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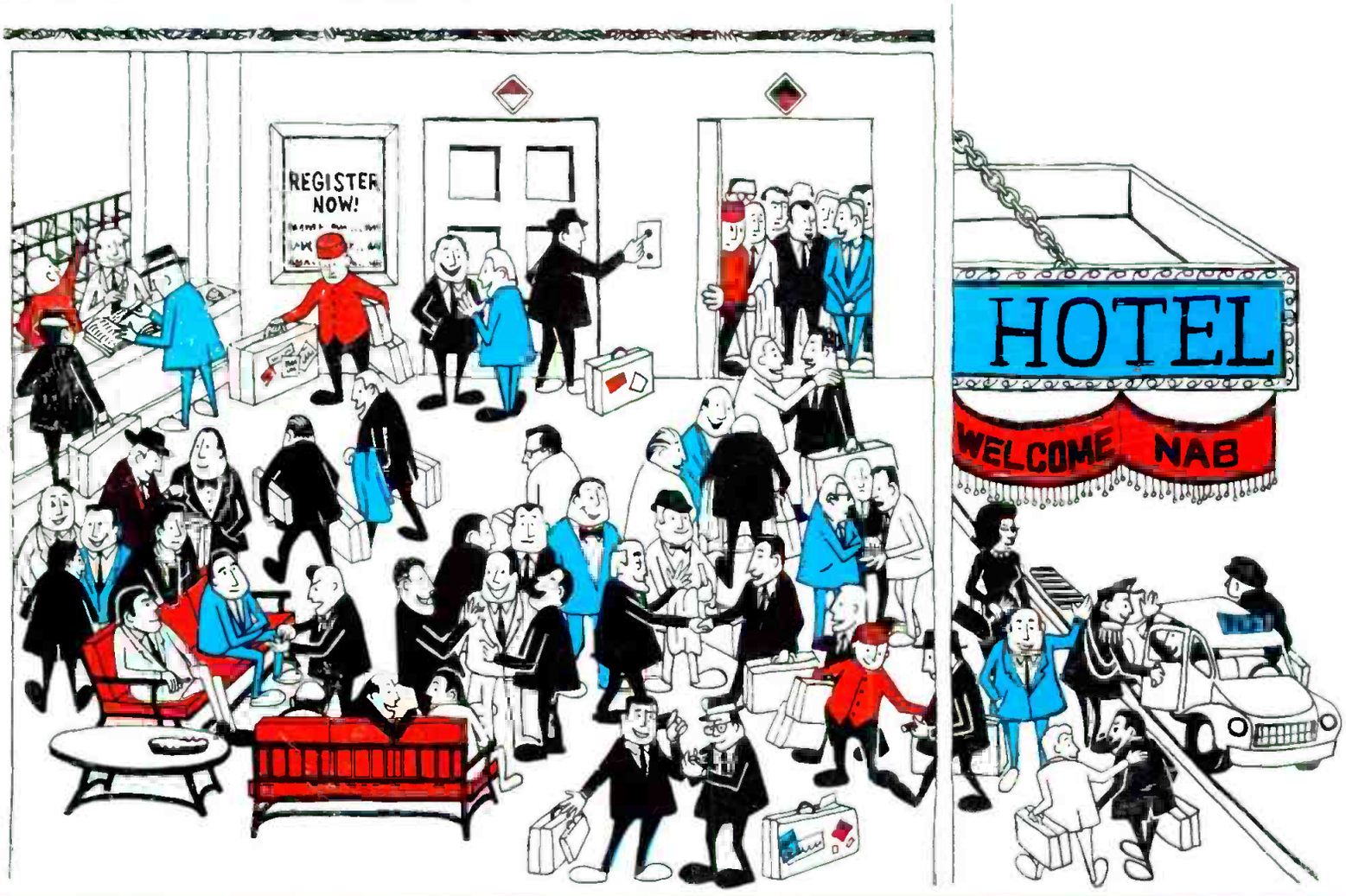
March, 1969/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry



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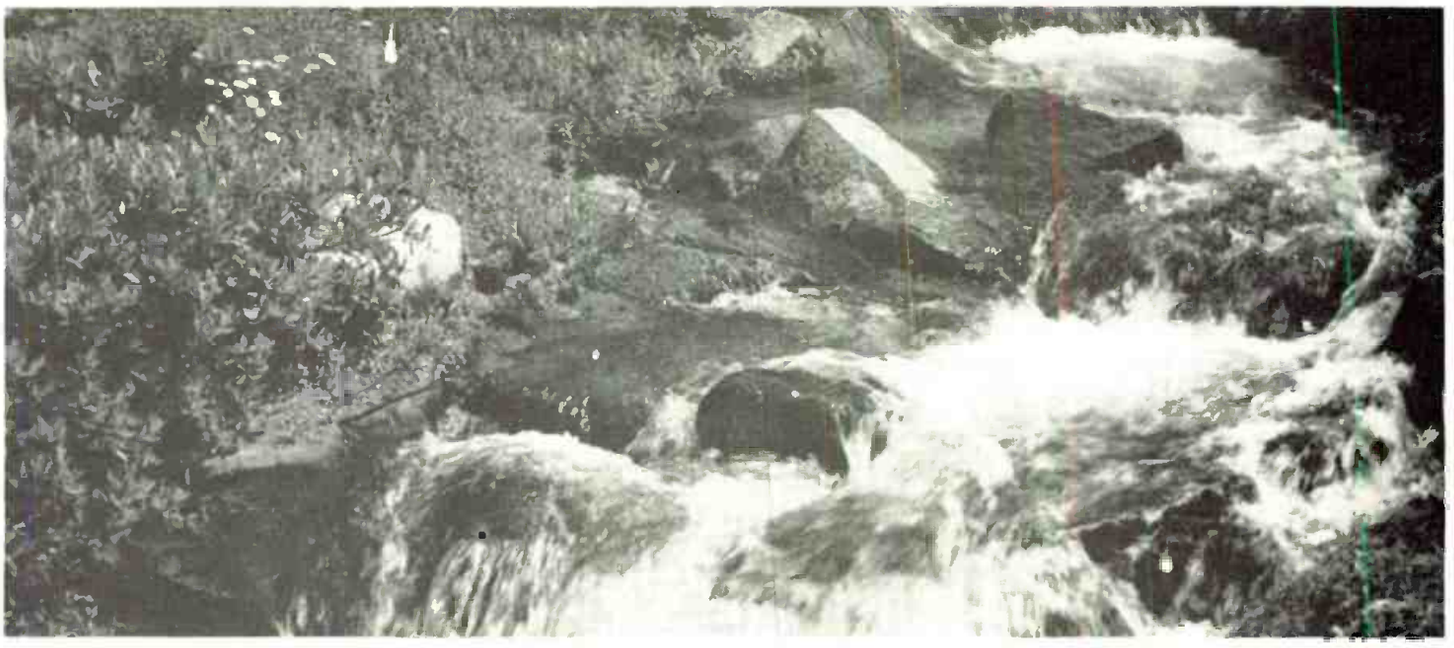

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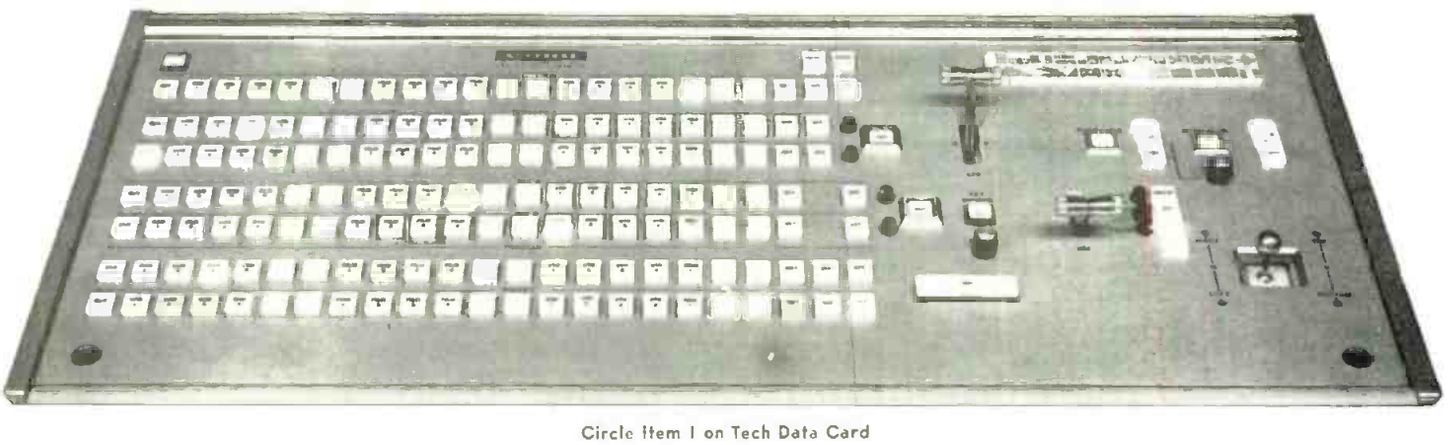

Circle Item 1 on Tech Data Card

March, 1969 • Volume 11, No. 3

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This issue features the National Association of Broadcasters national Convention and the new equipment being exhibited. Records will be set for attendance and the great number of new equipment models.

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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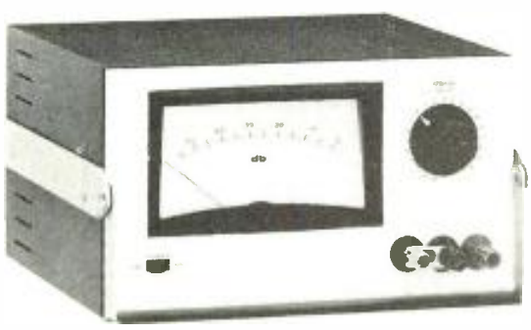

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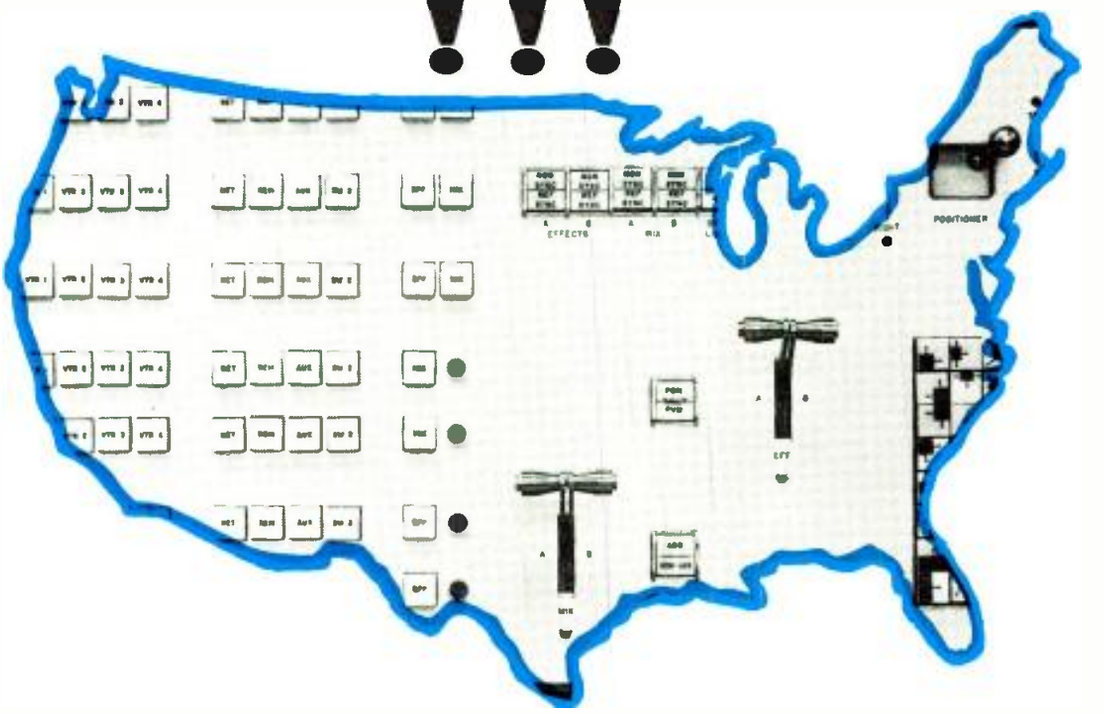

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* Write for a list of the TV stations that have switched to Ward. . . . and complete switcher specifications.

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LETTERS
TO THE EDITOR

I read with much interest the article on WWV in the September issue. Although the general coverage was excellent, I was somewhat disappointed that no description of the atomic standard was given.

My familiarity with WWV is intimate, for I must reset our master clocks on an almost daily basis. The frequency regulation of the primary power is very poor. Sometimes the clocks are off four or five seconds, and this makes joining the network a hit-or-miss affair.

Since there are many stations like ours that feel a Favag System is not justified, I wonder if one of my fellow engineers has dreamed up a crystal controlled power oscillator which could supply 115 VAC at 60 Hz to drive one of our clocks directly. If so, I'd like to correspond with him.

Many thanks for an outstanding publication.

George Lemmon
Chief Engr., WLRW
Champaign, Ill.

Ed. Note: First off, if there are any of you who can help George with the power oscillator, his street address in Champaign is 2424 West Skyline Drive.

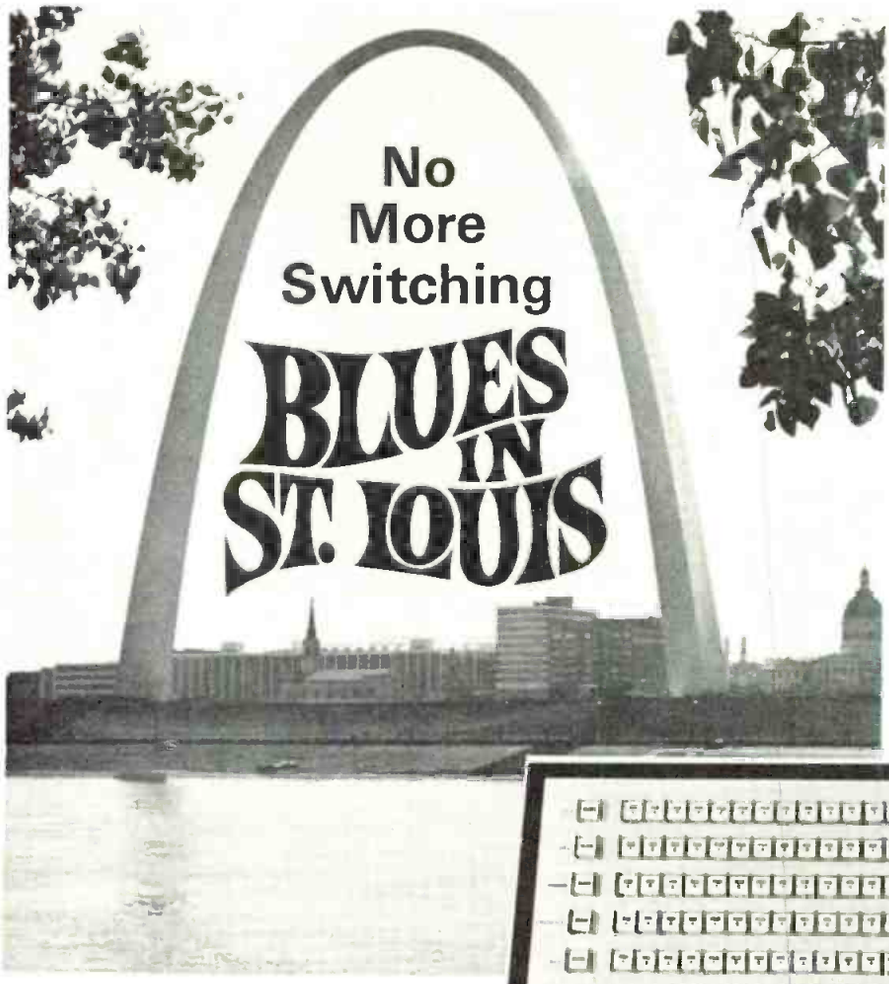
Now as for the atomic clock, it works like this. Metallic cesium is placed in a small chamber within the atomic clock. When the chamber is heated, cesium atoms are emptied through a small hole and into a beam tube.

As the atoms pass through an inhomogeneous field, they are separated into two beams. Parallel magnetic moments form one beam and those with anti-parallel moments form the other. By subjecting the two beams to an oscillating electromagnetic field, the moments are flipped from the parallel to the anti-parallel relationship, or the reverse.

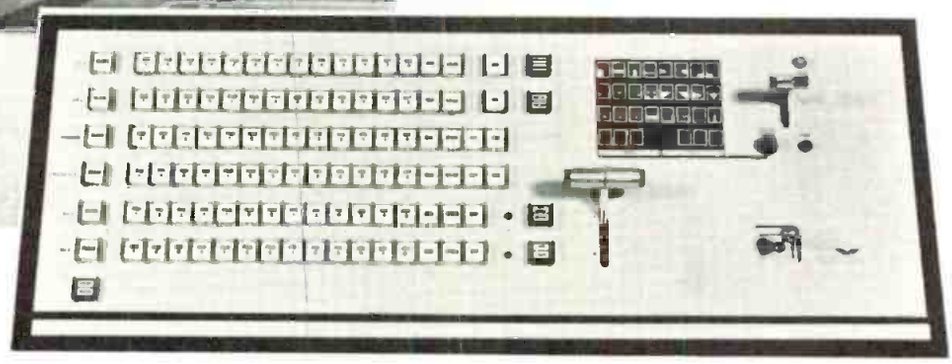
When the two beams pass through a second inhomogeneous magnetic field, some of the atoms will have switched to the opposite beam. Only the switched atoms can now enter a chamber containing a hot wire, where they are ionized and detected. If the frequency of the oscillating field is not exactly that needed for transition, none of the magnetic moments will be flipped and, obviously, no signal will be detected.

The frequency of the oscillator which applies the magnetic field is adjusted until a signal is received. The transition between the fundamental and two hyperfine states of cesium 133 is assigned as 9,192,631,770 cps.

Other oscillators are operated at frequencies related to the cesium frequency by various circuit devices. These devices are used solely for counting, and are checked periodically against the cesium standard. Since the cesium cps can be counted, this is not nearly as difficult as it may seem.



Vital switching equipment opens new vistas in production at KPLR-TV



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INDUSTRY NEWS

Nixon Inaugural Makes Two Firsts In Broadcasting

The inauguration of President Nixon marked two firsts in satellite TV transmission—the first Presidential inaugural to be shown live and in color to such a wide audience by communications satellite, and the first such satellite TV transmission to Panama and Mexico.

The satellite TV transmission was beamed to Europe, Latin America and the Caribbean through the joint efforts of Western Union International, Inc. and Communications Satellite Corp. Television sets an ocean apart received the Presidential inaugural pictures within one-quarter second of the event.

The TV signal was transmitted by the Western Union International (WUI) TV control center in New York, through an earth station in Etam, W. Va., and via the new Intelsat III satellite in synchronous orbit 22,300 miles over the Atlantic. From there it was beamed to receiving stations in Puerto Rico, Panama and European countries including the United Kingdom.

In Europe the broadcast was funneled via the European Broadcast Union. Commentary accompanying the video pictures was in more than a dozen different languages. On the evening of January 20, a special taped inaugural broadcast in Spanish was beamed via the WUI and COMSAT facilities to Panama, Mexico and Chile.

Following Apollo Requires Huge Supporting Cast

A vast network of international and domestic communications carriers was organized to bring to TV viewers pitcures taken by Apollo 8 astronauts as they orbited the moon.

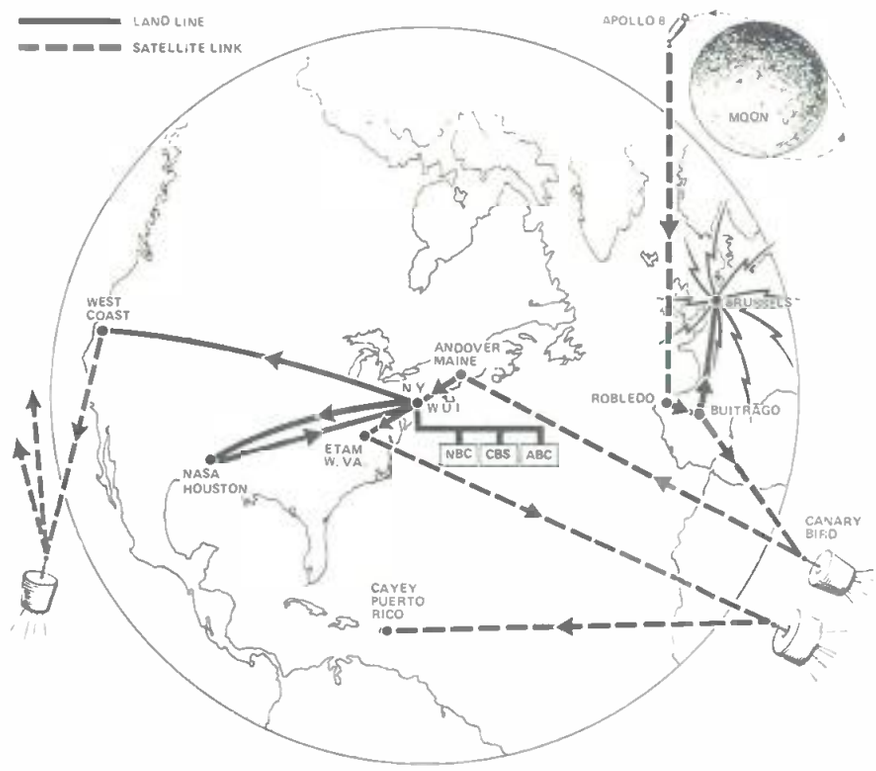
Plans also provided live color TV coverage of the recovery operation when the spacecraft and its crew returned to earth.

E. A. Gallagher, president of Western Union International, one of the major companies in the communications chain, said the TV transmission from spacecraft to home screens throughout the world involved privately owned companies, a U.S. government agency, an international communications agency, a European communciations agency, and a Spanish government installation.

The three astronauts orbiting the moon after launching from Cape Kennedy Dec. 21 utilized special TV cameras developed for NASA's Apollo program. The pictures, taken as close as 70 miles to the moon's surface and through its mysterious twilight zone between dark and light side, were beamed earthward to a NASA-owned earth station in Robledo, Spain.

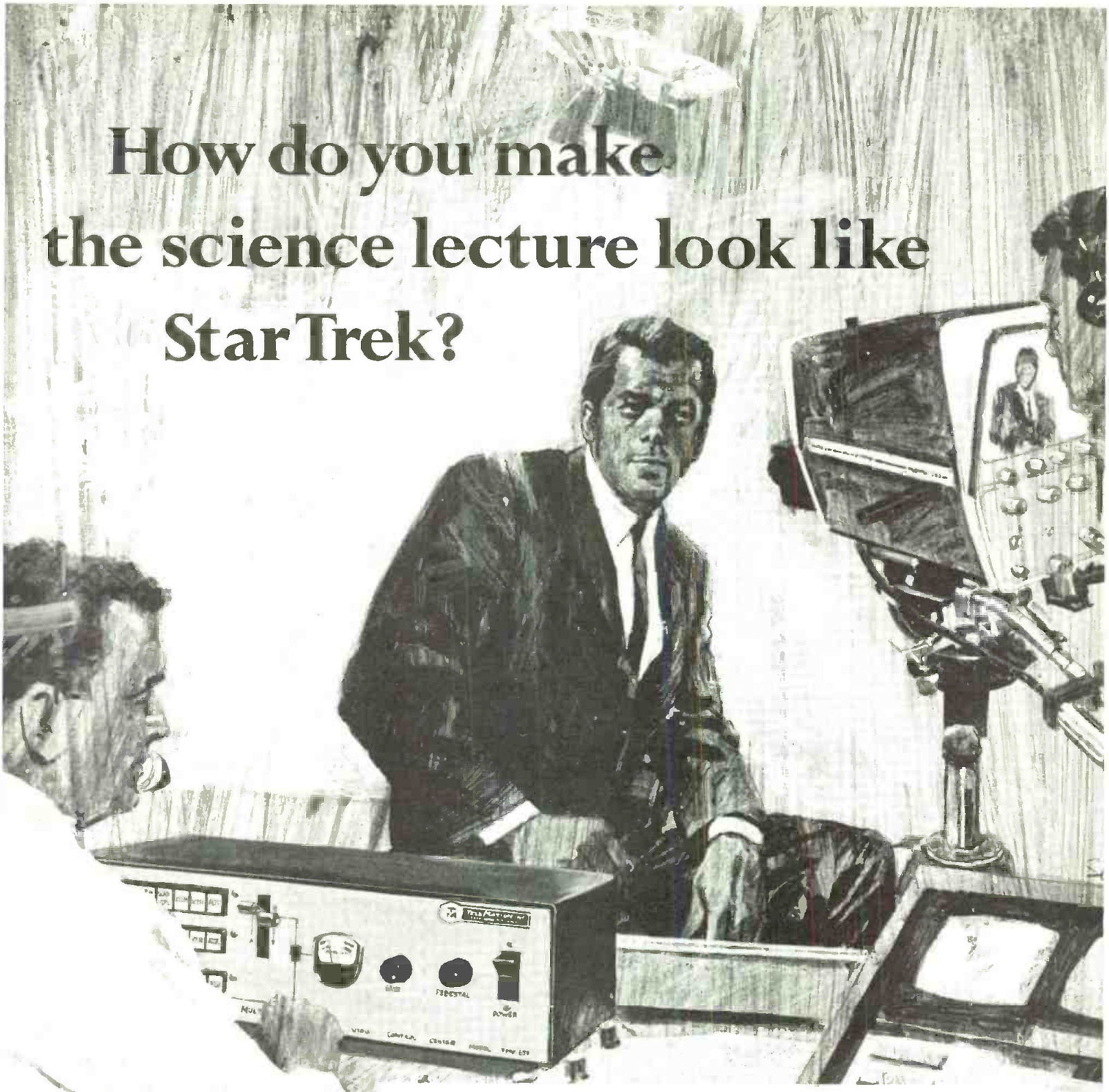
The station in Spain offered the best window through which the pictures could be beamed from lunar orbit at the time set for their transmission, Gallagher explained.

From Robledo, the TV signals were relayed to the Spanish government earth station at Buitrago from where they were bounced off a communications satellite in orbit over the Atlantic. The satellite, Intelsat II F-3 (Canary Bird), is owned by Intelsat, a joint venture of 63 member countries. Gallagher's company, WUI (no connection with the telegraph company) was responsible for receiving the satellite-to-ground station signals at Andover, Me. From there, Gallagher said, they were sent to WUI's TV control room in New York and NASA Space Headquarters in Houston.



Circle Item 8 on Tech Data Card

How do you make the science lecture look like Star Trek?



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ETS Elects Gunn; Sees Funding Need

Hartford N. Gunn, Jr., WGBH, WGBX, Boston, was elected chairman at the Board of Directors meeting of the Educational Television Stations, a division of the National Association of Educational Broadcasters. The ETS Board met here at the Washington Hilton Hotel, January 27-28.

Loren B. Stone, KCTS-TV, Seattle, was elected vice chairman, and Lloyd Kaiser, WITF, Hershey, Pennsylvania, secretary.

The Board recognized the need for full funding of the Corporation for Public Broadcasting and for ETV Facilities for fiscal 1969 and 1970. Under the Public Broadcasting Act of 1967, $9 million was authorized for the Corporation, of which only $5 million was appropriated. For Facilities, $12.5 million was authorized and only $4.375 million was appropriated. The ETS Board declared the need for the original authorization.

In the area of CATV, William J. Ballard, WUCM-TV, Delta College, Michigan, chairman of the ETS/CATV Committee, reported the recommendations of a recent meeting. The Board adopted the following recommendations; that ETS renew its objection to the FCC proposal to except ETV stations from the general protections of the rules either in final rulemaking or as part of any "interim procedures"; 2) that the Committee and the Board study further the implications of the proposed rules governing CATV, and prepare recommendations for written comments to the FCC.

Other members of the ETS Board of Directors are: Warren Kraetzer, WHYY, WUHY, Philadelphia/Wilmington; Howard Holst, WKNO, Memphis, and William J. McCarter, WETA, Washington, D. C.

Two New Members For ETS Board

Lloyd Kaiser, General Manager, WITF-TV, Hershey, Pa., and William J. McCarter, vice-president and general manager, WETA, Washington, D.C., have been elected to three-year terms on the Board of Directors of Educational Television Stations, a division of the National Association of Educational Broadcasters.

Jack G. McBride, KUON, Lincoln, Nebraska, and James Robertson, WHA-TV, Madison, Wisconson, retire from the ETS Board, having completed three-year terms. McBride served as ETS Board Chairman last year. Robertson has just completed a one-year term as Chairman of the Board of Directors of the NAEB.

Kaiser joined WITF-TV in 1964, at the time the station was founded. In 1957 to 1964 he was education television consultant to the Rochester (N.Y.) Board of Education and was instrumental in the activation of ETV in that city.

McCarter was named general manager of WETA-TV in 1964, and elected vice-president in 1966. From 1962-64 he was Development Officer for NET. Prior to that, he was with WHYY-TV, Philadelphia as production manager, program director, and later assistant general manager.

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FCC Moving On FM Translators To Extend Service

Steps toward establishment of new FM translator and booster services have been taken by the FCC in a Notice of Proposed Rule Making. The idea, first suggested in a Notice of Inquiry in Docket 17159, February 1, 1967, is to extend FM to areas with uneven terrain and to poorly served areas. Virtually all comments in response to the inquiry favored an FM service patterned on TV translators.

To its rule-making proposal, the Commission attached a set of suggested rules for FM translators and it said that it also proposed counterpart rules authorizing FM boosters. Although translators are in regular use to extend TV coverage, the only such operations authorized for FM have been on an experimental basis. Translators retransmit an originating station's signal on a different frequency. Boosters are repeating devices that amplify and retransmit a signal on the same channel as the originating station.

Describing the need for such services, the Commission said that local reception sometimes is unsatisfactory because of mountains or hills blocking line-of-sight transmissions. Some comments in the inquiry also claimed a need for service beyond the regular coverage areas of FM stations, and the proposed rules provide for this. "We do not find it desirable to restrict FM translators to gap-filling within predicted service contours of regular FM stations, provided that in individual cases a need is shown for FM translator service farther out," the rule-making notice said. However, stations would not be allowed to place translators outside their own areas in places where they would compete unfairly with one or more regular FM stations without having the burden of providing local program originations," the Commission said.

Generally, translators or boosters would be licensed either to local FM stations or organizations representing local inhabitants under the rules proposed.

Three Institutes Are Scheduled

Three Educational Broadcasting Institutes on the principles of supervisory management have been scheduled by the NAEB, according to James Fellows, NAEB's director of Research and Development. The Institutes, which were successfully initiated last year by the NAEB, are designed to meet the diverse and long-range needs for increasingly effective professional development in educational broadcasting, Fellows said.

Dates of the conferences and the cities in which they were scheduled: February 11-14 in Atlanta, Ga., at the Sheraton-Biltmore; March 19-22 in Cambridge, Mass., at the Holiday Inn; and April 13-16 in Chicago, Ill., at the Sheraton-Chicago. Details for additional Institutes on engineering and public relations, which will be held in the Spring, will be announced shortly.

FCC Remote Control and Calibration Proposals Set

Rule amendments to permit remote control of VHF television stations have been proposed by the Commission in response to a petition by the National Association of Broadcasters. (UHF stations are already permitted to operate by remote control under existing rules.)

On March 29, 1967, the Commission denied an earlier NAB petition to allow VHF remote control, but this time it found, "The showing accompanying the NAB petition is quite impressive and although it does not completely dispel all concern of the Commission, it has sufficient merit to warrant the institution of rule-making proceedings." This petition, submitted August 14, 1968, includes reports on experiments conducted for NAB by Metromedia Inc. on three of its stations: WNEW-TV Channel 5, New York, N.Y.; KMBC-TV, Channel 9, Kansas City, Mo., and KTTV, Channel 11, Los Angeles, Calif.

Although NAB proposed permitting remote control upon an applicant's showing that it is possible, the Commission has proposed a six-month test period of simulated remote control before permission is granted. It referred to NAB's admission of initial "shakedown" problems and called for the prior demonstration of feasibility.

The Commission said it would not require the six-month tests for UHF stations. For UHF stations the hazard of harmful interference from improper operation is substantially less, it explained, and "a more liberal attitude is consistent with the overall policy of the Commission to foster the expanded use of UHF channels."

Calibration

The Commission also proposed calibration and inspection of remote control facilities five days a week, as suggested by NAB. Unlicensed personnel could man the remote control facilities five days a week, as suggested by NAB. Unlicensed personnel could man the remote control position, supervised by a qualified operator on duty at the transmitter. The requirements would be in a new Section 73.676 of the Rules.

For multiplexing telemetry and alerting signals from transmitter to remote control point, the proposal specifies aural channels. This definition would be added to Section 73.681: "Multiplex Transmission (Aural). One or more information channels added to the regular aural channel of a television broadcast station by means of a modulated subcarrier." Transmission standards would be specified under Section 73.682. In view of the relative narrowness of the TV aural channel, the Commission proposed restricting multiplexing to a single subcarrier. "If there is an actual need for more than one subcarrier for remote control operation and such additional subcarriers may be used without noticeable degradation of picture and sound quality, comments should be directed to that point," the notice said.

Comments on the remote control proposal have been invited by March 28, 1969, and reply comments by April 11, 1969.

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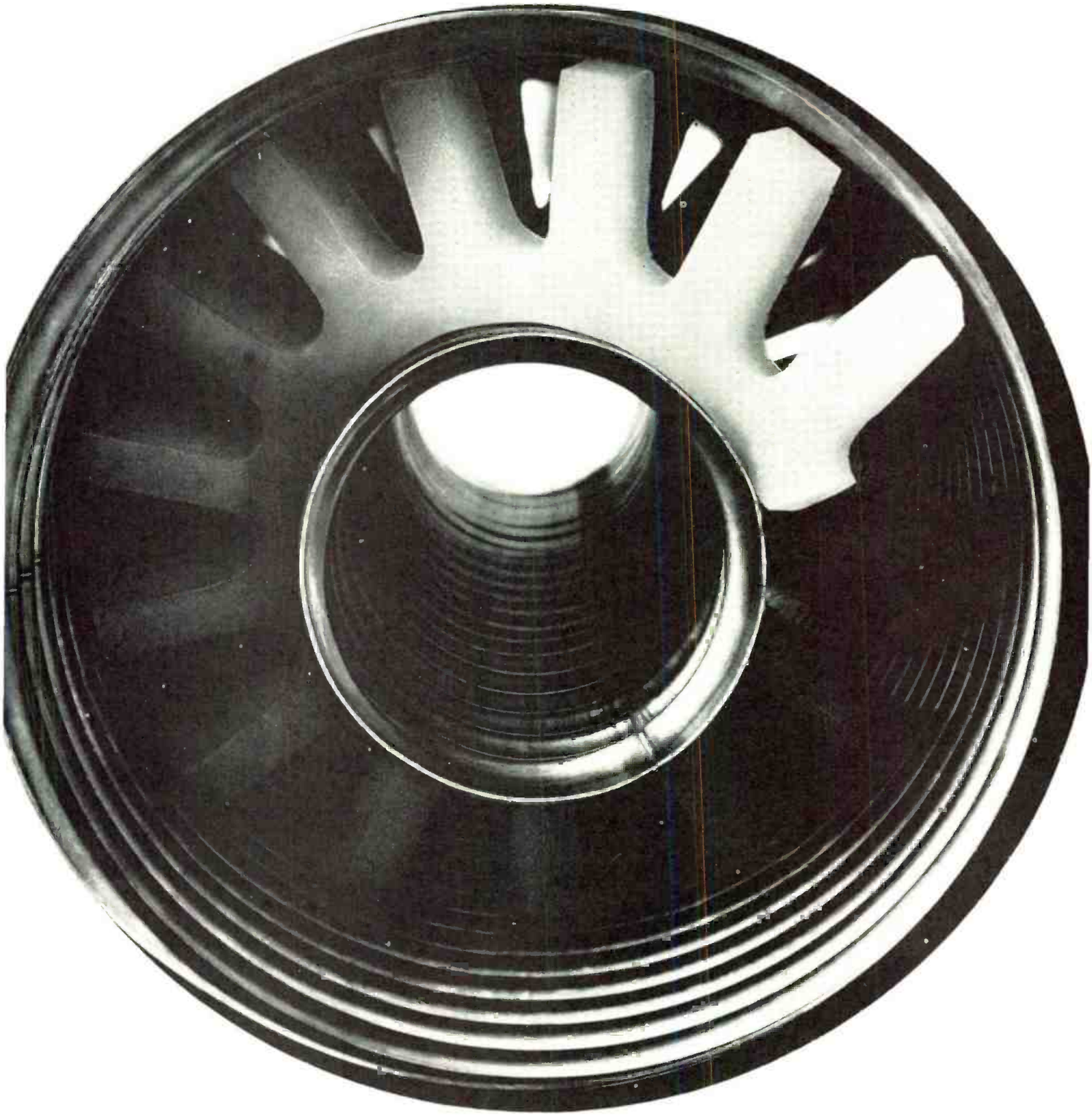

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Dropout Profile Recorder (DPR) for Color Video RIGHT: The logical companion to the DOC (above). The 3M Brand DPR produces a permanent strip chart showing the dropout rate and dropout annoyance factor during normal on-line video tape playback. It performs this evaluation electronically while the 3M DOC is compensating the dropouts. The DPR indicates when a tape is too degraded to commit to valuable programming. Five inches of chart reads one hour. Chart can be torn off and stored with video tape. Write for brochure.

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Circle Item 36 on Tech Data Card

Speakers and Awards:

Agenda Includes Goldwater and Godfrey

Sen. Barry Goldwater to address NAB convention

The National Association of Broadcasters has announced that Sen. Barry Goldwater of Arizona, the Republican party's candidate for President in 1964, will address the first Engineering Luncheon at the NAB's 47th Annual Convention in Washington on Monday, March 24.

The 60-year-old Republican, a major general in the Air Force Reserve, is serving again in the U. S. Senate. He was first elected in 1952 in an upset victory over the then Democratic leader, Sen. Ernest McFarland. He resigned 12 years later—in 1964—to contest Lyndon B. Johnson for the presidency. but came back this year after winning an election to succeed Sen. Carl Hayden, retired, who had served as a member of Congress from Arizona ever since the state was admitted to the Union.

Convention opens March 23

The convention's opening on Sunday, March 23, will be observed as "FM Day." Program features include presentations by Federal Communications Commissioner Robert T. Bartley and by Curtis B. Plummer, chief of FCC's Field Engineering department.

Arthur Godfrey

Arthur Godfrey, world famous radio-TV personality, will address the Radio Assembly of the 47th annual convention of the National Association of Broadcasters in March.

Mr. Godfrey, who will speak on Tuesday, March 25, is expected to discuss the effect radio has had on his life and how the medium now is an integral part in the life of everyone.

The Radio Assembly for management delegates is a regular feature of NAB's convention, which will be held March 23-26 at Washington's Shoreham and Sheraton Park Hotels.

Art Buchwald, columnist and humorist, also will address the Tuesday morning Radio Assembly. Mr. Buchwald recently began a syndicated, five-minute radio show called "Buchwald On."

A third speaker will be Henry Brief, executive director of the Record Industry of America, who will discuss changes in music programming during the past five years.

Frank Pace

Frank Pace, Chairman of the Board of the Public Broadcasting Corp., will address the NAB Convention in Washington.

Pace, former Secretary of the Army and one-time president and board chairman of General Dynamics Corp., will speak during the second-day luncheon of management executives on Tuesday, March 25.

The announcement was made by NAB's Convention Committee headed by Co-Chairmen Harold Essex, president and general manager of the Triangle Broadcasting Corp., Winston-Salem, N. C., and Donald A. Thurston, president of WMNB, North Adams, Mass.

The convention and the concurrent Broadcast Engineering Conference is scheduled for March 23-26 at the Shoreham and Sheraton Park Hotels.

The convention committee was advised of Pace's acceptance of the invitation by Harold Niven, NAB vice-president for planning and development.

Everett E. Revercomb, NAB secretary-treasurer and convention manager, told the committee that advance registrations for the Convention are excellent and that he expects to be "sold out" on exhibit space for the world's largest display of broadcast equipment.

William Carlisle, NAB vice-president for television, and Charles M. Stone, NAB vice-president for radio, outlined plans for separate TV and radio sessions during the annual assembly.

Jarrett L. Hathaway, senior project engineer for the NBC television network and a developer of ultra portable cameras, has been selected by the National Association of Broadcasters to receive its annual Engineering Achievement Award.

Hathaway, who joined NBC in 1929, has spent most of the last 14 years working on the ultra portable camera systems and radio microphones used at NBC. He wrote specifications for both projects, tested them, and supervised their development for operational use.

From 1941 to 1944, Hathaway served on the faculty of Harvard University. There he worked on the development of new and improved systems of underwater sound detection and missile guidance.

On return to NBC, he participated in a government sponsored project on high altitude night photography.

A graduate of the University of Colorado with a Bachelor of Science degree in electrical engineering, Hathaway has been granted 37 U.S. patents, mainly in the field of broadcasting.

During the early days of television, he played a substantial role in the broadcasters' choice of FM for TV's sound.

In 1956, he won an Emmy nomination for contributions to the first live broadcast from Cuba, and another Emmy nomination in 1962 for developing a system for transmitting sound over the video circuit during emergencies.

The award will be presented by George W. Bartlett, NAB vice-president for engineering, on Tuesday, March 25, at the second luncheon of the 1969 Broadcast Engineering Conference in Washington. The Conference will be held as part of NAB's 47th Annual Convention, March 23-26.

John E. Fetzer to receive Distinguished Service Award

John E. Fetzer, a pioneer broadcaster and owner of the Detroit Tigers, has been named to receive the 1969 Distinguished Service Award of the National Association of Broadcasters.

The award, in recognition of Fetzer's contributions to broadcasting, will be presented at NAB's 47th Annual Convention in Washington during the opening General Assembly.

Past recipients include President Herbert Hoover, comedian Bob Hope, and top station, network and industry leaders.

Selection of Fetzer to receive the 1969 award was announced by NAB's Convention Committee which met in San Juan as part of a four-day series of meetings by the NAB Board of Directors at the Americana Hotel.

Fetzer, a 40-year veteran in broadcasting, is president of the Fetzer Broadcasting Co., Kalamazoo, Mich., and of the Cornhusker Television Corp., Lincoln, Neb. The companies operate seven stations in Michigan—WKZO and WKZO-TV, Kalamazoo; WWTV-FM and WWTV-TV in Cadillac; WJEF and WJEF-FM in Grand Rapids, and WWUP-TV, Sault St. Marie—and two television stations in Nebraska—KOLN-TV, Lincoln, and KGIN-TV, Grand Island.

Long active in industry affairs, Fetzer was the first chairman of the NAB Television Code Review Board and played a major role in the drafting and promulgation of the industry Television Code in 1951. He also has served on NAB's Board of Directors and is a long-time member of the Michigan Broadcasters Association.

As president and owner of the Tigers, Fetzer has served as Chairman of the Major Leagues' Baseball Television Committee which was instrumental in establishing nationwide baseball telecasting. He has been responsible for negotiating broadcast coverage of the World Series, the All Star Games since 1966, and has handled the Game of the Week contract since 1965.

A graduate of the Radio Institute in Washington and Andrews University at Berrien Springs, Mich., he served as a radio censor in World War II, supervising high-level security matters in the regulation of the four national radio networks, 900 U. S. stations and 27 short-wave stations overseas.

The NAB Distinguished Service Award, established in 1953, is presented to individuals who make "a significant and lasting contribution to the American system of broadcasting by virtue of singular achievement or continuing service for or in behalf of the industry in any or all phases."

Previous recipients are Lowell Thomas (1968); Chet Huntley and David Brinkley (1967); Sol Taishoff (1966); Leonard H. Goldenson, (1965); Donald H. McGannon (1964); Bob Hope (1963); Edward R. Murrow (1962); Justin Miller (1961); Clair R. McCollough (1960); Robert W. Sarnoff (1959); Frank Stanton (1958); Herbert Hoover (1957); Robert E. Kintner (1956); Mark Ethridge (1955); William S. Paley (1954) and David Sarnoff (1953).

NAB Convention Program

Monday Afternoon

Shoreham Hotel

Presiding: Albert H. Chismark, Director of Engineering, Meredith Broadcasting Company, Syracuse, N.Y.
Coordinator: L. Keith Townsdin, Technical Director, KAYS, Inc., Hays, Kansas
8:30-2:40 pm: Opening of Conference—Vincent T. Wasilewski, President, NAB
2:40-2:55 pm: NAB Engineering Advisory Committee Report—Malcolm M. Burleson, Vice-President for Engineering, Metromedia, Inc., Washington, D.C.; Chairman, NAB Engineering Advisory Committee
3:00-5:00 pm: Satellite Program—James D. Parker, Staff Consultant, Telecommunications, CBS Television Network—Moderator
The Use of Satellites in Television
An Air Transportable Earth Terminal for Special Events—General Electric
TV Distribution—Panel
Direct Broadcasting

Tuesday Morning

Radio
Ambassador Room, Shoreham

Presiding: Charles Abel, Manager of Engineering, KFMB-TV, San Diego, California
Coordinator: Glenn G. Boundy, Engineering Consultant, Storer Broadcasting Company, Miami Beach, Florida
9:00-9:25 am: Audio Signal Processing by Means of AM/FM Limiters and AGC Amplifiers—Gates Radio Company
9:30-9:55 am: The Use of Computers in Broadcast Engineering—Serge Bergen, Consulting Engineer
10:00-10:25 am: An Aural STL System for Composite FM Stereo Signals—Howard Ham, Vice-President for Engineering, Moseley Associates, Goleta, California
10:30-11:25 am: Construction and Maintenance of Directional Antenna Systems—Orville J. Sather, Director of Engineering, WOR, New York
Fred L. Zellner, Jr., Manager of Allocations, American Broadcasting Company, New York
11:30-12:00: Enhancement of Telephone Line Performance—Post-Newsweek Stations, Washington, D. C.

Tuesday Morning

Television
Palladian Room, Shoreham

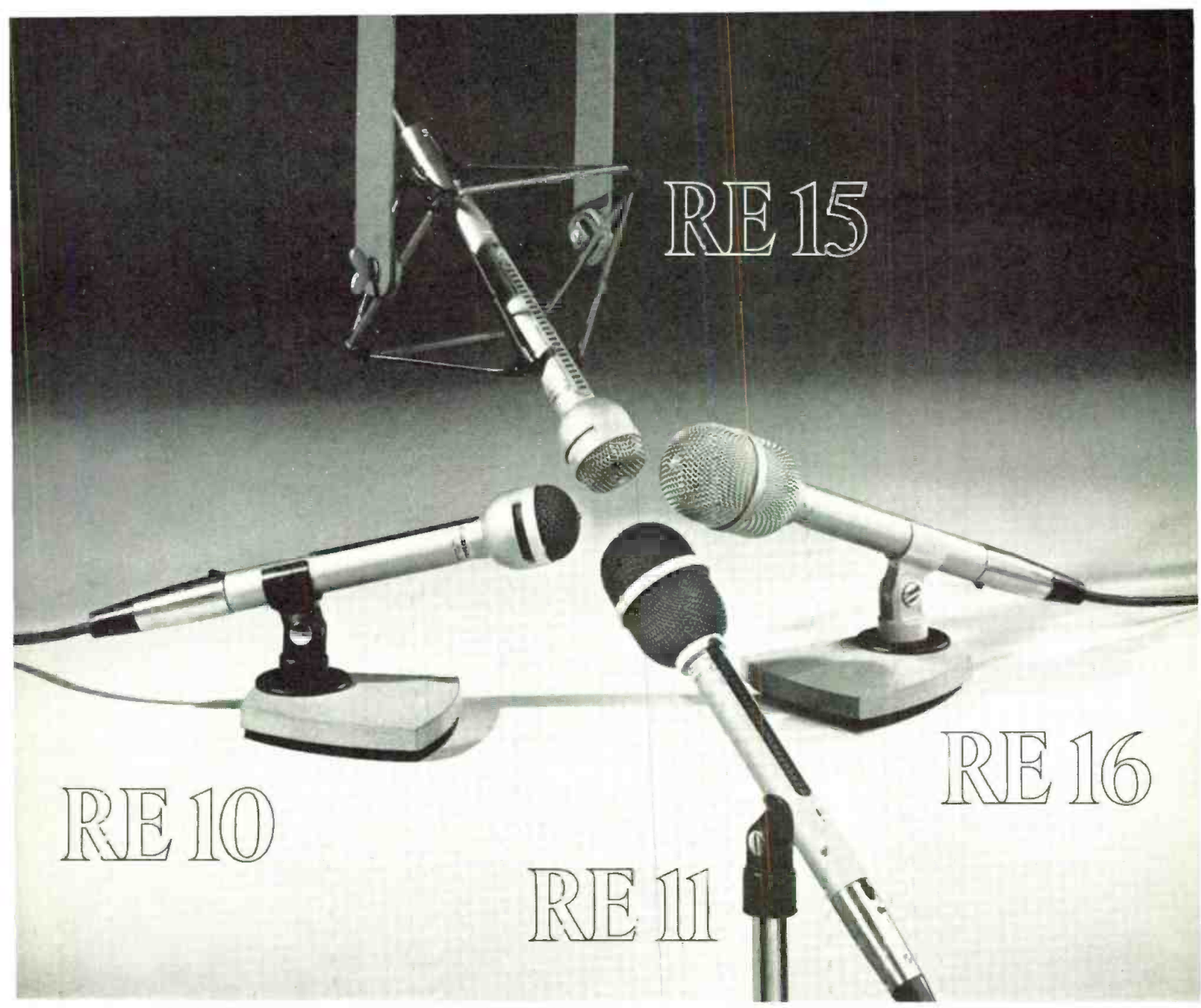
Presiding: Leslie S. Learned, vice-president for Engineering, Mutual Broadcasting System, New York, N. Y.
Coordinator: Royce LaVerne Pointer, Director of Broadcast Engineering, American Broadcast Company, New York, N. Y.
9:00-9:20 am: A New Solid-State TV Demodulator—George Stoeppel, Rhode & Schwarz, Passaic, New Jersey
9:25-9:45 am: A Logical Approach to Video Switching Systems—Fred M. Eames, General Electric Company
9:45-10:05 am: Film Automatic Level Control—National Broadcasting Company
10:05-10:25 am: Operational Color Camera Experience—American Broadcasting Company
10:30-10:50 am: A Completely New VHF Transmitter of Advanced Design—H. E. Small, Broadcast Transmitter Engineering, Radio Corporation of America
10:55-11:15 am: Automatic Correction of Network Chrominance & Luminance Levels—J. Ross, Director of Engineering, Central Dynamics, Ltd., Montreal, Canada
11:15-11:30 am: JCIC Ad Hoc Committee on Color Television—A Status Report—Blair Benson, SMPTE
11:30-12:00 N: The Importance of Color Temperature—Salvatore Bonsignore, Staff Lighting Consultant, CBS Television Network
12:30 pm: Engineering Conference Luncheon, Blue Room, Shoreham Hotel
Presiding: Robert W. Flanders, Chairman, 23rd Annual Broadcast Engineering Conference
Presentation of 1969 Engineering Award: George W. Bartlett
Acceptance of Award: Jarrett L. Hathaway, Senior Project Engineer, National Broadcasting Company
Speaker: Arthur Godfrey

Tuesday Afternoon—**No Sessions Scheduled**

Wednesday Morning

Ambassador Room, Shoreham

Presiding: James L. Wilson, Divisional vice-president, Engineering, National Broadcasting Company, New York, N. Y.
Coordinator: James D. Parker, Staff Consultant, Telecommunications, CBS Television Network, New York, N. Y.
9:00-9:20 am: New Color Camera Designs to Meet Today's Operational Requirements—Anthony C. Cuomo, Manager of Engineering, Philips Broadcast Equipment Corp., Paramus, N. J.
9:20-9:40 am: Measurement of Non-Linear Distortions in Color TV Systems—Charles W. Rhodes, Instrument Engineering, Tektronix, Inc., Beaverton, Oregon
9:40-10:00 am: New Two-Tube Color Cameras for Broadcast Use—B. M. (John) Poole, Manager, Broadcast Camera & Magnetic Disc Recording Section, Video Engineering Dept., Ampex Corporation, Redwood City, Calif.
10:00-11:00 am: FCC/Industry Panel—Moderator: Albert H. Chismark, Director of Engineering, Meredith Broadcasting Company, Syracuse, NY
11:00-1:00 pm: Joint Session with Management, Regency Room, Shoreham
1:30-3:00 pm: Joint Management and Engineering Luncheon, Sheraton Hall—Sheraton Park



NEW Model RE10 $90.00, shown on Model 421 desk stand $10.50. Model RE15 $153.00, shown with Model 307 suspension mount $20.70. NEW Model RE11 $96.00, shown with Model 311 snap-out stand adapter $3.90. NEW Model RE16 $159.00, shown on Model 421 desk stand $10.50. All prices suggested net.

Freedom of choice!

Professional sound has entered a new era. It started with the Electro-Voice Model RE15. And now there are four E-V dynamic cardioid microphones that share its distinctive advantages — with some unique benefits of their own.

Unaffected by Distance . . . Angle

Basic to all of these microphones is Exclusive Electro-Voice Continuously Variable-D* construction. Now it offers something you've never heard before with any microphone: no matter what you do, microphone response never varies!

Whether performers almost swallow the microphone, wander far off-mike . . . or even move around to the back . . . you'll still get the same smooth response. Only the level changes.

Once you set equalization it remains constant. You have full assurance that tonal balance won't change between the dress rehearsal and the final performance, no matter what the talent does.

Improved Cardioid Pattern

Only acoustics and noise can limit you. Yet even here these new E-V microphones gain an advantage from the super-cardioid pattern that provides better sound control than ordinary cardioids. With maximum rejection 150° off axis, it is easier to eliminate unwanted sound while maintaining normal stand or boom microphone positions. There's also an integral bass-tilt circuit to cut rumble below 100 Hz. when needed.

Now Select from Four Models

In addition to the original RE15, we've added the RE16. The same fine microphone with an external "pop" filter to solve the problems of ultra-close miking.

The new RE10 is the economy version of the RE15. The same concept and quality, but for slightly less rigid requirements. And the RE11 is the lower cost twin to the RE16.

These four great cardioid microphones give you new freedom to head off sound problems before they start. Your E-V microphone headquarters has them waiting. Choose today.

*U.S. Patent No. 3,115,207. Trade mark registered.

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Circle Item 12 on Tech Data Card

New Equipment Exhibits

This year's NAB convention exhibits will be heavily populated by new products shown for the first time that will add considerably to the broadcast industry's shift to automation and automated units. And by this time, it is obvious that solid-state and modular construction are on a clear track to the market place.

Some companies, such as RCA, prefer to make their new equipment introductions at the convention. Others who answered the **Broadcast Engineering** call for reports on equipment to be introduced did not reply by press time.

Visual, for instance, probably will show their low light level camera that was put to the test for the first time at the National Association of Educational Broadcasters meet in November. At that same convention, RCA jumped in with their one-tube color camera. It should be on display again.

And it was at about the same time that CBS Labs was preparing to show their EVR equipment. It might be in the booth and of special interest to educational broadcasters.

And now Schafer will show the first computer designed for broadcasters to be unveiled at an NAB convention. Other manufacturers are making it clear that their equipment can be used with computers.

With all the new amplifiers, switchers and special effects generators available, television should be less complicated, more challenging to the imagination, and less exciting during panic periods.

Meanwhile, no standard piece of broadcast equipment will escape change. From the bench and the bread board, we'll see innovations that have swept the field from microphones to lighting. And perhaps RCA will have more information on their latest transmitter that is supposed to improve the color picture.

Even in display units there are changes. Anderson is working on a device that will outline display lettering with a heavy black line to make reading easier regardless of home receiver settings.

For those not attending the convention, **Broadcast Engineering** will review in more detail some of this abundance of new equipment. For now, let's take a look at the new products that were reported prior to press time.

Get the Picture

CBS Laboratories will show their image enhancer unit, a device designed to sharpen the quality of TV signals as they are transmitted. All solid-state, the unit weighs less than 20 pounds. The company also will feature their digital display system originally developed for CBS news election coverage.

In addition, CBS Labs will introduce a pair of solid-state devices which provide automatic level and peak control to achieve improved program power. They are called Audimax and Volumax.

Other new equipment will include the 538 Color Masking Processor to improve fidelity and saturation of cameras, the 710 Automatic Loudness Controller, a control panel Joy Stick and Point Control, and a series of professional test records. **Booth No. 105-SP**

Conrac Corporation will take the wraps off their Model KHA25/C low cost color monitor. This solid-state unit will be available in 19 and 25 inch versions. Intended for use as audience viewing monitors, sponsors' lounge equipment, color displays for CCTV and for computer generated color alphanumeric display systems, the unit will be available in June.

The RHA19 color monitor, featuring an independent high voltage system, also will be on display. **Booth No. 102-SP**

A new automated 35mm slide projector is off the bench at **Spindler & Sauppe, Inc.** Named Spectrum 32, the unit designed for color TV chain integration employs two interchangeable 16-slide turrents, with single mirror reflection for each channel.

Previewing of all slides is built-in, and a fail-safe circuit prevents double cycling due to improper slide change command. All logic circuitry is solid-state to eliminate the need for relays. Modularly designed mechanical, optical and electronic subassemblies may be removed without disturbing the chain alignment. **Booth No. 561-S**

The **Kalart Company** will show three new products. They are the K/V STV-TB-A 16mm Uniplex Film Chain, the model VLM-1 Video Level Meter, and the model OM-300 Optical multiplexer.

The multiplexer utilizes front surface mirrors and field lens. Mirror positioning makes the transition of inputs self-dousing. Standard projector mounting hardware is designed for two STV-TB 16mm projectors and one PS-65 Soundview 35mm Film Strip and 2x2 Slide Projector. The Kalart/Victor VR-622 camera is utilized. **Booth No. 523-S**

Filmline Corporation will exhibit three models of 16mm color processors for Ektachrome film. Numbered models FE-15, FE-30, and FE-50, these processors are designed specifically for TV station news departments and labs of all sizes.

The exclusive Filmline features should be a fine example of the state-of-the-art in commercial laboratories. **Booth No. 573-S**

Roses are red, violets are blue.

And keep it that way.

The new color TV sets put more and more responsibility on the broadcaster to pump out pure color. At least as good as the color on the next channel. ☐ And that's one of the things you get from Microwave Associates' total-solid-state STL. Pure color, stable as a rock. Just what the camera sees. And total-solid-state means total-solid-state. No exceptions! ☐ You get a lot more, of course. Full fidelity program sound. A system of drift-free and tweak-free RF frequency generation to keep your color pure. Solid-state design that is modular, compact, easy to maintain, super-reliable, and less expensive than you think. ☐ But mostly, you get beautiful color. NTSC color that exceeds EIA and FCC standards and recommendations. And it stays that way. ☐ More than 400 installations of Microwave Associates' solid-state relay links color the country, and indeed, the world. Maybe even the one on the next channel is from us. Many are dual installations where hot standby means cold cash. Many are portable. Many are unattended relay hops. And a great many are STL, keeping the roses red and the violets blue. ☐ Write or call.

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MA-2B, MA-7B and MA-13B at 2, 7, and 13 GHz bands. Transmitter Power: 33, 27 and 21 dBm, respectively. Differential Gain: 0.25 dB. Differential Phase: ±0.3° S/N EIA weighted: 65, 63 and 60 dB, respectively. S/N (Sin² + window): 60, 60 and 58 dB, respectively.

Circle Item 13 on Tech Data Card

New Equipment

Automatic Shift

Schafer Electronics will unveil their digital automation broadcast computer. According to Schafer, the computer is capable of handling on a 48-hour or more basis virtually every forseeable event and emergency situation. This includes real time switching to join or leave the network to unexpected events such as corrective action to restore power after a power failure.

Designated the PCC/8000, the control computer comes complete with general purpose software. Five basic models will be available. **Booth No. 223-SP**

The **Rust Corporation** will demonstrate its complete package of equipment to remote control and automatically log a VHF television station.

The entire package—Autolog ALD-1—is designed to operate via a single pair voice line or a microwave system utilizing the aural transmitter subchannel as a path from the transmitter to the control point.

Rust also will demonstrate its Digital Readout Remote Control. **Booth No. 214-SP**

Telesync Corporation will demonstrate their Retro-Reflective Front Screen Projection System. A 35mm slide is projected via a mirror onto a retro-reflective screen. The image is reflected directly back along the same axis to the TV camera.

Retro-reflection is the product of spherical glass beads imbedded in a reflective backing material. Light rays entering the sphere return at the same angle, thus, the brillance of the picture on the monitor.

Telesync also will show prompting equipment and their horizontal-vertical color effects crawl. **Booth No. 226-SP**

Scantlin Electronics, Inc., will display their CATV Videotype system, which is an electronic character-generator to convert digital signals into TV compatible video signals. This system generates NTSC sync and operates at color frequencies. Construction is solid-state and silicon integrated circuits are used. **Booth No. 511-S**

Broadcast Electronics will put together its largest exhibit in ten years and it will feature the new Spotmaster 500C and its automatic record preset and all plug-in silicon amplifiers as well as improved versions of the 400A tape cartridge systems.

On display also will be a second generation version of the Spotmaster Five Spot and Ten Spot multicartridge equipment designed for use in automated and semiautomated broadcasting.

Also shown will be the all solid-state remote amplifier, the RA-4CB, featuring turntable inputs, tape inputs, tone generator, for line level adjustments as well as four microphone input channels.

Another new BE unit is the model MRM-600, a mini plug-in recorder module that converts the models 605B and 610B series to a recorder-playback unit. **Booth No. 205-SP**

International Good Music will present two automated audio control systems for radio, taped music services, and information on IGM automated switchers for ETV and TV.

In operation will be the model 500 equipment system. It features music modules and music sequencer as well as random select carousels and an automatic program logger. The IGM 600 system with automatic logging verified from the cartridge, random select and reel-to-reel inputs will be demonstrated. **Booth No. 317-SP**

Broadcast Products Company will introduce their new AR-1000 series Broadcast Automation System, featuring a digital programmer capable of controlling 10 or more sources with provisions for automatic real-time news network joining.

Other new items will include an all solid-state 10 channel audio switcher control monitor unit, a programmable digital clock with nixie readouts and an automation production unit for recording 25 cycle cue tones with stereo program line filters.

The digital clock is reported to have an accuracy of two seconds per year and has complete programming control of individual time-insertion events. The new BPC integrated circuit will also be available. **Booth No. 531-S**

Switching On

Telemet will show its vertical interval switcher, the SS-140. Included will be a black burst generator colorizer and a mixing amplifier. Also on display will be the RLS-100 which has ten inputs and ten outputs in the basic matrix but can be extended 1000 by 1000 and is intended to replace patch panels.

The RLS-100 routing switcher features a fast lap time printed circuit relays that enable the unit to be used on the air as a production switcher. Plug-in type relays allow audio and video switching on the same relay. The unit can be expanded by adding modules. **Booth No. 217-SP**

Dynair Electronics will show its VS-121B-RS solid-state low cost switcher-fader. The device is designed for use in CATV local origination and ETV and broadcast studios. All control functions necessary for professional studio programming are included.

And this year Dynair has added a special effects generator to its mini series line. The unit offers corner inserts, horizontal and vertical split screen presentations and wipes. It is designed for use in closed circuit, educational and industrial applications.

Dynair will be giving away free its new 51-page book on video transmission techniques. **Booth No. 324-SP**

McCurdy will show its new audio and distribution switching system. Other new products of interest will include the McCurdy production intercom system and monitor and program amplifiers.

Also on display will be the new modular console for television audio production as well as standard mono and stereo consoles. **Booth No. 326-SP**

The **Grass Valley Group, Inc.** will present a complete line of video switching systems called the 1400 Series. Greater flexibility and a

New Equipment

wider range of prices than previously available Grass Valley equipment provide applications coverage with "off the shelf" designs.

A major item in the line is their new programmable master control switcher. This device features automatic fades. And factory installed options include the Auto Black system which eases the burden on the switcher operator during panic periods. **Booth No. 219-SP**

Trompeter Electronics will be displaying VHF and UHF switching matrices featuring a new stub cutoff design. Compatibility is maintained both in 50 and 75 ohm configurations.

Additional design features include switchable parallel output connectors that permit on-site expansion to any additional number of crosspoints without performance degradation or reduced RF switching capability. Remote control of the switching matrixes can be performed by lighted pushbutton panels, preprogrammed sources or automatic computer outputs. **Booth No. 508-S**

Microwave

Lenkurt Electric Company will exhibit a microwave system designed for long-haul transmission of television signals. Designated the Lenkurt 75B, the heterodyne repeater system is all solid-state except for the traveling wave tube and operates in the 6825 to 7125 MHz band.

The radio meets CCIR and NTSC requirements for both monochrome and color television and can accommodate a television signal of 625-line resolution.

Lenkurt also will show their 78B1 system designed to work in the studio-transmitter-link band (6825 to 7125 MHz) to carry a standard television signal and accompanying FM program channels. **Booth No. 507-S**

Raytheon will display the Dual Link 2A hot-standby television microwave equipment providing automatic transmitter switching and duplicated receiver protection for STL's. All solid-state, the 2A is a second generation addition to the KTR series.

The company also will show their KTR 3A long haul heterodyne microwave unit for transmitting up to 1800 FDM channels.

Other new Raytheon equipment will include the SSA-75 solid-state FM transmitter-receiver system capable of providing broadcast quality audio program channels in radio or cable television systems. **Booth No. 207-SP**

RHG Electronics Laboratory will unwrap their solid-state TV microwave systems which feature integrated, readily replaceable RF modules, plug-in printed circuit cards and key-lock unattended operation.

Known as the MRS-A series, these relay systems are available in FCC authorized bands, such as the 1990 to 2110 and 6875 to 7125 bands. Offering built-in ferrite isolators, the series also includes plug-in pre/de-emphasis and meets the EIA, CCIR and FCC standards. These systems are designed for rack mounted STL, remote TV pickup or inter-city relay. **Booth No. 544-S**

Lighting Up

Berkey-ColorTran will show its new Maxi-Brute 6, which is suited for studio or field applications that require long throws. Maxi-Brute operates directly from 120 volts AC/DC and accepts 1000 watt PAR 64 "quartz" lamps with color temperatures of 3200 and 3400 degree Kelvin in three beam spreads. Other quartz lamps are available.

In addition, the company will present their fresnel lens fixtures that are well ventilated and compact. Called the PUP, the unit features full focusing control and a positive locking device.

Other new equipment includes their new Anti-G adjustable hanger support that will take up to 80 pounds, a color media called Gelatran and the Lumiscope. The last unit uses a screen process system for use in color programming. It can be used to project films, pictures and illustrations on the screen and is not affected by ambient light. And even with a low power source projection system, bright and uniform pictures will be projected on the screen. **Booth No. 303-SP**

Kliegl Brothers will exhibit their Quartz Fresnel spotlight, the 44Q-10TVG. This instrument is designed to use Quartz-halogen CYX 2 KW lamps, which have a Kelvin temperature of 3200 degrees with an average life of 200 hours.

An interesting innovation in this unit's design is the focusing mechanism. Using an offset focusing action, the control levers are horizontally mounted at the front and rear of the unit. They move a full 90 degrees left to right, from full spot to full flood position. **Booth No. 101-SP**

Skirpan Electronics, Inc. will present their modular solid-state dimmers. These units have power capacities that range from 2 KW to 12 KW for electronic lighting control and relay rack mounting control panels. A special feature of these units is that they offer remote presetting and mastering of studio lighting.

Skirpan also offers modular dimmer racks, packaged control stations and control panels for rack mounting plus cycle programmers for display lighting. **Booth No. 569-S**

Sylvania Electric Products Inc. and their Lighting Products Division will be showing the Tungsten Halogen lamps designed for studio lighting. Sylvania also will display over 20 new types that have been introduced since the NAB convention in 1968. **Booth No. 500-S**

Towers

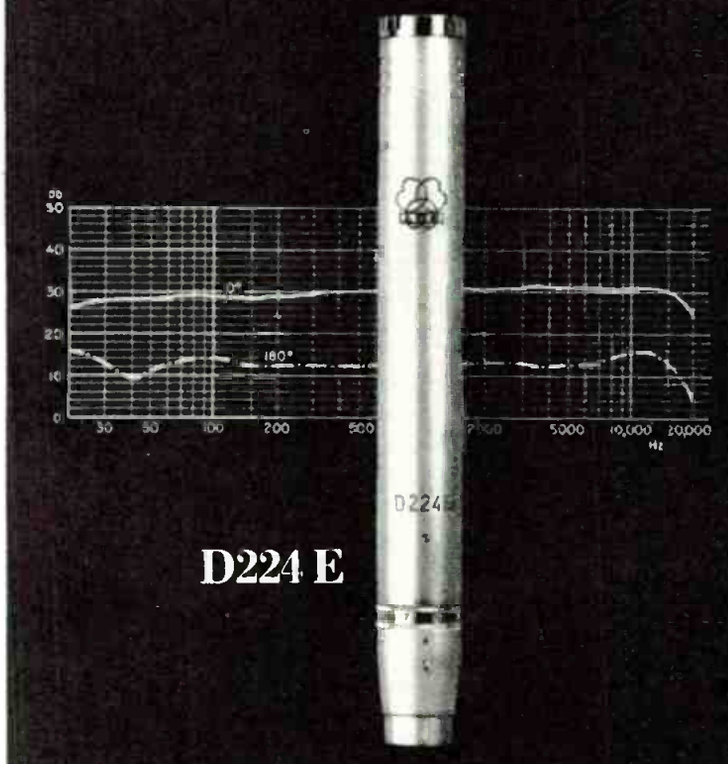
Ft. Worth Tower Company, Inc. will exhibit AM-FM-CATV- Microwave towers. Included in the exhibit will be passive reflectors and equipment buildings. **Booth No. 306-SP**

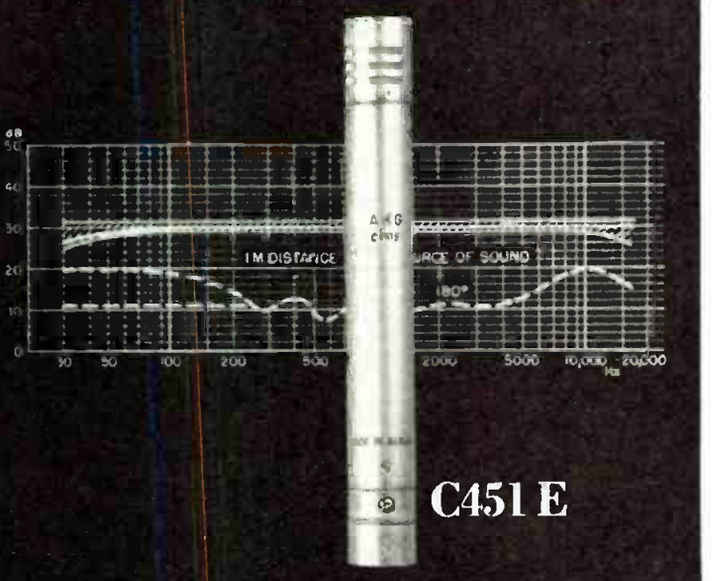
Transmitters

Collins Radio Company will offer the 831G-1 FM standard broadcast transmitter for the first time at the convention. The transmitter has a nominal output rating of 20,000 watts.

Also new at Collins is their Auto-Level Compression Amplifier and Peak Limiting Amplifier. They work together to provide automatic level control of program materials, per-

When your dynamics are this good... you have to make the best condensers





With the invention of two-way microphones **AKG** improved the quality of cardioid dynamic microphones drastically in many areas: *Flat frequency response* over the entire audible range. *Linear off-axis response:* 90° off-axis is reproduced as natural as 0° on-axis response. *Uniform front-to-back discrimination* of 20 db, even in the critical low frequency response and upper mid-range area. And in addition: *No proximity effect.*

In fact, the two-way microphones are out-performing some condenser microphones.

The next **AKG** step was the development of a new condenser microphone capsule. It consists of a gold-vapored *ceramic* electrode and a permanently mounted *metallic* alloy diaphragm. Both materials have the same expansion coefficient, thereby increasing the *longevity* of the capsule. In addition it is impervious to a wide range of temperature and humidity fluctuations, and it is free of deterioration and hysteresis.

The preamplifier of the C-451E requires 7.5v operating voltage, which is supplied via Phantom circuit. It permits central feeding via a two-conductor plus shield cable and *eliminates* the use of *power supplies.*

Of course, we also have AC and DC power supplies to operate the C-451E. Most important of all, it permits *interchanging of pick-up capsules* to CK-2 omni-directional, CK-6 variable pattern, and CK-9 shot gun (interference tube) attachment.

AKG-39

MICROPHONES • HEADPHONES

DISTRIBUTED BY
NORTH AMERICAN PHILIPS COMPANY, INC.
100 EAST 42nd STREET, NEW YORK, NEW YORK 10017

AKG CANADA • DIVISION OF DOUBLE DIAMOND ELECTRONICS • SCARBOROUGH, ONTARIO
Circle Item 14 on Tech Data Card

New Equipment

mit high average transmitter modulation, and minimize overmodulation. Both units employ the latest solid-state techniques.

Also new this year is the 212V-1 Broadcast Audio Console. All solid-state, the console has eight mixers and two metered program channels. And Collins rounds out their new equipment with the 900F-1 SCA monitor that is capable of monitoring and displaying the modulation characteristics and carrier frequency error of a 67KHz SCA subcarrier. **Booth No. 224-SP**

Marti Electronics will introduce their new all solid-state aural STL system. The system is specifically designed for AM broadcasting and is reported to meet or exceed all specifications required by the FCC.

Operating on an output power of 5 watts, the new system will be using field proven varactor diodes. And other new equipment scheduled for the Marti exhibit is their new 150 and 450 MHz remote pickup transmitters incorporating all solid-state audio circuits.

A new Marti solid-state limiter amplifier also will be on display. **Booth No. 300-SP**

Amplifiers, Generators

Sparta Electronic Corporation will display their model MAS-50 stereo amplifier. The MAS-50 offers peak power output of 50 watts per channel. Also new is the MAS-50Q, which is identical to the MAS-50 but incorporates a small cue amplifier.

The monaural version of this series, the MA-25 and MA-25Q, also will be shown. The MA series of monitor and cue amplifiers are offered in a standard rack panel. The Sparta complete line of audio equipment will be on display. **Booth No. 304-SP**

Applied Electro Mechanics, Inc. will exhibit the AEM-VKA-1 Keying Amplifier. The unit features Capacity for double reentry switching, titling by video insert, headlines and inserts, circuit identification by insert, and live backgrounds can be added to announcers with black or chroma keying.

The unit has dual isolated outputs and complete remote and local control on clipping level and internal-external keying. **Booth No. 540-S**

Listec Television Equipment Corporation will show a range of new distribution amplifiers, special effects generators and video test equipment. Also on display will be their lightweight camera, the random slide projector and the 16mm TV projector. **Booth No. 528-S**

Altec Lansing will have several new products to show. Among these will be their compressor amplifier that is all solid-state and is designed to operate in place of a booster amplifier. The 9477 power amplifier, rated at 100 watts, also will be shown.

Other new Altec Lansing equipment to be shown is their solid-state compressor amplifier, model 9473A. It is designed on the con-

cept of spectral separation. In addition, their new model 9300 console will be on display for the first time. It is of modular design, offering 28 inputs and 24 output channels. A new light type volume indicating device will be used in lieu of meters. The unit includes preamps, echo and cue facilities. **Booth No. 309-SP**

Rhode & Schwarz will exhibit their type SBTF TV channel signal generator, comprising two plug-in units—one for modulation and one for transmission. Also to be shown is the type SDFA TV signal generator, a new demodulator, an oscilloscope, and a TV Transposer Test Assembly. The test assembly includes a sweep generator, a receiver, and visual display unit. **Booth No. 525-S**

Belar Electronics Laboratory, Inc. will introduce their new RFA-1 RF Amplifier as well as a host of other new pieces. The TVM-1 Television Modulation Monitor will be on display, along with the AMM-1 AM frequency and modulation monitor, the MML-1 "Mod Minder," and a VPM-1 Peak Indicating Meter.

The Mod Minder is a new concept in automatic broadcast control. It features complete modulation level control. It controls the level of peak modulation at a preset value. The AMM-1 is designed especially for the AM broadcaster and features solid-state and flasher circuitry. The RFA-1 allows off-the-air monitoring. **Booth No. 562-S**

Cohu Electronics, Inc. will introduce the 2600 series background generator which provides a composite and/or non-composite video signal which is adjustable from mono-black through all shades of gray to white and all the colors of the NTSC color spectrum.

A remote control panel provides finger-tip selection of monochrome or color and the adjustment of hue, saturation and luminance. And the circuit module plugs into a frame that occupies a small vertical space in a standard 19-inch rack.

Cohu also will show their new sync generators of the 2600 series. These generators conform to FCC and EIA specifications. **Booth No. 552-S**

Camera Accessories

Boston Insulated Wire & Cable Co. will show their TV-81N miniature camera Cable designed for applications that require a light weight cable. It is compatible with the standard TV-81N cable since the configurations are identical.

Insertion loss of the miniature cable is reported to be two and a half to three times that of the standard TV-81N cable. And standard fittings are available which permit cable assemblies to be made with the TV-85C connectors and connect directly to existing cameras and cables. **Booth No. 314-SP**

Camera Accessories

Tele-Cine Inc. will show several new products headed by the Schneider 11 to 1 f/2.1 Varigon zoom lens for broadcast plumbicon color cameras. The lens are available for all broadcast color cameras.

Additional products on display new at Tele-Cine will be the model 5404 Tele-Tec programmer for editing on quadraplex video tape recorders. Also available will be the Tele-Log model 404 accessory that allows creative editing on quadraplex video to be done on kine. film or slant track video tape.

Video tape search and control equipment on display will include an automatic search and cueing unit with control search panel that allows preselecting of up to 10 spot cues on and video tape.

Another new piece will be their Sondor 16/35 mm magnetic sprocket recorder/reproducer designed for full interlock with any standard film camera, projector, distribution system, sync signal, video tape recorder, and other units. **Booth No. 542-S**

Power Optics, Inc. will display operating models of their servo driven sliding carriage assemblies for Angenieux 10 x 18 J1 f/2.2 Plumbican Zoom Lens/Norelco PC 60 and PC 70 broadcast cameras. Also included is a zoom rate control unit designed to replace the pan bar for standard panning heads, a shot box with focus control and a new air pedestal with provisions for optional addition of power assistance for elevation and servo control for camera height. **Booth No. 555-S**

Davis & Sanford will display their new ETVG-W tripod that is specifically designed for educational television and other CCTV installations. The tripod is made of aluminum and features accommodations for CCTV viewfinder cameras weighing less than 100 pounds. It is portable and can be folded without removing the wheels.

The unit has a gear driven elevator column that slides on nylon sleeves, and utilizes a self-locking gear mechanism that keeps the center post in position regardless of the weight on the tripod head. **Booth No. 527-S**

The Arriflex Corporation of America will exhibit several new products. Among these will be a precision tuning fork motor control for the Arriflex 16BL camera. Also, they will show the new behind-the-lens exposure control for this camera.

The exhibit also will feature the Arriflex Mark 11 amplifier, the 16BL tripod and a new offset viewfinder. **Booth No. 311-SP**

New Sounds

Gotham Audio Corporation will introduce the Neumann FET-80 series condenser microphones that feature "phantom" powering. One power supply serves up to 40 of these new mikes through existing mike outlets without wiring changes. Seven models of this series will be on display.

The new Gotham wall mounted loudspeaker system containing two 30-watt amplifiers will be shown. Also, they will show the EMT 970 Audio Delay Unit. which makes it possible to delay secondary audio frequency signals by given periods in relation to the primary signal.

Other new units include: EMT 156 PDM Compressor, ME 202B and ME 104 Wow and Flutter Meters, and the ME 301 Wave Analyzer. The ME 301 is fully transistorized and is suitable for vibration investigations in a range from 1 to 330 Hz. **Booth No. 310-SP**

Suburban Sound, Inc. will display several new electronic devices for the recording industry. Included will be a solid-state mixer, a re-mix module for use with 8 channel recorders to yield a mono two track monitor signal, and a retroflex 8 channel record/play electronics system for existing multi-channel recorders. **Booth No. 531-S**

Stanton will display their heavy duty model 500A stereo cartridge for constant handling applications. The 500AA and 500E also will be introduced. They are high compliance, low-mass styli types for applications that demand low tracking.

This group offers wide, flat frequency response and are available in either conical or elliptical stylus.

Stanton also will exhibit the 681 calibration standard series. The 681A is designed as a primary standard in system checkouts for linearity and equalization. The 681EE is designed for low distortion tracking with minimum stylus force, regardless of the velocity or the distance of the groove from the center. **Booth No. 574-S**

Johnson Electronics, Inc. will introduce their SCA multiplex transistorized equipment for the background music industry. Featured will be multiplex receivers, an educational demonstrator, audio amplifiers and an antenna preamplifier. **Booth No. 315-SP**

Other Equipment

Tracor will show equipment for television broadcasters that synchronizes multiple remote video sources to a master location. These remotes are both raster-locked and color phase-locked. This allows inserts, fades, and split screen operation.

Tracor television equipment permits any number of remotes to be locked to the master and requires only a single class D telephone line in addition to normal video link. **Booth No. 539-S**

Cooke Engineering Company will show their two new additions to their coaxial patching jack line. Copatch 2-2A is a double, non-normalling, terminating jack that will terminate two live standby equipments at a patch field where they will be immediately available in event of equipment failure.

The Copatch 2-2 is a non-terminating, non-normalling, double coaxial patch jack that may be used in trunk lines and with test equipment. **Booth No. 537-S**

Microwave Associates, Inc., Communications Equipment Division will display its new solid-state television relay and wireless microphone equipment.

Highlighting the exhibit will be the company's "B" line Fixed and Portable FM television relay systems for stable color television relay in STL, Dual STL, TSL and intercity applications. Microwave Associates' solid-state equipment is frequency stable with no klystrons to tweak and no high voltages.

In addition to the "B" line TV relay links, Microwave Associates will display its new PORTAMIKE™ subminiature solid-state FM wireless microwave transmitter. Designed for professional use, PORTAMIKE transmits the entire audible spectrum with high fidelity.

When Stanton engineers get together, they draw the line.

The frequency response curve of the new Stanton 681 Calibration Standard is virtually a straight line from 10-20,000 Hz.

That's a guarantee.

In addition, channel separation must be 35 dB or greater at 1,000 Hz. Output must be 0.8 mv/cm/sec minimum.

If a 681 doesn't match these specifications when first tested, it's meticulously adjusted until it does.

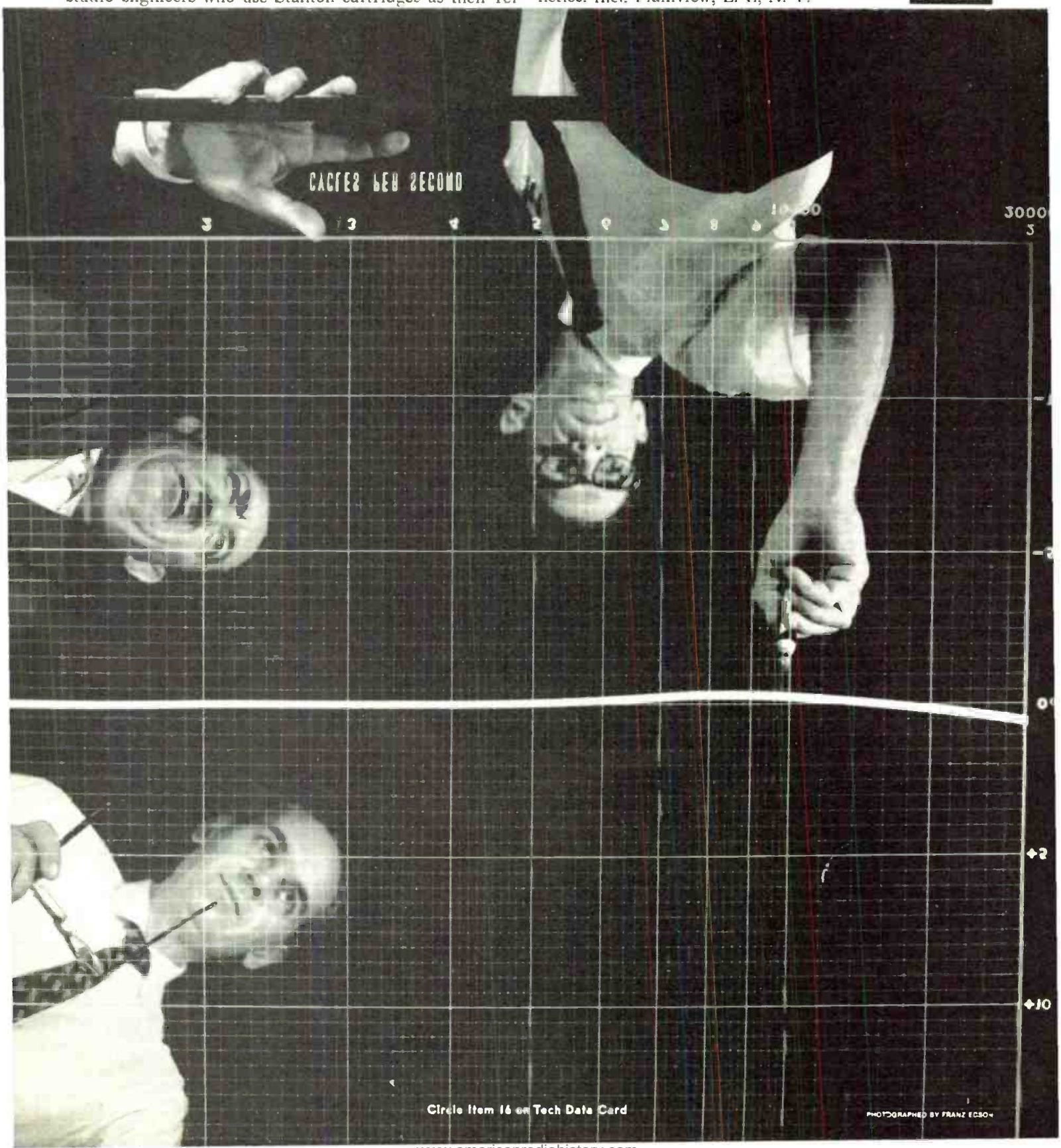
Each 681 includes hand-entered specifications that verify that your 681 matches the original laboratory standard in every respect.

Nothing less would meet the needs of the professional studio engineers who use Stanton cartridges as their reference to approve test pressings. They must hear exactly what has been cut into the grooves. No more. No less.

But you don't have to be a professional to hear the difference a Stanton 681 Calibration Standard will make, especially with the "Longhair" brush which provides the clean grooves so essential for clear reproduction. The improvement in performance is immediately audible, even to the unpracticed ear.

The 681 is completely new, from its slim-line configuration to the incredibly low-mass moving system. The 681A with conical stylus is $55.00, the 681EE with elliptical stylus, $60.00.

For free literature, write to Stanton Magnetics, Inc., Plainview, L. I., N. Y.



..100% transmitter redundancy... 100% transmitter standby...

Off-air time—even just when switching from main transmitter to standby—is one budget-spoiler that parallel operation can take care of once and for all. Our parallel VHF-TV's have been logged at 150,000 hours of combined operation—with less than 60 minutes off-air!

But that's only one of the budget advantages of parallel operation.

Consider initial cost. If you bought a 25KW main and a 25KW standby, you would invest about $279,000. Reduce the standby power to 12.5KW and you would still spend about $245,000. But a pair of RCA transmitters—parallel mains for 25KW—cost only about $237,000.

Consider day-to-day costs. In many areas, operating costs, maintenance costs, power costs, tube costs all drop markedly. (See new brochure for substantiating data)

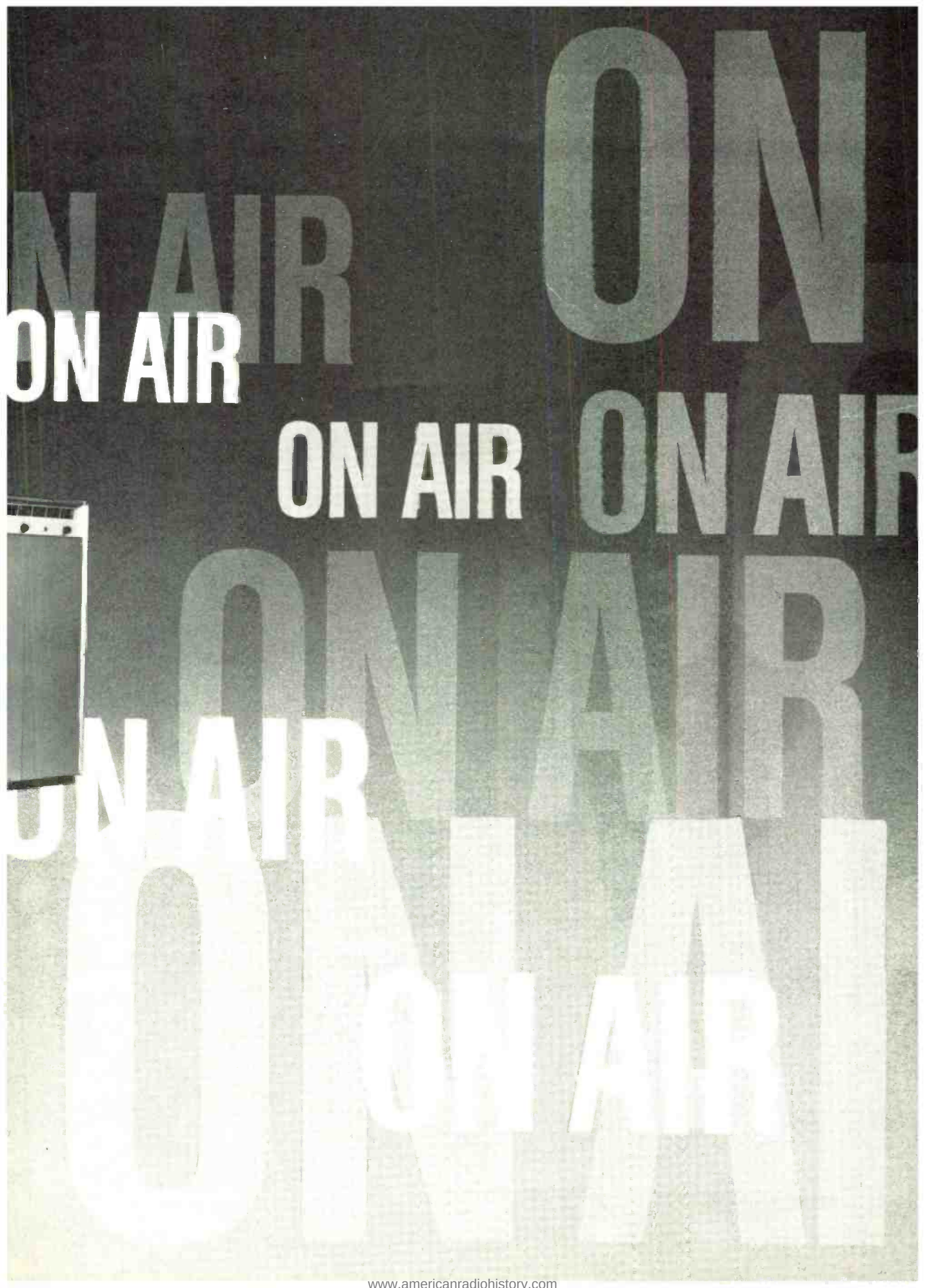
Consider performance. Parallel operation assures 100% redundancy for full-time dependability. By diplexing two transmitters you gain a standby "hot" exciter that is ready to go when needed. And, of course, with RCA transmitters you deliver superior monochrome and color pictures all the time.

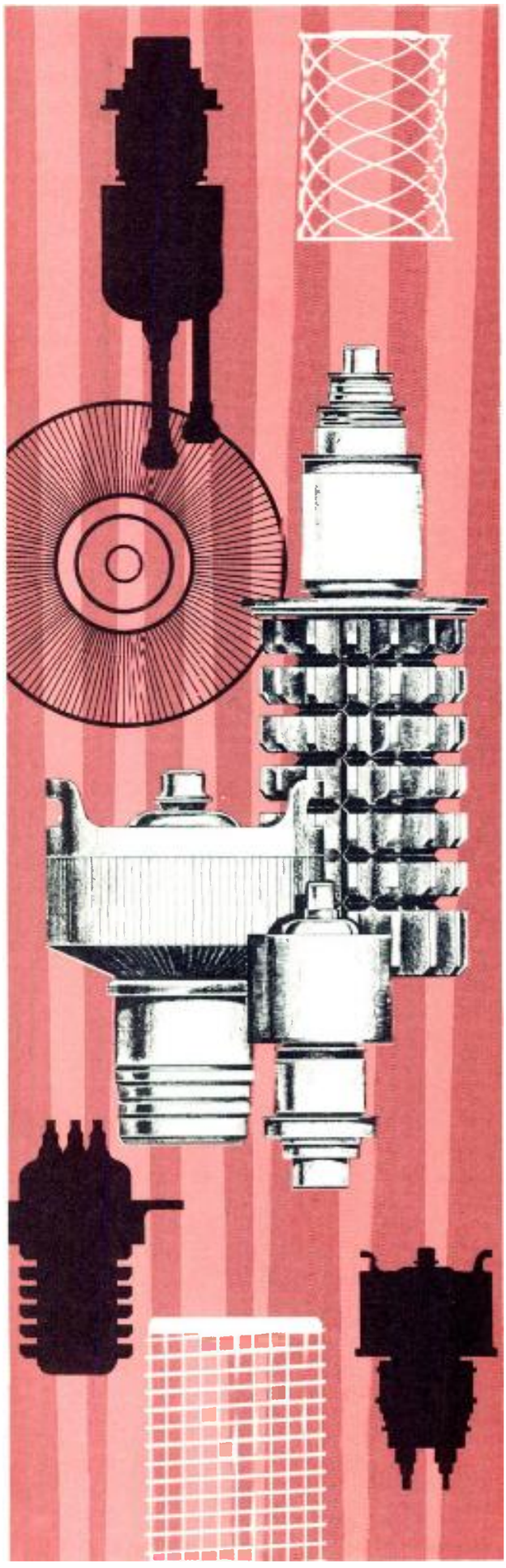
We've worked out a number of standard packages that meet most of the standard requirements. For low-band systems, we offer parallel 6KW, 12.5KW, or 15KW's. For high band, channels 7-13, we offer parallel 5KW, 12.5KW or 25KW systems.

As soon as you're ready for "paralleling" call your RCA Broadcast Representative. Or write for our new brochure to RCA Broadcast Equipment, Bldg. 15-5, Camden, N. J. 08102.

RCA

Broadcast Equipment





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Communications has been our business for almost fifty years. We understand what it means to run at reduced power when you lose a transmitting tube and we have what it takes to get you back to full power faster. What's more, mesh cathode construction and double vacuum processing used on all of our newer tube types is designed to keep you at full power longer.

A partial listing of the popular types of ITT tubes available appears below. Call or write for a complete catalog and the name of the nearest ITT Regional Tube Specialist. He's prepared to discuss ahead of time the means for delivering factory fresh tubes to you when you need them fast. ITT Electron Tube Division, P.O. Box 100, Easton, Pa. 18042. Telephone Area 215 252-7331.

F-6696A	F-7482	F-8550
F-6697A	F-8388	F-7007

8161/3CX2500A3	8242/3CW5000A3
8162/3CX3000F7	8251/3CX2500F3
8238/3CX3000A1	8169/4CX3000A
8239/3CX3000F1	8170/4CX5000A
8240/3CW5000A1	8171/4CX10,000D
8241/3CW5000F1	8281/4CX15,000

See ITT at NAB Booth 560 in the SHOREHAM

ELECTRON TUBE DIVISION ITT

Circle Item 17 on Tech Data Card

NAB Exhibit Listing and Booth Numbers

Don't get lost in the exhibit area or wander in circles for hours.

The following is a list of NAB exhibitors who had confirmed reservations for booth space by the **Broadcast Engineering** March issue deadline. Note that exhibitors' booth numbers are followed by the letter "S" for the Shoreham Hotel or an "SP" for the Sheraton Park Hotel.

A

Addressograph-Multigraph Corp.
Booth No. 522 — S
AEC Veritas
Booth No. 568 — S
Albion Optical Co.
Booth No. 320 — SP
Alford Mfg.
Booth No. 203 — SP
Alma Engineering
Booth No. 533 — S
American Electronic Labs
Booth No. 506 — S
Ampex Corp.
Booth No. 200 — SP
Ampex Storage
Booth No. 200A — SP
Anderson Labs
Booth No. 537 — S
Andrew Corp.
Booth No. 208 — SP
Angenieux Corp.
Booth No. 518 — S
Applied Electro Mechanics
Booth No. 540 — S
Arriflex Corp.
Booth No. 311 — SP
Audio Devices Inc.
Booth No. 501 — S

B

B&K Co.
Booth No. 543 — S
Ball Bros. Research Corp.
Booth No. 321 — SP
Bardwell and McAllister
Booth No. 566 — S
Belar Electronics
Booth No. 562 — S
Berkey Colortran
Booth No. 303 — SP
Boston Wire and Cable
Booth No. 314 — SP
Brand Rex Div.
Booth No. 559 — S
Broadcast Electronics
Booth No. 205 — SP
Broadcast Products
Booth No. 531 — S

C

CBS Labs
Booth No. 105 — SP
CCA Electronics Corp.
Booth No. 216 — SP
Central Dynamics-Videometrics, Inc.
Booth No. 517 — S
Century Lighting Co.
Booth No. 209 — SP
Cronolog Corp.
Booth No. 220 — SP
Cleveland Electronics, Inc.
Booth No. 212 — SP
Cohu Electronics
Booth No. 552 — S
Collins Radio
Booth No. 225 — SP
Conrac Div.
Booth No. 102 — SP
Continental Electronics Mfg. Co.
Booth No. 224 — SP
Craftsman
Booth No. 510 — S

D

Davis and Sanford Co.
Booth No. 527 — S
Delta Electronics
Booth No. 557 — S
Dresser Industries
Booth No. 313 — SP
Dynair Electronics Inc.
Booth No. 324 — SP

E

Eastman Kodak
Booth No. 526 — S
Eemcee
Booth No. 326 — SP
Effective Communications
Booth No. 327 — SP

F

Fairchild Recording
Booth No. 218 — SP
Filmline Corp.
Booth No. 573 — S
Ft. Worth Tower Co.
Booth No. 306 — SP
Front Projection Corp.
Booth No. 538 — S

G

Gates Radio Co.
Booth No. 213 — SP
Gauss Electro-Physics
Booth No. 550 — S
General Camera
Booth No. 541 — S
General Electric Co.
Booth No. 210 — SP
Gotham Audio Corp.
Booth No. 310 — SP
Grass Valley Group Inc.
Booth No. 219 — SP
Gray Research
Booth No. 563 — S

H

Harwald Co.
Booth No. 318 — SP
Houston Fearless Corp.
Booth No. 307 — SP

I

I.G.M.
Booth No. 317 — SP
International Video Corp.
Booth No. 530 — S
ITT Electronics
Booth No. 560 — S

J

Jamieson Film
Booth No. 572 — S
Jampro
Booth No. 305 — SP
Jerrold Corp.
Booth No. 510 — S
Johnson Electronics
Booth No. 315 — SP

K

Kahn Research
Booth No. 523 — S
Kaiser CATV
Booth No. 512 — S
Kalart
Booth No. 567 — S
Kliegl Bros.
Booth No. 101 — SP

L

Lenkurt Electronic
Booth No. 507 — S
Listec TV Equipment
Booth No. 528 — S
LTV Ling Altec
Booth No. 309 — SP

M

MaCarta Inc.
Booth No. 319 — SP
Marconi Instruments
Booth No. 534 — S
Marti Electronics
Booth No. 300 — SP
McCurdy Radio
Booth No. 325 — SP
McMartin Industries Inc.
Booth No. 211 — SP
Memorex Corp.
Booth No. 529 — S
Microwave Associates
Booth No. 502 — S
D. B. Milliken
Booth No. 553 — S
Minolta Corp.
Booth No. 545 — S
Mole-Richardson
Booth No. 556—S

Mosley Electronics
Booth No. 328 — SP
MVR Corp.
Booth No. 570 — S

N

Nippon-Columbia
Booth No. 547 — S
Norelco
Booth No. 223 — SP
Nortronics Co.
Booth No. 513 — S

O

Optical Coating Lab
Booth No. 532 — S

P

Paillard Inc.
Booth No. 546 — S
Phillips Broadcast Equipment
Booth No. 206 — SP
Power Optics
Booth No. 555 — S

Q

Quick-Set, Inc.
Booth No. 521 — S
Q-TV
Sales and Distributing
Booth No. 302 — SP

R

Raytheon Co.
Booth No. 207 — SP
RCA Broadcast Systems
Booth No. 100 — SP
RCA Components
Booth No. 104 — SP
R.H.G. Electronics
Booth No. 544 — S
Richmond Hill Labs
Booth No. 503 — S
Riker Video
Booth No. 215 — SP
Rohde and Schwarz
Booth No. 525 — S
Rohn Systems Inc.
Booth No. 308 — SP
Rust Corp. of America
Booth No. 214 — SP

S

Scantlin
Booth No. 511 — S
Schaefer Electronics
Booth No. 223 — SP
Scully Recording
Booth No. 565 — S
Seeburg
Booth No. 535 — S
Shibaden Corp.
Booth No. 323 — SP
Shure Bros.
Booth No. 301 — SP
Skirpan Electronics
Booth No. 569 — S
Sony Corp.
Booth No. 221 — SP
Sparta Electronics
Booth No. 304 — SP
Spindler and Sauppe Inc.
Booth No. 561 — S
Standard Electronics
Booth No. 312 — SP
Stanton Magnetic
Booth No. 574 — S
Stranger Assoc. (Bauer Elec.)
Booth No. 316 — SP
Swancor
Booth No. 515 — S
Sylvania
Booth No. 500 — S

T

Tapecaster TCM
Booth No. 520 — S
Tape-Athon
Booth No. 514 — S
Tektronix Inc.
Booth No. 201 — SP
Tele-Cine Inc.
Booth No. 542 — S
Telemation, Inc.
Booth No. 536 — S
Telemet
Booth No. 217 — SP
Telepro Industries
Booth No. 554 — S
Telesync Corp.
Booth No. 226 — SP
Telex Communications Div.
Booth No. 548 — S
3-M Company
Booth No. 106 — SP
Tracor Inc.
Booth No. 539 — S
Trompeter
Booth No. 508 — S

U

Utility Tower
Booth No. 204 — SP

V

Varian Associates
Booth No. 524 — S
Vega
Booth No. 212A — SP
Vikoa, Inc.
Booth No. 504 — S
Visual Electronics
Booth No. 103 — SP
Vital Industries Inc.
Booth No. 322 — SP

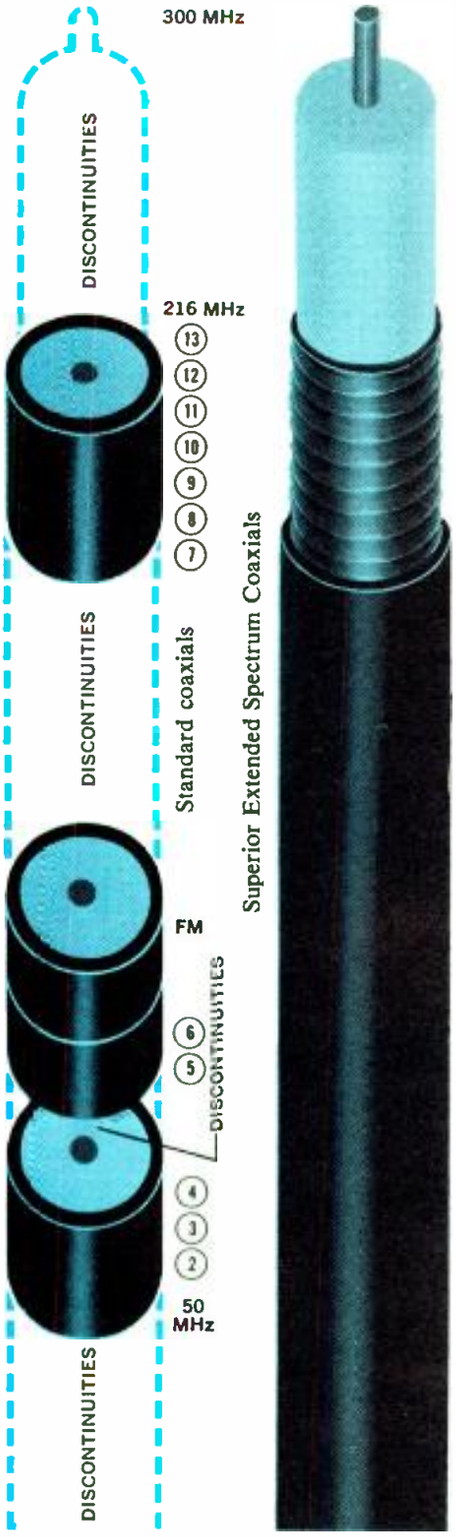
W

Ward Electronics
Booth No. 519 — S
Westel Co.
Booth No. 558 — S
Wilkinson Electronics
Booth No. 516 — S

Z

Zoomar TV
Booth No. 505 — S

Not enough megahertz hurts!



That's why the big switch is to Superior Continental's Extended Spectrum Coaxials. The extended-range coaxials with the extra 84 MHz at the top. And no discontinuities anywhere.

Don't cut yourself out of future revenues by installing just standard coaxials.

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SUPERIOR CONTINENTAL CORPORATION

Superior Continental's Extended Spectrum Coaxials provide continuous transmission to 300 MHz and beyond!

Circle Item 18 on Tech Data Card

The Stew In Homebrew

Switcher Tightens Quality Control

Panels removed from switcher control console, showing control logic (lower left), touch plate (center), and audio amplifier circuits at upper and lower right.

By Wayne Simister*

Instructional television is a complicated art. Complicated because of multiplicity of diverse operational tasks that need to be performed in short order, yet the product must be an art since nearly all programming is "homebrew." And if this weren't enough, it often must compete with its commercial counterpart for viewers.

Five years ago the University of Utah designed and put into operation an automated distribution switcher. But its success was not simply because it was automated.

The success or failure of the instructional television system is not necessarily gauged by the amount of equipment it can get installed and operating, but the ingenuity and effectiveness with which equipment and capability meets the needs of education. Typically, the good present-day educator has little time to re-adapt to the television medium. It is, rather, how well the television medium can adapt to the instructor and students. Experiments in instructor-director television[1] (the instructor switching cameras while at his teaching desk) have demonstrated tremendous potential for cutting instructor rehearsal time in the studio and bringing about unprecedented freedom to the studio situation.

The automated distribution system has demonstrated an ability to accurately and simultaneously distribute several programs. Valuable

*Supervisor, University of Utah, Instructional Television

student and instructor class time lost due to manual switching errors has been virtually eliminated. Tighter quality control, uniform spread of personnel work load, instantaneous response to last minute change because of machine failure or program change, and reduced work force are a few of the other advantages of the system.

Since the switcher "punches-up" both video and audio into and out of programs automatically, one operator easily handles all programming, cueing, and rewinding of videotapes. It has been observed that the busiest and most frantic moments are getting "in" and "out" of the programs. It requires split-second accuracy, and usually one person for each distribution channel position, especially if the patching method is utilized. With the automated switcher taking over this task, the operator is released for the more important job as overseer to assure quality and correctness. In his other duties, he is working on up-coming programs, rewinding videotape machines, and cueing-up programs. Since each block of programs can be preset to start up to one hour in advance, checks and double-checks are in order. Once set, the operator is cleared for the more important tasks that seem to come up at a program start, a time when "if anything can go wrong. . . it will".

The University operates almost four miles of television distribution cable. It has at this facility two experimental low power UHF television transmitters, several radio-frequency cable transmitters, and directly fed classrooms. University instructional programs as well as programs for two surrounding school districts are broadcast on the low power UHF transmitters. Already, plans are on the drawing board for microwave distribution, computer linkup, and connection to the state-wide VHF, KUED translator network.[2]

The automated switcher is a crossbar switcher operated by the campus bell system, clock timers, or dial access command. It has eighteen inputs, twelve of which are for videotape machine operation. Other inputs are for live studios, film chains, and an indentification slide channel. There are 15 output channels. With plans for the future as extensive as they are, this switcher probably will reach full capacity in less than one year.

Switcher Operation

The switcher automatically channels low background music into the distribution channels prior to program start. When the classroom bell rings, videotape records start, the music fades, and a switch to the program is made. At the conclusion of each program, the switcher will automatically return the distribution channel to an identification slide. If desired, a recorded identification or message of varying length can be made at the end of the program.

Not all programs are started from the school bell system. Where a different time schedule for playback is necessary, one of two clock timers or an external command source, such as a dial access, is employed.

Essentially, the switcher is programmed up to one hour in advance by two selector switches. One switch determines whether bell, clock, or external trigger is used. Another determines which input channel is to be selected for distribution. The one hour advance programming capability has proved to be adequate and, in fact, desirable, since variables such as tape machine breakdown would complicate programming if made much further in advance.

Motion picture films, like videotape machines, can be run directly and automatically into any channel without going through other program switchers. The video identification slide lamp is automatically turned on a few minutes prior to program release times; and various warning systems indicate proper operation of the UHF transmitters, failure of the background music, and program releases made by the switcher. It is not within the scope of this article to cover all of the circuits involved, but rather to discuss those which would be of general interest to the engineer and technician.

All circuits including audio and video amplifiers were fabricated by our own personnel to meet space requirements and needs of the switcher. All circuits are placed on plug-in boards for ease of maintenance. Whenever possible, boards were wired so that each is interchangeable. Duplicate boards in critical areas and two power supply assemblies are available.

In order to compromise between cost and reliability, as much logic and switching is performed by solid-state circuitry as is practical. Relays were incorporated in the crossbar portion of the switcher for economic reasons. Some 300 relays are required to switch audio, video, and indicator lamps. Had solid-state switching been employed, it would have cost three times as much. Other relays are used to control AC power.

Power Supply Assembly

Special note should be made regarding the interconnection of one supply to another. The 6.3 V.A.C. supply for indicator lamps connects to the —20 volt regulated supply on the —20 volt side. This allows the silicon controlled rectifier indicating lamp circuits to function properly. Such a circuit is shown in Figure 4. A separate supply is used for the capacitance touch-plate monitoring system. This supply is linked to the hot side of the AC line via a low amperage fuse and isolated from all other supplies and ground connections.

Tape Start And Program Generators

Several delay circuits precisely control different cycles within the switcher. One of these delays allows the videotape machine to stabilize after AC power is applied to the recorder. It was found that the Ampex VR660B has fully stabilized after fifteen seconds (See Figure 2).

A Schmidt trigger (Q2 and Q3) was used to minimize temperature drift. A —20 volt pulse causes Q1 to discharge the 1,000 ufd. capacitor. It is the re-charging of this capacitor through the 50K variable resistor that determines the correct delay.

A tape start pulse is immediately produced at the emitter of Q4. A 50 ufd. capacitor integrates the leading edge of this pulse to shorten the pulse duration. After fifteen seconds, the monostable multivibrator (consisting of Q5 and Q6) fires, producing a short pulse which later will be amplified and activate one of the crossbar relays. Thus this circuit develops a pulse first to start a videotape machine, then after a delay, develops a pulse to select that machine on the distribution channel. One circuit is used for the bell, each clock, and the external start circuit. The pulse outputs go into a selector switch so that each distribution channel can be activated by any particular pulse generator.

Bell Detector

The class change bell is detected by a twin-T filter in Figure 3 designed at a center frequency of 3,510 hertz. This signal is superimposed upon the AC line to ring bells on this campus. The signal is routed to the base of Q1. Q1 is biased slightly beyond its point of natural oscillation by means of R2. This 100K resistance value may have to be adjusted for individual gain characteristics of the transistor. Likewise, R1 should be selected to establish —10 volts at the collector.

When the bell signal is received, Q2 conducts on the positive half cycles, discharging C1 more rapidly than the 2700 ohm resistor in the collector circuit can charge the capacitor. This results in a DC pulse which will trigger the class change bistable multivibrator.

Class Change Bistable

The purpose of this bistable is to attain a division by two of the bell signals. The automation panel must distinguish between a class start bell and a class end bell. This circuit changes state each time the bell rings and produces a usable pulse only on every other bell. An indicator lamp switched on by a sensitive silicon controlled rectifier indicates which state the circuit is in and remains lighted during a class change. See Figure 4.

The trailing edge (positive going) pulse from the bell signal detector switches this circuit. This assures that the trigger occurs after the bell has ceased ringing. The negative pulse appearing at the collector of Q2 is used to fire the bell, tape start and program take generator.

Of special note will be capacitor C1 in this circuit. It prevents accidental triggering of the multivibrator by stray noise pulses sometimes developed by nearby AC switching transients.

VTR Start-Stop

A multivibrator similar to the one described for the class change bistable is incorporated for a pulse sensitive on-off switch to control AC power to the video tape machine. A relay in one leg of the bistable circuit performs the AC switching. Remotely situated pushbuttons alternately turn power off and on.

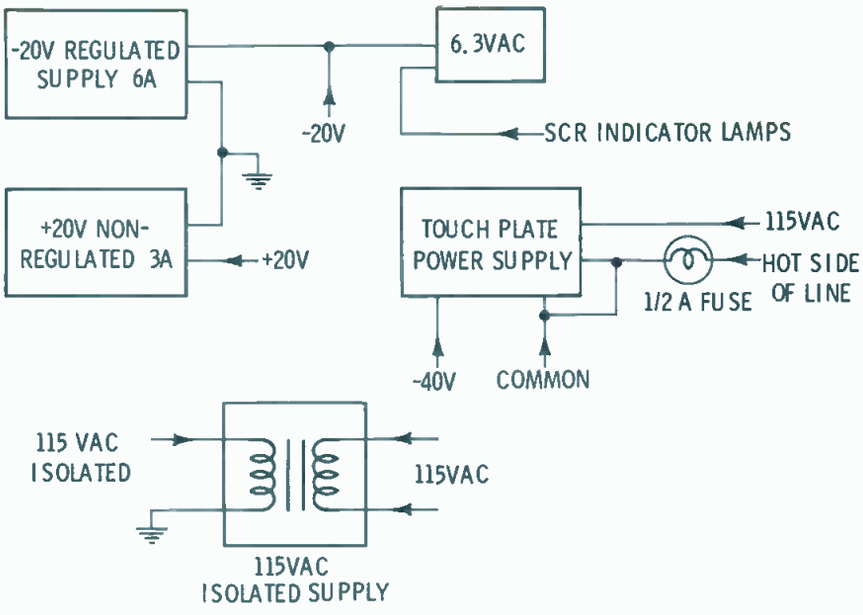

Fig. 1 Power supply configuration.

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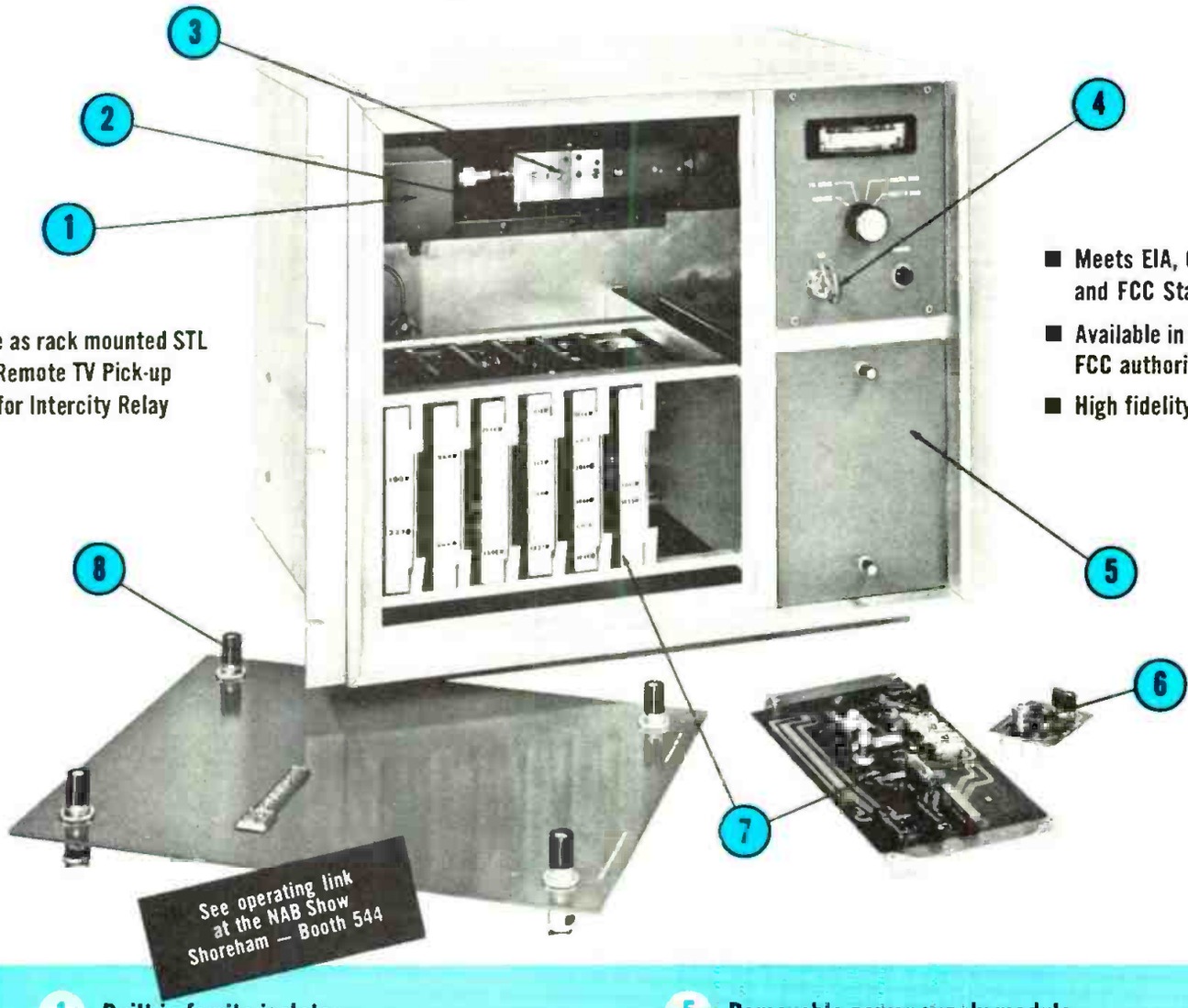

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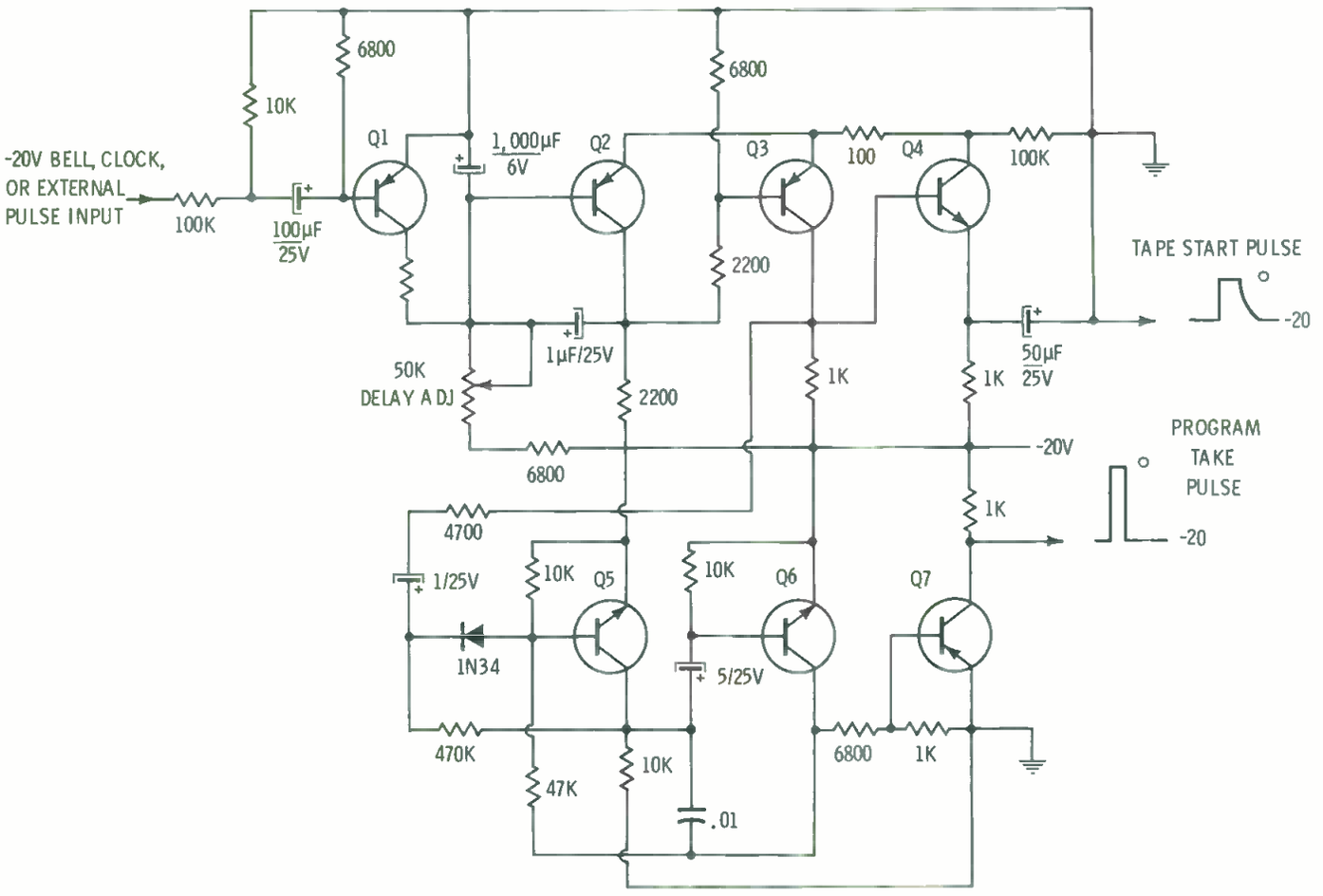

Fig. 2 Tape Start, program take delay and pulse generators.

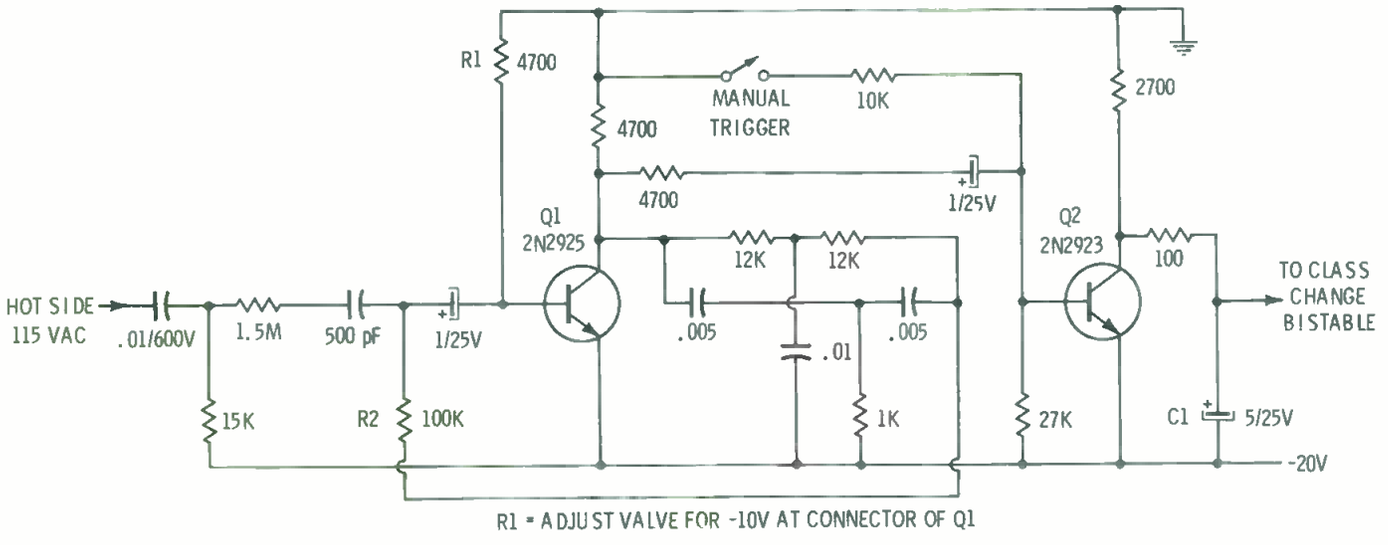

Fig. 3 Bell signal detector.

A positive pulse from the tape start and (Figure 5) program take generator also controls the turn-on of this circuit. There is no provision for turning off this circuit by automatic control since videotapes are rewound immediately after playback.

Sync Pulse Detector

The sync pulse detector provides a means for returning the distribution channel to an identification slide after a program is finished. Each program is produced with a complete drop-out of sync at the end of the program. This detector senses the loss of sync and develops a pulse which automatically selects an identification slide. Refer to Figure 6.

Q1 acts as a high frequency amplifier particularly sensitive to the 15.75 kilohertz sync pulses. Q2 changes this AC signal into a large DC pulse which is shaped and inverted by Q3. This pulse is directed to the identification channel relay amplifier to return the channel to an I.D. slide. This pulse is used to activate a warning signal circuit alerting the operator that a program has released from the switcher.

Output Channel Relays

The nature of this system requires that gap type relay switching be guaranteed. Any overlap of relay contacts as the new channel is selected up would cause a flash-through of video and audio information. In Figure 7, Q1 and Q2 form a circuit which is activated only when the previous relay has released. When the manual push-button is depressed, there is insufficient current to pull in the relay.

At the same time, the "take line" is now loaded heavily by the low impedance of the relay coil. This reduced current releases the previously held-in relay. It is at this

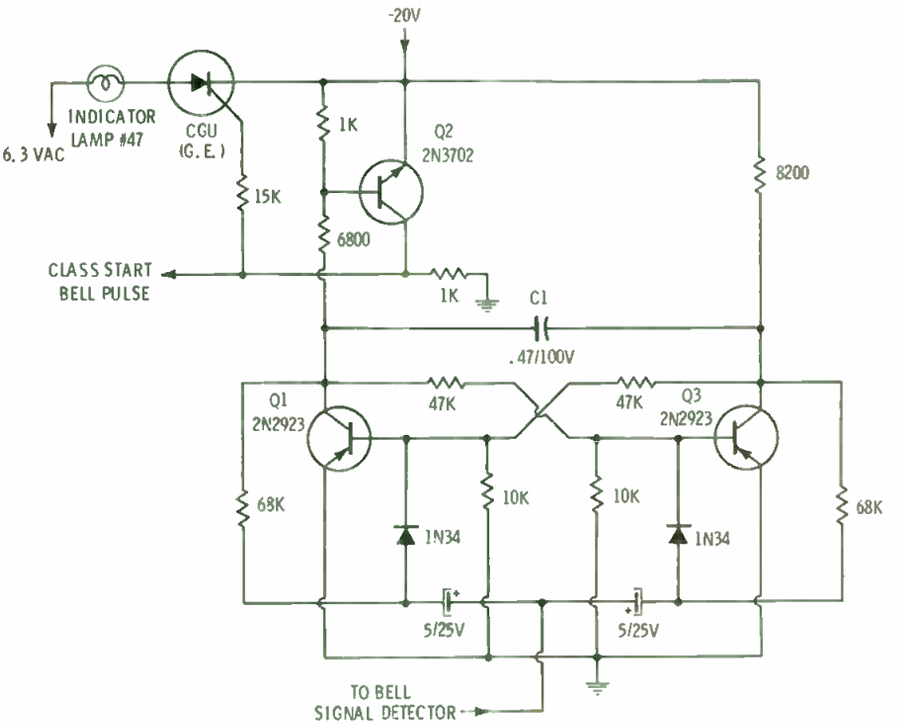

Fig. 4 Class change bistable.

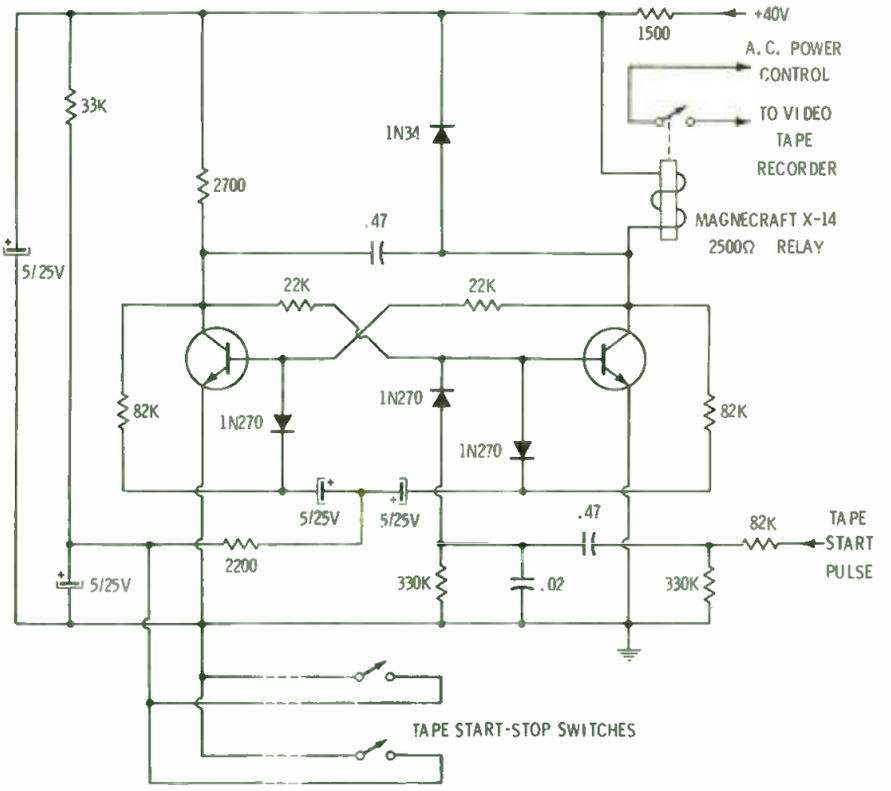

Fig. 5 Videotape machine start-stop.

time that the voltage on the "hold line" now increases, because the previously held-in relay no longer loads the "hold line". This voltage is now sufficient to exceed the break-over voltage of zener diode D1. Both Q2 and Q1 go into conduction paralleling resistor R1 across R3. This allows sufficient power to now pull in the newly selected relay. The new relay cannot, then, energize until the previous relay has released.

Q3 acts as an amplifier for the program take pulse; or in the case of the identification channel, the sync detector pulse. This transistor, in effect, takes the place of the pushbutton in the automatic mode of operation. Although not shown on this particular diagram, the emitter of Q3 may be run to a selector switch which then directs the transistor to the proper input channel relay. In this way, only one transistor is needed to activate any one of the relays within the distribution channel bank.

The indicator lamps for lighted pushbuttons share the same contacts as the "hold" contacts of the relay. The relay coil effectively shorts out the neon bulb when in the relaxed state. When energized, voltage flows to the lamp through the 100K resistor from the 115 V.A.C. supply. Please note that this is an isolated supply. See figure 1.

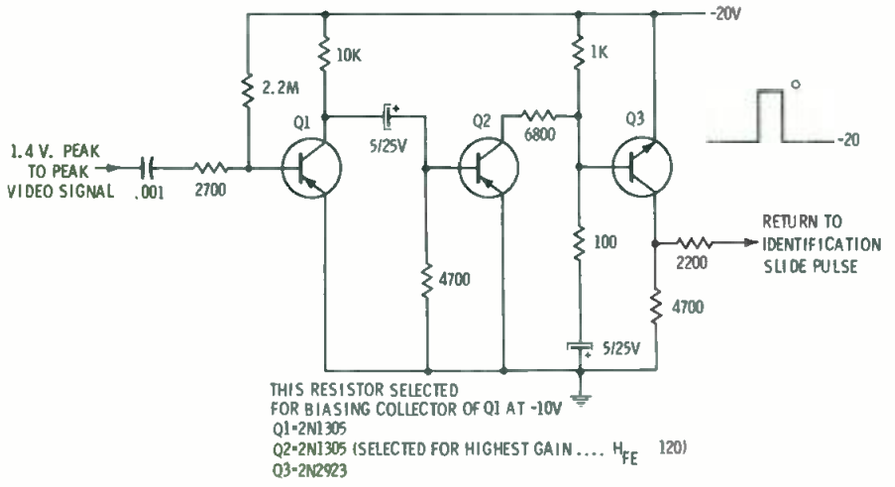

Fig. 6 Sync pulse detector.

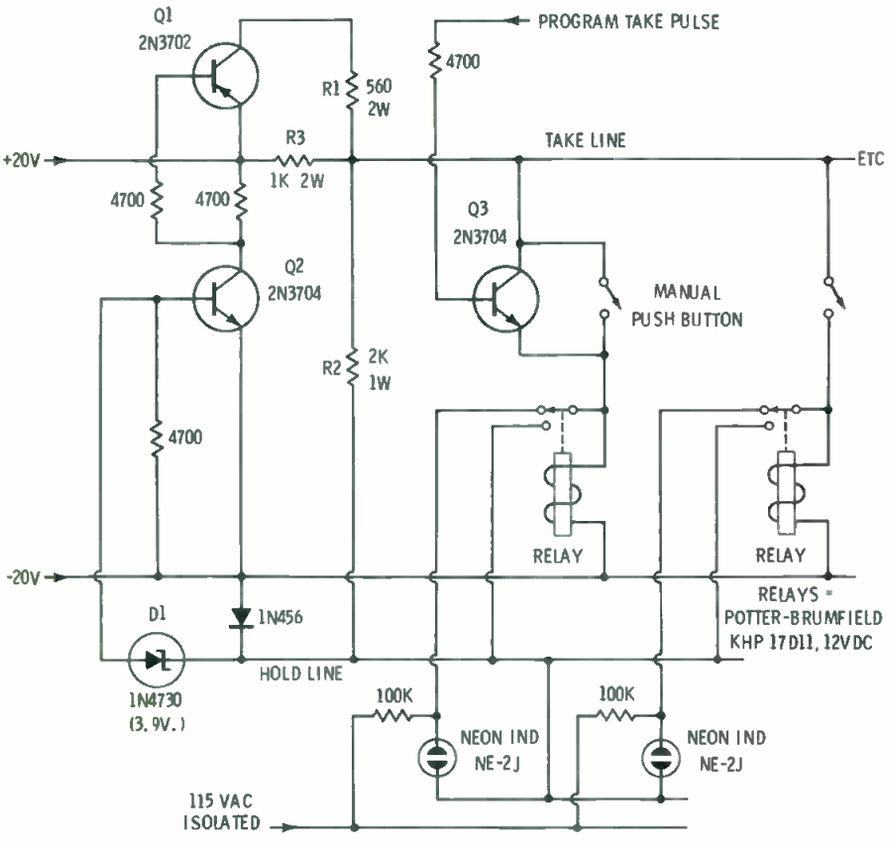

Fig. 7 Output channel relay schematic.

Touch Plate System

A capacitance touch plate system used to monitor the outputs of each channel is shown in Figure 8. In this way, audio level, video level, and quality of the signal from any channel can be selected and viewed quickly. Although novel, it is the most used part of the switcher and is truly an effortless switching system which can be tirelessly used for hours.

Unlike other touch plate systems, long control lines may be employed without additional circuits at each touch plate. Up to 100 feet of shielded cable will still give excellent sensitivity at all plates. It is important that an isolating capacitor be used at each plate location to

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prevent damage to the input transistor.

Amplified, in phase feedback along the shield of the control line from the emitter of Q4 is used to effectively cancel line capacitance and thus increase sensitivity at the touch plate. Q5 and Q3 act as pulse generators energizing the selected relay in the output channel. The operation of this bank of relays is identical to those described under "output channel relays." It is, however, important to note that the power supply polarity is opposite and the transistor types are different. This power supply is shown in Figure 1. If the hot side of the AC line is not connected to the supply as shown, poor sensitivity will result at the touch plates.

Audio Playback

Audio announcements are sometimes desired at the ending or beginning of a program. Provision is made to automatically play these announcements without special tape preparations such as tone signals or conductive tapes. A silence-sensing circuit was used so that ten second pauses could be left between each announcement. These individual audio segments will then play in sequence throughout the day to the channel so programmed . . .

A bistable multivibrator consisting of Q1 and Q2 can be manually controlled (Figure 9) by a momentary pushbutton switch or turned on by the sync detector or other pulse. When turned on (Q2 not conducting), the relay driver consisting of Q3 and Q4 energize the relay which applies AC power to the audio machine motor. Audio from the sound track is then amplified by Q5, rectified by D1, and drives field effect transistor Q7 out of conduction.

The resulting ground potential

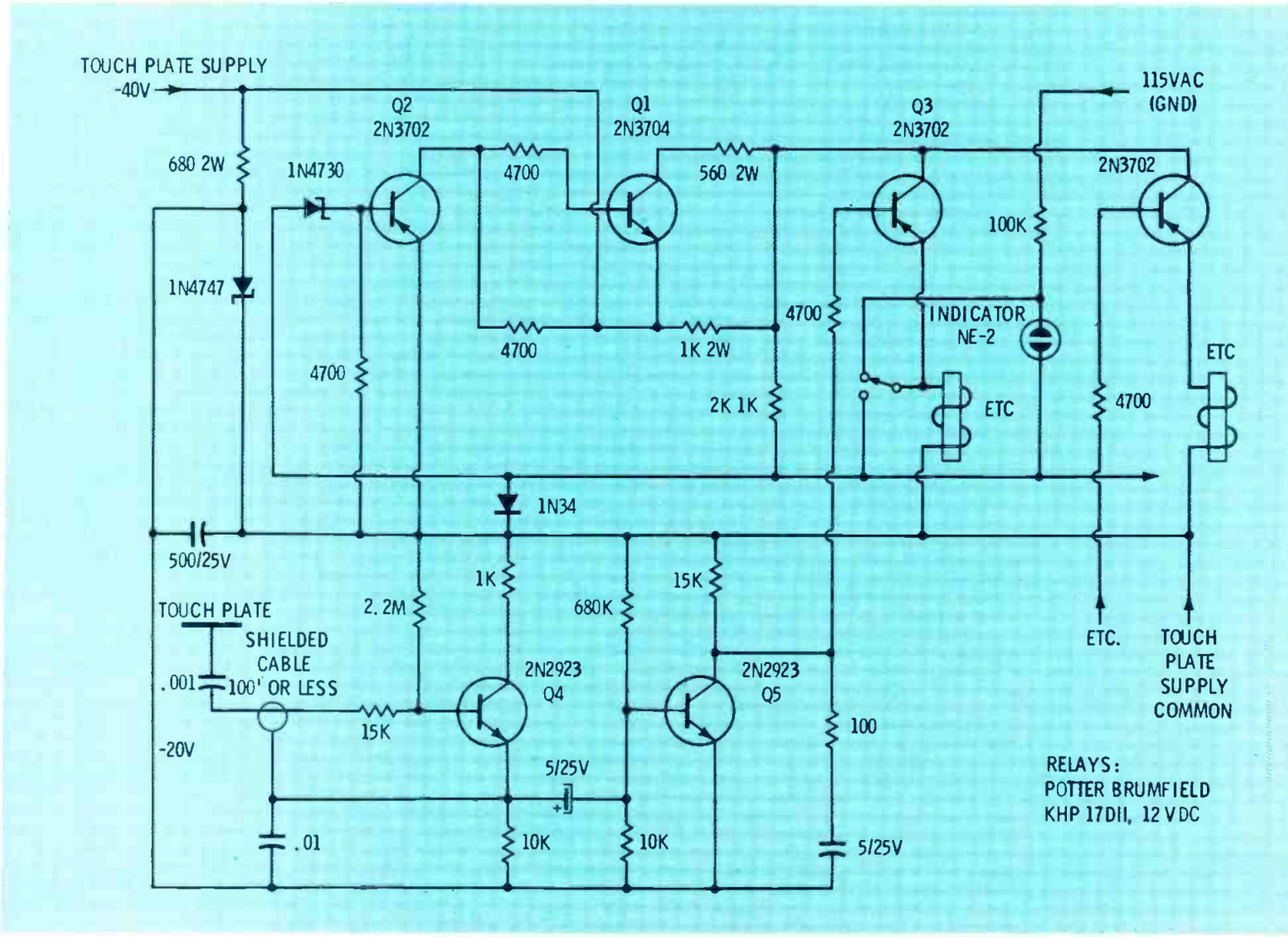

Fig. 8 Touch plate monitor system.

voltage does two things. It keeps the relay energized by maintaining conduction of Q3 and Q4; and, at the same time, grounds the base of Q2 via R1, causing Q2 to go into conduction. This turns off the bistable circuit, but the relay does not drop out until C1 has discharged sufficiently to allow the source voltage of the field effect transistor to return to about —20 volts. At this point, Q3 and Q4 no longer can conduct and the relay is de-energized. It is in this way that the motor of the tape player keeps running until the conclusion of the announcement and stops only after a five second pause.

The audio can be switched by one of the relay contacts or by electronic switching as was worked out in our case. In this way, background music can be switched back into the circuit after the audio message has played.

Selector Switches

Little attention has been given to this aspect. Choices will depend upon the needs of the facility. In general, provisions to disable certain circuits such as the sync detector are desirable. Remotely received programs often have sync dropouts which would otherwise release themselves from the switcher.

Each facility will have its individual personality. The use of UHF transmitters, one of which is programmed on a highly erratic schedule for two major school districts, relies heavily upon the timers, while the University generally follows the campus bell system. Both these cases are easily accommodated by the switcher.

Often six to seven videotape recorders are played through this automated switcher at one time. Each program is precisely handled by the automatic switcher from moment of start to final closing credits. The error rate in switching has virtually been eliminated by reason that checks and double-checks can be made in the unhurried moments.

Should all fifteen output channels be needed at one time, one operator can comfortably handle the load. Yet, whether there be one or fifteen different programs, the student is unaware of the mechanics.

1. See **NAEB Journal,** "Instructor-Directed Television" by Keith M. Engar and Dail Ogden, March-April, 1966.
2. See **Broadcast Engineering,** June, 1967, "The Utah ETV Network" by Dail Ogden and K. Dean Stephens

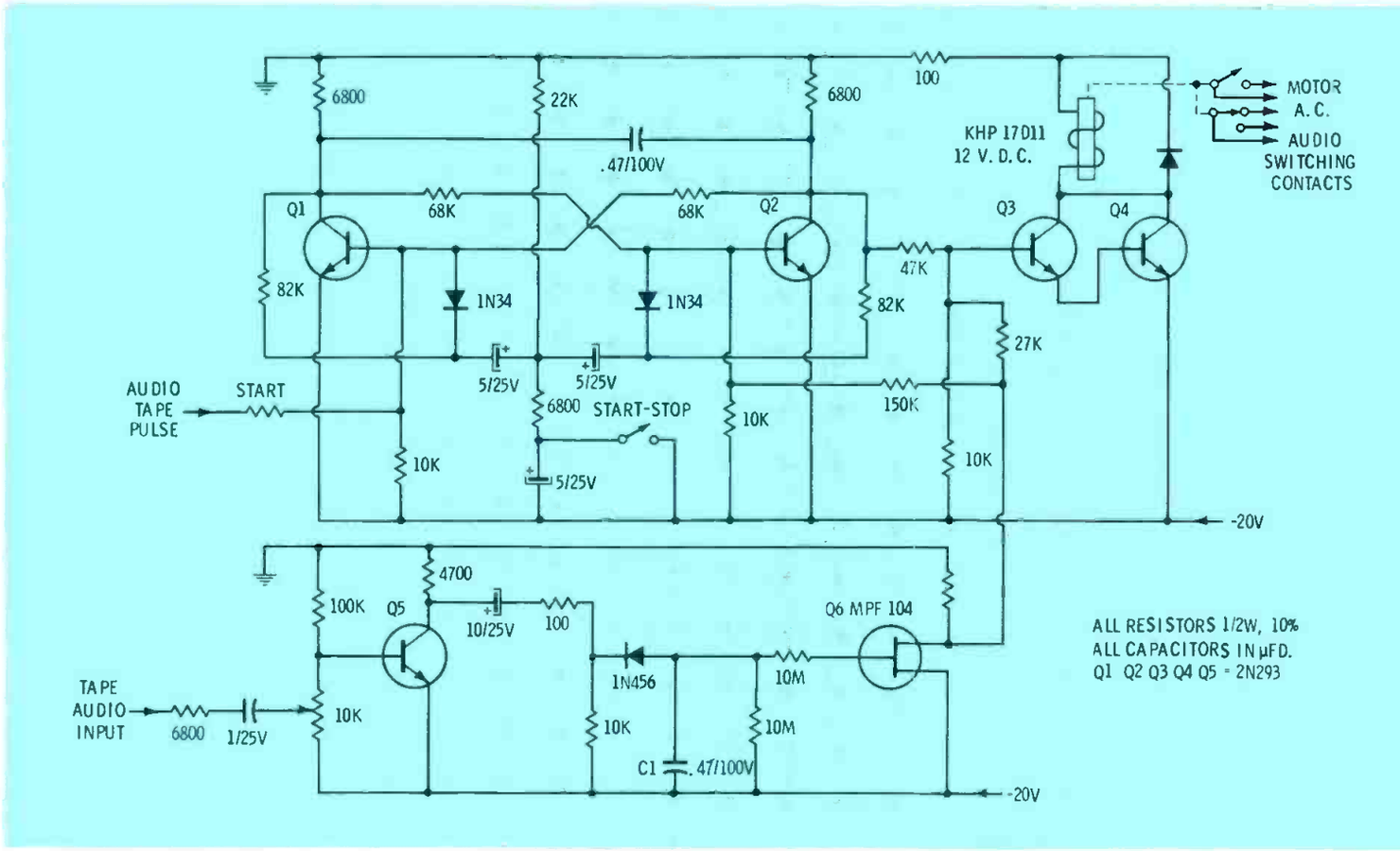

Fig. 9 Audio announcement playback.

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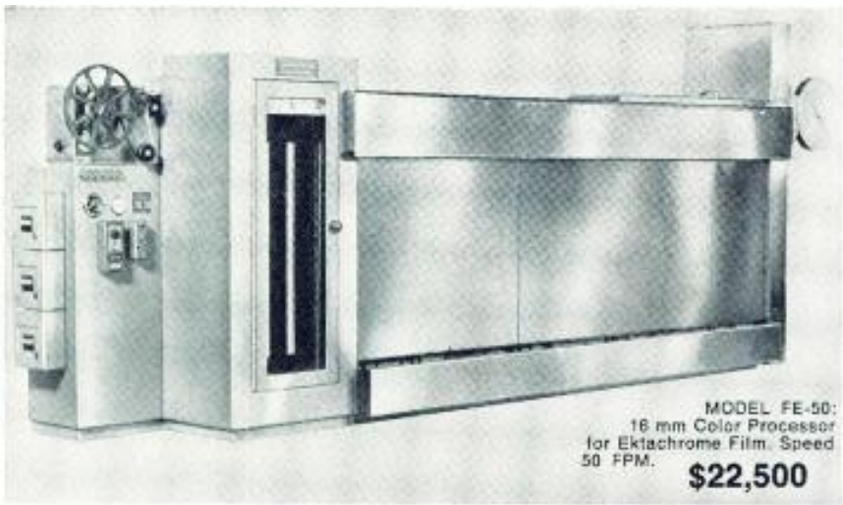

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Getting it on the air

SHIFTING TO STATION AUTOMATION

By Morris Courtright, Jr.*

A brief visit to the traffic and sales departments of a typical broadcast station and observation of the massive paper work throughout will create a sense of impending catastrophic failure in even the most casual system manager. Combined with those hectic moments that occasionally occur in the control room, spurred by the harried search for that seldom needed component and paced by the relentless march of the studio clock, the resultant operational environment bears close resemblance to an unrehearsed fire drill.

Small wonder that prime time is occasionally filled with a lengthy silence and the front office must devise another new way to explain technical difficulties to a skeptical customer. As a result, station management is blazing an ever widening path to the doors of friendly computer salesmen, energetic equipment manufacturers and ingenious engineers.

Tone-cued station automation equipment systems of a wide variety, ranging from home-brew projects to gleaming commercial products, have vastly eased the burden of "getting-it-on-the-air." Simultaneously, accounting machines, from expanded desk calculators, through punch card systems to digital computers, have assumed many of the mundane tasks of bookkeeping. Impressive solutions, and many times sophisticated equipment, but why haven't the "technical difficulties" and billing problems evaporated as expected?

In both cases the machines are completely dependent on the quality and timeliness of manual inputs. Rapid computation and automated customer billing are meaningless without complete, accurate spot logging.

Smooth airing of program material will not reduce the penalty of using yesterday's spot, nor will it mitigate FCC distaste for an unkempt, incomplete transmitter log. Dazzling claims and astounding computational feats serve only to confuse and compound a basic premise of any automated system: "Equipment usability and work quality are governed by the design of the man-machine interface." And the man-machine interface will not be satisfactory unless it is specifically designed to accomplish the tasks at hand.

The systems currently in use in broadcasting, while quite satisfactory for their intended tasks, are not always addressed to the basic problem of total station automation. The data processing system, usually a punch card or small digital computer system, is basically an accounting or bookkeeping tool. These systems were originally intended to solve record keeping and computational problems.

Any direct adaptation of such a system to perform station traffic or program control functions are a distortion of the basic man-machine interface design and consequently dilute total system effectiveness. As a corollary, station automation systems are designed to satisfy the interactive, analog-oriented nature of broadcast engineers. Any adaptation to perform a bookkeeping or logging function again diverges from the original man-machine interface philosophy.

If it is true that neither system is readily capable of complete station automation, the next obvious solution would seem to be a combination, or hybrid device. Even though digital computer people consider analog computers archaic machines and the analog computer people think digital computers operate in a world of binary fantasy, each

*Consulting Engineer, San Jose, California.

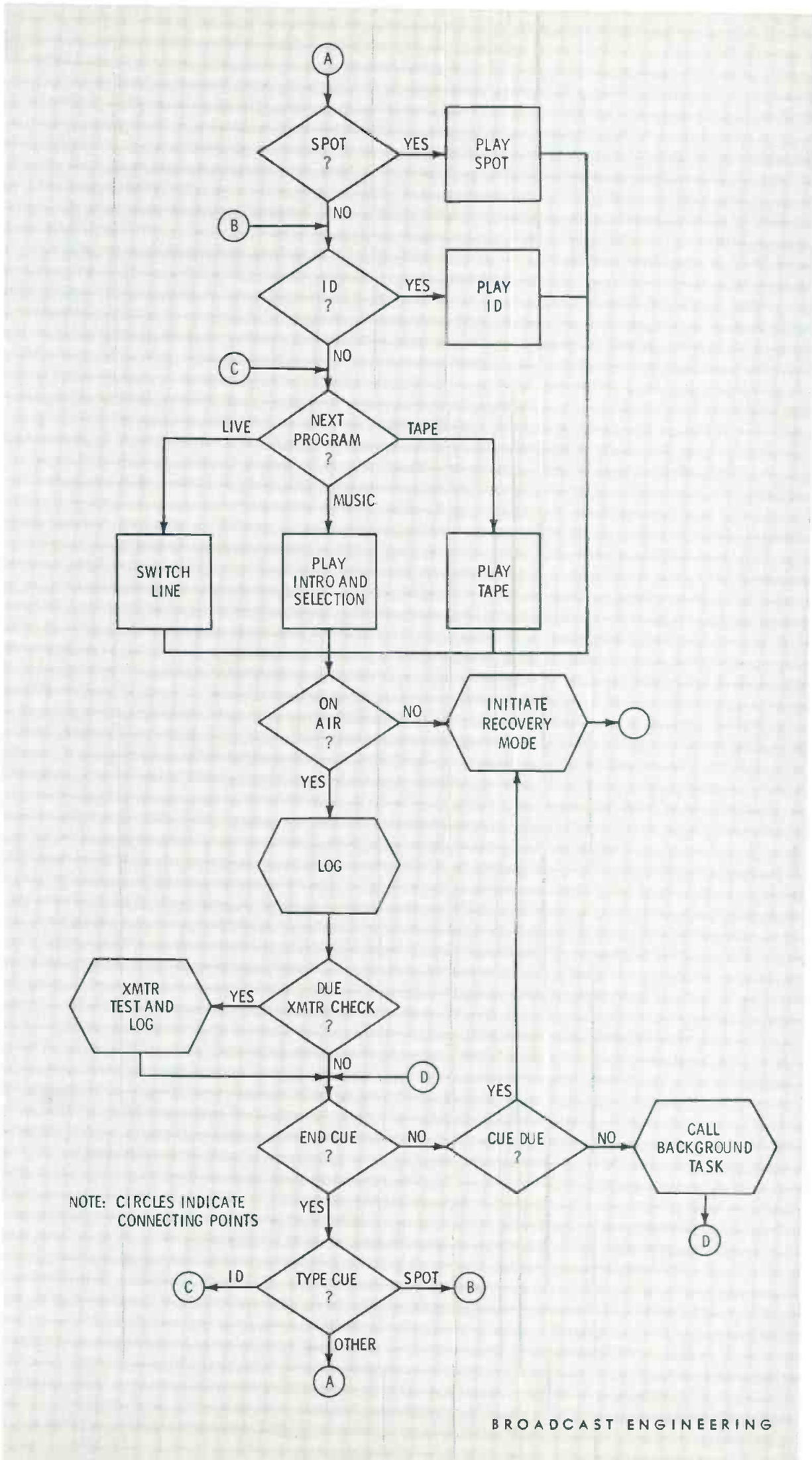


Fig. 1 Flow chart of typical program operation. Note that circles indicate connecting points.

type machine has its own unique advantage that can be applied to the task of total station operation.

The analog computer is of a continuous nature, producing an output based on a measured input such as temperature, rotation, voltage, pressure, etc. The digital computer, on the other hand, operates on discontinuous data or numbers expressed by electrical impulses. Either machine can be readily adapted to communicate with the other via digital-to-analog or analog-to-digital converters.

It can be readily seen, then, that the analog computer is the appropriate choice to perform the station operating parameter logging and control functions, while the digital computer is best utilized doing the switching, record keeping and accounting tasks associated with program material. The immediate thought is that this choice has already been made and such equipment is currently available. Which is entirely true. The needed quantity is system design: proper combination of the machines to produce a useable man-machine interface. To attempt such a design, the various sub-tasks of station operation must be considered. Basically these are:

1) Program Operation—traffic control, program management, station logs.
2) Equipment Operation—maintaining proper operating parameters.
3) Accounting—billing, payroll, sales reports, statistics, sales forecasts.
4) Stock Control—spare parts, equipment life, record library.

Program operation clearly lends itself to automation as demonstrated by the proliferation of systems based on tone or analog cueing. The addition of, or interface with digital equipment can provide a far more flexible decision-making process, limited only by the size of the data base available. Data base in this case might include music, intros, spots, IDs, PSAs, customer accounts, musical selection criteria, or any other desired operation parameter.

Typical flowcharts are shown in Figure one and two. Recall that the simplest of digital computers operates at millisecond speeds and that third generation equipment operates in nanoseconds, and the duration of the seemingly involved decision-making task is reduced to an eye-blink.

The decision is merely the beginning, however. While the chosen material is being aired, the computer produces an on-line log, updates the customer account, monitors equipment parameters, and has time to call up sub-routines for payroll computation, inventory control, sales reports, or a myriad of similar tasks. The laborious, manual clerical effort of transferring information from operating logs in account records can be eliminated, monthly billing cycles can be reduced to a few minutes and station records will be free of illegible, mysterious handwriting.

Equipment Failure

Maintaining specified equipment parameters and accurate logging at proper intervals is not only required, but trend analysis can be important in predicting possible equipment failures and establishing preventive maintenance cycles. Manual logging, subject to the usual human interpretation errors, is at best a glimpse of actual equipment operation. Automatic logging can furnish a continual record of operating parameters, periodic sampling of various critical values, a complete check of critical equipment points at specified intervals, or any combination thereof; all free of human environmental factors.

The computer also has the capability to go far beyond the task of logging, and actually control operation of the equipment. The software (computer programs) can include appropriate logic to adjust operating parameters to specified tolerances, note any adjustments made, set alarms or flags for engineering attention, and even shut down the transmitter if necessary.

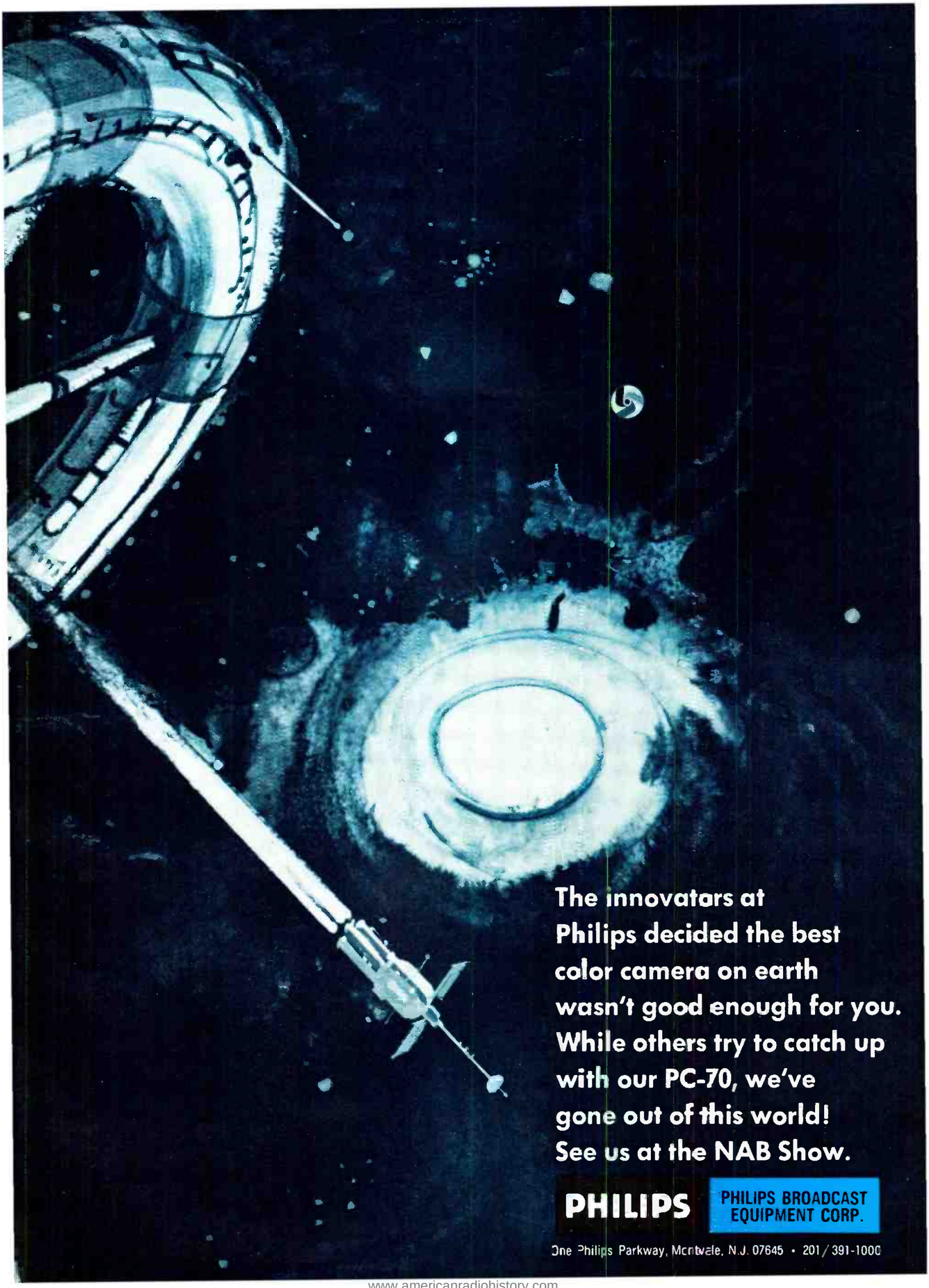
Certain manual actions are now required by FCC regulations, and will be for some time to come. Even though computer control and automatic logging can not entirely supplant these actions at this time, the on-line records can be effectively used to establish maintenance cycles and maximize equipment performance.

Accounting and bookkeeping are terms that usually elicit shudders of dismay from a harried station engineer, but are of prime importance to continued profitable operation of any station. Rather commonplace hardware and software can be furnished by many reputable computer manufacturers to compute payroll, perform various bookkeeping functions and in general assume most of the workload performed manually by a clerical staff.

Various report generating programs give management the flexibility of having accurate, real-time reports on station operation, account status, sales effectiveness, and other statistical summaries. The machine will generate accounts payable and receivable, create account statements, flag or pin-point problem areas for the attention of management, and in general assist the business and financial side of station operation.

Stock Control

Stock control is another common area of computer application. Parts levels to meet FCC and station requirements, record library content, and equipment inventories are established in the data base. Then as items are withdrawn or used, appro-



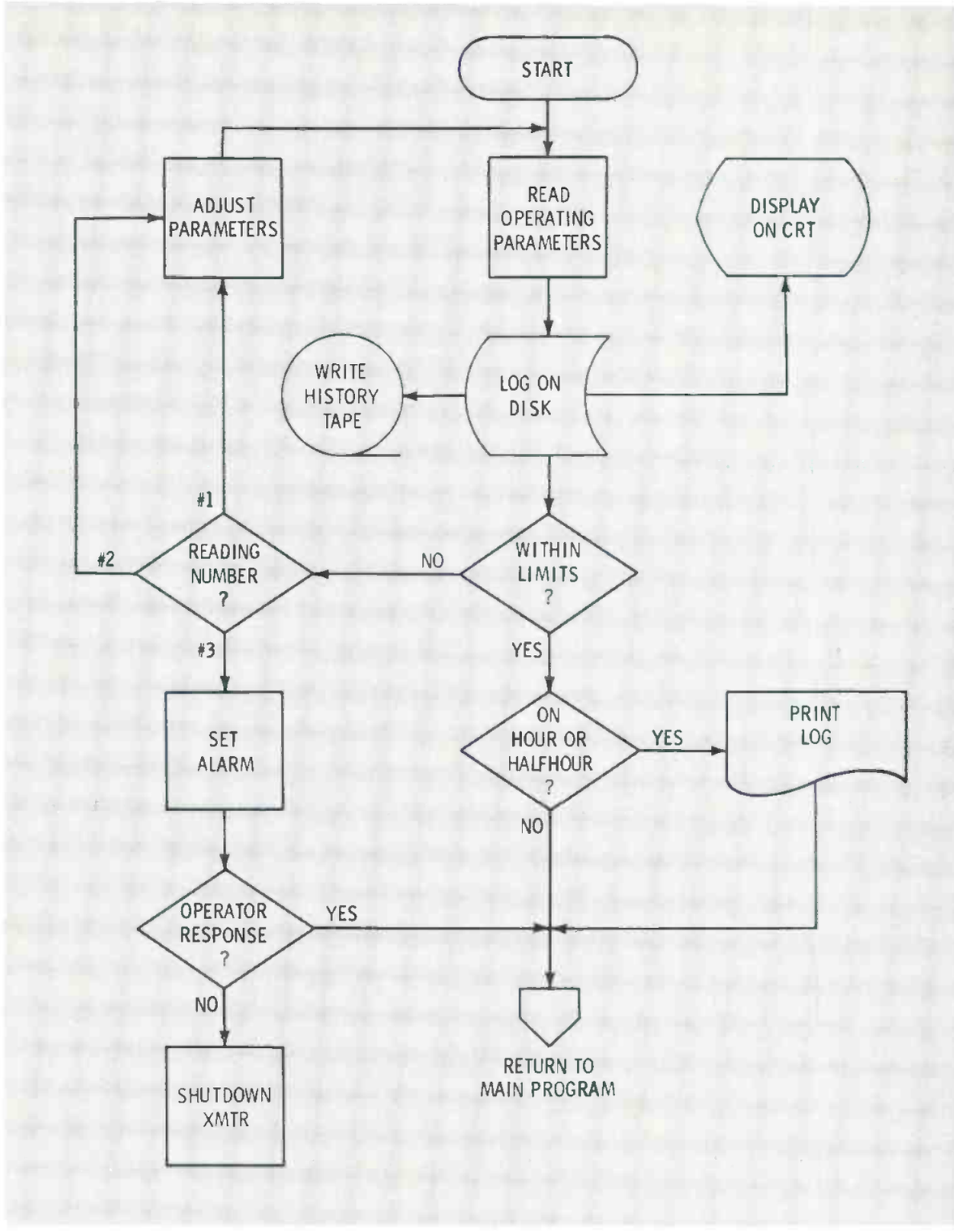


Fig. 2 Flow chart of transmitter check and log operation.

priate entries are made and the machine will produce life-cycle records of replaced components, create reorder lists, produce music repetition rates and monitor any desired stock level.

System Design

In spite of the seemingly astounding capabilities of computers, they cannot think. They can only perform those tasks and make those decisions for which they have been programmed. Thus we return to the basic premise: the need for system design to produce a useable man-machine interface in the broadcasting environment. In particular, the interface must be designed to meet the specific needs of the individual station concerned. Certain general considerations may apply to various classes of stations, but the actual hardware/software operating philosophy must differ according to the varying operating techniques employed at each broadcast station.

Figure three is a block diagram of a typical operating system. An on-line system, it is intended to provide continuous control and monitor of the total broadcast task. The computer master program or executive is resident in core, all sub-routines are on one of the tape units, account records and stock level information are on one of the disk units. The permanent operating log is recorded on the other tape unit, the second disk is used to maintain the real-time log and generate display information. Current logs are displayed on the CRT, printed logs, reports and statements are output on the printer, and operator instructions are input via the alphanumeric keyboard, the CRT light pen or the card reader.

In accordance with program format guidelines contained in the ex-

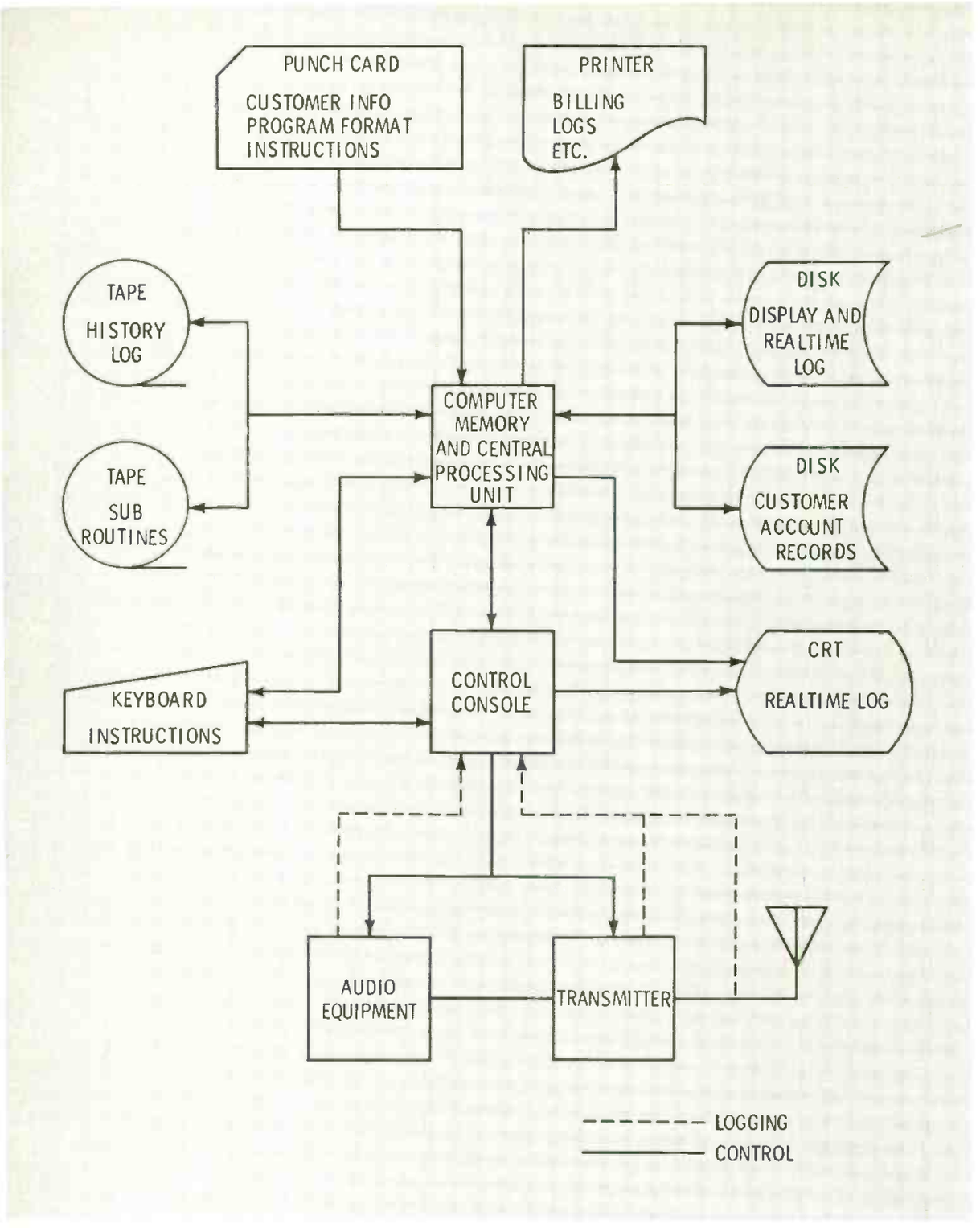


Fig. 3 Block diagram of a system providing on-line control of broadcast operation.

ecutive, various program sources are activated for transmission, and address or coding information verified to ascertain that the proper material is being broadcast. Simultaneously, a log entry is made which appears on the CRT display, is written on the permanent history tape for later printout, and is tallied on the customer account records. At specified intervals the transmitter operating parameters are also checked, logged on tape, and displayed on the CRT.

If adjustments are required, these are made and also logged. The executive then checks to see what time is available before the next real-time task is due and calls in one of the sub-routines to perform bookkeeping, report generation or similar non-real-time tasks. A priority interrupt system must be employed to insure that an operator entry or real-time task requirement will override the background tasks. Reports of maintenance performed, stock level changes, customer account changes, library index changes and so on are input via the card reader or the keyboard and handled as a background task as time is available. Recall again the operational speed of computers and it can be seen that many such entries can be made and computations performed in the time it takes for one musical selection.

The choice is yours. Routine or complex, simple or sophisticated, machines are ready to take over as many of the tasks of broadcasting as you care to give them. The use of computers and automated equipment for the routine functions of station operation can free some on the staff to perform more creative and profitable endeavors, and provide a timely, accurate analysis of both technical and financial aspects of station operation.

BUILDING TRANSISTOR AUDIO CIRCUITS

Part 5 of 6-part series

By Norman Crowhurst

As a note on the versatility of transistors for extempore audio work, one example occurred during a recent election year. A candidate wanted some taped interviews made in a hurry, by telephone, and I didn't have any kind of beeper handy to make the taping legal. I had only a few hours' notice—not enough time to get a beeper delivered.

Timed Beeps

So I set about to string together a circuit that might work. First I ascertained the FCC specifications for the beep. The tone should be 1,400 Hz, ± 10%. The beep should be 15 seconds, ± 3 seconds.

With transistors, I figured this would take just two multivibrators: one to generate the tone, and the other to generate the asymmetrical intervals; also a rectangular wave with an 'up' time of 0.2 second and a 'down' time of 15 seconds. The tone generator could itself be the collector load of one unit of the time interval generator transistors (Fig. 5-1).

The most difficult part would be getting the time intervals correct, so I worked on that part first. I could observe the intervals with a voltmeter (Fig. 5-2) and stop-watch. If I used electrolytics of 50 mfd and 500 mfd, with identical resistors, I should get a time ratio of 10:1. The ratio I needed was 75:1. The remaining 7.5:1 ratio should be possible by using asymmetrical resistors.

A 15 second time interval, using a 50 mfd capacitor, should require about 5.6K. This is based on base being biased to non-conduction by a voltage equal to supply voltage in each case, so the time between cut-off and cut-on is 0.7 times the calculated time constant. Thus, 500 mfd with 42K gives a time constant of 21 seconds, 0.7 of which is 14.7 seconds; and 50 mfd with 5.6K gives a time constant of 0.28 second, 0.7 of which is 0.196 second.

The bias resistor feeding the right transistor, that is cut off most of the time, could be more than the active gain times the value of that transistor's collector resistor. But the left one that is conducting most of the time must be capable of maintaining saturation in that transistor.

The latter transistor has its base coupled by the 50 mfd with about 5.6K. A transistor with better than 20 current gain could use a collector load of 330 ohms with a fair mar-

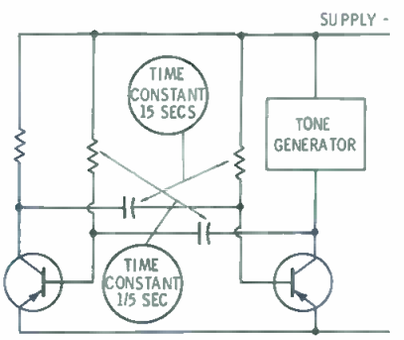


Fig. 5-1. The basic concept of the beeper developed here.

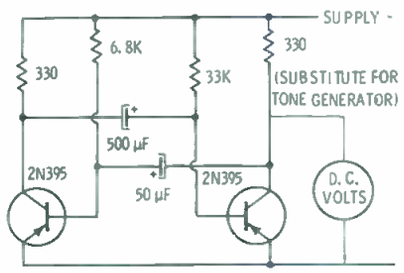


Fig. 5-2. Developing the timer generator for the beeper.

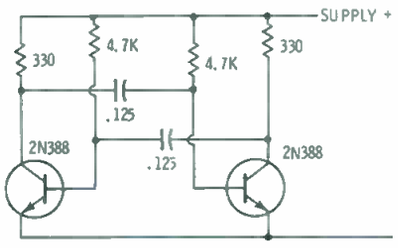


Fig. 5-3. The tone generator for the beeper.

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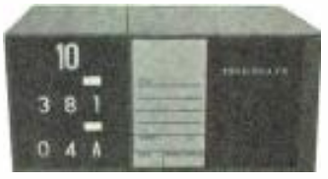

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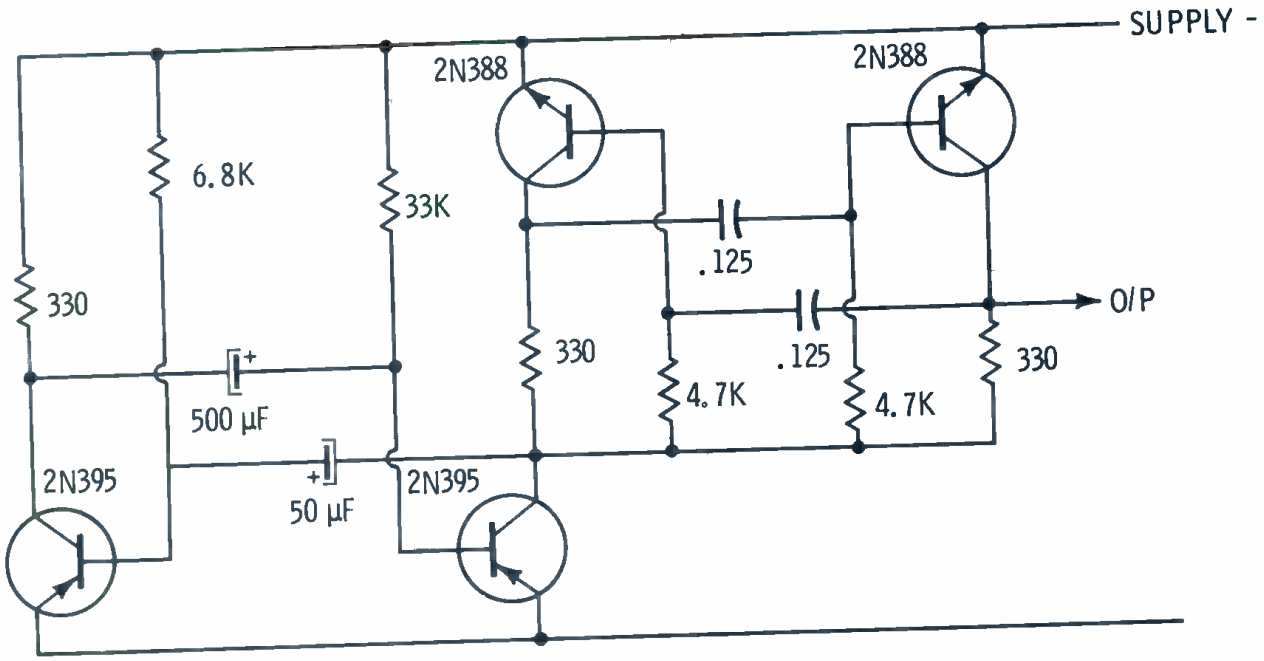

Fig. 5-4. Putting the tone generator into the timer circuit.

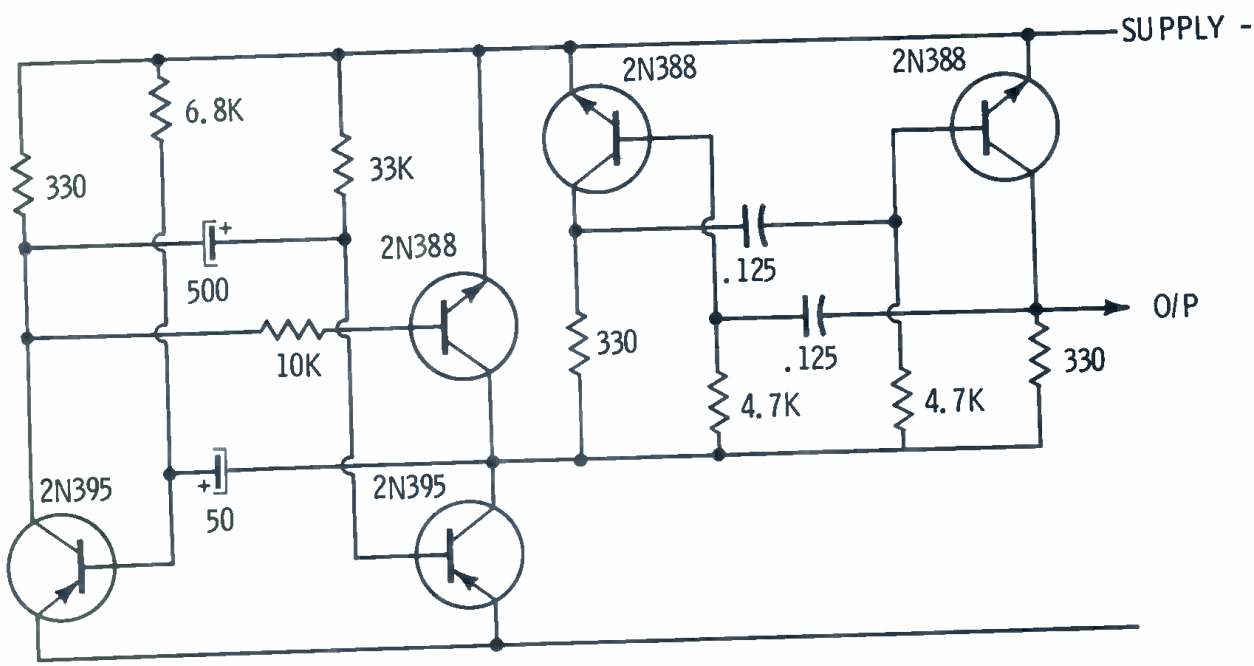

Fig. 5-5. The extra transistor to get rid of the squealing pig effect.

gin. So both transistors should be able to use collector resistors or loads of 330 ohms. I set this circuit up, and found it a good starting point.

The interval intended to be 15 seconds was off, being almost 20 seconds. The 1/5th second interval was closer.

The 42K to 33K resistors were changed, which corrected the 20 second interval to 15 seconds. Now the short interval seemed a little too short. Changing the 5.6K to 6.8K corrected this. The only thing I could not be quite certain of was how steady the voltage would be during the respective periods. Would the tone 'wow' due to its supply voltage fluctuating during the on or off periods?

The voltmeter clearly indicated the initiation of switching, each way, but the needle movement wasn't quick enough to follow the change and show whether it settled down to a steady voltage immediately after each change.

Time Constants

At this point, we may check all the relevant time constants. If our calculations hadn't come so close, we'd have had to do that to find why, and to work out a way of correcting it. The 15 second interval is set by the 33K and 500 mfd. The recharge for this is 330 ohms (left transistor collector resistor) which gives 0.15 second.

The fact that the 500 mfd will not fully charge during the 0.2 second interval explains the greater adjustment needed to the theoretical 42K than to the theoretical 5.6K.

The 0.2 second interval is set by the 6.8K and 50 mfd. Its charge uses 330 ohms also, with a time constant of about 16.5 milliseconds. In 15 seconds this capacitor is certainly fully charged!

The next step was to make a tone generator, using collector loads of 330 ohms for each transistor. As each conducts for only half the multivibrator period, this will make a steady load of 330 ohms, one at a time, as resistor for the timing multivibrator collector. Bias resistors of from 4K to 6K should serve to provide a stable oscillator.

I'd used pnp transistors for the timer (2N395 type). So I used npn types for the generator (2N388 type). An important feature in any transistor used for a multivibrator or similar function is that the emitter-base contact is rated for a high reverse voltage. This is why 2N395s are used. 2N323s have a higher gain, but a lower base-to-emitter reverse-voltage rating.

Now I needed to tune the tone generator to 1,400 Hz. This frequency corresponds to a period of 715 microseconds, or a half-period of 358 microseconds. The time constant should be 358/0.7 = 513 microseconds. Using resistors of 4.7K in each base, the capacitors would need to be a little over 0.1 mfd. Taking these values as a starting point, I found I could get 1,400 Hz by adjusting each capacitor to 0.125 mfd.

A Squealing Pig

Now I put this complete multivibrator (Fig. 5-3) in the collector circuit of the timer multivibrator, where it would be 'on' for the 1/5th second interval (Fig. 5-4). The easiest way to tell whether this beep was any good was to listen to it.

I found that the tone started sharply enough, but it died like a squealing pig. As I thought about this, I realized that though the timer transistor applied full voltage to its collector load, which was the tone generator, with a sudden action, it had no way of removing the voltage as suddenly.

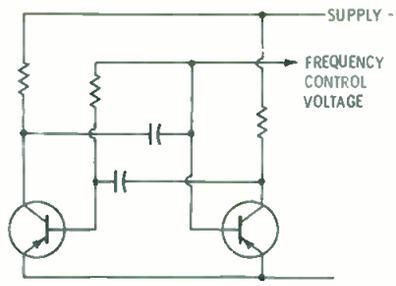

Fig. 5-6. Frequency controlling a tone generator with voltage (repeat of Fig. 4-4).

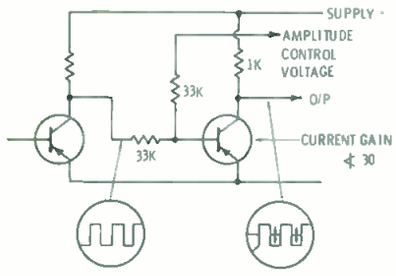

Fig. 5-7. Amplitude control by chopping a square wave.

All the timer transistor could do was to switch off the current to the tone generator as collector load. The voltage across this load had to die down as the corresponding current built up the charge on the 50 mfd coupling capacitor, using a time constant of 16.5 milliseconds, which is quite audible.

The solution to this proved fairly simple. A transistor switched the voltage on, so that once the source of voltage had been removed by switching that transistor off, another transistor could suddenly charge the capacitor, rather than having to wait for it to charge slowly (in 16.5 milliseconds) through the 330 ohms of the tone generator.

So in order to accomplish this I added the transistor (Fig. 5-5). Its base is coupled to the collector of the other timer transistor so that

the instant the transistor feeding the tone generator cuts off, this extra transistor shorts the generator. A 10K resistor does the job of providing the base current to enable the collector to short-circuit the 330 ohm load.

This 5-transistor circuit produced a good beeper, quite stable. It would work well from about 3 volts supply. The recorder I was using used tube amplifiers. A quickie bi-phase rectifier from the center-tapped 6-v heater supply gave me the needed voltage, using 1N34s, as the current is quite low. Another 500 mfd capacitor provided adequate smoothing at this low current.

All I needed now was to couple an output into the high level recorder input (and a phone pickup for the audio) and I was in business. Total time: a little over an hour. As I had a little time to spare, I drew out a "printed circuit" with tape on a copper-clad board, made a printed version of the same thing, and transferred it all, mounting it up neatly, using spacers as mounting posts. My old recorder now had a built-in beeper for use whenever I wanted it!

Controlled Amplitude

That was so easy that I began to think of other things to do with timers and multivibrator tone generators. I had already discovered how to control frequency in a multivibrator by voltage, as discussed in the last part, and shown again at Fig. 5-6. The beeper-type control could cut tones on or off as required by making appropriate combinations in the circuit. All kinds of possibilities began to come to mind. One thing more would be useful—a voltage controlled amplitude.

An obvious requirement would be to control the supply voltage of the generator multivibrator. But I'd already found that this altered frequency, sometimes unpredictably, as well as amplitude. However, a simple amplitude control that has no effect on frequency and, when the output wave is square, has no effect on waveform, merely biases a stage to clip the square's dimensions (Fig. 5-7).

With amplitude control voltage at zero, the conduction of the control transistor follows the input square wave at full amplitude. With amplitude control at maximum negative, the control transistor saturates, leaving no gain for the square wave. Intermediate control voltages vary the output amplitude from zero to maximum.

As discussed in the previous part, frequency can be controlled with this kind of multivibrator circuit over a range that is limited by current-gain factor at one end, and by charge-discharge time ratio at the other. The frequency range can be extended to some four octaves, by compounding transistors, so a pair of them in each flip of the flip-flop act as a single unit with a current gain of 5,000 or more (Fig. 5-8)

With the combination of a 2N-323 and 2N395, each side acts as one high-gain transistor. The effective collector resistor is split, 330 ohms in the 2N395 collector and 2.7K in the 2N323 collector. The 100K base resistors can use a con-

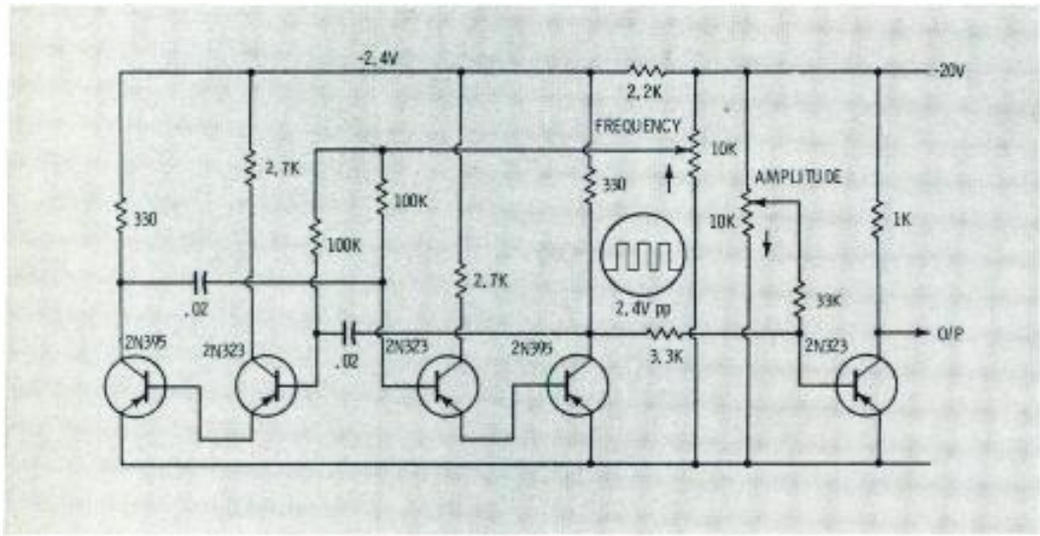

Fig. 5-8. A wide frequency-range tone generator, with voltage control of frequency and amplitude (for convenience provided by potentiometers in the circuit).

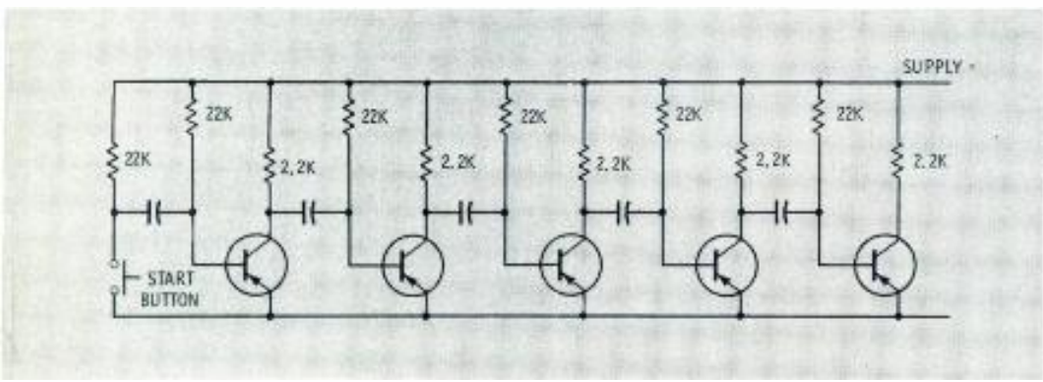

Fig. 5-9. An experimental sequencing circuit.

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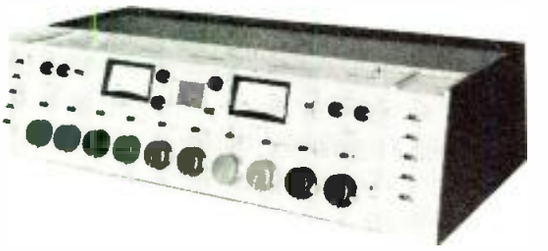

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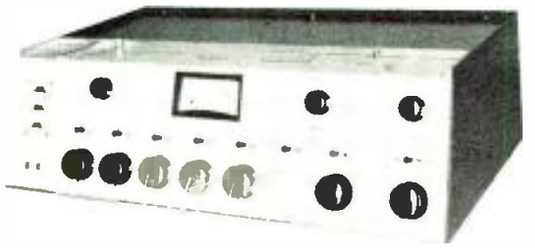

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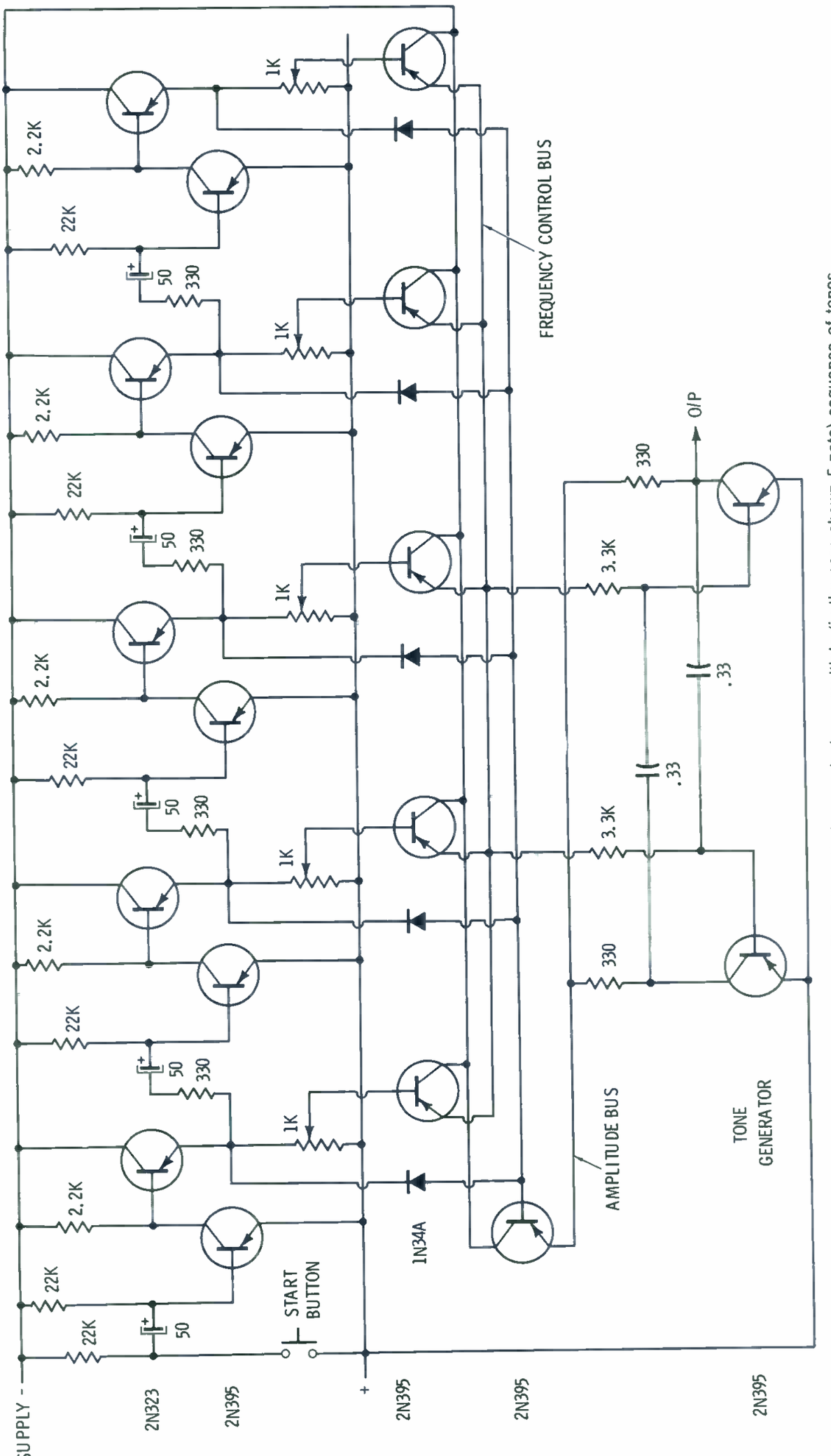

Fig. 5-10. The sequencing of Fig. 5-9 applied to producing a multiple (in the case shown 5-note) sequence of tones.

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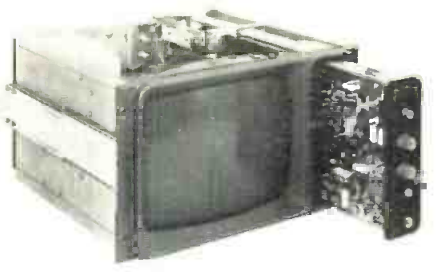

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trol from zero (or very close to it) up to over eight times supply voltage.

The multivibrator collector supply voltage is dropped from 20v to 2.4v in the 2.2K series resistor, because the multivibrator presents a constant, through-the-cycle load of 300 ohms (330 and 2.7K in parallel). The 10K potentiometers control frequency and amplitude for experimental purposes. For application, any voltage source will serve.

The output square wave can be controlled from 0 to 20 volts peak-to-peak (which can be attenuated down as required). With the values shown, frequency can be controlled from 170 Hz to 2900 Hz, a little more than four octaves.

Sequencing

The next step is to introduce automatic sequencing so any signal desired could be produced merely by touching a button. The simple, two-part multivibrator used for timing the beeper can be extended to more stages, initiated by triggering the first (Fig. 5-9). I set this up and found that the duration of each flip could be controlled easily by changing the coupling capacitors.

At saturation, all stages are normally conducting. A pulse biases a stage cut-off, during which time the coupling capacitor to the next stage charges. When that stage reverts to conducting again, it biases the following stage to cut-off. This continues until the sequence reaches the end of the line and all transistors are again conducting.

Using a 50 mfd coupling capacitor with a 22K bias resistor, the time constant is 1.1 seconds. The following stage is cut off for 0.7 of this, or 0.77 second. A 100 mfd will give a stage sequence time of 1.54 second.

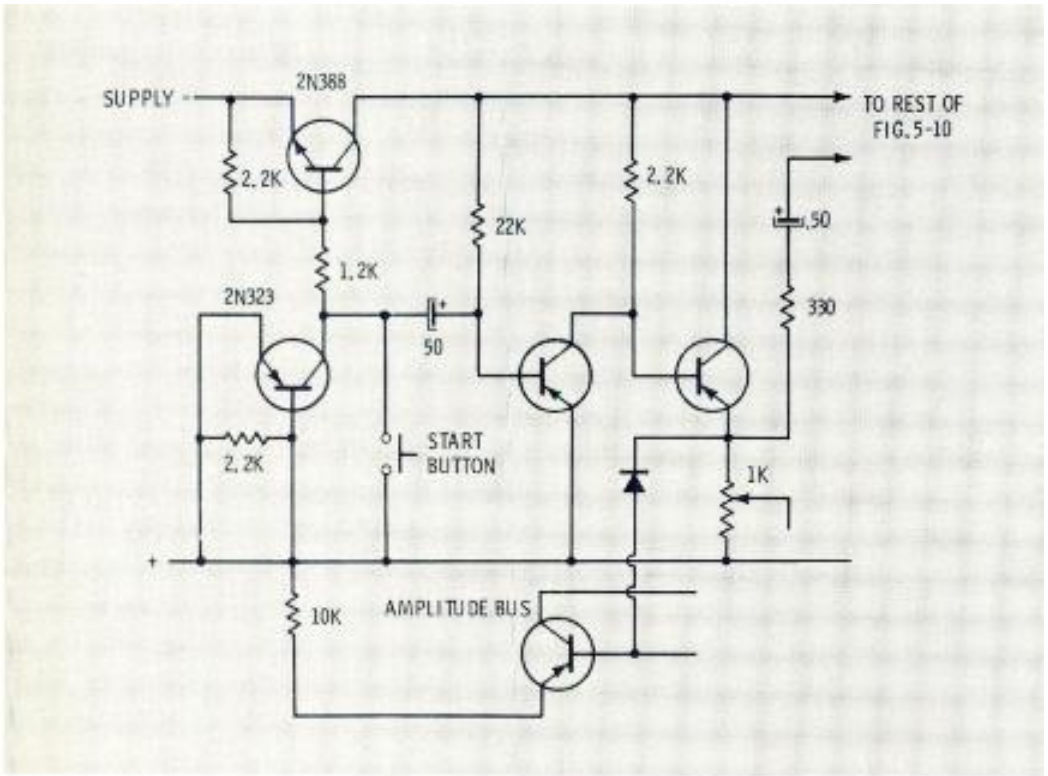


Fig. 5-11. Adding 'hold' feature that avoids dependence on careful button-pressing.

Circuit Output

To get an output, each stage is provided with an emitter follower. This helps square off the waveform by providing a lower source resistance for the coupling capacitor, and providing a point from which output voltage can be taken, without interfering with the circuit's action.

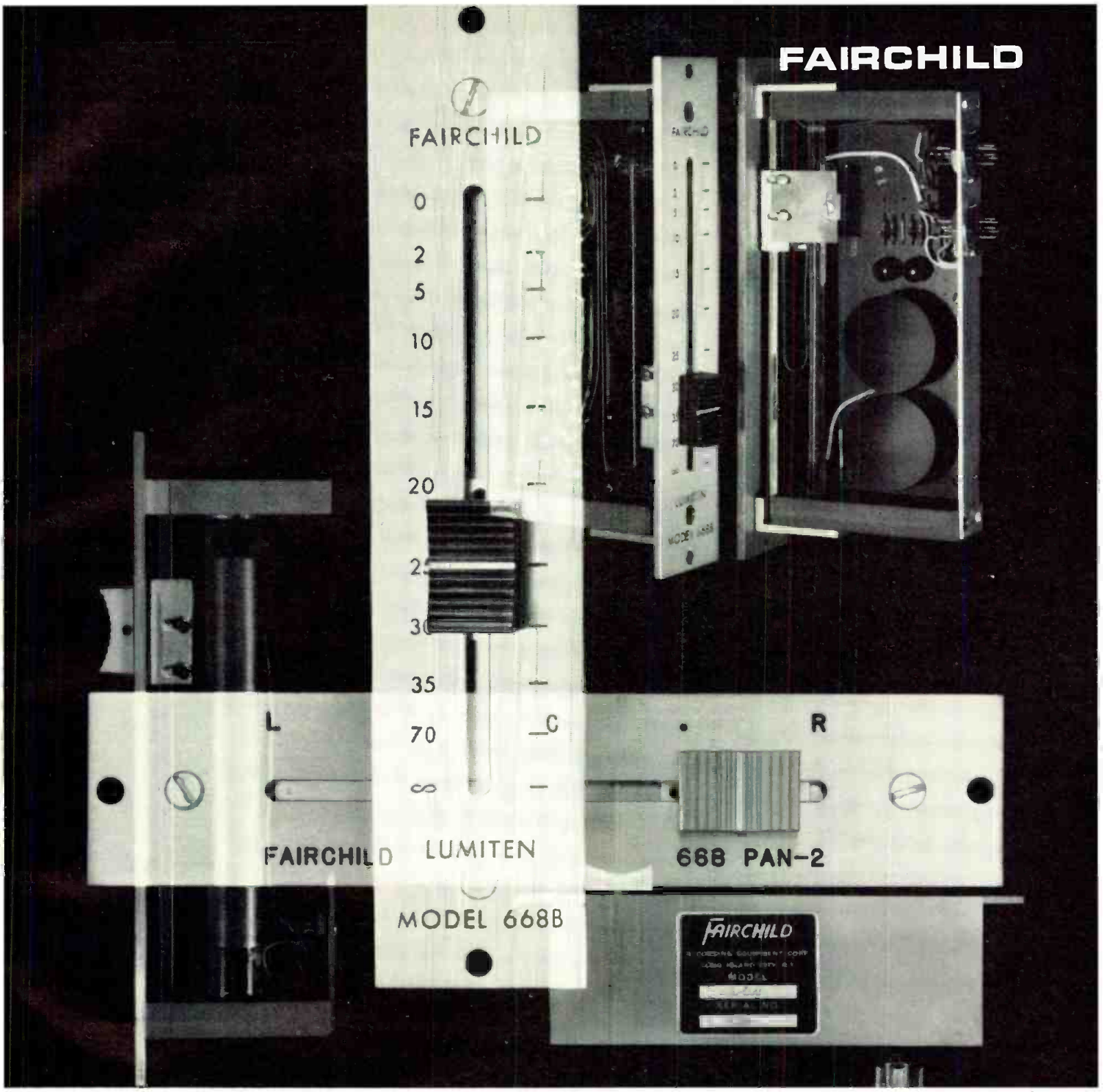
In Figure 5-10, the circuit includes voltage selectors in the form of 1K potentiometers to predetermine the frequency of each period in the sequence. Each potentiometer slider feeds an emitter follower to provide a stable voltage supply for the frequency control, as well as for isolation from the various voltage sources of successive stages.

The output voltage fed to the frequency control is always determined by the emitter follower that is conducting at the moment; the others aren't, because their emitters are negative with respect to their bases. This is why 2N395s must be used for this position rather than 2N323s.

The group of diodes couple each output to another emitter follower so that while one of the sequence is activated, the multivibrator receives full collector supply. Thus, no tone is generated until the sequence is started, and the tone ceases when the sequence comes to an end.

Only the diode connected to the stage momentarily operative is conducting. The others are block feeding this voltage to the other circuits.

The 330 ohm resistors in series with the timing capacitors proved necessary to desensitize the sequence as an amplifier in its 'saturated' state. Saturation is only relative, never perfect. Consequently, a sequence of 'saturated' stages can produce some gain. Without the 330 ohm resistors, this gain can be enough to allow stage jumping, so



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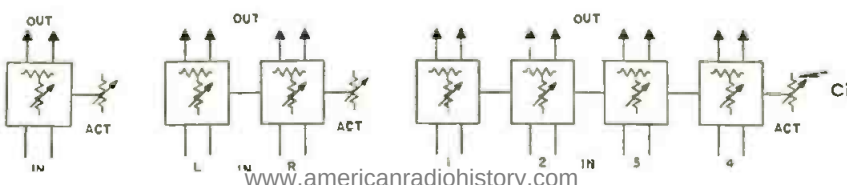
All Fairchild Lumiten attenuators use the same light principle. As light intensity is made to vary, cadmium sulphide cells within the circuitry effect identical and simultaneous variations of the audio signal. The Fairchild Lumiten is, in fact, as noiseless as a beam of light.

Fairchild Lumitens (available in 600 and 150 ohms) include: 668II Attenuator, 668 PAN-2 Pan Pot Actuator, 668 ACT Remote Cell Actuator, 668 STII Stereo Attenuator, 668 RSB Remote Stereo Attenuator, 668 MC 4-channel Master Control Attenuator card, 668 RAB Remote Attenuator packaged on compact PC card, 692 D1 Single Remote Attenuator, 692 D2 Two independent Attenuators. Slide Wire Fader: SWL 600 (600 ohm L pad).

Contact your Fairchild Recording Distributor or write **FAIRCHILD RECORDING EQUIPMENT CORPORATION,** Dept. BE-3, 10-40 45th Avenue, Long Island City, New York 11101.



Circle Item 31 on Tech Data Card

that stage 1, for example, can trigger stages 2 and 4, both of which require the same phase of pulse.

All the timer capacitors are shown as 50 mfd. These may be varied to produce tones of different duration. The .33 mfd capacitors in the tone generator, working the 3.3K resistors, produce a useful frequency range of approximately 250 Hz to 650 Hz.

This circuit, with an appropriate number of stages, will provide tones for a musical call sign, or signals to introduce weather or newscasts. It has only one remaining deficiency: the button must be held firmly until the first tone of the sequence is complete and has initiated the second, after which the button can be released without affecting the rest of the signal. But if the button is released too soon, the sequence may not behave correctly or predictably.

To overcome this, a further refinement was added by using the button for a trigger that lets a transistor do the 'holding'. It also holds the supply on until the sequence finishes (Fig. 5-11). These two transistors at the 'front end' mutually sustain each other's conduction or nonconduction.

The lower one (2N323) gets its base current from the supply to the tone generator collectors. The upper one (2N388) is triggered by the button, which also biases the first sequence to cut-off, because the first coupling capacitor remains charged (while the circuit is inoperative) to supply voltage through the upper transistor base-emitter contact and its base resistor, and thus initiates the sequence.

The lower transistor then acts as a 'hold' contact across the button, until the sequence is finished. Once triggered, each of these transistors keeps the other conducting, until the end of the sequence cuts off the supply to the tone generator collectors. This then cuts off the lower control transistor, which in turn cuts off the upper one.

The values are figured out on the basis of current gain, residual currents, saturation. The base resistor (shown as 1.2K) is figured to saturate the upper transistor at the operating load current. The base resistor for the lower transistor (shown as 10K) saturates it to provide the base current for the upper transistor. Each has a base-to-emitter resistor to eliminate leakage current due to residual gain in the 'off' condition.

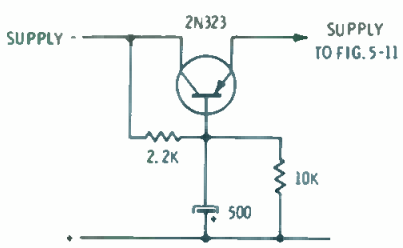


Fig. 5-12. Decoupling, using an emitter follower, to avoid triggering from external supply fluctuations.

Another Jolt

The circuit now proved prone to another problem: accidental triggering, with a sudden jolt in supply voltage from some other circuit. You don't want your call sign going out any time a slight audio overload occurs.

The reason for this was that such a change causes the first coupling capacitor to pulse a base current through the upper control transistor (2N388 of Fig. 5-11). Once triggered, the circuit runs through its sequence before quitting.

The remedy for this is to provide decoupling to the whole circuit, adequate enough to prevent a change of supply voltage and fast enough to allow a large current to trigger the circuit. An emitter follower with a large capacitor and a long time constant serves this purpose (Fig. 5-12).

It uses potentiometer rather than series feed for the base, to ensure that its output voltage is sufficiently below its input voltage so that a momentary downward fluctuation of the external supply won't reverse the 2N323 polarity, removing its control. The time constant of 2.2K and 10K with 500 mfd is about 1 second.

Incidentally, the circuit of Fig. 5-12, assuming the 2N323 has a working current gain of 100, is equivalent to resistors of 22 ohms and 100 ohms, with a 50,000 mfd capacitor, directly in circuit. Thus using the transistor saves both space and cost.

Circuit Variations

The number of things you can do with these basic ingredients is limited only by personal imagination. For example, a siren can be simulated by producing a circuit that controls amplitude and frequency separately, in a realistic way (Fig. 5-13).

When the operating button is not pushed, the current through the 4.7K and 33K resistors from supply negative to the base of the 2N323 transistor saturate it, preventing any output. If this saturation is not adequate, the 33K may be reduced in value.

Pushing the button drops the charge on the 100 mfd capacitor from about ⅞ of supply to about 1/6, with a time constant of 1/10 second. This opens up the 2N323 to amplify signal relatively quickly.

At the same time the change in the voltage on the 100 mfd is transferred to the 50 mfd through the 68K resistor. The bias current to the 2N388 changes from a value due to ⅛ of supply voltage through 134K (across the 4.7K resistor) to about 5/6 of supply voltage, with

a time constant of about 1.7 seconds.

This raises the voltage fed to the 3.3K base resistors in the tone generator from about 1/6 of supply voltage to full voltage, changing frequency from about 400 Hz to about 1,000 Hz. If the start from 400 Hz dips before starting to rise, it means the starting voltage for frequency control is too low. It can be remedied by reducing the value of one or both the resistors shown as 68K.

When the button is released, the 100 mfd capacitor recharges, with a time constant of about 2/5 second, while the 50 mfd follows it, at the 1.7 second rate. This lowers the power and the frequency in succession, until the tone dies.

If desired, a further multivibrator can be arranged to provide the amplitude and frequency control automatically (Fig. 5-14). Amplitude should lead frequency change to give the impression of power applied on the rising frequency and power removal when it dies down.

To achieve this, the frequency multivibrator is symmetrical, using 500 mfd capacitors with 4.7K base resistors. Time constant is 2.35 seconds, giving on and off periods of 0.7 x 2.35 = 1.6 seconds each.

The intensity control uses 4.7K with 100 mfd. This means intensity rises and falls, at the beginning of each change, at a time constant of ½ second.

The frequency control uses 4.7K and 250 mfd, feeding the base of the emitter follower at top left, time constant 1.2 second. Making this shorter than the half period means the full power is held for a moment after "run-up" and there is a moment of off, or quite low power, after "run down."

The pushbutton or switch kills the action in its open position by biasing the output (2N323) transistor to saturation. Closing it initates the automatic rise and fall by pulsing the bottom left transistor to cut-off and thus starting the first rise in intensity and frequency.

If the switch is opened when the right transistor is conducting, it prematurely stops the cycle, naturally. If it is opened when this transistor is non-conducting, it prevents the next cycle from starting.

In the next part of the series, I will go over some simple transistor units than can fulfill more conventional audio functions, either at short notice, or as a permanent item of equipment. Following that, we will go over some practical feedback problems in transistor circuits.

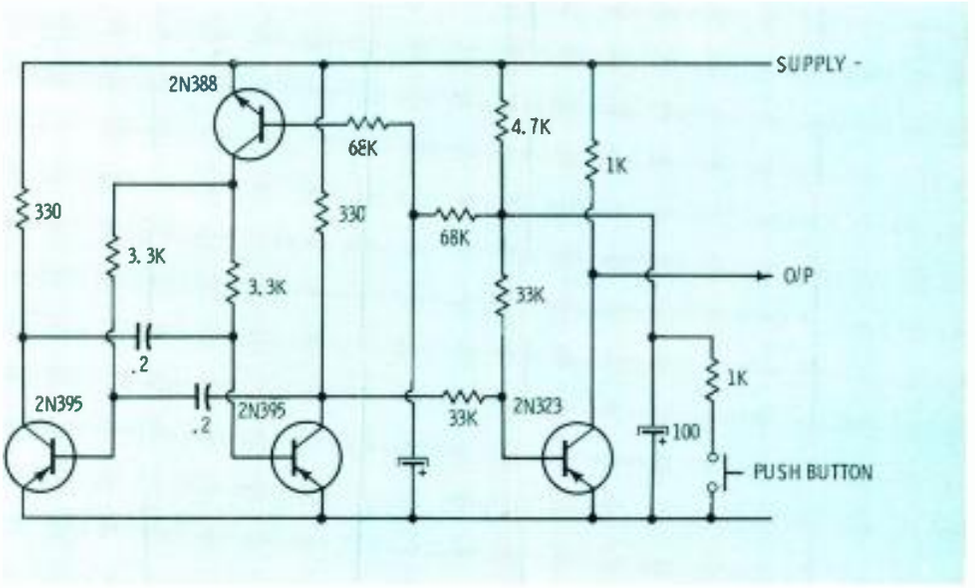


Fig. 5-13. A manually-operated siren simulator circuit.

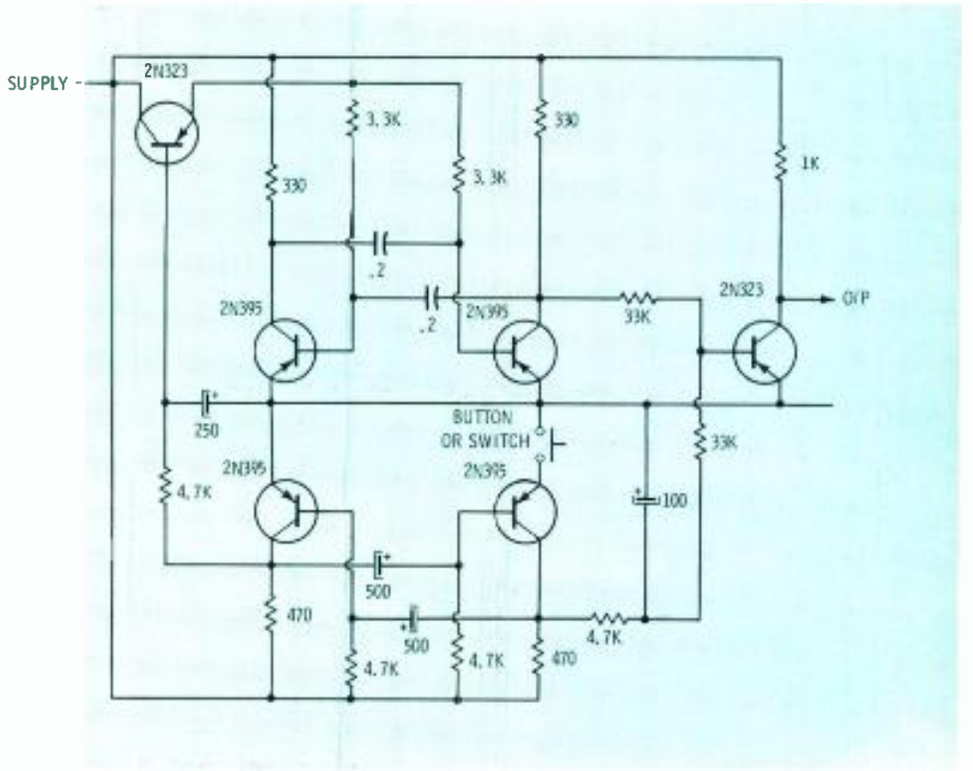


Fig. 5-14. An automated siren simulator circuit.

CBS Bubbles Up For Coverage

When the Columbia Broadcasting System was planning its television coverage of the presidential election returns on the Walter Cronkite Show, it decided to use an "arena staging" format to give added interest to its telecast. Cronkite and his assistant commentators would be photographed by five cameras placed on the studio floor to create a number of unusual viewing angles for the audience. The "arena staging" technique has been utilized often to telecast plays, but had never been employed on a news broadcast.

But a major problem had to be solved before this intriguing format could be adopted. As any individual cameraman "shot" Cronkite and his colleagues, he could not help but photograph other cameramen in position across the room. The sight of television cameras—either focusing intently or swiftly moving into position—was bound to distract and annoy much of the huge election night audience.

CBS solved this problem by housing the five cameramen filming the Walter Cronkite Show inside six-foot-diameter domes of green colored Plexiglas acrylic plastic. The tinted acrylic domes—appearing as giant green "bubbles" on color TV sets, and as dark gray hemispheres on black and white sets—completely concealed the movements of the cameramen inside from the audience's view. At the same time the cameramen had a completely unobstructed view of the set and took excellent pictures of Cronkite and his colleagues.

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Circle Item 40 on Tech Data Card

March, 1969

by Howard T. Head

Commission Proposes VHF Television Remote Control

In response to a petition by the National Association of Broadcasters (NAB), the Commission has proposed to permit the operation of VHF television transmitters by remote control. The rules already permit remote control of UHF transmitters.

Under the new proposal, the Commission would require a six-month "shakedown" of the remote control equipment with a licensed operator on duty at the transmitter, to demonstrate the feasibility of each VHF remote proposal. These tests would not be required for UHF remote control operation. The "shakedown" tests would permit employment of unlicensed persons at the control point under the direct supervision of a properly licensed operator, but a first class operator would be required at the remote control point during subsequent regular remote control operation.

The Commission's proposal also would provide for a single multiplex channel on the TV aural carrier for telemetry and alarm signals. This would consist of a single subcarrier in the 20-50 kHz range. Calibration and inspection of remote control facilities would be required five days a week, in line with the NAB proposal.

New Rules Proposed For Nighttime Operation

New rules dealing with the nighttime operation of Class I and II standard broadcast stations sharing the same Class I channel have been suggested by the Commission. The rules would provide that limited-time, Class II stations which share the same channel with dominant, Class I stations may not operate except during times permitted in their licenses or other hours not actually used by the Class I stations; also, that co-channel Class I stations must file their anticipated hours of operation four times a year with the Commission, so that limited-time stations may be aware of them. Limited-time stations are Class II stations broadcasting on Class I-A or I-B clear channels. March 17 was deadline for reply comments.

Rules Tightened For Calibration TV Power Output Meters

Rules governing calibration of power output meters on TV broadcast transmitters have been ammended by the Commission to insure stricter adherence. The new rules became effective March 17. Comments were received from the NAB, Mid-America Television Company, and the Broadcast Equipment section of the Electronic Industries Association. The comments of the three organizations generally were in accord with the ruling. However, it was noted that many TV transmitters are not capable of operating at 110 per cent of the authorized power, because of lack of reserve power or aging components.

More . . .

FM Translators And Boosters Proposed

The Commission has proposed to establish a new FM translator and booster service. The translator and boosters are intended to extend FM service to areas of uneven terrain or areas which are otherwise poorly served. The new translators and boosters would be licensed either to local organizations or to the FM stations themselves. However, they would not be permitted to extend the service of the FM station outside of their own service areas and within the service areas of other stations.

The output power of the translators would be restricted to 1 watt, thus permitting effective radiated powers up to 10 or 20 watts. Commercial operation would be permitted on the 20 non -commercial channels. Operation would be on the basis of non-interference to other broadcast reception.

FCC Moves to Control UHF Tuner Performance

The Commission has proposed to adopt rules which would require that UHF television tuners have ease of tuning comparable to that for VHF tuners. Rather than proposing specific regulations, the Commission has asked the television receiver industry to comment on the technical problems involved in the industry's plans to eliminate disparaties in UHF and VHF tuners. The Commission has asked for information on the cost of such tuners, with particular emphasis on the low-priced receivers.

Courts Uphold Non-Duplication Rules

In several recent cases the Courts have upheld the authority of the Commission to adopt CATV non-duplication rules and to order that CATV provide non-duplication protection for the television broadcast stations. The cases involved at least one instance where the Commission has ordered a CATV system to provide such protection to a television translator.

It looks like television station protection is a one-way street. In two recent cases the Commission declined to protect the head-ins of CATV systems from interference received from translator signals. Let the CATV system relocate its head-end, the Commission said, or go to microwave.

Short Circuits

The NAB has asked the Commission to authorize subaudible tones on AM carriers for telemetry purposes . . . Filings were heavy in the Commission's proposal to reallocate UHF television channels 14-20 and 70-83 to land mobile use . . . The JCIC color studies have confirmed the existence of wide variations in color transmission and reception . . . The Commission has proposed that CATV systems notify affected television stations of plans to carry or discontinue carriage of their signals . . . The Commission has moved to implement the provisions of a new law giving it control at the source over devices producing RFI . . . The Commission had declined to permit power in excess of 10 watts for Class D educational FM stations.

Howard T. Head . . . in Washington

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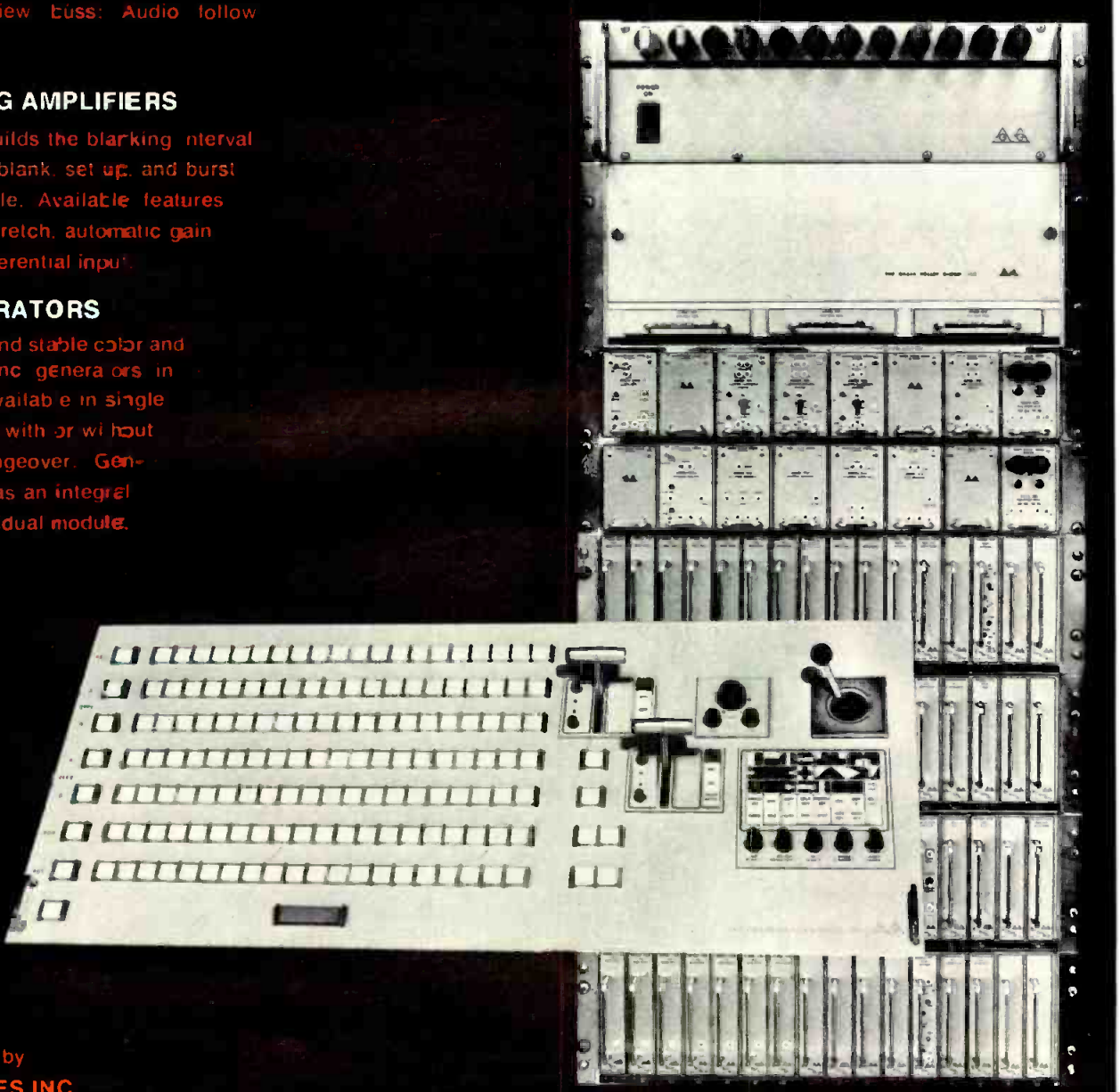

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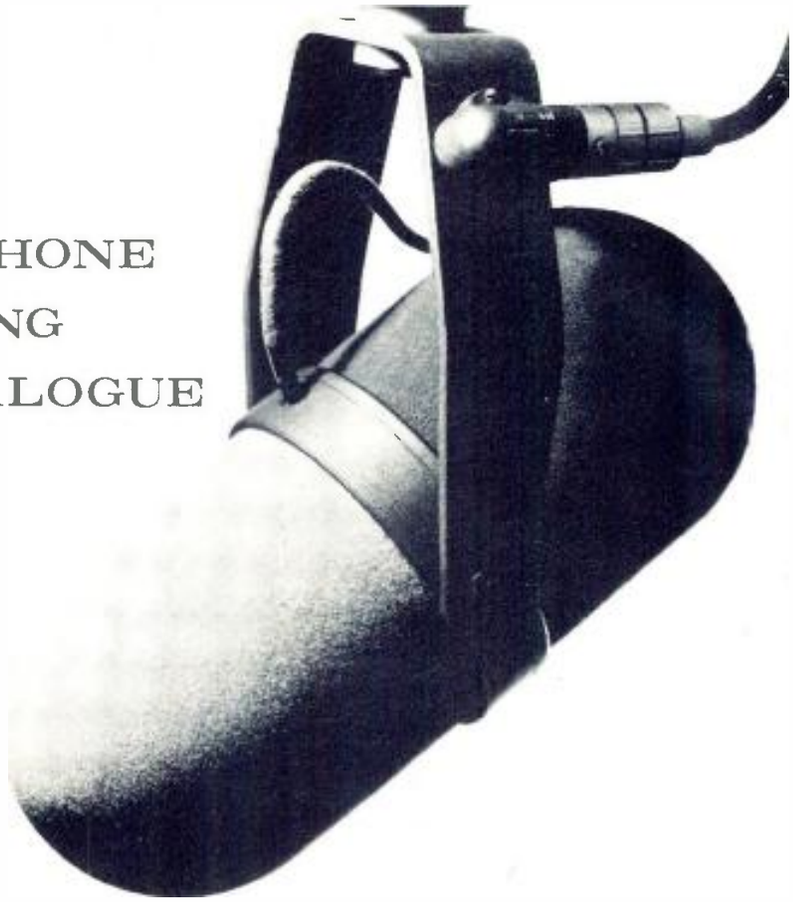

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PEOPLE IN THE NEWS

The Royal Society (London)—Britain's oldest scientific institution—has awarded its distinguished Rumford Medal to **Dr. Dennis Gabor,** staff scientist for CBS Laboratories, a division of Columbia Broadcasting System, Inc.

The Rumford Medal, given biannually for scientific discoveries in "light or heat" was presented to Dr. Gabor for his outstanding contributions in the field of optics and his discovery of holography.

Dr. Gabor, who is known throughout the world as the "father of holography," provided the mathematical basis for its beginning 20 years ago with his discovery of how to reconstruct objects from their light wave interference patterns. The interference principle was used by Dr. Gabor to construct the first ho-

logram in 1948—a three-dimensional image of an object on a glass plate. Named after the Greek word holos (meaning whole), holography is a form of lenseless photography. In recent years it has become a dramatic tool for use in industry, science and government.

Dr. Gabor, who is Professor Emeritus of the Imperial College of London, has also been responsible for numerous mathematical contributions to the advancement of communications and color television. He holds many patents in these fields, and is a member of the scientific team from CBS Laboratories which developed Electronic Video Recording. EVR makes it possible for the first time to show on conventional television sets, in the home or classroom, prerecorded programming from motion picture film and video tape at low cost.

He is the recipient of several scientific honors including the 1968 Michelson Medal for scientific achievement from the Franklin Institute, and the International Christopher Columbus Prize for communication theory.

He is a Fellow of the Royal Society, founded in 1660. He also is a Fellow of the Institute of Physics,

(Continued on page 85)

KONI Xmtr Gets Big Lift

It was a crisp fall day in Spanish Fork, Utah, when KONI Radio took delivery of a new FM transmitter and antenna. The problem was how to transport the units to the mountain-top site of KONI's transmitter building, accessible overland only by foot traffic. The solution: a helicopter and some pinpoint pilot work.

Several factors worked in favor of this solution. The 250 watt transmitter, manufactured by Gates Radio Co. is a transistorized, one tube, solid-state unit weighing 610 pounds; not too hefty for a helicopter to ferry the payload 2200 feet up the sheer mountainside without incident.

KONI chose a circularly polarized FM antenna to gain general coverage from the new transmitter unit. Broadcast range of the equipment is estimated at 80-miles.

Topography is one of the primary concerns of mountain-west radio stations, and KONI Radio faces typical terrain problems of the region. The Spanish Fork Canyon is the result of an initial 10,000 foot displacement of slippage in the Wasatch Fault, a well-known geological fissure. Even today on the south or "shallow" end of this valley, the mountains of the Wasatch Mountain Range jut abruptly, high above the valley floor. From this vantage point, KONI's transmitter broadcasts the new FM signal to one of the richest markets in the western states.

The mountain peak transmission site, now named Mount KONI, puts the new transmitter at 6,700 feet above sea level with direct line of sight to every town in Utah County. Eighteen poles carry power transmission lines up the mountain, where the antenna rises well above all possible obstruction to the signal. A collective, the Strawberry Water Users, provides power to the transmitter site, while Mountain States Telephone lines serve the station.

PEOPLE
IN THE NEWS

a Fellow of the Institute of Electrical Engineers (IEE), and an honorary member of the Hungarian Academy of Science.

Dr. Gabor has authored numerous scientific papers for leading technical journals, and his book on social problems entitled "Inventing the Future" has been published in seven languages.

Dr. Gabor was born in Budapest, Hungary. He studied in Budapest and in Berlin, where he acquired his doctorate.

The Rumford Medal is one of the oldest scientific honors in the world, and was founded in 1796 by Count Rumford (Benjamin Thompson) the famed eighteenth-century American-born statesman and scientist who proved among many other things that heat is motion rather than a substance.

The Rumford Medal was last presented in 1966 to Lord William Penney, the noted atomic energy authority.

Robert H. Jacobson, news managing editor at KBHK-TV, San Francisco, has been promoted to manager of the news department at Kaiser Broadcasting's WKBD-TV, Detroit.

Previously, Jacobson was news producer at KTVU-TV, San Francisco-Oakland. He was a sports reporter for the San Francisco Examiner for four years and new editor of the Berkeley Gazette for two years.

He is a graduate of the University of Washington in Seattle.

Gary D. Suggs, general manager of KOSO, Modesto, Ca., joins Kaiser Broadcasting as operations manager of KFOG, San Francisco.

Suggs replaces Ernest MacDaniel who has resigned after six years with KFOG to go into private business.

Suggs was program director at KXIV and KBUZ, Phoenix from 1961-1965.

PEOPLE IN THE NEWS

The re-election of **Leonard H. Marks** and **E. William Henry** to the Executive Board of Directors of the National Association of Educational Broadcasters was announced recently by **Dr. George Bair,** NAEB Board chairman. Each will serve a two-year term as Public Members, Dr. Bair said.

Marks, former director of the United States Information Agency, served as a Public Member prior to assuming his government post in 1965. He also served as NAEB's general counsel from 1946 until 1964. Marks is presently head of the U.S. delegation with personal rank of Ambassador, to negotiate permanent arrangement for the International Telecommunications Satellite Consortium, (INTELSAT).

Henry was elected a Public Board Member two years ago. He was appointed to the Federal Communication Commission in 1962 by the late President Kennedy; named FCC chairman the following year, and served in that capacity for three years. In 1966, Henry was the recipient of NAEB's Man-of-the-Year Award for his contribution to the field of educational broadcasting. He is a former partner in the Washington law firm of Arnold & Porter and is currently associated with Management Television Systems, New York, N.Y.

Roy M. Furmark, president of Founders Corporation, announced today the appointment of 33 year-old **Dan Covell** as general manager of Radio Hawaii, Inc., owner and operator of Radio Station KORL in Honolulu.

Since 1965, Covell has been general manager and an owner of Radio Station WGMZ-FM in Flint, Michigan. A graduate of Michigan State, he began his broadcasting career 15 years ago as an announcer.

While at the helm of WGMZ, Covell guided the station from a limited 8 A.M. to 10 P.M. broadcast day to a 24-hour stereo sound schedule.

PEOPLE
IN THE NEWS

Jerry Jensen, newscaster/reporter for eight years at KRON-TV, San Francisco, joins Kaiser's KBHK-TV as anchorman of The Nine O'Clock News.

Other TV stations with which Jensen has been associated are KCCC-TV (now KTXL) and KOVR, Sacramento-Stockton, KGO-TV, San Francisco and KNTV, San Jose.

The San Mateo Times annual reader survey recognized Jensen as "Most Popular Newscaster" in 1962 and "Best TV Newscaster" in 1966. The San Francisco Press Club awarded him second prize for "Best Bay Area TV Newscast" in 1961 and "Outstanding TV Field Reporting" in 1965.

He is a graduate of the University of the Pacific and has done graduate work at San Francisco State College, where he was a staff instructor in radio-tv from 1964-1965.

In action taken at a recent meeting of the board of directors of Superior Continental Corporation, Hickory, N. C., **Walter L. Roberts** was elected a company officer and advanced to the position of vice-president, research and engineering.

Formerly director of research and quality control, Roberts is well-known throughout the communications industry for his wire and cable development work. He joined the Superior organization in 1956 as a laboratory technician, later moving into research and development engineering and advancing to become section director.

Roberts is a member of the Institute of Electrical and Electronic Engineers, the Society of Plastic Engineers, the American Society for Testing and Materials, and is currently serving on the advisory board of the National Cable Television Institute. He has authored technical papers for the American Institute of Electrical Engineers, National Community Television Association, U. S. Army Signal Corps, Institute of

PEOPLE IN THE NEWS

Electrical and Electronics Engineers, and communications trade journals. He also holds a number of patents in the field of communications technology.

The Armstrong Medal was awarded to **Jerry B. Minter** at the 59th anniversary celebration banquet of The Radio Club of America on December 10. Minter is president of Components Corporation, Denville, New Jersey, and is a director and past president of the club.

The citation on the occasion of

the award of the Armstrong Medal to Minter reads as follows:

"The Armstrong Medal of The Radio Club of America is awarded to Jerry Burnett Minter II in recognition of his outstanding record of contributions to the radio art. A radio amateur from age 12, Jerry developed during secondary school a sound knowledge of the best in radio practice. Conversely, during the years following his graduation from MIT, he brought to the problems of a new and rapidly expanding technical frontier a brilliant, disciplined mind.

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"As practicing engineer and organizer he has devoted his skills and resources to improving and refining his chosen field. He has contributed substantially to the knowledge and techniques of modulation, propagation and detection of radio energy. He has also contributed materially to the improvement of nuclear instrumentation and electrical contacts. Always alert to anomalies between existing theory and observed practice, Jerry is respected for his honest, critical and independent appraisal of all matters at hand. His engagement in quantitative measurement of radio transmission led to an exhaustive study of radio noise sources in automotive electrical and other equipment and to the pioneering of suitable measurement instrumentation.

"Jerry has devoted substantial time, service, and leadership to many technical and educational organizations with particular dedication to The Radio Club of America. In addition to many personal achievements, he is known for his unselfish encouragement and assistance to his associates and friends in the achievement of their technical accomplishments."

The National Association of Broadcasters has announced the election of 13 prominent broadcasters from throughout the nation to its 29-member Radio Board of Directors.

All were elected by mail ballot to serve two-year terms beginning on Wednesday, March 26, the concluding day of NAB's 47th annual convention in Washington.

Those elected:

District 1—(Connecticut, Maine, Massachusetts, New Hampshire and Vermont) Frank A. Balch, WJOY, Burlington, Vt.

District 3—(Delaware, Maryland, Pennsylvania, West Virginia and the District of Columbia). Jerry Lee, WDVR (FM), Philadelphia, Pa.

District 5—(Alabama, Florida, Georgia, Puerto Rico and the Virgin

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Islands). Joseph S. Field, Jr., WIRK, West Palm Beach, Fla.

District 7—(Kentucky and Ohio). James M. Caldwell, WAVE, Louisville, Ky.

District 9—(Illinois and Wisconsin). A. F. (Fritz) Sorenson, WKRS, Waukegan, Ill.

District 11—(Minnesota and North and South Dakota) N. L. Bentson, WLOL, Minneapolis, Minn.

District 13—(Texas) Wendell Mayes, Jr., KCRS, Midland, Tex.

District 15—(Northern California, Hawaii and Nevada) Floyd Farr, KEEN, San Jose, Calif.

District 17—(Alaska, Oregon and Washington) Carl O. Fisher, KUGN, Eugene, Ore.

AM Stations (Class "A" Markets) Andrew M. Ockershausen, WMAL, Washington, D. C.

AM Stations (Class "B" Markets) R. W. Chapin, KFOR, Lincoln, Neb.

AM Stations (Class "C" Markets) John F. Hurlbut, WVMC, Mt. Carmel, Ill.

FM Stations Julian F. Haas, KAGH (FM), Crossett, Ark.

Results of the mail balloting were certified by a special three-member Elections Committee appointed by NAB President Vincent T. Wasilewski.

Harry A. Karr, Jr., WRC, Washington, served as chairman. Other members were John Burgreen, WAVA, Arlington, Va., and Everett L. Dillard, WDON, Wheaton, Md.

Edward Leonard Ginzton, Chairman of the Board of Varian Associates, Palo Alto, California, has been awarded the Medal of Honor of the Institute of Electrical and Electronics Engineers. The award consists of a Bronze Medal and Certificate and carries this citation to Ginzton.

"For his outstanding contributions in advancing the technology of high-power klystrons and their application, especially to linear particle accelerator."

Presentation to Dr. Ginzton will be made at the Annual Banquet of the Institute March 26, at the New York Hilton, the major social event of the IEEE International Convention and Exhibition, March 24-27.

Dr. Ginzton was born in Russia in 1915 and came to the United States in 1929. He received a B. S. degree in Electrical Engineering from the University of California in 1936 and an M.S. in 1937. He attended Stanford University from 1937 to 1940, receiving an E. E. degree in 1938 and a Ph.D. in 1940. He was Research Associate in the Physics Department at Stanford University and as a member of the Varian Brothers-Hansen group, contributed to the development of the klystron tube. In 1941, with this group he was transferred to the

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Research Laboratories of the Sperry-Gyroscope Company in Garden City, New York, where he remained throughout World War II. In 1946 Dr. Ginzton returned to Stanford where he became Professor of Applied Physics and Electrical Engineering. From 1949 to 1959 he was Director of the University's Microwave Laboratory. In addition to teaching and other academic responsibilities he supervised the construction of 10 microwave linear accelerators. Also from 1956 to 1961 he was in charge of Project "M" a Stanford project involving the construction and operation of a two-mile linear accelerator.

He was one of the founders of Varian Associates and has been a member of its Board of Directors since the Company's inception in 1948.

Dr. Ginzton has written many papers in the field of electronics and microwaves and has published a text "Microwave Measurements." He is the sole or joint holder of approximately 50 patents in the field of electronics and microwave devices.

In 1958 he received the Morris Liebmann Memorial Award presented by the IEEE (formerly the IRE) for his contribution to the development of high-power pulsed klystrons.

Dr. Eugene C. Starr, formerly Chief Engineer and now Consulting Engineer with the Bonneville Power Administration at Portland, Oregon, was presented the William M. Habirshaw Award today by the IEEE. Dr. Starr received a bronze medal and a $500.00 honorarium at the New York Hilton during an awards luncheon held as part of the IEEE Winter Power Meeting which

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runs from January 26 to January 31. The citation to Dr. Starr reads "For outstanding contributions to the development of more economical and reliable a-c and d-c transmission."

Established in 1958, the Habirshaw Award is presented annually by IEEE to an individual or group of individuals making outstanding contributions to the field of electrical transmission and distribution.

Eugene Carl Starr attended Oregon State University where he received his B.S. degree in electrical engineering and later the professional degree of electrical engineer.

In 1954 he became BPA's Chief Engineer. Since 1961 he has served Bonneville as Consulting Engineer specializing in EHV a-c and d-c transmission and in nuclear power development.

In addition, Starr attended the Bikini atomic bomb tests, Operation Crossroads, in 1946. He served as a consultant to the Reactor Development Division, Atomic Energy Commission, on industrial power and was a member of the Advisory Committee to the AEC on reactor policies and programs. In 1947 he was a member of the American delegation to World Power Conference in Belgrade, Yugoslavia. In 1959 he accepted a special five-week assignment in India, as a Consultant to the United Nations where he evaluated three engineering research grants-in-aid requests of the Government of India.

In 1958 the Department of the Interior presented him with its highest award, the Distinguished Service Award and Gold Medal for his service to the Government in electrical engineering and nuclear power fields. In 1965 he was appointed a member of the Federal Power Commission's Alaska Power Survey and is serving as chairman of the study committee on Coordinated System Development and Interconnection.

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Broadcast Engineering

FOR ISSUE OF MARCH, 1969

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3	18	33	48	63	78	93	108	123	138	153	168	183
4	19	34	49	64	79	94	109	124	139	154	169	184
5	20	35	50	65	80	95	110	125	140	155	170	185
6	21	36	51	66	81	96	111	126	141	156	171	186
7	22	37	52	67	82	97	112	127	142	157	172	187
8	23	38	53	68	83	98	113	128	143	158	173	188
9	24	39	54	69	84	99	114	129	144	159	174	189
10	25	40	55	70	85	100	115	130	145	160	175	190
11	26	41	56	71	86	101	116	131	146	161	176	191
12	27	42	57	72	87	102	117	132	147	162	177	192
13	28	43	58	73	88	103	118	133	148	163	178	193
14	29	44	59	74	89	104	119	134	149	164	179	194
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- ☐ H. Consulting Engineer
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Four Major Annual Awards of the Institute of Electrical and Electronics Engineers (IEEE) will be presented in 1969 as follows.

The IEEE Edison Medal—to **Hendrik Wade Bode,** Gordon McKay Professor of Systems Engineering, Harvard University, Cambridge, Massachusetts (formerly vice-president, Military Systems Engineering, Bell Telephone Laboratories Murray Hill, New Jersey) The Award, established in 1904, consists of a Gold Medal and Certificate and carries a citation to Dr. Bode:

"For fundamental contributions to the arts of communication, computation, and control; for leadership in bringing mathematical science to bear on engineering problems; and for guidance and creative counsel in systems engineering."

The IEEE Founders Award—to **Emmet Finley Carter,** Research Management Counselor, Portola Valley, California. This Award, established in 1952 is a Bronze Medal and Certificate. The citation to Carter reads:

"For outstanding contributions to the electrical engineering profession and to the Institute of Electrical and Electronics Engineers through wise and imaginative leadership in the planning and administration of technical developments in electronics and telecommunications."

IEEE Lamme Medal—Established in 1928, consisting of a Gold Medal and Certificate. Awarded to James **Dillon Cobine,** Physicist, General Electric Research and Development Center, Schenectady, New York. Cition reads:

"For his contribution to the knowledge and development of gaseous discharge devices and their adaptation to the development of high-power vacuum interrupters"

IEEE Education Medal—to **Donald O. Pederson,** Professor of Electrical Engineering University of California, Berkeley, California:

"For inspiring teaching and for educational leadership in electronics, notably integrated circuits."

Dr. Pederson received a Bronze Medal, Certificate, and an honorarium of $500. The Institute established its Educational Medal Award in 1956.

Presentation to all four recipients will be made at the Institute's Annual Banquet on March 26, at the New York Hilton.

Dr. Otto H. Schade, Sr. receives the Vladimir K. Zworykin Award of IEEE "For broad technical contributions to the electronics and optics of television." Dr. Schade is with Electronic Components Activity of the Radio Corporation of America at Harrison, New Jersey. Established in 1952, this award honors technical contributions in the field of electronic television.

TECHNICAL DATA

114. **AMPEX CORP.**—Bulletin V200 detailing features and specifications of the BC-100 hand-held color camera for broadcast television use is available.

115. **ANACONDA**—Sealmetic, a 75-ohm, all-weather coaxial cable designed for CATV systems, is described in "The Sealmetic Story," a new bulletin.

116. **BIRD ELECTRONIC CORP.**—A discussion of pitfalls in the accurate measurement of Peak Envelope Power of video, pulse, AM and other envelope modifying modulations is the subject of a new 3-page application note.

117. **COHU**—Use of closed-circuit television to provide real-time close-up observation of airborne test activity is the subject of a new technical application bulletin (8-94).

118. **DYNAIR**—A new 51-page book called "Video Transmission Techniques" is available, free of charge. Profusely illustrated, the publication describes in detail the problems encountered in routing video through cable, and presents solutions.

119. **ENDEVCO**—A 6-page brochure is ready on the new Model 2720 charge amplifier.

120. **HEWLETT-PACKARD** — "Low-Frequency Network Analysis with the 675A/676A" (AN 112-1) is the title of a new 13-page application note. The note describes how the Model 675A Sweeping Signal Generator and Model 676A Phase/Amplitude Tracking Detector work together to measure the gain/attenuation and phase response characteristics of networks.

121. **ITT**—A catalog describing IRRAVIN insulated electronic hook-up wire and cable for military and industrial applications has been announced.

122. **NAB**—The National Association of Broadcasters has sent its FM member stations an 8-page booklet to help them determine the number of radio receivers capable of receiving FM programs. The booklet is entitled "Methods for Measuring FM Set Penetration," and is based on an NAB study which analyzed four different methods of measurement.

(Continued on page 96)

INDUSTRY CALENDAR

April

Apr. 11 International Radio and Television Society Radio Day newsmaker luncheon at the Waldorf-Astoria Hotel, New York.

Apr. 13-16 National Association of Educational Broadcasters will hold its Institute on principles of supervisory management at the Sheraton-Chicago Hotel.

Apr. 13-14 The Florida Association of Broadcasters spring board meeting and broadcasting day at the University of Florida, Gainesville.

Apr. 16-19 IEEE Regional Six Conference, Phoenix, Ariz.

Apr. 17-19 Oregon Association of Broadcasters spring meeting at the Dunes motel, Lincoln City.

Apr. 21-22 The Twelfth Midwest Symposium on Circuit Theory held at The University of Texas, Austin.

Apr. 21-25 The 1969 spring meeting of the USNC/URSI-IEEE to be held at the Shoreham Hotel, Washington, D.C. in conjunction with the American Geophysical Union meeting at the Sheraton Park Hotel.

Apr. 22-24 IEEE National Telemetering Conference, Washington, D.C.

Apr. 29-May 2 Alpha Epsilon Rho twenty-sixth annual national convention, Statler Hilton Hotel, Detroit.

May

May 6-8 Illinois Broadcasters Association annual spring meeting at St. Nicholas Hotel, Springfield.

May 8-10 Kansas Association of Radio Broadcasters will meet at Statler-Hilton Inn, Salina.

May 11-13 Pennsylvania Association of Broadcasters spring meeting at the Hershey hotel, Hershey, Pa.

May 12 This is the new date for the oral argument before the FCC on its proposal to prohibit networks from owning or controlling more than 50% of their non-news prime-time programming, and also to limit participation in syndication activities. Dec. 12 was previous date.

May 15-16 Ohio Association of Broadcasters will hold its annual spring convention at Imperial House South, Dayton.

May 16-17 Iowa Broadcasters Association will have its spring meeting at Holiday Motor Lodge, Clear Lake.

May 25-26 Alaska Broadcasters Association meeting at Mount McKinley National Park.

TECHNICAL DATA

123. **NARDA MICROWAVE**—Criteria for selecting the right microwave attenuators for the proper application is the subject of a 12-page article appearing in the technical publication, The Narda Probe.
124. **SCALA RADIO CORP.**—A data sheet on the Color Log, a completely housed frequency-independent array designed to meet the requirements of professional users of UHF TV pick-up antennas, is offered.
125. **SEMI-ELEMENTS**—A catalog sheet providing information on electro-optic single crystals is available.
126. **SENCORE**—A flyer describes the latest maintenance equipment including a Field Effect voltmeter with 1.5% accuracy and a new mutual conductance tube tester with all the latest tubes listed.
127. **SIGMA INDUSTRIES** — A bulletin on thick wall, heat-shrinkable, self-sealing tubing and molded parts is available.
128. **SIMPSON**—A bulletin has information covering meter characteristics, a glossary of terms, calibration data, and stock sizes and types of panel meters.
129. **SPARTA**—A price list of Fidelipac Cartridges and Reloading Service is available.
130. **SPRAGUE** — Catalog CN-116M1 is available. Sprague is also issuing a series of engineering bulletins including complete information on the new additions to the TH Series of transistor chips. In addition, complete data on a revised series of layer-built axial-lead resin-coated Monolytic® ceramic capacitors is given in Engineering Bulletin No. 6201E.
131. **SUPERSCOPE**—32-page catalog, "All the Best From Sony" features Sony/Superscope tape recorders, magnetic tape, microphones, and accessories. Additional catalog gives technical specifications of consumer and professional microphones.
132. **SWITCHCRAFT** — Bulletin 174 describes a low-cost multiple station push-button switch, the DW "Multi-Switch," Series 65000.
133. **SYLVANIA ELECTRIC PRODUCTS INC.**—A new CCTV Systems Catalog is available.
134. **TAPECASTER TCM**—Tape Cartridge Machines are discussed in a brochure which has schematic diagrams, specifications, and prices of the Series 700.
135. **TEKTRONIX**—A brochure provides details on television waveform monitor and other products.
136. **TELEMATION** — Literature describes the TMC-2100 monochrome vidicon camera, the TPS-12X3 broadcast video switcher, and TMV-550 video distribution amplifiers.

Visual Electronics To Hold Post-NAB Seminar March 27th

Visual Electronics Corporation will again hold its Post-NAB Seminar on Thursday, March 27th, it was announced by Charles E. Spicer, vice-president of Visual. The event takes place in the Sheraton Park immediately following the National Association of Broadcasters Convention in Washington, D. C.

According to Spicer, several papers will be presented on recent advances in broadcast equipment. The formal program soon to be announced will include technical developments in color television cameras, video tape recorders, visual information display systems, and studio automation.

Presented annually by Visual, these Post-NAB Seminars have given broadcasters an opportunity to participate in greater depth on subjects relating to studio equipment and systems development, than is possible during the NAB exhibit and convention.

NAB Convention Starts With "FM Day" Sunday

The 23rd National Association of Broadcasters Conference will get under way Sunday, March 23, by observing "FM Day." The opening day program will include presentations by FCC commissioner Robert T. Bartley and by Curtis B. Plummer, chief of the FCC's Field Engineering Bureau.

On Monday, March 24, there will be a joint session with management for opening of the convention at 10:30 am. At 12:30 pm, Sen. Barry Goldwater will address the first engineering luncheon. It will be held in the Blue Room of the Shoreham Hotel, with Lee R. Wallenhaupt of the WSJS stations presiding.

The invocation will be by the Rev. Thomas D. Bowers, Rector, St. Patricks Episcopal Church, District of Columbia.

See Page 33
For Exhibit Floor Plan

FCC Announces Modified POPSI Charts Are Ready

Modified curves to replace those in the POPSI (Precipitation and Off-Path Scattered Interference) Report No. R-6801 dated March 15, 1968, have been announced by the FCC. The new charts carry the same numbers as those in the Report with letter suffixes added for easy substitution.

The report is a statistical analysis of the mutual interference between a satellite earth station transmission and the reception by a microwave radio relay station sharing the same frequency. It is based on a study of the scattering of a radio signal by precipitation and other causes in the region where the transmitted signal of the one station intersects the received signal of the other.

The new curves reflect a different statistical grouping of the computer input data to show the highest signal extreme on the probability distribution curves. The grouping eliminates some of the discontinuities due to percentile calculations coincident with data points.

The charts are available in limited quantities at the FCC Research Division, Room 716, 1919 M Street Northwest, Washington, D.C. 20554, telephone 632-7040.

Rules have been proposed by the Commission as an initial step in implementing the new Section 302 of the Communications Act on devices which interfere with radio reception. This section was added by Congress July 5, 1968, authorizing the Commission to "make reasonable regulations governing the interference potential of devices which in their operation are capable of emitting radio frequency energy by radiation, conduction, or other means in sufficient degree to cause harmful interference to radio communications."

Discussing the reason for new regulations, the Commission said, "The continuing increase in the use of radio frequency devices in all phases of our nation-wide economy and activities has helped to bring

about a situation sometimes referred to as 'spectrum pollution' or 'radiation smog,' a condition not unlike those described as water pollution of atmosphere smog in other fields and with similar deleterious effects. This condition is an unwelcome by-product of the nation's explosive technological growth and has become a definite hindrance to the attainment of efficient radio service throughout the country."

Until now, under Section 301 of the Communications Act, the Commission has regulated interference potential of radio frequency devices through the user. The new section enables the Commission to require suppliers to comply with technical standards.

For many years the Commission has prescribed radiation levels and related technical standards for RF devices, and the use of them has been licensed individually or authorized by general rule. The limitation of restraints to actual use of the devices created problems of detection that were almost "insurmountable," the Commisson said. In fiscal year 1966 the staff devoted more than 150,000 man hours to tracing and eliminating interference. This went up in fiscal year 1967, when more than 40,000 complaints of interference were received.

December Letters Complain to FCC About Commercials

Complaints from the public to the FCC about broadcasting during December 1968 total 1,175, a decrease of 421 from November. Comments and inquiries totaled 3,300, an increase of 829 over the November total.

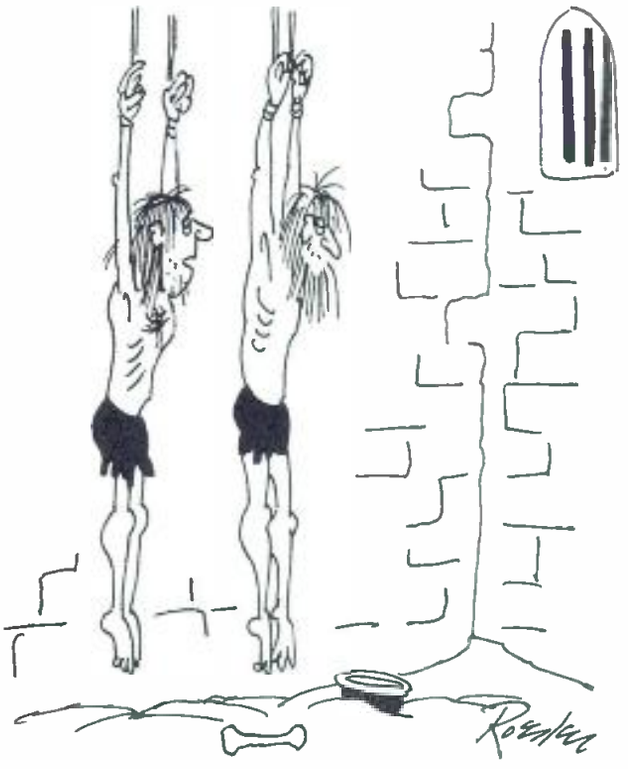
A number of the complaints received concerned loud or offensive commercials, allegedly obscene or indecent promotional announcements for movies on television or in local theaters, and distortion or suppression of news.

A total of 1,589 letters were sent by the Commission's staff in response to complaints, comments and inquiries.

FCC Chairman Rosel H. Hyde testified today in support of an amendment to the Communications Satellite Act of 1962 that would permit the number of common carrier elected stockholders on the board of the Communications Satellite Corporation (Comsat) to be reduced as carrier ownership of voting stock fell below 50 percent.

Chairman Hyde told the Senate Commerce Committee that the amendment was "much needed." He pointed out that the amendment provides for the number of common carrier elected directors to be based on the total Comsat voting stock owned by the carriers and that it would create "a more equitable voting formula for the election of directors. . . "

Noting that the carriers had reduced their Comsat holdings to 38 percent of the total voting stock as of December, 1968, Chairman Hyde said that under the present provisions of the Act they are still entitled to elect 50 percent of the Comsat board. "The fact that this 50 percent ownership expectation has not been realized is a valid reason for the proposed amendment," he stated.



62 Per cent of ETV Stations are Ready To Transmit Color

For a color session at the 1968 NAEB Convention, Marvin L. Bowman of Western Kentucky University conducted a survey of the 170 (Oct. 30) educationally licensed television stations to determine the extent of color facilities. He received 89 replies representing 140 television stations. This survey shows that some 62 percent of the respondents are capable of transmitting color and 15.7 percent have full color facilities (VTR, Film chain, live cameras). There was only one reply that indicated anything more than a handful of color classroom receivers. By far, the majority of replies said that the number of color classroom receivers is either unknown or pitifully few (10-40).

This survey was taken in an effort to project what the status of color television would be one year from now (Oct. 1969). Though these figures are valid, there is reason to question the asterisked percentages in that (a) the survey could have been misinterpreted by a few to include both their present and future facilities under the one year projection column; (b) some did not indicate by number; (c) some projections are based on pending grants.

Table 1

Now	Item Numbers	Numbers	% of Replies with Equipment
Transmitter:		87	62%
Film:	46	37	26%
VTR:	78	48	34%
Cameras	54	22	15.7%
Classroom Receivers:	?	(WBRA-TV-1000)	——
Remote Facilities:		11 (includes film)	8%

Table 2

In One Year	Item	Station	% of Replies	Totals Projected for Existing TV Stations
Transmitter:		29	20.7%	82.8%
Film Chain:	27	24*	17%*	43%*
VTR:	53	32*	23%*	57%*
Cameras:	30	15*	10%*	26%*
Classroom Receivers:	?	?	. . .	
Remote Facilities:		7	5%	13%

NAFMB To Meet March 23 in D.C.

Washington, D.C. will be overflowing with broadcasters during the latter part of March. The National Association of FM Broadcasters' annual convention will run from March 21-23. The usually well attended National Association of Broadcasters will open their convention doors March 23.

The NAFMB was founded in 1958 by a small group of independent FM broadcasters who felt that the "new" medium had special problems which then existing broadcaster' groups were not giving full treatment. Since its founding, only the NAFMB has been exclusively devoted to the welfare of FM broadcasters.

Today there are more than 300 NAFMB members spread throughout the nation, Canada and Mexico. Membership is about evenly divided between FM-onlys and AM-FM'ers.

The NAFMB sponsors regional seminars and conventions. The organization has an active working arrangement with RAB, liason with the NAB and is represented on the Broadcast Rating Council. The NAFMB has been on the committee to revise SRDS and has sponsored and conducted national surveys on penetration, audience size, demographics, programming, and sales and market data.

The "NAFMB Report," regularly sent members, covers sales, management, promotion, engineering, and Washington activities monthly. Timely news items keep members up to date on regional and national FM activities.

The purpose of the Association is to foster and promote the development of the art of frequency modulation broadcasting in all its forms; to protect its members in every lawful and proper manner from injustices and unjust enactions; and to do all things necessary and proper to encourage and promote customs and practices which will strengthen and maintain the frequency modulation broadcasting industry to the end that it may best serve the public.

In particular the Association:

1. Promotes, in the public in-

terest, the broadest possible use of the FM spectrum as an effective means of mass communication, and encourage separate FM programming.

2. Promotes the sale of FM receivers and their increased usage.
3. Promotes the purchase of FM broadcast time by local, regional and national advertisers and agencies.
4. Promotes the use of both qualitative and quantitative audience measurements by responsible research firms.
5. Acts as a central FM public relations, publicity and advertising bureau.
6. Fosters local and regional FM associations, and encourages their affiliation with the NAFMB.

FCC Denies Bauer FM Petition

A petition by Bauer Broadcast Products Division of Granger Associates for amendment of the Rules (RM-1273) to increase the permissible transmitter output power for noncommercial educational FM (Class D) stations has been denied by the FCC. The petition requested amendment of the transmitter output power limitation of 10 watts required by Section 73.504 (b) (1), and the standards of good engineering practice (Section 73.505) of the Rules by increasing the permissible transmitter output power to 20 watts for stations employing a combination of vertical and horizontal polarization.

Bauer Broadcast Products said that it does not seek to expand the coverage area of Class D FM stations, but only to make possible improvement of signal quality within the limited reception areas served without increasing interference potential. Bayer contends that Class D stations could add a vertical transmitting antenna and divide the 20 watts power equally between the vertical and horizontal antenna to improve service without increasing the interference potential of the station above that of one employing a 10-watt transmitter and a single plane of polarization. Equally effective results could be obtained through use of the present 10-watt transmitter and a better transmitting antenna, Bauer Broadcast Products said, but this might mean an unreasonably expensive antenna and a poor economic balance between transmitter and antenna costs.

Rules providing for licensing of low-powered noncommercial educational FM stations, the Commission noted, were adopted on August 19, 1948 (FCC 48-1958, Docket 9048). The stations were not intended as alternates to regular educational FM broadcast stations but were considered substitutes for wired carrier "campus" systems using AM broadcast channels which often created interference problems through frequency leakage from the wires used for signal distribution. The service, which offered a low-cost means of training students in operation and programming of a station, was intended to be limited to a small area, usually a college or university campus or the immediately surrounding area.

New Products At NAB Show

(Continued From Page 28)

Anderson Laboratories, Inc., Robert Fletcher, manager of video engineering for Anderson will introduce the company's zero studio delay unit that allows direct switching from a camera or other source to a second source which has been routed through a separate studio.

The unit permits dissolving, wiping and other special effects normally restricted by delay effects. It features 1 H minus studio delay plus or minus 10 nsec. Other features are: bandwidth—flat to ±0.5 db to 4 MHz; output S/N—50 db (peak to RMS); gain —0 ±1 db adjustable; and differential phase is less than 2 per cent with an input signal level at 1 volt peak. **Booth No. 537-S**

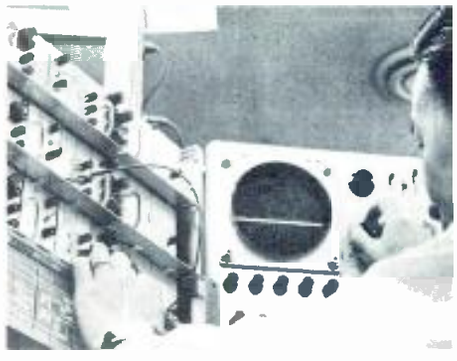
Zoomar, Inc. will introduce their new Zoomatar lenses for low light level television and photography. They will be available in two models, with a focal length of 75mm and 180mm and speeds of f/1.3.

The company also will show their new f/1 zoom lenses for Vidicon and Plumbicon monochrome cameras, utilizing Zoomar's variospeed control box which is adaptable to all studio cameras. Also, Zoomar will be ready to detail their new optical testing service. **Booth No. 505-S**

Gates Radio Company will show their automated radio station and for the first time will demonstrate their automatic program logging system in which teletype impulses from first seconds of tape cartridge travel activate a page printer and the schedule of programs logged are typed directly from the tape cartridge. The system is a direct printout of a complete and permanent program log, recorded automatically.

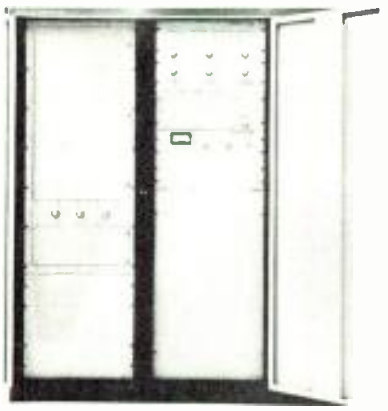
Also on display will be a host of Gates audio products, including the TV-15 Console with a TVS-6 submixer panel. In addition, there will be a group of AM and FM transmitters on display. Group features include digital logging and accessory monitors and amplifiers. **Booth No. 213-SP**

Anderson—Zero Delay



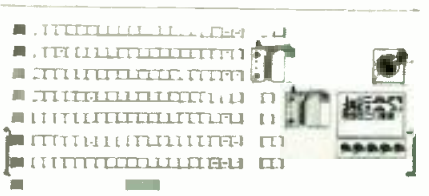
CBS—Image Enhancer

Spindler-Sauppe



Collins—EM Transmitter

Kahn—Transmitter



Grass Valley—Switcher

Berkey—Maxi-Brute

ENGINEERS' EXCHANGE

Dear Editor:

One of our three Ampex PR-10s developed a popping noise on playback. This noise was present only when the transport mechanism was running. The noise had a definite time constant, and sounded like an arc, such as would occur when a relay or switch breaks contact. It was found that grounding the belt that drives the supply reel via the eddy current clutch assembly would eliminate the noise. The noise was also eliminated by grounding the supply clutch housing. A quick check with an ohmmeter revealed that the clutch assembly was above ground, thus permitting a static charge to build up on the drive belt and then discharge, causing the popping sound. The eddy current clutch and brake assembly is mounted to the front panel with three screws; however, fiber washers are employed between the brake assembly and the front panel. Although the screws are threaded through the front panel, it was discovered that the paint was preventing the screws from making a ground connection. All that was necessary was to scrape the paint from the panel under the screw heads in order to make a good ground connection for the eddy current clutch assembly.

Barry Atwood
Chief Engineer
WBKY-FM

Dear Sirs:

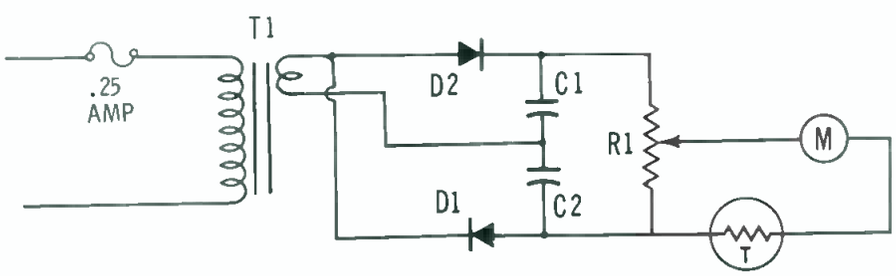
Here's one for your submission to a future issue of one of the finest trade magazines in the business.

What is more annoying than trying to guess at the temperature outside when an operator is busy trying to hold things together in the control room? I have tried a number of combinations and came up with one some time ago that I'd like to share with my colleagues behind the soldering gun, who are still running outside to see how cold it is

From other combinations I had tried, some parts for the project were already on hand. No. 12 volt filament transformer was available, so I used one with a 6.3 winding and made a voltage doubler. Some 400 PIV diodes were in the parts drawer, and I uncovered a 2 Watt WW 100 K pot, which serves to vary the voltage across the meter-thermister and thus is used to calibrate the temperature with an official thermometer. The thermister (from Allied Electronics) was soldered on the end of a pair run out to the dog house which also contains our official thermometer, a line about 50 feet in overall length. It would appear the length of line is immaterial to the performance of the unit. The 100 microammeter falls off in linearity on the lower end of the scale but this is only slight, and if desirable, a meter face can replace the original to follow the path of the thermister. We have had this unit in use for some time and although the operators still check the official thermometer about once per shift, very little calibration is necessary.

Walt Rice
Chief Engineer, KWIL,
KWIL-FM

Ed. Note: Got any tips you think would help solve other nagging problems? Any worthy shortcuts? A better electronic mouse trap? Send your tips to The Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo., 64105.



Parts List

T1—Filament Transformer/6.3 volt Winding
D1, D2—400 PIV Diodes
C1, C2—40-40/150 WDVC.
R1—100,000 ohm 2 watt wirebound potentiometer
THM—Thermister 135,000 ohm at 25° C. (Allied Electronics Part #60F6615)

Circle Item 92 on Tech Data Card

Circle Item 93 on Tech Data Card

Advertisers' Index

Professional Services

Classified

Advertising rates in Classified Section are 15¢ per word, each insertion, and must be accompanied by cash to insure publication.

Each initial or abbreviation counts a full word. Upper case words, 30¢ each.

Minimum classified charge, $2.00.

For ads on which replies are sent to us for forwarding, there is an additional charge of $2.00 to cover department number, etc., which is printed in advertising copy, and processing of replies.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or a distributor.

Equipment Wanted

Zoom lens, other cameras, and tubes wanted. Ted Dames Co., 308 Hickory St., Arlington, N. J. 07032. 1-69-3t

Help Wanted

VIDEO TAPE ENGINEERS

Expansion in the video tape machine field has created new opportunities for engineers to test equipment at our plant and supervise installations at customers' facilities. You should have previous experience on video tape equipment, either with a manufacturer or a broadcast station.

If you are a self-starter and have the experience required, this is an opportunity to grow with a dynamic, expanding national company in the broadcast field. Attractive salary will be commensurate with background and experience. Send your resume to Mr. Frank Haney, General Manager.

VISUAL ELECTRONICS LABORATORIES
725 San Aleso Avenue
Sunnyvale, California 94086

IMMEDIATE OPENINGS: Qualify for any of the following positions: RCA CCTV Equipment, monochrome or color, TV Systems Engineers - Maintenance Technicians - Video Engineers - to work in either New York, New Jersey or California area. Write: RCA Rep., 1559 Jericho Tpke., New Hyde Park, New York 11040. tf

TV Transmitting Technician

Desire person with two to five years experience in TV/FM transmitter experience in broadcasting facility, or experience as expert color TV receiver service technician to perform final production test activity.

Technical school training or equivalent in U.S. Armed Forces desirable.

Complete employee benefit program. Modern, air conditioned plant. Medium midwest city with excellent public and parochial schools.

Write or phone collect. Personnel Department, 217-222-8200.

Gates Radio Company
A Division of Harris-Intertype Corp.
Quincy, Illinois 62301

An equal opportunity employer (M&F)

Help Wanted (Cont.)

MANAGER, SALES & MARKETING
TV RELAY LINKS

We are a leading supplier of militarized microwave relay equipment, now offering a line of all solid state TV relay links for STL and intercity use to the TV Broadcast industry.
The man for this job has contacts at TV stations throughout the country, and has the ability to organize and manage an aggressive sales and marketing campaign including the selection of a nation-wide rep organization.
This is a top position for a top-notch man. Visit us at NAB Booth 544 (Shoreham), or contact R. B. Hirsch at

RHG Electronics Laboratory, Inc.
94 Milbar Boulevard
Farmingdale, L. I. 11735
(516-694-3100)

Job Headquarters for all Radio and Television Engineers. Immediate openings exist in 9 western states and elsewhere for qualified engineer and technical personnel. All categories from trainees to experienced transmitter maintenance, chief, assistant chief, live color video maintenance and technical operations. Send us your complete resume now. The AMPS Agency, 3924 Wilshire Blvd., Los Angeles, California 90005. Telephone DU 8-3116. By Broadcasters—For Broadcasters
11-66-tf

MARKETING—Application engineers are needed by a MOVE-AHEAD corporation strong in broadcast and closed-circuit television systems. Direct work with customers and outside sales engineers. FIELD ENGINEERS also are required for installation, setup and repair. Recent large or medium-size station experience and/or broadcast sales experience is desired. Some travel may be necessary. If you are interested in a CHALLENGING position, this may be the chance to make the positive move in your career. EXCITING SAN DIEGO: major league football, baseball, basketball and hockey; surfing 55 miles from the snow line; deep sea sportfishing; 65 year-round golf courses. Call R. J. Schlicht, general sales manager, at 714-277-6700, or send your resume to COHU ELECTRONICS, INC., Box 623, San Diego, California 92112. An equal opportunity employer. 3-69-1t

ENGINEER/MALE. Growing Radio Broadcast Company looking for Chief Engineer to oversee two AM and two FM stations. Both located in Florida. The man we want is a shirtsleeve, "Do-it-Myself" engineer interested in top quality studio sound. 80% of our equipment is brand new, the other 20% will be replaced if you recommend it. Starting salary $8,000 per year, hospitalization and a chance to build a career with a young company that is offering to put you in complete charge of all engineering. Tell all in your first reply. Broadcast Engineering, Dept. 227, 1014 Wyandotte, Kansas City, Mo. 64105.
3-69-1t

Wanted Immediately: FIELD TECHNICIANS READY FOR BIGGER JOBS—Capable and competent men with experience in TV systems or carrier systems. Rapid promotion; security plus fringe benefits; all replies confidential. Send resume with current salary level to Vern L. Coolidge, V. P. and General Manager, Comm/Scope Corporation, P. O. Box 489, Hickory, North Carolina 28601.
3-69-1t

TELEVISION ENGINEERS—Join a CREATIVE corporation working on broadcast and closed-circuit television for applications in space, ground, sub-surface and underwater. DESIGN ENGINEERS are needed for video processing, video switching, CCTV systems and color camera systems. More than 120 television stations use our equipment. SEVERAL OPENINGS exist in the above design fields. Applicants should have recent circuit or system design experience in related fields and have a BSEE or MSEE physics or equivalent. BEAUTIFUL SAN DIEGO University of California and three other four-year institutions; first-rate symphony orchestra; aero-space and art museums; fine arts gallery; light opera; family recreation unlimited; America's finest climate. Call J. W. Barnes, Chief Engineer, 714-277-6700, or send your resume to COHU ELECTRONICS, INC., Box 623, San Diego, California 92112. An equal opportunity employer. 3-69-1t

PRODUCT MANAGERS

BROADCAST EQUIPMENT

Continued expansion of a dynamic national company has created two key openings in Product Management. Your principal function will be to provide recommendations for levels of quality, quantity, price, service and parts, plus sales support in presentation of sophisticated systems. Requires full working knowledge of products and markets.

(1) AM/FM BROADCAST EQUIPMENT

All products, including microphones, consoles, monitoring equipment, towers and antennas.

(2) VIDEO TERMINAL EQUIPMENT

Video switchers, amplifiers, special effects, sync generators, monitoring and test equipment.

All inquiries will be treated confidentially.
Send your resume to
Miss P.M. Hicks, Personnel Manager.

VISUAL ELECTRONICS CORP.

356 West 40th Street, New York, N.Y. 10018

An Equal Opportunity Employer

SALES REPRESENTATIVES
TV RELAY LINKS

Openings exist for qualified organizations in territories throughout the United States. RHG Electronics Laboratory, Inc. a leading supplier of militarized microwave relay equipment, is now offering a complete line of all solid state microwave relay equipment for STL and intercity use to the TV broadcast industry.
Visit us at NAB Booth 544 (Shoreham), or contact R. B. Hirsch at:

RHG ELECTRONICS LABORATORY, INC.
94 Milbar Boulevard
Farmingdale, L. I., New York 11735
516-694-3100

Available July, 1969. Openings for TV Engineers and TV Technicians. Duties include installing and operating color and black and white TV systems. Salary commensurate with experience. Send resume to Ronald Lask, Chief Broadcasting Engineer, University of Ill. Medical Center, P. O. Box 6998, Chicago, Illinois 60680.
3-69-3t

HELP WANTED—TECHNICAL. Assistant Chief Engineer position available in a combined AM-FM-TV facility located in medium sized Minnesota market. Contact Broadcast Engineering, Box 228, 1014 Wyandotte St., Kansas City, Mo. 64105.
3-69-2t

COMMUNICATION PRODUCT DIRECTOR. Are you the experienced administrator we are seeking to guide our company's well-established communication product line; to plan and direct future expansion into related fields of your selection? Our outstanding engineering staff is standing by to accept your direction for product design and development. This completely autonomous key executive will report to our vice-president—marketing. We invite your reply, which will be held in complete confidence. Please contact: C. D. Haverty, (402) 342-2753. McMARTIN INDUSTRIES, INC. 3104 Farnam Street, Omaha, Nebraska 68131.
3-69-3t

TV Technician for new station—First phone, experienced in color or transmitter. Supervisory position. Contact KMTC, P. O. Box 3417 GS, Springfield, Mo. 65804.
3-69-1t

Situation Wanted

Radio Station Manager, married, desires Midwest Station Management. Strong on Sales. Good References, non-drinker, presently manager 1000 Watt Northwest station. Broadcast Engineering, Box 229, 1014 Wyandotte, Kansas City, Mo. 64105.
3-69-1t

Training

To advance in electronics, knowledge and ability are required. Grantham offers correspondence and resident instruction, in depth, leading to the degree of Associate in Science in Electronics Engineering. G. I. Bill approved. Credit for previous training and experience allowed. Free Catalog. Write: Dept. E-2, Grantham School of Electronics, 1505 N. Western Ave., Hollywood, California. 90027. 6-67-tf

First phone through tape recorded lessons at home plus one week personal instruction in Washington, DC, Atlanta, Boston, Detroit, New Orleans, Minneapolis, Seattle, Denver, Portland, Los Angeles. Proven results. Our 17th year teaching FCC license courses. Bob Johnson Radio License Preparation, 1060D Duncan, Manhattan Beach, Calif. 90266. Phone 213-379-4461.
1-69-tf

Equipment for Sale

AM or FM Audio P.O.P. form kit $1.50 postpaid. Broadcast Service Co., Box 2605, Corpus Christi, Tex. 78403.
2-69-tf

CRYSTAL AND MONITOR SERVICE: Crystal service with us is usually a matter of hours, not weeks! Repair or replacement of oven type broadcast crystals at reasonable prices, most all makes. Also repair or frequency change of AM frequency monitors and H-P FM monitors—inquire. Many years experience Call or write: Eidson Electronic Co. Box 96, Temple, Texas. Phone (817) 773-3901
3-69-EOM

RCA MONOCHROME REMOTE UNIT — INTERNATIONAL TRUCK, GERSTENSLAGER BODY, 4 CAMERA & VTR CAPABILITY. NEW EARLY 1965. COMPLETE, READY TO ROLL. WRITE FOR FULL DESCRIPTION—WKBD-TV, BOX 359, SOUTHFIELD, MICH. 48075—A. MARTIN, ENGINEERING MANAGER.
3-69-1t

3 Daven 50/50 ohm T attenuators, 1 Daven 250K ohm attenuator. Presto model 8K 3 speed disc recorder, make offer. Doc's Radio, 723 N. Horton St., Marion, Indiana 46952.
3-69-1t

EQUIPMENT FOR SALE—RCA TF5CM television antenna—10 years old. Available for immediate inspection. Contact E. M. Tink, KWWL-TV, Waterloo, Iowa.
3-69-2t

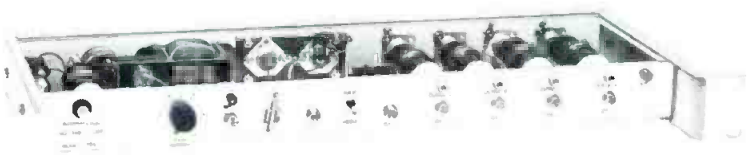
FOR SALE: Western Electric 504-B2 and 504-B6 transmitters. Identical one kilowatt driver stages, can be used as transmitters. Both working. Contact: F. P. Clay, Jr.: C. E.: WRVC, 2712 Colley Avenue Norfolk, Virginia, 23517. Phone 322-4600.
3-69-1t

CoAx TRANSFER SWITCHES—3⅛" Andrews 6720 50 ohm—Unused. $500.00 each. Sierra-Western Elect. Co., Oakland, Cal. 94607. Phone 415-832-3527.
3-69-tf

Business Opportunity

EXCELLENT OPPORTUNITY IN COMMUNICATIONS. New exciting Cablecasting field, (same as Television broadcasting except over CATV systems). Annual potential of $250,000 in advertising sales. All modern studio including video tape machines and Cortez Van Mobile Studio. Will finance right party. Phone area code 517 356-1510.
2-69-3t

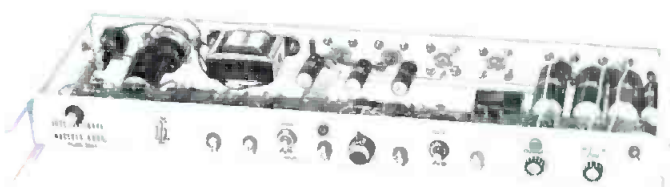
TDA2D VIDEO/PULSE DISTRIBUTION AMPLIFIER



The now-famous TDA2 Distribution Amplifier, in use at most television stations and networks, has a recently added feature. The "D" stands for Differential Input, which we added to the TDA2. And not only did we add a differential input, we subtracted $30.00 from the price. Instead of $325.00, we're selling the new improved TDA2D for $295.00 F.O.B. Nashville, Tennessee. The compact TDA2D fits neatly into 1¾ inches of panel space and produces virtually no heat. For complete information, write to:

INTERNATIONAL NUCLEAR CORPORATION
608 Norris Ave • Nashville, Tenn. 37204 • Ph.: (615) 254-3365

TDA5 BALANCED/UNBALANCED VIDEO/PULSE DISTRIBUTION AMPLIFIER



For the many occasions when signals must be transmitted balanced, yet must be fed to other equipment unbalanced, International Nuclear offers the TDA5. Two inputs are provided, selection of which is accomplished by a front panel switch. The balanced input is the bridging type and may be terminated in 124 ohms. The unbalanced input is high impedance and may be terminated in 75 ohms. The TDA5 serves both video and pulse functions at the flip of a switch. The TDA5 sells for $400.00 F.O.B. Nashville. For additional benefits of this system and complete information, write to:

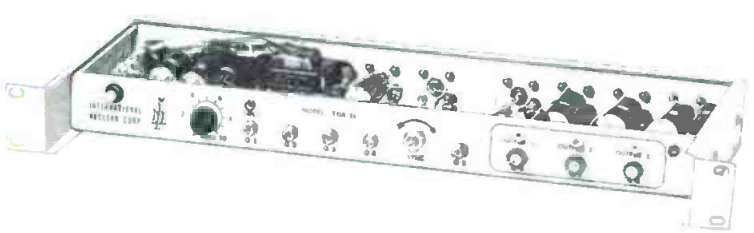
INTERNATIONAL NUCLEAR CORPORATION
608 Norris Ave • Nashville, Tenn. 37204 • Ph.: (615) 254-3365

TDA7 VIDEO/PULSE DISTRIBUTION AMPLIFIER

The TDA7 is a completely transistorized distribution amplifier constructed as a plug-in module. The rack will hold 10 TDA7's and occupies only 5¼ inches of panel space. Each plug-in unit provides the video and pulse functions with the flip of a switch. Provision is made to add a sync-adding circuit directly to the TDA7. This is specified as TDA9. The individual TDA7 plug-in units are $295.00 each F.O.B. Nashville, Tennessee . . . with sync-add feature $320.00. The mounting frame accommodates up to 10 units and sells for $270.00. For complete specifications and information on other accessories, write to:

INTERNATIONAL NUCLEAR CORPORATION
608 Norris Ave • Nashville, Tenn. 37204 • Ph.: (615) 254-3365

TDA26 HIGH GAIN VIDEO AMPLIFIER



The TDA26 is a compact, completely transistorized Pulse Distribution Amplifier designed to be used at the output of camera branching pads or in any application where 28 DB gain is required. The TDA26 mounts in a standard 19-inch rack, using type 83 connectors throughout. It has 3 signal outputs, weighs less than 4 pounds, mounts in 1¾ inches of panel space. The TDA26 sells for $400.00 F.O.B. Nashville, Tennessee. For complete information, write to:

INTERNATIONAL NUCLEAR CORPORATION
608 Norris Ave • Nashville, Tenn. 37204 • Ph.: (615) 254-3365

Circle Item 38 on Tech Data Card

Even during a power failure, the routing path of the RLS-100 stays memorized by use of magnetic latches.

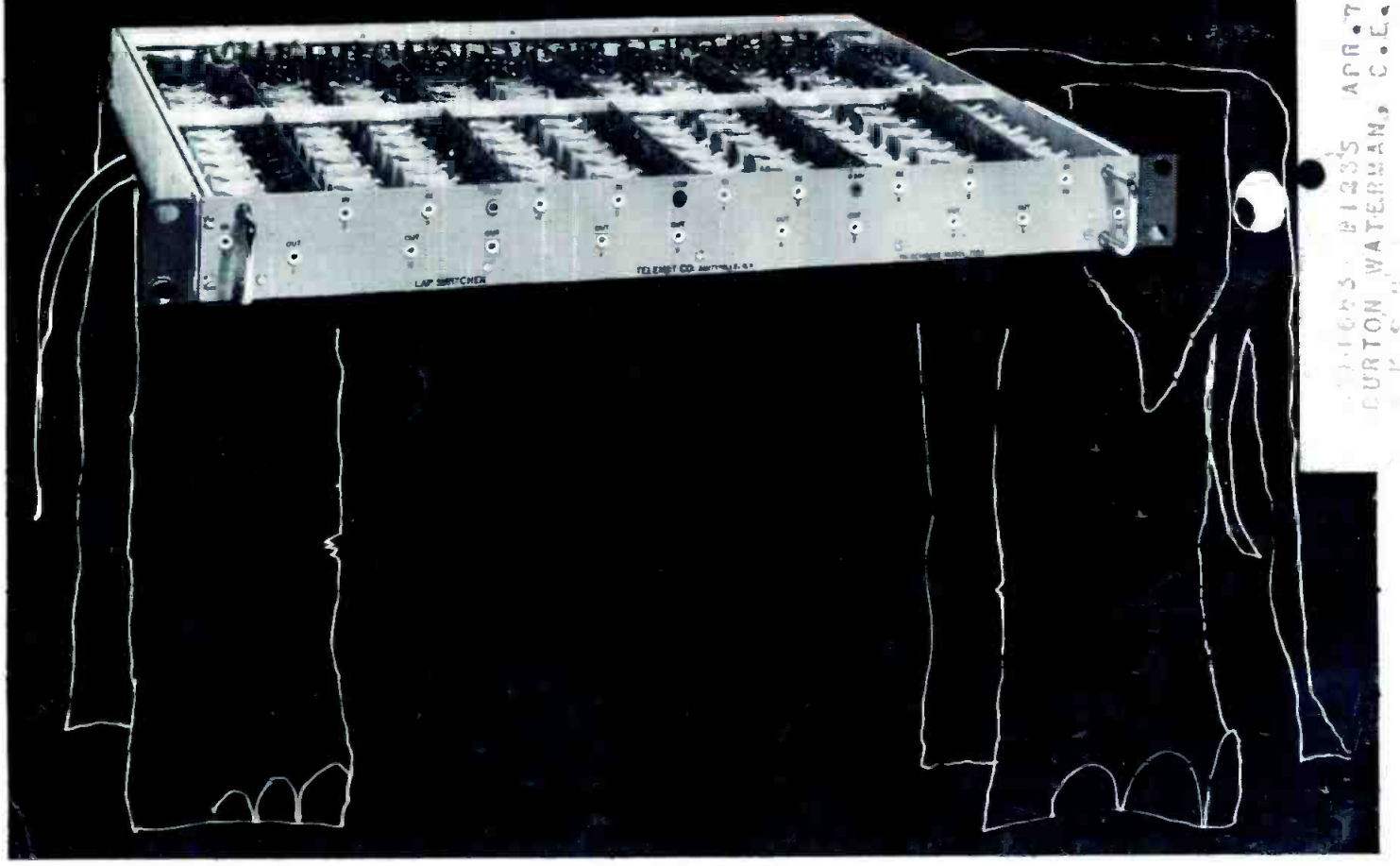
Compact (1¾" high) and extremely low cost, the Telemet RLS-100 Routing Switcher can be expanded . . . and expanded . . . and expanded again . . . simply by adding modules. This versatility makes the RLS-100 ideal for both the smallest stations and the largest networks.

Thoroughly tested PC board type plug-in relays insure highest reliability: and audio and video can be switched on the same relay. The plug-in feature also allows easy access for simplified maintenance.

Telemet's Routing Switcher never forgets. And don't **you.** Call or write us today for complete specifications.

TELEMET
a division of GEOTEL, INC.
185 Dixon Avenue, Amityville, New York 11701
Telephone (516) 541-3600

Telemet's routing switcher never forgets.



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