Grass Valley also has a pulse-delay amplifier, model 712, which accomplishes variable pulse delay using multivibrators and no delay lines.

Northern Electric emphasized that their video switcher is random, rather than vertical-interval, in nature. They state that special circuits and wire-spring relays let them switch without visible transients. It is their opinion that vertical-interval switching will go out with the advent of data pulses in the vertical interval.

Dage is making a strong attempt to break into the commercial and educational-television market with their Model 520 solid-state camera. Notable are the price, $5000 for the 1" vidicon chain, and the options—35mm lens inserts, separate mesh vidicons, and Plumbicons.

Riker Industries showed their solid-state video monitors. The 17" model is priced at $465, the 8" model is $405.

Tektronix has come out with a modification of their Model 527 called the 529 waveform monitor. Its price is $1100. It offers bandwidth to 8 mc, switchable DC restoration, line selection, improved brightness of vertical-interval signals, and a field-shift switch that identifies the field being viewed. The unit, mostly solid-state, consumes 80 watts.

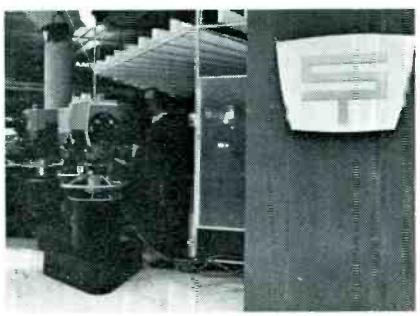
We noted that EMCEE is now selling the Sadelco portable field-strength meter which covers VHF, TV, FM, and UHF TV. The VHF model sells for $295; the UHF attachment, including a UHF antenna, is another $120.

Studio Equipment

Milton Forman, executive director of ColorTran Industries, described the use of quartz-iodine lighting. In pointing out the electrical-current reduction with quartz-iodine, he said that a sample set was lit with standard tungsten studio lights and required over 800 amps for 150 foot-candles. The same set lit at 400 foot-candles for color with quartz-iodine required only 280 amps.

Other advantages of quart-iodine, according to Mr. Forman, are the small size per watt, its ability to retain the same color temperature throughout its life, and its ability not to darken with age or lose its intensity.

K. B. Benson, director of audio and video engineering for CBS, and John Whittaker, CBS photographic engineer, delivered an engineering paper on a gyro-stabilized lens system which overcomes picture jump and wobble due to camera motion. The system consists of a clear fluid contained between two normally parallel glass plates located in front of the camera lens. The plates are axially supported in separate flexible mountings; therefore the angle of one plate relative to the other can be changed. (The front plate rotates on a horizontal axis and the rear plate on a vertical axis.) A bending of the light rays is produced by the resultant prism action. Torque motors provide power to shift the plates. Rotation, and thus refraction, is controlled by two gyroscopic sensing systems, one for correction of



vertical movement or tilt, the other for horizontal movement. A demonstration of the unit yielded impressive results. The stabilizer should be useful where long lenses and wobbly platforms are used. The unit is expected to be in production shortly.

Television Transmission

Interest in remote control of television transmitters is increasing constantly. The Monday technical session included a review of the multiplex off-the-air system and the DC wire system now under test. The conclusion was that either system is feasible, accurate, and reliable, but that not all present equipment could be readily modified; about half of the existing equipment would require excessive modification or complete replacement. As a result of these tests, a petition has been submitted to the FCC requesting extension of transmitter remote control to the VHF television band.

R. E. Winn of RCA presented a paper on the operation of transmitters in parallel. Though parallel operation is principally for increased reliability, Mr. Winn pointed out further advantages of easier maintenance, fewer spare parts, "ghost cancelling," and better proof of performance due to output averaging. The system he described utilized two exciters, an exciter power splitter, two power amplifiers, and a second power splitter. The system is used extensively by overseas stations and has been in use for over a year by WNAC-TV, Boston, Massachusetts.

An old problem is STL microwave paths that are interrupted by construction. George Driscoll, vice-president of engineering for WOKR-TV, Rochester, New York, presented a paper on the use of passive microwave repeaters to bypass such obstacles. The system he explained uses two microwave dishes, one aimed at the STL transmitter and the other aimed at the STL receiver. The two dishes are connected by waveguide. Over a 1.9-mile path, signals underwent a 28-db loss when 4′ dishes were used and a 16-db loss when 6′ dishes were used. Due to the short path length and the high signal-to-noise ratio inherent in the equipment, it was possible to maintain a −51.5-db noise level, which Mr. Driscoll found completely satisfactory.

In another paper, R. E. Fisk, antenna consultant to General Electric, told of the problems encountered in the replacement of the WPIX channel 11 antenna on the Empire State Building in New York City with a new GE Zig-Zag model. The presence of one UHF and seven VHF station antennas on the building made the job particularly delicate. Also, the work had to be accomplished in the period between 2 and 7 AM to avoid disturbances to the neighboring antennas. The installation took six weeks to complete, with WPIX operating on its emergency antenna facility while the switch was made.

RCA showed a new 55-kw UHF transmitter employing a klystron final and an older 10-kw design employing a tetrode final.

Standard Electronics Corp. showed their new line of air-cooled UHF transmitters with powers to 40 kw.

Jampro Antenna Co. showed their new UHF Zig-Zag antenna. The design is straightforward, using modular panels to allow directional operation. A 15-kw single-bay antenna with a power gain of 10 costs about $8000.

Alford Manufacturing Co. had a slotted-cylinder UHF antenna. A 15-kw model with a gain of 10 costs around $12,000.

The antenna booths continually drew good crowds. It seems that most engineers and managers are concerned about that one piece of equipment they cannot examine easily.

EMCEE had something for the educator—a solid-state 2500-mc receiver-converter priced at about $900. The unit is mast mounted and converts up to three 2500-mc signals to standard VHF channels, and the VHF signals are amplified 25 db. The whole unit is crystal controlled, is powered through the video cable, and features a tuned input. EMCEE also showed a 10-watt 2500-mc transmitter with a solid-state modulator for $8900.

Frequency Modulation

Discussion and promotion of television's VHF spectrum neighbor, FM, were also brisk. W. J. Kabrick, advanced development engineer of Gates Radio Co., called for a ten-year program to eliminate pre-emphasis of FM signals in an effort to prevent overmodulation in FM broadcasting and in the television aural signal. In a paper presented to the engineering conference, Mr. Kabrick suggested a plan to reduce pre-emphasis to zero in these steps: July 1965 reduce 15-kc pre-emphasis to −12 db; in 1970 reduce 15-kc pre-emphasis to −6 db; in 1975 eliminate all pre-emphasis.

Mr. Kabrick contended that tone controls on present receivers would allow compensation for changes through 1970, that conversion of receivers and transmitters would be relatively simple, and that the FM system would be enhanced since gross overmodulation and associated distortion would be completely eliminated. He stated that because there have been many advances in the state of the art since the original pre-emphasis decision, the original noise-reduction requirements could probably be met with modern components and design.

In an attempt to solve another FM problem, John Moseley, president of Moseley Associates, called for standardization in the measurement of crosstalk. He advocated the use of a shaped-noise source as a practical method for measuring crosstalk products in the SCA channel. He contended that such a standard signal would permit subchannel operators to optimize adjustments on transmitters and receivers for minimum crosstalk.

McMartin Industries showed a $1000 FM stereo monitor that is self-contained, has no tuned circuits, allows simultaneous monitoring of left- and right-channel modulation, provides crosstalk measure-

ment on each channel in excess of 40 db, and provides measurement of the pilot signal injection.

AEL, well known for antenna tuning and phasing units, showed a 7.5-kw FM transmitter. The unit possessed rugged, straightforward design and several desirable safety features. These include interlocks to short out B+ as well as to remove primary power, and a shorting stick that is interlocked to prevent its being left hanging on a high-voltage terminal. A shorting stick is an item often over-looked in the manufacture of smaller transmitters.

CBS Laboratories showed their new solid-state Audiomax III Automatic Level Control priced at $665 (with a stereo model at $1390) and their Volumax peak controller at $665.

Wilkinson Electronics, Inc., is putting out solid-state replacements for diode tubes. Not only can these replacements be repaired, but they also include neon indication of diode conditions. Price for a 5U4 replacement is $1.95; replacements for an 8008 are priced at $42 and up.

Federal Communications Commission

Even the FCC had a display. Serge MartiVolkoff, FCC Radio Inspector, showed the delegates through the field-monitoring truck and explained its functions and operations. He emphasized that monitoring is not clandestine; rather, an attempt is made to insure that the monitoring is representative of actual day-to-day operations.

Some General Impressions

If we were to inventory all of the hardware on display and then try to summarize the list in one or two words, it would be hard to decide between "solid-state" and "automation." To some degree, one or both of these words can be applied to almost any kind of broadcast equipment that comes to mind. Solid-state sync generators, video amplifiers, audio consoles, etc., are not new, but they are becoming more numerous.

But what the broadcast engineer wants to know is how these trends will affect him. It seems safe to say that the days when the engineer spends most of his day riding gain and cuing records are numbered. True, there will still be production work to be done — after all, somebody has to cut the tapes for the automation machine — but an entire day's programing can be recorded and/or scheduled often in a matter of minutes. This is particularly true of radio, but it applies to TV as well.

If all this sounds unbelievable — or frightening — contrast broadcasting in 1965 with broadcasting in 1945, and then compare 1945 with 1925. There will always be technological changes in broadcasting and a need for broadcast engineers, and there will always be engineers who rise to the challenge.

In the months and years to come, BROADCAST ENGINEERING will work to help you meet that challenge. — The Editors

BROADCAST ENGINEERING ENTERTAINS AUTHORS AND MANUFACTURERS

Talk by NCTA Chairman Highlights C-A Dinner

Editor Forest H. Belt (right) greets guest speaker Bruce Merrill of NCTA.

The second annual dinner for those BROADCAST ENGINEERING Consulting Authors attending the NAB Show was hosted by Editor Forest H. Belt at the National Press Club on the evening of March 23. The dinner was preceded by a cocktail hour. In attendance were James M. Moore and Allen B. Smith of the headquarters staff and Steven A. Cisler, Mr. & Mrs. J. Gordon Elder, Patrick S. Finnegan, Melvon G. Hart, Mrs. Howard T .Head, Robert A. Jones, Bill Kessel, Mr. & Mrs. George C. Stitts, Mr. & Mrs. Len Spencer, Mr. & Mrs. Frank B. Ridgeway, and John J. Walsh. Special guests included Lester H. Nelson, vice-president, engineering, Howard W. Sams & Co., Inc.; the guest speaker, Bruce Merrill, chairman of the National Community Television Association, Inc., and Mrs. Merrill; Robert H. Huston, director of public relations and advertising, Ameco, and Mrs. Huston; and Don Anderson, NCTA director of information, and Mrs. Andersson.

During the evening, the promotions of five members of the Consulting Author staff to the title of Regional Editor were announced by Editor Belt. The five are: George M. Frese, Northwestern region; Thomas R. Haskett, Central region; Howard T. Head, Washington region; Robert A. Jones, Midwestern region; and George C. Sitts, Eastern region.

The regional editors will continue to contribute feature articles to BROADCAST ENGINEERING. In addition, they will enable the magazine to better provide its readers with nationwide coverage of news and technical developments of interest to broadcasters.

In his talk and the question-and-answer period that followed, Mr. Merrill presented some of the viewpoints of the CATV operator. (Excerpts from Mr. Merrill's talk appear on page 44 of this issue.) He stressed that he sees CATV as an additional service to, rather than as a replacement for, broadcast television; he does not propose program origination by CATV systems. He pointed out the the revenue of commercial broadcast television has increased threefold during the period of greatest growth of CATV. He added that a number of TV stations base their rates in part on the extended coverage given them by CATV systems.

Mr. Merrill expressed the view that if CATV operators must pay copyright royalties for program material, then they should have the right to delete broadcast commercials and insert their own. He said that if the CATV system must pay royalties, the public is in effect "buying two tickets for one performance." He also feels that the proposed 15-day nonduplication rule poses a virtually insurmountable mechanical problem to the CATV operator; one analysis shows as many as 72,000 program possibilities for a single broadcast day.

BE editors (l to r) Forest Belt, George C. Sitts, Robert A. Jones, James Moore.

In response to a question about pay TV, Mr. Merrill stated that he regards pay TV to be equally harmful to CATV and broadcast television. He added that some broadcasters have started pay TV operations, but CATV operators have not.

Manufacturers' Reception

On the evening of March 23, the advertising sales staff of BROADCAST ENGINEERING hosted a cocktail party in the Washington Hilton Hotel for representatives of broadcast-equipment manufacturers and suppliers.

At the conclusion of the party, a drawing for door prizes was held. The numbers were drawn by Mr. L. J. Andolsek, U. S. Civil Service Commissioner. First prize, a portable TV set, was won by Mr. A. A. Menegus (shown above) of Visual Electronics. Second prize, a five-band transistor radio went to Mr. Ray Weiland of International Nuclear; and third prize, a transistor radio, was won by Mr. Thomas Muocarello, of Telepro Industries.

Excerpted Comments from a Speech by Bruce Merrill, Chairman, NCTA, to the BE Consulting Authors' Staff

"It has been said that we need four times as many as the six hundred stations (now) in operation to serve the conutry adequately. I cannot imagine the public supporting four times as much advertising as that to which we are now exposed. If my figures are correct, this would place the burden on TV of generating over eight billion dollars annually in advertising revenue. It would seem an impossible task. At least I would imagine that the newspapers and magazines of the country would hope so.

"The problem, then, is how to give the public the improved and enjoyable service that it wants in a pattern consistent with our current system of advertising-supported broadcast television and its inherent limitations.

"There is a solution to this riddle, and it is the complexity of the riddle and simplicity of the solution that makes inevitable the development of a nationwide CATV system.

"If you attach a wire or cable to a TV set, and you attach the other end of the wire or cable to an advantageously placed antenna, you transform that set into a window on the world. And, if there are enough TV signals available, every notch on your channel selector will open another window.

"The fellow that owns that TV set has made a substantial investment in it. He wants to look out of the window that provides the scene that fits his own particular pattern of likes and dislikes. He is an American and is accustomed to what I like to call the 'ceaselessness of change' in this country. Of this man who owns this set you can be sure of only one thing: His tastes, his likes and dislikes as they relate to TV viewing will surely change.

"The TV-set owner wants his reception to be clear, troublefree, automatic, and accomplished with minimum effort on his part, and he wants a choice of programs.

"To every home in the nation, cable TV can make available 12 channels—or more.

"A nationally developed CATV system, compatible with our current TV broadcasting system, could greatly relieve the pressure for a more equitable reallocation of the available spectrum space.

"A nationally developed CATV system could accelerate the growth of UHF television, particularly in the rural areas where it is really needed.

"In spite of all these things that can be accomplished by the free and orderly development of our industry, the vested interests in TV broadcasting and others are making a tremendous bid to have our industry stifled and fenced in to the point of eventually being eliminated.

"But, I tell you, as I have told them at every opportunity, they cannot succeed in this outrageous plan. They work from a base that seeks self-perpetuation—a base of monopoly and self-interest.

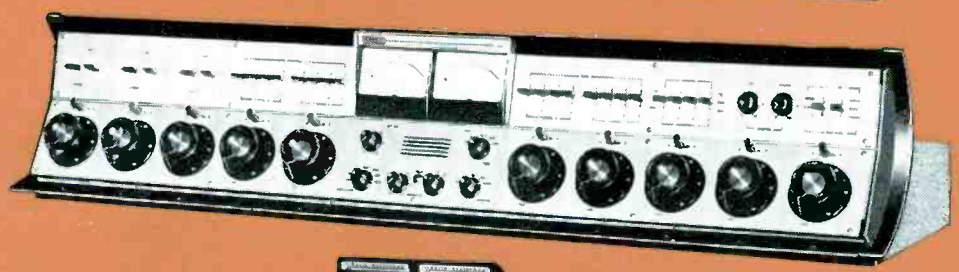
"The development of a national CATV system is inevitable because the public's right to a better deal in televsion is (in) the public interest, and will not be denied." ▲

Circle Item 9 on Tech Data Card →

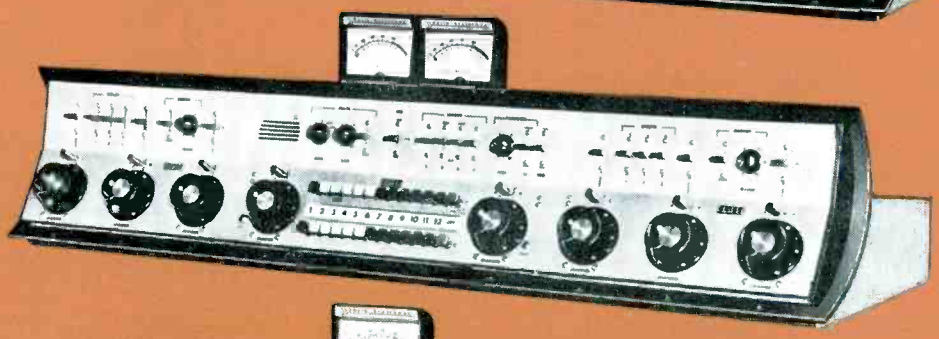
The soundest sound in Broadcasting is the new sound of GATES

Gates Executive, 10-channel stereophonic, fully transistorized console, meets the critical needs of stereo or monaural dual-channel broadcasting.

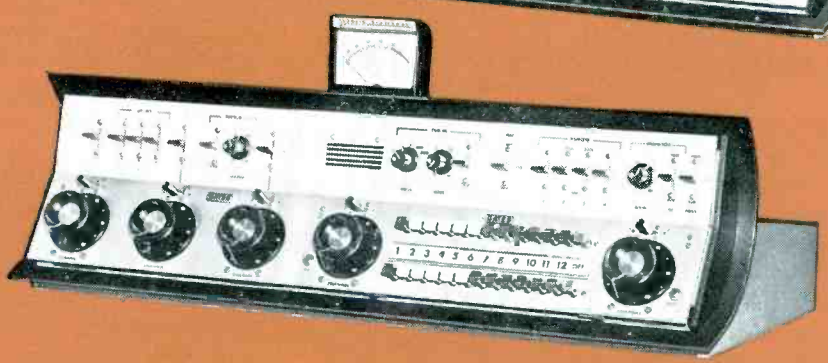
Gates Diplomat, 10-position dual-program channel, completely transistorized console, provides all of the audio-system facilities of the Executive with exception of stereo.



Gates President, dual-channel, completely transistorized console, provides 8 input mixing channels, has totally new 12-position control center. Program selection is by individual illuminated touch-control keys for precise finger-tip control. Eight ladder-type mixers accommodate 28 inputs for exceptional versatility in AM, FM or TV dual-channel broadcasting.



Gates Ambassador, completely transistorized 5-channel console. 22 medium- and high-level inputs are provided with input expansion potential to 30 by using all of the 3-position utility switches.



The "Solid Statesmen" of Broadcasting... Gates Fully Transistorized Consoles

Transistor amplifiers for superb sound reproduction. Precise finger-tip control. Ease and versatility of programming. These are the features you'll like in Gates Audio Control Consoles. And there are infinitely more. To name them all takes 24 pages in our four new illustrative brochures. "Must" reading for the progressive broadcasting engineer or executive. Write for "Solid Statesmen" console brochures.

HARRIS INTERTYPE CORPORATION

GATES

GATES RADIO COMPANY
A Subsidiary of
Harris-Intertype Corporation
QUINCY, ILLINOIS 62302

Offices: New York, Houston, Los Angeles, Washington, D.C.
Export: Rocke International Corporation, New York City
In Canada: Canadian Marconi Company, Montreal

IMPROVING SENSITIVITY OF PHASE MONITORS

by Robert A. Jones, Consulting Author and Consulting Engineer, LaGrange, Illinois, and David K. Barr, Manager and Chief Engineer of WERK, Muncie, Indiana

In recent months, the FCC has been receiving and granting many applications for new clear-channel daytime stations. Some of these employ low power and require directional antennas. One installation where this experience occurred is WERK in Muncie, Indiana, with 250 watts at 990 kc and a six-tower array.

The FCC Rules require that, with a directional antenna, base current of each tower must be sampled and relative phase angles between towers must be checked. To enable us to measure these remotely, we installed a commercially built phase monitor and gave no further thought to the FCC requirements until we fired up all six towers. Several towers in the array gave us barely enough signal to deflect the remote base-current meter needle, and we simply couldn't calibrate the monitor to read phases. By checking base currents in the various towers, we found that less than 1 to 1.2 amps is insufficient to calibrate the monitor; the amplitude indication falls in the lower part of the monitor scale.

Without being able to read the true phases between towers, we were unable to know if we were even close to the correct pattern adjustment. All we could read with any certainty were the actual base currents. We had either to find a more sensitive phase monitor or re-engineer this one into a more sensitive unit. Obviously, we couldn't raise the base currents in the towers, because that would mean modifying the theoretical design and would only cause delay in getting WERK on the air. A quick check of other available phase monitors indicated that no "more sensitive" unit was available. Thus, we really had no choice.

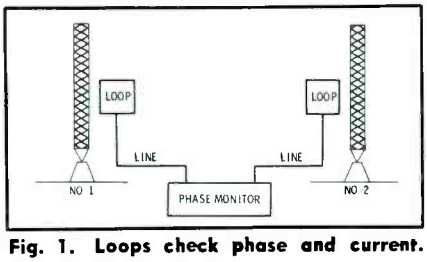


Fig. 1. Loops check phase and current.

Fig. 1 shows that the sampling system is typical, with phase loops and lines. Fig. 2 shows the remote amplitude circuit; its reading depends on the current flowing up tower No. 1. The only way to increase the remote indication is by reducing R1 to its lowest resistance. Limiting resistor R2 is used to keep the meter on scale, so we deduced that reducing its value significantly would increase the meter sensitivity. This changing R2 enabled us to read base currents, but did not help with calibrating the phase-angle reading.

Table 1. Effects Loop-Change

Loop Turns	Meter Reading
1 RG-8/U	30
4 #14	36.5
3 #14	54
2 #14	47

Phase angle is read by adjusting the sample voltages from two towers to a reference value—usually indicated by a red line on the meter scale—and then reading their vector sum. For angles above 90°, it is usually the difference voltage that is read. Obviously, if we do not have enough sample signal to bring the reference settings to the red line, we can't get accurate phase readings.

The sampling loops employed with the monitor at WERK are standard insulated shielded loops. Conferring with the manufacturer's engineers, we learned that other stations experienced this low-sensitivity problem, but none to the degree that we were facing. At their suggestion, we removed the line-terminating resistors (R3) across the inputs to the phase monitor. This gave us a 40% increase in signal, and we could then check towers 1, 2, 4, and 5. (It might be noted that eliminating these loading resistors will change the indicated phase angle by about 15°. If you lift them, carefully check the readings before and after; failure to do so might lead you to believe your pattern had shifted when, in fact, it had not changed at all).

In order to assure the greatest pickup for standard loops, see that each loop is mounted at the maximum current point on the tower. In most broadcast towers, this is one-quarter wave length down from the tower top. Since we were employing 90° towers, our current node was exactly at the bottom of the tower.

We then decided that, since the current induced in pickup loops is proportional to turns in the loop, we could increase pickup by increasing the number of turns. We started by taking the RG-8/U cable out of the copper tubing in the loop and substituting four turns of No. 14 house wire. Much to our surprise, these four turns gave very little more signal than the single

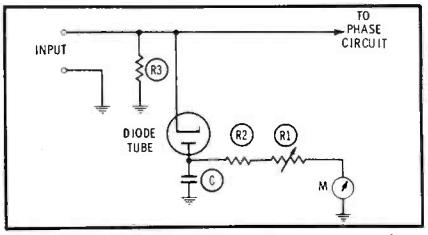
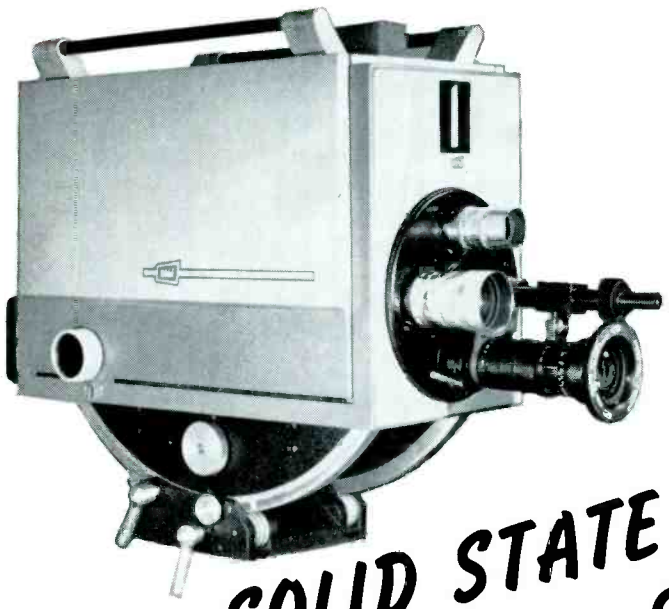


Fig. 2. The current-monitoring section.

outstanding

★ FEATURES ★ PERFORMANCE ★ RELIABILITY ★



DAGE

520

BROADCAST VIDICON CAMERA CHAIN

SOLID STATE

Almost 15 years of engineering know-how have produced a vidicon camera combining economical operation and exceptional performance:

- All Transistorized Circuitry with Cascode Nuvistor Front-End
- More than 800 Line Horizontal Resolution at Pic Center
- 600 Line Resolution Average in All Four Corners
- 42 DB Signal-to-Noise Ratio at 10 Megacycles
- Adjustable Delay Line Aperture Correction
- Adjustable Gamma Correction
- 3-Position Viewfinder Video Selection
- Individual Camera Identification Numbers
- Relay Operated Sweep Reversal

Dage invites you to compare the 520 with *any other* equipment available for commercial or educational broadcasting.

- Exclusive Dage Television "Sweep Entry"
- Standard Rear-Controlled Zoom Lens Kits
- Illuminated Lens Position Indicator
- 8-Inch Bonded Faceplate Viewfinder Kine
- Half-Rack Turret Lock for Vidicon Protection
- Focus Wobble
- Target Meter
- Elapsed Time Meter
- Detail Response 100% Beyond 300 Lines
  55% at 600 Lines

Dage Television Company • DIVISION OF DAGE-BELL CORPORATION

455 Sheridan Avenue, Michigan City, Indiana (219) 874-3251 Att: Dept. 30-C

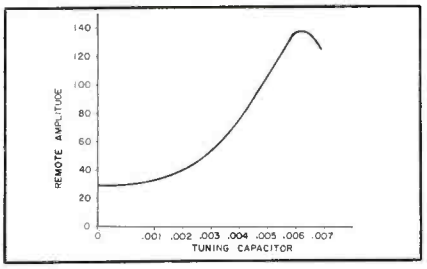


Fig. 3. Capacitance-vs-amplitude graph.

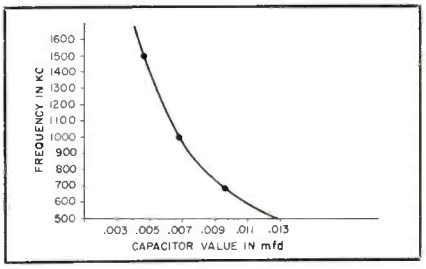


Fig. 4. A chart for other frequencies.

turn of RG-8/U. By trying three and then two turns, we found the best number of turns was three. The results of our trimming are indicated in Table 1.

Sensitivity didn't improve as we increased turns because, as we pushed more and more turns through the copper tubing, the individual turns were overlapping and twisting together. The turns tended to cancel each other and thereby reduced overall pickup. Also, the loop impedance was considerably changed, and the loops no longer matched the monitor.

We then compared shielded loops with unshielded ones to see which yields the greater signal. The shielded loop drove the meter to read 75; a single-turn unshielded loop, of the same physical size, produced a reading of 84. Though there was a noticable gain, the improvement was not significant.

Our next approach was to try to resonate these loops, since a pickup coil will absorb the greatest amount of energy at resonance. We went back to our original loop and connected a variable capacitor in parallel with the coaxial connector at the bottom of the loop. As we increased the capacitance (toward resonance), the remote signal reading increased rapidly. Fig. 3 shows a graph of this adjustment.

We had needed a 4-to-1 improvement in signal to the monitor, since our two lowest-current towers had only about ¼ amp of current. We therefore adusted the capacitor for about 4.5-to-1, leaving the loop tuned on the inductive side of resonance. This provided a more stable seeting than if the loops were left exactly at resonance. For WERK, at 990 kc, we found that 7000 pf was the value to use. Fig. 4 gives an idea of the capacitance value for other broadcast frequencies. This table is only a guide, and these values would hold true only for the type of loops (Gates) we used at WERK. Other loops would have different inductances, and the capacitor values would be different.

Fig. 5 shows the physical arrangement we finally used. The capacitors were mounted in weatherproof metal boxes fitted with coax connectors and were then inserted by using coaxial T-fittings. If these capacitors absorb moisture, they will change in value and produce an apparent change in remote phase-angle readings.

Keep in mind that these capacitors will affect the phase angle on the phase monitor. In order to retain symmetry, install capacitors exactly the same on all towers. It is also a good idea to hand-pick the several capacitors, trying them in position one at a time, making sure they all give the same readings on the monitor. As you know capacitor values can vary from what they're stamped by as much as ±10%.

We were able to develop a way of increasing the sensitivity of standard loops and phase monitors by about four times—at least we did for the towers at WERK. Thus, resonating the loops made it possible to read antenna currents as small as ¼ amp. Somewhat similar results should be possible with other antennas and loops. ▲

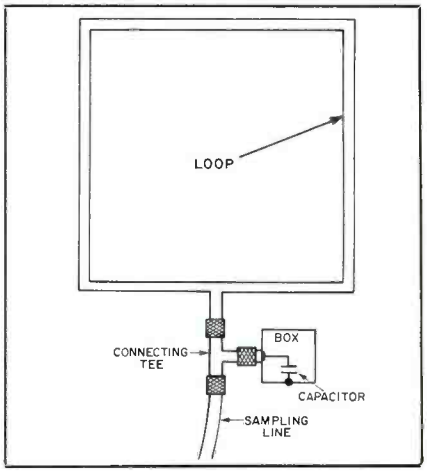


Fig. 5. How the capacitor can be added.

May 1965

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

FM Interference Problems

The Commission has been receiving an increasing number of complaints concerning FM harmonic interference to television reception (June 1964 Bulletin). These complaints have become so numerous that a form letter explaining the nature of the interference and suggesting means for reducing it is now being sent in reply. Typically, the interference is generated by strong signals overloading the RF stage of the television receiver or preamplifier; in some instances, however, there may be actual second-harmonic radiation from FM transmitters. There appears to be little prospect at present that the Commission will attempt to solve the problem by changing the FM allocation table.

In a related move, however, the Commission has acted to propose the addition of mileage separations to the FM spacing table to provide intermediate frequency (IF) protection to FM stations. This change would require mileage separations ranging from 5 miles to 30 miles, depending on the class of station, between stations either 53 or 54 channels (10.6 mc or 10.8 mc) apart.

Aural-Visual Power Rules Made Final

The proposed rules governing the aural-to-visual power ratio of television broadcast stations (April 1964 Bulletin) have been made final. Under the new rules, the aural power is required to range between 10% and 20% of the peak visual power. The previous range was 10% to 70%.

Television stations will be permitted to operate with aural powers greater than 20% until March 1, 1966. By that date stations which have not reduced power must file a formal application on FCC Form 301 requesting a radiated power within the authorized range.

Duplication Limit Postponed

The Commission has postponed until October 1, 1965, the effective date of new Rules requiring commercial FM stations in cities having a population over 100,000 to program separately from their AM affiliates at least 50% of the time. The Rule was originally scheduled to take effect on August 1, 1965.

At the same time, the Commission made it clear that this requirement does not apply to noncommercial educational FM stations operating on the educational channels; educational stations on the commercial channels, however, are subject to the duplication limitation.

AM Allocation Rules Clarified

The Commission has made minor changes in the standard broadcast allocation rules to clarify instances where "prohibited overlap" of specified contours would occur entirely over sea water or would involve a contour of a foreign station lying solely in the United States (December 1964 Bulletin). Under the modified rules, applications for new and changed AM facilities will be accepted and processed where contour overlap occurs so long as the overlap is entirely over sea water. Also, applications for changed facilities will be accepted even though some new overlap area may be created, provided that no net increase in the total overlap results. In the case of foreign stations, overlap is permitted so long as the pertinent treaty requirements are met.

Unused UHF Permits To Be Reviewed

The Commission has scheduled oral arguments for early May on the question of whether to grant further extensions of long-outstanding permits for UHF television stations that have never begun operation or have been dark for substantial periods of time (January 1965 Bulletin). Approximately 25 authorizations are affected. In some instances, the authorizations have been outstanding for many years. The cancellation of these unused construction permits will make the vacant channels available to new applicants.

Changes in Broadcast Filing Fees

The Commission has proposed to increase the filing fees for broadcast applications. The fee for an application for a new television station or a major change in an existing station would be increased from $100 to $150. Fees for AM and FM stations would be increased from $50 to $75, and those for call-letter changes would be raised from $20 to $30. Fees for translators would be reduced from $30 to $10, and the $25 fee for remote-pickup stations would not be charged for mobile units if the mobile application is part of the application for the base station.

Howard T. Head...in Washington

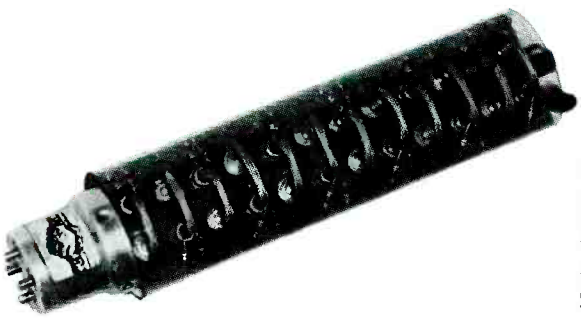
End OFF AIR PANIC

REPLACE MERCURY VAPOR TUBES

with DIRECT PLUG-IN

SILICON RECTIFIERS

New From Wilkinson Electronics



SR 20-12 — 20 KV PIV — 12 AMPS AV.

WE TYPE	REPLACES TUBE TYPE	P.R.V.	NOM P.S. AMPS	VOLTS	UNIT PRICE
SR-3-1	866A 816	3KV	1	1500	9.90
SR-10-6	872 8008	10KV	6	5000	42.00
SR-10-12	872 8008 575	10KV	12	5000	50.00
SR-14-6	872 8008 575	14KV	6	6000	72.00
SR-14-12	872 8008 575	14KV	12	6000	84.00
SR-20-6	6894 6895 673	20KV	6	9000	95.00
SR-20-12	6894 6895 673	20KV	12	9000	110.00

FOOL PROOF

PANIC PROOF

SPEND PROOF

EACH DIODE HAS A GO — NO GO NEON INDICATOR — A GLANCE TELLS ALL

MULTIPLE SAFETY FACTORS ASSURE RELIABLE ON AIR CONDITION

EASY INDIVIDUAL DIODE REPLACEMENT AT LOW COST — NO ENCAPSULATION USED

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

Circle Item 12 on Tech Data Card

TRANSISTORIZED MICROWAVE TELEVISION SYSTEMS

A tale of two cities and the solid-state television links that serve them.

Development of transistorized microwave systems has made it economically feasible to bring high-quality network television into desert and mountainous areas because of the ease with which such systems can be installed and maintained by station engineers. Lightweight, modular "plug-in" construction, coupled with built-in test and checkout facilities, added to low power requirements, all contribute to easy and economical installation. Take the case of two Nevada stations in the Donrey Media chain, CBS/ABC affiliate KOLO - TV, Reno, and NBC affiliate KORK-TV, Las Vegas. Both recently installed intercity microwave systems.

The new KOLO-TV equipment, which is all solid-state except for klystrons, was installed by their two-man engineering department during August of 1964. Microwave terminals are located at Reno, Slide Mountain, and Freel Peak, which also served as the sites for the former tube-type system. The network TV signal is fed into the microwave system at Sacramento, Calif. From Sacramento, the video is transmitted via microwave to Freel (96 miles), to Slide Mountain (38 miles), and on to Reno (15 miles). The link between Sacramento and Freel operates in the 2-gc band, while the new system operates in the 7-gc frequency range.

Total cost for the new 7-gc system including conversion of the 2-gc Sacramento site, new microwave equipment, batteries, and helicopter/pilot time for installation work amounted to approximately $31,000.

For maximum coverage of the area, a TV transmitter is located on Slide Mountain, with a duplex channel between Slide Mountain and Reno, where an auxiliary TV transmitter and tower are installed for backup. The TV studio at Reno maintains control of studio programing and taping, but the Slide Mountain site is the station's principal transmitting site and is manned around the clock.

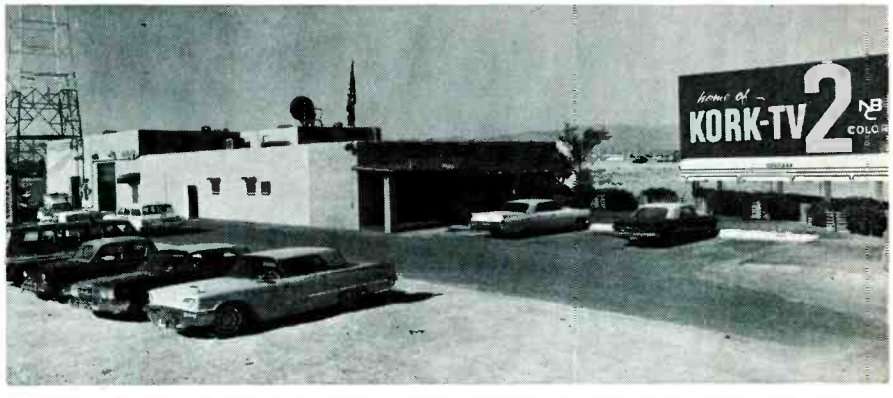
An unusual feature in this microwave installation is the use of a new elliptical waveguide, which eliminates reflections found in conventional waveguide using numerous flanges, bends, and twists. Some 300′ of the new waveguide is used at Slide Mountain to interconnect the microwave dish (mounted on the television transmitting tower) to the microwave terminal equipment, which is housed in the TV transmitter building.

All the transistorized equipment is operated from 24-volt battery banks at all sites. In the event of primary power failure, each battery bank is capable of operating the

CE James R. Bull, Sr. tests the terminal.

terminal for more than 10 hours, thus assuring continuous programing. A stable power source, and a transmission system relatively free of maintenance, are essential because of the area's extremely bad winters. Freel Peak is accessible only by helicopter during the entire year, and the Slide Mountain site (elevation 9800′) is often locked in by winter storms. During the winter on Slide Mountain, 20′ snows with winds between 100 and 200 mph are not uncommon.

Reno terminal of the microwave system.



Rooftop antenna at the Las Vegas studio receives signals from solid-state system.

NEW CONCEPT in VTR simplicity and troublefree operation

An *Allenized* VTR Provides Simple Troublefree Operation with Top Performance and Convenience

Brilliant engineering achievements provide simpler equipment with better performance.

- Simpler Operation — far fewer controls, adjustments and components
- Best Performance — routinely meets or exceeds all performance specifications of the latest, most expensive "deluxe" VTR equipment
- Stable "Sync-lock" Servo — positive lock frame and line comparable to best sync generator "gen-lock," instantaneous lock-up when tape guide pulls in, automatic recovery
- High Band Color Operation — at modest cost; ALL BAND operation at the turn of a switch
- Self-Contained Console — all plug-in transistor modules fit in factory-rebuilt VR1000 console, eliminating all racks and troublesome tubes

Available as a complete machine to add to your facilities.

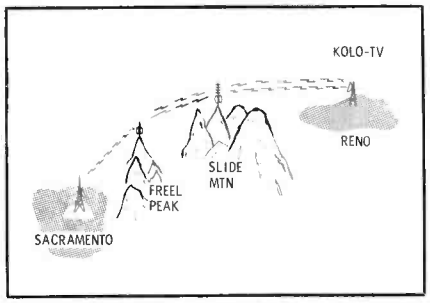
Available as system components to re-equip your existing VTR by factory rebuilding exchange.

VISUAL ELECTRONICS CORPORATION

356 west 40th street • new york, n. y. 10018 • (212) 736-5840

LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

Circle Item 13 on Tech Data Card

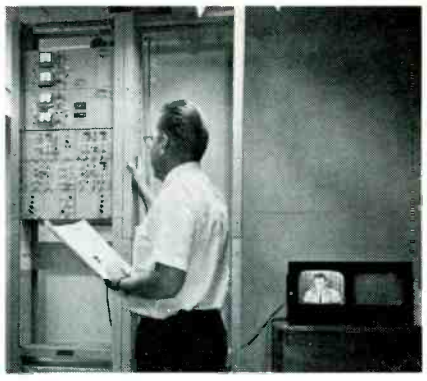


Microwave relay setup of Reno's KOLO-TV.

The 7-gc installation for KORK-TV, Las Vegas, was completed during September 1964. The entirely new system was engineered by the KORK-TV technical crew. Location of the microwave sites and distances between them include: Las Vegas to Potosi Mountain, 25 miles; Potosi Mountain to Calico Peak, 102 miles; Calico Peak to Blue Ridge, 65miles; and a 2-gc modified link between Blue Ridge and Mt. Wilson, 28 miles. KORK-TV had to use 2 gc at Mt. Wilson because of frequency congestion.

The single-channel intercity system is supplemented by an additional off-air pickup channel between Calico Peak, Potosi Mountain, and Las Vegas. Currently, KORK-TV's television transmitter is located at its Las Vegas studio; however, plans are to move it to Potosi Mountain for better area coverage.

Off-the-air pickups are located at Blue Ridge and Calico Peak. These, along with the hot standby channel between Calico Peak and Las Vegas, plus the 7-gc transistorized system, assure KORK-TV of continuous and dependable operation. Network programing from NBC's



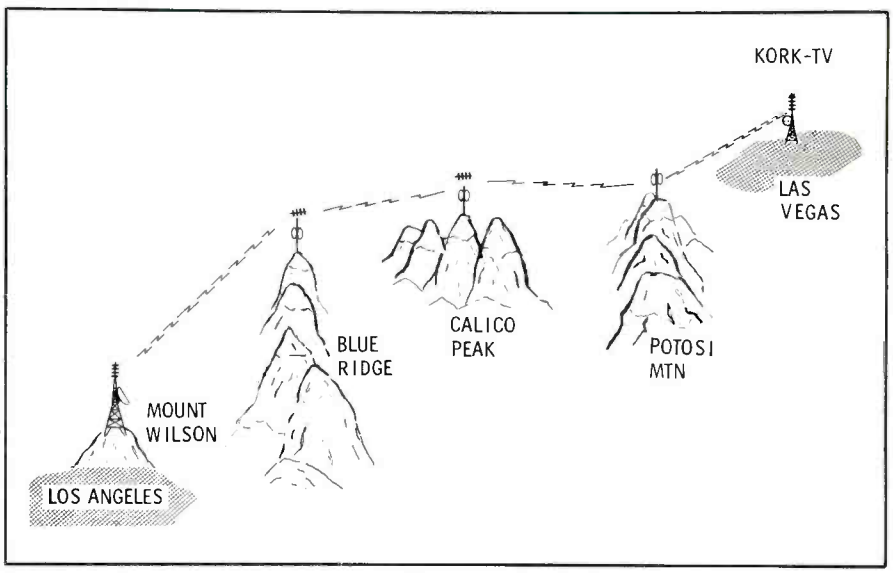
CE James Garner checks network pickup.

West Coast affiliates is fed into the microwave network at Mt. Wilson.

Prior to the installation of the new 7-gc system, KORK-TV received its network signal from an East Coast feed. Due to the differ ence in time, KORK-TV was forced to video-tape programs for later telecast. The new microwave system has enabled the station to eliminate the taping process and release its two taping machines for other work.

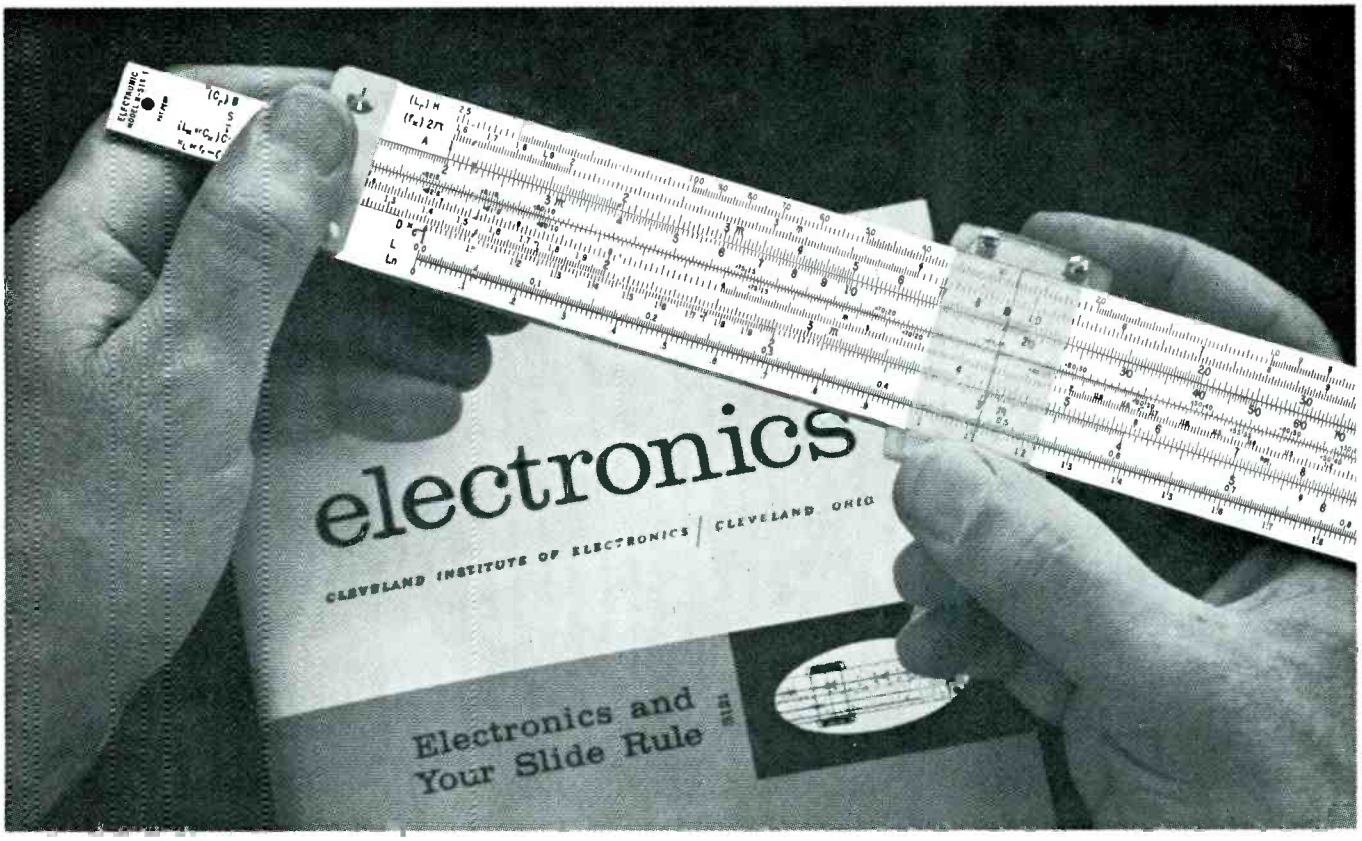
Like KOLO-TV, KORK-TV required a highly reliable system with little or no maintenance because of the extreme weather conditions experienced at its remote sites, and float-charged battery banks are used.

Solid-state dependability, coupled with overall transmission reliability, makes the probability of an outage almost nil. Nevertheless, for additional protection, both KOLO-TV and KORK-TV carry spare modules for the microwave system in an "on hand" inventory. In case of equipment failure, the faulty module can be located and a new one inserted in its place. ▲



Intercity microwave relay system provides network television programs to KORK-TV.

A New Electronic Slide Rule with Instruction Course



Why didn't someone think of this before?

Here's a great *new* way to solve electronic problems accurately . . . easily. The Cleveland Institute Electronics Slide Rule* is the only rule designed specifically for the exacting requirements of electronics computation. It comes complete with an illustrated Instruction Course consisting of four AUTO-PROGRAMMED lessons . . . each with a short quiz you can send in for grading and consultation by CIE's expert instructors. With this personal guidance, you'll soon be solving complex electronics problems in seconds while others still struggle along with pad and pencil.

Here's what Mr. Joseph J. DeFrance, Head of the Electrical Technology Dept., New York City Community College, has to say about it:

"I was very intrigued by the 'quickie' electronics problem solutions. It is an ingenious technique. The special scales should be of decided value to any technician, engineer, or student. The CIE slide rule is a natural."

See for yourself. You will learn how to use special scales to solve problems dealing with reactance, resonance, inductance, AC and DC circuitry, etc. And, as an added bonus, you can use this high-quality rule for conventional computation, too.

This all-metal Slide Rule is a full 10″ long and is made to our rigid specifications by Pickett, Inc. Slide Rule, Instruction Course *and* handsome top-grain leather carrying case . . . all yours for just $14.95. Cleveland Institute of Electronics, 1776 East 17th St., Department BE-101, Cleveland, Ohio 44114.

SATISFACTION Warranty

The Electronics Slide Rule with Instruction Course is available only from Cleveland Institute of Electronics, and is covered by CIE's exclusive "Satisfaction Warranty." Order it now . . . use it for ten full days. Then, *if you're not completely satisfied*, CIE will refund full payment. *U.S. Patent Number 3,120,342.

SEND COUPON TODAY

to: Cleveland Institute of Electronics

1776 East 17th St., Dept. BE-101 • Cleveland, Ohio 44114

☐ Please send FREE brochure only . . . without obligation.

☐ Please send me your Electronics Slide Rule with Instruction Course and leather carrying case. I am enclosing $14.95.

Name_____
(Please Print)

Address_____ County_____

City_____ State_____ Zip_____

A leader in Electronics Training . . . since 1934

A HETERODYNE OFF-THE-AIR RELAY

by Allen Bell, Corning, New York —
A report on tests conducted to determine the practicality of using heterodyne methods for off-the-air FM relays.

Network FM programs received in Corning, New York after several air relays (which include phone lines and studio equipment) are satisfactory, but when the same program was brought from the network key station to Corning experimentally by microwave, a listening comparison on the local CATV system showed an obvious loss of quality in the network relaying process. Also, the network is able to relay the stereo programs of the key station only in monophonic form.

It was suggested that the FM broadcasters investigate a heterodyne method of off-the-air relaying to improve quality and allow FM stations not equipped to originate stereo to carry stereo from the network at moderate cost.

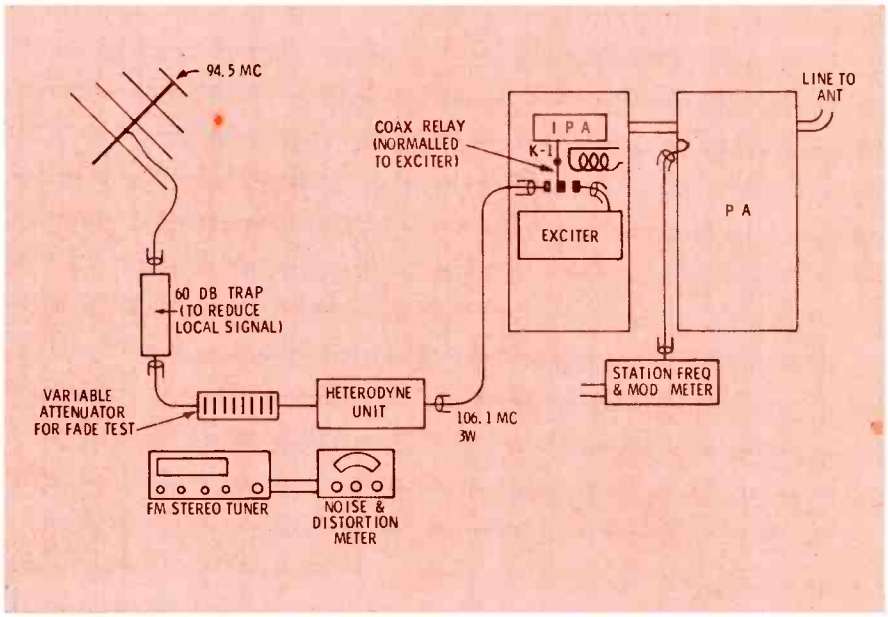


Fig. 1. Block diagram of the setup used in the tests of the heterodyne FM relay.

Test Setup

WCLI-FM obtained FCC authorization for tests during the experimental period. WSYR-FM provided the program and test signals. The manufacturer of heterodyne equipment used by the microwave company modified standard units and loaned them for the tests. A temporary receiving antenna for WSYR-FM was erected at the WCLI-FM transmitter site, and 60 db of trapping was inserted to prevent the local signal from overloading the equipment (Fig. 1). A steady 50 to 60 uv signal from WSYR-FM was obtained at the equipment input terminals.

Table 1. Frequency Response

Frequency (cps)	Receiver Output (db)
1000	0 db
50	+1
100	+1
400	+½
5000	−7
10,000	−12
15,000	−17

The incoming 94.5-mc signal was fed into the heterodyne unit. The output was adjusted to 106.1 mc ± 1000 cps at 3 watts. The 106.1-mc signal was fed into the WCLI-FM transmitter intermediate power amplifier via a coaxial relay normalled to the regular exciter. The unit had barely sufficient output to drive the 829B; it supplied .25 ma compared to the usual 1.25 ma. However, grid drive to the two following 4-250A5s was normal and due to the AGC action in the heterodyne unit did not vary with fluctuation of the received signal.

Test Results

Frequency-response, stereo-channel-separation, and noise measurements were made using the trans-

Table 2. Signal-to-Noise Measurements for the Relay System

S/N, complete setup	−39 db
S/N, via station FM modulation monitor	−39 db
S/N, stereo receiver connected to the output of the heterodyne unit at 106.1 mc	−39 db
S/N, stereo receiver connected directly to receiving antenna tuned to 94.5 mc	−48 db

Some plain talk from Kodak about tape:

Print-through and sound brilliance

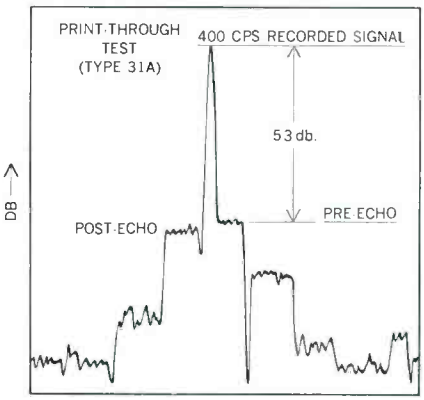
Kodak
TRADEMARK

Put a magnet near a piece of iron and the iron will in turn become magnetized. That's print-through. With sound recording tape, it's simply the transfer of magnetism radiating from the recorded signal to adjacent layers on the wound roll. Print-through shows up on playback as a series of pre- and post-echoes.

All agreed. Print-through is a problem. There are some steps you can take to minimize it. You can control the environment in which you keep your tapes, for example. Store them at moderate temperatures and at no more than 50% relative humidity. Also store them "tails out" and periodically take them out for "exercising" by winding and rewinding them. What fun! If worse comes to worse, you can even interleave the layers with a non-magnetic material such as paper. Any volunteers? A better way, however, is to start with a tape that doesn't print much to begin with . . . which leads to low output problems *if* you don't make the oxide coating substantially more efficient.

And this is Kodak's solution. It's not simple, but it works, and it works well! It starts with the selection of the iron oxide. In order to achieve low print-through, the oxide needles must have the proper crystalline structure. Kodak's oxide needles have that structure . . . offering the highest potential of any oxide currently available. But oxide alone doesn't make a low-print tape.

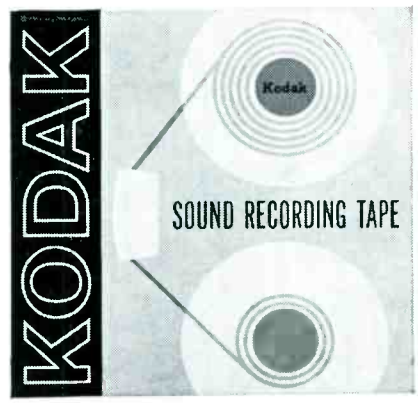
Milling the oxide ingredients, for example, is very critical. If you mill for too long a time, the needles will be broken up and print-through will be drastically increased. Too short, and the dispersion will be lumpy. But other factors in the milling process are equally important. Like the speed at which the ball mill turns. It can't be rotated too fast, otherwise the needles will be broken up, and broken needles, you know, exhibit horrible print-through behavior. If you rotate the mill too slowly, the oxide and other ingredients will not be blended uniformly. Other factors such as temperature and the composition and viscosity of the ingredients must also be critically controlled. One more thing. You've got to make sure all the needles end up the same size (.1 x .8 microns) if print-through is to be kept down.



A very important contributor to low print-through is the binder that holds the oxide particles in suspension. The *chemical composition* of a binder contributes nothing magnetically to the print-through ratio. What a binder *should* do is completely coat each individual oxide needle, thus preventing the particles from making electrical contact. And that is just what our "R-type" binder does. The final step is to take this superb brew and coat it on the base. The coating mustn't be too thick, for print-through increases . . . or too thin, for then output suffers. For best results, extreme uniformity is the word. Here's where our film-making experience really pays off.

Print-through tests are a million laughs. We record a series of tone bursts . . . saturation, of course. We then cook the tape for 4 hours at 65°C. and then measure the amplitude of the loudest pre- or post-echo. The spread between the basic signal and the print-through is called the signal-to-print-through ratio. The higher the number, the better the results. Most of the general-purpose tapes you'll find have a ratio of 46-50 db. Low-print tapes average about 52 db. You can see from the graph that our general-purpose tape tests out at 53 db., so it functions as both a general-purpose tape and a low-print tape —and at no extra cost. High-output tapes with their thicker coatings have pretty awful print-through ratios—generally below 46 db. Kodak's high-output tape (Type 34A) has something special here, too. A ratio of 49 db—equal to most general-purpose tapes.

KODAK Sound Recording Tapes are available at all normal tape outlets: electronic supply stores, specialty shops, department stores, camera stores . . . everywhere.



FREE! New comprehensive booklet covers the entire field of tape performance. Entitled "Some Plain Talk from Kodak about Sound Recording Tape," it's yours free on request when you write Department 8, Eastman Kodak Company, Rochester, New York, 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

Circle Item 16 on Tech Data Card

Table 3. Separation Results

Stereo channel separation at 400 cps, complete setup	
Left	**Right**
0	−26
−22	0
Adjusted receiver phasing	
0	−32
−30	0
(Separation at the WSYR-FM transmitter was 35 db)	
S/N measured in the individual channels	
Left	**Right**
−35 db	−40 db

mitted signal of WSYR-FM. A stereo receiver was used as demodulator. Results of the frequency-response measurements (including receiver de-emphasis are shown in Table 1. Results of the monophonic signal-to-noise measurements, made on the complete setup and individual units at 400 cps, are given in Table 2. Table 3 shows the results of the separation measurements.

Occasional audio beats were noticed during some very low passages of music. This is attributed to cochannel interference with WSYR-FM. FM listeners in the area notice this interference at times.

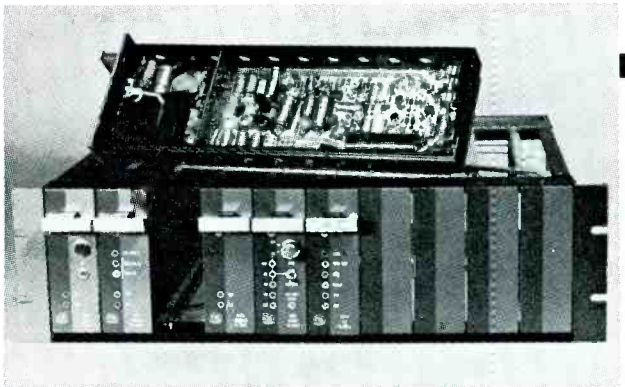
In an additional test, stereo program plus channel-separation test signals were rebroadcast. The program was tape recorded and critically checked at prearranged locations in Corning and Elmira, N. Y. Measured separation at the WSYR-FM transmitter was 31 and 30 db. At approximately 15-minute intervals, a 400-cps tone was transmitted on each channel individually for separation measurements.

Conclusion

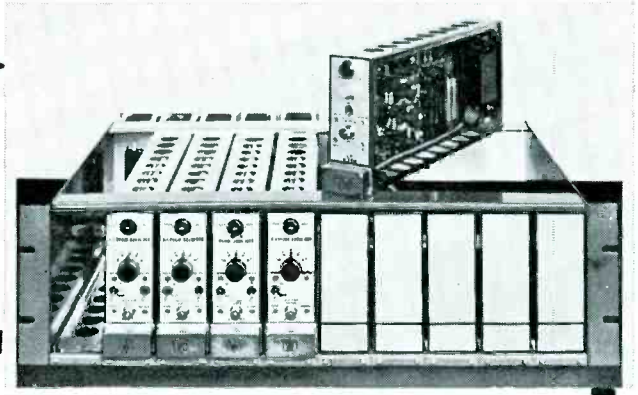
This means of air relaying appears very promising. The only unsatisfactory measurement in this test was the signal-to-noise ratio. The receiver S/N was 9 db better than the heterodyne unit. It appears, however, that a better signal pickup or the use of a low-noise preamplifier should alleviate this problem and make use of the technique feasible for broadcast application. ▲

MODERNIZING?

START WITH THE MOST ADVANCED TRANSMITTER INPUT & OUTPUT EQUIPMENT



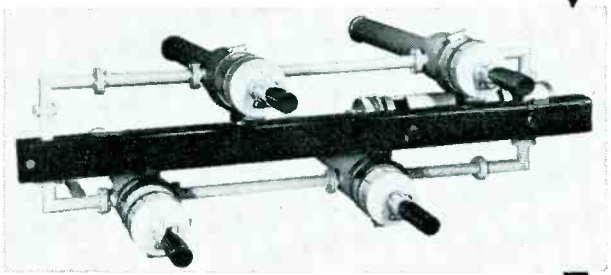
CDL SOLID-STATE TRANSMITTER INPUT STABILIZING AMPLIFIER . . . for Color/Monochrome Operations.



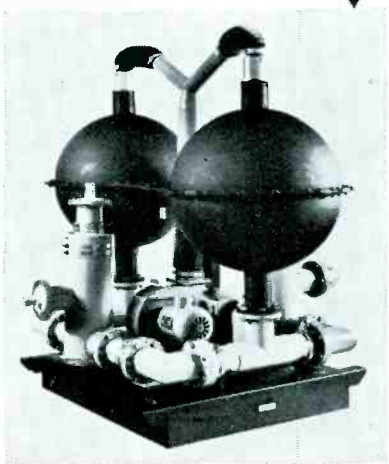
WARD VIDEO LOW PASS FILTER & COLOR PHASE EQUALIZING SYSTEM. Features built-in Solid-State Isolation Amplifiers & Regulated Power Supplies.

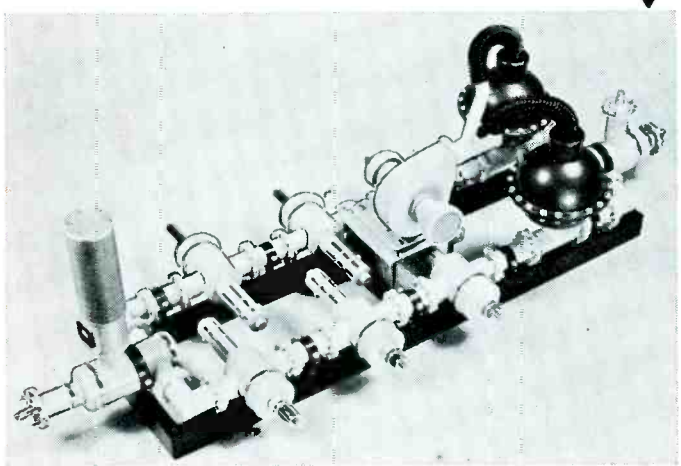
YOUR TV TRANSMITTER

CO-EL UHF VESTIGAL SIDE BAND FILTER FOR KLYSTRON TRANSMITTERS.



CO-EL UHF NOTCH DIPLEXER — No Gases Needed — For use with up to 50KW transmitters.





CO-EL UHF FILTERPLEXER — No Gases Needed — For use with up to 50 KW Transmitters.

Ward Electronic Industries

P.O. BOX 1045 • MOUNTAINSIDE, NEW JERSEY • (201) 232-1167

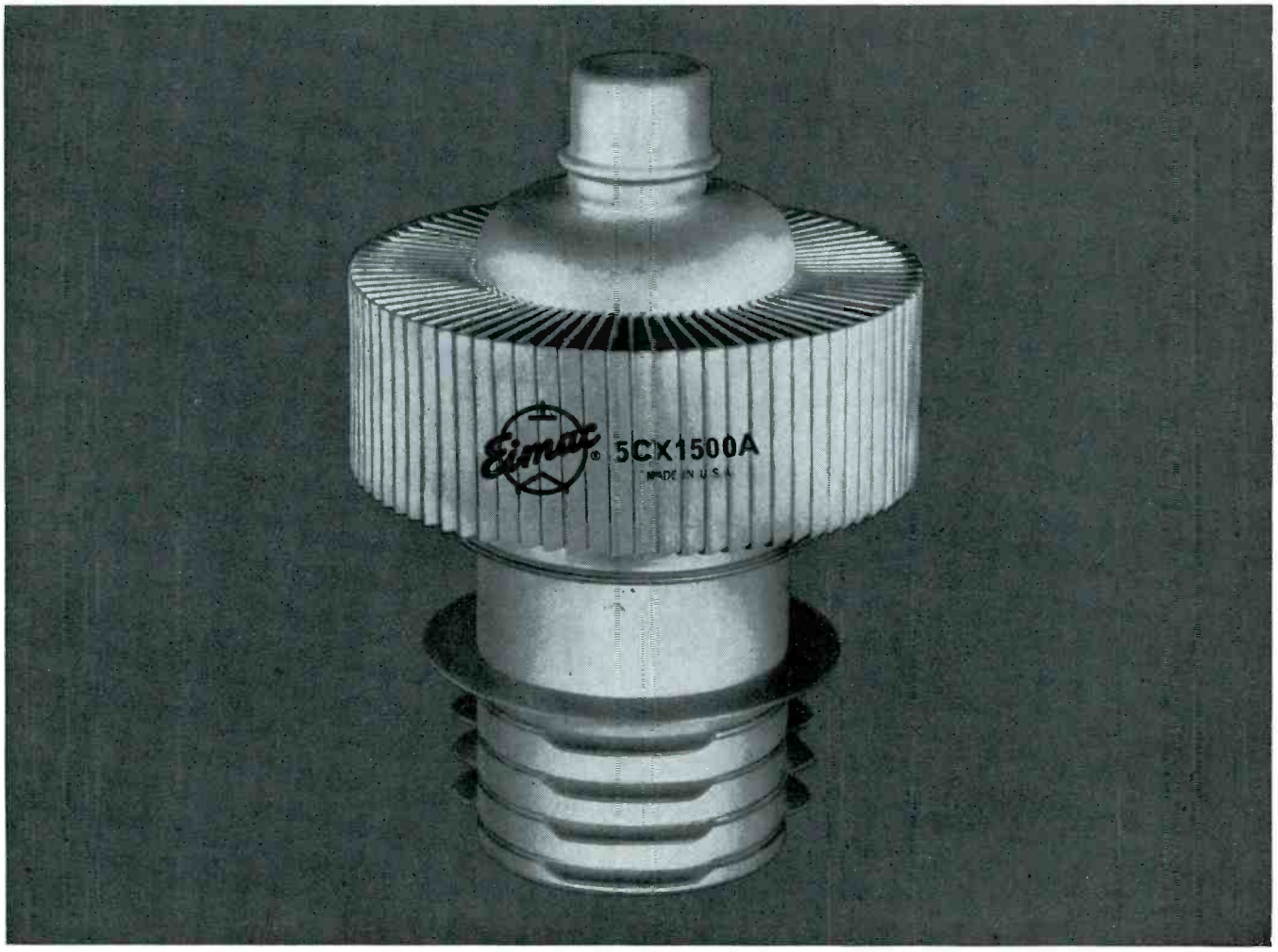
EIMAC

new power amplifier pentode provides excellent linearity

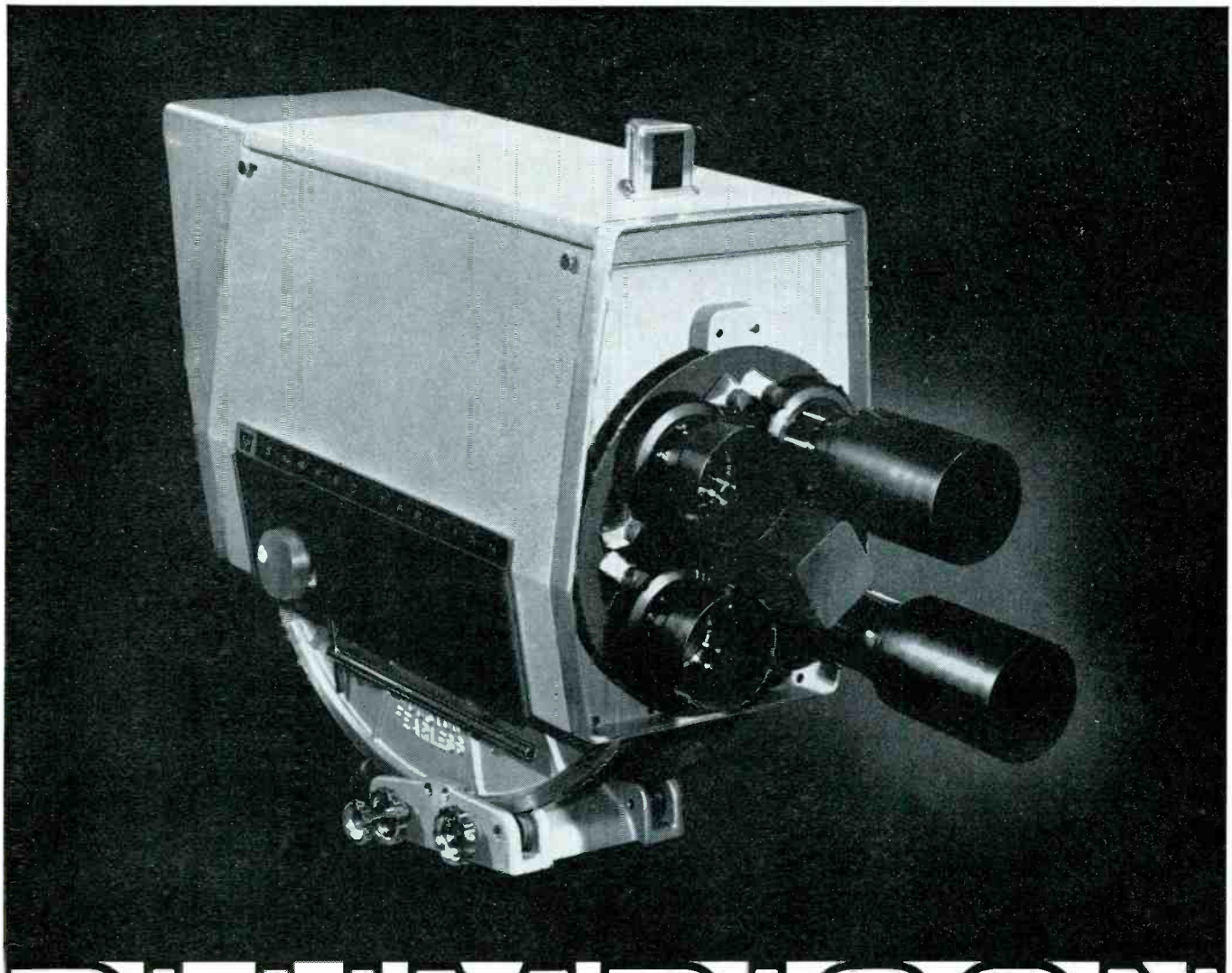
Now you can have reliable power in a new 1500 watt pentode. Eimac's 5CX1500A power amplifier tube is designed for use at the popular 1000-2000 watt peak envelope power range. And it's compact: height, 4⅞", diameter, 3½". Physical configuration is similar to Eimac's well-known 4CX1000A tetrode. The tube carries control and screen grid dissipation ratings of 25 and 75 watts, respectively. The 5CX1500A is ideally suited for Class C operation. In linear service the tube can provide a two-tone signal with third-order products of −39 db at 1000 watts PEP or −35 db at 1700 watts PEP. Write Product Manager, Power Grid Division, for details.

5CX1500A	
CLASS C MAXIMUM RATINGS	
DC PLATE VOLTAGE	5000 V
DC PLATE CURRENT	1.0 Amp.
DC SCREEN VOLTAGE	750 V
PLATE DISSIPATION	1500 W
SCREEN DISSIPATION	75 W
GRID DISSIPATION	25 W
SUPPRESSOR DISSIPATION	25 W
TYPICAL CLASS AB_1 LINEAR AMPLIFIER MEASURED VALUES IN TWO TONE TEST	
DC PLATE VOLTAGE	4000 V
DC PLATE CURRENT (No Signal)	250 mA
DC PLATE CURRENT (Two Tone)	485 mA
DC SCREEN VOLTAGE	500 V
PEAK ENVELOPE POWER OUT	1785 W
THIRD ORDER IN MAXIMUM	−35 db

EITEL-McCULLOUGH, INC., San Carlos, Calif.
In Europe, contact Eitel-McCullough, S.A., 15 rue du Jeu-de-l'Arc, Geneva, Switzerland



Circle Item 18 on Tech Data Card



PLUMBICON

Field proven? Tarzian's is. Tarzian plumbicons are in use today . . . in actual station operation. And, Tarzian's on-the-job experience verifies plumbicon as the first really significant improvement in television camera pickup tubes in years.

Here's a camera with a high sensitivity and the ability to handle wide contrast ratios, like an IO, combined with an exceptionally high S/N ratio (48 db) . . . especially well-suited for taping. The new plumbicon tube is excellent for both color and monochrome use, exhibits no lag, and has an exceptionally long life of several thousand hours.

For your early delivery or additional information on the Tarzian plumbicon, contact your Tarzian regional manager, or call or write direct.

SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION BLOOMINGTON, INDIANA

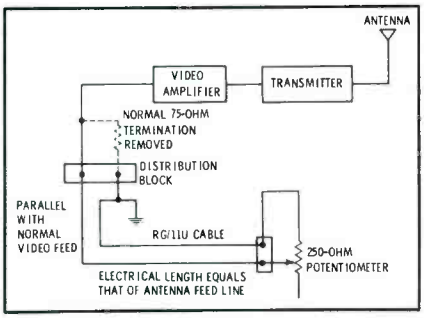
Circle Item 19 on Tech Data Card

ENGINEERS' EXCHANGE

A Method for Diminishing Ghosts

by Revis V. Hobbs, Transmitter Supervisor, WSM-TV, Nashville, Tenn.

Specifications for WSM - TV's completely new transmitting plant included two antennas of four bays each, with separate pairs of transmission lines. The antennas were to be used simultaneously in normal operation, but each was to be usable independently of the other. The voltage standing wave ratio, looking into the transmitter end of the transmission lines, was to be 1.05 to 1.0 or less.



The system was constructed as specified, and the electrical specifications were satisfactorily met. There was, however, enough reflection from the antenna system to produce a ghost on the "line out" monitor when a fixed picture (such as that from a monoscope) was being transmitted. After the system had been worked down to the practical end, as far as SWR was concerned, we looked for another method to reduce the ghost.

The "line out" monitor is connected to a directional coupler which is sensitive to the flow of energy toward the antenna. The ghost observed on the monitor is the result of energy which has been reflected from the antenna and reflected again by the transmitter output impedance. It has the same amplitude and phase, relative to the main signal, as that radiated from the antenna.

The method we developed, and are now using, is based on the idea of producing a signal at the output of the transmitter coincident with and of opposite polarity to that reflected from the antenna. This is accomplished by using an RG/11U cable, cut so that its electrical length is equal to that of our antenna feed lines, in place of the normal 75-ohm termination at the input jack of the video amplifier which feeds the transmitter. The other end of the cable is connected to a 250-ohm potentiometer (see diagram). Any reflection present on this cable is superimposed on our video signal. The length of the cable determines the coincidence (at the transmitter output) of the ghost and the reflection-cancelling voltage. The polarity and amplitude of the cancelling voltage, relative to the normal 75-ohm match, are varied by the potentiometer.

The system is adjusted by observing a picture or waveform monitor connected to the "line out" signal and adjusting the potentiometer for minimum ghost or reflected image.

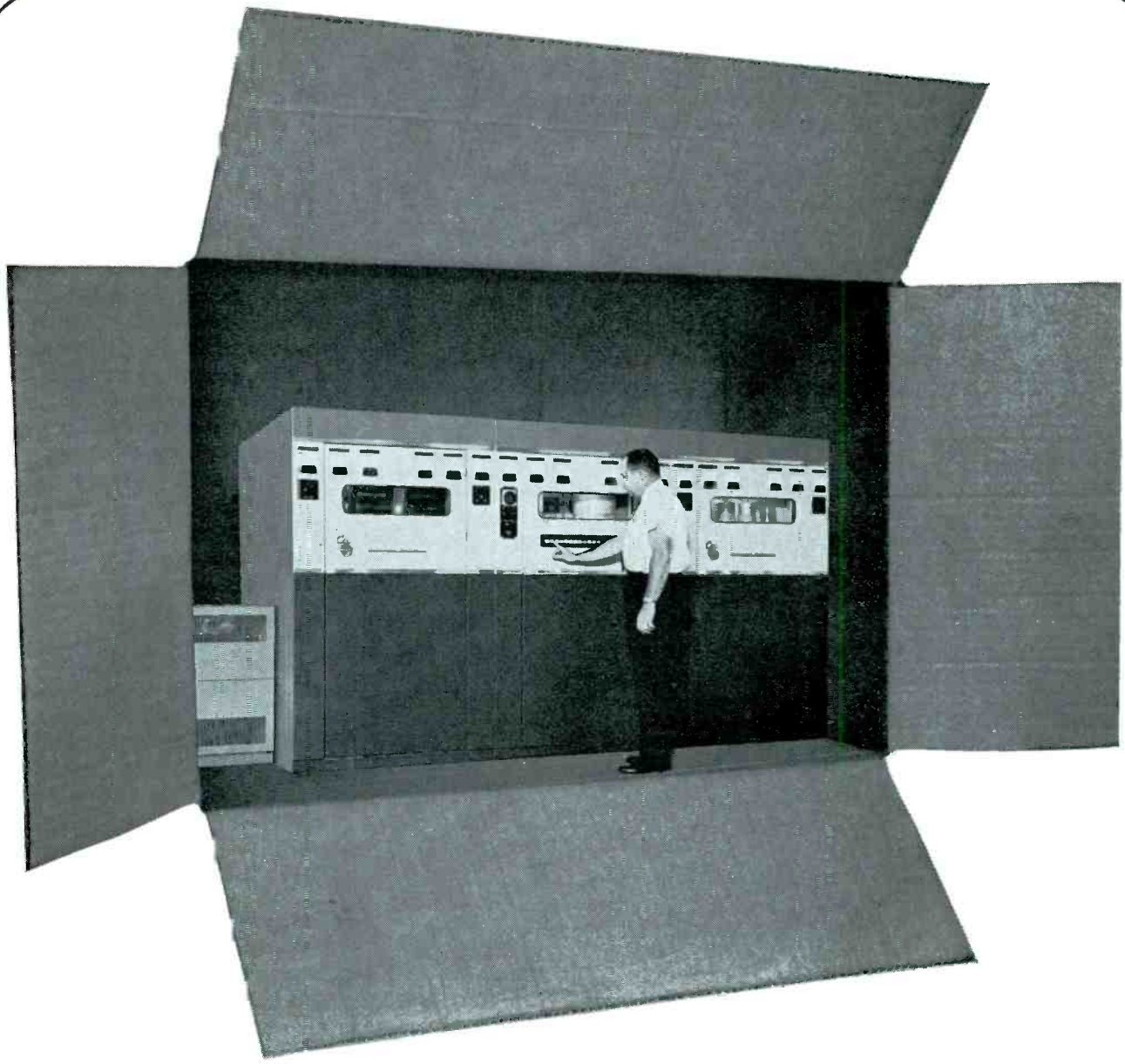
We are able to reduce the ghost by at least 10 db, which takes it down to the point where it can barely be seen even when specifically looking for it.

Economical Waveform Camera

by Troy Mallon, Chief Engineer, KRBC-TV, Abilene, Texas

In many TV stations, the engineering budget does not allow for "luxuries" such as waveform cameras. Yet, there is nothing that will beat a good waveform picture for comparison in troubleshooting or for future reference. We solved our no-camera problem by salvaging a Polaroid camera that had been discarded by our news department. The bellows leaked light, and the folding mechanism was jammed, among other faults. We applied a little black tape over the light leaks, determined to make a waveform camera out of this piece of "junk."

We found that if we used Polaroid No. 1 and No. 3 close-up



ONE NEAT PACKAGE

gives you the most efficient 50 kw AM broadcast transmitter built anywhere!

□ overall efficiency: 62% or better □ plate efficiency: 80% or better □ power consumption: 120 kw @ 100% modulation, 92 kw @ 30% modulation, 82 kw @ 0 modulation □ completely self-contained, including blower: compact design assures minimum installation cost and uses only 62 sq. ft. of total floor space.

for a descriptive brochure on Continental's new Type 317C 50 kw AM broadcast transmitter, write: Commercial Sales, Continental Electronics Manufacturing Company, Box 17040, Dallas, Texas 75217

LTV Continental Electronics
A DIVISION OF LING-TEMCO-VOUGHT, INC.

Circle Item 21 on Tech Data Card

lenses in tandem (with the camera-focusing lever set at 3½') the plane of critical focus fell 9" in front of the camera lens. We located a discarded electrical fixture which had previously been used in the control room to provide a directional light source. By removing the hood from this fixture and attaching it to the front of the camera with a couple of braces, we achieved the required 9" distance between CRT face and the camera lens. The small end of the hood is fitted over the close-up lenses, and the large ends fit very nicely over the oscilloscope bezel.

The only requirements to take good, sharp waveform pictures are to place the large hood opening flush against the scope face and hold the camera level—a little experimenting will establish the correct exposure for the type of film being used. (We use Polaroid 3000-speed film which requires an exposure of about 1 second.)

Since we've thrown this camera setup together, we've had field engineers and consultants show up burdened down with high-powered (expensive) camera gear for recording waveforms during new equipment checkout and proof-of-performance measurements. They nearly always end up using our camera to take their pictures, because there are no setup problems. The rig is so simple to operate that we use it on a regular basis to keep a running record of equipment performance.

Improving The GE BT-1B Low-Voltage Supply

by Bruce L. Mackey, Technical Supervisor, WKRT AM-FM, Cortland, New York

Modifications suggested in the following paragraphs are designed to improve regulation of the low-voltage power supply in the GE BT-1B FM transmitter and to update the tubes employed as regulators.

The modifications include removing voltage-divider resistors 1R182, 1R183, and 1R184, the values of which are 8K, 220 ohms, and 5K, respectively. These resistors tend to cause the minimum VR-tube current (which occurs with low line voltage and maximum power-supply load) to fall below the value required for stable tube operation. This condition results in VR-tube oscillation at random audio frequencies.

The following procedure should be employed to remove these resistors: Remove 1R183, the uppermost resistor on the board located at the rear of the power-supply panel; connect a jumper wire between the terminals to which this resistor was initially connected; remove the wires which run from terminal No. 1 to 1R182 and from terminal No. 2 to 1R184. Resistors 1R182 and 1R184 are located just to the right of the terminal board and are tubular, wirewound units bolted to the panel. Disconnect the grounded end of resistor 1R184 and remove the resistor from the panel, pulling the lead connected to the other end of the resistor through the wiring harness. (It is

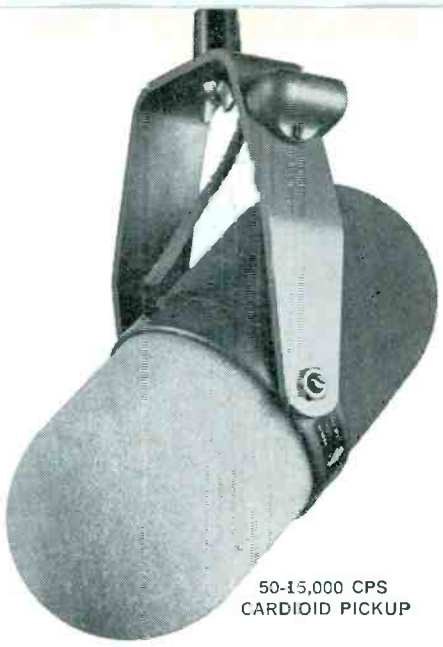
NEW

SHURE SM5

UNIDIRECTIONAL DYNAMIC BOOM MICROPHONE

SOLVES THE AUDIO ENGINEER'S MOST ANNOYING BOOM PROBLEMS

THE PROBLEM	HOW THE SHURE SM5 SOLVES IT
Sound coloration—from stage reflections or off-mike performers.	True Cardioid pickup pattern—symmetrical about the axis and exceptionally uniform with frequency. Excellent background noise rejection.
Wind and Boom noise from fast boom swings.	Two-stage mechanical isolation—two-stage permanent windscreen assembly. Element and isolation completely surrounded by outer wind shell, minimizing wind and mechanical noise in any indoor or outdoor application.
Pickup of electrical hum	No transformers or inductors. May be used in extreme hum fields.
Maneuverability	Perfectly balanced, lightweight — excellent stability, minimum overswing.
Mechanical Damage	Element and isolation assembly protected by outer windscreen and steel reinforcing rods.



50-15,000 CPS
CARDIOID PICKUP

SHURE STATION-ENGINEERED BROADCAST AUDIO EQUIPMENT

MICROPHONES

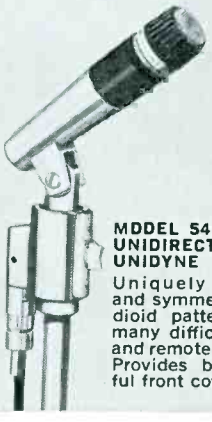
Specially designed for exacting studio applications.
Extensively field-tested, many in use by
leading radio and TV stations.

MODEL 576
OMNIDIRECTIONAL
DYNAMIC

Only ¾" diameter! 40% smaller diam., 60% smaller area than popular dynamic omnidirectionals. Virtually flat from 40 to 20 Kc. Rugged steel case.

MODEL 570
LAVALIER DYNAMIC

Outstanding on the job. Specially shaped response cuts "chest boom" . . . provides unequalled presence. Non-metallic "Flex-Grip" hanger . . . silent, secure. Only ¾" diam.



MODEL 546
UNIDIRECTIONAL
UNIDYNE III

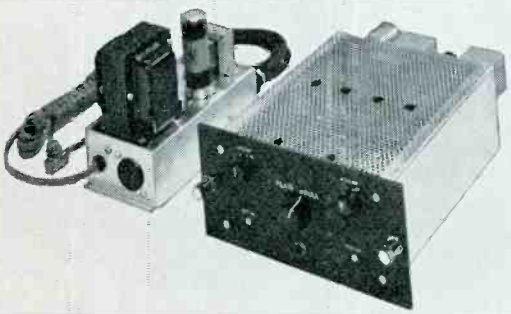
Uniquely uniform and symmetrical cardioid pattern solves many difficult studio and remote problems. Provides broad useful front coverage.

MODEL 333
UNIDIRECTIONAL
RIBBON

Extremely rugged. Exceptionally attractive and compact. Ideal for music (stereo or mono) and general applications on stand or boom. Super cardioid, flat wide-range response.

CIRCUITRY

Shure stereo equalizer and preamplifiers are praised as MAJOR contributions to upgrading station quality by broadcasters.



SE-1 STEREO
TRANSCRIPTION PREAMPLIFIER

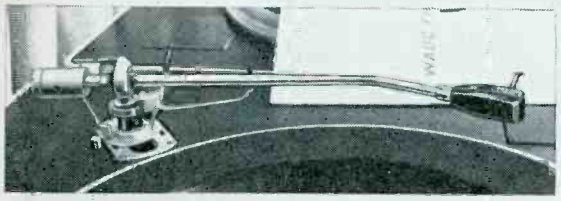
Provides precise RIAA equalization from magnetic phono reproducers at line levels. Separate high and low frequency response trimmers. Lowest distortion, noise level, susceptibility to stray RF fields.

M66 BROADCAST
STEREO EQUALIZER

Passive equalizer compensates recorded frequency to three playback characteristics: RIAA, flat, roll-off. Provides precise equalization from magnetic pickup at microphone input level.

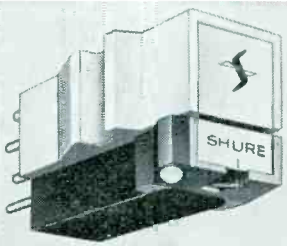
TONE ARMS & CARTRIDGES

World standard for quality sound.



SHURE SME
"THE BEST PICK-UP ARM IN THE WORLD"

Utterly beyond comparison. Supremely accurate, proved reliable in quality music stations.



STERED DYNETIC
Phono Cartridges

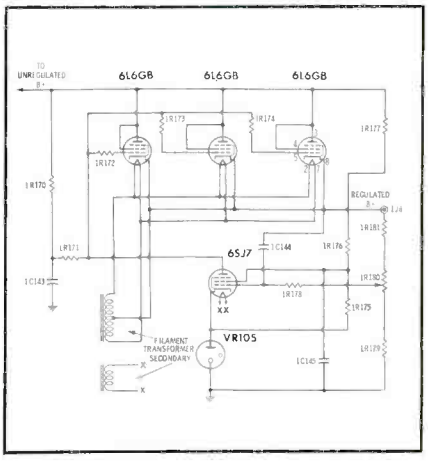
First choice on every count—standard in the quality music stations.

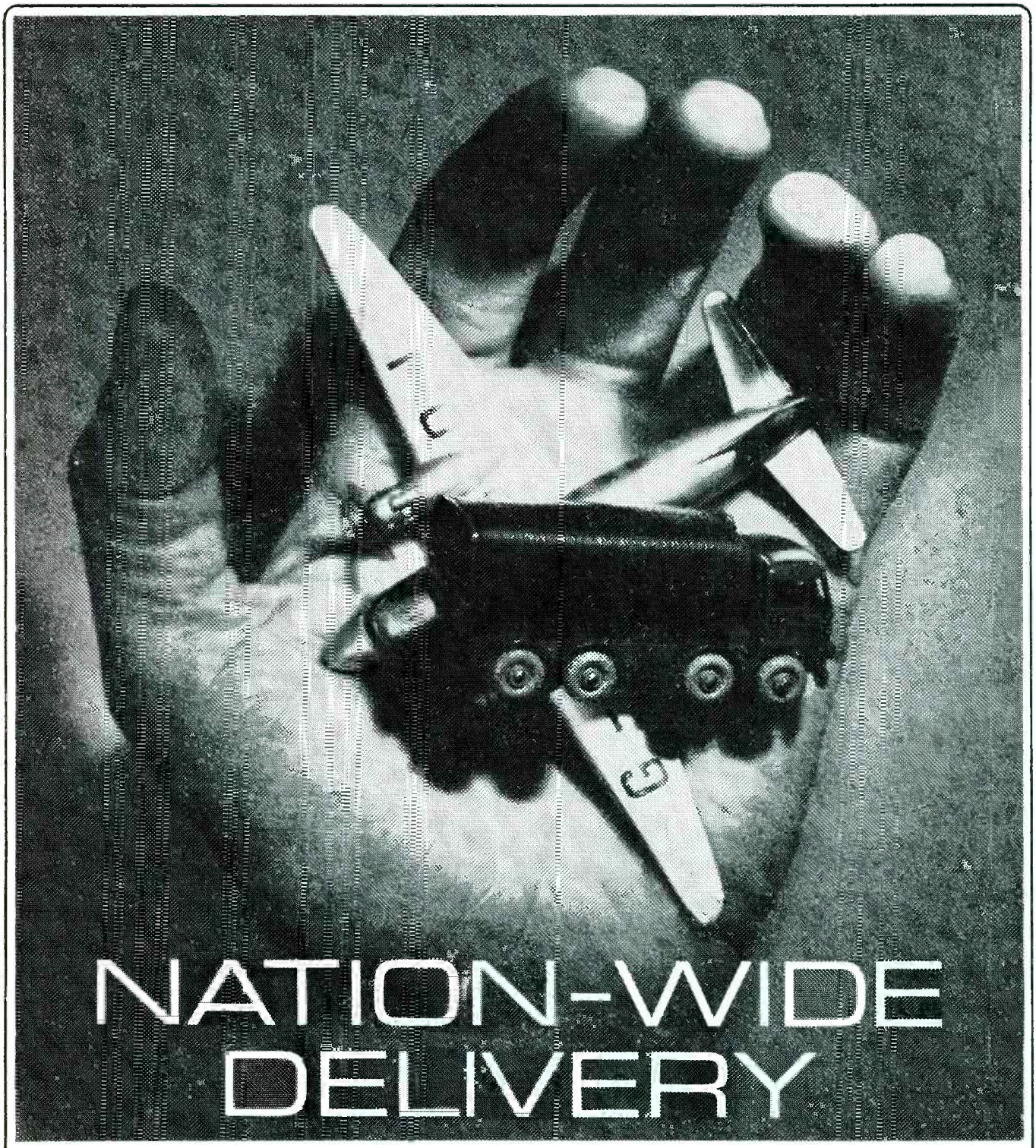
Write directly to Mr. Robert Carr, Manager of Professional Products Division, for personalized assistance, technical data, samples for testing: Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill.

easiest to pull the wire through from the free end a section at a time, beginning two or three turns of the cable lacing from the free end and pulling the free end through. While this procedure is not as easy as simply taping the wires, it makes a much neater job.) Next, remove 1R182 from the panel and remove the lead which ran from 1R182 to terminal 1 on the resistor board. The remaining lead connected to 1R182 is soldered to terminal 13 of the resistor board. Clip this lead from 1R182 at the resistor, leaving it connected to terminal 13. Pull the lead through the cable lacing and connect it to pin 8 of each of the 6B4 sockets. Tie pins 3 and 4 of each socket together.

An additional change, although not absolutely essential, further reduces the possibility of regulator-circuit oscillation at only a small sacrifice (.5%) of regulation capability. This change consists of substituting a 47K, 2-watt resistor for the 18K, 2-watt unit originally used for 1R175.

The final step is to remove the 6B4's and insert 6L6GB's in the same sockets. The 6L6GB's are considerably cheaper to obtain than the 6B4's and are often more readily available. If, however, you have lots of 6B4's, they may still be used without any wiring changes. The final overall schematic is shown in the accompanying drawing.





NATION-WIDE DELIVERY

HARVEY RADIO CO., INC.

103 West 43rd Street / New York, N.Y. 10036 / (212) JUdson 2-1500
Federal Electronics, Inc. (Subsidiary) / Vestal Parkway, Vestal, N.Y. / (607) Pioneer 8-8211

Wichita Falls or Walla Walla—wherever you are—you'll find that you can depend upon Harvey—**America's oldest distributor of professional broadcast and recording equipment—to fill your orders from stock in depth**...whether you need a studio tape deck, image orthicon tube, cable, or the smallest replacement part. What's more, we ship the fastest possible way—from truck to air freight. The three major networks find we save them time and the trouble of hunting around. You will, too. To order, write or call—collect—today.

Always on hand: A.D.C. • ALTEC • AMPEX • A.P.I. • CANNON • CBS LABORATORIES • DAVEN • ELECTRO-VOICE • LANGEVIN • MCINTOSH • NEUMANN • PULTEC • R.C.A. • SENNHEISER • UNIVERSAL AUDIO

Circle Item 26 on Tech Data Card

(Continued from page 11)

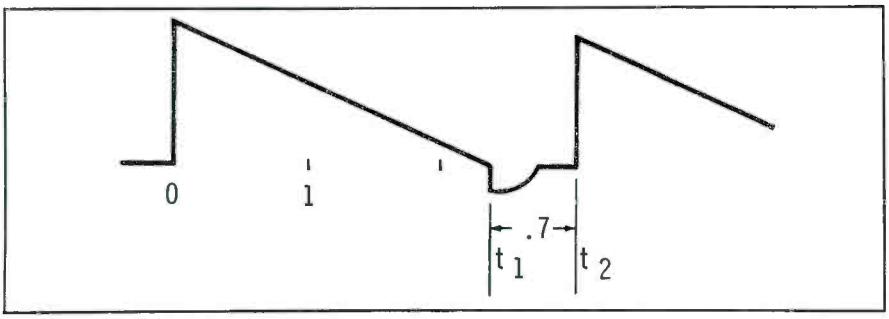


Fig. 2. Correct multivibrator waveform upon completion of potentiometer adjustment.

Adjust each of the pulse-forming multivibrators for proper pulse widths as shown in Table 1. All width adjustments are made by changing the potentiometer settings at each multivibrator.

Note: The vertical-blanking pulse is also used to reset the two bistable multivibrators in the generator. For this reason, the width of this pulse is adjustable only for discreet pulse widths. For easiest adjustment, monitor counter No. 2 while adjusting this pulse.

The timing adjustments for the leading edge of all pulses are made by moving the taps on the two delay lines. All final adjustments should be made while monitoring the output waveforms, not the individual multivibrator outputs. The adjustments which may be made are: (1) control over the amount of time by which the horizontal-synchronizing pulse lags the horizontal-blanking pulse, and (2) adjustment for achieving coincidence of the leading edge of the 9H pulse and the leading edge of the equalizing pulses.

The pulse-shaper unit can now be constructed, and the outputs of each OR circuit tested. The output waveforms were shown in Fig. 3 of Part 1.

After the pulse-shaping section is functioning properly, the final output amplifiers can be constructed. These amplifiers will not be needed if the generator is to be mounted on the camera and the inputs to the camera are of high impedance instead of the normal 75-ohm cable-terminating impedances.

In selecting a cabinet for this generator, the builder will have to determine the dimensions from the components selected and the existing studio equipment space. Since the power dissipated by the generator is in the range of 10 watts, heat dissipation is not a problem. The generator needs no warm-up period, but it should not be placed near extremely warm tube-type equipment. ▲

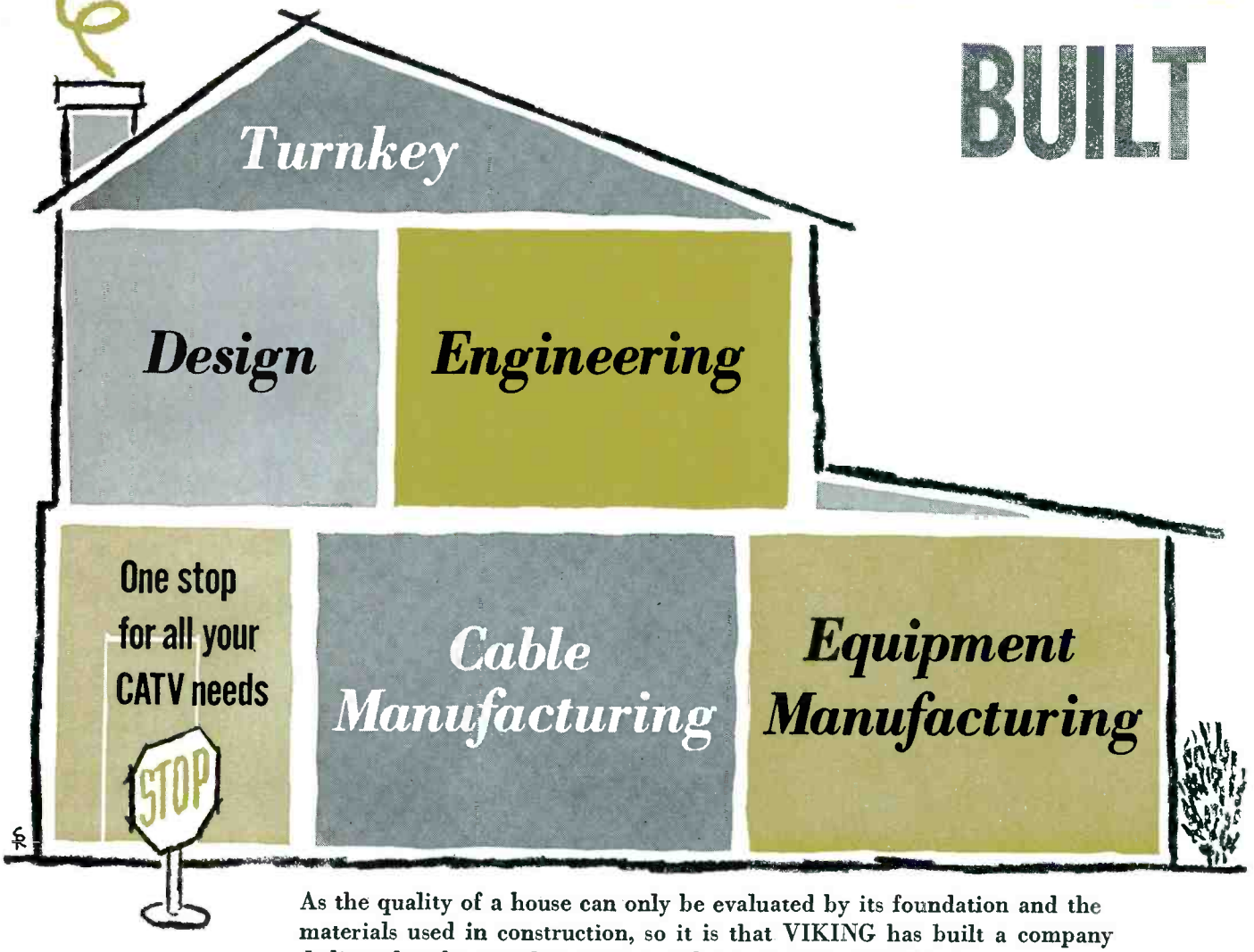
[1] Jacob Millman and Herbert Taub, **Pulse and Digital Circuits** (New York: McGraw-Hill Book Company, Inc., 1956), pp. 174-199.

[2] As above, pp. 199-201.

[3] A. J. Aronson and C. F. Chong, "Monovibrator Frequency Divider for Sync Generator," **Modern Transistor Circuits,** ed. John M. Carroll (New York: McGraw-Hill Book Company, Inc., 1959), pp. 86-87.

[4] **Transistor Circuit Design,** ed. Joseph A. Walston and John R. Miller, (New York: McGraw-Hill Book Company, Inc., 1963), pp. 373-377.

viking THE HOUSE THAT SERVICE BUILT



As the quality of a house can only be evaluated by its foundation and the materials used in construction, so it is that VIKING has built a company dedicated to the complete services and growth of the CATV industry.

Each specialized division at VIKING has been carefully planned to meet the expanding requirements of the CATV Industry and has resulted in the unique formation of an organization "that does everything"; equipment manufacturing, coaxial cable manufacturing, systems designing and engineering as well as complete turnkey construction.

When next you are considering the construction of a new CATV system, or rebuilding an old system, why not call upon VIKING — "THE HOUSE THAT SERVICE BUILT." No job is too big or too small.

viking

Manufacturers of Quality Coaxial Cables and Television System Products

DISTRICT SALES OFFICES

Hoboken, New Jersey—830 Monroe Street—201-OL 6-2020
New York, New York—212-WH 3-5793
Atlanta, Georgia—Fulton Federal Building, Suite 908—404-52-3-8379
Dallas, Texas—56-35 Yale, Room 212—214 EM 3-8054
Lewistown, Pennsylvania—17 S. Dorcaus—717-248 8844
Omaha, Nebraska—119 South 19th Street—402-341-1443
Los Angeles, California—1001 Glendale Blvd.—213-386-3030

Circle Item 28 on Tech Data Card

Recording Facilities

(Continued from page 15)

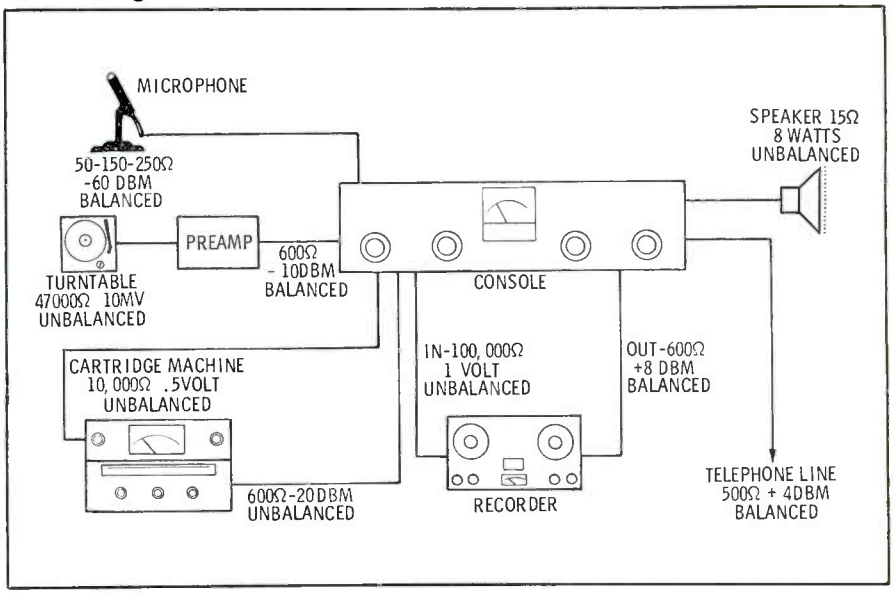


Fig. 4. Typical levels and impedances encountered during sound recording work.

to sound bad was found to have been dropped into a cup of coffee! Most manufacturers will repair their microphones and restore them to "like-new" condition for a fraction of their original price. Again, use your best equipment for recording.

Choosing New Equipment

Logically, the first question to come up here is: "tubes or transistors?" Any equipment normally used in recording is available either way, and either is capable of excellent performance. To decide which route to take, you must weigh the lower initial cost of tube equipment against the increased reliability and lower maintenance costs of transistor gear. Don't let your unfamiliarity with solid-state equipment bother you; once you do a little transistor troubleshooting (and there is generally very little to do), you will develop the same feel for solid-state circuits that you have for tubes.

To choose a recording console, consider the number of inputs you need, add a few spares, then stop. An overelaborate console can cause more pain than improvement if it is confusing to the operating personnel. Consoles made especially for production work are excellent.

A two-speed recorder (7½ and 15 ips) is best for production because it permits you to play back almost any tape that may come in from another station or advertising agency, and it lets you take advantage of the easier editing and relative freedom from tape dropouts offered by 15 ips.

Turntable selection should be for low wow and flutter, combined with fast starting. Low rumble need not be a prime consideration, since subsequent equipment will not pass the very-low-frequency rumble. Twelve-inch tables are good, since they usually start faster and are less expensive than their sixteen-inch brothers. Sixteen-inch arms should always be used, however, so that large transcriptions may be accommodated.

Most pickup cartridges available today are of the magnetic or reluctance type, and have adequate frequency response for most purposes. You should choose the more rugged ones that track at 5 grams or more; lighter tracking pressures often make cueing difficult. A stereo cartridge is satisfactory for monaural work, if the two channels are paralleled. Either passive equalizers or equalized preamps may be used.

A dynamic or condenser microphone with a sharp cardioid directional pattern and smooth frequency response should be chosen. Omnidirectional mikes may pick up outside noises or such in-studio noises as cartridge machines stopping. Ribbon mikes, though they give excel-

lent results in many applications, are not well suited to production work because of their heavy bass response when worked "close-in" as is often necessary. (They can be used, however, equipped with a low-frequency rolloff filter.)

When installing new equipment, keep these points in mind:

1. Keep the operator in the middle of things. He should be able to reach all normally used controls without moving about.
2. Make it simple to operate. Never use two switches where one would do.
3. Match up your levels. Try to set your incoming and outgoing levels so that all channels are at correct levels with about the same fader setting, and so that the console VU meter agrees with those on the recorders.
4. Keep your impedances matched. Fig. 4 shows some of the many impedances and levels encountered in a typical installation.
5. Install a good monitor speaker. Even the best production man can't do a good job if he can't hear the finished product.

Finally, make the installation neat. Lace your cables, use terminal boards, and don't spare any effort. A little well-placed paint can do wonders, too.

Happy Updating! ▲

BOOK REVIEW

Basic Theory and Application of Transistors: Department of the Army, Dover Publications, Inc., New York, New York; 263 pages, 6½ x 9¼, paperback, $1.25. This book is a re-publication of Department of the Army Technical Manual TM 11-690. Following a brief introductory chapter are 12 chapters that progress from the fundamental theory of transistors to pulse and switching circuits and modulation, mixing, and demodulation applications. Other chapters are devoted to amplifier fundamentals; bias stabilization; transistor analysis and comparison using characteristic curves and charts; audio, tuned, and wide-band amplifiers; and special semiconductor devices. Two appendixes (listing letter symbols and a number of references), a glossary, and an index complete the volume.

Numbered headings throughout the text identify the major topics. Each main section within the chapters begins with a general introduction to what follows. A brief summary concludes each chapter. The book is thoroughly illustrated with line drawings, schematic diagrams, charts, and graphs. In the second chapter, a number of "three-dimensional" drawings aid comprehension of crystal structure and the action at PN junctions.

To fully understand some portions of the text, a knowledge of simple algebra is required. The book is written on the assumption that the reader has good familiarity with vacuum-tube principles and circuits.

The word "basic" should not be construed to mean "superficial"; this is a book that must be studied if the reader is to acquire the knowledge contained within its pages. An understanding of the fundamental principles of transistors and their related circuits should result from this study.

Automate

(Continued from page 17)

to activate units A, C, D, etc., through multiple tone-controlled relays. Musical introductions and commercials, or other program material not otherwise reproduced, are recorded on the "broadcast" half of this tape. Control tones are recorded on the other half.

Some broadcasters may wish to note at this point that fast-cue switching between music and announcer (including dubbed commercials) may be achieved with units A and B alone. Better production will result from using the reel-to-reel tape transport for unit B (because of the ease with which corrections and changes can be made). However, an existing cartridge tape deck can be substituted at a substantial saving.

Unit C is a multideck (15 or more) cartridge-tape transport, with all decks operated from a single vertical capstan shaft powered by a single continuous-duty motor. This arrangement permits the use of a larger-diameter capstan for more tape-surface contact and more reliable drive. Pressure-roller solenoids may also be isolated for silent operation.

Commercial announcements, public service, and special production cartridges are loaded into this unit in the order to be broadcast each hour and are programed in sequence by a control tone (originated in unit B) and a stepping relay. Broadcast programing permitting, the decks of this unit may be programed at random through multiple tones, thereby eliminating the need to reload cartridges every hour. An "end of message" tone returns control to unit B after each announcement.

Units D, E, and F may be either wide-tape (Gates 101 Spot Tape) or drum-playback units with movable playback heads to be positioned over individual tracks to reproduce prerecorded time announcements ("It's 18 minutes past the hour," should do it), temperature announcements (a spread of 100 degrees should be enough), barometric pressure, etc. Here is an opportunity for some imagination, say a temperature jingle with commercial added; "It's a warm 92 degrees and wouldn't a glass of good old Sus-so taste great?" The playback head on each unit is positioned on a precise track through the use of conventional drum data-recording instrumentation. One control signal (tone, photoelectric cell, or even a cam-operated switch) can be used to return control to unit B on a tight cue if all information tracks on a given unit are the same length.

Unit Y is a conventional sound-powered relay fed from units A, C, D, etc., which starts the control-tape transport (unit B) on signal from any other unit. It may be bypassed for manual operation to start or stop the sequence, or for direct switching, by any unit (such as an information drum) controlled by a cam or photoelectric relay switch.

Unit Z is a multichannel sound-powered relay with tone switching to activate any unit in the chain upon "hearing" the proper prerecorded tone reproduced by unit B.

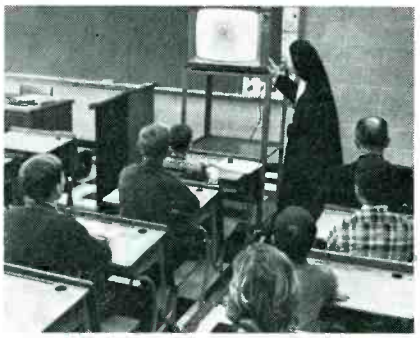
A third reel-to-reel tape transport (not included in the block diagram) with compatible two-track stereo record heads, recording amplifiers, tone generators, and tone-pulse switching completes the list of equipment required for this concept of automation. ▲

NEWS OF THE INDUSTRY

NATIONAL

ETV by Microwave

The first successful 2500-mc microwave broadcast in color for educational television purposes has been made from **Bradley University,** Peoria, Illinois, to TV receiving sets at Blessed Sacrament School in Morton, Illinois, 15 miles away. This was the first step in developing a regional educational TV network using microwave transmission to broadcast taped educational and instructional programs.



The tests—conducted by **Medicom, Inc.,** Chicago, in cooperation with Bradley—signaled the advent of 2500-mc microwave television on a multipurpose basis to educational, industrial, community and medical receiving locations. E. R. Kuchel, President of the Illinois Valley Educational Television Association and Vice-President of Bradley, said, "This microwave system has the potential of reaching institutions and organizations throughout central Illinois at an economical cost. Receiving locations would include elementary and secondary schools, libraries, industrial plants, research and development centers, hospitals, and mental-health centers."

Through the use of automatic repeater stations, the system will have the capability of reaching receiving locations in sparsely populated areas. Programming to these locations could include medical training, in-plant apprentice and technician training, cultural events, adult-education programs, and supplementary lectures for schools.

Bradley's plans for educational television include the establishment of a complete production center with 2500-mc transmitting facilities. The cost of putting up the 2500-mc microwave facility is about $35,000 compared to approximately $500,000 for a UHF station.

It is anticipated that within a few years Bradley will have four channels feeding programs to school receivers and an additional channel for industrial and medical programming.

To Increase CATV Activity

The **General Electric Company** has announced plans to broaden its participation in the community antenna television (CATV) business. At the same time, Robert B. Hanna was named General Manager of the General Electric Cablevision Corporation, a subsidiary company formed to develop and operate CATV systems.

The CATV corporation will file for franchises in a number of communities across the country. In addition, the company plans to expand its CATV operations by securing franchised systems now in operation. The GE Cablevision Corporation, chartered in late 1964, recently was awarded franchises in Schenectady and Colonie in eastern New York. The corporation has also filed for franchises in the Central New York towns of Cicero, Van Buren, and Camillus.

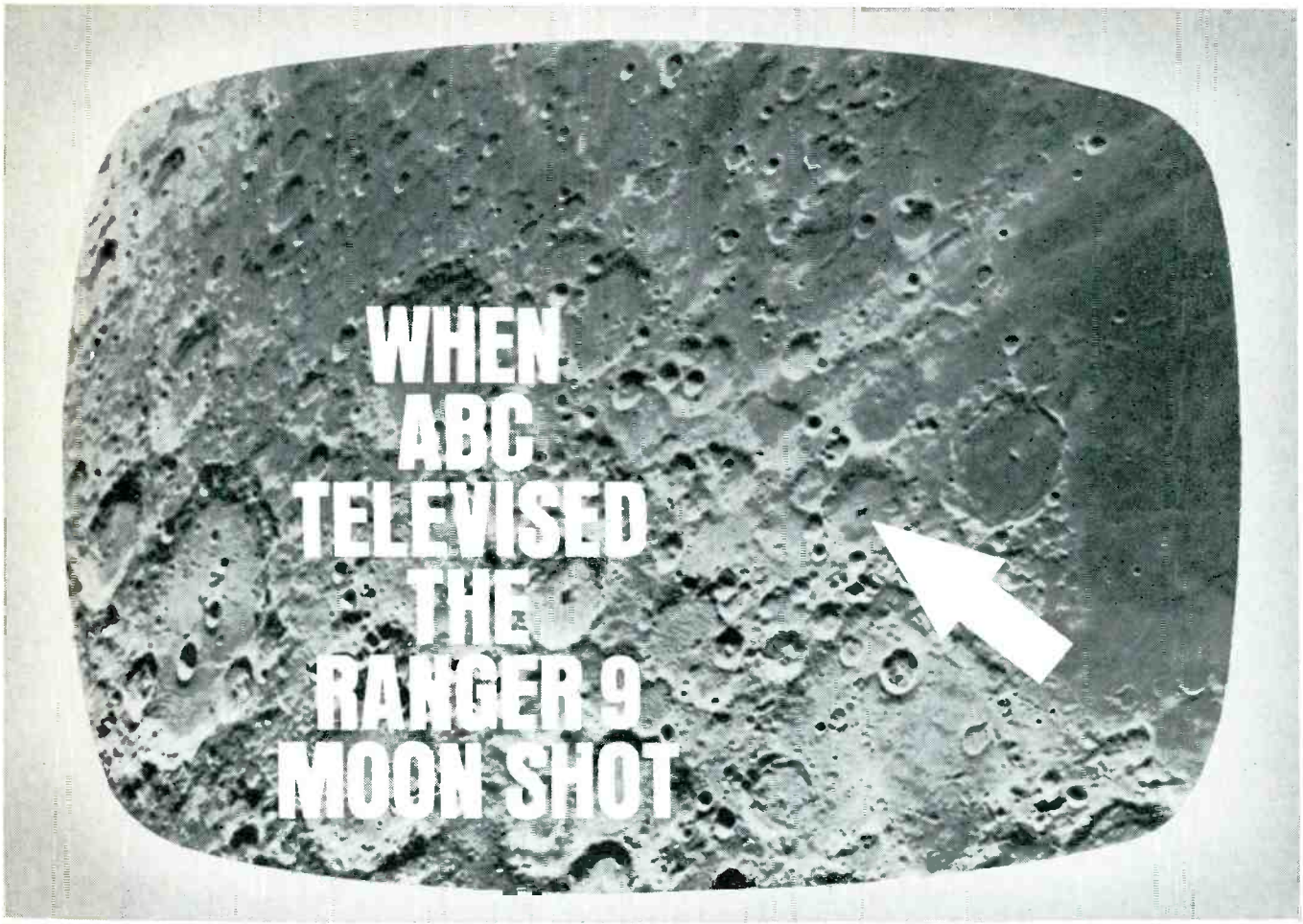
PERSONALITIES

Leonard Hedlund, Chief Engineer, **McMartin Industries, Inc.,** Omaha, Nebraska, has been elected to the Board of Directors and named Vice-President and Director of Engineering for the firm. Mr. Hedlund, a veteran of 25 years in the electronics field, joined McMartin six months after the firm began operations early in 1956. His basic design concepts are a part of every piece of equipment designed and manufactured by the firm, according to its president, Ray B. McMartin.

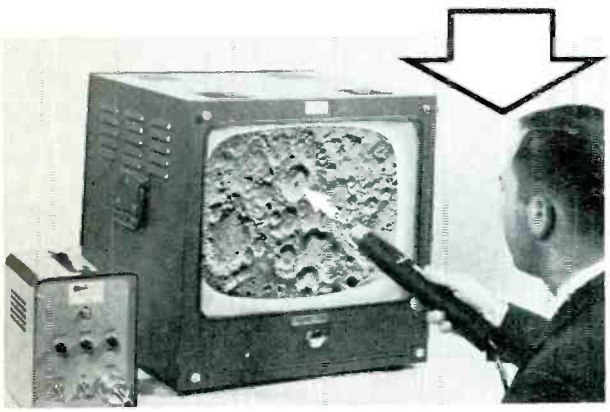
Mr. Hedlund has two patent applications pending. One deals with a selective programming system using undetectable audio tones to trigger devices for various commercial applications. The second is an application for an FM detector for use in FM monitoring and receiving equipment.

Mr. Hedlund holds memberships in the Institute of Electronic and Electrical Engineers, Audio Engineering Society, and the Electronics Industries Association. He is also a member of the TR-2 Subcommittee (AM and FM Broadcast Transmitter Systems) of the E.I.A.

John T. Jones, Jr., has been appointed Director of Engineering for **WCAU Radio,** Philadelphia. Mr. Jones, a graduate of Philadelphia Wireless Technical Institute and Temple University, joined WCAU in 1949 as a radio technician. In 1960 he was promoted to Radio Operations Supervisor and was in charge of over-all construction of the new $120,000 WCAU Radio studios. He is replacing Ralph Green who has been appointed Director of Technical Operations for WCBS, New York. ▲



They Used Telemet's New ELECTRONIC POINTER



Not a toy—but a professional electro-optical pattern generator. Simply insert the appropriate slide (arrow, circle, ring, cross, square, etc.) into the lightweight hand-held "gun" and point it at any picture monitor which is locked to the program video source.

Feather-touch switch permits flashing or full on-off operation. The pattern amplitude is level limited and non-additively mixed with the video signal.

APPLICATIONS

• NEWS EVENTS • SCIENCE LECTURES • SPORTS EVENTS
• WEATHER FORECASTS • CCTV BRIEFINGS and many more

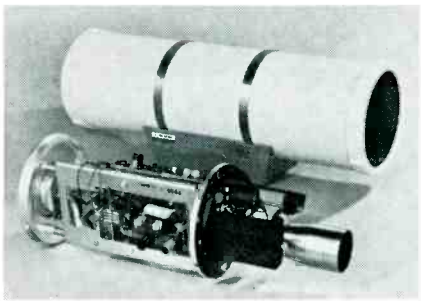
Non-commercial applications include: SPACE SIMULATORS, WAYPOINT INDICATORS, AIRCRAFT SILHOUETTES, RANGE CIRCLES and COMPASS ROSE GENERATION.

Write today for full specifications.

TELEMET COMPANY
a division of
GIANNINI SCIENTIFIC CORPORATION
185 DIXON AVENUE, AMITYVILLE, N.Y. • PHONE (516) 541-3600

Circle Item 39 on Tech Data Card

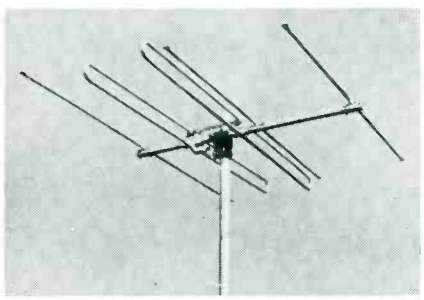
NEW PRODUCTS



Remotely Controlled Iris and Focus

Production of a newly designed mechanized unit for remotely controlling iris and lens-focus functions has been announced by **Cohu Electronics, Inc., Kin Tel Division.** Specifically engineered for mounting on the Cohu 3000-series cylindrically housed television camera, these units permit the remote controlling of lenses with fixed focal lengths from ½" to 6". Both the optics and the drive mechanism are protected by the environment-resistant camera housing. Lens-adjustment rings are gear driven by small DC motors and are powered via the camera cable. Slip clutches prevent damage to lens and drive assembly when power is applied beyond the adjustment limits. Price of the assembly is $245.

Circle Item 91 on Tech Data Card



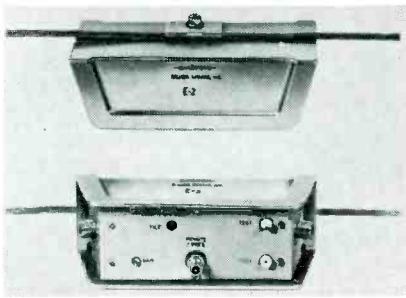
Rugged Antenna for 82-88 mc

For TV remote pickup and rebroadcast on channel 6, **Taco** offers the Y-51-6. This antenna features 1¼" square crossarm, ⅝"-diameter elements, and ¾" reinforcing sleeves where the elements are attached. Vibration dampers are installed in the longer elements to reduce fatigue and crystallization which might lead to eventual breaking. The yagi offers direct coaxial connection to either 50- or 75-ohm coax with matching accomplished through a re-entrant internal balun. VSWR is 1.4:1 and remains relatively flat across the entire band. Power rating is 700 W, and nominal gain is 8.0 db over an isotropic source.

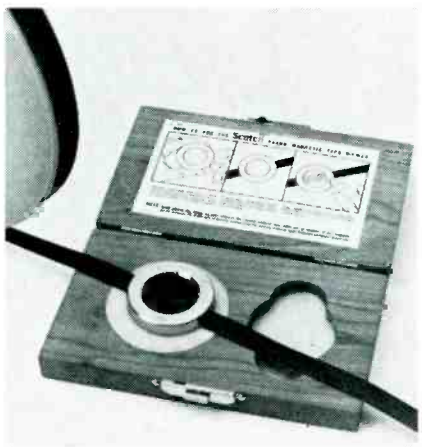
Circle Item 92 on Tech Data Card

Remote-Powered CATV Amplifier

A new transistorized extender amplifier, Model E-2, is being offered by **Entron, Inc.**, CATV equipment manufacturers. The new, high-gain, high-output unit is designed for use as an extender in CATV distribution lines. Its strand mounting feature and weatherproof design permit installation at any point where the signal level requires amplification. The E-2 uses silicon semiconductors and is powered through the coaxial cable by a remote 60-volt, 60-cps transformer. The Model E-2 accepts remote power form either the input terminal or the output terminal and will also feed remote power straight through.



Circle Item 93 on Tech Data Card



Magnetic Pulse Viewer

Editors of video tapes are finding a tape-viewing instrument useful for editing, even though the instrument was developed for use with computer and instrumentation tape. The viewer, developed by **3M Co.,** makes visible the data recorded on magnetic tape without damaging the tape and without the use of exterior chemicals. In editing magnetic film, the viewer exposes synchronizing pulses, sound cues, and the high-frequency components of speech, sound effects, and music tracks. The tape editor merely places the viewer on top of the film and looks at the exposed magnetic signal.

Other uses for the viewer include checking recorder head alignment, track placement, pulse definition, interblock spacing, and dropout areas in computer and instrumentation work. In addition, it can be used to examine and synchronize the audio track on video tape and to see the pattern of recorded sound on audio tapes.

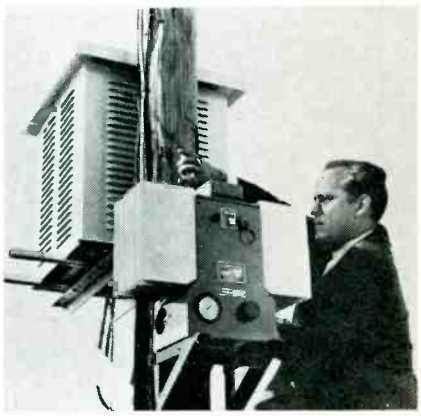
The "Scotch" No. 600 viewer is an instrument which requires no preparation to use and is priced at $50. It is covered by a six-month guarantee against defective materials and workmanship.

Circle Item 94 on Tech Data Card

TV Modulator

The MPS-15 TV Modulator, designed for closed-circuit applications using standard TV receivers, is available for channels 2, 3, 4, 5, or 6. The unit produces two radio-frequency carriers and modulates one with sound, the other with picture. Thus, both picture and sound are transmitted on the same channel to one or more standard TV receivers in a closed-circuit system. The **Packard-Bell Electronics** unit is self-contained, crystal-controlled, transformer-operated, fully automatic, and transistorized. It has an RF output of 50 db at 75 ohms and 30 db at 300 ohms. 75-ohm attenuators of 3db, 10db, and 20db are available to balance standard TV receiver closed-circuit systems by reducing output as required. Video input is 75 ohms (terminated in the modulator), coaxial cable output is 75 ohms, and twin-wire output is 300 ohms. Power input is 5 watts at 115 volts AC; size is 5" x 7" x 3"; list price is $125.

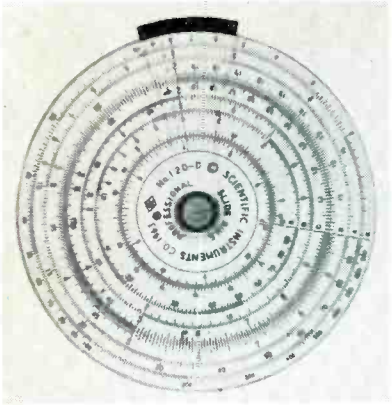
Circle Item 95 onTech Data Card



New Commercial Thermoelectric Power Plant

An all-weather thermoelectric generator —an automatic power plant that operates unattended in snow, heat, rain, or wind storms and provides a continuous flow of electricity from the flameless combustion of propane gas—has been developed for commercial production by the **General Instrument Corp., Thermoelectric Division.** The generators will operate for a full year on only 150 gallons of propane gas, at a fuel cost of approximately $40, and are available in a range of power outputs from 6 to 50 watts. A 12-watt generator is priced at approximately $500. The unit shown, coupled to a voltage-controlled DC-to-DC converter, provides 8 watts of power continuously.

Circle Item 96 on Tech Data Card



Round Pocket Slide Rule

A new circular slide rule permitting one-hand operation and continuous readings has been developed by **Scientific Instruments Co.** Called the Rotorule, the device employs a rotating center disc and single-cursor design which allow operation identical to a straight (linear) slide rule. The method assures simple operation, as other circular slide rules have multiple cursors and require learning a different method.

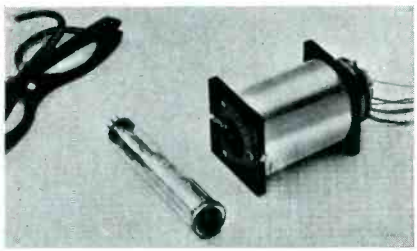
The single cursor and continuous scale readings eliminate the inconvenience of running off-scale as is possible on straight slide rules. The circular design doesn't need DF, CF, or CIF scales. The rotating inner disc also permits readings either clockwise or counterclockwise. The circular slide rules have "P" Pythagorean and "Ei" scales and are available in 3", 4", and 5" diameters with scale lengths up to 15.7". All sizes will fit either shirt or coat pockets and are constructed of white, phenolic-resin plastic over an aluminum-alloy core. Cost is said to be 50% less than comparable linear slide rules.

Circle Item 97 on Tech Data Card

Binaural Headset

The **Roanwell** TV Special No. 106100 Boomman's Binaural Headset is specially designed for modern television-studio use. The earphones are housed in noise attenuating earcups. Circumaural foam-filled ear cushions fit closely against the head to assure proper acoustical sealing. Frequency range of each earphone element is 300 to 3500 cps, impedance is 275 ohms, and sensitivity is 113 db (reference .0002 dynes/cm^2) at 1000 cps with input of 1 mw. The earphones are wired binaurally to permit the boomman to monitor the program and receive cue directions simultaneously. A 28" coiled neoprene cord (15' extended) contains four multistrand cadmium-copper conductors. List price is $92.00.

Circle Item 98 on Tech Data Card



The Vidicon 20PE11 and Yoke Assembly is an achievement in miniaturization and low power drain for the Electronic Component Division of **Matsushita Electric Corp. of America.** Specifications of the miniature vidicon: maximum sensitivity livescene pickup—10 Lux; resolution—500 center, 380 corner; weight—.7 oz.; heater—6 volts at .1 amp (DC or AC); diameter ⅔", overall length 4". The Yoke Assembly has a built-in magnet mechanism for electron-beam alignment. Price for the Vidicon and Yoke Assembly is $150. ▲

Circle Item 99 on Tech Data Card

ENGINEERS' TECH DATA

AUDIO & RECORDING EQUIPMENT

43. ATLAS SOUND — Catalog 564 describes line of public-address speakers and microphone stands for commercial and industrial sound-distribution systems.
44. BEHREND'S—Midwest supplier offers new catalog showing complete line of audio and recording equipment.
45. BROADCAST ELECTRONICS—Packet contains specifications and price information for "Spotmaster" tape-cartridge systems and new "Portapak" playback unit. Data also available on "Ten-Spot" multiple-tape system.
46. CBS LABS—Literature on the "Volumax" automatic peak controller and the new "Audiomax III" solid-state automatic level control.
47. CINE SONIC—Data sheet describes rental service which supplies background music prerecorded on 7", 10½", and 14" reels of tape, or in cartridges.
48. GATES — Technical specifications of new solid-state, frequency-sensitive FM audio-level control unit to prevent over-modulation and increase average modulation level.
49. GOTHAM — Artificial reverberation techniques and applications listed in engineering bulletin 10F.
50. NORELCO — Technical specifications and brochures on condenser and dynamic microphones for use with professional audio equipment and accessories.
51. RUST—Data sheet on 1965 solid-state stereo console.
52. SENNHEISER—Folder describes physical and electrical characteristics of Model MD 42 noise-cancelling dynamic microphone.
53. VIKING — Series of brochures describes new amplifiers for tape playback and provides information on other new tape transports and duplicators.

COMPONENTS & MATERIALS

54. AMPEREX — Condensed (short-form) catalog lists basic specifications of broad tube line.
55. CALVERT — Information on English Electric CR1100 extended life expectancy replacement for 6076, requiring no rewiring or modification.
56. DENSON—Several lists of new, used, and surplus equipment; cameras, sync generators, tripods, pedestals, lenses, etc.
57. QUAM-NICHOLS—New general catalog describes speakers for variety of original-equipment and replacement uses.
58. SWITCRAFT — New 12-page, 2-color phone plug and patch-cord catalog P-202 lists current product line and describes six-conductor "Twin Plugs."
59. TEXWIPE — Brochure provides information on industrial cleaning materials and aids which include lint-free wiping cloths and compressed-gas-dusting aerosols.

MICROWAVE DEVICES

60. MICRO-LINK—Three sets of data on 2500-mc ITV planning, Model 420A portable relay link, and Model 600 fixed 12-kmc relay link.
61. MICROWAVE ASSOCIATES—Description and specifications of new, portable 20-watt TWT RF power amplifier for TV broadcast relay operations.

MOBILE RADIO & COMMUNICATIONS

62. MOSELEY—Data sheet provides specifications and description of remote-pickup transmitter/receiver system for operation at 140-174 mc.
63. MOSLEY—Product folders, specification sheets, and brochures give information on line of Citizens-band and industrial antennas.
64. TREPAC—Condensed "Datatone" brochure shows complete line of modular communications systems.

POWER DEVICES

65. HEVI-DUTY —Bulletin No. 7-12 describes line-voltage regulator using a saturable-core reactor.
66. ONAN—Standby electric plant equipment and controls are listed and described in catalogs 31d/On and F-205.

RADIO CONTROL ROOM EQUIPMENT

67. ATC — "ATC's of Automation" brochure illustrates various automatic installations with systems ranging in size from a single rack to eight racks.
68. BAUER — Compact silicon-transistorized console, available in finished or kit form, is described in illustrated specification sheet.
69. WALLACH — Description of sectional double-door cabinets, mobile units for storing and filing records, tapes, films, filmstrips, and slides.

REFERENCE MATERIAL & SCHOOLS

70. CLEVELAND INSTITUTE OF ELECTRONICS — Brochure describes electronics slide rule with four-lesson instruction course and grading service.
71. JAMPRO — Technical paper entitled "A Study of Vertically Polarized Radiation" supplies results of data gathered using this radiation method.

STUDIO & CAMERA EQUIPMENT

72. CLEVELAND ELECTRONICS — Data concerns deflection yoke and alignment coil for 3" image orthicons.
73. TV ZOOMAR—Information on Angenieux lenses for IO's and vidicons and data on Evershed Mark II servo-controlled pan and tilt equipment.

TELEVISION EQUIPMENT

74. DAGE-BELL—Specification sheets give particulars on portable video-tape recorder using broadcast-approved stabilizer for remote recording applications.
75. DYNAIR — Comprehensive catalog gives specifications and descriptions of a wide range of television switching, processing, transmission, and distribution equipment and accessories.
76. EMC—New 100-watt VHF TV translator operating on any VHF channel is described in product-report sheet.
77. INTERNATIONAL NUCLEAR—Model TVA1 transistorized stabilizing amplifier featuring stripped sync, stripped video, sync-tip clamping, and back-porch restoration is fully described in folder.
78. TELEMET — Literature describes new Model 3203A1 solid-state clamper amplifier which provides 40-db hum rejection.
79. VITAL—Data sheets provide information on video-distribution amplifier Model VI-10A, pulse-distribution amplifier VI-20, and video clamper/stabilizer VI-500.

TEST EQUIPMENT & INSTRUMENTS

80. BALLANTINE — Product sheet describes Model 345 DC/AC volt-ohmeter.
81. EICO—New catalog lists several late additions to broad line of test equipment in factory-wired or kit form.
8. LECTROTECH — Data sheets provide technical information on Models V-6 and V-7 color-bar generator and color-bar generator plus vectorscope.
83. SECO—Catalog sheet describes Models 107B, 88, and 98 tube testers.
84. VITRO—New Model 112 phase monitor featuring solid-state circuitry is described in product report.

TRANSMITTER & ANTENNA DEVICES

85. AIR SPACE DEVICES—Brochure describes "Saf-T-Climb" device designed to give protection from falls when performing tower maintenance or repair.
86. CCA—Information available on complete line of AM and FM broadcast transmitters and accessories.
87. CONTINENTAL — Folder describes Model 317C 50-kw AM broadcast transmitter.
88. DELTA—Series of application bulletins describes use of Model OIB-1 and Model CPB-1 impedance bridges.
89. HUGHEY-PHILLIPS—Bulletin HPS-181 provides information on tower-lighting systems featuring lamp-failure alarm for unattended installations.
90. SCALA — Catalog sheets describe antennas for monitoring FM and TV signals in industrial and broadcast applications.

Professional Services

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

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

LAWRENCE BEHR ASSOCIATES, Inc.
RADIO ENGINEERING CONSULTANTS
FM Applications and Field Engineering
also
AM — Communications — CATV
LAWRENCE BEHR, PRESIDENT
2501 East Fourth Street
Greenville, North Carolina
919-PL 8-3966

OSCAR LEON CUELLAR
Consulting Radio Engineer
AM-FM-TV
411 Phoenix Title Building 623-1121
Directional Antennas Design
Applications and Field Engineering
Tucson, Arizona 85701
Member IEEE

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

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

Classified

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

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

EQUIPMENT FOR SALE

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

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

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

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

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

Everything in used broadcast equipment. Write for complete listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee. 11-64 6t

Laboratory Test Equipment, microwave components, all frequency and makes at real low prices. Write or call for information. Jericho Electronic Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N. Y. (516) WA 1-7580. 12-64 6t

AMPEX 350 SERIES reconditioned capstan idlers for $7.50 exchange. Send us your old ones, or order them for $10.00 and get $2.50 back after sending the old ones in. Ours have new bearings, the rubber softened and surface precision ground. TABER MANUFACTURING & ENGINEERING CO., 2619 Lincoln Ave., Alameda, California. 1-65 12t

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

Parabolic antenna, 4-ft. diameter. New solid surface aluminum with hardware and diapole, $85 each. Empire Device heads for NF 105, half price. Jericho Electronics Supplies. Sid Gordon Electronics, 80 West Jericho Turnpike, Syosset, Long Island, N.Y. (516) WA. 1-7580. 3-65 3t

ELECTRONIC TUBES—Top Brands SOLD at substantial savings; (Minimum Order $15.00). Authorized GE, Amperex, Dumont and Eimac Distributor. Send for FREE Buyers' Guide for all your Tube Requirements. TOP CASH PAID for your excess inventory. (New Only—Commercial Quantities). Metropolitan Supply Corp., 443 Park Avenue South, New York, N.Y. 100161 (212) MU 6-2834. 3-65 5t

2-GATES FM-1B 1 KW FM Transmitters, reconditioned. Less exciter or with new Gates exciter and spare tubes. Tuned to your frequency. Write Broadcast Engineering, Box 128. 5-65 1t

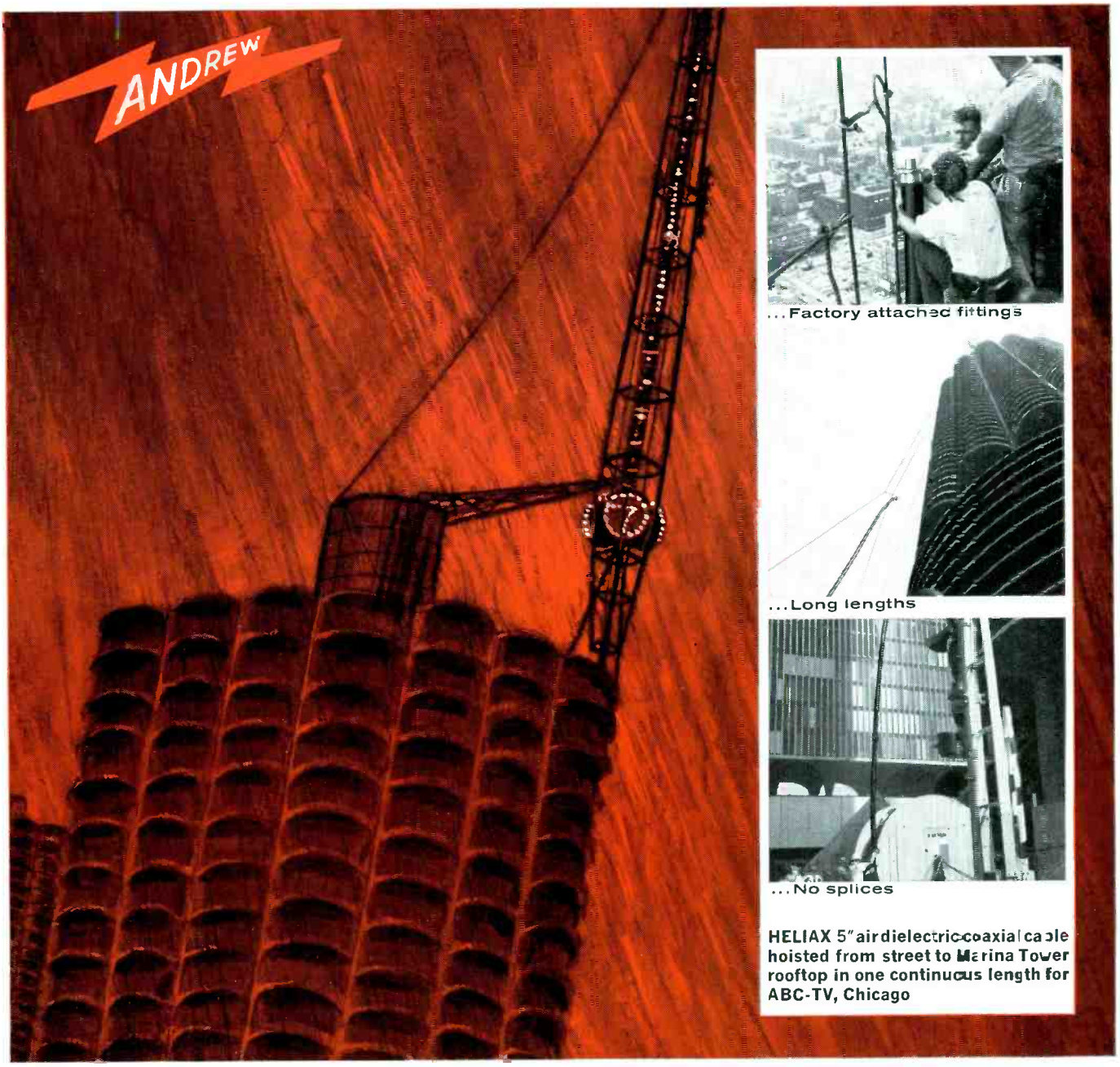
Caterpillar, diesel generating set used approximately 3,000 hours. Output 220 volts, 3 phase, 60 cycles, 40 kilowatts. For outdoor installation with 8 hour fuel tank. Excellent emergency power source. Write Box No. 127 for details. 5-65 1t

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

CO-AXIAL CABLE Heliax, Styroflex, Spiroline, etc. Also rigid and RG types in stock. New material at surplus prices. Write for list. Sierra-Western Electric Co., Willow and 24th St., Oakland, Calif. Phone 415 832-3527. 5-65 tf

BROADCAST EQUIPMENT — RCA 76-B2 Consolette, 2 RCA (3 speed) turn-tables, 2 RCA BA-11-A Pre-amplifiers and 1 Schafer Automatic Programmer. All equipment in good condition. Make offer. WUNI, MOBILE, ALABAMA. 5-65-1t

Advertisers' Index



...Factory attached fittings

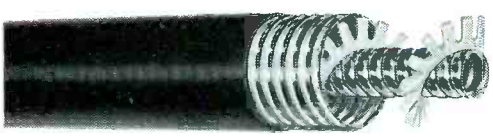
...Long lengths

...No splices

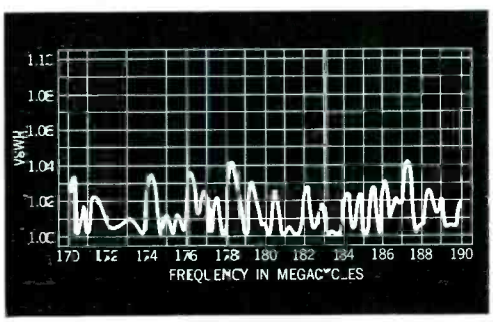
HELIAX 5" air dielectric coaxial cable hoisted from street to Marina Tower rooftop in one continuous length for ABC-TV, Chicago

HELIAX® FLEXIBLE COAXIAL CABLE

guaranteed reliability for high power RF transmission



Actual measured VSWR for installed 742 foot length of 5" HELIAX



Long continuous lengths, and flexibility of Andrew HELIAX cable made this critical transmission line system possible. Installation required less than six hours. Cost was dramatically reduced.

Type H9-50 HELIAX cable insures long term reliability in high power RF transmission*. Corrugated copper inner and outer conductors absorb stress and cable retains superior electrical qualities after repeated flexing. Andrew end connectors firmly anchor inner to outer conductor and eliminate any RF noise from vibration or temperature changes.

Contact your Andrew sales engineer, or write for information on this superior transmission line.

*Handles average power of 250 kw @ 10 Mc or over 50 kw @ 200 Mc

28 YEARS OF ENGINEERING INTEGRITY

4-65

Andrew CORPORATION

P. O. BOX 807 • CHICAGO, ILLINOIS U.S.A. • 60642

Circle Item 102 on Tech Data Card

Created by the hand of experience

RCA-7295B 4½-INCH IMAGE ORTHICON

Unmatched picture quality in black-and-white pickup

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

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

The Most Trusted Name in Electronics

AVAILABLE THROUGH YOUR AUTHORIZED RCA BROADCAST TUBE DISTRIBUTOR

FOR NAME AND ADDRESS OF YOUR LOCAL DISTRIBUTOR WRITE OR CALL YOUR NEAREST RCA DISTRIBUTOR PRODUCTS SALES OFFICE—NEW YORK, NEW YORK: 36 W. 49th St., (212) MU 9-7200; NEEDHAM HEIGHTS 94, MASSACHUSETTS: 80 "A" St., (617) HI 4-8480; WASHINGTON 6, D. C.: 1725 "K" St., N.W., (202) FE 7-8500; ATLANTA, GA.: 134 Peachtree St., N.W., (404) JA 4-7703; CLEVELAND, OHIO: 1621 Euclid Ave., (216) CH 1-3450; CHICAGO, ILL.: Merchandise Mart, (312) 467-5900; DALLAS 7, TEXAS: 7901 Carpenter Freeway, (214) ME 1-3050; KANSAS CITY 14, MO.: 7711 State Line, (816) EM 1-6462; HOLLYWOOD, CALIFORNIA: 6363 Sunset Boulevard, (213) 461-9171; SAN FRANCISCO 2, CALIFORNIA: 420 Taylor St., (415) PR 5-5135-6-7. DES PLAINES, ILLINOIS: 446 E. Howard Ave., (312) 827-0033.