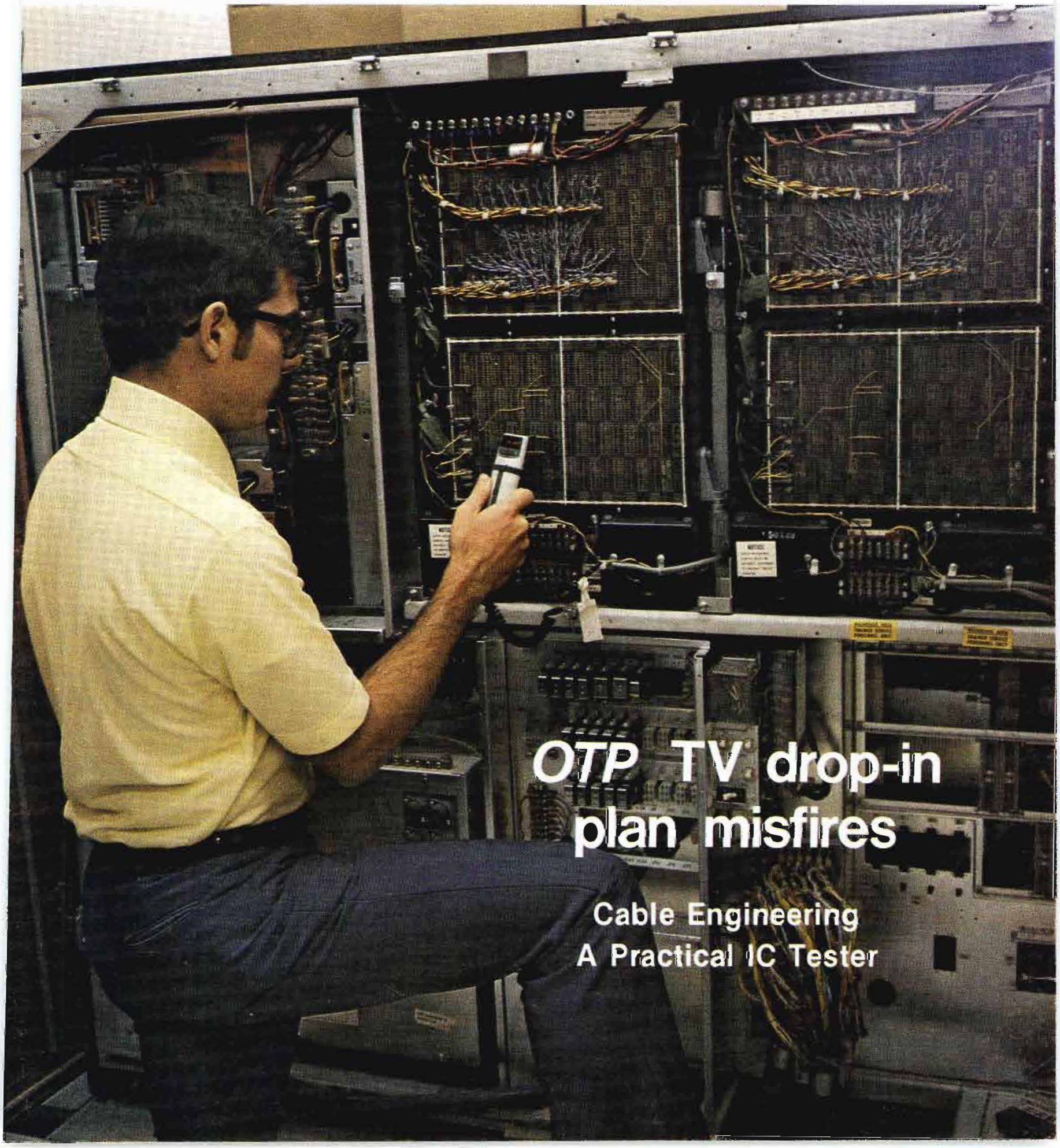
BROADCAST engineering®
April, 1974/75 cents

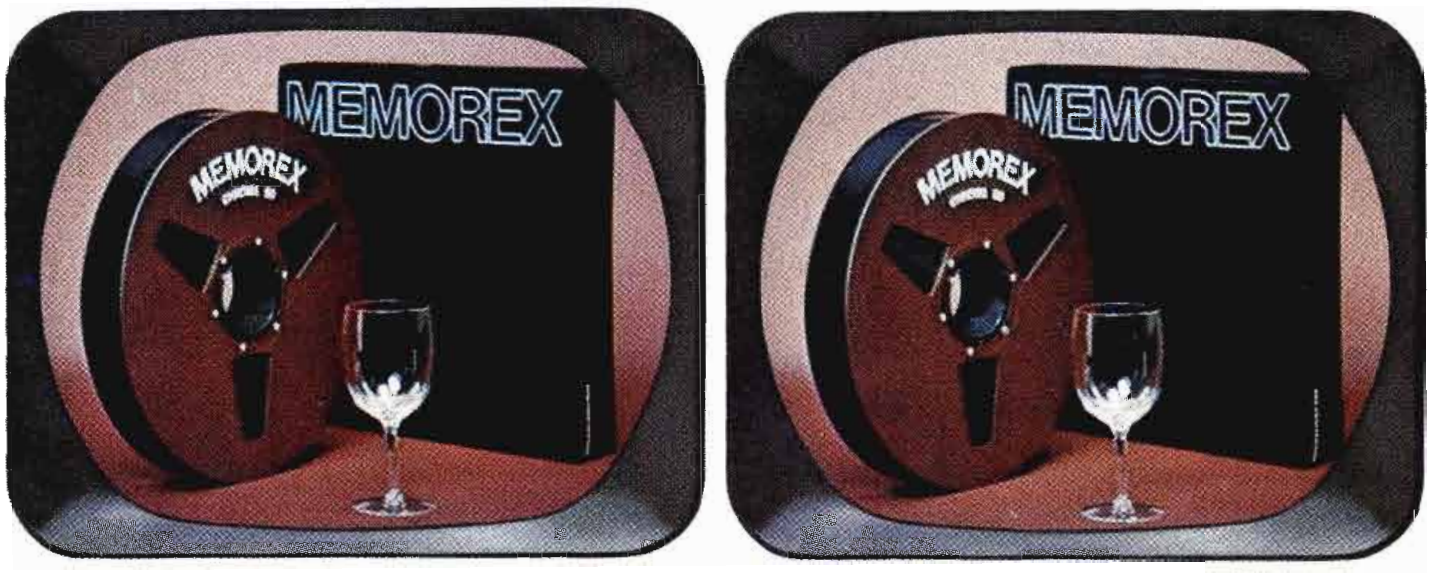


OTP TV drop-in plan misfires

Cable Engineering

A Practical IC Tester

Is it live or is it Memorex?



(All unretouched photos.)

With Memorex Chroma 90* Video Tape even Jack Calaway couldn't tell.

Eyes don't lie. Or at least not very often. That's why we asked Jack Calaway, VP Engineering and Operations of Trans-American Video, to loan us his expert eyes for a test.

Here's the test.

First we put Jack in front of a professional broadcast TV monitor. Then we alternated between a live picture (the one at the left) and a Memorex Chroma 90 Video Tape picture.

After Jack had studied both for several minutes, we asked him which was live and which was Memorex.

His answer: "I really thought I could tell the difference . . . but I can't."

*Chroma 90 is our broadcast video tape. Of course, we also make the very highest quality of helical scan tapes, including video cassettes. No matter what kind of video equipment you've got, chances are we've got a tape that'll surprise you.

MEMOREX VIDEO TAPE.

Reproduction so true we can ask, "Is it live or is it Memorex?"

For More Details Circle (1) on Reply Card

Swiss Performance

Our new Electro Sound ES-505 Professional Recorder/Reproducer has what it took the Swiss centuries to develop. A heritage of classic design and precision performance. The ES-505's essential mechanical and electronic specifications compare favorably to Studer's A-80. And at ½ the price! □ European or American—no other professional machine has more significant "Operator Engineered" features. A disappearing headgate for easy editing or cleaning. A built-in reference audio oscillator that supplies test frequencies 50 through 15K for instant alignment. An optical motion sensing system prevents tape damage during control sequencing. And differential disc brakes for ultra smooth tape stops. □ Operator simplification. Our ES-505's "Record" indicator light also continuously monitors bias. There are two calibrate positions: one for record and one for reproduce. Our optional third reel is the ultimate in convenience for those heavier editing jobs. Operating modes are instantly recognized with fully illuminated transport controls or optional remote controls. □ Operator satisfaction. Electro Sound's unique viscous damped idler fly wheel lowers flutter up to 25%. The ES-505's non-slip capstan improves playback timing accuracy to ±1.8 seconds in 30 minutes recording. □ The ES-505 is available in console, portable, and unmounted configurations in ¼" or ½" versions, with 1, 2 or 4 channels of electronics. □ The Electro Sound ES-505 comes with the world's only 1½ year extended parts warranty. The American machine to match Swiss excellence.

Performance	Electro Sound ES-505	Studer A-80
Mechanical		
Timing Accuracy	±0.1%	±0.1%
Wow and Flutter 7½ ips	−0.08 rms	−0.07 rms
Electronic		
Frequency Response 15 ips	30-18K Hz ± 2dB	30-18K Hz ± 2dB
Signal-to-Noise 15 ips— Two Track	63 dB Unweighted	62 dB
Distortion	0.4% 2 HD @ 500 Hz. Peak Record	−1.0% @ 1K Hz, Operating Level
Price	$3,395	$6,670

ELECTRO SOUND, INC.
725 Kifer Road
Sunnyvale, CA 94086
(408) 245-6600 Telex: 34-6324
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American Prices

For More Details Circle (4) on Reply Card

April, 1974 • Volume 16, No. 4

BROADCAST ENGINEERING®

The technical journal of the broadcast-communications industry

in this issue...

About The Cover

Working with and testing state-of-the-art devices is the theme of this issue. Note the use of a miniature DMM by the engineer pictured. Photo courtesy of Hewlett Packard.

Departments

BROADCAST ENGINEERING is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105. Telephone: 913 888-4664.

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Robert E. Hertel, Publisher

INTERTEC PUBLISHING CORP.
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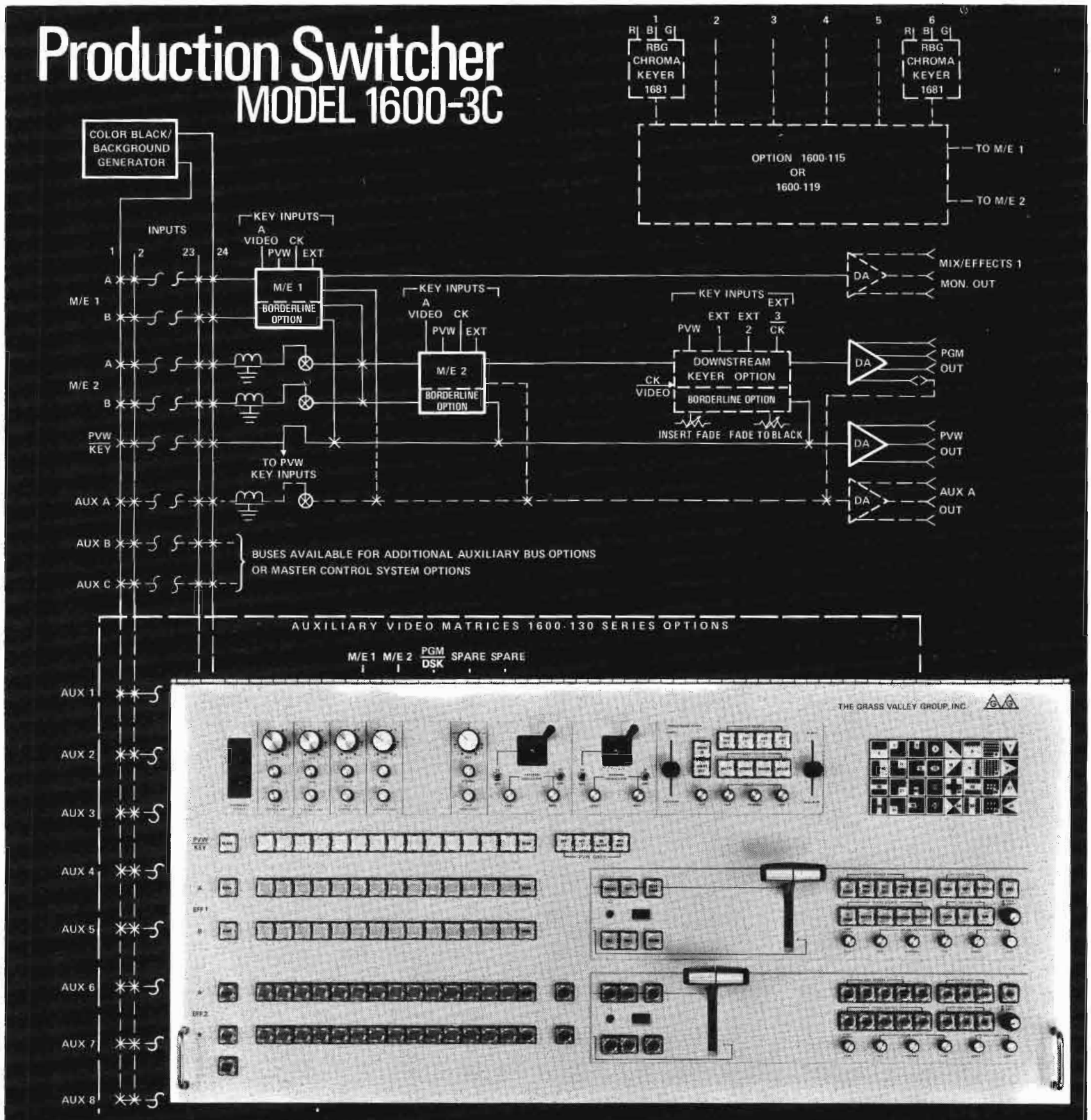
Production Switcher
MODEL 1600-3C



Would a new modern dual effects production switcher fit within your budget? Consider the GVG Model 1600-3C.

This 16 input 5 output bus model provides the production capability formerly found only on larger conventional switchers with six or more operating buses. The 1600-3C features two identical and completely independent mix/special effects systems each including individual pattern generators (32 patterns), color matte generators, and modulated pattern positioner as standard equipment.

Each effects system allows mix or wipe transitions between sources, to a keyed insert, or to a preset split screen without use of the other. Proportional (linear) control elements are used in all modes resulting in adjustable soft wipe or vignette effects and greatly improved keying, especially chroma keying. The fifth bus on the 1600-3C serves as both key signal selector and a preview selector. The base price of the Model 1600-3C is $23,000. Optional items such as chroma key generators, chroma key switchers, Borderline generators, downstream keyer system, and auxiliary bus systems are available at additional cost.

THE GRASS VALLEY GROUP, INC.
A TEKTRONIX SUBSIDIARY

For More Details Circle (5) on Reply Card

DIRECT CURRENT FROM D. C.

April, 1974

by Howard T. Head

NCTA Activities

The NCTA Convention opens in Chicago on April 21 with a variety of interesting sessions. Topics will include subscription cablecasting, pole attachment problems, rural extension methods, two-way services, and helical VTR interchangeability. In recognition of the technician's increasing importance in modern communication, an engineers' reception is planned for the evening of April 22.

There is bound to be considerable discussion of the cable report prepared by a cabinet level committee and transmitted to the President by OTP Director Dr. Clay T. Whitehead. Although this report deals principally with non-engineering matters, it does urge that the Federal Government preempt in the technical area to the extent of assuring uniformity of Technical Standards throughout the U.S. Presumably, this would also insure uniform standardization with neighboring countries.

New IEEE Cable Committee

The Institute of Electrical and Electronic Engineers (IEEE) has established a new Standards Coordinating Committee (SCC19) dealing with cable television systems. The IEEE continues to receive a substantial number of inquiries from franchising authorities, and is anxious to arrive at suitable cable standards to permit adequate responses. However, much of the standardization work will either reflect activity of the Cable Television Technical Advisory Committee (CTAC), or will be reviewed by that organization. Until this work progresses further, there appears to be little that IEEE can add to existing Technical Standards in the cable area.

"Carrier-Current" Campus Stations Under Attack

The Commission recently ordered a campus "carrier-current" AM station to reduce power. The station had been operating with an input power of 6 Watts, compared with the 100-milliwatt limit imposed by FCC Rules on carrier-current operations.

The National Association of Broadcasters (NAB) has aksed the Commission to prohibit the "extension" of carrier-current service beyond that provided by the normal service range of carrier-current operations. Some carrier-current stations are being carried on cable systems, and there is a trend toward "networking" of carrier-current stations. NAB makes it plain that it is not opposed to carrier-current operations, only their "extension" by non-carrier-current methods.

BROADCASTING'S BEST BUYS —

- selection
- quality
- price

CENTURY SERIES modular tape cartridge machines. Quad cabinet, all playbacks.

AC155B REMOTE/STUDIO CONTROL unit. Stereo also available.

AS40B 8 CHANNEL stereo console. A20B 8 CHANNEL monoural also

GT12 CUSTOM TURNTABLE. Choose 4-pole or synchronous versions.

did you know .... we manufacture a full line of AM and FM transmitters, and audio products.

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A DIVISION OF COMPUTER EQUIPMENT CORPORATION

For More Details Circle (6) on Reply Card

(Continued from page 4)

High-Intensity Lighting Rules Proposed by FCC

The Commission has proposed to modify its tower painting and lighting Rules so as to prescribe high-intensity daytime strobe lighting for towers higher than 500 feet above ground (See June, 1973 Direct Current). The new Rules would apply only to new structures and existing requirements would remain unchanged.

Tests have indicated the strobe lighting systems to be effective during daytime hours, especially in conditions of marginal visibility. During nighttime hours, strobe systems might be employed with greatly-reduced luminosity, or the conventional red obstruction lighting system might be employed. There is some indication that strobe lighting during nighttime hours might provide some "optical pollution" for neighboring residents.

UHF TV/Land Mobile Sharing Might Be Expanded

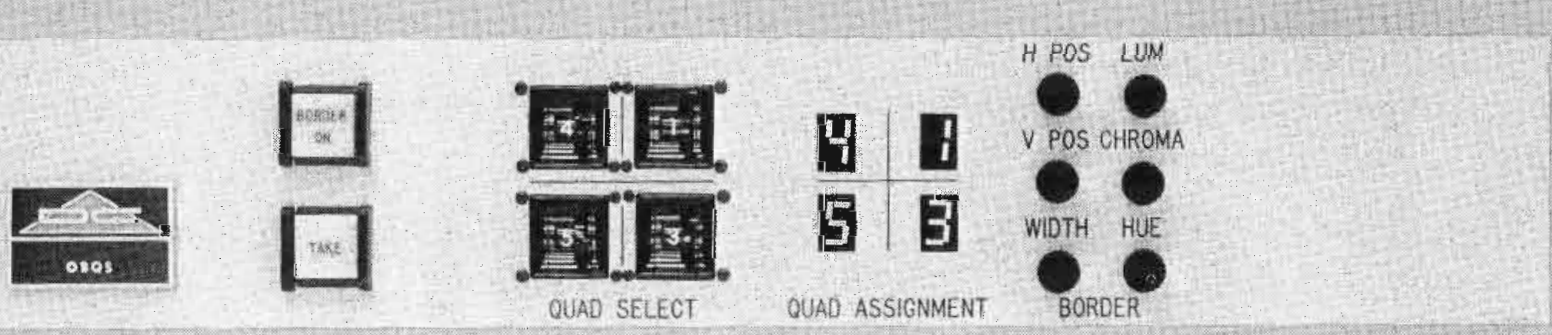
The Commission's present land mobile rules currently permit the sharing of two of the UHF television channels from Channels 14-20, inclusive, by land mobile operations in the top 10 markets. The land mobile people are urging the Commission to extend this sharing, first, to relax present sharing criteria and, second, to include markets below the top 10.

Broadcasters are strenously opposing such activities, but the land mobile groups have well-organized lobbies. However, the broadcasters are urging that as a minimum the Commission employ its newly-developed monitoring capabilities (See August, 1971 Direct Current) to assure that land mobile claims of existing frequency congestion have any real merit.

Short Circuits

FCC Commissioner Robert E. Lee has been named 1974 Patron of the IEEE....The Commission has clarified the Emergency Broadcast System (EBS) Rules....A subcommittee of the Joint Council on Intersociety Cooperation (JCIC) is studying digital television techniques....The Commission and the courts are finally cracking down on illegal CB operations, with stiff fines and jail sentences in many instances...The Commission has informed Queer Blue Light Gay Revolution Video in San Francisco that CBS did not treat its presentations on homosexuality problems unfairly.

OB/QS [äb-/kwiz] *n*: (one bus quad split) A device manufactured *only* by American Data Corporation: a device which generates a quad split effect using *no* switch buses on your primary switcher: a device which now provides a quad display as a *primary* switcher input: a device which may be used with *any* switching system with as few as two buses or as many as (?): a device which sells for $1250, or $1600 with colorized borders: a device *you* should have.



Model 1290 "O B Q S"

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INDUSTRY NEWS

Two Major Firms Merge

Orrox Corporation, moving to broaden its base in the professional video recording industry, has acquired CMX Systems, Emmy Award winning developer of computerized systems for editing videotape. The announcement was made by William H. Orr, Executive Vice President of Orrox.

CMX, jointly owned by subsidiaries of CBS and Memorex Corporation, has been purchased for an undisclosed amount of cash, according to the announcement. The company is located in Sunnyvale, California, close to Videomax and Barger/Calfor subsidiaries of Orrox.

Orrox, headquartered in Opelika, Alabama, is a company intensely involved in professional video products and magnetic oxides. It operates a plant in Opelika which manufactures iron oxides for recording tape. It is aligned with Bayer AG of Leverkusen, West Germany, in combined research activities in new magnetic materials.

The company has two subsidiaries on the West Coast, Barger and Videomax Corporations. Barger designs, prototypes and builds special purpose tape and disc drive systems. Videomax rebuilds professional television recording heads.

In May, 1973, CMX Systems was awarded an Emmy by the National Academy of Television Arts and Sciences for its development of a sophisticated controlled videotape editing and assembly system.

Capra To Address SMPTE Conference

Frank Capra, three-time Academy Award-winning film director, accepted an invitation to speak at SMPTE's 115th Conference, it was announced by SMPTE President Byron S. Roudabush.

According to Roudabush, Capra will appear as Guest Speaker at the Conference's Get-Together Luncheon on Monday noon, April 22. The Technical Conference, runs from April 21 through April 26 at the Century Plaza Hotel in Los Angeles.

Progress in the development of the Conference technical papers program has been announced by Program Chairman Fred J. Scobey, DeLuxe General. Scobey outlined the schedule of session topics under which the program will be organized. The schedule is: Monday morning: Laboratory Practices and Photo-Sensitive Materials; Monday afternoon: Energy Crisis and Conservation; Tuesday morning: Sound; Tuesday afternoon: Production Practices; Wednesday morning: Small Format Films; Wednesday afternoon: Projection and Theater Presentation; Thursday morning and afternoon: Television; Friday morning: Videodisc Systems; Friday afternoon: Safety and Environment.

Conference registration begins on Sunday April 21 and continues all week. In addition to the technical papers sessions, a 92-booth Equipment Exhibit will run from Monday afternoon through Thursday evening Conference Week. Several social events are planned, including a Sunday evening Wine and Cheese Party sponsored by Treise Engineering and Frank Holmes Labs; the Monday Get-Together Luncheon; and the Wednesday evening Cocktail Party (sponsored by the Eastman Kodak Co.) and Banquet. In addition, a special ladies program has been planned.

For Latest News See Direct Current page 4

Automated ACR-25

When you're ready for real automation, you'll have to learn to stay out of the way.

The only manual function is loading the cassettes.

The rest is automatic.

When you're on the brink of automation, our Automated ACR-25 is the *only* sound choice in a cassette VTR. There are two reasons: it can be rolled by the computer on cue, and now it actually can be programmed by the computer.

All that's needed besides ACR-25 are two optional accessories: the Identification Data Accessory (IDA) and the Automation Data Accessory (ADA).

Here's how it works.

Loading. Your operator doesn't have to program the machine. Instead, he simply loads the empty bins of the carrousel in sequential or random fashion. As soon as he shuts the door and walks away, he is free for other, more creative duties.

Reading. Instantly, the IDA comes to life and "reads" each tape in each bin by examining the identification recorded on the Pre-Roll segment of the *cue* track. This is important because it means *there is no wear at all* on the video head.

Table of Contents. Next, ADA writes a Table of Contents, listing the status and contents of each bin. It stores all this in memory and then transmits the data to your computer.

Play List. Your computer makes up a Play List from your program schedule (up to 63 events) and then tells ADA which spot or segment to run at what time. ACR-25 then executes it all reliably with split-second timing.

Automated ACR-25

Reloading. Bins available for reloading are identified by load control lamps which light up after the tape is played. As a reminder, a remoteable signal alerts someone else when less than 10 bins remain to be played.

All day long and into the night, the *only operator action necessary is to reload cassettes as necessary*. After each reloading, the ADA automatically updates its Table of Contents, and your computer updates the Play List.

Fail-Safe Operation. Even if your computer goes down, the ACR-25 continues to operate because the Play List is stored in ADA's memory.

Both the Play List and the Table of Contents are always available for immediate printout, should you desire to reprogram the ACR-25 manually.

Amazing? Yes — more so because it's a reality today.

Automated ACR-25 is the most complete broadcast/production unit ever conceived. No matter how you use it, it saves money, man power, and mistakes, making it the only logical choice as a short- and long-range VTR investment.

For More Details Circle (10) on Reply Card

For complete details, contact your local Ampex Broadcast Video Sales Engineer, or write for full information.

AMPEX

Ampex Corporation
Audio-Video Systems Division
401 Broadway, Redwood City,
California 94063

New Automation BIAS Package

BIAS, (Broadcast Industry Automation System), a division of Data Communications Corp., a supplier of computerized broadcast information systems for radio and TV stations, has unveiled its proposed new automated system for radio stations during a three-day seminar for member stations.

Visitors to the seminar were given the opportunity to study the automated information system which is now operating in test form at station WMC-AM, the Scripps-Howard station in Memphis. The new automated "On-Line, Real-Time" radio system is similar to that designed for the 57 TV stations now using the BIAS system.

According to Norfleet Turner, President of DCC, the new automated system for radio stations will be made available for installation in Mid-summer. It will offer much of the type of information available now on the system being used by TV stations, but will be completely separate from the TV station operation where both are operated.

Cost of the automated radio system, (On-Line) will range from $1500-2500 per month, considerably under the fee for TV systems.

Cable Seminar

I. A. Faye announces the completion of the second of its latest series of technical seminars planned for AELCC CATV equipment users.

The second seminar was attended by engineers and technicians from cable systems as far away as Texas. A previous seminar was held in October 1973.

Instruction, provided by the AELCC technical staff, covered maintenance of cable systems utilizing AELCC equipment and the latest FCC Standards. AELCC plans to hold its next seminar in early Spring and is accepting reservations at this time. For further information, write to: P.O. Box 507, Lansdale, Pa. 19446.

Arizona Cable Assn. Resolutions

The Arizona Cable Television Association has unanimously adopted resolutions supporting cable TV industry stands on five vital issues.

At its annual meeting, held in Phoenix, ACTA adopted the following: 1). a concurring resolution on the NCTA's position condemning NAB and network's misleading programs to stifle the development of **subscription cablecasting**; 2). a resolution supporting the **McClellan Copyright Bill (S.B. 1361)** with fixed copyright fees, compulsory licensing and central depository and under-3,500 subscriber exemptions; 3). a resolution protesting the present FCC **non-duplication regulations** and supporting the RMCTA contention that same-day protection is unfair and discriminatory; 4). a resolution opposing any and all forms of **government ownership of cable systems;** and 5). a resolution endorsing the CCTA stand on overhead and underground rearrangement costs, pole rental rates and joint pole ownership in dealing with utilities and municipalities.

ACTA, which is one of only four cable associations to have a paid executive secretary, has 30 active members and 23 associate members representing more than 95% of Arizona's 57,000 cable homes.

TelePrompTer Tightens Its Belt

TelePrompTer has described the status of two of 22 cable television systems whose futures are under review, which was originally announced November 5, 1973.

The cable television system in Newark, New Jersey, **will not be built.** TelePrompTer has no subscribers in the Newark franchise. In its 1973 year-end report, TelePrompTer will write off its Newark investment of approximately $2,150,000.

In Oakland, California, city officials and TelePrompTer representatives are reviewing proposed amendments to the Oakland franchise. If satisfactory amendments result, TelePrompTer intends to continue construction of its Oakland system. If not, however, TelePrompTer may be subject to penalties, including possibly losing its franchise there.

TelePrompTer also released new subscriber totals for February.

For 1974 the net subscriber gain is 18,786, based on the Federal Communications Commission formula adopted by TelePrompTer on January 1, 1974.

Nationwide in TelePrompTer's 143 cable television systems, net subscribers total a record 975,403.

More than 2,100,000 potential subscribers (including the 975,403 signed) are behind cable in those TelePrompTer systems.

Send Your Industry News To Broadcast Engineering For Better Coverage

SOCIETY OF BROADCAST ENGINEERS, INC.
P.O. Box 88123 Indianapolis, Indiana 46208

SBE Salutes James C. Wulliman, WTMJ

The Annual Meeting of the Society of Broadcast Engineers will already have been held by the time this issue reaches you. The meeting, scheduled for March 17th, in the Stinson Room of the Rice Hotel, Houston, Texas, gives outgoing officers a chance to report on the activities of the previous year, and members a chance to express their opinions or to make whatever other comment they desire. Also, the newly elected officers take over the leadership of the Society for the coming year.

The SBE has been fortunate to have found outstanding and dedicated leadership during its relatively short ten years of existence. James C. Wulliman, the most recent example of such a leader, just completed a term as SBE president. Having been nominated again, it is likely that by now he has begun his second term. One of Mr. Wulliman's major objectives has been to attain a substantial increase in growth of SBE membership; another has been to enhance the image of the broadcast engineer; yet another has been to make the SBE a voice to be heard by the FCC, by equipment manufacturers, and by station owners. He has made considerable progress on all of these and it is likely, if reelected, he will continue working toward these goals during his second term.

Chapters In The Making

Location	*Contact*
York-Harrisburg-Lancaster, Pa.	Charles Morgan, WARM, Avoca, Pa. (717) 346-4646.
Puerto Rico	Bob Beurket, WRIK-TV, Ponce-San Juan. Telephone (809) 724-7575.
San Francisco	Robert Daines, CBS Labs, 1 Embarcadero Ctr., San Francisco.
Petersburg, Va.	Paul H. Bock, WSSV, Petersburg (804) 733-4567.
Youngstown, Ohio	Leno Leo Laner, NABET Local 47, 7447 Southern Blvd., Youngstown.
Albuq., N. Mex.	Guy Smith, C. Engr., KRZY/KRST, Albuquerque, (505) 266-5833.
Columbus, Ohio	Richard L. Walsh, WRFD Radio-88, Columbus, (614) 885-5342.
Quincy, Ill.	Lynd Carter, Tektronix, 3028 Lawrence Rd., Quincy.
Johnstown, Pa.	W. B. Martin, 70 Colgate Avenue, Johnstown, Pa. 15905.
Louisville, Ky.	Paul Kelly, WLKY; Charles Kendall, WKPC; Gil Lochner, WLKY.
Las Vegas, Nev.	Joe DeAngelo, 1536 Sombrero Drive, Las Vegas.

Insured SBE Members To Get Credit Notice

Members insured under the Life Insurance Plan will receive a credit on their April 1 payment notice equal to 40 percent of the amount they contributed during the policy year ending September 30, 1973. This credit was made possible by favorable experience and the continued growth of the Plan.

Annual credits amounting to a substantial percentage of premium contributions made by insured members during previous policy years have been made since the first year of the Life Insurance Plan. The average credit has been 35 percent. These credits, of course, cannot be guaranteed.

All inquiries about the Life Insurance Plan or any of the other Plans in the Group Insurance Program for SBE members should be made to the Administrator, 1707 L Street, N.W., Washington, D.C. 20036. Telephone (202) 296-8030.

Nick Foster Urges Tech Paper Progress

For possible reaction by SBE Members, we would like to pass along the following quote from Nick Foster, Editor of the **News Letter** of the SBE Seattle, Washington Chapter:

"....Been thinking about the Meeting items printed in the SBE section of the Magazine. The space alloted to us was intended to be used for tech papers, and such items of general interest to members—and it seems a better use could be made by the Society, than **just** the meeting descriptions—all past tense, and of no great hot interest except to those who appreciate the name in print—Let us think of using this space—with tech items—maintenance suggestions—operational suggestions—such as would interest, and inform, other chapter members, and as far as the Chapter Meetings; list the Chapters Locations, Chairman Addresses, and forget the past history listing of what-happened!"

SOCIETY OF BROADCAST ENGINEERS, INC.
P O Box 88123 Indianapolis Indiana 46208

Chapter Activities

Chapter 2: Northeastern Pa.
Chairman: Paul Evanosky,
Pittston, Pa. 18640

On February 1st, at WVIA-FM-TV, Alex Meyer and Bud Yankowski of Ampro Corporation provided an in-depth technical description of their tape cartridge equipment including the logic circuitry and solid-state switching. Ampro claims to provide the best of this type of equipment presently available with regard to noise, distortion, line isolation, special biasing, and reliability.

Chapter 9: Phoenix, Ariz.
Chairman: Charles Deen,
Phoenix, Ariz. 85001

The January 17th meeting, at KTAR-TV, featured Robert Manahan of Amperex provided a videotape on the manufacturing and testing facilities at Amperex for plumbicons and other tubes.

Chapter 15: New York, N.Y.
Chairman: John M. Lyons,
Woodside, N.Y. 11377

On February 14th Byron E. Fincher, Manager, Radio Station Equipment, RCA Corporation, spoke on the Latest in AM and FM Audio Equipment. He was assisted by Wally Warren, FM Product Manager, Mel Leiberman, AM Product Manager, and Gene Bidun, Audio Product Manager.

Chapter 16: Seattle, Wash.
Chairman: John Maxson,
Seattle, Washington

A refreshment session preceded the noontime meeting and luncheon on February 13th at the Norseland Restaurant where guest speaker Rich Walsworth, engineering vice-president of Time and Frequency Technology, Inc., spoke on their noted modulation and frequency monitors and super-accurate clock systems and slave clocks. Bob Dietsch of the FCC provided a status report on the latest from the Commission. In the latest chapter News Letter, editor Nick Foster reminded members that the space provided for SBE members by the publisher of **Broadcast Engineering** was available also for the publication of technical articles, technical items, maintenance suggestions, and operational situations, as well as for reports on chapter meetings.

Chapter 20: Pittsburgh, Pa.
Chairman: Hank Kaiser,
Pittsburgh, Pa. 15212

Members and guests met on January 17th for a luncheon meeting at Buddies Restaurant where Jerry Grever, Manager, Electronic Recording Equipment, RCA, gave a slide presentation on new formal video recording being explored by RCA. Chairman Kaiser also provided a brief review of the new county-wide communications system. On February 21st, the luncheon meeting at Buddies featured Dick McLean of Microtime Corporation who covered the use of a Time Base Corrector for transfer of video tape from one formal to

For More Details Circle (90) on Reply Card →

AMPEX AVR-2: ALL THINGS TO ALL PEOPLE

...but most will buy it for what it isn't

It's small—it isn't big.

Yet it will give big performance, flexibility, economy. It is a VTR that can be anything or everything you want it to be: bare bones, fully equipped, studio, portable, or mobile recorder. And more. It's easy to operate and so small you can take it anywhere. It's a **modular system** that you can tailor to any configuration to answer your particular needs and save you money.

It's quad—it isn't a whole new standard.

That means excellence: superb picture quality and high performance.

AVR-2 is a single standard (more if you wish), high band recorder that delivers broadcast performance that will exceed your most critical expectations.

At 7½ ips or 15 ips, picture quality is matched only by the very finest quad recorders. A new extended-range digital time base corrector means better performance and faster lockup. The picture endures through successive dub-downs.

An integral sync generator is a standard feature and permits "stand-alone" machine operation.

Everything you expect from quadruplex, AVR-2 delivers.

It's low cost; isn't expensive.

AVR-2 is the first quad to break the barrier of budget for true quad performance. It produces a broadcast signal comparable to any recorder, but the machine comes to you in many cost-saving configurations.

Initially, you will save many thousands of dollars by selecting only the features that fit your particular needs and objectives.

Downstream, the low cost of operation, in maintenance and man-hours, will save you much, much more.

It's modular and portable—it isn't immobile.

Put it together any way you like.

The two lightweight modules (transport and electronics) let you assemble any configuration to fit your space, preference, or budget.

In the studio, you can mount the modules in a lowboy console, with an optional monitor bridge, if you like.

On location, you can place the modules side by side, or on top of each other, with or without the monitor bridge—any way that fits into a station wagon or van or even a boat or aircraft.

All components are light enough so two men can disassemble and move AVR-2 in minutes. You can even roll the entire studio console through a standard 36″ doorway. By yourself.

It's "human engineered"—isn't hard to operate.

It's a joy to operate, in fact—in the studio or on location. Because it is a single standard machine, fewer controls are needed, and these few are logically grouped and well lighted so operators can work even under extreme conditions.

Side-by-Side Configuration

Top Stack Configuration

Low-Boy Configuration

Full System

Lockup time is 1 second in NTSC, or 2 seconds in PAL/SECAM. Record and play on 90 minute reels (3 hours at 7.5 ips) for greater program flexibility.

It saves money—isn't expensive to operate.

AVR-2 operates off any standard AC outlet; generates less heat. That's a serious consideration in these days of the energy crisis.

The unique new video head assembly lets AVR-2 run cooler, too, with less noise. It is the smoothest, quietest, coolest VTR ever designed.

It's expandable—isn't limited to any configuration, big or small.

That's how you save money. But you can add accessories as you need them for super performance.

You'll want to consider refinements like our Dropout Compensator to eliminate effects of dropouts in color or monochrome playback.

Or a Velocity Compensator for better dubs. And Auto-Chroma, for high-speed, automatic equalization of color saturation.

Other options include Automatic Tracking Control which lets you play back every tape precisely.

Or Editec* for faultless editing—it lets you make single-frame inserts, move cue tones, and verify placement.

And ask about our Compatible Dual Track Audio System that gives you greater audio mixing and editing flexibility without sacrificing the cue track. You can even record in a second language or add voice-overs.

Options are simply too numerous to list. Tell us your needs, and AVR-2 can be tailored to them —even if you call for stereo.

It's a new breed of recorder— not a cut-down version of something else.

Any Ampex video recorder bearing the "AVR" designation has a big reputation to live up to. And AVR-2 is no exception.

But since every user has different needs, objectives, and budgets, we designed AVR-2 to meet these needs. To provide unmatched flexibility and economy consistent with quadruplex quality.

There is nothing in the world like AVR-2.

It is the most versatile, economical recorder ever built. No matter how or where you use it, it will save you money and man-hours, in both initial cost and daily operation.

For full details, contact your local Ampex Broadcast Video Sales Engineer or write for full information.

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All components are light enough so that two men can disassemble and move AVR-2 in minutes.

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April, 1974

CABLE ENGINEERING

in this issue

MICROTIME!

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For handling those wild and wiggly signals from low cost VTRs with large tension error, we've added the DIGI-MATIC™ Wide Aperture TBC.

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Court "No" On Copyright

The Supreme Court of the U.S. has ruled that CATV systems incur no copyright liability for the carriage of programs received from television broadcast stations, no matter how distant the station. This finding reversed a ruling of the Court of Appeals, which had held that CATV systems enjoyed such freedom from copyright liability only when carrying signals which were generally receivable in the area served by the cable system.

The Supreme Court's decision served only to emphasize the practical difficulties in stretching the provisions of the present 1909 Copyright Act to cover technology such as cable television which was not even remotely foreseen at that time.

Future Convention Dates

The National Cable Television Association has announced a new line-up of cities for future conventions. This year's 23rd annual meeting will remain at the Conrad Hilton in Chicago from April 21 through 24.

Following is the revised schedule of meeting dates and locations for 1975 through 1983:

1975 - New Orleans	April 13-17
1976 - Dallas	April 4-7
1977 - Chicago	April 17-22
1978 - New Orleans	To be announced
1979 - Chicago	April 22-25, or April 29-May 1
1980 - Dallas	To be announced
1981 - Chicago	April 26-29
1982 - New Orleans	To be announced
1983 - Chicago	April 17-21

The 1975 convention in New Orleans will be held at the Rivergate Convention Center. All conventions in Chicago will be at McCormack Place; all in Dallas, at the Dallas Convention Center.

Originally, conventions for 1975, '76 and '77 were slated for Washington, D.C., Chicago and Las Vegas respectively.

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Receiving our **Perspective** newsletter? IF you're an advertising or sales executive, you qualify to receive our timely monthly newsletter. It highspots trends and developments in the broadcast/communications industry.

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Perspectives newsletter is a timesaving service provided by the editors of **Broadcast Engineering.**

Getting to know color

By Ron Whittaker
University of Florida,
Gainesville, Florida

The successful and creative use of color in television programming depends upon more than just possessing the necessary color equipment. Color in television has now moved from the "technical embellishment" stage to the realm of being a central creative tool in the television process. An intimate knowledge of the physics of color as applied to the television process can add a major dimension to the effectiveness of the television message (not to mention the fact that it will help you eliminate many time-consuming and costly production errors).

First of all, it is essential to both the production and engineering aspects of color television to have a thorough knowledge of the additive color process. Problems in understanding additive color generally center on it being confused with the subtractive color process which governs the results of mixing paints and pigments. The two processes are, in a way, the exact opposite of each other. The additive process, which is central to color television, deals with the interaction of colored light. The difference is literally the difference between black and white.

When the major pigment colors are mixed together, you end up with black (or something closely resembling it), and when you mix the right proportions of colors together by the additive light method, as in color studio cameras or in a color television picture tube, the result is white. Figure 1 illustrates how this works.

Assume that the illustration in Figure 1 was made by projecting colored light from three slide projectors onto a white piece of paper so that they partially overlap in the center as shown. Assume also that the light from each of the three projectors is filtered through a colored piece of glass so that the light from one projector is red, light from the second projector is green, and the light from the third is blue.

Notice that where the red and blue light overlap (add together), the result is magenta (bluish-red), where the green and blue overlap, the result is cyan (greenish-blue), and where the green and red overlap, the result is yellow.

The first three colors—red, blue, and green—are referred to as the "primary colors" in television. The

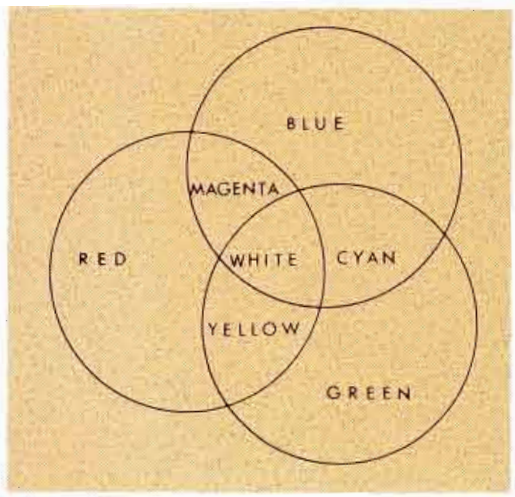

Fig. 1 When all three primary colors overlap, they produce white. This is basic to optical color mixing, and quite the opposite of mixing paints.

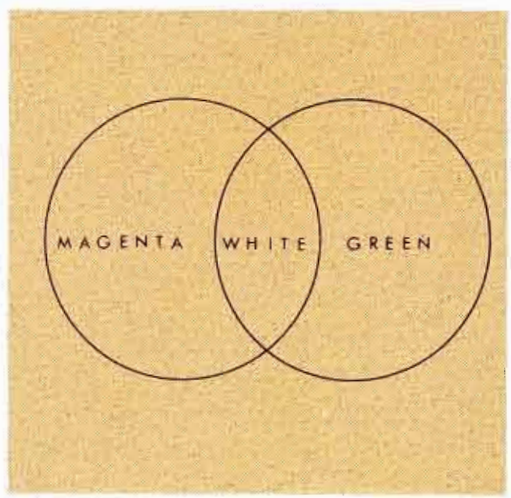

Fig. 2 When light from a primary color is mixed with the light of a secondary directly across from it, the result will be white.

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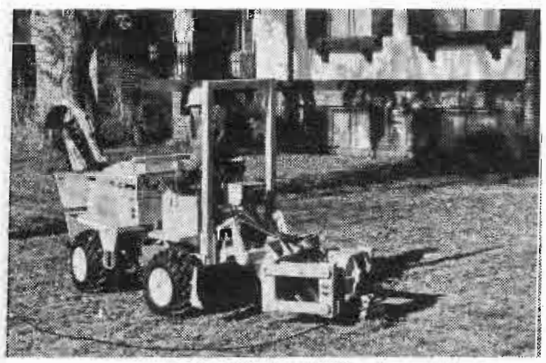

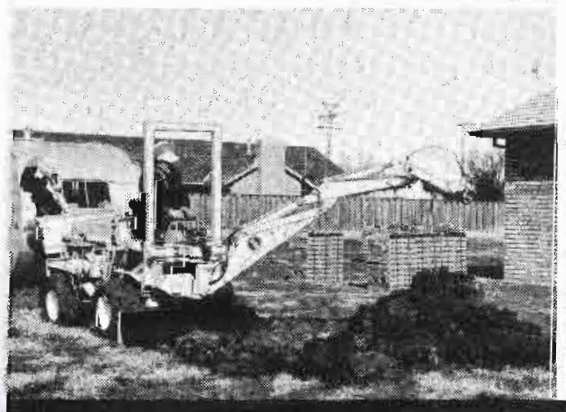

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colors which are produced when any two of these primary colors overlap are called "secondaries" (yellow, cyan, and magenta).

From Figure 1 it will also be noted that when all three primary colors overlap (as in the center), the result is white light. From Figure 2 you can see that when the light from a primary color is mixed with the light of a secondary directly across from it (i.e., its complement), the result will also be white. This is because two primaries go into the making of the secondary and when these are added to the other primary, the result will be white. The interaction of these colors is the basic key to all of color television.

By referring to Figure 3, the color wheel, you can see the relative relationship that the colors have with each other. Figure 3 is simply an abbreviated way of expressing the basic relationships in Figure 1. By traveling around the circumference of the circle in Figure 3, you go through all the colors in the rainbow, or all of the colors it is possible to reproduce.

The top of the color wheel represents the "break" in the spectrum with red, the starting point, and violet (slightly to the right of red), the ending point. The beginning of the color spectrum has been wrapped around and connected to the end to form a circle. The bottom part of Figure 5 illustrates the colors as they would look if they were laid out in a straight line, as they are by wavelength on the electromagnetic spectrum. In color television, however, we can assume—just as color television engineers do on their vectorscope—that the colors are arranged in a circle.

The picture tube in a color television set uses combinations of the three primary colors to produce any color of the rainbow (or peacock). Phosphor dots or stripes on the front, inside surface of the tube are made to glow red, blue, or green as they are hit by beams of electrons directed at them from the back of the tube.

By changing the relationship between the relative brightness of these three primary colors (phosphors), once again, any color can be created. White is the presence of all three primaries, and black is the absence of all three.

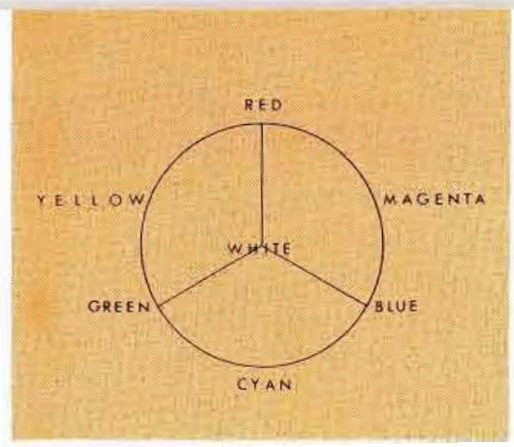


Fig. 3 The color wheel.

The Color Camera

The color television camera works in somewhat the reverse manner of the color television picture tube. Various systems are used, but essentially the three primary colors entering the camera through the lens are separated into three color pictures, each representing a breakdown of the original color picture in terms of one of the primary colors. Whereas the color television picture tube brings together the three primaries on the surface of the picture tube, a color television camera "unmixes" the three primary colors so that they can be transmitted in terms of separate primary color information. Although the actual process is highly complex, the concept is rather simple, and it is by working with the concept that a great deal of pictorial control can be exercised in the reproduction process.

True Colors

For example, one of the major problems in color television is maintaining "true" colors. By applying a knowledge of the color wheel, colors can generally be "trued up" without too much difficulty. Balances among colors can be altered, either by attacking the color directly or by the addition of other colors. The amount of green in a picture can be reduced, for example, by reducing green-channel intensity or by increasing the intensity of red and blue. The latter method will lighten or desaturate the green. White that is slightly on the yellow side can be corrected by reducing red and green or by in-

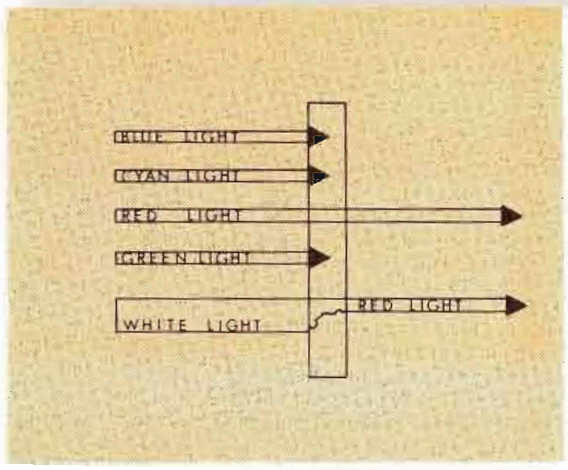


Fig. 4 A dense color filter will only allow its color to pass.

creasing blue.

Subtractive Color

A brief word about subtractive color will probably further aid in understanding the total color process. When a colored filter or gel is placed over a camera lens or light source, various colors or wavelengths of light will be removed. Figure 4 illustrates how this works. A dense filter consisting of a pure primary color will allow only that color to pass. In the illustration all colors are subtracted from the light except red. In actual practice it is difficult to get an absolutely pure color filter that will block all other wavelengths (colors) of light. Depending upon its purity, filters will tend to pass the colors that are closest on the color wheel and will progressively block colors which are opposite (complementary) on the color wheel.

In black-and-white photography, a deep yellow filter will block out (or greatly darken) a blue sky and make any clouds stand out in stark contrast. Altering the tones of colors such as this is one of the great controls in black-and-white photography where you are not concerned with the introduction of a dominant color.

As stated earlier, the subtractive color process is central to mixing paints and pigments. A red object is red because it subtracts all of the colors from an illuminating white light except red. The color of an object is determined by the color of light it reflects. What is absorbed is transformed into heat which explains why a black object, absorbing all of the colors of light hitting it, gets much hotter in sunlight than a white object, reflecting all the colors.

With all this in mind, you should be able to predict what will happen if you shine a deep red light on a blue television background, or a blue light on a yellow background. Depending upon the purity of the color involved, in the first case, you should get magenta, and in the second case you should get close to nothing (probably a dull grey). Theoretically, in the latter case, no light would be reflected, since the yellow background would absorb all the blue and there would be no yellow in the light source to reflect.

Lighting Errors

Lighter colored (less saturated) filters are used to correct errors in lighting and in the relative color balance in film and television cameras.

You have probably noted that, compared to sunlight, tungsten or incandescent lights appear rather yellow (although your eye, unlike television or film cameras, will automatically adjust to, or "make right," this difference in illumination). To correct for the yellowish tungsten studio lighting, more blue must be added to the picture in one way or another. In the television process this is generally done electronically; with film cameras it is accomplished either through the use of a special film or by using a light blue filter over the lens. Conversely, color pictures from cameras balanced for tungsten light will appear very blue when used in sunlight, unless the proper adjustments are made.

Through the phenomenon of "approximate color consistency," the human eye psychologically adjusts to differing light conditions on subjects it views **directly**, generally "correcting" in such a way that white always is seen as white and skin tones look relatively normal, even when illuminated by light which is not truly white. For some reason the human eye is not nearly as tolerant when viewing subject matter **reproduced** by film or television processes.

Figure 5 shows that the human eye is not linear in its perception of different colors. By studying the diagram you will note that the eye

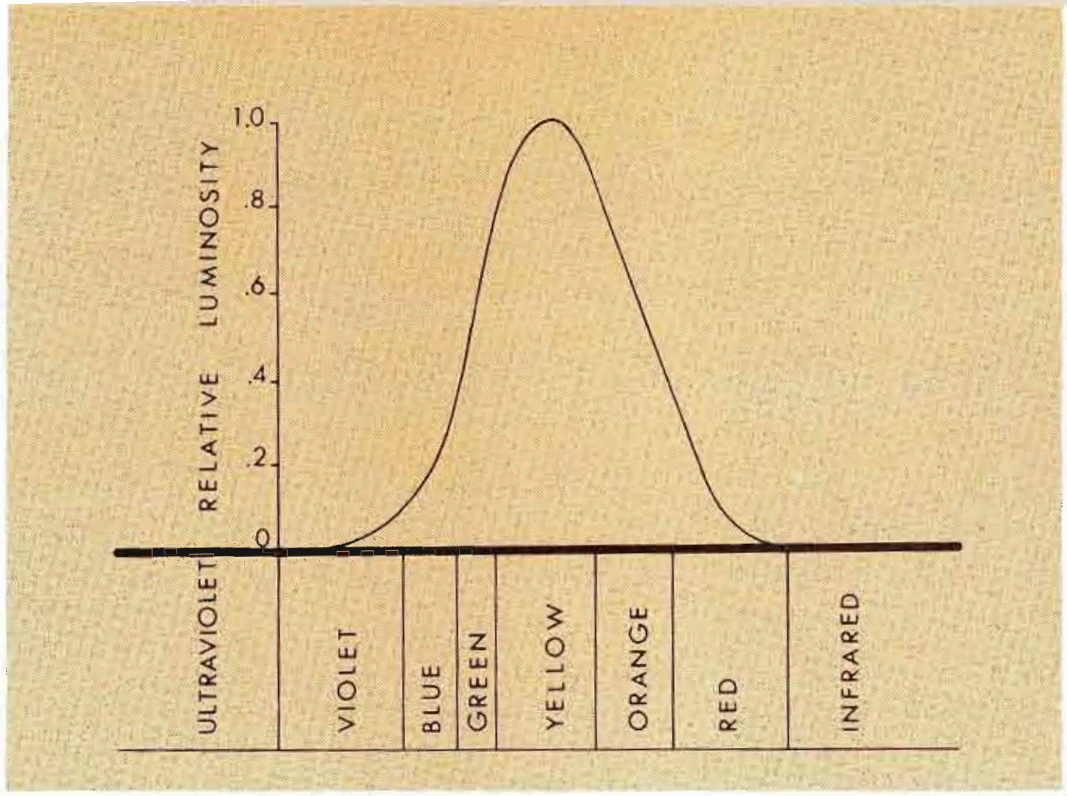


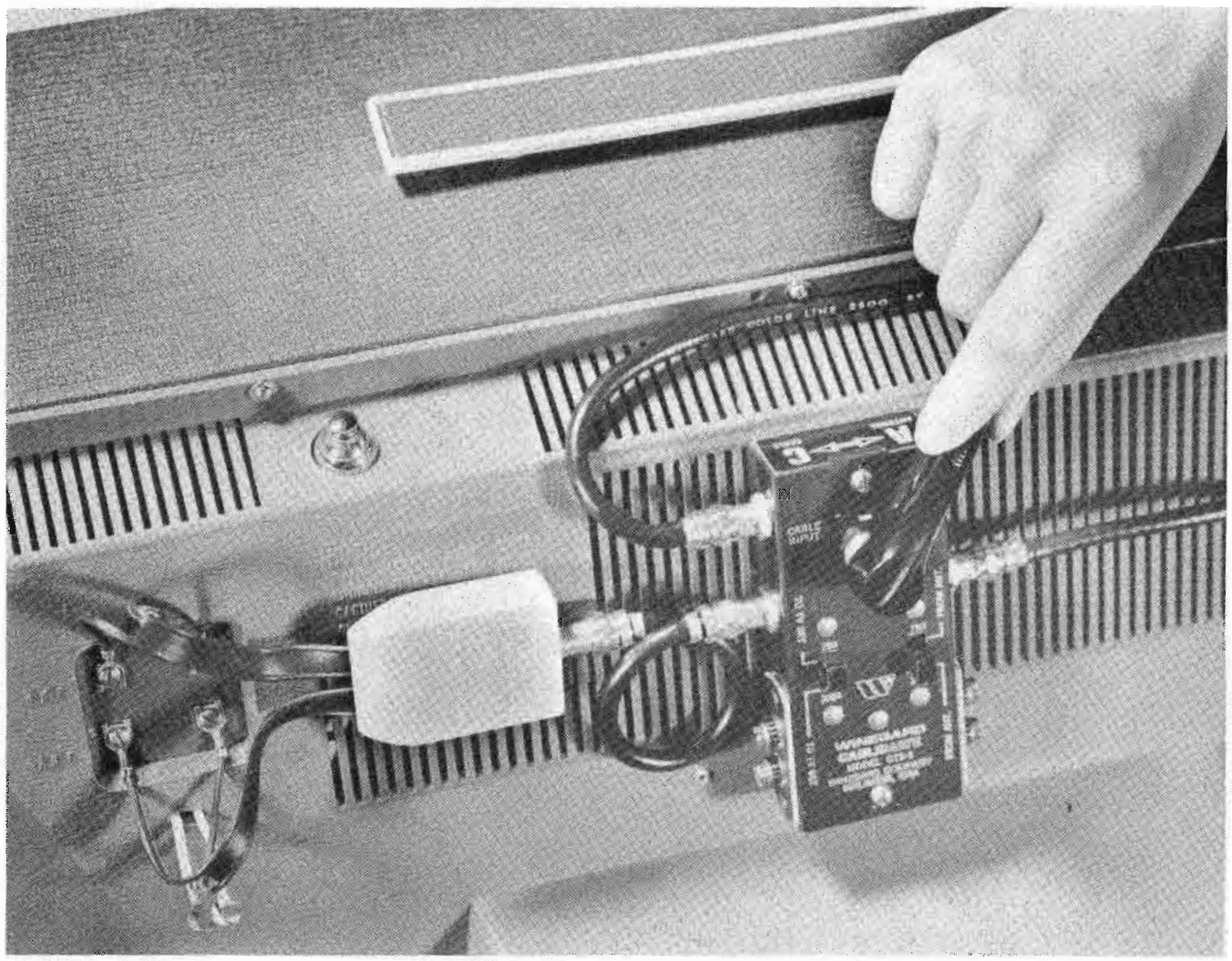
Fig. 5 Colors as they would look if they were laid out in a straight line.

is much more sensitive to yellowish-green than it is to either blue or red—in fact, about five times more sensitive. For this reason, an equal amount of the three primaries will not reproduce white. Because of the greater sensitivity of the eye to the green-to-orange portion of the spectrum, an equal one-third mixture of each of the primary colors would result in a decided yellow hue instead of white.

The Actual Mix

The actual mix used in the color television process, in order for the picture to be reproduced as the eye sees it, is 59 percent green, 30 percent red, and 11 percent blue. This mixture approximates the color "distortion" seen as normal by the human eye. (As hi-fi enthusiasts know, the human ear has a similar "distortion" which must be reckoned with.) The peculiar 59-30-11 primary color mix does not invalidate the color wheel in any way; it only means that you must keep in mind the bias of the human eye when trying to rather specifically predict results of color mixes.

With these principles well in mind and after a little experimentation with your particular studio equipment, you need never be lost on how to attack a particular television color problem. Ultimately it all comes back to what you can do with red, blue, and green. □



A new device offered by Winegard allows the subscriber to keep his original antenna available for emergencies.

Is cable fail-safe?

Ron Merrell

Despite the fact that we know a quality signal can be pumped down the line to the subscriber, cable systems do pass a lot of homes that are not on a drop. Despite the fact that cable can offer some unique program services, not everyone is buying.

However, despite the fact that there are problems, we think there are some good answers. First, let's take a look at some basic problems.

What Happened To My Old Channels?

What do you do when you have a subscriber who likes your additional not-available-direct channels, but tells you he has trouble with channels that he used to get fine without the cable?

Well you look at the receiver and see that there are signs of adjacent and/or co-channel interference. Or there may be evidence of ignition or herringbone. We've covered these types of interference and annoying detractions before, yet in some cases they just keep reappearing.

What often happens in many areas is that you have no complaints about those channels that were weak or not available before the cable was installed. And as luck would have it, the subscriber still watches those old "easy to get" channels more than the newly available ones. Certainly is hard for you to explain and hard for him to accept.

Blacked Out Games

Some sports shows still are blacked out. And when you run into sports oriented people and you can't deliver that hot game, how do you answer the would-be subscriber?

His sales resistance sounds like this: "I have a good antenna pointed at that out-of-town station that carries the blacked out games. And you say you can't deliver them. Then why should I disconnect my antenna and hook onto the cable?"

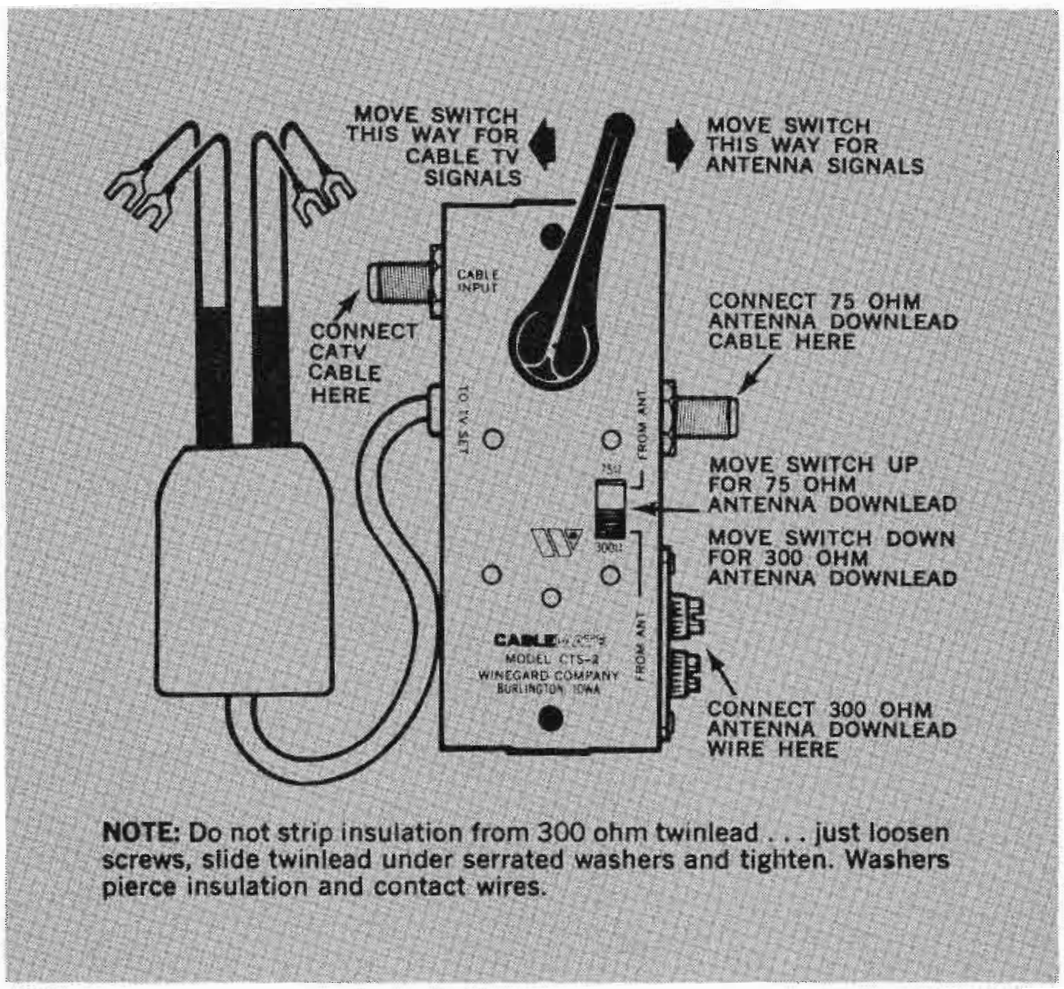
You reply that with the cable he could get a weather channel, an educational channel, council meetings, and other peripherial services he couldn't get elsewhere.

And to this, he counters, "That's fine, and I like the idea of a weather channel so I can monitor the weather when storms are approaching. But I want to watch the game. If you expect me to forget about the game, you can forget about putting me on the cable!"

You can go on and on into the virtues of being on cable, but if you can't offer what he already has at least as good or better than he has it now, you probably will lose the sale.

Unavoidable Downtime

Let's face it, all communications systems have problems that creep in....sooner or later. In the Midwest, for example, it can't be avoided. The storm seasons bring gale force winds and rain. And that means that power lines will be crunched by falling trees or branches. When we lose power at the head



NOTE: Do not strip insulation from 300 ohm twinlead . . . just loosen screws, slide twinlead under serrated washers and tighten. Washers pierce insulation and contact wires.

end or on the trunk, we lose the picture in the home. As a matter of fact, we all know it doesn't take a disaster to have downtime on a key channel. It takes a lot of PR talent to keep subscribers content when their receiver goes black!

So here you have complaints and/or sales resistance based on things that do happen to our systems or services we cannot provide. And before we continue, **Cable Engineering** wants to make it clear that good engineering and installations practices **can** cure most technical problems. That should be the first approach to any cable or closed circuit system. However, we think there is an additional tool that can be of help in aleviating reception problems, lower sales resistance, and be a real aid to subscribers and system operators alike.

Recently we were asked to test an antenna fail-safe unit manufactured by Winegard Television Systems. Along with our sister publication, **Electronic Servicing,** we agreed to tie these units into two different local cable system drops and see if Winegard had the answer to the problems we've been discussing here.

A Simple Answer

The Winegard unit, called the "Cablemate", is a switching system that, when properly installed, allows the subcriber to switch from the cable to his own antenna by flipping one switch on the back of his receiver. The idea is quite simple. If there is trouble on the line, or any of the problems we've already discussed, the subscriber simply flips the switch and his receiver will give him at least what will temporarily satisfy him.

Of course there are many ways to approach the use of such switching units. It could be offered to the subscriber at the time the cable is hooked on. Trouble is, without the proper sales approach, it may plant seeds of doubt about the systems' ability to consistently offer a quality signal.

It could be installed as part of the permanent setup on the back of the subscriber's receiver and its operation and use simply explained...."It's a failsafe device, and we will not let you down."

It could be used as a last resort option in a sales presentation. If the sports enthusiast resists, you can point out that he can still use his super antenna. After all, there is an ego that must be delt with. If the home owner has gone to the trouble of installing a big antenna and a rotor, he may find that admitting cable in his house also is admitting that he foolishly invested money in an antenna system.

Each system can argue their own philosophy into or out of how such a unit could or should be handled. But it shouldn't be rejected because we can't admit that problems will happen on our lines. If we don't want to consider the assist this kind of unit can give, let it be because our engineers and technicians are so dedicated to quality control that they would feel defeated if they had to install one. And even then, how can we solve **all** the problems this unit would solve?

Please note that this is not a simple DPDT switch. It is especially designed for high isolation and to protect against capacitance feedthrough. □

For further information, circle number 75 on our reader service card.

Mission Cable TV Selling Test

Mission Cable TV, Inc. is participating in the first nation-wide experiment in the use of cable television for the presentation and sale of apparel, accessories and items for the home, it was announced by Donald O. Williams, Vice President and General Manager, Mission Cable TV, Inc. Mission is the nation's largest metropolitan CATV system and is a subsidiary of Cox Cable Communications, Inc.

The pioneering concept, called CABLE CATALOG, will be cablecast frequently on Channel 4, displaying merchandise from Neiman-Marcus, the world-famous chain of specialty stores. Stanley Marcus, Chairman of the Board of the Dallas-based chain, said, "This is a test of cable TV versus the print media. I have long been tantalized by TV and the CABLE CATALOG offers us an unusual opportunity to extend our service to customers who live far beyond the range of our retail stores." Neiman-Marcus has stores in Dallas, Fort Worth, Houston, Atlanta and Bal Harbour, Florida.

INDUSTRY NEWS

120 System Cable TV Test

A national experiment involving some 120 cable TV systems has been launched to test CATV's ability to heighten citizen interest and participation in setting public policy on an issue of critical national importance.

The issue is land use to accommodate urban growth. The experiment will allow more than 5.5 million cable viewers in 28 states to see and hear land use policy examined from both national and local perspectives, and then register their opinions with state legislators, most of whom will be considering land use legislation in their spring sessions.

The two presentations are to be shown back-to-back on cable television systems in each of the communities.

"The experiment constitutes the first national use of cable television's unique ability to program to small communities (and audiences), with the flexibility of involving local groups and resources in local programming," says David Foster, president of NCTA.

This cable experiment is sponsored by the National League of Women Voters and the Citizen's Advisory Committee on Environmental Quality, with participation from the National Cable Television Association. It is funded by a grant from the Rockfeller Brothers Fund with additional support from Thomas Y. Crowell Company, publishers of **The Use of Land,** the Video Access Center of New York and Calvin Kytle Associates of Washington, D.C.

Foster Comments On The OTP Plan

"We are pleased that the President's Cabinet Committee recognizes that cable television is becoming an important and unique communications medium in its own right, one that demands a regulatory scheme based on the television of plenty, not the television of scarcity. The Report reflects the strong confidence of Dr. Whitehead and the Committee in cable's viability and its capacity to provide meaningful services to the country.

"The Committee suggests, and we agree, that the kinds of experimentation, innovation and growth necessary for cable to fulfill its promise will come only in an atmosphere of greater reliance on free market conditions and sensible regulation. We will continue to study the Report and look forward to the opportunity to participate in future refinement and development of national communications policy in the areas covered by the Report's recommendations."

RCA To Enter CCTV Market

RCA has announced it is entering the rapidly expanding $100 million closed-circuit video equipment market with a line of black-and-white closed circuit television (CCTV) cameras.

"RCA's intent is to provide the closed-circuit TV equipment user with a camera that has the most desired features, is easy to operate, competitively priced, reliable and backed by service at the manufacturing location," according to Victor C. Houk, Manager of Video Equipment Marketing, RCA Electronic Components. "Initial sales emphasis will be in the domestic market," he noted.

The announcement, made by RCA Electronic Components during its annual sales meeting, pointed out that the new RCA cameras were primarily designed for use in the industrial surveillance, audio/visual, specialty and general CCTV equipment market.

For Better Results Use Classified Ads In The Back Of This Issue

NEW PRODUCTS

Time Base Corrector

The **MICROTIME** 300 series HETROCOLOR Time Base Corrector references either an internally installed MICROTIME gen lock sync generator or any external monochrome or color sync generator, and corrects the time base jitter of the luminance portion of the signal against the sync generator's reference.

The equipment is especially designed to handle time base errors peculiar to heterodyne record VTRs and VDRs which do not reference H sync on playback. This includes any capstan servo'd, power-line driven, or battery powered cassette or open-reel VTR.

The HETROCOLOR corrector design, however, processes the output of any VTR with quality indistinguishable from 200 Series processing of an H-locked VTR playback, except on calibrated test signal measuring equipment.

With the sync generator installed internally, the 300 Series units will process composite video signals with either RS-170 (broadcast) or RS-330 (2:1 industrial) composite sync, without adjustments.

For More Details Circle (76) on Reply Card

Video Cassette Machine

JVC has updated their video cassette line again, this time with a second generation unit that is completely solid state, can be operated by remote control, offers random selection of programs, and a protection circuit that automatically shuts off the machine before any tape can be damaged by operator goofs.

JVC now operates through a national dealer network. Their line will be on display at the annual NCTA convention this month.

For More Details Circle (77) on Reply Card

High Performance Video Tape

TDK Electronics announced recently the development of a new type of magnetic video tape which offers the high-output performance of chromium-dioxide combined with superior physical characteristics.

A Master Video Tape version of TDK's new tape, for duplicating purposes, has also been announced.

Development of the new tape was announced in the USA by Mr. S. Tokuda, Vice President & General Manager of TDK Electronics Corp., Garden City, NY. "Our new video tape is called 'AVILYN'", said Mr. Tokuda in making the announcement. "AVILYN provides electromagnetic characteristics equal to or better than those of chromium dioxide, while also offering very much lower head wear characteristics and much better resistance to high temperatures. AVILYN's characteristics are completely compatible with those of chromium dioxide tape, while its lower abrasiveness and more stable residual magnetization characteristics at high temperatures overcome two of the principal problems associated with CrO_2 tape in video use."

For More Details Circle (78) on Reply Card

Economy Color Camera

From **Sony** comes a new color video camera with pro performance and an economy price tag. It is their DXC-5020BP.

This is a two-tube system that will adapt to your choice of "C" mount or "MS" mount lenses. This makes it applicable for studio, remote pickups, sporting events, or documentary coverage.

By removing or interchanging lenses, the DXC-5020BP can be operated with microscopes, fiber optic applications, or in film chain systems. But by mounting a zoom lens on it, you're back into regular operation.

The professional Plumbicon® tube assures low light level, lag-free performance.

This camera, while economy priced, was designed to meet the strictest requirements of cable, educational and CCTV applications.

For More Details Circle (82) on Reply Card

Drop Cable

A new series of bonded aluminum tape CATV drop cable designed specifically for metropolitan areas has been designed by **Cerro Wire & Cable.**

The new drop cables reject direct pickup even in strong signal areas. A heavy (8 mil thick) bonded aluminum tape shield prevents pickup of signals directly from local TV and FM transmitters.

"Direct pickup is an acute problem in CATV markets where local channels are available," said Mr. Spexarth. "Our new bonded tape cables are designed to overcome this problem by providing shielding to FCC Standards."

The new FCC Technical Standards, Part 76, limits system radiation to 20 microvolts per meter at 10 feet.

"Radiation and direct pickup are two sides of the same coin," explained Mr. Spexarth.

Cerro bonded aluminum tape drop cables use copper clad steel center conductors for extra physical strength. Attenuation is kept low through the use of expanded polyethylene dielectric. The 8 mil aluminum shield is overlapped ¼" and is bonded permanently to the jacket with a rugged copolymer adhesive. The heavy tape is much more effective at rejecting radiation than thin aluminum tape. Covering the cable is a black vinyl or polyethylene jacket.

Available in RG-59 and RG-6 sizes, bonded aluminum tape cable is recommended for use in aerial installations only with integral messenger. Because it is extremely moisture resistant, it can be used underground.

For More Details Circle (79) on Reply Card

TV Cameraman's Headset

The new **Telex** TV cameraman's headset is available in either single or dual muff, and with or without push-to-talk switch. The dual muff version is wired binaural for program and cue lines. The headset has magnetic microphone and headphone elements and is equipped with a 12-foot unterminated cord. Color: Black and gray. They are made in USA and warranteed for one year. You can see them in booth 301.

For More Details Circle (80) on Reply Card

Tele Cine Adapter

Akai is now offering a unique Tele Cine Adapter for economy and cable systems. You simply connect the VLC-8 to your Akai video camera, line it up against your projector, and you have an instant film chain.

When used with the Akai VC-150 portable color camera, reproduction is quite good, because the camera is equipped with an automatic iris that adjusts instantly to light variations. This system also will allow you to preview film on a monitor before it is put on the line.

For More Details Circle (81) on Reply Card

another. His demonstrations included use of 1-inch and 3/4-inch video tape machines.

Chapter 22: Central New York
Chairman: Hugh Cleland,
Liverpool, N.Y. 13088

The February 28th meeting, held a week later than usual at the Syracuse Northway Inn, spotlighted the rules and regulations of the Occupational Safety and Health Act (OSHA), as applied to radio-TV broadcasters, as well as microwave and CATV systems. Jim Doran, Syracuse Safety Co., covered equipment conforming to OSHA requirements and ANSI standards. Doran reviewed what OSHA expects and what inspectors will be looking for during a typical visit.

Chapter 26: Chicago, Ill.
Chairman: Bradley Anderson
University of Illinois, Box 6998,
Chicago, Ill. 60680

The January 22nd meeting held at NBC Studios, featured Ralph Johnson, regional manager, Amperex, who presented a program on the manufacture and use of the plumbicon camera tube. His program included a video tape demonstrating some of the common faults that may occur in manufacturing or due to operational misadjustments. NBC provided refreshments. On February 21, at ABC-TV Studio B, State and Lake Sts., Joe Kresnicka, chief engineer of WLS-TV, discussed the new antenna on the Sears building, and RCA demonstrated their completely redesigned Video Tape Area with their video cartridge machines. Chairman Anderson thanked sustaining members Rich Electronics, Mike Dyer Distributor, Telemation Productions, and Swiderski Electronics, in addition to the ABE Credit Union for assistance in conducting chapter meetings.

Provisional Chapter: Southwestern Ohio
Chairman: John McNally,
Fairfield, Ohio.

On January 30th 24 members and guests met to elect officers as follows: chairman, John P. McNally of WCNW/WFOL; vice chairman, Jerry L. Bowers of Collins Radio; secretary-treasurer, Mark Ehrhart of WSAI/WJDJ.

Let's See Now....

What was that *OTP* TV drop-in plan?

The White House Office of Telecommunications Policy (OTP), stirred up yet another controversy last September when its director, Dr. Clay T. Whitehead, announced that 85 new VHF television stations could be "dropped-in" to the top 100 markets, without impairing existing service, if the FCC would reduce its co-channel separation requirements by 10 percent.

Dr. Whitehead, referring to a study prepared by OTP, emphasized the prospect that these drop-ins, many of them said to be in the most important markets, could provide enough additional VHF stations to make possible a viable fourth commercial television network to compete with the other three.

Dr. Whitehead's announcement was greeted skeptically by both broadcasters and engineers familiar with the crowded VHF spectrum. Some thought another shot had been fired in the White House feud with the networks over television news coverage. Others thought that this time OTP might have been more concerned with demonstrating its own usefulness at a time when its budget was being severely cut back by a hostile Congress.

The September announcement was vague about specifics and was not accompanied by any documents. The documentation came a month later, in response to Congressional pressure. The published study, described as only "a preliminary analysis," bore faint resemblance to the study Dr. Whitehead had described in September. Instead of 85 possible drop-ins, the study listed only 66—a total promptly reduced to 62 by a post-release OTP correction. (See Table I.) Of the 62, only one was in a top-10 market, and fully 37 were in markets below the top-50. Moreover OTP's drop-ins would be located in only 41 different markets, and would add a fourth commercial VHF station available for fourth-network affiliation in only 23 markets, most of them below the top 50. Thus, even if all 62 were feasible they could hardly support a fourth network.

A Question Of Feasibility

From the first it was apparent that there would be questions about the feasibility of many of the listed drop-ins. For example, no less than 10 would use channels adjacent to existing stations in the same market. The OTP report assumed 15 percent mileage separation reductions, applicable to adjacent-channel separations as well as to co-channels, with off-setting directionalization for all 15 percent of the former reductions and for 5 percent of the latter.

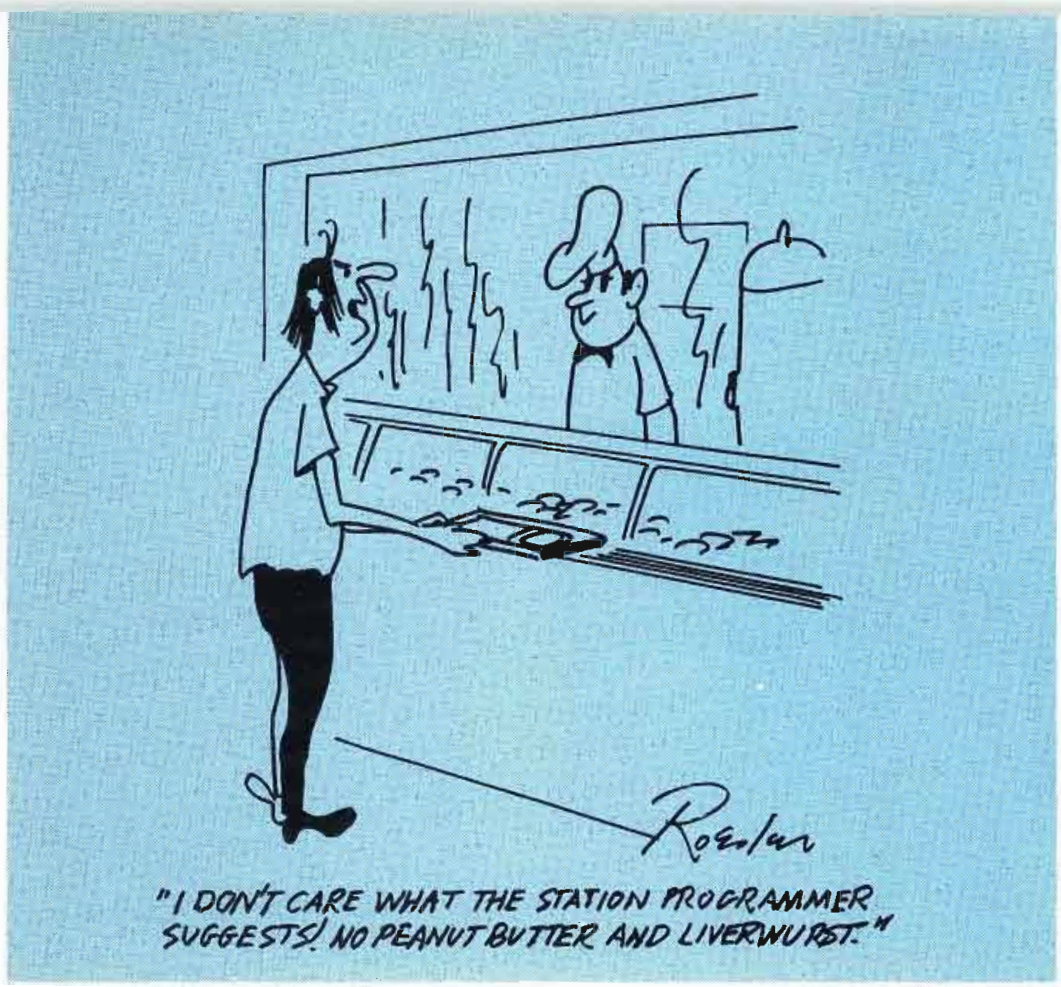
Such obvious problems led engineers at the FCC, the networks, and a television trade association—the Association of Maximum Service Telecasters (MST)—to dig deeper. They all found many more problems than those that initially met the eye. While their preliminary conclusions varied as to precisely how many of the OTP drop-ins would be unuseable, they all agreed that the list was riddled with errors.

MST published the results of its preliminary analysis in the form of a point-by-point, drop-in by drop-in refutation of the OTP study. **By MST's reckoning, 34 of the 62 proposed drop-ins—more than half—would not meet even OTP's own reduced separation criteria.** All but 8 of the rest would suffer from critical defects that would make them impracticable. Even as to the remaining 8, the indications were that they would be inferior to competing stations and might well suffer from critical defects not disclosed by a preliminary analysis.

What is OTP?

OTP was established by President Nixon in 1970 by Executive Order as a White House agency responsible for coordinating and directing the telecommunications activities of the Executive Branch. Its specific duties include cooperating with the FCC in preparing a long-term plan for improved spectrum management, and assuring that the Commission is informed of Executive Branch views on telecommunications policy matters in general. However, OTP has no regulatory authority over non-governmental activities and no authority at all over the Commission.

Although it has done creative work in technical areas such as federal government spectrum allocation and utilization, under Dr. Whitehead it is best known for its political role as an advocate of controversial White House policies towards the television networks and television generally. Dr. Whitehead drew particular public attention with his December 1972 speech attacking "ideological plugola" in network news commentaries and urging local stations to police the content of network news broadcasts.



MST attributed OTP's badly-mistaken conclusions to a host of errors and omissions—in addition to that of proposing adjacent-channel stations in the same market:

•The study simply overlooked many existing educational and Canadian stations.

•The study overlooked instances of multiple short-spacing, where the drop-in could be located far enough from the most obvious interfering station only by placing it too near to some other station.

•The study overlooked the effect of directional signal suppression on the service that the drop-in could provide to its designated market. In many cases signal would have to be suppressed in the very direction of the principal city to be served.

•The study gave no consideration to the problem of site availability, and ignored instances where sites meeting OTP's reduced separations would be precluded by FAA regulations or by terrain blocking the signal from the market to be served.

•The study paid no heed to the characteristics of the markets which its drop-ins would serve. In UHF markets such as Fresno (five UHF stations), which was slated for no less than **five** VHF drop-ins, the OTP proposal was a solution for which there was no problem. Adding a VHF station to compete with established UHF operations could serve no purpose except perhaps to displace a successful UHF station. In other markets, the proposed drop-in would be inferior to its competitors because it would have to be located much farther from the market center or at a site where it would suffer from adverse antenna orientation in the market.

Separation Crunch

Notwithstanding the air of discovery with which Dr. Whitehead presented his proposal, reducing separation requirements to make room for new VHF stations is hardly a new idea. The FCC considered shorter separations at length when it established the table of allocations for VHF stations in 1952. It considered them at length again in 1963, when short-spacing was insistently promoted as a means of helping the third network, ABC, to reach competitive parity with the other two.

On those as well as many subsequent occasions, the Commission rejected reduced separations (1) because the resulting interference between stations would deprive viewers of existing service, and (2) because squeezing in VHF drop-ins would cripple the development of stations in the UHF band.

Co-channel interference blacks out the area between interfering stations in which the interference occurs, so that the population of those areas—where there is often little or no other service available—do not receive a signal from **either** station. The FCC's separation requirements are designed to insure wide-area coverage for all stations and at least some service for people living in areas remote from major markets.

The UHF band has space for many more new stations than the VHF band with reduced separations would ever accomodate, but the success of UHF depends on the extent of its acceptance by the public and by broadcasters. In 1963, the Commission concluded that the prospects for eventual UHF acceptance would be badly damaged if the most pressing needs for additional service were accommodated by means of drop-ins in the VHF band.

The OTP study does not point to any new solutions for the interference problem; it simply asserts—contrary to the plain fact according to most engineers who have studied the matter—that the reductions it proposes would not cause any substantial impairment of existing service. And the study does not so much as mention UHF, where the potential has only partly been tapped since 1963.

OTP asserted that separation reductions on the order of its proposal are no greater than existing derogations from separation rules which have been permitted by the Commission. But MST maintained that OTP was simply wrong on the facts. Except for six unique cases

OTP'S PROPOSED VHF DROP-INS IN TOP 100 MARKETS

Market Number (In Top 100)		City	Proposed Drop-In Channel Number	*Industry Analysis*
(1)	7	San Francisco	12	
(2)	11	Dallas/Ft. Worth	2	X[1]
(3)		Dallas/Ft. Worth	9	X[1]
(4)	15	Seattle/Tacoma	3	X[1]
(5)	18	Miami	3	X[1]
(6)		Miami	9	X[1]
(7)		Miami	13	X[3]
(8)	19	Atlanta	4	X[1]
(9)	22	Houston	5	X[1]
(10)	23	Kansas City	8	X[1]
(11)		Kansas City	12	X[1]
(12)	25	Milwaukee	8	X[3]
(13)	28	Dayton	11	X[1]
(14)	30	Portland, Oregon	4	X[1]
(15)	32	Memphis	12	X[1]
(16)	33	Nashville	10	X[1]
(17)	34	Altoona/Johnstown	5	X[1]
(18)		Altoona/Johnstown	12	X[2]
(19)	35	Birmingham	3	X[1]
(20)		Birmingham	8	X[1]
(21)	36	Greenville/ Spartanburg	2	X[1]
(22)	43	Albany/Troy/ Schenectady	4	X[3]
(23)	47	Louisville	6	X[1]
(24)	48	Charleston/ Huntington	2	X[2]
(25)		Charleston/ Huntington	11	X[2]
(26)	53	Salt Lake City	10	X[1]
(27)		Salt Lake City	13	
(28)	61	Salinas/Monterey	10	X[1]
(29)	62	Wichita	5	
(30)	66	Shreveport	11	X[1]
(31)	68	Little Rock	9	X[1]
(32)		Little Rock	13	X[1]
(33)	69	Mobile/Pensacola	8	X[1]
(34)	70	Green Bay	8	X[1]
(35)	71	Davenport	11	
(36)	73	Knoxville	8	
(37)	74	Champaign/ Decatur/ Springfield	6	X[3]
(38)		Champaign/ Decatur/ Springfield	13	X[1]
(39)	75	Portsmouth, N.H./ Portland, Me.	3	X[3]
(40)	77	Jackson	10	X[1]
(41)	79	Spokane	9	X[1]
(42)		Spokane	13	X[1]
(43)	82	Columbia, S.C.	8	X[3]
(44)	84	Fresno	2	X[3]
(45)		Fresno	4	X[3]
(46)		Fresno	7	X[3]
(47)		Fresno	9	X[3]
(48)		Fresno	13	X[3]
(49)	85	South Bend	4	X[3]
(50)		South Bend	12	X[3]
(51)	87	Des Moines	4	X[3]
(52)	90	Paducah	10	X[1]
(53)		Paducah	13	X[1]
(54)	91	Evansville	5	X[3]
(55)		Evansville	12	X[1]
(56)	92	Sioux Falls	6	
(57)		Sioux Falls	7	X[3]
(58)	94	Binghamton	4	X[1]
(59)		Binghamton	7	X[1]
(60)	95	Wilmington, N.C.	8	
(61)		Wilmington, N.C.	10	
(62)	100	Monroe, La.	4	X[3]

X[1] Drop-in would violate OTP's own reduced separation criteria.

X[2] Drop-in could not serve principal city because of disabling site problems (signal obstructed by terrain or blocked by same-market adjacent channel interference.)

X[3] Drop-in, not otherwise disqualified, likely to be unuseable or purposeless because of other obvious defects, i.e. great distance from vital parts of the market, signal suppression in the direction of the principal city, adverse antenna orientation, probable FAA constraints on tower height, and/or location in a UHF market.

involving special circumstances—such as interference occurring over the water between Puerto Rico and the Virgin Islands—the average mileage derogation has been a scant 2.9 percent, and there have been no derogations greater than 10 percent.

So while the OTP study urged a re-examination of deep-rooted policies, it did not say why re-examination should be expected to lead to any different conclusions. Theoretically, the reasons for rejecting reduced separations might have lost their force as a result of new technology or other developments during the last decade. But MST says they have not. And curiously, the OTP study does not say that they have.

It may be that the OTP drop-in proposal, like OTP's political role in general, will soon be allowed to die a quiet death. If so, there will remain the question how such a proposal ever came to be made in the first place. □

FCC Gets New Chairman

President Nixon has designated Richard E. Wiley to succeed Dean Burch as Chairman of the Federal Communications Commission. Wiley's designation will be effective upon the resignation of Burch, who was chosen recently to take over a cabinet-level post in the Nixon administration as Counselor to the President.

Wiley first joined the Commission on September 29, 1970, as General Counsel. Although President Nixon nominated him to the Commission November 30, 1971, to replace Commissioner Robert Wells, who had resigned November 1, 1971, Wiley took his seat on January 5, 1972, following a recess appointment the day before. Selected to serve a complete term running through June 30, 1977, Wiley was confirmed by the Senate on May 30, 1972, and was sworn in on June 5, 1972.

The new FCC Chairman is from Northbrook, Ill., and had been a partner in the Chicago law firm of Durditt, Calkins and Wiley before coming to the Commission.

After serving as a Captain in the Office of the Judge Advocate General of the U.S. Army from 1959 until 1962, Wiley was associated with the Chicago law firm of Chadwell, Keck, Kayser, Ruggles and McLaren until 1968.

Wiley, at left, in the field with Roy Fritcher, CE at WTIM, Taylorville, Ill.

Canadian Engineering Meet

The 24th Annual Western Association of Broadcast Engineers (WABE) Conference is being held in the Palliser Hotel, Calgary, Alberta on May 7, 8 and 9th of 1974.

The Conference consists of technical papers morning and afternoon with exhibitors' displays open on the 2nd and 3rd floors afternoons and evenings.

Technical Directors and Chief Engineers of nearly all the radio and television stations in the four western provinces attend the conference and in addition, there is good representation from the Canadian Broadcasting Corporation (CBC), Canadian Television Network (CTV), Trans Canada Telephones and CN/CP Telecommunications. Fifty exhibitors representing the broadcast manufacturers the world over are expected to display this year.

The FCC expects you to know

By Ron Merrell

When you look over the broadcast fines levied in recent years, there are some distinct points that stand out above the groaning and complaining. They warrant the spotlight, because they always play a part in the hearings.

There probably is nothing that fires up the ire of the FCC more than to not answer FCC correspondence. In their view, there just is no excuse for not answering FCC questions or assertions. To not answer will probably help nail down a fine that otherwise might have been lowered or dropped, depending upon the facts of the case.

And while the Commission can be irritated, it also can be soothed. How? Simply by being truthfull and as candid as possible. Time and time again the reports of hearings indicate that being candid swayed the ruling from a heavier to a lighter fine or meant the difference of being fined rather than losing the license.

Meanwhile, it does no good to say (even though it may be true) that the Rules were not known or were misunderstood. The FCC expects the licensee to know the Rules, so lack of knowledge here is no defense.

But let's say that there was a violation of a Rule, and this violation continues over a period of time....as opposed to something that happened once. The longer the violation continues, the less likely any argument forwarded will satisfy the Commission. If the violation was a technical engineering type, the chances are fair that an immediate reply to correspondence explaining the situation and proceedures taken to assure it won't happen again will suffice. On the other hand, if the violation is one involving programming (Fairness Doctrine, Equal Time, etc.), once is enough to expect the wrath of the hearing. And one area that is getting the spotlight these days is fraudulent billings.

You can tell a Traffic Court judge that since you got your ticket for speeding, you have been driving under the speed limit. He'll be happy to hear that, but it won't change the fine. And you can go on to tell the judge that you are a courteous driver and that you stop to help other motorists along the roadside. He'll commend you for being that kind of driver, and that will be that.

So, neither does it change the situation in correspodence with the Commission or in hearings to say that the licensee is a community service-minded individual who can point with pride to his record. In the case of the Commission, they expect the station to be a service to the community.

Well how about asking that the fine be reduced? It's certainly worth mentioning, but in most cases the extent of the fine was based on the financial capability of the licensee. If there is anything that can be done to reduce a fine, it's being prepared to present all the relevant facts and to do so in a candid manner.

With these guidlines in mind, let's take a look at some recent Commission actions and see if you can predict what the outcome was. We're hoping that licensee awareness will help reduce further such actions and forfeitures.

Fraudulent Billing

Last year a broadcast company in Pittsburg was ordered to show cause why an order revoking the license should not be issued for violation of Section 73.1205. In other words, for fraudulent billings. The show cause order also constituted a notice of apparent liability for forfeiture of $10,000 or less for violations of the Commission's Rules and the Communications Act.

The licensee was ordered to provide evidence whether it had knowingly engaged in fraudulent billing practices; whether advertising rates charged a retail store owned and operated by an officer and stockholder of the licensee were substantially lower than those charged other advertisers; whether a shareholder and officer of the licensee had used the stations' facilities for competitive advantage; and whether the company was qualified to remain a licensee of the Commission.

In her initial Decision, Judge Ehrig noted that evidence had established that for about 11 months of one year, the company president issued his brother (also a stockholder) affidavits of performance on station letterhead representing to national manufacturers that the brother's clothing store had been charged more than $6,400 for advertising broadcast over the company station. In fact, the brother actually had been charged a little over $1,000. There was evidence that, based on the $6,400 figure, the brother was given credit allowances of more than $3,000.

With regard to the discrimination issue, Judge Ehrig said that "dollar-for-dollar, the rates which were charged.....were substantially lower than those charged other advertisers."

Judge Ehrig said that there was no question that the company had violated 73.1205, nor, she said, did its president's explanation that the services his brother was providing for the station and expenses he was incurring for which he was not reimbursed, more than equalled the card rates for the spots broadcast, "excuse its violation."

She noted, however, that the fact that the brother did perform services for the station had not been contridicted by the Broadcast Bureau and was a mitigating circumstance. In addition, the Judge said that the brother had repaid all monies received from his co-op ad-

vertisers and that the licensee had taken action to assure proper future billings. Then she added, the broadcast company principals had been completely candid and cooperative throughout the proceeding and had not misrepresented the facts to the Commission.

The result: the broadcast company was ordered to forfeit $10,000 for knowingly engaging in fraudulent billing practices. **They did not lose their license.**

Excessive Power

In other recent cases similar predictable results are a matter of record. For example, a Mississippi station was cited for operating with excessive power during daylight hours for a period of five weeks and for excessive pre-sunrise power for seven weeks.

In response to the Notice, the company denied that the violations were willful, stated that corrective action had been taken, and requested reduction of the forfeiture based on financial hardship. The result: the Commission did not excuse the licensee because of later corrective action. And, it said that it already had reconsidered the licensee's financial condition and was not persuaded to remit or mitigate the forfeiture.

Engineering Goof

A station in North Carolina was cited for repeated violations of Sections 73.47(b) and 73.111(a). These two deal with equipment performance measurements and the maintenance log. Repeated here meant that the measurements were not available to inspectors for a period of two years and that the maintenance log was not kept for a period of about two months.

The licensee requested a waiver of the fine, citing industry-wide personnel problems, its good service to the area, and lack of a fair economic return on the licensee's investment. It added that violations were not done willfully or flagrantly.

The Commission said that, having found the violations to be repeated, it would not be necessary to bring additional charges as to willfullness. Still, it was not persuaded to waive the forfeiture. In this case, unless contested further, the company must pay $750. For, as the report says, "Licensees are expected to comply with the technical rules as well as to make continued efforts to serve the community to which they are licensed".

Personnel Problems

As for the comments on the industry-wide personnel problem, we feel the subject deserves more than a passing comment. After all, the problems where operators build problems with the Commission for the licensee are usually small market stations. And when the Commission began to relax the operator requirements, they further open the door for violations. Certainly, it made it easier to begin each day in accordance with the Rules, but it also hampered the ability of the station to complete its broadcast day without some kind of violation. Reliance upon engineering for a quality signal processed according to the Rules is difficult to imagine when a Third Class ticket is all a station might need to open its doors for business each day. And here, especially, is where you find the biggest crunch of all: not answering Commission correspondence. And do you wonder why it occurs at that level?

In fairness to the Commission, we must say that its justice is neither blind nor hard-nosed. Forfeitures can be contested, and even those that are ordered take into account the recent past financial condition of the station and the size of the market it serves. Ability to pay is a consideration.

We may never get away from inspections by those who know less about station operations and the state-of-the-art than broadcasters do, but you must allow their basic premise: they expect you to know the Rules. And we hope that this kind of article will help you avoid violations and effectively handle one should it come your way. □

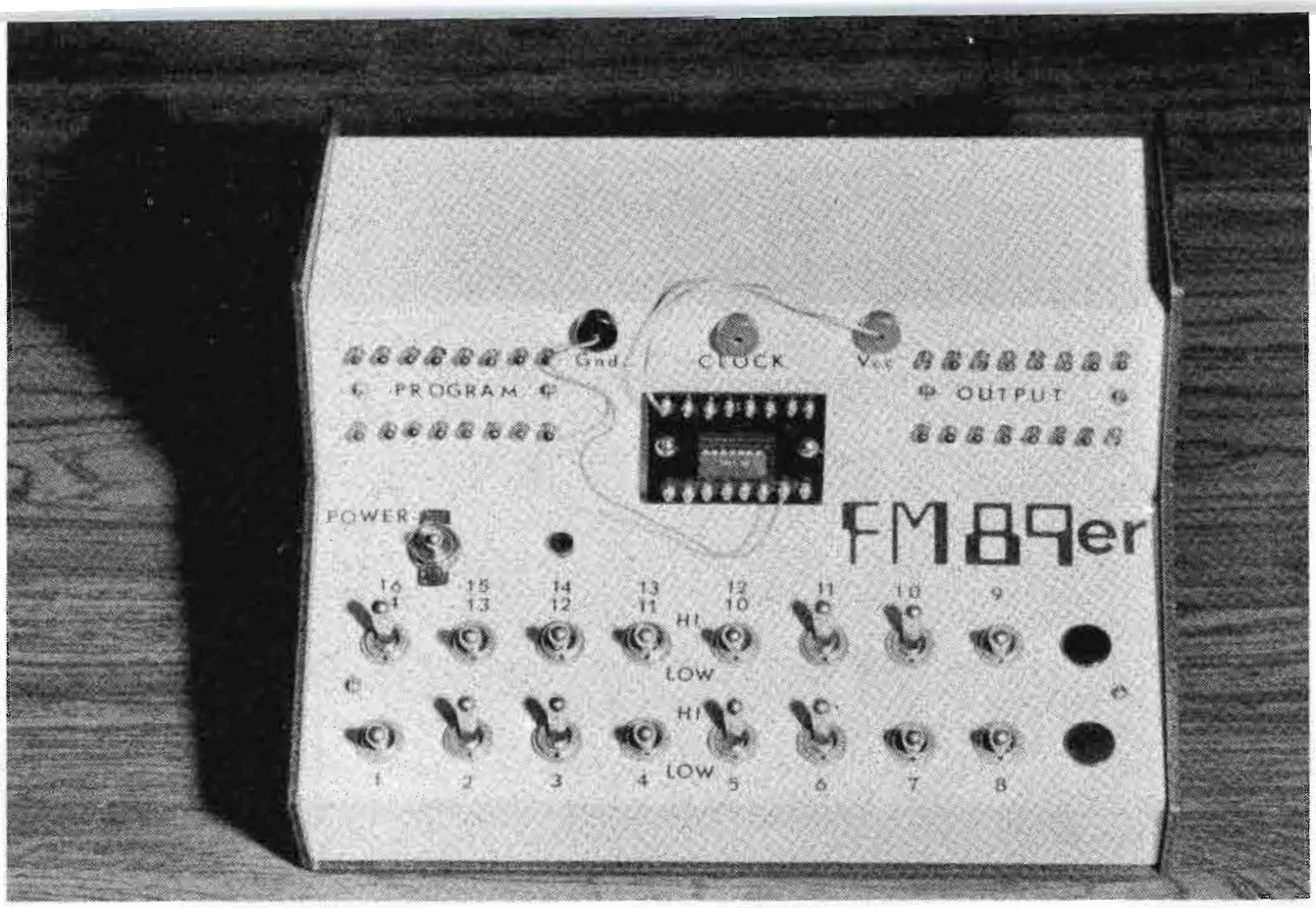


Fig. 1 The completed "FM-89er is used at WLCC to check out integrated circuits.

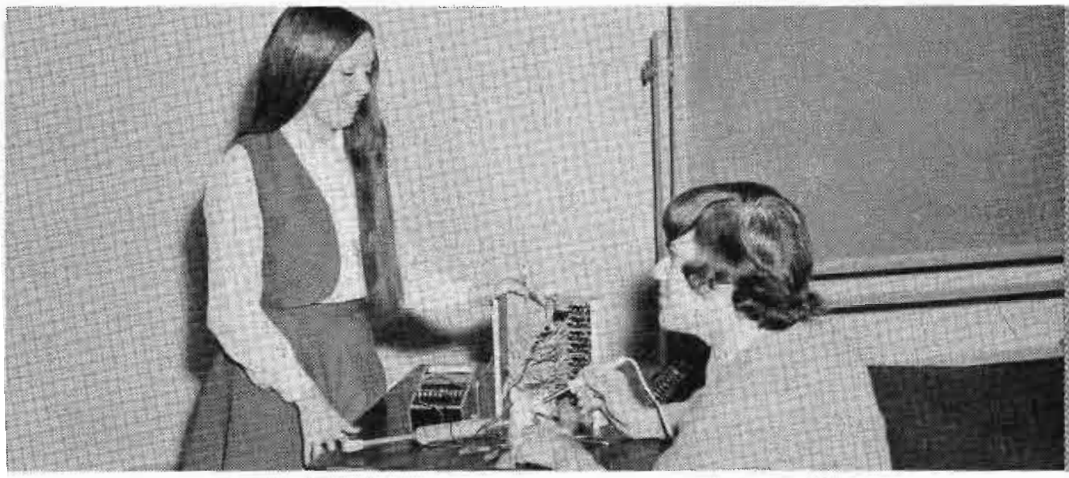


Fig. 2 Randy Bennett wires up the FM-89er as Pam Henwood looks on. If you know your broadcast history, you'll recall that a great many old timers got their start in college radio stations.

Testing digital chips

By C. Dave Copeland
CE, WLCC, Lincoln, Ill.

When it comes to designing something new or repairing a piece of equipment which includes digital chips, it is very handy to have a tester which meets the needs and saves time. It is difficult to set up a circuit each time something breaks down, not to mention the time delay when time is most critical. There are various testers on the market and they run a bundle for what we needed. Allied Electronics had one for $190 which is similar to our final circuit capabilities. There is an inexpensive, $20 kit from Southwest Technical Products Corporation. Being an in-circuit device, this tester is good but limited in that it cannot be programmed for out of circuit tests or tests when the power has to be off.

The unit which came up with uses two sets of 16 LEDs each. One for programming inputs and one looking at what the state is on each terminal. You can even check out a lamp driver circuit by programming the gate output terminal high. When the driver gate switches low, the output LED will go out, indicating an OK driver.

All of these great things are accomplished by a resistor which isolates the programming switch from the IC terminal so that the gate can drop the voltage on its side of the resistor. You might not care to spend the time and money on the programming LEDs and drivers. Our LEDs were purchased from a surplus company and we noted a considerable variation in the amount of current required to operate them. Some didn't work at all, so we settled on a maximum current and put in a 220 Ohm limiting resistor.

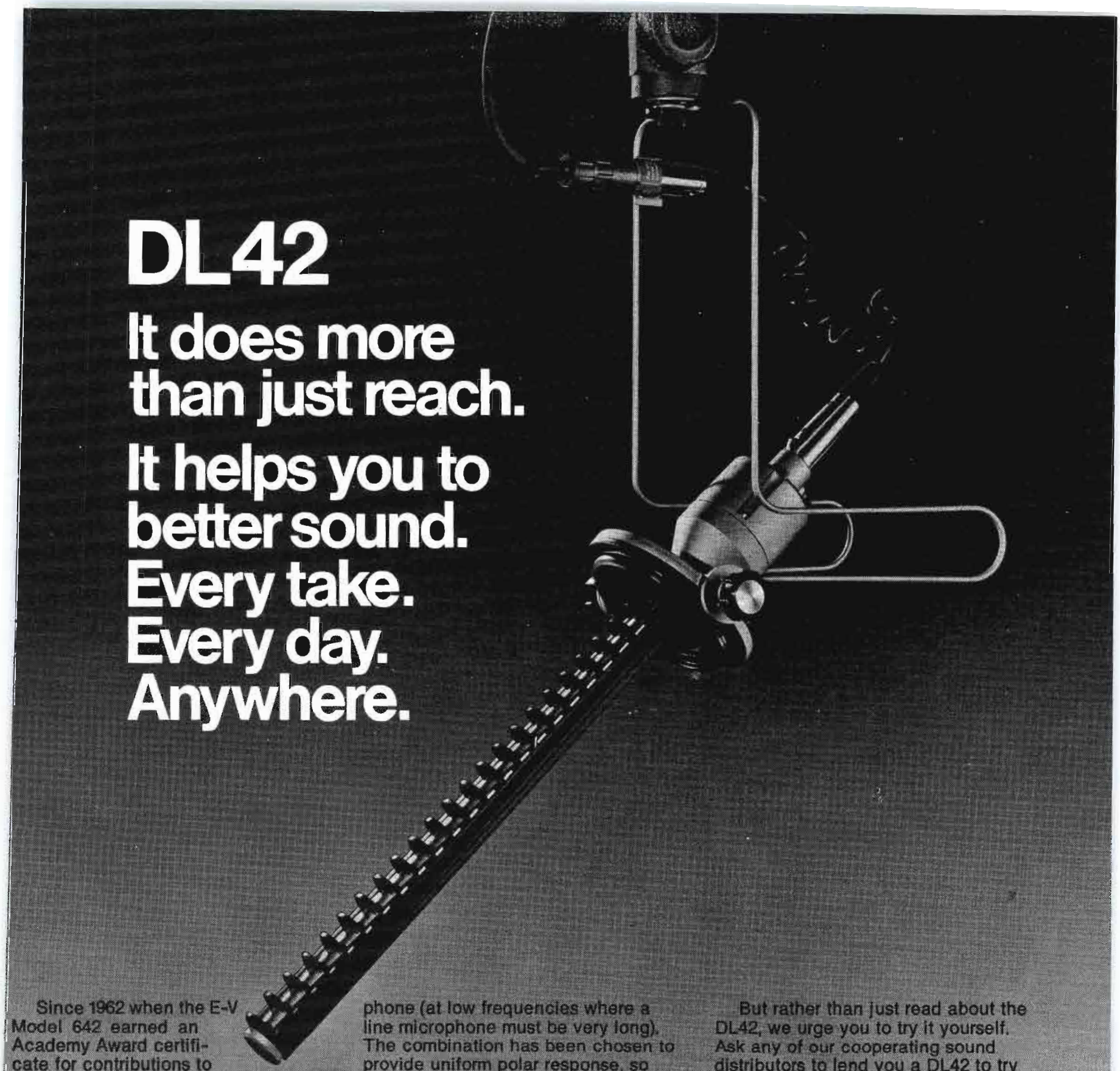
Would you believe that the first chip that we used while designing the circuit was defective? That makes you feel ***, but emphasizes the need for such a tester. You will note by the diagram that the circuit is very simple. The clock circuit uses three inverters from the 7405 for an oscillator and one for a buffer. This is an open collector device and you will note it is very hard to wire up a standard IC to oscillate. That is, to say, that units with internal collector leads won't work.

The smooth lines of the chassis

DL42

It does more than just reach.

It helps you to better sound. Every take. Every day. Anywhere.



Since 1962 when the E-V Model 642 earned an Academy Award certificate for contributions to motion picture sound, there have been a lot of attempts to better this pioneering design.

Admittedly, some similar-appearing microphones were lighter and a bit smaller. But often it was at the expense of uniform polar response and wide range. Now there's a long reach microphone that's both smaller and lighter, yet maintains wide range response even off mike.

It's the E-V DL42.

Weight has been reduced to 1/4 of the 642... even less than most highly-directional condenser microphones. And size has been shaved wherever possible. The DL42 is a unique combination of line microphone (at the high frequencies) and cardioid microphone (at low frequencies where a line microphone must be very long). The combination has been chosen to provide uniform polar response, so important to consistent sound quality. Off-mike pickups even sound good (although lower in level), a particular advantage to documentary units and free-wheeling shows where the unexpected is always happening.

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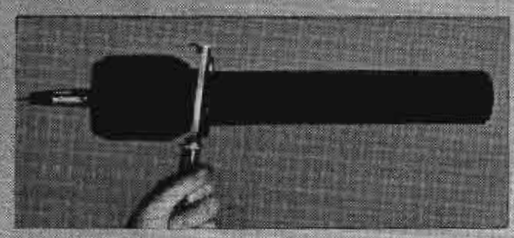

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Management Highlights

Here is what creative engineering can do at your station, if given time and funds. We are not suggesting that all test equipment be home brew. But we are saying that the new technology makes new demands, and with encouragement, engineering can meet the challenge it brings along with it.

Fig. 3 With the tester completed, Randy fires up the unit by testing a SN7401. Can you test yours?

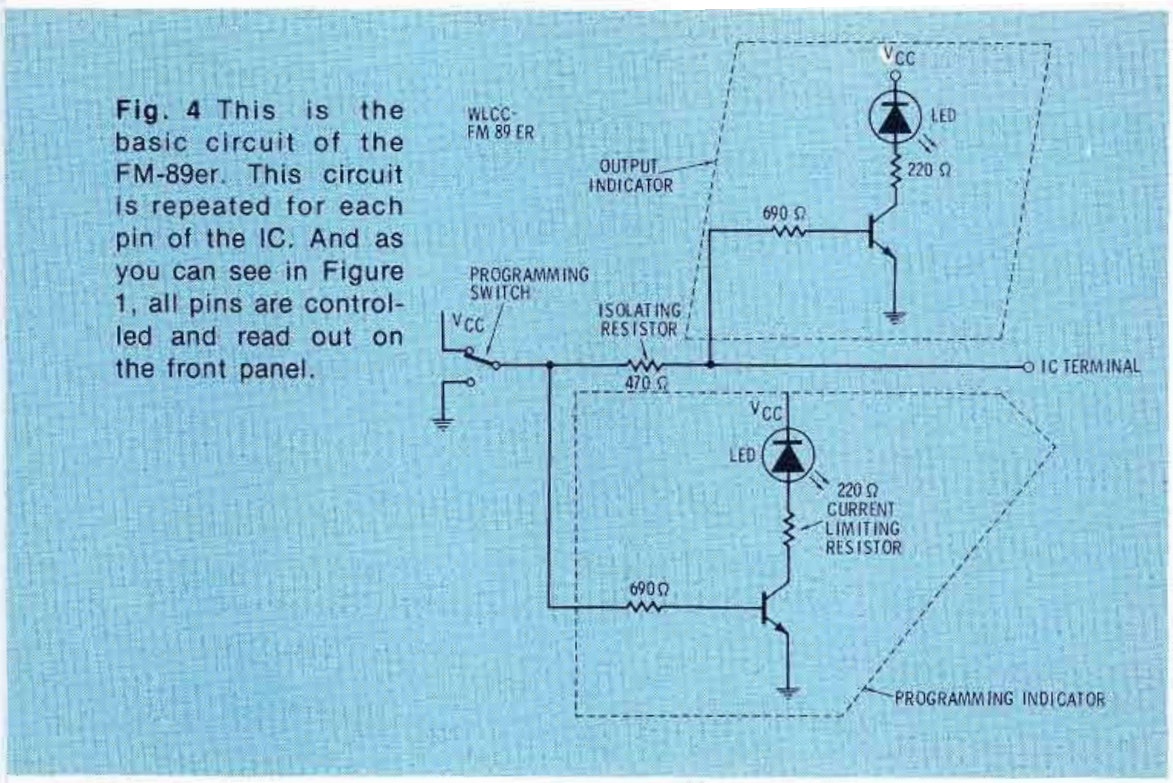

Fig. 4 This is the basic circuit of the FM-89er. This circuit is repeated for each pin of the IC. And as you can see in Figure 1, all pins are controlled and read out on the front panel.

are courtesy of Bud "COMPU-CAB". The number is SC-13100 and it was purchased from Allied Electronics. Note that they have the same number down for this and the larger size. Mounting of the components is not critical and the power supply, like everything else, is quite basic. My first unit didn't get its own power supply, but we had a fire and this is rebuilding time. It also used some available incandescent lights and a nice lettered plastic panel. Numbering systems for a unit accomodating both fourteen and sixteen pin ICs are a bit awkward, unless you want to wire in some monster of a waffer switch. We chose the dual numbering system, being a little lazy. Dubbed the FM 89er, this cute little device is a real time and headache saver. □

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The *IC* Op amp story part 3

By Walt Jung
BE Solid State Devices Editor

Last month we looked at a few IC op amp circuits which are useful in the processing of electronic signals. This month we'll focus on the generation of signals using IC op amps-various kinds of oscillators.

If you're wondering why the processing section was done prior to generation, you'll see shortly. Actually, the signal processing functions we've already discussed are an integral part of the circuits which are used to generate signals. So, when you see some of them, they won't look altogether so new.

Sine Wave Oscillators

There are a great many different types of sine wave generators which employ op amps, actually about as many as there are different kinds of filters, since the filter fixes the frequency. In any oscillator you need a filter and an amplifier. The filter provides a feedback path at the resonant frequency, and the amplifier provides gain to make up circuit losses and sustain oscillations, and also to provide sufficient output to drive external loads.

A classic form of sine wave oscillator is the Wien bridge type, which is shown in Figure 1. R1-C1 and R2-C2 form the tuning elements of the Wien network. At the resonant frequency of the network (fo), the phase shift through it is zero, and it supplies positive feedback to the op amp (+) input. When R1=R2 and C1=C2, the Wien network shows a loss of 3 to 1, thus the (+) input will see a signal 1/3 of the output. As long as the amplifier provides a gain of 3 or more, oscillations will be sustained. This is one of the keys to a stable, low distortion output. The amplifier gain must be maintained at the level required for stable output—otherwise, the oscillations will diminish and die out, or at the other extreme, grow in amplitude until amplifier saturation is

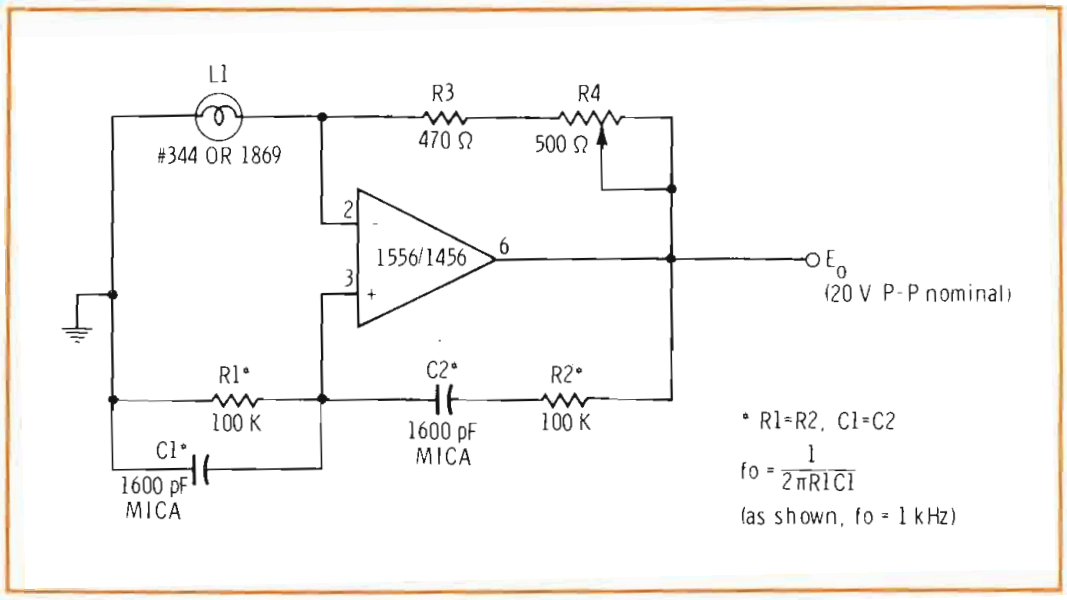

Fig. 1 Wien bridge oscillator yields low distortion sine waves with simplicity.

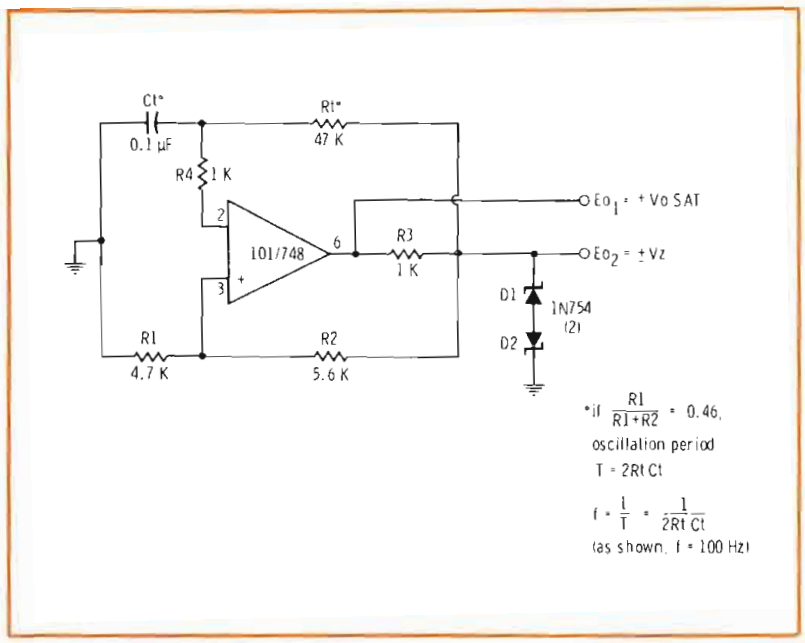

Fig. 2a Op Amp astable multivibrator is a natural source of square waves.

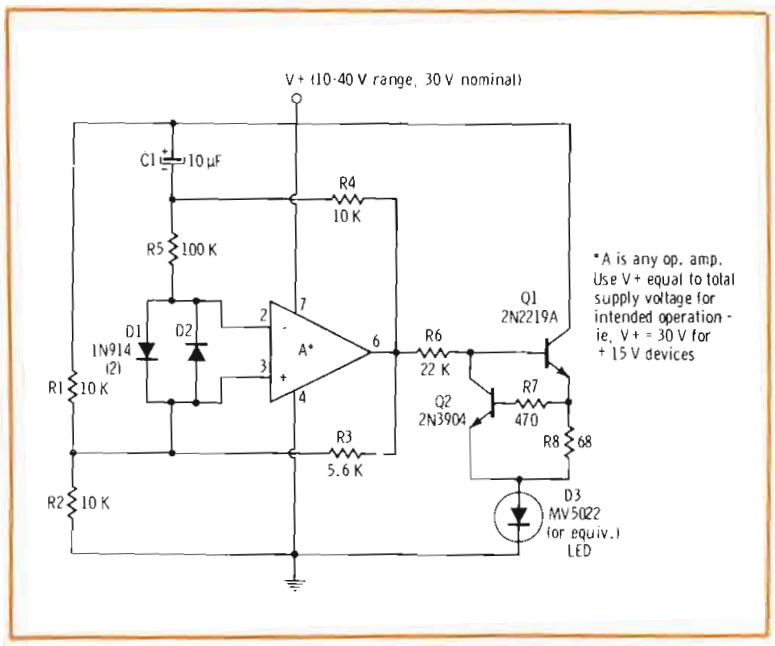

Fig. 2b Astable oscillator used as an Op Amp checker.

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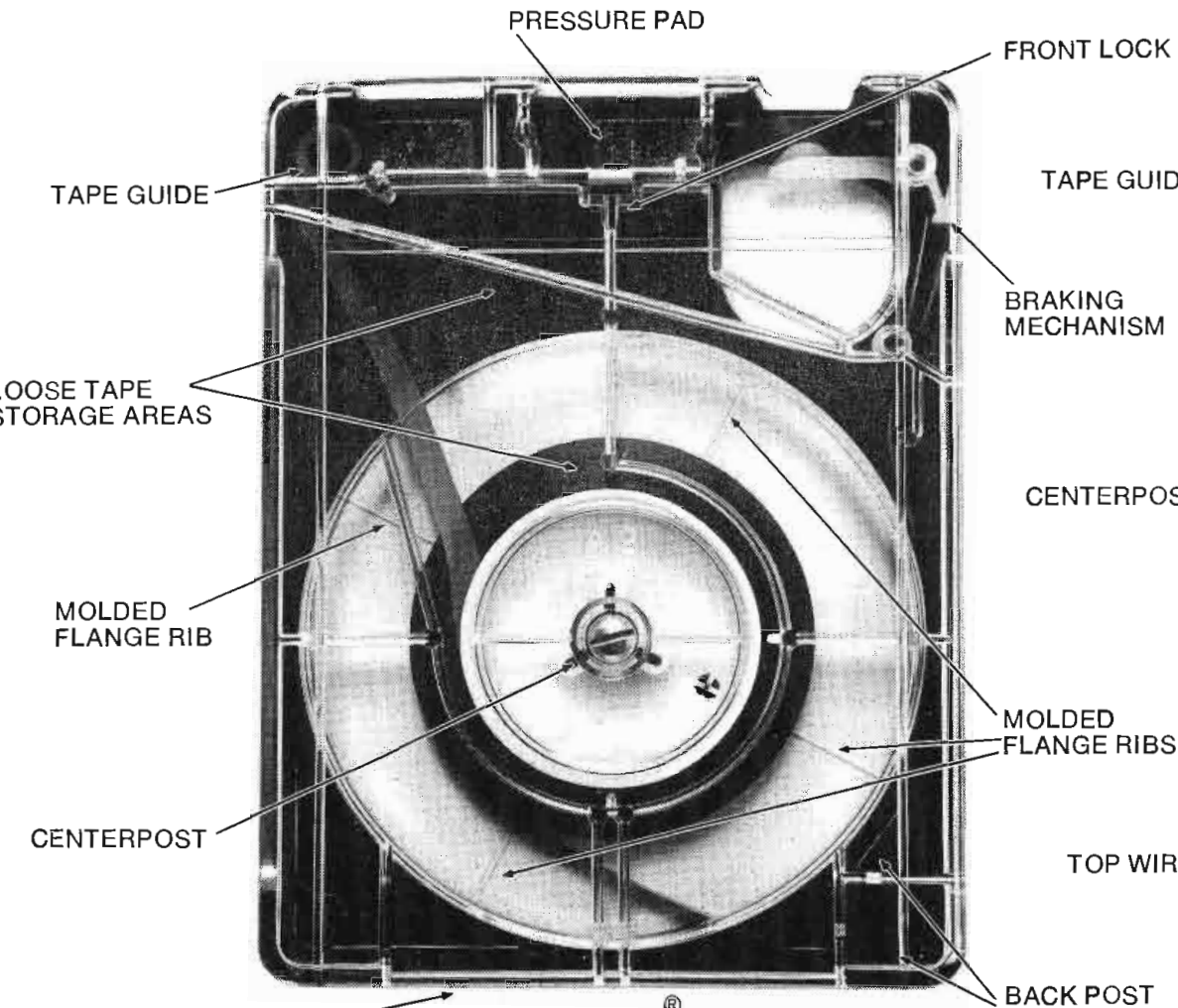

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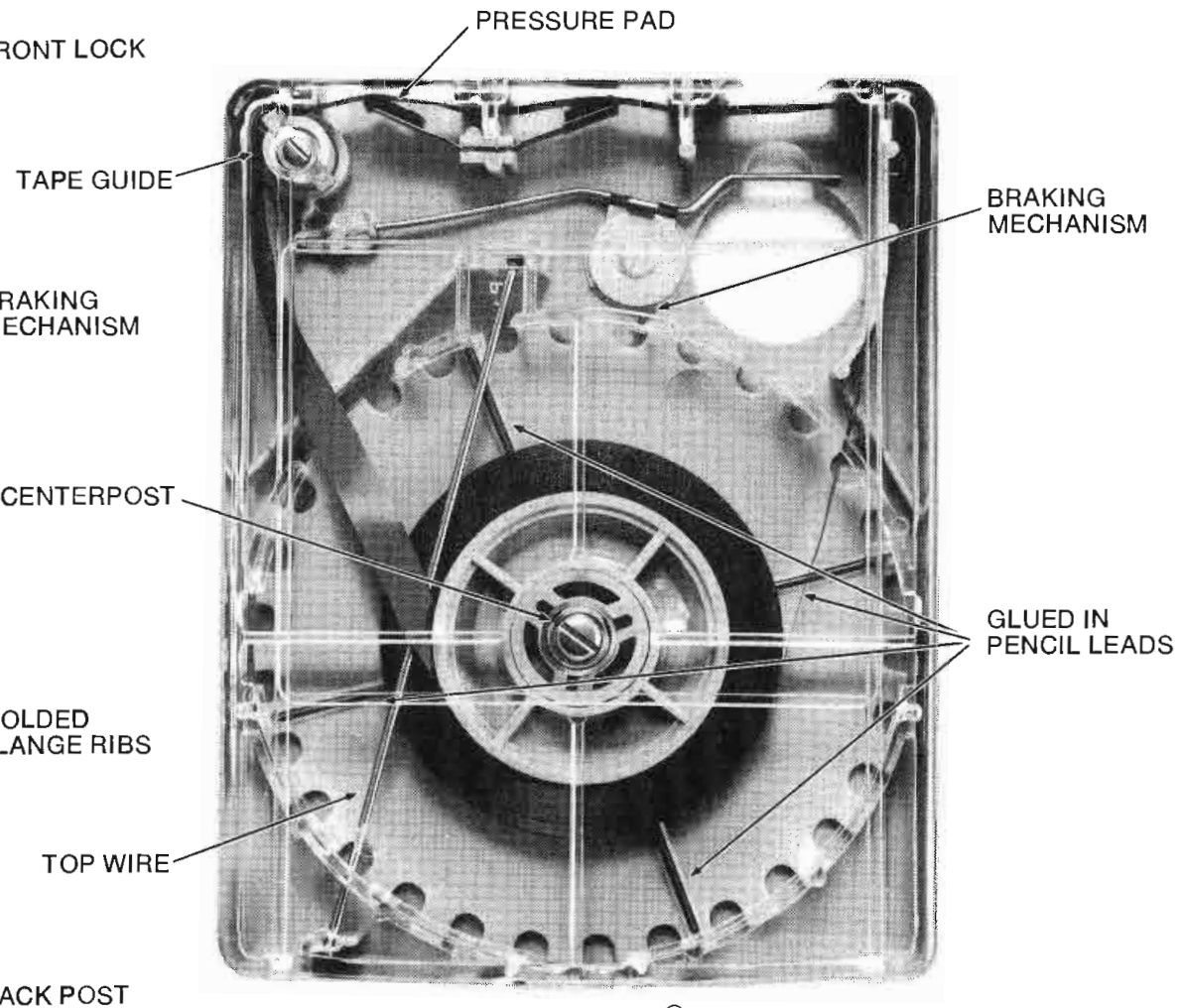

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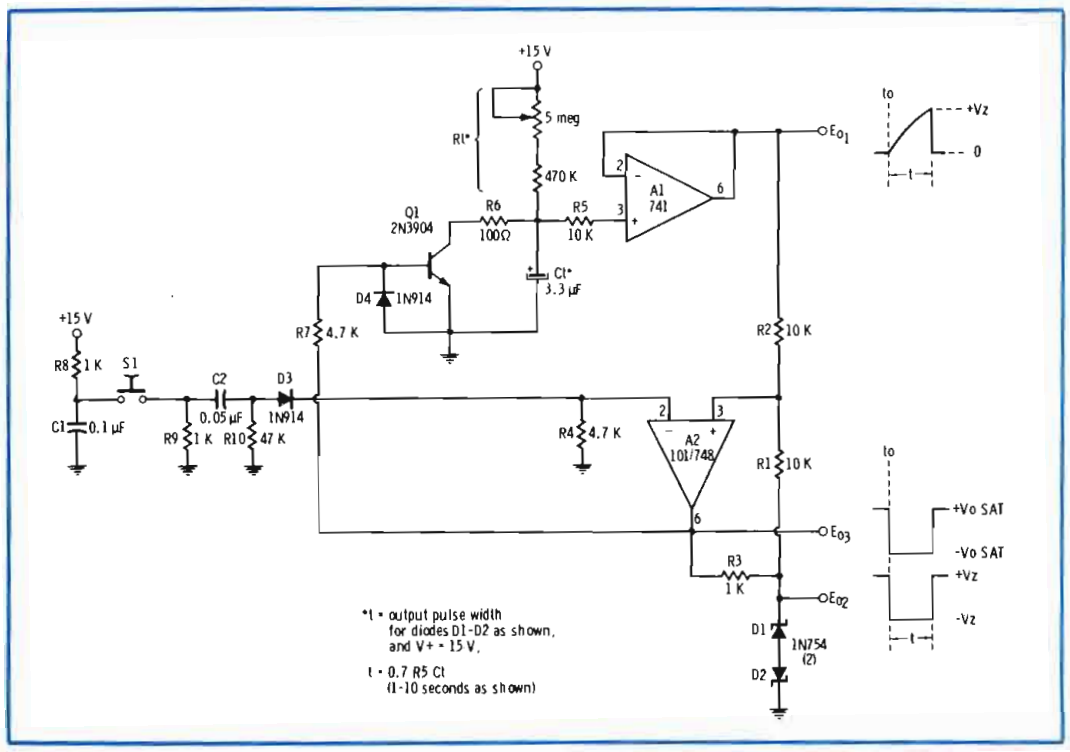


Fig. 3 Timer circuit has pushbutton triggering, with periods up to minutes.

reached. Both conditions are undesirable, so a good Wien bridge oscillator must use some form of AGC to stabilize the gain of the loop.

In Figure 1, L1 provides AGC action by adjusting the negative feedback through R3-R4 at the level necessary for an undistorted sine wave output. As the output tends to change in level, L1, being an incandescent lamp (with the characteristic non-linear resistance versus applied voltage property), adjusts its resistance. As a result, the "magic" 3 to 1 gain is maintained automatically.

You can see why its called a Wien bridge. The Wien network and the lamp network are the two arms of a bridge. When the bridge is at null, the op amp sees (ideally) zero voltage input. In practice, you want the amplifier to have as high a gain as possible at the oscillation frequency, this makes its input voltage small and keeps the bridge balanced.

To counter lamp manufacturing variance, a trim control (R4) is useful for adjusting the output to a specified level. As shown, the circuit generates a 20 V p-p output, but lower levels can be obtained by dividing down if necessary.

General purpose op amps like 741's will work well in this circuit below a few kHz and when R1 is 100K or less. For full output over the whole audio range, however, a higher slew rate device, the 1556/1456 (1456 is the commercial part) is shown here. This will also allow timing R's up to a megohm or so, which lets you keep the size of the C's down.

You can use this circuit as a fixed frequency tone source, just as shown. In general, R1-R2 and C1-C2 should be close tolerance, stable types — for instance film resistors and mica or plastic dielectric capacitors. This will give best stability with time and temperature.

Want to tune the circuit? Use a ganged pot for R1-R2 and switch select C1-C2. The pot sections should track well for best results. This circuit is capable of low distortion, on the order of 0.1 percent when the considerations here are applied.

Op Amp Astable Multivibrator

A circuit useful for generating square waves is the astable multivibrator, and an op amp version is shown in Figure 2a. This circuit operates by charging and discharging a timing capacitor (Ct) through a resistor (Rt). This generates an exponential timing ramp across Ct. End points of this ramp are determined by R1 and R2, which feed back a portion of the output voltage, which is the square wave.

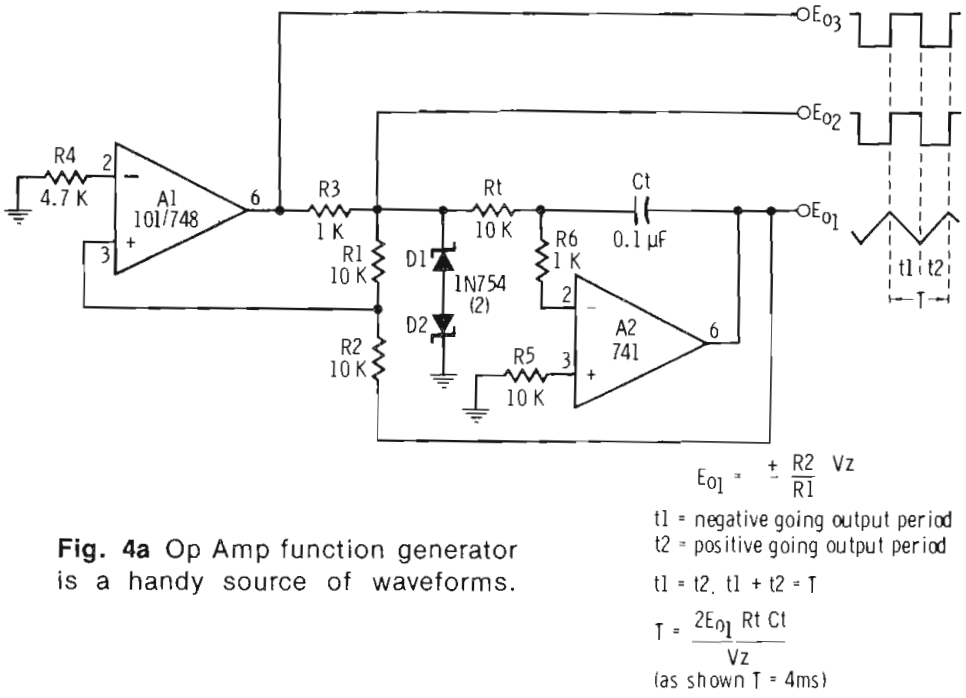
This circuit has some very interesting properties, one of which is the fact that its oscillation period is **not** dependent on the supply voltage—only Rt-Ct and R1-R2! So, you can feedback from either the op amp output, or a lower voltage (such as the back-to-back zener clamp) without changing the frequency. This will give you a stabilized output (Eo2) as well as the high level output (EO1). The general equation for the timing period involves natural logarithms, but you can bypass this nuisance if you make R1 and R2 the ratio shown. This makes the natural log part of the equation "1", so the period T is then simply 2 Rt Ct.

Amplifier choice should be one suitable as a comparator, for this is just how it functions in the circuit. It should be uncompensated, (like the 101/748 types) if you want high speed and fast square waves. 101's or 748's are good up to about 100kHz, but a high speed type like the 715 will go even higher.

Good quality component types for Rt and Ct are important here also, if you want good frequency stability. If you go down to low frequencies, where Ct is 0.1uF or greater, use a small resistor (R4) in series with the (-) input of the amplifier to prevent destructive discharge of Ct. When Rt is large (100K or more), use a low input current amp like the 1456 or the 8007, a FET type. An 8007 will permit Rt to go to 100 megs, (if you have a 100 meg resistor!) allowing very long periods with capacitors of only a uF or so.

You can probably find many uses for a circuit as basic as the square wave generator, but a specialized version you might find useful around the shop is the op amp checker of 2b. This is an astable also, but arranged to operate from a single supply and with a winking LED to indicate when the circuit is oscillating. The astable oscillator is such a simple and basic circuit, it makes a good functional tester. In fact, any op amp which is functional will oscillate when plugged into this tester, and the 5 Hz oscillation frequency flashes the LED to tell you it's "GO".

There are no adjustments, other than to apply power at the rated voltage for the amplifier you intend to check. The pin numbers shown are standard, but you can add sockets in parallel if you need other configurations. If you use op amps,



$$E_{O1} = \pm \frac{R2}{R1} Vz$$

t1 = negative going output period
t2 = positive going output period

t1 = t2, t1 + t2 = T

$$T = \frac{2E_{O1}\ Rt\ Ct}{Vz}$$

(as shown T = 4ms)

Fig. 4a Op Amp function generator is a handy source of waveforms.

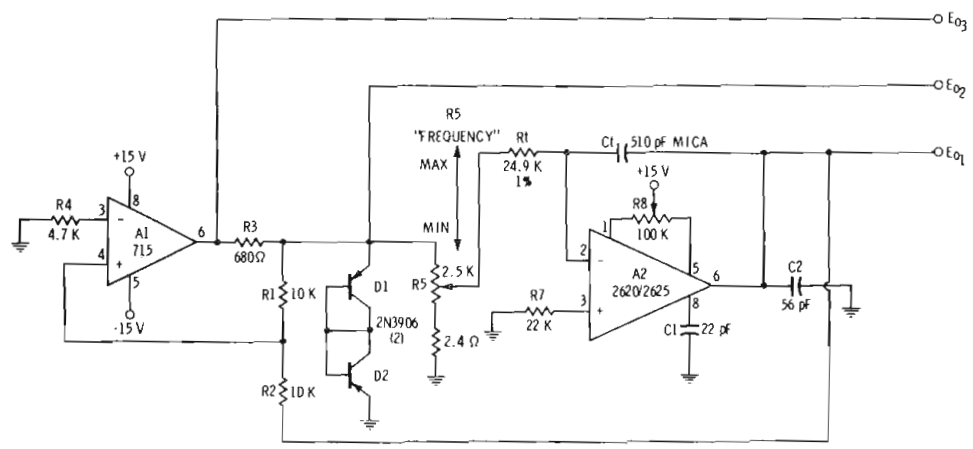


Fig. 4b Variable frequency generator sweeps entire audio range.

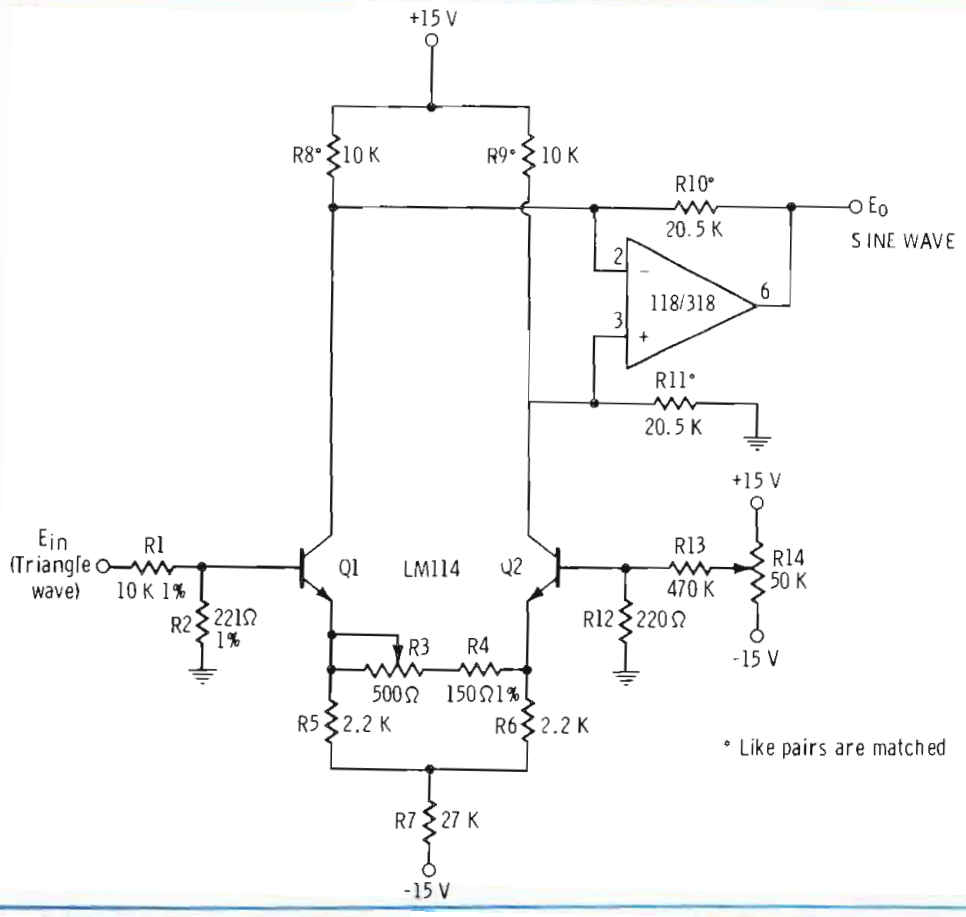


Fig. 4c Triangle to sine wave converter synthesizes low distortion sine waves.

this little circuit could be a real time saver for you when you have to troubleshoot. To be safe, plug in and remove the op amp with power off.

Timer Circuits

A handy circuit to have is a triggerable timer which generates a single gate pulse of a specified length when a trigger is applied. Figure 3 is an op amp timer which can be used for long timing periods, and it has pushbutton trigger capability.

The circuit consists of an RC timing network Rt Ct, a buffer amplifier A1, a control flip flop A2, and a reset switch, Q1. Statically, (before t_0) A2 rests at a high output state, where both Eo2 and Eo3 are at a high level (see waveform diagram). In this state Q1 is saturated through R7, thus Ct is shorted to ground through R6-Q1. With Ct shorted, the voltage follower A1 has an output Eo1 which sets at zero volts (again, see waveform). Since Eo2 is at +Vz, Eo1 at OV, and R1=R2, A2's (+) input will be at $\frac{+Vz}{2}$. Consequently, (due to the theory of zero input differential) a positive pulse greater than $\frac{+Vz}{2}$ Volts at A2's (-) input will trigger the circuit into its timed state.

The push button and its associated network form a bounce free pulse generator which pulses A2 to its low output state when S1 is depressed (t_0). Q1 then switches off, and Ct charges toward V+ through Rt, forming an output ramp at Eo1. When the ramp reaches +Vz Volts, the retrigger threshold of A2 is reached (since +Vz and -Vz sum to zero at A2's (+) input). A2 then quickly returns to the high state, shorting CT and resetting the circuit to its standby state.

For the values shown, the time interval (t) is 0.7 Rt Ct. In this example Rt and Ct allow a max time of 10 seconds or more. For longer times, you can increase Ct, but stick to low leakage types, where possible. Theoretically you could increase Rt, but a 5 meg pot is about as high as they go in practice. The op amps used are general purpose, but if you don't need high speed you could simplify it by making A1-A2 dual 741 types, such as a 1558 or 747. You can interface the output with LED's,

relays, or whatever type of load desired. (See last month's discussion on comparators for guidelines for this.)

Function Generators

A highly developed form of op amp waveform generator is the function generator, of which a basic version is shown in Figure 4a. In its ultimate form, a function generator can produce just about any type of waveform imaginable; the basic square, sawtooth and sine waveforms; and also pulse, rectangular and sawtooth waves. In addition, all of these may be swept in frequency, period or amplitude if desired. In short, the function generator is just about the most useful single signal source imaginable, as you can use it for testing many types of circuits-audio, video, and even pulsed and/or logic circuits.

Figure 4a is a basic example of function generator which illustrates the principles of operation. You'll note that A1 is a comparator with positive feedback, similar to the one in the timer circuit. Its output is similarly clamped by D1 and D2 to $\pm$Vz Volts, and R1=R2. Therefore the trigger points to set and reset A1 (seen at R2) are simply (+) and (-) Vz when R1=R2.

A2 is an integrator, a form of inverting amplifier which integrates the input, developing a time varying voltage across the feedback capacitor, Ct. For a steady input voltage to Rt (in this case, Vz), the voltage across Ct will linearly change at $\frac{It}{Ct}$ Volts per second, where It is simply $\frac{Vz}{Rt}$. So for a given polarity of Vz, Eo1 will ramp linearly up (or down) at a rate set by Vz, Rt, and Ct. When +Vz is applied to Rt, Eo1 ramps down (t_1) until it reaches the A1 trip point of -Vz. A1 then quickly reverses states, applying -Vz to Rt. This causes A2 to begin ramping upward (t_2), towards A1's upper threshold of +Vz. At +Vz it switches again, beginning a new cycle. The total period T is the sum of the two half periods, and is equal to

$$T=\frac{2Eo1\ Rt\ Ct}{Vz}$$

In the example shown, the diodes clamp at $\pm$7.5 Volts, so the works out to 4 ms for T, or a 250 cycle frequency.

To tune this oscillator there are many things you can do. Most directly, you can switch Ct and vary Rt as a rheostat. In fact, Rt can be varied by a factor of 10, 100 or even 1000 upward to give wide range tunability. As previously, these components should be stable types. R1 and R2 in conjunction with D1-D2 set the output amplitude and frequency. These should be fixed, and have good stability.

For best speed, A1 should be uncompensated and A2 a high speed type. 741's are "ok" for A2 up to a few kHz. Above this use a high speed type like a 118/318. In any case, A2 must be compensated, but A1 need not be.

An example of a high speed, wide range function generator is the circuit of Figure 4b. This circuit uses different op amp types, and adds single knob tuning capability over a 1000/1 range. For high speed square waves, A1 is a 715 type operated with no compensation, and low capacity transistor clamping diodes are used for D1-D2. A2 is a high speed type, but also has low input current. With the voltage applied to Rt made a fraction of $\pm$Vz, this in effect varies $\pm$Vz, and thus the frequency. The circuit tunes over a range of 20Hz to 20kHz with a single sweep of R5. R8 is trimmed for best waveform symmetry at the low end.

There are many other variations possible with function generators. Among these are frequency and amplitude modulation, gated capability, and asymetrical timing which yields pulse and sawtooth waveforms.

Sine Wave Converter

To make any function generator complete, it should also have the capability of generating sinewaves. This is typically done by shaping the linear triangle wave via a non-linear network, which yields an output which follows the sinusoidal shape. If the shaping network is designed carefully, this can yield good sine waves with the excellent amplitude stability that the precision control of the function generator allows.

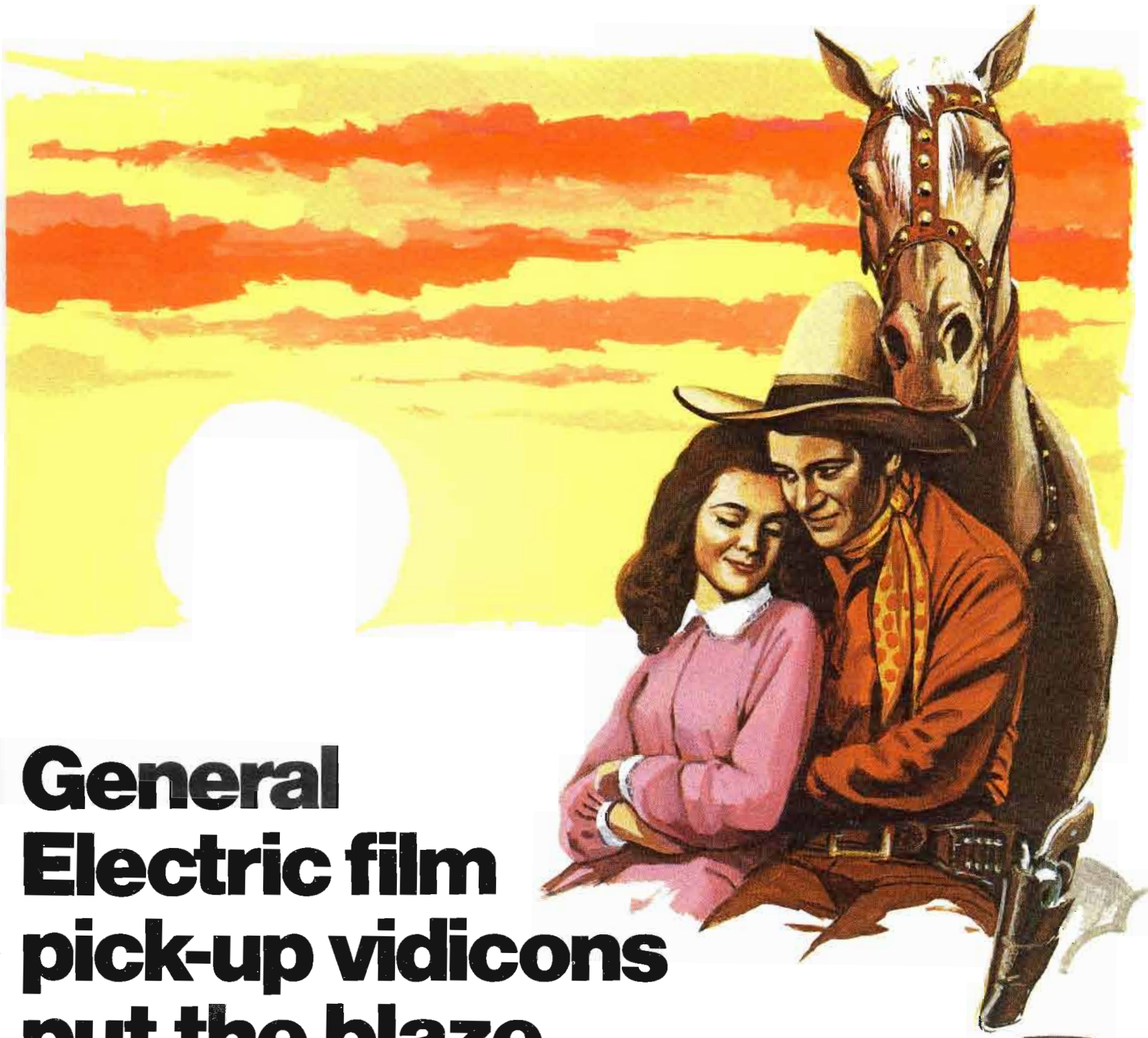
Figure 4c is a high quality sine wave converter which can be used with either of our function generators. It has the capability of low distortion output with relative simplicity.

The circuit uses the non-linear cutoff characteristics of a differential pair, driving Q1-Q2 with a low level triangle wave. When underdriven, Q1-Q2 amplify linearity. If overdriven, they will limit and produce square waves. If adjusted between these points by adjusting the emitter coupling (R3), the circuit can convert triangle waves to quite reasonable sine waves. The output current of Q1-Q2 (when properly trimmed) is a sine wave with THD of 0.5 percent or less. The output op amp is a differential to single-ended converter, which yields a buffered sine wave output of about 16V p-p, as shown.

There are a number of precision components which enhance the overall performance of the circuit. R8-R11 form a differential amplifier bridge network (see Part 1) which rejects power supply noise. R3 trims the coupling of Q1-Q2, and is adjusted for lowest output THD. R14 "adjusts" out the DC offset of Q1-Q2, which also minimizes THD. Q1 and Q2 ideally should be a matched pair, but any reasonably well matched devices will work if R13 and R14 are retained. To use with other triangle wave input levels, adjust R1-R2 for 400 mV at Q1, the optimum drive level.

Summary

This time we've looked at a number of circuits which have a high likehood of being helpful around your station. Timers are useful and sine wave oscillators are always necessary as test oscillators, but function generators are even more useful once you get the hang of interpreting what they can tell you. Here's hoping you'll get some use out of this batch of circuits and I'll see you next month with some audio circuits using op amps. □



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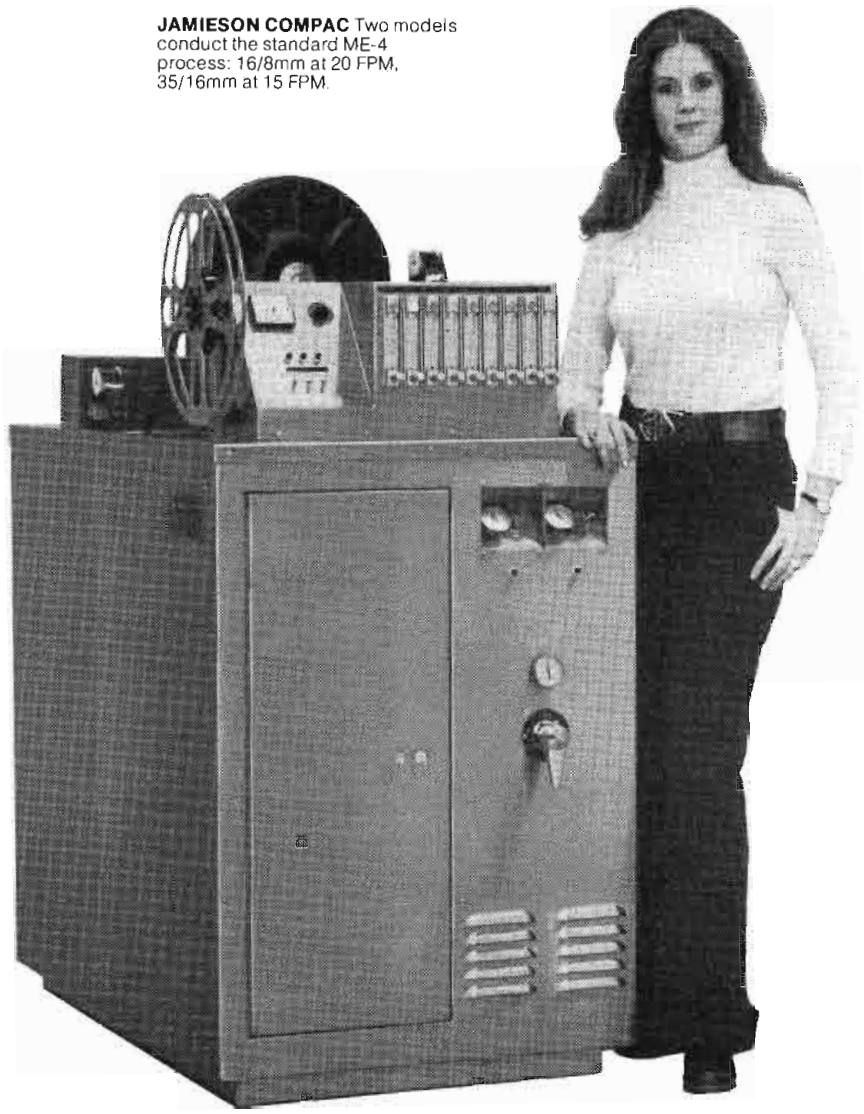

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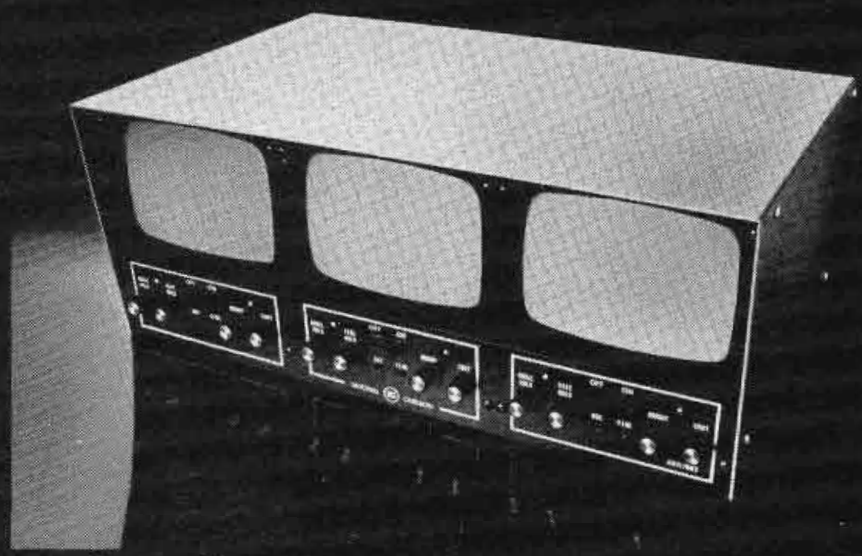

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PEOPLE IN THE NEWS

Frank G. Nickl has been appointed head of scanner development for the Systems Division of National Semiconductor Corporati n....The appointment of **Harold J. Rainey** as a Regional Sales Manager for LPB Inc. has been announced....**Donald W. Slack** has been named national marketing manager and **Jack Ames** has been named national sales manager for Cetec Inc....The James G. Biddle Co. announces the appointment of **Edward J. Querner** as Factory Manager.... **Daniel M. Zinn** has been appointed a Group Vice President of Superior Continental Corporation.

Cohu, Inc. has announced that **James W. Barnes** has been appointed president and general manager of the San Diego based corporation's Electronics Division.... **Jerome E. Vielehr,** president, Aqua-Chem, Inc., Milwaukee, has been elected to the board of directors of Koss Corp....**Wulbur "Bud" Klint** has been named Media Director for Radio Shack's Chicago, Midwest and Pittsburg regions, covering a 15-state area....Lynch Communication Systems Inc. announced that **Sherman B. Weiner** has been named Vice President, Engineering.

CATV

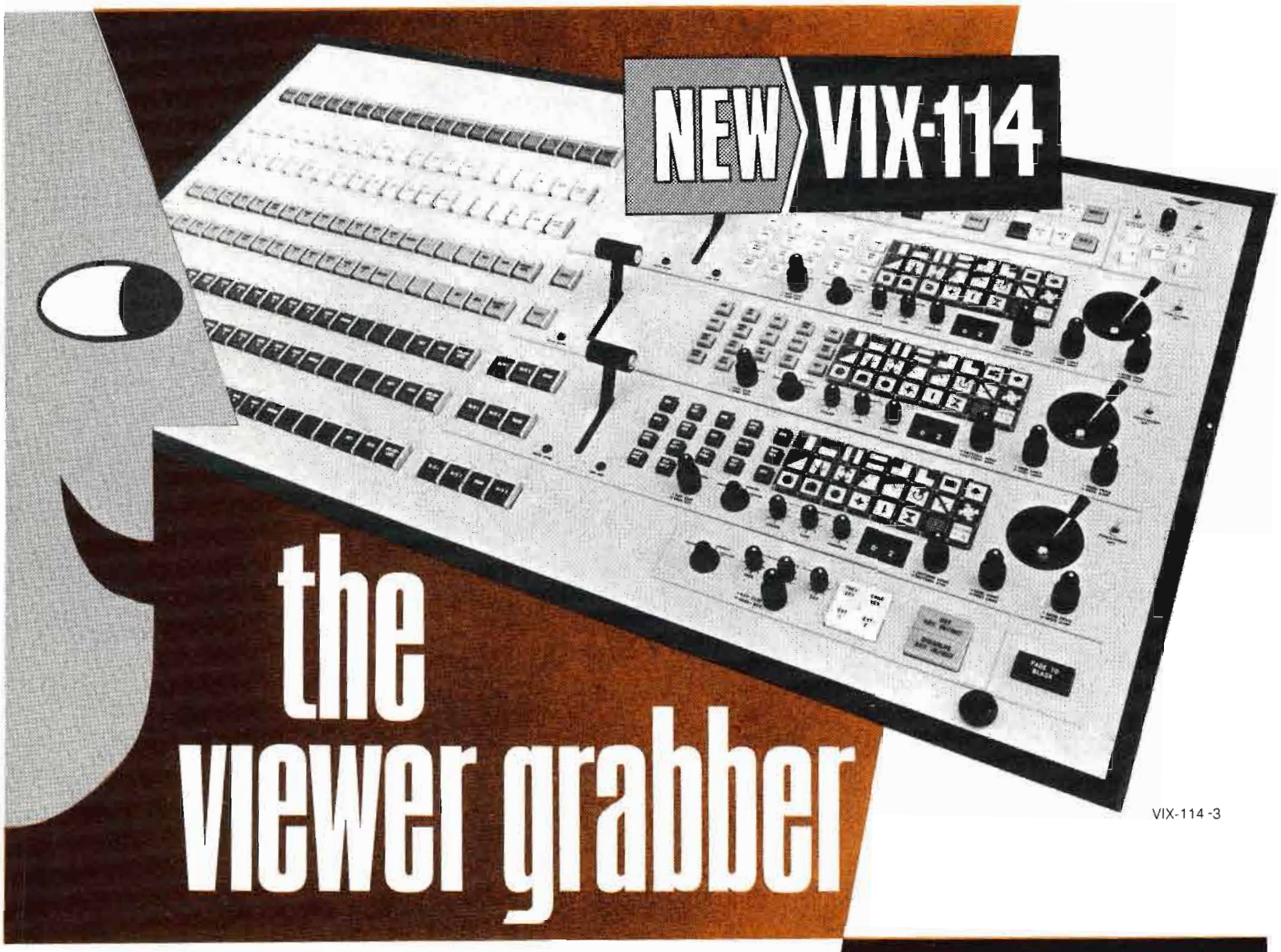
The board of directors of LVO Cable, Inc. elected **Joseph L. Seger** its chairman, succeeding **Wayne E. Swearingen,** who remains on the board of directors of LVO Cable....Five new district sales managers have been named in TelePrompTer's Cable Television Division. **Harvey L. Johnson,** for Danbury, Conn., and Ventnor, N.J.; **Monty J. Montez,** El Paso Tex.; **Robert D. Rose,** Seattle Wash., and Lewiston, Idaho; **Jack Ugar,** San Bernardino, Calif.; and, **Duane E. Wangenheim,** Florence, Ala.

Roger A. Williams has been appointed to controller, Oak Communications Group....Warner Cable Corp. has named **John Selenko** as manager-technical operations staff....The appointment of **Robert C. Bailey** as Vice President has been announced by AEL Communications Corp. (AELCC)....UltraCom, a subsidiary of American Electronic Laboratories, Inc. (AEL) announced the appointment of **Samuel M. Merion** to the new position of Vice President/Operations. UltraCom is nationally involved in the design, construction, programming, management and maintenance of community CATV systems....**Swapan Kumar Bose** has joined Network Analysis Corporation, Glen Cove, L. I., as a CATV Systems Engineer.


Bud Klint


Roger A. Williams


Swapan Kumar Bose



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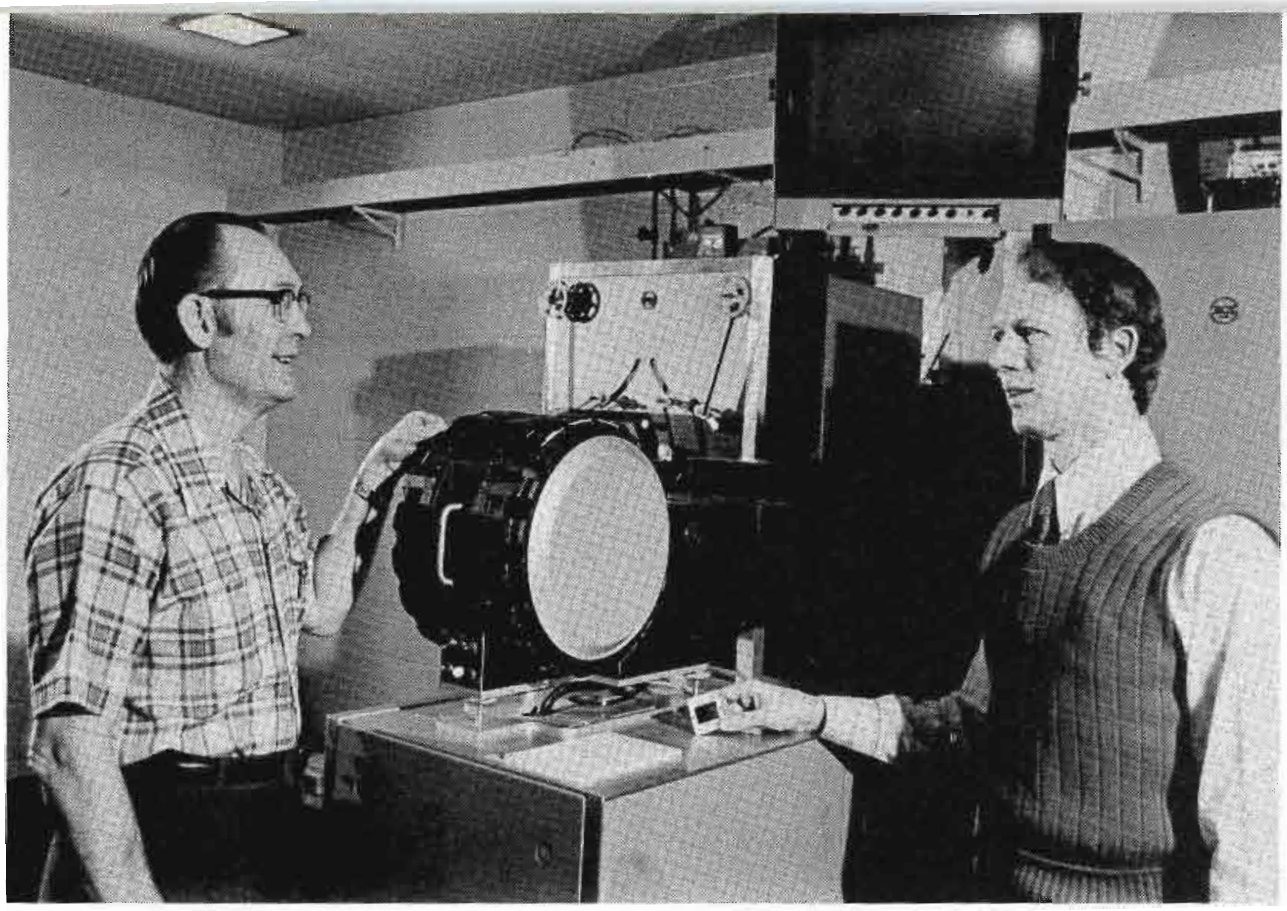
For More Details Circle (24) on Reply Card

Endorsed Article



Engineer Leon Osbeck loads a slide into the TP-7 slide projector, while the author (r.) stands by with an ID slide. Holes drilled in either end of the plastic slide mount are for activation of the ID logic.

Using logic with ID's

By Bob Zuelsdorf

CE, Wisconsin TV Network,
WKOW-TV, Madison, Wis.

A network primary feed station is constantly under pressure to keep the proper material coming down the line. Sometimes it can get too much on the line. How? By failing to cut its own ID off the line during station breaks.

This was a problem at WKOW-TV on the Wisconsin TV network until they took the step into station ID logic.

A typical station break may consist of national spots, a station identification (ID) and local spots. The entire break (including the preceding and following programs) is fed from WKOW-TV by microwave. It is then necessary for the Wisconsin TV Network stations to air the national spots, cut away from the microwave feed to originate their own station identifications and local spots, and rejoin the microwave feed for the following program.

Timing must be accurate and switching crisply done on both ends of the network to maintain smoothness and to prevent airing improper material. There are occasions when everything doesn't go as anticipated. To avoid viewer confusion, it is particularly important to insure that a station ID from the originating station does not air on one of the other stations. It was to provide this insurance that the ID Logic was designed.

Primary Station ID

The WKOW-TV ID's are originated, video-wise, from a slide projector in telecine. This projector can be fed to either a color or monochrome camera chain. Outputs from these cameras go to a 15 x 12 master switcher used for routing within WKOW-TV and for feeding the network stations, and to a 20 x 7 studio/production switcher. It is necessary first to detect an ID slide and then to determine if it is being fed through the switchers to a network station. If so, black and no audio, or another video/audio combination must be substituted for the ID.

The first problem we had was detecting the ID slide. We wanted to keep the system all electronic for maximum reliability, so photocell and proximity detection methods were investigated. Proximity detection seemed cumbersome and difficult to implement, so a method of photocell detection was devised which appeared reliable and easy to integrate into our system.

All 35mm slides normally used for television have an opaque outer perimeter around the useful picture area. Our "in-house" slides are the typical glass mount type. These consist of the two outer pieces of glass with the film and an opaque paper mask being sandwiched between. It seemed feasible to cut a notch in the paper at the edge of the ID slide, leaving a transparent area for light to pass through for photocell detection.

The projector used is an RCA TP-7. With the edge-notched ID slide in the gate, there is enough light from the projection lamp to adequately illuminate the photocell. A 0.2" x 0.2" silicon cell will produce 700 μA short circuit current or 0.4V open circuit voltage. This eliminates the need for auxiliary sensing lamps and gives improved reliability. Figures 1 and 2 provide details of the cell mounting and ID slide notching.

With the ID slide identified, it is necessary to determine whether it is being fed to one of the network stations. In a logic system of this moderate size it is still possible to look at the switching combinations and draw the gates in schematic form as you go. However, this is a tedious process whereas Boolean Algebra[1] will provide a more systematic approach. To use this method

Engineer Homer Bellus is shown here switching a station break. the LINE and XMTR monitors show the WKOW-TV ID being aired, while the ID logic has switched black to WAOW and WXOW-TV.

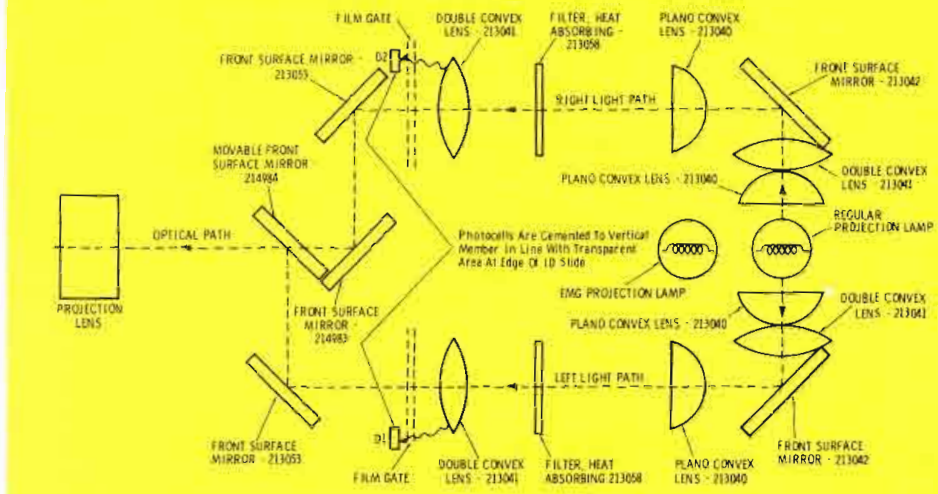


Figure 1

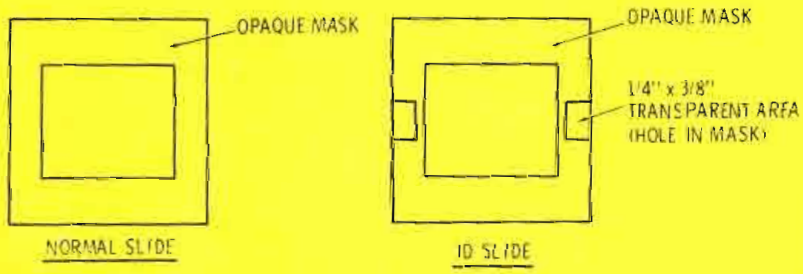


Fig. 2 A comparison of the normal and ID slides.

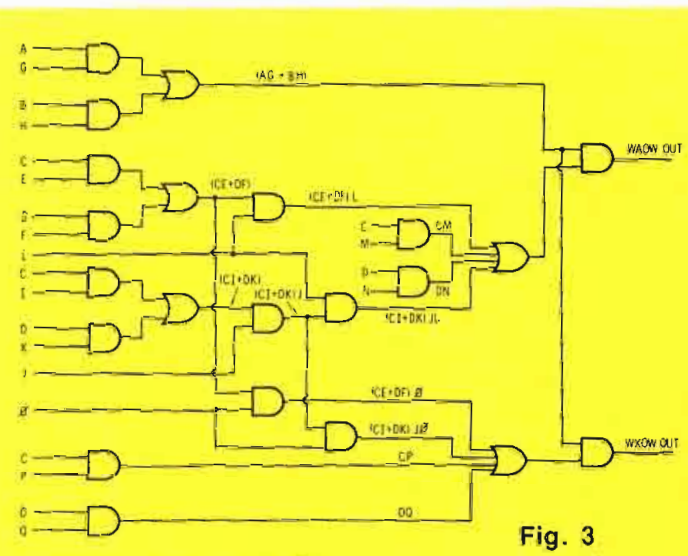


Fig. 3 ID logic arrangement.

you must consider all the combinations which will cause an ID to be aired on one of the network stations. These are written down in equation form and the equations simplified by factoring, if possible, to yield an optimum system.

Table I lists the possible functions. These have been given letter designations for usage in the logic equations. The switching combinations which will send an ID to one of the network stations are shown on the Table. For example an ID will be sent to WAOW-TV if (A) the left slide is showing, AND (G) the left slide is an ID, AND (C) the TP-7 is fed to F1, AND (M) F1 is fed to WAOW, OR if we have (A) AND (G), AND (D) the TP-7 is fed to F2, AND (N) F2 is fed to WAOW. Using the standard Boolean symbols of + for OR and a multiplication indication for AND, we may write the preceding statement as follows: AGCM + AGDN. This can be simplified to: (CM + DN) AG. It is quite simple to produce a schematic from the equation. All you need to do is start with the small, inner functions and work to the outer functions.

It may seem as though simplifying the equation did not produce a more simple configuration. This one requires four gates with a total of nine inputs, while the original equation would require three gates with ten inputs. The advantage of simplification becomes apparent as system complexity increases. It is cheaper to add one gate early in the system than to add an extra input to many gates later in the system.

Proceeding, as in the example, the logic equations for all possible combinations may be obtained.

$$(AG + BH)\,[(CE + DF)\,L + (CI + DK)\,JL + CM + DN]$$
for WAOW-TV

$$(AG + BH)\,[(CE + DF)\,O + (CI + DK)\,JO + CP + DQ]$$
for WXOW-TV

These equations can be used to generate the schematic of Figure 3.

RTL IC Logic

RTL Integrated Circuits[2] were used to perform the logic. These are available only as NOR gates (OR function, inverted output), so it is necessary to perform the AND function with negative logic. Some of the inputs were available as positive voltages, while in other cases only negative signals were available.

Two types of logic cards were used in the ID Logic, a Multiplexer /Logic Output card (ID-1) and a Switcher Logic card (ID-2). This arrangement was used to reduce intercard data routing and minimize interfacing connection prob-

Table I

A Show Left Slide
B Show Right Slide
C TP-7 to Film 1 (F1)
D TP-7 to Film 2 (F2)
E F1 to Xmtr
F F2 to Xmtr
G Left slide is ID
H Right slide is ID
I F1 to SS
J SS to Xmtr
K F2 to SS
L *PGM to WAOW
M F1 to WAOW
N F2 to WAOW
O *PGM to WXOW
P F1 to WXOW
Q F2 to WXOW

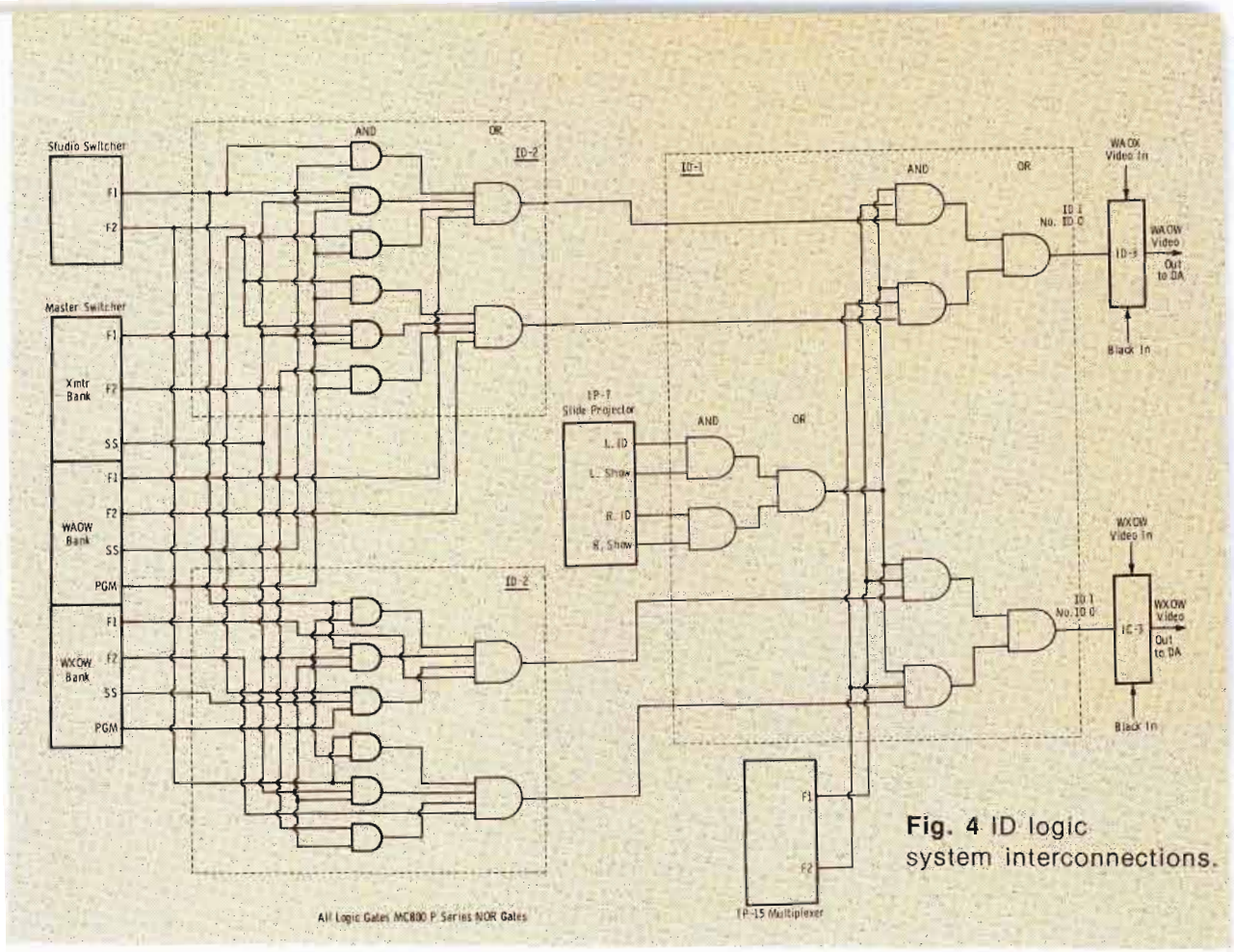


Fig. 4 ID logic system interconnections.

*The Master Switcher contains one re-entry involving the ID Logic. The WKOW-TV transmitter output (Xmtr) is re-entered as program (PGM) input. This allows feeding of program to the network without extra switching if the transmitter feed is shifted from say, the Studio Switcher output (SS) to another source such as F2 or VT3. The Master Switcher also permits the feeding of a source, such as ABC Network, directly to a Wisconsin TV Network station. This is desirable when the network station is not taking any part of the break being originated at WKOW-TV.

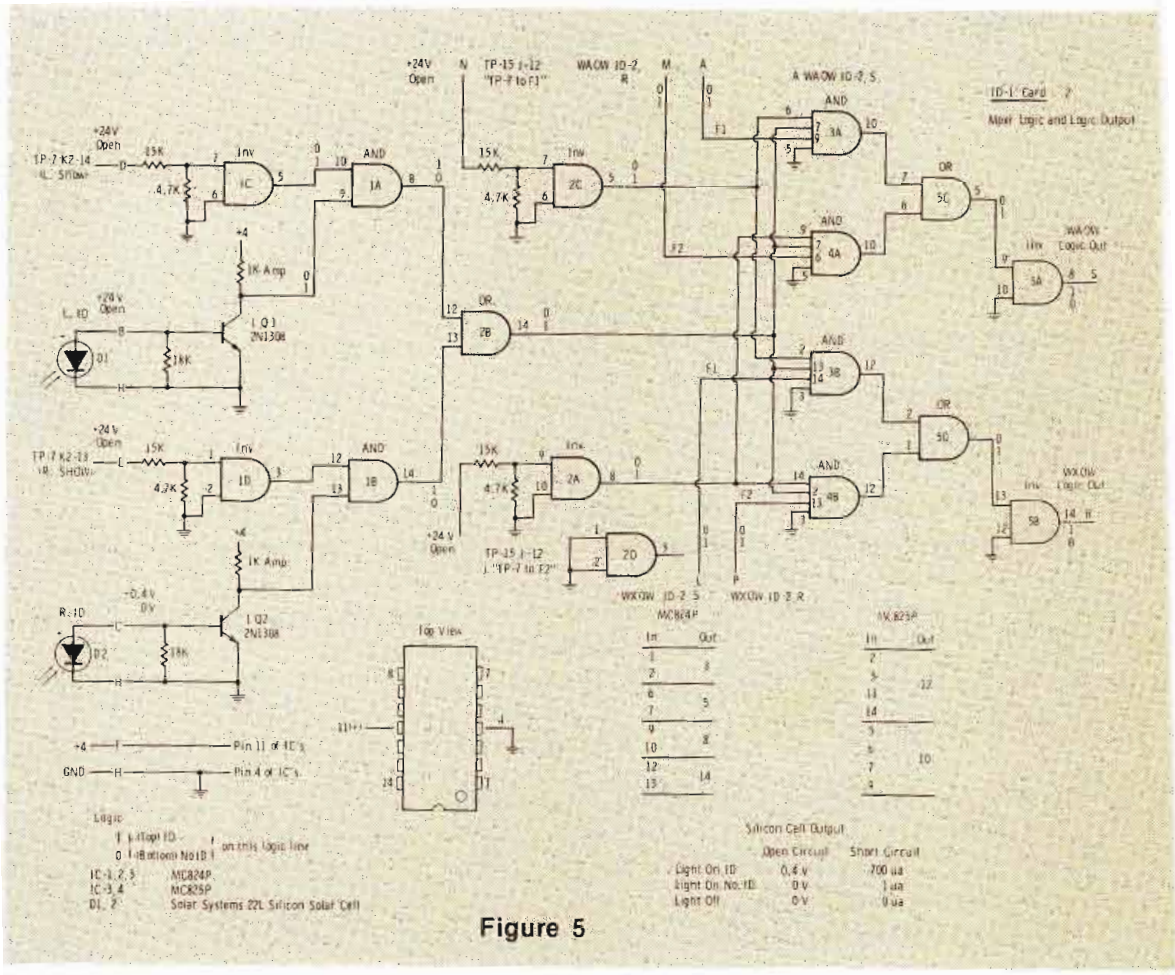


Figure 5

lems with the peripheral equipment. Owing to these things the system block diagram of Figure 4 is not identical to Figure 3. However, the differences are not significant and the system results are identical to those of the Boolean equations.

Outputs from the silicon photodiodes go to 1Q1 and 1Q2 on the ID-1 card, (Figure 5). Germanium transistors are used here as the 0.4V photodiode output would not be sufficient to turn on a silicon transistor. With no light striking the photocell, (no ID slide) the transistor is turned off, producing a logical 1 at the collector.

When light strikes the cell (ID slide present), its output saturates the transistor and a logical zero is produced. Inputs from the TP-7 slide projector and TP-15 multiplexer to the ID-1 card are either + 24V or an open circuit. In these cases voltage dividers are used at the gate input terminals to keep the input voltages from exceeding RTL voltage ratings[3] and to provide input grounding when the source is in the open circuit condition. Gate 1C is an example of the voltage divider input.

An inverse situation exists with the switcher outputs to the ID-2 cards (Figure 6) where the voltage is either -24V or zero. Here the voltage divider is used with a diode clamp to maintain the proper voltage limits. Gate 2D uses this input circuitry.

Part 2 continued in May

Announcing a new concept in audio control consoles . . .

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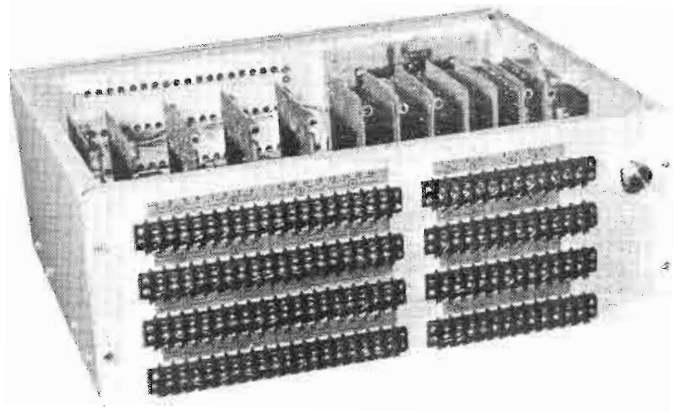

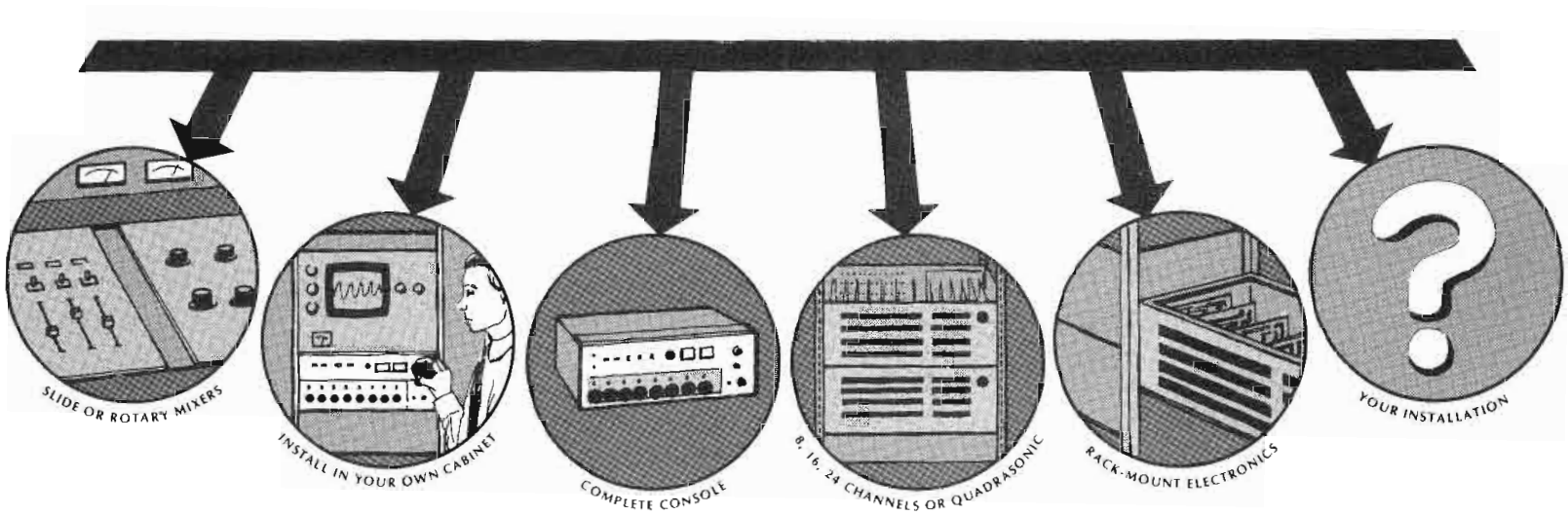

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Features of the Series 35 Audio Controller include 8 channels (expandable up to 24); mono, dual mono, stereo, dual stereo or a combination of these; quadrasonic capability; fail-safe internal power supply; plug-in interchangeable cards; and highly reliable mixing pots or attenuators. Of course, performance is the best: 0.1% or less distortion; 128dBm equivalent noise; 25W power consumption; low crosstalk; balanced bridging/matching inputs; and response within ½dB, 20Hz to 20kHz.

Before you get boxed-in, check out Ramko's Series 35 Audio Controller. Our two-year warranty guarantees you get exactly what you want. Our surprisingly low, low prices will let you order what you really need.

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For More Details Circle (26) on Reply Card

NEW PRODUCTS

Lighting Control

A unique and economical high capacity memory control system for theatrical and television lighting, now makes it possible to store 128 complete cues or presets for up to 96 dimmer units. Called Mini-Q/11, the new system was developed by and is available from **Strand Century Inc.**

At no additional cost, it offers a substantial advance over the 100-preset maximum capacity of similar equipment.

Mini-Q/11 is completely modular in concept to ensure maximum production control. Its plug-in component design also gives Mini-Q/11 the widest latitude in meeting greatly varying requirements. Modules can be added to, substituted or removed from the system without affecting its overall operation.

Mini-Q/11 is also totally self-contained. Each module, with its mounted electronic components, potentiometers, switches and other devices, plugs directly into a master console. Since the components are all housed within this master console, the need for a separate equipment rack is eliminated, further simplifying the new system.

For More Details Circle (60) on Reply Card

Audio Recorder/Reproducer

Ampex Corporation introduced the AG-440C Series professional audio recorder/reproducer for recording studios, radio stations and professional recording uses in education, industry and government.

Charles A. Steinberg, Ampex vice president - general manager of the audio-video systems division, said the new AG-440C Series incorporates significant performance improvements and conveniences for the sophisticated user.

"The design of the 440C stems from the proven AG-440 and 440B Series," Steinberg said. "The 440C has more than two decades of audio technology and development behind it and the reputation of reliability of more than 26,000 units placed in service since the introduction of the Models 350 and 351 by Ampex in 1953."

Improvements in the 440C manual controls, tape guidance, electronics, signal-to-noise ratio, tape editing and serviceability make the new Series the finest on the market today, Steinberg said.

The 440C transport eliminates the problem of switching from fast forward-rewind to play by adding motion sensing. Edit control now releases transport brakes eliminating handling of the tension arm. Sapphire guides and a flutter idler reduce skew, thereby improving tracking.

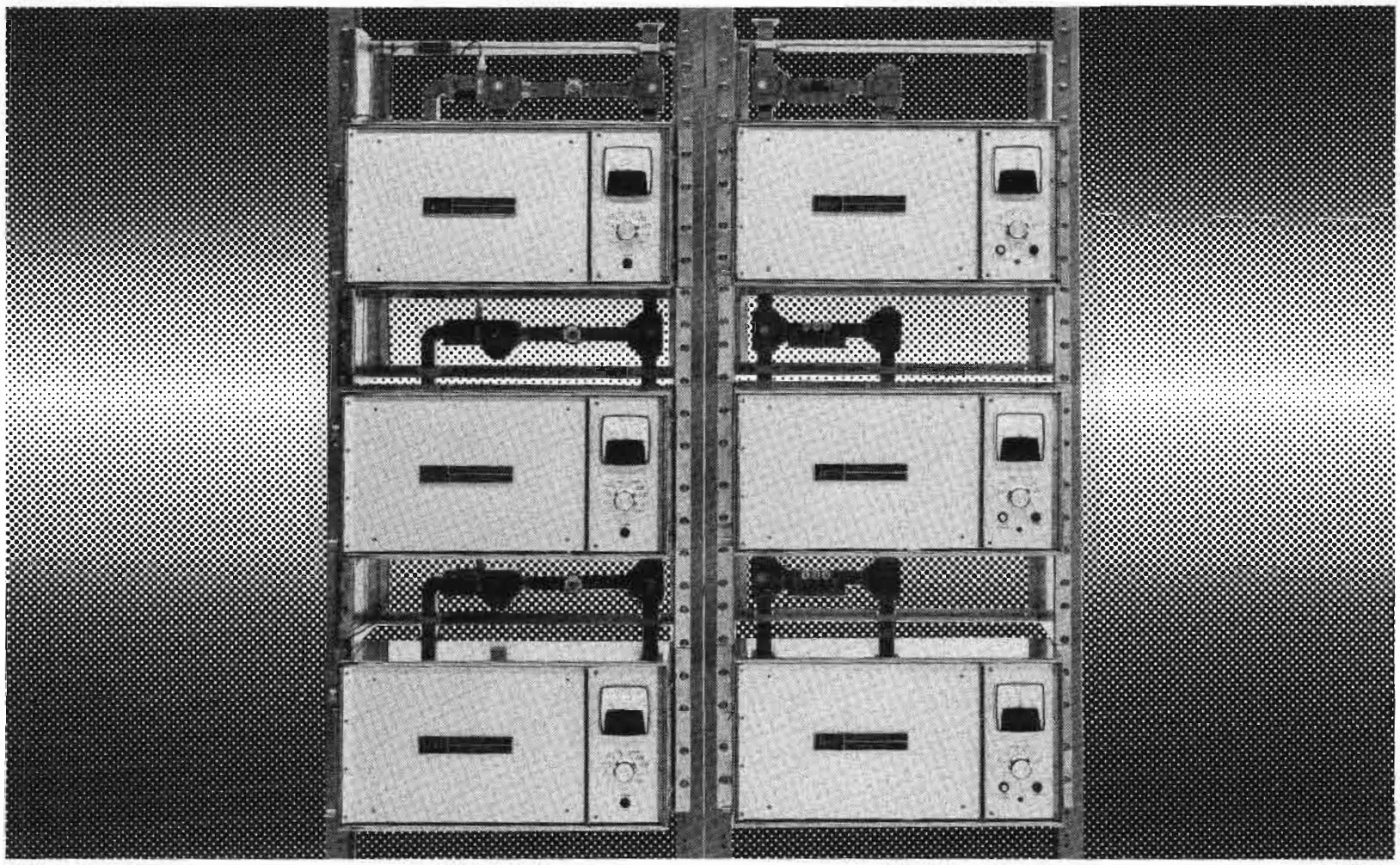
For More Details Circle (61) on Reply Card

Portable Digital Counter

An economical precision, direct-reading digital counter developed for the communication and microwave in-

(More...)

Versatile Stackable Microwave for Video Transmission in the 12-13 GHz Bands



One of the Farinon Heterodyne and Remodulating-Baseband Systems with Unique Power-Doubling Protection

Farinon's SS12000 Solid-State Microwave for signal importation and intercity relay in the 12-13 GHz CARS allocations is a solid, conservatively-designed system. It is easily expanded in the field by adding transmitters and receivers without affecting working channels. A 12.5 MHz close-channel spacing option is available.

Terminals may be configured for non-protected or protected one-way or duplex transmission. Farinon's patented On-Line Protection, combining the output of two phase-locked transmitters, provides doubled power output while in the standby mode. It protects transmission without interruption in case of signal loss on one transmitter. SS12000 also may be equipped for monitored hot standby or diversity protection.

Supporting equipment includes a variety of waveguide apparatus for indoor or outdoor power splitting, clamper and distribution amplifiers and subsystems providing up to four sub-carriers for program audio, FM stereo, weather, data or order-wire channels above the composite video. Farinon all-solid-state microwave systems and related equipment are in use throughout the United States, and in 60 other countries.
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For More Details Circle (48) on Reply Card

NEW PRODUCTS

(Continued from page 46)

dustry. The 200 MHz counter is available with plug-ins for individual Communication Band Coverage or a phase-locked oscillator for broadband coverage from 0 to 15 GHz in a single unit.

This unit is offered by **Power-Waves, Inc.**, and satisfies the future FCC frequency requirements. The unit has a 6-digital solid state LED display with decimal point. The accuracy of the unit is $\pm$ 2 parts in 10^6 from 0° to 50°C. The main frame can operate from A.C. or D.C. with the optional Battery Pack. The unit is very small in size and weight and is extremely rugged because of the large scale integration.

For More Details Circle (62) on Reply Card

1,000 Watt Linear TV Amplifier

Acrodyne Industries, Inc. has announced the introduction of its A-140U 1 kW single-tube amplifier. The unit is intended for TV transmitter and translator applications and exceeds FCC requirements. Out of band spurious specifications are inherently satisfied by using a new RCA tube and cavity design without need of an output filter.

An important standard feature, unique to the industry, made part of the A-140U is a "Fault Detection Center." This feature assists the operator to immediately localize and rectify any substandard operation condition which might occur.

The Acrodyne exclusive "Fault Detection Center" is a logic circuit which in case of an overload condition as an example, recycles the amplifier 5 times in an effort to keep the unit on the air. When such recycles occur, the location of the fault is permanently displayed on the "Fault Detection Center" until the condition is rectified and the memory erased.

For More Details Circle (63) on Reply Card

Dual Channel Audio Amplifier

Just completed for the NAB convention, **RUSSCO ELECTRONICS** introduced their new Monitor Master 260 dual-channel broadcast audio amplifier.

The MONITOR/MASTER 260 was designed as an all-purpose amplifier, requiring little service and dependable performance. Here's some of the features: All solid-state construction; 60 Watts RMS each channel; differential input; balanced or unbalanced inputs without transformers; .25% harmonic distortion 20 to 20,000 Hz at 60 Watts; plus or minus ½ of 1 dB 20 to 20,000 Hz at 60 Watts.

The 260 is a perfect companion to the New STUDIO/MASTER 505S stereo audio-mixer (the 505 monaural has a built-in amp) and matches in looks with an annodized maroon finish. The 260 rack mounts conveniently in a 3½" by 19" space.

For More Details Circle (64) on Reply Card

Audio Level Optimizer

Inovonics' Model 220 Audio Level Optimizer provides a substantial increase in average program level without "pumping" or "swishing" noise during pauses in the program.

The Model 220 is an automatic gain control device for AM, FM, and TV broadcasting. It features selectable peak limiting and average compression functions.

A unique gating circuit inhibits compression release in the absence of an input signal. This feature permits a high degree of compression without the usual upsurge of background noise experienced with conventional limiters.

For dealing with extended program interruptions, the user may elect to have the Model 220 hold gain indefinitely at the previously compressed value, hold gain for 10 seconds and release, or hold gain for 10 seconds and fade. Resumption of program restores normal operation.

For More Details Circle (65) on Reply Card

Pulse Delay Unit

Television Equipment Associates now offers a small metal box with BNC Connectors for the delay of pulse signals. Inside, two modules are tapped by the user for delays of 5 to 155 ns; 160- to 1655 ns; and 1660 to 3155 ns, in increments of 5 ns.

A second range of between 180 to 1500 ns; 1600 to 3000 ns; and 3100 to 4500 ns, with increments of 100 ns is also available. Prices begin at $40.

For More Details Circle (66) on Reply Card

Audio Control Center

Cetec, Inc., has announced the introduction of a new audio control center in their Langevin product line. The Series 10 is designed specifically for radio and TV broadcasters and incorporates a wide range of flexibilities with greatly simplified operational functions. Modern-day styling and economical pricing are also highlighted features of this new console.

Highlighted features include built-in

stop-start switches for auxiliary sound sources, digital clock, panel mounted on-the-air light, contacts for remote microphone switching, cue speaker, fail safe auto-switched dual power supply and dual 10 Watt monitor amplifier.

For More Details Circle (67) on Reply Card

Economical Weather Station

The high cost of weather instruments has long kept many stations and communications facilities from seriously considering such a purchase. The **Heath** company is now offering a four-instrument package "weather station", the IDA-1290.

Suspecting that this system might be an economical means of obtaining reasonably accurate weather readings, **BE** built the IDA-1290. Surprisingly, it went together in a matter of hours.

The "station" consists of (1) a barometer, (2) wind direction indicator, (3) wind speed indicator, and (4) indoor-outdoor temperature indicator.

The wind speed indicator is switch controlled to indicate on a calibrated scale of 0 to 30 mph and 0 to 90 mph. The temperature indicator also is switch controlled to read indoor and outdoor temperatures.

Circuitry is solid state and easy to follow. Instruments are easy to read and easy to install. And our tests over a three month period show that the "station" gave good, consistent results in all types of weather, once all calibrations were accurately done.

If this instruments is used within a high RF field, we recommend that a .1 ufd capacitor be inserted between the temperature meter case and the circuit board ground.

For More Details Circle (68) on Reply Card

Video Delay Trimmer

TV Engineers often need to make minor video delay adjustment, sometimes because the delay properties of coax cable change with temperature. **Matthey's** new Rubber Coax—the video delay trimmer UN3/9—provides an infinitely variable delay of 3-9 ns. by screw adjustment.

For More Details Circle (69) on Reply Card

Station to Station

Okay, Let's Hear About It!

All exchange tips and ideas used in this column are paid for upon acceptance at the highest rates in the industry. We invite your comments and ideas, and we invite you to send in pictures of your station for use here.

This is a crossroads section of the magazine where engineers and managers can talk Station to Station. You have a problem or a helpful idea? Let us help you spread the word. Send your correspondence to: Ron Merrell, Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105. And don't worry about being a draftsman, we have an art department that will make your penciled drawing look professional. If there's something great happening at your station, let's hear about it!

On Installing ACX PA Tubes

A common problem in using the 4CX-P.A. tubes is seating the tube in the socket without breaking any finger stock. I solved the problem by first applying a light spray of tape/head cleaner on the plate finger stock and the plate blocking capacitor. This light coating reduces the friction momentarily, so the 4CX tube can be seated properly without any finger stock damage.

John L. McCarthy, Jr.
Engineering Mgr.
KFOG
San Francisco, Cal.

Squeaking Tape? Don't Just Deal With Symptoms

I read with interest your column on tape squeal that appeared in the February issue. However, the solutions offered only deal with the symptoms of the problem and not the problem itself. It is true that cleanliness of the heads and guides is necessary but we have to look to the tape itself as the source of the problem.

Many of today's tape suppliers use rosin in the manufacture of their tapes, particularly their low noise tapes, that is not completely cleaned from the tape prior to packaging. It is this rosin remaining on the tape and not the oxide itself that is responsible for the squeal. An effective solution is to clean the tape prior to its initial use. The simplest way to do this is rewind the tape while sandwiching it between two cotton balls moistened with alcohol. I have found this method quite effective in eliminating squeal.

Tom Hayes
Audio Division
Moose Scenic Studios
Theatre Consultants
Teaneck, N.J.

Cleaning Up The Stereo Phasing

We agree with John Garabedian (Letters to the Editor, March 1974) about the need to clean up the phasing of stereo signals when using reel-to-reel or cartridge tape recorders. To answer this need we introduced the STE-100 Stereo Phase Enhancer at last year's NAB.

The STE-100 corrects phase errors by sensing the mono sum material on the stereo signal. If there is an error the STE-100 electronically retards the phase of the channel that is leading in phase. The operation of the STE-100 is continuous and dynamic phase shifts, that would cause a swishing sound in the mono sum signal, are corrected. Channel separation is not affected.

We developed the STE-100 after concluding that many of the causes of phase errors were out of the control of the tape recorder manufacturers. Some of the mechanical factors that can contribute to phase errors are gap scatter in the tape heads, variation in wear patterns of the tape heads, variation in tape thickness and width; and in cartridge recorders, the variation between individual cartridges.

Some of these causes may seem small or insignificant, but it must be remembered that the amount of mechanical dimentional change to cause a 180 degree phase change at 10 KHz is very small.

Garron Electronics
Ronald S. DeBry
President

Help Needed

I am a recipient of a hand me down copy of your magazine each month, and I enjoy the articles.

I read almost every week about some sort of educational radio or television station operated by the local school system, and there are several of us interested in trying to start an educational FM station at our local school.

Could anyone give us some information on how one runs or how we may be able to get one started?

Robert D. Sassaman
331 Cathedral Drive
Canal Fulton, Ohio

Looking Inside

We have two Ampex 440's and six Ampex 351's all vertically mounted. The 440's are both less than four years old, but the 351's are about twelve years old. In all cases of screech the 351's were to blame and not the tape.

By listening I traced the noise to the reel idler assembly located just below the supply reel. I removed the flywheel from the back and pulled the idler shaft out. The shaft was either corroded or dirty, so I carefully polished it with crocus cloth. After I put the assembly back together the screech was gone.

Ralph L. Bell
WIKY-AM-FM

NAEB Board To Full Strength

The National Association of Educational Broadcasters (NAEB) has brought its 15-member Board to full strength with the addition of six new members. Heading the list is H. Rex Lee, a former FCC Commissioner.

The new group includes: Warren Cannon, senior VP of McKinsey & Co.; Frankie Freeman, attorney, St. Louis; John Gregory, manager, KPCS-FM, Pasadena, Calif.; Warren Park, program director, Maryland Center for Public Broadcasting.

Southern Cable Convention Set

The Southern Cable Television Association has just announced that their annual convention will be held at Walt Disney World, in Florida, September 7-9.

Cable Operators and equipment manufacturers interested in attending should contact John P. Weeks, 383 Pine Forest Drive, Lawrence, Georgia 30245 (Phone (404) 963-7870). At present, the convention can house 70 equipment exhibits.

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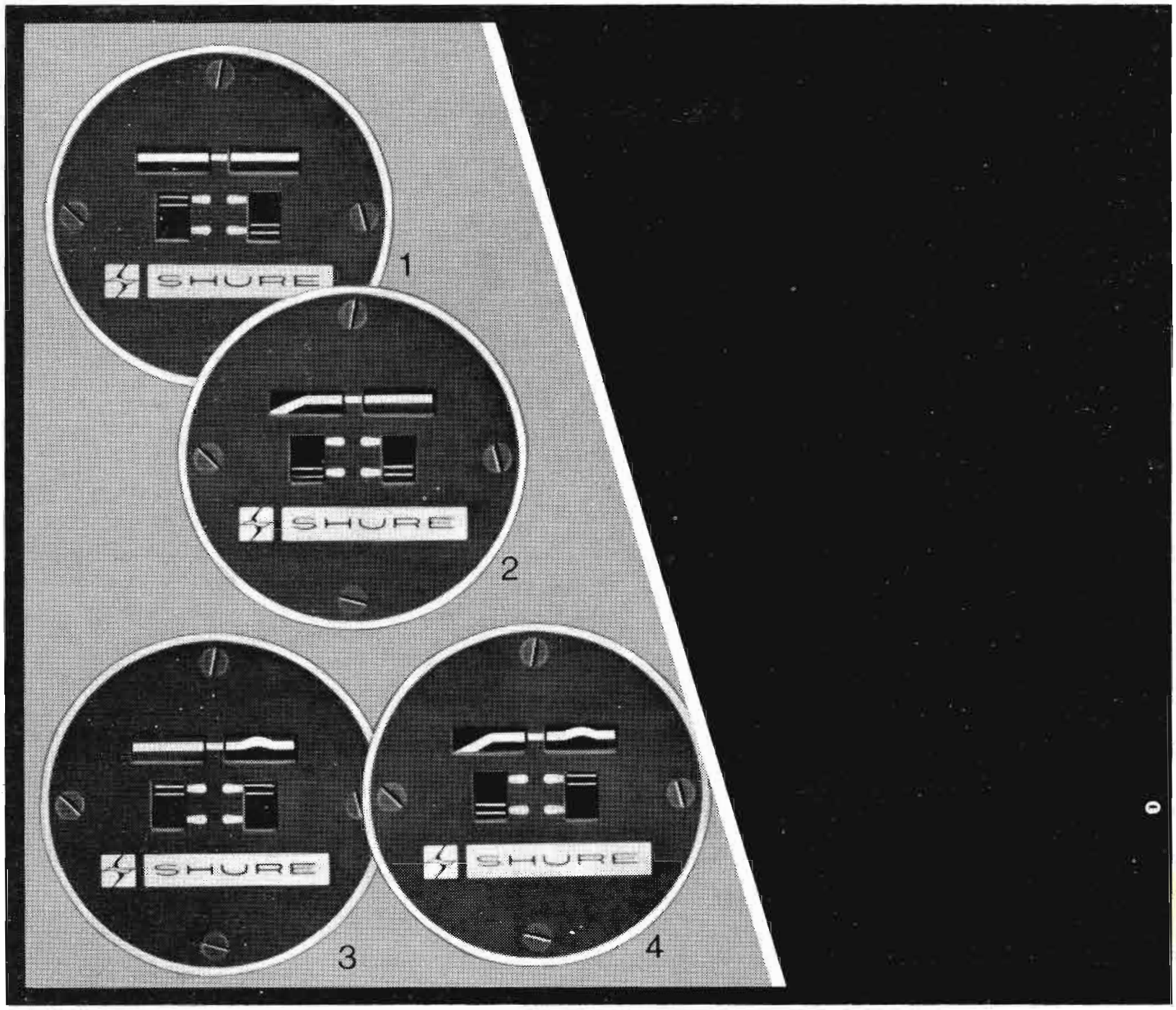

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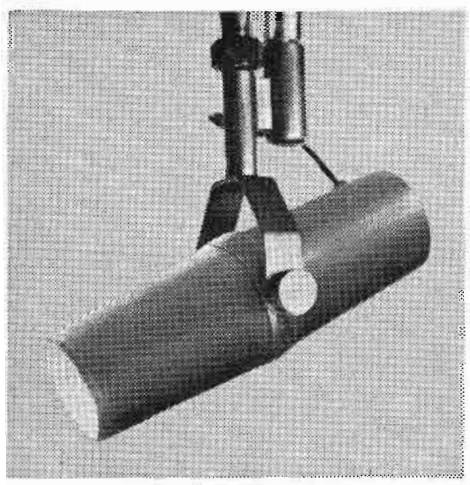

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