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November, 1968/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry

Communications satellites: How will we use them?

Page 16

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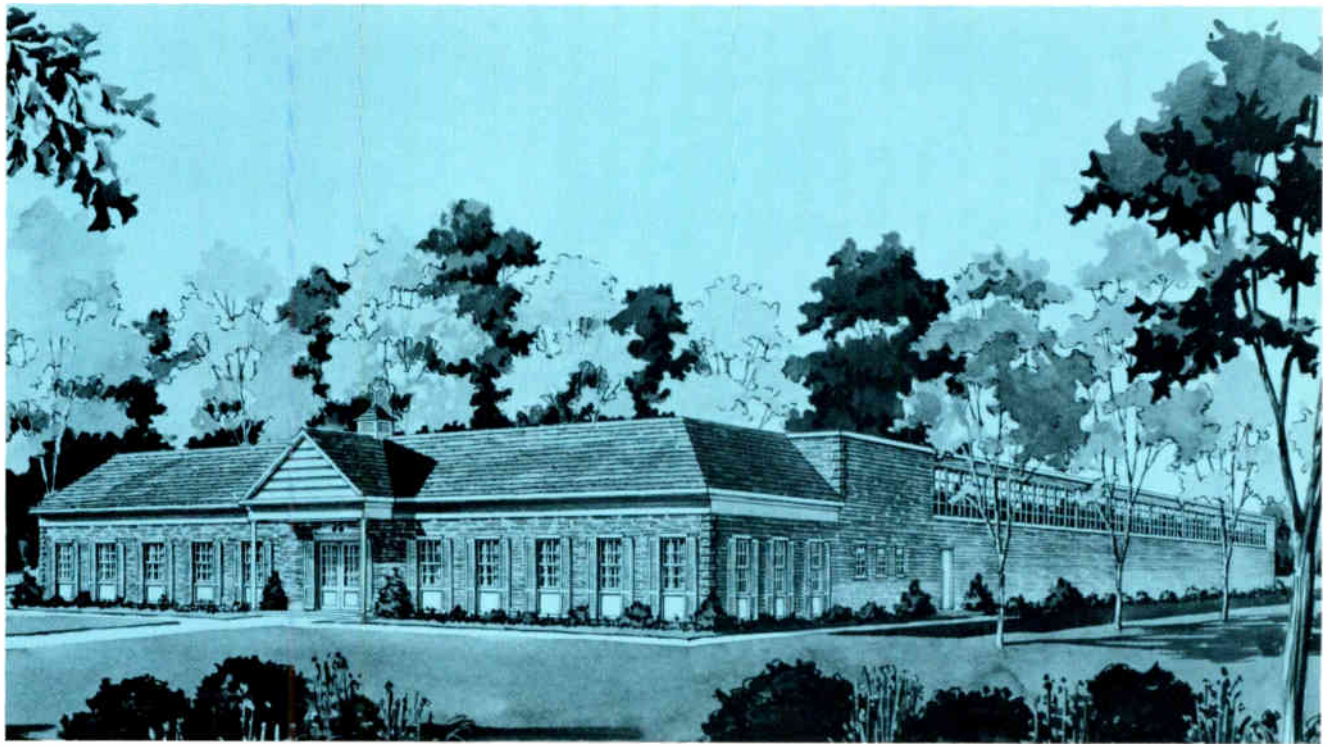

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Circle Item 1 on Tech Data Card

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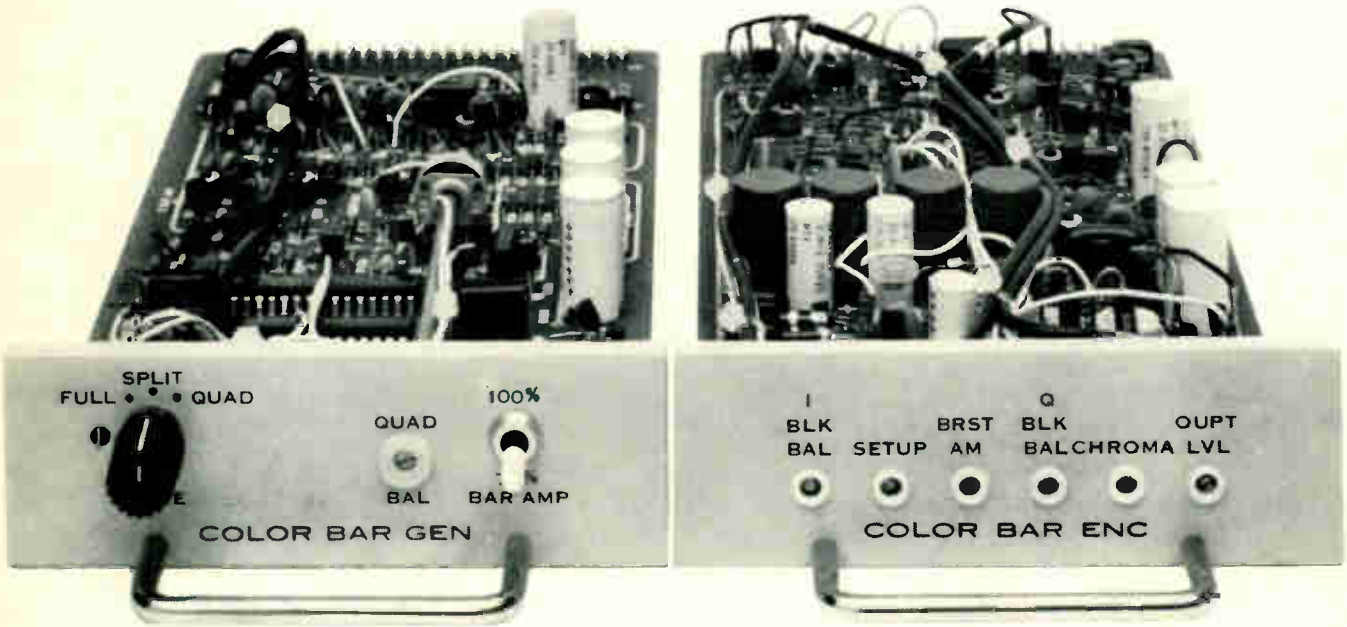

Cohu's Color Bar Generator facilitates adjustment of color monitors, encoders and other studio equipment requiring RGB I-Y-Q signals which meet EIA specifications. Video bar outputs are switchable from 100 to 75%. Special test pulses allow adjustment of quadrature without use of a vectorscope.

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For specific data on each accessory, contact your local Cohu representative, or call Bob Boulio direct at 714-277-6700 in San Diego. Box 623. San Diego, California 92112. TWX 910-335-1244.

COHU ELECTRONICS, INC
SAN DIEGO DIVISION

Circle Item 4 on Tech Data Card

November, 1968 • Volume 10, No. 11

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

Pictured on the cover is a satellite communications antenna. See inside story on page 16.

DEPARTMENTS

BROADCAST ENGINEERING is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105.

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Comes the Evolution

Audimax and Volumax

Television Mobile Vans

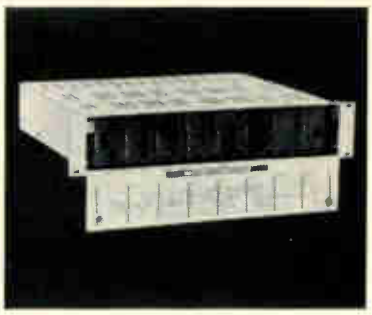
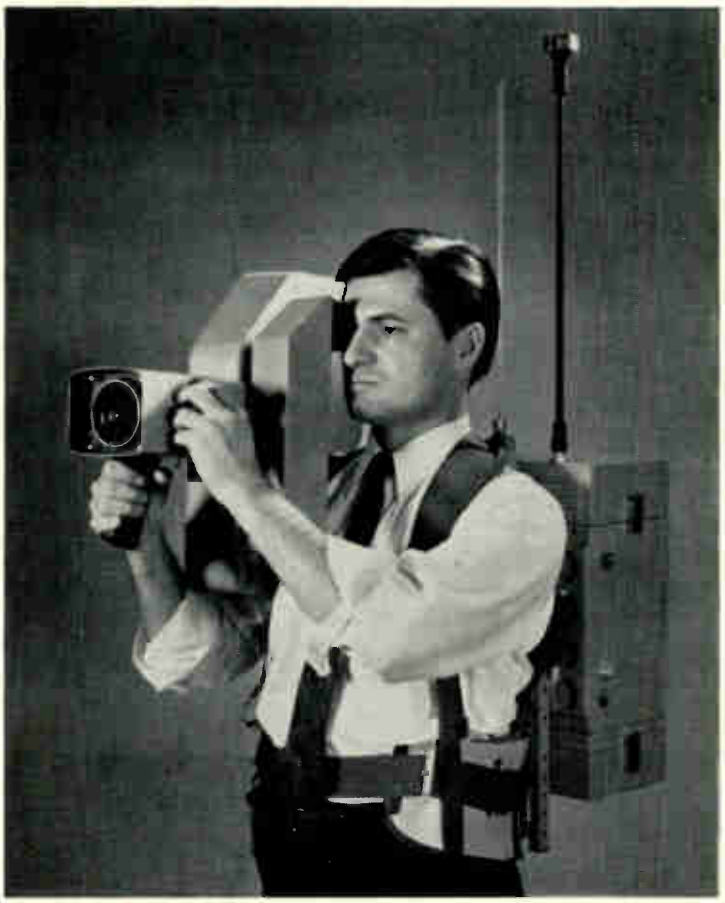


Image Enhancer

...and now the Minicam VI



The new Minicam VI is just one more innovation from CBS Laboratories—the organization which has researched, developed, produced and marketed such remarkable advances in the science of sight and sound as the Audimax and Volumax, Mobile Television Vans, and the Image Enhancer. The organization with vision on the move. Now the new Minicam is free to go anywhere: land, sea or air—riding easily on the shoulder of a single cameraman. And brings you studio-quality color pictures live right from the scene of action! Look to CBS Laboratories for tomorrow's electronics today.

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Circle Item 5 on Tech Data Card

LETTERS TO THE EDITOR

Editorial Notes

The Broadcast Engineering editorial office often receives requests for back issues and reprints. Back issues requests should be sent to: Pat Osborne, Howard W. Sams Co., 4300 W. 62nd Street Indianapolis, Ind., 46206.

Reprint requests should be directed to: Dean Kroeker, Intertec Publishing Corp., 1014 Wyandotte, Kansas City, Mo., 64105. A reprint policy handbook will be sent by the editor when requested.

Change of Address

All correspondence for the BE editorial staff should be sent to Intertec Publishing Corp., 1014 Wyandotte, Kansas City, Mo., 64105.

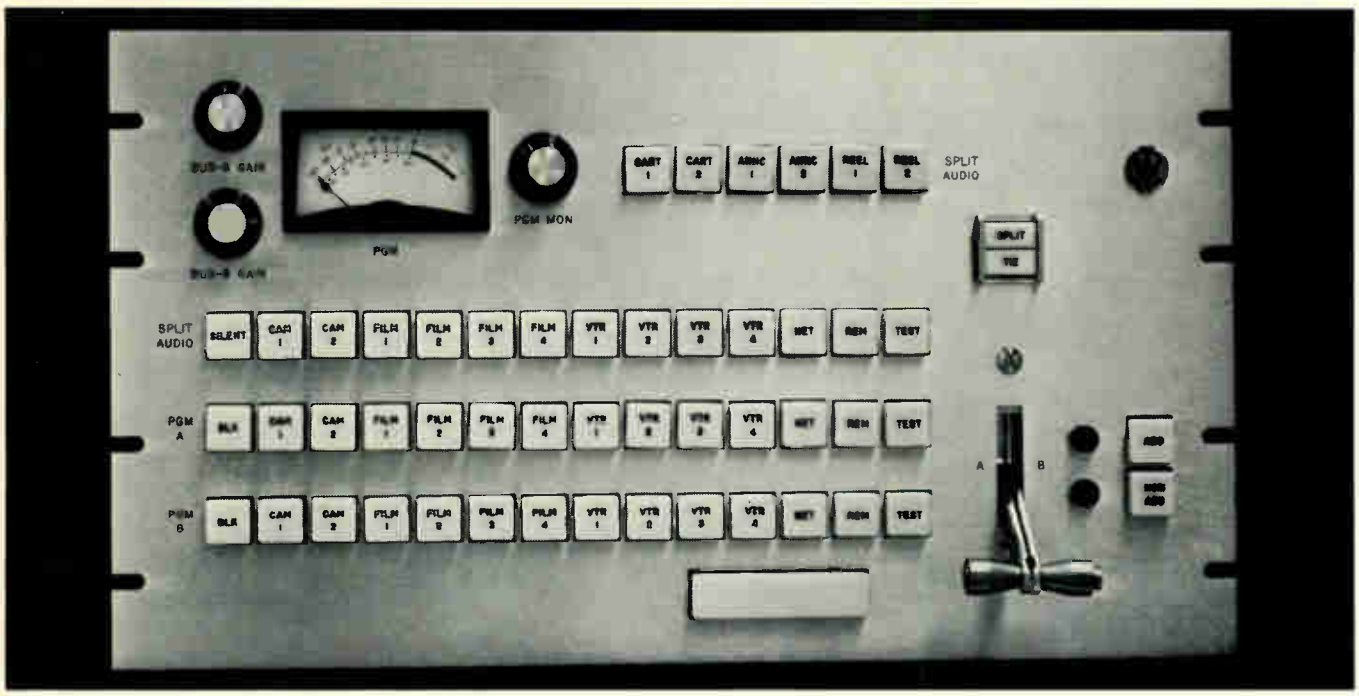
Many news items are still being sent to the former BE offices in Indianapolis. Since using the former address causes long delays, some news items sent well before the editorial closing date arrive too late for publication.

Editorial Changes

Why wait for conventions to pass along the news about who has become a CE, who has been transferred or who is working on a new installation? Take a look at the BE departments. It should be apparent that they are designed with the engineer in mind. Pass along your news through BE.

Occasionally we get letters asking about the Engineer's Exchange column. Why doesn't it appear in every issue? Mostly because the items do not come in regularly. And while we're on the subject of submitted materials, BE is on the lookout for articles on lighting. Regardless of subject matter, we'd like to know what you're doing and how you're doing it. An author's guide will be sent upon request.

+ video
+ audio
+ cutbar
+ non-additive mixing
+ breakaway audio



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Circle Item 7 on Tech Data Card

INDUSTRY NEWS

Apollo 7 Camera Is Successful; Manipulators Next?

Apollo 7 got into orbit in good shape Oct. 11, and along with it went the much disputed half million dollar RCA camera. The dispute got its start when Commander Walter Schirra indicated he didn't like the idea of flight controllers looks over his shoulder.

What's more, the crew insisted that the picture quality was not good, and that they did not want to take anything along that was not perfect. Those who saw the picture relayed to earth on Oct. 14 had to agree that, contrary to previous doubts, the picture quality was good.

The 4½ pound camera consumes a little more than six watts of power and uses a 500 Hz bandwidth. It works at 10 frames a second and has 325 scan lines. The reception of acceptable signals should allow a high public relations value for the Apollo series.

Remote-controlled manipulators could be used to construct satellites in space—or even to repair or maintain satellites in orbit—according to a recent study conducted by engineers at the General Electric Company.

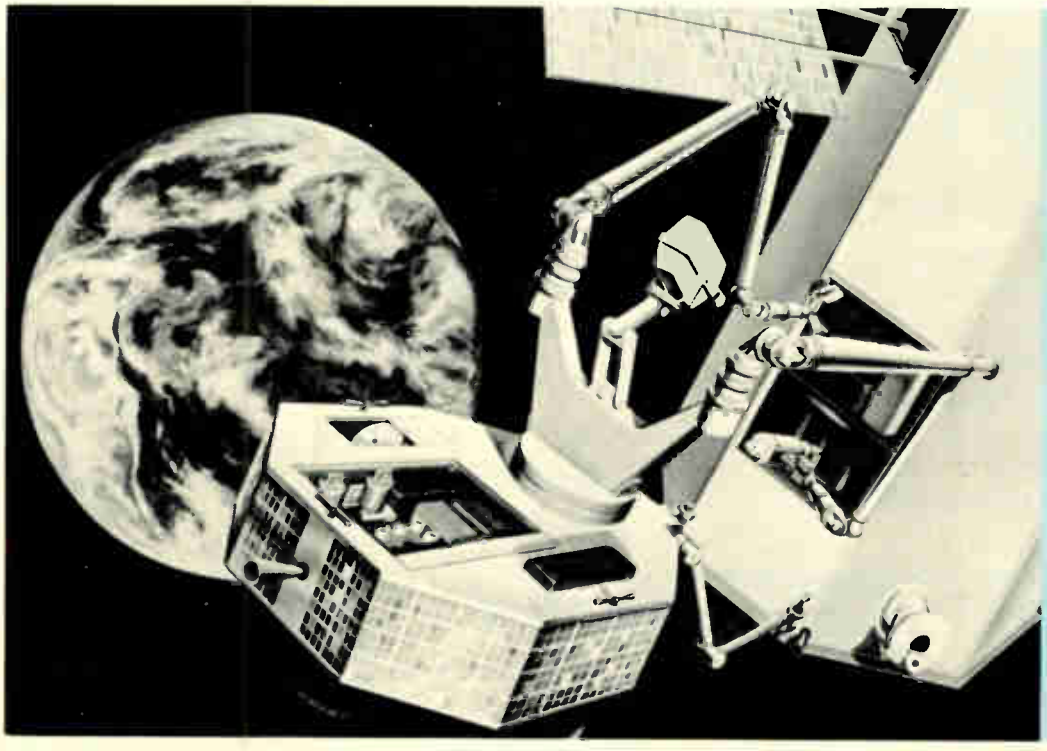
The GE effort—performed under a contract from the U.S. Air Force Aero-Propulsion Laboratory at Wright Patterson Air Force Base—has established the preliminary specifications for a system that would permit operators to perform sophisticated construction and repair tasks in space with remote-controlled manipulators. The operators could be located on the ground or in neighboring spacecraft.

The study indicates that a space manipulator system—equipped with TV cameras that would act as "eyes" for the operators—could be mounted aboard a maneuverable "repair spacecraft." Unlike conventional robots, the slave manipulators would incorporate "force feedback," so that an operator could feel what the manipulators are doing.

Under this system, an operator's hand and arm movements would be transmitted by telemetry to the repair satellite's slave manipulators, which would mimic the operator's motions. Proportions of the forces generated or encountered by the machine would be transmitted back to the operator's hands, providing him with an accurate sense of touch necessary to perform delicate, complex tasks by remote control.

The study of remote-controlled manipulators was conducted by GE's Specialty Materials Handling Products Operation in Schenectady, New York, and the company's Space Systems Organization in Philadelphia.

One major problem would be created by the time lag in communications between an operator on the ground and a remote-controlled manipulator in space, according to the study. Depending upon the distance of the manipulator from the operator, the time delay could range from three tenths of a second to one second or even longer. Although the operator can adjust to this time delay, additional research on force-reflecting systems is required to improve task speed without affecting the stability of the manipulators.



In this artist's concept, electronic components are installed in an orbiting scientific satellite by slave manipulators mounted aboard a remote-controlled "repair spacecraft."

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Kentucky ETV: Nation's Largest

The nation's largest state educational TV network, a 12-station RCA transmitting system covering all of Kentucky, went on the air recently when Gov. Louie B. Nunn pushed a button to begin the first broadcast.

The ceremonies at network headquarters marked the start of weekday televised instruction for pupils in Kentucky elementary and high schools. Adult continuing education and cultural program broadcasts for home viewers during the evening hours will begin next January.

UHF broadcast facilities at the 12 sites make use of TV transmitters and antennas produced by the RCA Commercial Electronic Systems Division and supplied under a $4 million contract, representing the largest single purchase of broadcast equipment received by RCA.

Common-carrier microwave connects the transmitters in a broadcast network and links the transmitting locations in turn to the network center in Lexington where most of the programs will be produced or originated. Studios at six state institutions of higher education and one at the Jefferson County School System also may originate programs for the network.

O. Leonard Press, Executive Director, Kentucky Authority for Educational Television, said programs will be transmitted in both color and black-and-white, with color broadcasts originated from film and TV tape until the color equipment is fully installed and operative later this year.

He added that programs for classroom viewing will concentrate on the elementary and secondary school levels and, with full operation of the network, TV lessons will reach nearly all of the state's 750,000 pupils in these schools.

Computer Control Streamlines NHK

One of the most advanced information and control systems in the broadcasting industry, and one of the most advanced such systems in the world, was dedicated in September by the Japan Broadcasting Corporation (NHK).

The system, called TOPICS (for Total On-line Program and Information Control System), will coordinate all production and broadcasting activities of NHK's two television and three radio networks—a complex roughly equivalent to a commercial network like CBS, an educational network like NET, plus an FM and two AM radio networks.

TOPICS, developed by NHK with the collaboration of IBM, will help administer the simultaneous production of some 1800 programs by 1000 directors and 2700 technicians at work in 26 TV and 33 radio studios and on location. It will do so without the memorandums, letters and phone calls that characterize other, similar environments.

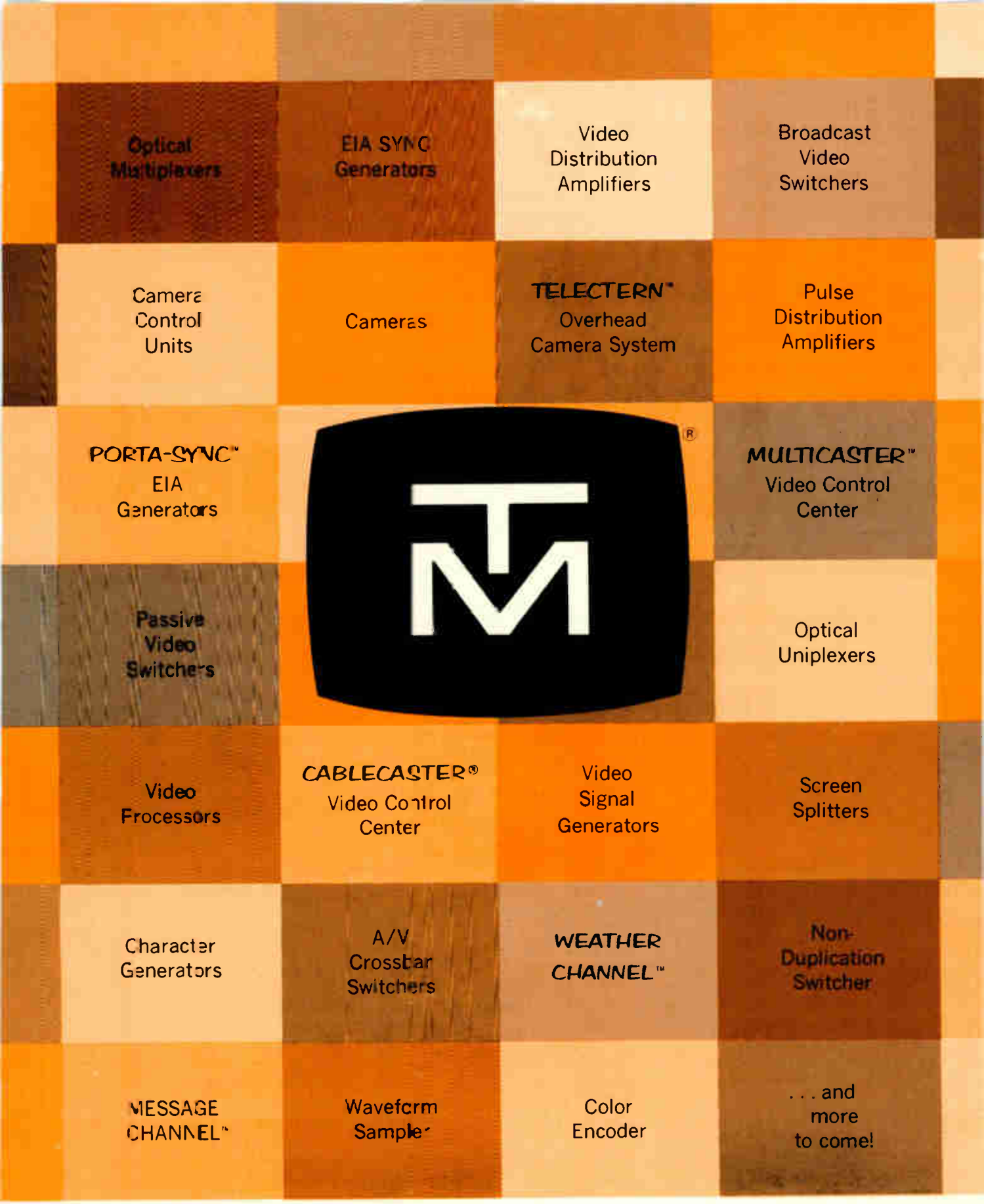
The system will also provide management reports and perform general accounting tasks.

The nerve center of TOPICS and of NHK's broadcasting activities is a Broadcast Control Center (BCC), a large, brightly-lighted room at NHK headquarters in downtown Tokyo, where fewer than two dozen personnel plan and supervise the production of the 640 TV shows and the 1200 radio programs constantly in production and monitor the five that are at any given time on the air.

Commenting on the new system, NHK President Yoshinori Maeda, under whom it was developed, observed that with TOPICS the computer reaches into a new era. NHK, he said, is not using the computer simply in individual applications, such as information retrieval, simulation, computation, or process control, but for all, simultaneously and in a completely integrated way.

NHK, Mr. Maeda continued, has made the computer the technological underpinning of its entire $280 million a year complex of operations. It is using the computer online in the planning, production and actual broadcasting activities of its five networks, and though the computer is fusing those formerly separate activities into a single, continuous process.

A line of television screens (back) monitor programs being broadcast by Japan Broadcasting Corporation's two television networks and those of five competing channels. The corporation also broadcasts on an FM and two AM radio networks.



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Annual Engineering Conference Dates Set By NAB

The Broadcast Engineering Conference Committee of the National Association of Broadcasters recently approved the format for the 23rd Annual Broadcast Engineering Conference and named two subcommittees to select a recipient of the Engineering Achievement Award and luncheon speakers.

The Conference will be held in conjunction with the 47th Annual Convention of the National Association of Broadcasters, March 23-26, at the Shoreham and Sheraton Park hotels in Washington, D.C.

In addition to reviewing outlines of technical papers submitted for presentation at the Conference, the Committee also agreed to include on the agenda a discussion of satellite communications.

Named to select the Engineering Achievement Award recipient were: Robert W. Flanders, director of engineering, The WFBM Stations, Indianapolis, Ind., chairman; Charles Abel, manager of engineering, KFMB-TV, San Diego, Calif.; Leslie S. Learned, vice president for engineering, MBS, New York; L. Keith Townsdin, technical director, KAYS, Inc., Hays, Kans., and William H. Trevarthen, vice president, operations and engineering, NBC, New York.

The subcommittee for the selection of luncheon speakers consists of James D. Parker, staff consultant, telecommunications, CBS television network, New York, chairman; Glenn G. Boundy, vice president for engineering, Storer Broadcasting Co., Miami Beach, Fla.; Albert H. Chismark, director of engineering, Meredith Broadcasting Co., Syracuse, N.Y.; Royce LaVerne Pointer, director of broadcast engineering, ABC, New York, and Lee R. Wallenhaupt, vice president for engineering, The WSJS Stations, Winston-Salem, N.C.

Candidates Use CATV; Duplication Rule News Again

In a case involving a Greensboro, N. C., cable system, owned by the Jefferson-Carolina Corporation, the FCC dismissed petition asking that the cable system be ordered to cease and desist in both program originations and the selling of commercials. At the same time, the Commission announced that it would shortly initiate a general rule-making proceeding into these key issues.

In the Greensboro case, the City Council only last month amended terms of the system's franchise to permit all types of program originations and to eliminate a previous ban on advertising.

In refusing to strike down the City Council's action, as it had been requested to do by entrenched broadcast interests, the FCC said opponents of the franchise revisions had failed to prove their contention that cable-system originations and the acceptance of advertising would cause economic injury to TV stations in the area.

The National Cable Television Association has taken action aimed at encouraging advertising agencies and related businesses to come up with the kind of creative promotional material that will help the cable television industry add significantly to its subscriber rolls.

The move came at an NCTA Board of Directors' Meeting held recently in Washington. Acting on a staff recommendation, the board agreed that NCTA should discontinue the production of most advertising specialties and other promotional items and, instead, should concentrate on calling the industry's attention to the availability of such material from outside sources.

Spokesmen for both the Republican and Democratic presidential candidates disclosed plans to make extensive use of cable television as a free public service medium to reach thousands—perhaps millions—of voters between now and election time, Nov. 5.

The action came in response to an invitation extended to all three national parties by the National Cable Television Association, nation-wide trade group representing the cable television (CATV) industry. Officials of the American Independent Party said they were still considering whether, and how, to utilize cable system facilities.

Frederick W. Ford, president of NCTA and a former chairman of the Federal Communications Commission, hailed the political interest in cable television as "a significant milestone in communications progress and a possible answer to the high cost of future political campaigns."

The FCC's "nonduplication rule" is back in the news again. The rule, designed to protect local stations from competition by imported signals, says that the local CATV system cannot bring in programs duplicating those of the local stations.

Conley Electronics Corp., operator of a CATV system in Liberal, Kansas, recently challenged the rule as a violation of the Constitutional right of free speech. Conley has been bringing in programs from Texas, but, according to the rule, it cannot duplicate same day programming of the local stations. An appeals court upheld the FCC's rejection of the Conley challenge.

In a case brought up by another CATV operator, the Supreme Court upheld the FCC's authority under existing law to regulate CATV systems in general. However, the Court decision did not concern itself with individual FCC rules such as the nonduplication rule.

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GATES

Circle Item 10 on Tech Data Card

General Telephone Announces New Hawaiian System

A multi-million-dollar microwave radio system interconnecting the Hawaiian Islands will make possible a 12-fold increase in the number of inter-island communications circuits when construction is completed in mid-1969, General Telephone & Electronics Corporation announced today.

The project, which was started in 1964, utilizes microwave radio, multiplex, and related communications equipment produced in San Carlos, Calif., by Lenkurt Electric Co., Inc. for Hawaiian Telephone Company. Both companies are subsidiaries of GT&E.

The communications network extends a total of 388 miles, principally over water, between Hilo, Hawaii, and Lihue, Kauai, and includes 16 microwave relay and terminal stations. It provides up to 600 voice channels for inter-island communications, in comparison with a 48-channel capacity in the existing inter-island system.

The new system is being installed in three sections. The initial portion between the islands of Oahu and Molokai was completed in 1965. A second link between Molokai, Maui, and Hawaii was placed in service in June, and the final Oahu-Kauai section is scheduled for completion next year.

Although the operating portions of the microwave system are being utilized primarily for voice transmission, data communication links have been provided for U.S. military installations, several university-operated observatories, and facilities of the National Aeronautics and Space Administration and Federal Aviation Agency.

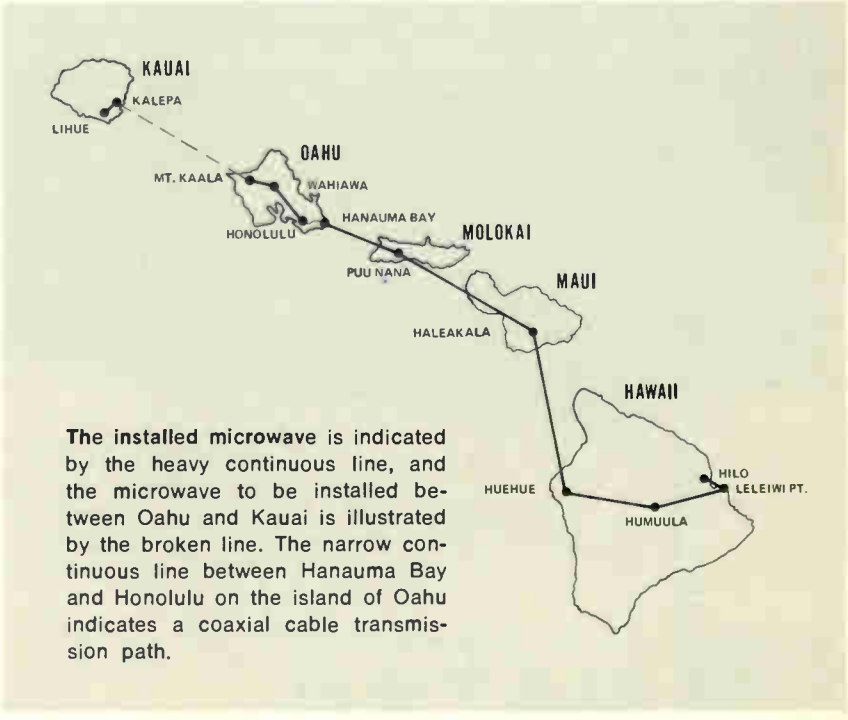
On the island of Oahu, the system includes two separate microwave networks that relay voice and video communications traffic between the Communications Satellite Corporation's earth station at Paumalu on the northern tip of the island and a major switching facility of Hawaiian Telephone in Honolulu.

In microwave communications, radio signals are focused like a beam of light and relayed from point to point over line-of-sight distances until the desired terminal station is reached. Hundreds of telephone conversations may be transmitted simultaneously in this manner through the use of multiplexing techniques.

The microwave radio equipment manufactured by Lenkurt for the inter-island network includes the company's types 75 and 76A2 systems. A Lenkurt type 46A multiplex system also is utilized, together with a 936A alarm system which enables Hawaiian Telephone to monitor all of the microwave relay sites from a master station at Honolulu.

In addition to the new inter-island microwave network, Hawaiian Telephone has invested several million dollars for the installation of five Lenkurt microwave systems and related equipment for intra-island communications. Extending over a total of approximately 500 miles, the intra-island systems include a total of 43 microwave relay and terminal stations, and each of the systems is linked with the new inter-island network.

The new system (shown, above) is being installed in three sections. The initial portion between the islands of Oahu and Molokai was completed in 1965. A second link between Molokai, Maui, and Hawaii was placed in service in June, and the final Oahu-Kauai section is scheduled for completion next year.



The installed microwave is indicated by the heavy continuous line, and the microwave to be installed between Oahu and Kauai is illustrated by the broken line. The narrow continuous line between Hanauma Bay and Honolulu on the island of Oahu indicates a coaxial cable transmission path.

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Collins' new Twintape System, completely solid-state and available in monaural or stereo models, is the most convenient, flexible, and easy to operate cartridge machine on the market. The Twintape System consists of two units: the 642E Twintape Playback Unit, and the companion 216D Record Amplifier. Combined, these units permit:

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- Recording on one cartridge while playing the other.
- Dubbing from one cartridge to the other.

Tape transport assemblies in the Playback Unit are easily removed. Rugged, direct-drive capstan motors eliminate flywheels, rubber belts, etc., and produce extremely low wow and flutter. With extra heavy Mu-metal magnetic shields, the unit has very low susceptibility to magnetic pickup of noise. Rear terminal strips provide for optional remote control, automatic sequencing of multiple machines, cue detector contact outputs, etc. Routine maintenance of the Playback Unit may be performed in seconds.

Cue tone oscillators, record level metering, operation controls, and an amplifier are contained in the 216D Record Amplifier. One cue tone is standard, with option for three cue tones. The amplifier may be stacked compactly with the Playback Unit, or rack mounted with an optional adaptor.

All Twintape System electronic circuits are mounted on plug-in, etched epoxy boards.

For a descriptive brochure on this new Twintape System, write or call Broadcast Communication Division, Collins Radio Company, Dallas, Texas 75207. Phone (214) AD 5-9511.

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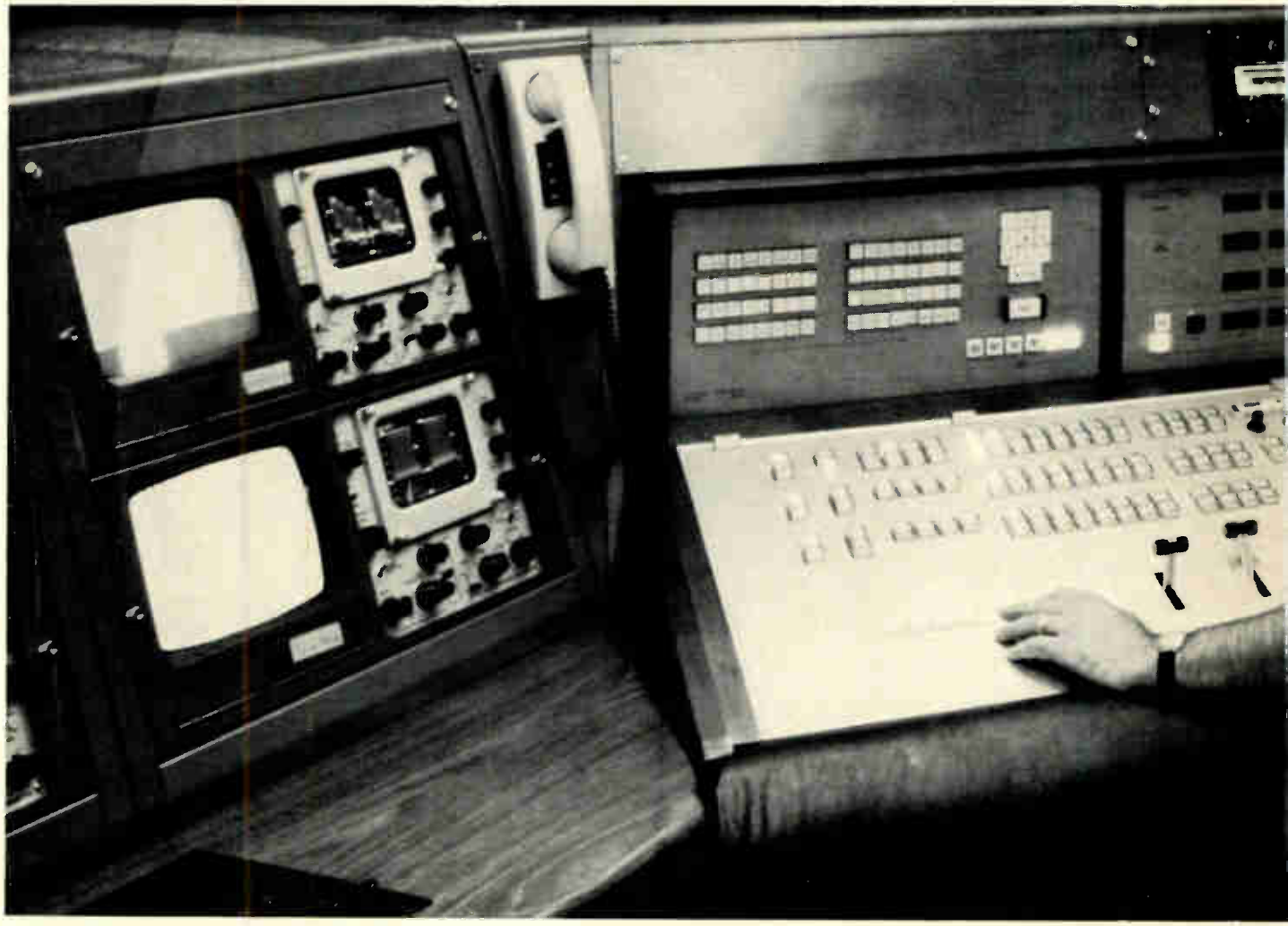
HOW DOES IT WORK?

The system incorporates a "memory", loaded either by magnetic tape, by punched cards, or manually from control panel push buttons. The memory, in turn, activates the control logic which provides the machine control output for film projection, slide projection, VTR and cartridge tape, causing all functions of these machines (start, stop, change, etc.) to proceed automatically. Included in the system is a dynamic alpha-numeric display of the program schedule on conventional TV monitors, enabling operators to check or change the program at will.

Control room at WVNY-TV, Burlington, Vermont, showing the APC 210 installation.



what will it do for your station?

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- takes the burden of mechanical direction from the director.
- eliminates the possibility of human error.
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two systems available

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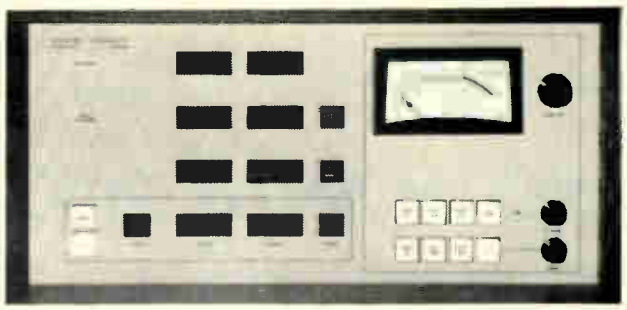

Detail of read-out panel

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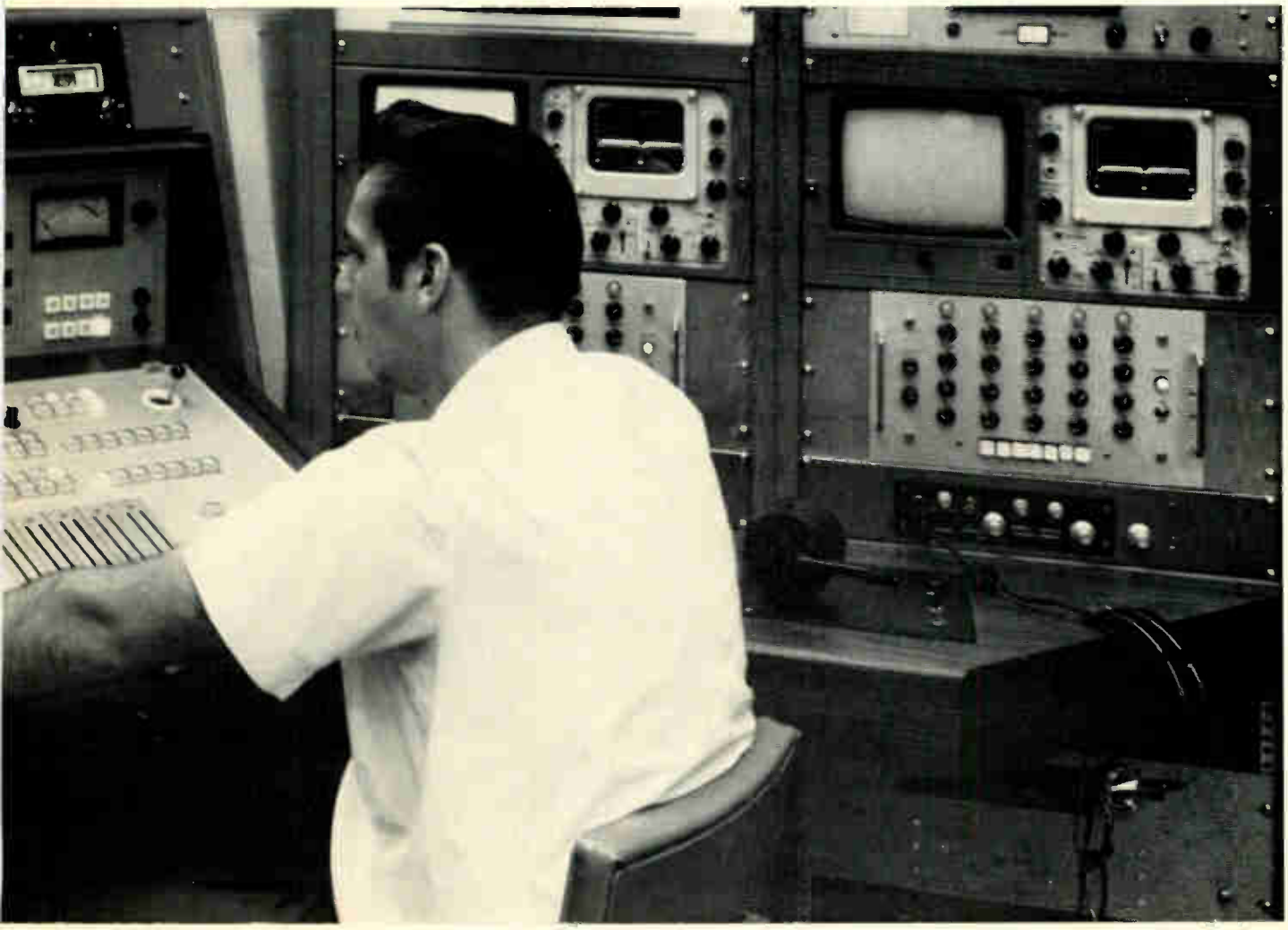


Circle Item 12 on Tech Data Card

COMMUNICATION SATELLITES:

How will we use them?

By Ron Merrell

We already have some clear ideas about what we can get out of our weather satellites. Space weather pictures are commonplace. But what about communications satellites? What effect will they have on broadcasting?

While there is considerable speculation, we are not likely to see the final answers for another 10 or 15 years. Until then, it does not seem unreasonable to pinpoint at least two areas of broadcasting as recipients of the benefits of communications satellites. These two would be instructional and remote area broadcasting.

But before going further, it is important to first take a look at communications satellite developments.

INTELSAT

The International Telecommunications Satellite Consortium (INTELSAT) is a unique international joint venture that is bringing satellite communications to a growing number of countries around the world.

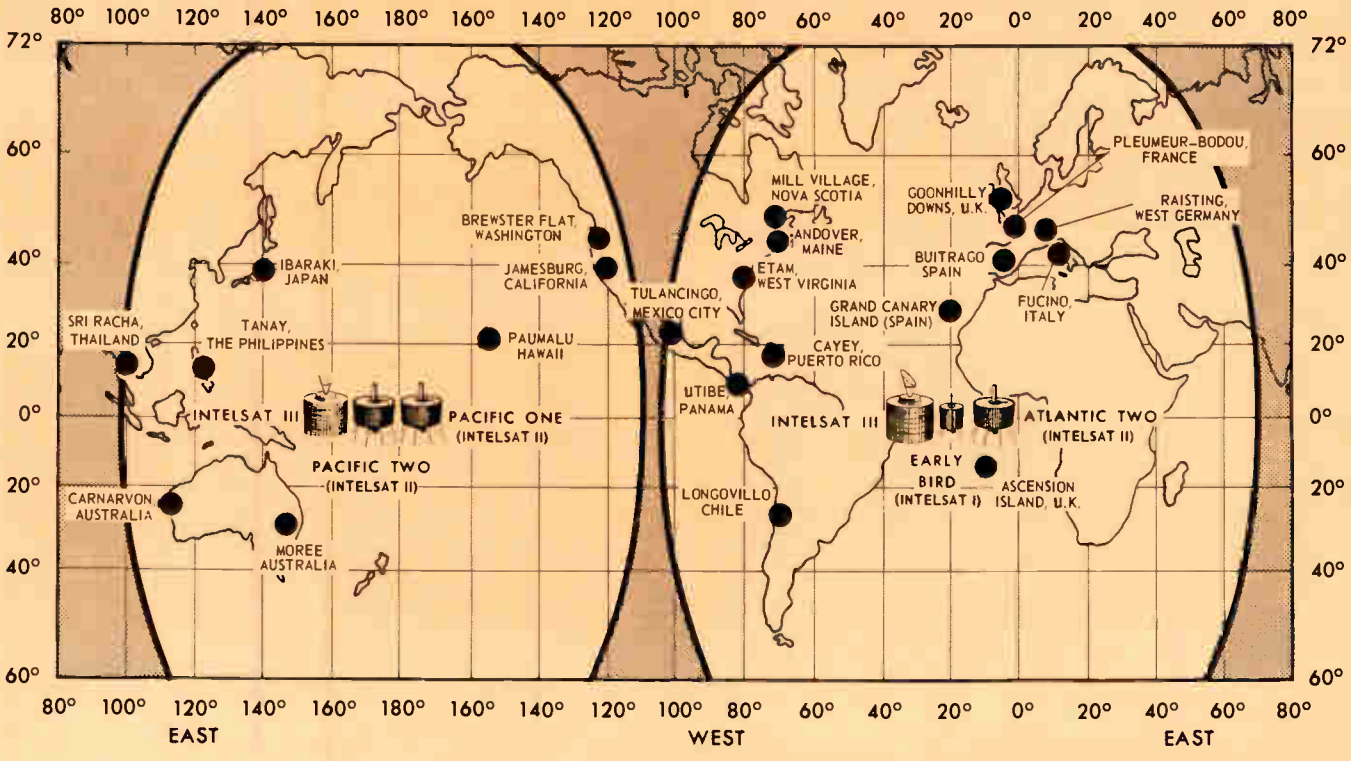
Although international telecommunications have always required a high degree of cooperation among the nations involved, satellite communications present an additional challenge and an opportunity for cooperation on a global basis beyond anything that has gone before.

The structure chosen as the instrument for this cooperation was an international consortium. Accordingly, in 1964 INTELSAT was formed.

The Consortium was established by two International Agreements for Interim Arrangements first opened for signature on August 20, 1964. On that date 14 countries signed. By September 3, 1968, there were 63 signatory nations. The growth rate of the venture has been cited as one of the fastest of any international organization in history.

The first of the two agreements, the Interim Agreement, was signed by the governments of the participating nations. The basic objective, as set forth in this agreement, called for international cooperation in "the design, development, construction, establishment, maintenance and operation of the space segment of the global commercial communications satellite system." This agreement also established broad principles to govern the system, and create the Interim Communications Satellite Committee as the governing body until the "Definitive Agreements" are in effect.

Since each of the governments could designate either a government agency or a private interest to repre-



sent it in the Consortium, INTELSAT stands as a unique partnership of governments and private interests.

Each of the governments of their designated entities then signed the second agreement, the Special Agreement. This agreement deals with the financial, technical, operating and contracting principles relating to establishment and operation of the system.

Communications Satellite Corporation (COMSAT), is the United States representative in the consortium and under the agreements acts as manager on behalf of the consortium. The new satellites, as their predecessors, will be operated by COMSAT as manager for INTELSAT.

INTELSAT I

Early Bird (INTELSAT I), the world's first commercial communications satellite with a capacity of 240 high quality voice circuits, was launched from Cape Kennedy, Florida, on April 6, 1965 and emplaced in synchronous equatorial orbit over the Atlantic Ocean at 25° west longitude. Its antenna was focused north of the equator to serve the heavy communications requirement between North America and Europe. This satellite also made the commercial transmission of live television possible consistently across oceans for the first time.

Four satellites have been successfully injected into synchronous equatorial orbit to create the existing INTELSAT system. On January 11, 1967, a satellite of the INTELSAT II series with a capacity of 240 circuits, but capable of coverage north and south of the equator, was launched and emplaced over the Pacific Ocean at 174° east longitude to connect North America with the Far East and Australia.

On March 22, 1967, a second satellite of the INTELSAT II series was launched and emplaced over the Atlantic Ocean at 6° west longitude to expand capacity in the Atlantic. Its coverage also included Latin America and Africa.

On September 27, 1967, a third satellite of the INTELSAT II series was launched and emplaced over the Pacific Ocean at 176° east longitude to serve as a spare in space, and to expand capacity in the Pacific basin.

These four satellites extended communications satellite coverage to more than two-thirds of the world, and work with earth stations which are either operational or nearing completion.

Now, the launching of four satel-

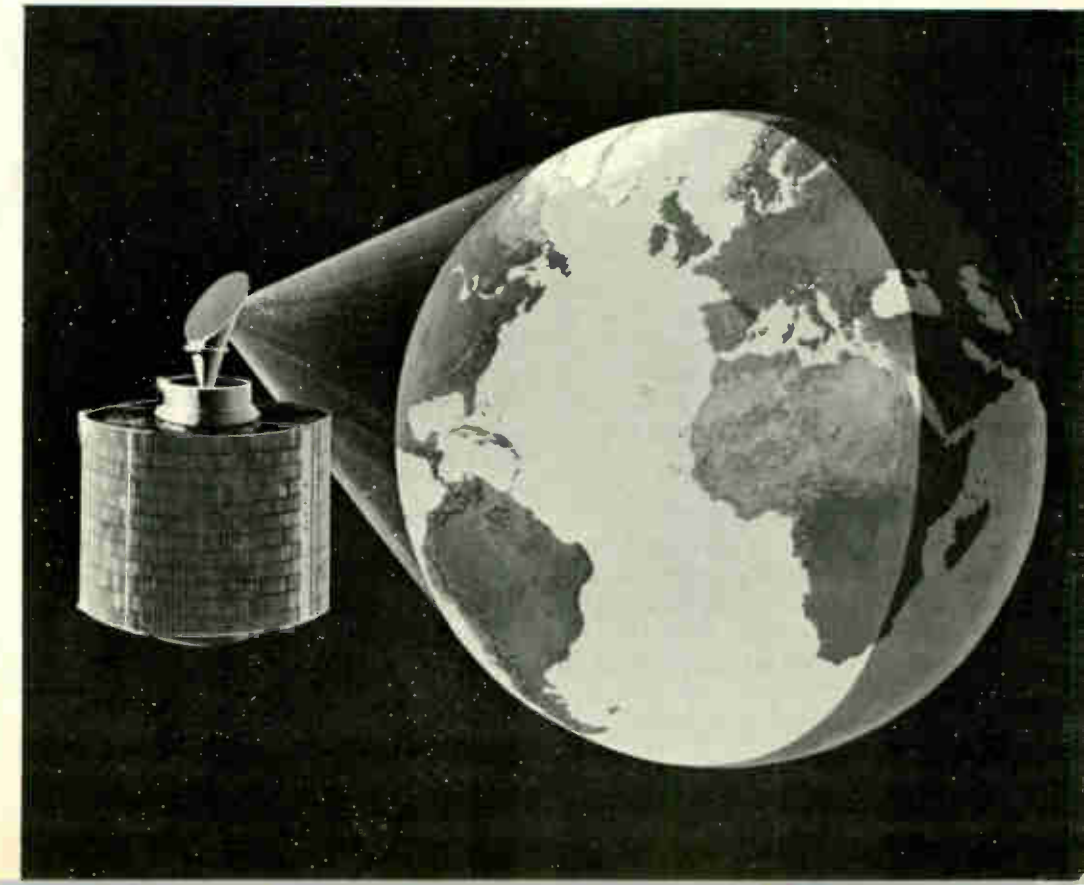


Fig. 1 Operational communications satellite earth stations and satellite coverage areas.

Fig. 2 Artists conception of an INTELSAT III satellite in orbit. The light area on the earth's surface shows satellite coverage.

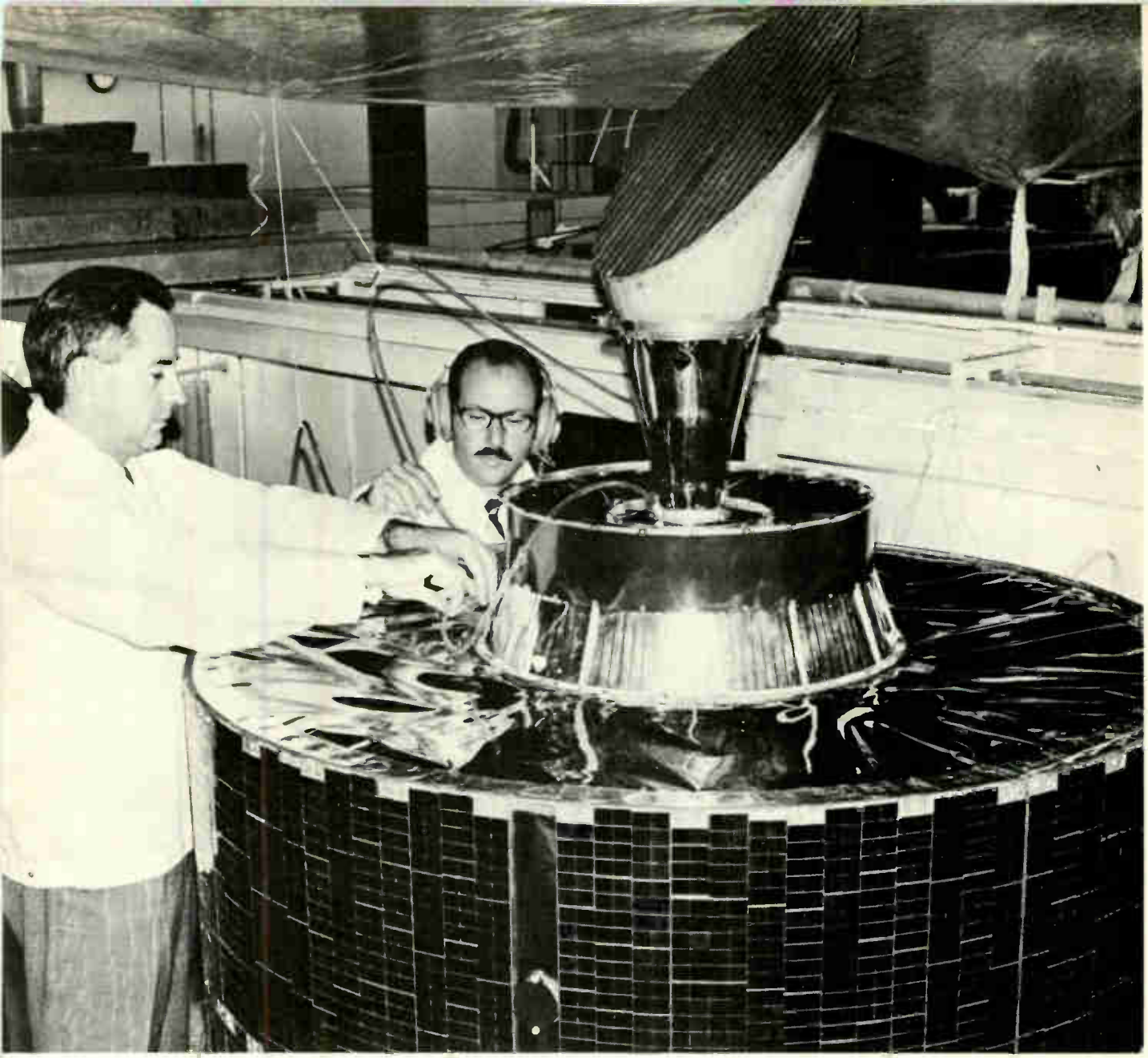


Fig. 3 James P. Wilde, COMSAT engineer at left, and Simon B. Bennett, manager of INTELSAT III Project Radio Frequency Branch, connect test equipment.

lites of the INTELSAT III series each with a designed capacity of about 1,200 circuits. Their one-third of earth coverage is planned to expand capacity in the Atlantic and Pacific basins and, with the emplacement of one of these satellites over the Indian Ocean, to provide a global series of commercial communications satellites.

Satellite Characteristics

The INTELSAT III satellites are designed to receive transmissions in the 5.930 to 6.420 Gigahertz band (up-link) and to transmit back to earth in the 3.705 to 4.195 Gigahertz band (down-link). (Gigahertz (GHz) means millions of cycles per second.)

A satellite command subsystem will be used to signal ignition of the apogee motor and to control the satellite during its lifetime. Each satellite will have two command and telemetry sets, one for each communications repeater. The telemetry sends information through the omnidirectional or mechanically despun antenna to the earth stations equipped with telemetry and command ground equipment. Information concerning spin rate of the satellite, the spin rate of its antenna and whether the spacecraft is properly oriented toward the earth is received by the earth station and transmitted to the Control Center in Washington. Engineers evaluate the data with the aid of computers and relay necessary commands back to the satellite through the telemetry and command earth station.

Each INTELSAT III satellite has been designed for a minimum life of five years in orbit, 22,300 miles over the equator. At launch, each satellite will weigh 632 pounds. In orbit, after the apogee motor fuel has been expended, the weight will be 322 pounds.

The body of the INTELSAT III satellite is a cylinder 41 inches tall and 56 inches in diameter. On top of this cylinder is the antenna system which, combined with the height of the body, gives the spacecraft an overall height of 78 inches.

Among the major subsystems or operating components which com-

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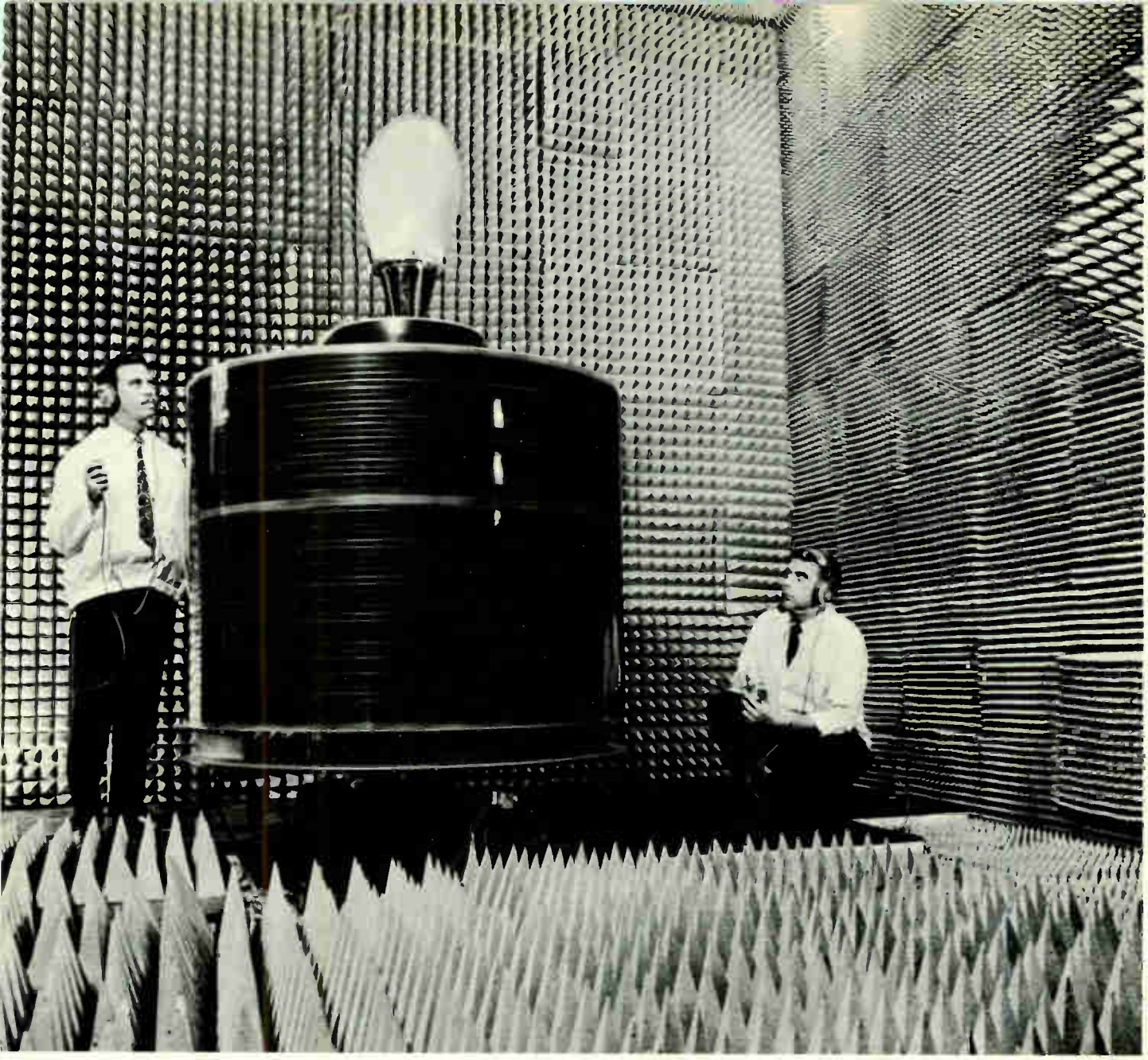

Fig. 4 COMSAT engineers check out satellite in the anechoic chambers. The chamber is soundproof and also prevents electronic echoes.

bine to make an INTELSAT III communications satellite are:

Antennas - A directional communications/omnidirectional telemetry and command antenna, mounted on top of the structure, enables the satellite to receive and transmit signals. The antenna is mechanically despun. As the satellite spins clockwise, the antenna spins counterclockwise at precisely the same speed. This keeps the antenna always pointed toward the earth in the proper communications position.

Communications - Two repeaters (transponders) receive, process and transmit many different kinds of signals simultaneously. The effective radiated power from the satellite is more than 22 dbw. Each INTELSAT III has a design capacity of 1, 200 two-way voice circuits or 4 television channels. They are designed for simultaneous communications between several earth stations.

Orientation - Earth sensors and electronic equipment are used to measure the attitude, and the control station fires small thrusters to keep the satellite properly aligned with the earth.

Electric Power - 10,720 solar cells, mounted on the outside of the satellite, convert sunlight into electrical energy for operating the equipment. More than 130 watts of power are supplied to the satellite for operating the various electrical and electronic components. At synchronous altitude, the spacecraft is in sunlight most of the time. During the spring and fall, however, there are 45-day periods during which each satellite is in and out of the earth's shadow. During these periods, the required electrical energy is provided by a battery which is recharged by the solar cells when the satellite reenters the sunlight.

ATS—III Satellite

The ATS-III is the latest in a series of NASA satellites orbited with multiple experiment packages on board. The satellite precedes the more advanced ATS F/G, but it is part of the initial step toward demonstrating programming possibilities for reception in homes.

Earlier this year, the Philadelphia

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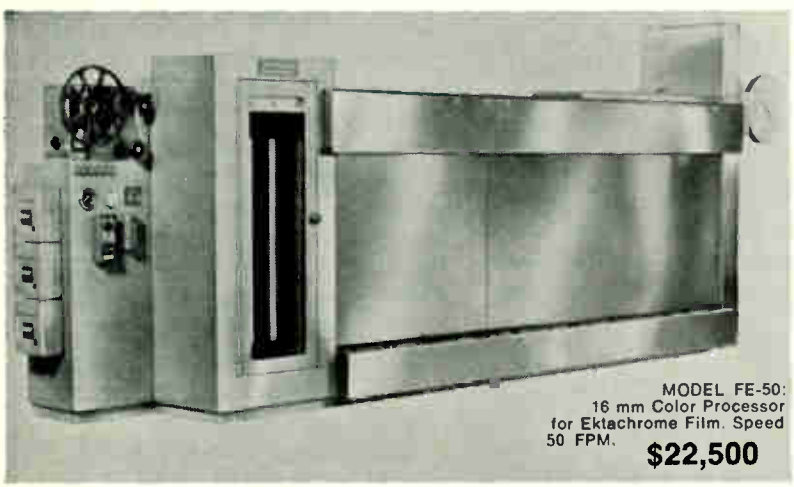
After you check these exclusive Filmline features you'll want to install a Filmline processor in your news department ***NOW!***



MODEL FE-50: 16 mm Color Processor for Ektachrome Film. Speed 50 FPM. **$22,500**

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- **"FILMLINE OVERDRIVE FILM TRANSPORT SYSTEM"** This marvel of engineering completely eliminates film breakage, pulled perforations, scratches and operator error. The film can be deliberately stalled in the machine without film breakage or significant change of film footage in solutions. The heart of any film processor is the drive system. No other film drive system such as sprocket drive, bottom drive or simple clutch drives with floating lower assemblies can give you the performance capability of the unique Filmline Overdrive Film Transport System.
- **"TORQUE MOTOR TAKE-UP"** gives you constant film take-up and does not impose any stress or strain on the film itself. Completely independent of the film transport system. This FILMLINE feature is usually found in professional commercial processors but is incorporated on the FE-30 and FE-50 models as standard equipment. Don't settle for less!
- **"TEMP-GUARD"** positive temperature control system. Completely transistorized circuitry insures temperature control to well within processing tolerances. Temp-Guard controls temperatures accurately and without the problems of other systems of lesser sophistication.
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- **"ZERO DOWN TIME"** The reputation of any film processor is only as good as its reliability. The combination of the exclusive and special added Filmline features guarantees trouble-free operation with absolute minimum down-time and without continual operator adjustments. Recapture your original investment in 2 years on maintenance savings alone. Filmline's "Push the button and walk-away processing" allows inexperienced operators to turn out highest quality film.
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Additional Features included in price of machine (Not as extras).

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Circle Item 14 on Tech Data Card

section of the IEEE sponsored a three-day conference which ranged over the technical aspects of communications systems and planning. The meet concluded with a keynote address on "Communications in Education".

It was during this conference that the General Electric Company demonstrated the use of satellites for dissemination of information by completing a space link into downtown Philadelphia using an ATS satellite "parked" in orbit above the east coast of Brazil.

The telephone link spanned more than 45,000 miles. Originating in the Sheraton at a dial telephone in the GE exhibit booth, conversations travelled overland to the NASA tracking station in Rosman, N.C., and then were transmitted to the satellite. Through the use of a high-gain 15-foot parabolic-type antenna (pictured on the cover of this issue), delegates conversed via satellite loop with other visitors in the exhibit booth.

Other Satellites

During the latter part of July and early part of August, Dr. W. Deming Lewis, president of Lehigh University and former space scientist, served as chairman of a group of 100 scientists, engineers and economists. Their purpose was to continue an intensive American study begun last year on the peaceful uses and applications of space satellites.

In their work, the scientists are looking into eight areas with satellite applications. They include broadcasting, hydrology, geology, oceanography, navigation, traffic control and other areas.

Satellites 600 miles above the earth are guiding ships at sea with an accuracy of about 1/10th of a nautical mile, anywhere in any weather. The equipment aboard the ships is supplied by IT&T. It makes use of existing polar orbiting satellites of the U.S. Navy Navigational Satellite System (NNSS). The system has been operational since 1964 and is now available to most nations.

In August, COMSAT issued a request for proposals for an aeronautical communications satellite. The request calls for proposals on two options; one for two and the second for three satellites which could be used for two-way simplex voice communications between aircraft in transoceanic flight and fixed earth stations.

Earth Stations Needed

According to the Electronic Industries Association (EIA), powerful, low-cost earth stations hold the key to future satellite telecommunications uses. This was the report of an ad hoc EIA engineering group in a major study sent to the President's Task Force on Communications Policy.

The study group, part of the EIA Industrial Electronics Division's Satellite Telecommunications Subdivision, submitted a 200-page report entitled "Future Communications System Via Satellites Utilizing Low-Cost Earth Stations," which it said will serve as a basis for a comprehensive document on all aspects of satellite communications.

The study is part of the EIA satellite Telecommunications Subdivision's active push for a domestic telecommunications satellite system. In a policy position taken in May, the subdivision called for "aggressive pursuit" of a domestic system and urged that "all appropriate responsible governmental, legislative and industrial activities vigorously work toward this end without further delay."

When commercial service first began across the Atlantic via the pioneering Early Bird satellite in the summer of 1965, five stations were in operation—four in Europe and one in the United States. The next year three more stations went on the air. In 1967, six more stations joined the steadily growing system when INTELSAT II satellites were placed in synchronous orbits, extending service to the Pacific as well as the Atlantic.

This year a total of 22 stations equipped with powerful sending and receiving antennas are scheduled to be in commercial operation—14 in the Atlantic and eight in the Pacific —when the first of the new generation of INTELSAT III series satellites is launched. Service was in-

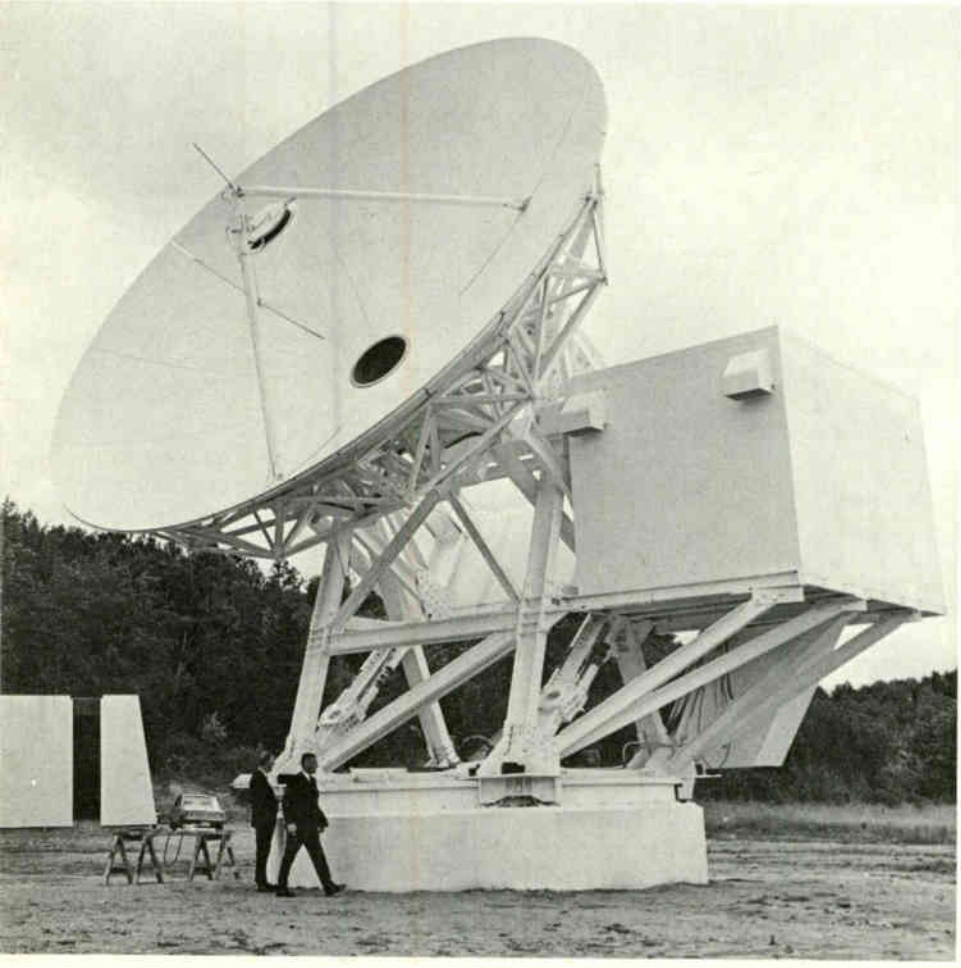
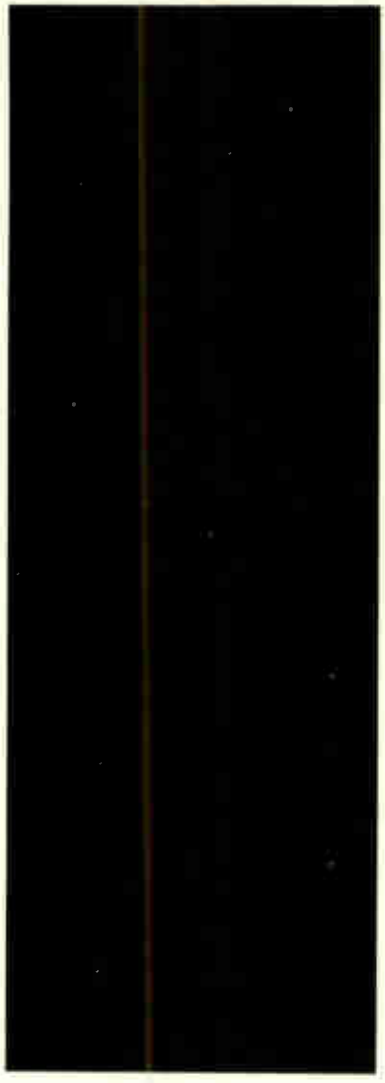
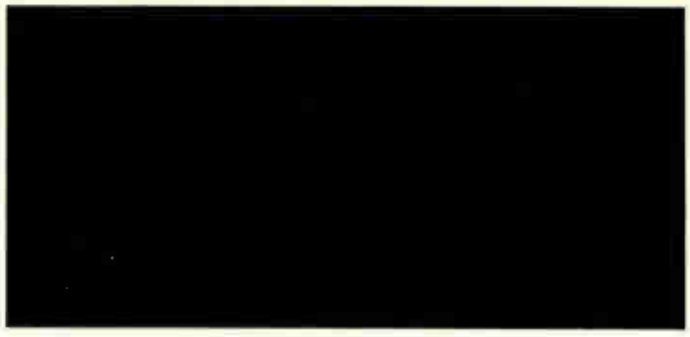
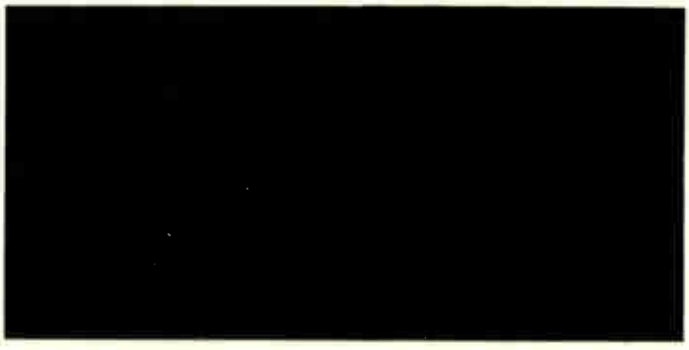


Fig. 5 Demonstrating its 0 to 37 degrees elevation range, the Bouchette satellite earth station nears end of tests.







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Circle Item 16 on Tech Data Card

augurated to Latin America earlier this year with the opening of new stations there.

General standards, or operating characteristics, for earth stations in the commercial satellite system have been established by the governing body of INTELSAT. A standard station is considered as one having an antenna 85 feet in diameter, or larger, and meeting certain other technical specifications.

Standard stations are capable of handling and processing all forms of overseas traffic—multi-channel telephone, telegraph, facsimile, data, both color and black-and-white television. Communication signals transmftted by a station, after passing through a high-power amplifier, are concentrated by the antenna into extremely accurate, narrow beams. In turn, faint incoming signals, a mere fraction of a watt in power by the time they reach earth, are simultaneously received by sensitive equipment, and boosted billions of times in power for further processing. The stations transmit in the six gigacycle range.

Cover Remote Areas

During the 18th Symposium of the IEEE-GB, held in Washington, D.C. during September, Roy Cahoon mentioned the future possible use of satellites by the Canadian Broadcasting Corporation (CBC). He said that one of the major problems facing the CBC was that of providing television signals to the remote areas of Canada. The solution, he added, could be the use of satellites.

While Cahoon, CBC's chief engineer, was addressing the group, Northern Electric was busy checking out Canada's first domestic satellite communications earth station. The station was expected to be in operation by October.

The 35-ton antenna complex is now erected, and is presently undergoing antenna pattern measurements to test the performance of the 30-foot parabolic dish and elaborate feed system. The station (at Bouchette, Quebec) capacity depends upon the satellite with which it would work. It might amount to one or two television channels, several radio program channels, and some 60 message channels. The message channels could carry either telephone conversations or other forms of telecommunications.

Community television broadcast via satellite, as suggested by GE, would be intended for use in developing countries that otherwise could not have a nationwide broadcasting service. The satellite designed for community service also could provide for the distribution of additional radio or television signals to large cities near the target area. The signals could be retransmitted by ground transmitters to urban areas.

Instructional Satellites

Instructional radio and television broadcast via satellite could provide formal educational programs for integration into school curricula. This would be especially useful, again, in underdeveloped countries and for broadcasting into remote areas.

Programs would generally be recorded and used on a well-publicized advance schedule, to allow for maximum use of material within the class schedule. Current events would probably be confined to one channel. Recorded programs could originate at a single area, with current events relayed through this area or sent to the satellite by "up-terminals" at major cities.

Direct broadcast satellites are another matter. In order to keep the cost to the individual viewer to a minimum, the satellite must radiate a signal level that will provide an acceptable picture grade to an inexpensive receiving installation. This would require that the satellite be capable of an ERP far in excess of that currently in use. Once again, the highest potential may be for use in instructional or educational broadcasting.

Conclusion

It is possible that communications satellites could provide faster introduction of broadcast service into new areas. They might eventually offer a low cost for providing full coverage. In fact, satellites might make more efficient use of radio and television frequencies. The effect communications satellites will have on broadcasting rests on the future decisions of the broadcast industry itself. ▲

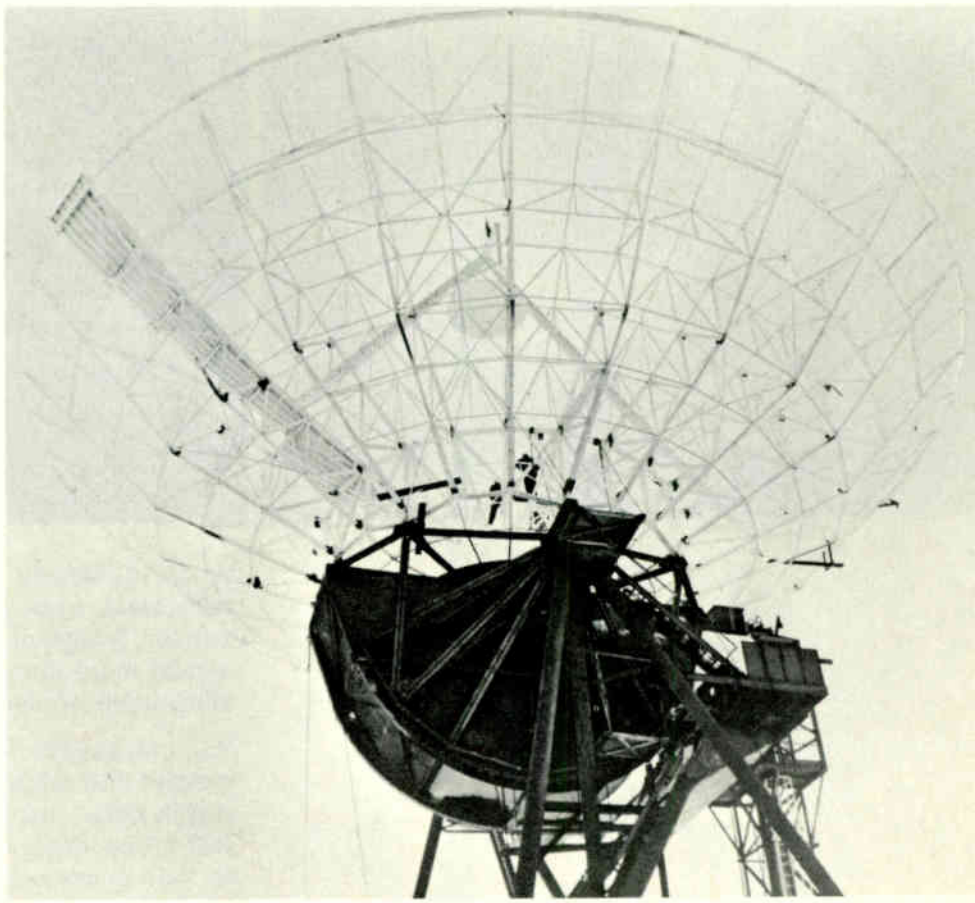
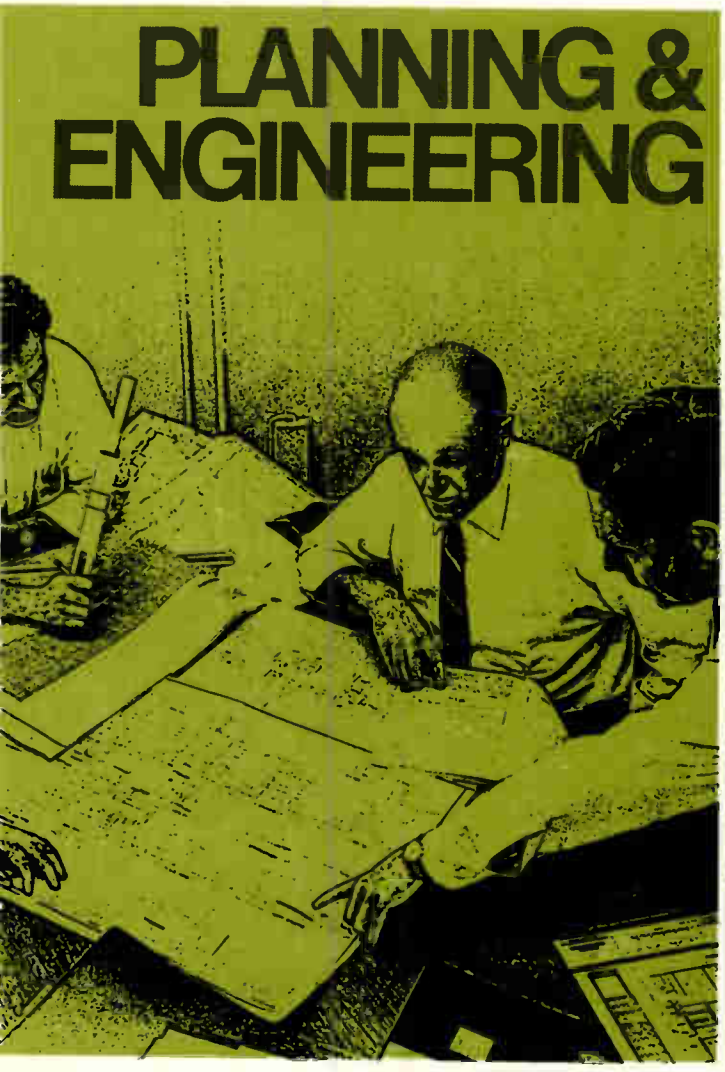


Fig. 6 This giant is located at Santiago, Chile. It was constructed by GT&E International for Empresa Nacional de Telecommunicaciones S.A.

The Lenkurt total



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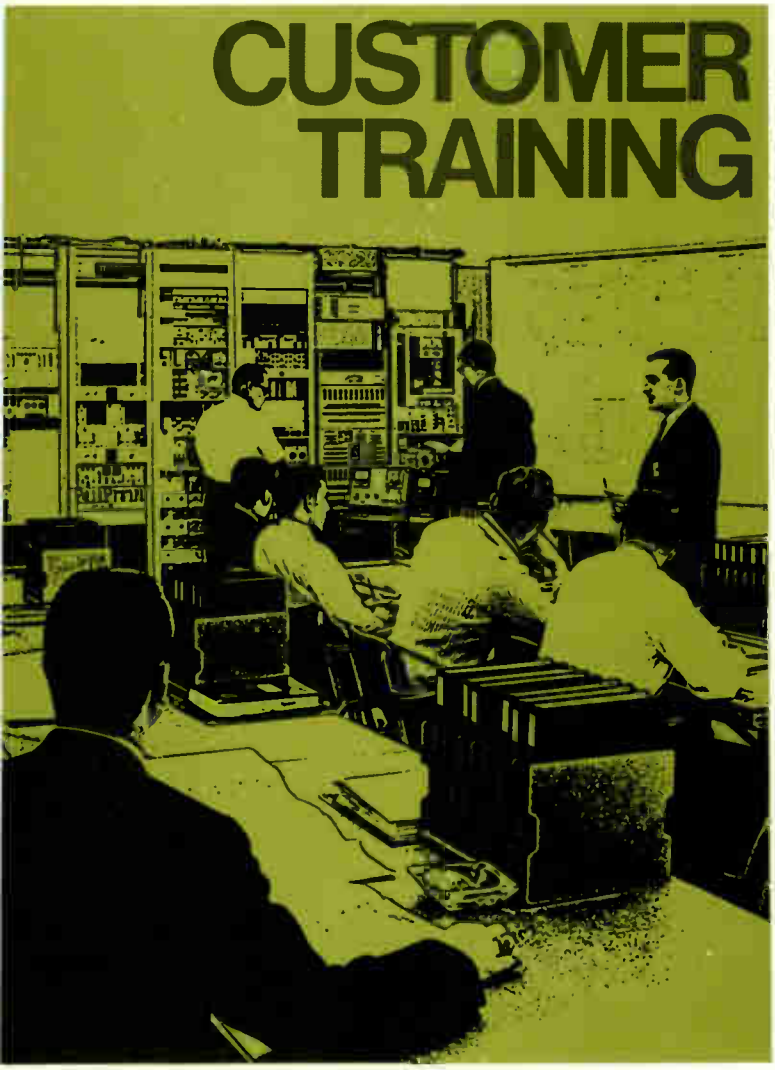

is the telecommunication business; the kind you get when a company was the first to offer engineering, planning, and installation services.

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WTMJ central control room.

Automation:

WTMJ-TV Solves Switching Problems

By Phil Dean*

I'm sure that every engineer who has ever sweated out a major break with a number of complicated switching assignments from a number of complicated pieces of television equipment, will welcome the new trend toward computerization of production operation in the control center.

At WTMJ-TV, Milwaukee, Wis., we have been dedicated to the principle of "systems engineering" for our overall station operation for some time, and the belief is that the sooner we gear up for overall automated operation, the more effective and efficient our complete operation will be.

In our long-range planning, WTMJ-TV hopes eventually to develop a system that will cover every phase of station operation. We have designed plans which will encompass all of these operations and have initiated and effectively adapted one phase, the master control operation to computerization with dramatic results.

Before discussing the approach we have used for our automated master control operation, it might be interesting to point out some of the problems we have encountered on the inculation of the overall computerization process.

We have found that much of our trouble stems from a lack of planning; this is probably the most important phase of eventual full computerization. Not only is the planning for an eventual systems engineering concept of vital importance, but also the people involved in such planning are equally important.

When the possibility of adapting various automated equipment to broadcast purposes first became apparent, many television broadcasters rushed to buy computer equipment they felt would suddenly make their whole operation a push-button affair.

Unfortunately, the people they depended on too often were people with too limited a background in the overall engineering requirements to provide an effective and adaptable system which could be integrated into other systems developed as required. Thus, in many instances, despite the optimism of the computer salesmen and the administrative people involved, many broadcasters ended up with expensive computer equipment which was obsolete for its original purposes and completely unadaptable for integrating into other automated units which were being developed.

Thus the importance of long planning and the equal importance of who is doing the planning. I would recommend for any broadcaster planning future automated innovations in his operation that he use his engineers as catalysts in joint meetings with the heads of the various departments in planning specific automation programs for their benefit.

Thus the sales department would determine recommendations for demographic and sales analysis needs, the accounting department for billing, etc. But the engineering department would act as advisors on the type of equipment to be used in con-

*Phil Dean Associates, Inc.

Station personnel checking computer stage.

junction with the data experts from the manufacturing company.

In fact, I would suggest a complete and exhaustive analysis of the entire flow of the station operations with all department heads and station engineers working jointly to develop the final requirements.

At WTMJ-TV, for instance, we spent about three years in the development of the systems engineering we wanted. It took about one year to integrate the hardware into the operation.

The phase we have had so much success with—computerization of the switching operation in our master control room—is the key, we think, to eventual integration of other phases of the overall operational system on an automated basis.

We bought a Sarkes-Tarzian APT-1000 to automate our overall switching operations. The APT-1000 is a solid-state computer designed specifically for control of television station programming. Its video automation, video and audio switcher/mixer, and computer control panel make it a totally integrated system. Its input is the program log . . . its output is the activation of all video, audio and machine sources—slide, film projection and video effects.

Program instructions include such data as video source, audio source,

Hallway view of computer complex.

Model FIM-120E (WX2C)

Four reliable reasons why experienced broadcast engineers prefer Nems-Clarke equipment ...now available from DEI

In the broadcast industry, the quality, reliability, accuracy, and durability of Nems-Clarke equipment have earned it a reputation that is unique. DEI, now manufacturing and distributing this famous equipment, can assure you that it will continue to adhere to the same high standards that built this unmatched reputation.

Model FIM-107A (Test Set)

Field Intensity Meter Model FIM-120E A compact, lightweight, portable instrument for measurements in the 540 to 1600 kHz range. Sensitivity range is from 10 uv per meter to 10 v per meter. Performance data includes a 540 to 1600 kHz frequency range and a 10 uv/m to 10 v/m intensity range. Power supplied by internal alkaline batteries, insures operation at 32°F and below and can be calibrated at any frequency at either high or low temperatures. Both linear and logarithmic indications permit use with recording equipment. Accuracy of this unit is essentially independent of battery voltage ambient temperature and modulation. Accuracy, linearity, and stability are vastly superior to any currently available solid state field intensity meter. Over 1,000 of these field-proven units are currently in use.

Model PM-112

Field Intensity Meter Model FIM-107A (Test Set) Includes in one portable unit a radio receiver of laboratory quality with a metered output and an accurately calibrated signal generator. It covers a frequency range of 54 to 240 mHz without band changing. Operates from automobile batteries or standard 117 vac line. Performance data includes a 1.0 uv sensitivity. Signal generator output level is adjustable from 1 uv to o.l.v. A calibrated dipole provides 1.6 uv/m to 16 v/m field intensity measurements at 54 mHz.

Phase Monitor Model PM-112 This new solid-state unit replaces our model 108E and monitors phase and current relationships in directional AM arrays. Adaptable to remote control. Provision for switching of day-night reference levels can be provided. Performance data includes ±1 degree phase accuracy, 0.5 degree phase resolution and 2% repeatable current accuracy. Will monitor up to 9 towers. Outputs are available for a digital voltmeter to provide increased resolution. Well over 100 of these units are now in world-wide use.

Model PPM-101

Precision Phase Monitor Model PPM-101 This unit is designed for use with critical directional AM arrays where a high degree of resolution and stability is required. Provides both phase and current indications. Contains digital counter. Nuvistor and solid-state design. Repeatable phase accuracy is ±0.1 degree, phase resolution is 0.1 degree and repeatable current accuracy is within ±0.1%. Will monitor up to 12 towers.

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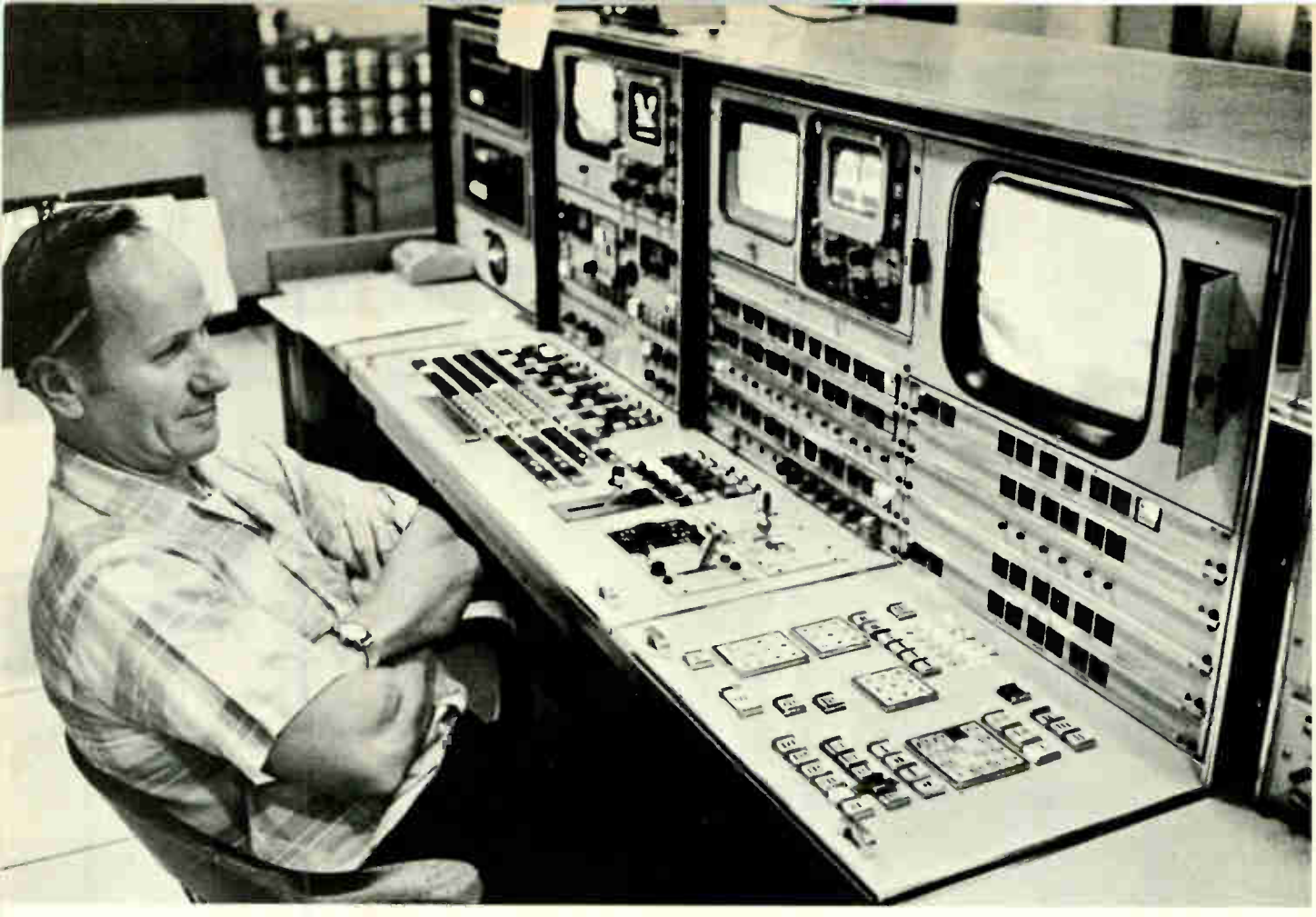


Operator relaxing at switching console.

type of transition, speed of transition from one event to another, the time which the event must go on the air, the duration of the event and any special instructions such as lock time switching, audio lock, projector roll on, cue instruction or manual operation instructions.

The APT-1000 accepts such instructions—which, in the semantics of the computer, are called words —and stores them in its memory for later use at a selected time. APT automatically searches and totals duration time (or waits for a VTR or film cue) and at the precise moment performs the complicated switching and video effects functions stored within its memory.

The output capacity of the APT-1000 is enormous: machine controls are activated, slides sequenced, previews are made, film or VTR's pre-rolled or stopped, all in precise timing with the program requirements.

Each program event word is assigned its own number, called an address, and each word also contains the address of the next event which is to follow. Because of these number assignments, modification to the program is easily made at any time. Even though the facility to make last minute changes is one of the computer's features, the touch of a button puts the operation in complete manual or semi-manual control of all functions by the operator.

The operation of the computer during the past six months has facilitated station operation. The efficiency has been a boon to our salesmen, who detest, above all things, the situation that calls for a "make good." And our engineers, skeptical in the beginning, have mastered the capabilities of the switching computer.

Computerization has taken the strain of complicated switching assignments from them, thus giving them more time to work on further creative engineering plans, and has increased the overall efficiency of operations to a high degree.

I might point out, however, to any broadcaster contemplating the switch to automation in the near future, that it took a long time for WTMJ-TV to achieve its current efficiency with the new APT-1000.

The major problem was interfacing the Sarkes-Tarzian computer with the variety of other equipment we had, to make a fully integrated and effective system. Along these lines, most manufacturers are willing to help in overcoming these problems which are indigent to the adapting of a number of different pieces of equipment to one central computer switcher. They are often on call for any emergency.

The ultimate development of complete systems engineering concepts for television stations seems inevitable. The increasing use of more complicated equipment, particularly in the master control rooms, is creating a need for more efficient and accurate automated devices. It may be only a matter of time before many of the stations in the major markets are fully automated.

Although many executives will complain about suppliers costs for such computerization, I think that the ultimate results possible by such automation will be especially worthwhile in the long run. ▲

What do these top CBS stars have in common?

Be on time with CHU

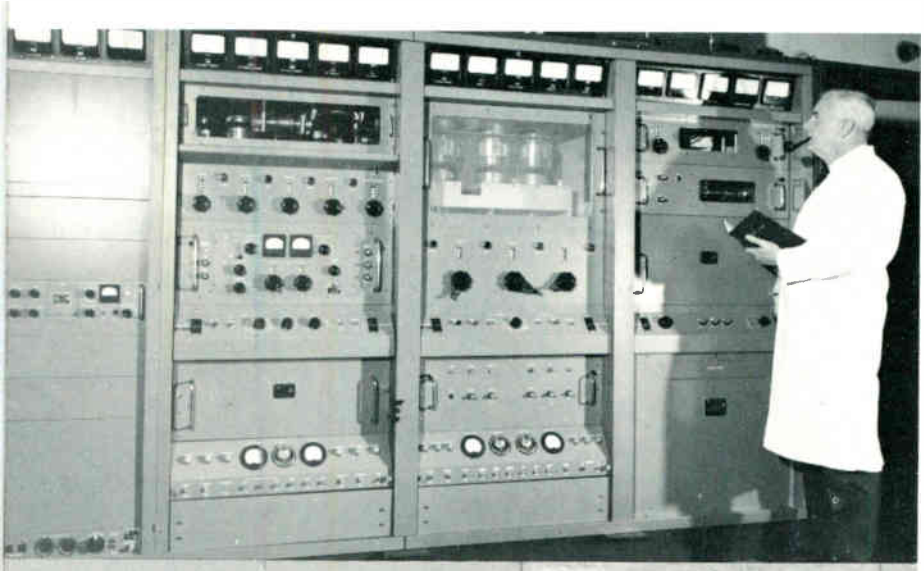
by Ron Merrell

The National Bureau of Standards' radio station WWV offers eight services to listeners. Who could want anything more?

CHU, WWV's Canadian counterpart, does not transmit propagation forecasts, geo-physical alerts and the like, but it does have one major advantage: the correct time is given in a voice transmission each minute. In fact, it is given in English and French.

Rather than compete in any way, CHU and WWV stations simply offer time and frequency standards over such a wide spread of frequencies that the basic information can be received regardless of prevailing propagation conditions.

While the two stations combine for nine possible checking freqencies (see table), it is not likely that all will be received during any given hour.



The 40 kw 7335 KHz main transmitter.

CHU transmitter site.

Time Standard Stations

Stn.	MHz Freq.	Power
WWV	2.5	2.5 kw
CHU	3.330	3.0 kw
WWV	5.0	10.0 kw
CHU	7.335	10.0 kw
WWV	10.0	10.0 kw
CHU	14.670	3.0 kw
WWV	15.0	10.0 kw
WWV	20.0	2.5 kw
WWV	25.0	2.5 kw

The CHU antenna on the 3.330 MHz transmitter uses a dipole that produces East-West lobes. The curtain antenna used on 14.670 MHz is directed to 315 degrees. This makes the 7.335 MHz signal, transmitted from a vertical antenna, the best receiving possibility for most American listeners under normal conditions.

Depending upon conditions and geographical location, as many as nine standard frequencies are available for checking. CHU is of special importance to amateur radio operators, because its frequencies lie in or are adjacent to the amateur bands. Such checking sources are important, because vfo's and receivers often suffer from drift and/or mechanical calibration defects.

Long Time Service

The radio "voice" of the Dominion Observatory was first broadcast in 1923. This was the same year that WWV initiated its service. During this early period, time signals from the observatory were sent by telephone to a local Ottawa station where they were put on the air.

Like WWV, CHU has been involved in experiments that have aided commercial and noncommercial broadcasting. And until 1946 this was accomplished with power inputs of no more than 25 to 75 watts. Today CHU's high power transmitters deliver precise time signals that are controlled by an atomic frequency standard and solid state units.

A point which must be remembered when taking advantage of time signals is that there is a lag between transmit and receive time. And if you want to get into microsecond accuracy, there is some time lag within the equipment. Normally, the total of these time lags will not detract from the precision required by domestic broadcasters and amateur radio operators. ▲

Raytheon reliability keeps you turned on...

and on...and on...

Raytheon's KTR series of hot standby microwave relay equipment can be serviced during normal working hours, eliminating after-hours maintenance and added expense.

KTR-2, -3, and -4 solid-state systems cover microwave-frequency band assignments from 2 to 13 gHz. All three meet or exceed applicable DCA standards, Bell System specifications, EIA standards, NTSC color requirements, and CCIR and CCITT recommendations.

The KTR-2 consists of solid state, base-band-type terminal equipment with extremely wide bandwidths for handling up to 960 FDM (Frequency Division Multiplexed) channels, NTSC color TV with up to four program audio channels, or 40-megabit wide-band data communications.

The KTR-3 is made up of solid state, long-haul, heterodyne repeater equipment with heavy route applications for transmitting up to 1800 FDM channels, NTSC color TV with up to four 15 KHz program audio channels, or wide-band data communications.

The KTR-4 is solid state auxiliary terminal equipment complying fully with Bell System spec KS-20098, Issue 2. It is designed to handle up to 72 message channels as well as order wire and alarm information over wide-band radio routes.

The KTR line has set performance and reliability standards for the communications industry. Our delivery schedule is better than ever. So turn to Raytheon and keep turned on. For more information, contact: Jack Banister, Raytheon Company, Communications and Data Processing Operation, 1415 Providence Turnpike, Norwood, Mass. 02062.

RAYTHEON

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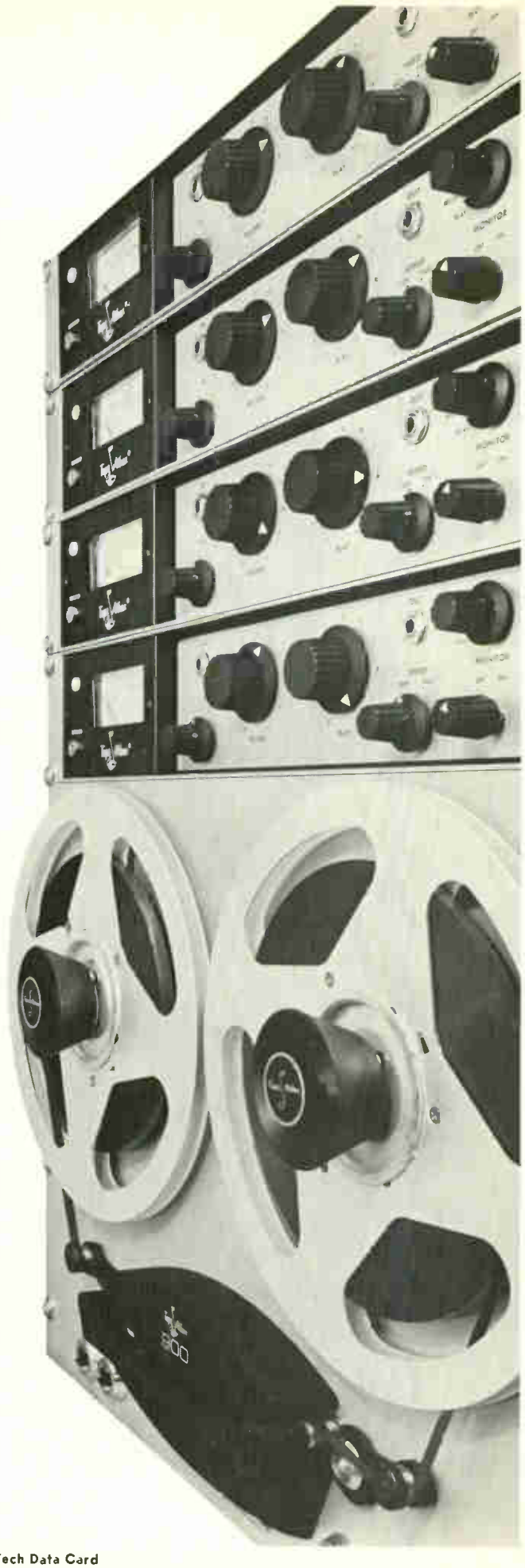
THE 900

is a 33⅓%oer!



And that's no arbitrary figure. Here's a recorder/reproducer that out performs its competition by a third more, costs 33⅓% less, and has a reliability factor ⅓ better than most.

Using dual capstans for smooth and precise tape control, the Tape-Athon 900 performs with a new low in wow, flutter, and scrape. Recorded sound is pure and sure every time.

That other big plus factor, reliability, is a function of component selection and craftsmanship, and Tape-Athon has staked its reputation on excellence in both areas throughout production of over 15,000 tape transport units.

But price is something we can prove right away. Let us quote your next system, and get you started out 33⅓% better off.

If you'd like more details on the Tape-Athon 900 Recorder/Reproducer, write for catalog TA250, Tape-Athon Corp., 523 S. Hindry, Inglewood, Calif. 90307

Tape-Athon

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Circle Item 22 on Tech Data Card

STUDIO CONSOLE:
Tomorrow's features today

By Oliver Berliner*

■ The final link in the unique KTBT Radio/Telaudio Centre complex, and unquestionably the most unusual portion, has now been placed in service. This is the recording studio known as Studio-B. A full two years were required for analysis, specification, design, laboratory experimentation, manufacture and construction. The result has been the emergence of a recording studio console containing more features and more versatility than virtually any other signal installation.

Philosophy of Design

The advent of 8-channel (or more) consoles and tape recorders of 24-track (or more) capability, combined with the currently popular use of modules, has produced control panels which are not only often displeasing appearancewise, but are also awkward from an operator's standpoint. Some panels are confusing, particularly when the operator is under pressure. The modular concept, created mainly for cost-saving purposes, has been responsible primarily for control panels that are not pleasing to the eye and force the operator into physical discomfort due to distant location of the controls. Furthermore, many off-the-shelf modules offer either the wrong features or insufficient versatility.

For these reasons, Telaudio wanted a recording console that was fully "human engineered" while containing capabilities second to none. It was decided to incorporate space-age technology by eliminating all audio from the mixing panels. In fact, there is no audio in the console except to run the VU meters and the talk-back microphone imbedded in the main mixing panel for the operator's convenience.

Telaudio Studios are located near Disneyland and about 35 miles from Hollywood. For this reason, the bulk of Telaudio's recording activity is centered on other than commercial phonograph record sessions. Since the primary uses for the studio are for recording radio spots, amateur, school and religious groups, a 4-channel output capability was decided upon and a single mixer-recordist operation was established.

The Studio-B console (Fig. 1) consists of a main operating panel, a meter-monitor panel and a subpanel, the latter located under the operator's forearm as it rests on the padded front edge of the console. The row of ten large knobs are the main mixing controls and the operator's arm automatically is positioned so that his hands come to rest on these knobs. Just below them are the 18 input level-setting knobs, slightly smaller in size.

Although it is possible to mix here, the system is designed for a slightly different method of operation. It is almost impossible for the operator to accidentally hit any preset knob, whether it be on the mixing panel or on the subpanel.

Fig. 1. Operator at main operating panel. Note subpanel arm rest.

*Oliver Berliner and Associates

Contrary to the case of many contemporary boards, which are mounted at awkward angles, making operation and reading of designations difficult and strenuous, our mixing panel is at the most comfortable slope. The meters are low, but exactly perpendicular to line of sight. The subpanel is perfectly horizontal, and the depth of the console is minimal, making all controls easily accessible.

RCA knobs are used, because they are easy to grip and to read. All four standard sizes are utilized. Another type of knob with ⅛-inch shaft acceptance was needed for various subpanel controls. Behind and to the right of the operator is the equipment rack (Fig. 2). The producer sits to the operator's left. Behind him are the two 4-channel/2-channel tape recorders operated by remote control from the console. To get to the rack quickly, the operator need only push his roller-chair straight back. The front faces the tape recorders which plug into a panel at the bottom.

Electronics

In order to reduce console size and cost, all amplifiers are housed in the separate equipment rack. Consequently, the console houses only controls and is connected to the rack via some 650 wires carrying direct current only. The duct between the two also carries the eighteen microphone lines to the studio, 4 high-level lines to the studio, 4 studio playback loudspeaker lines, 4 controlroom monitor speaker lines, studio warning light cables, cut and intercom circuits, and metering lines.

As everything is on plugs, the console and rack may be disconnected and removed completely in minutes. This system is also ideal for test purposes and minimizes the number of patch bays and jack "normals". Patching is required only for insertion of limiters or special devices as occasionally needed, otherwise it is not used.

At the top of the rack (Fig. 3) are the various low-voltage, high-current power supplies which incorporate over a thousand light-dependent resistors. This is the heart of our amplifier and equalizer design, created by project engineer Charles S. Broneer.

We created our own printed circuit amplifier cards for all amplifier and equalizer stages, using Field Effect Transistors which are controlled by the LDR's. The bulbs in

Fig. 2. Studio view of panel with equipment rack behind and to the right of the operator.

the Light-Dependent Resistor units are designed for 6-volt operation and are rated at 50,000 hours of life. Because we put a maximum of less than half this voltage on them, and because voltage is applied gradually from zero via the rheostat, the bulb life should extend to over a million hours.

Furthermore, this low voltage minimizes the inherent hysteresis effect, an unfortunate characteristic of LDR's today. Each of the 18 preamplifiers has two separate inputs. One accepts any source of —65 to —17 dB level; the other handles high-level sources and is selected by a switch on the rack.

The 8 outputs of the two tape recorders are normally connected to the high-level inputs of the first 8 preamplifiers (positions 1 thru 8). They are kept out of the circuit and microphones are substituted at the inputs of these preamplifiers by the appropriate selector switches. Tapes on either machine are heard directly from tape to monitor amplifiers without going through the mixer inputs, of course. The FET's, coupled with unique circuitry, eliminate any possibility of input overloading.

All amplifier cards are housed in the rack, and spares are available in case any stage fails. Spares for each of the three types of power supplies are available for instant plug-in, but normally stay in the service shop for use in other equipment testing.

It has been recently shown that microphones of even —56 dB output can actually generate peaks of as high as —19 dB. This is why so many amplifier inputs tend to overload when theoretically they are capable of substantial microphone output levels. Having anticipated this phenomenon, we created a preamplifier circuit with substantial biasing of the input FET, yet with sufficient gain. However, as one increases the setting of the gain control (clockwise rotation) the biasing of the input FET diminishes while maximum clockwise rotation is being achieved. At the maximum point the biasing has been fully "shorted out" and the preamplifier will have an additional 10 dB of gain. Thus, in cases of high microphone output, the biasing is greatest, gain is least and distortion is nearly impossible to create. Conversely, low micro-outputs create negligible chances for distortion.

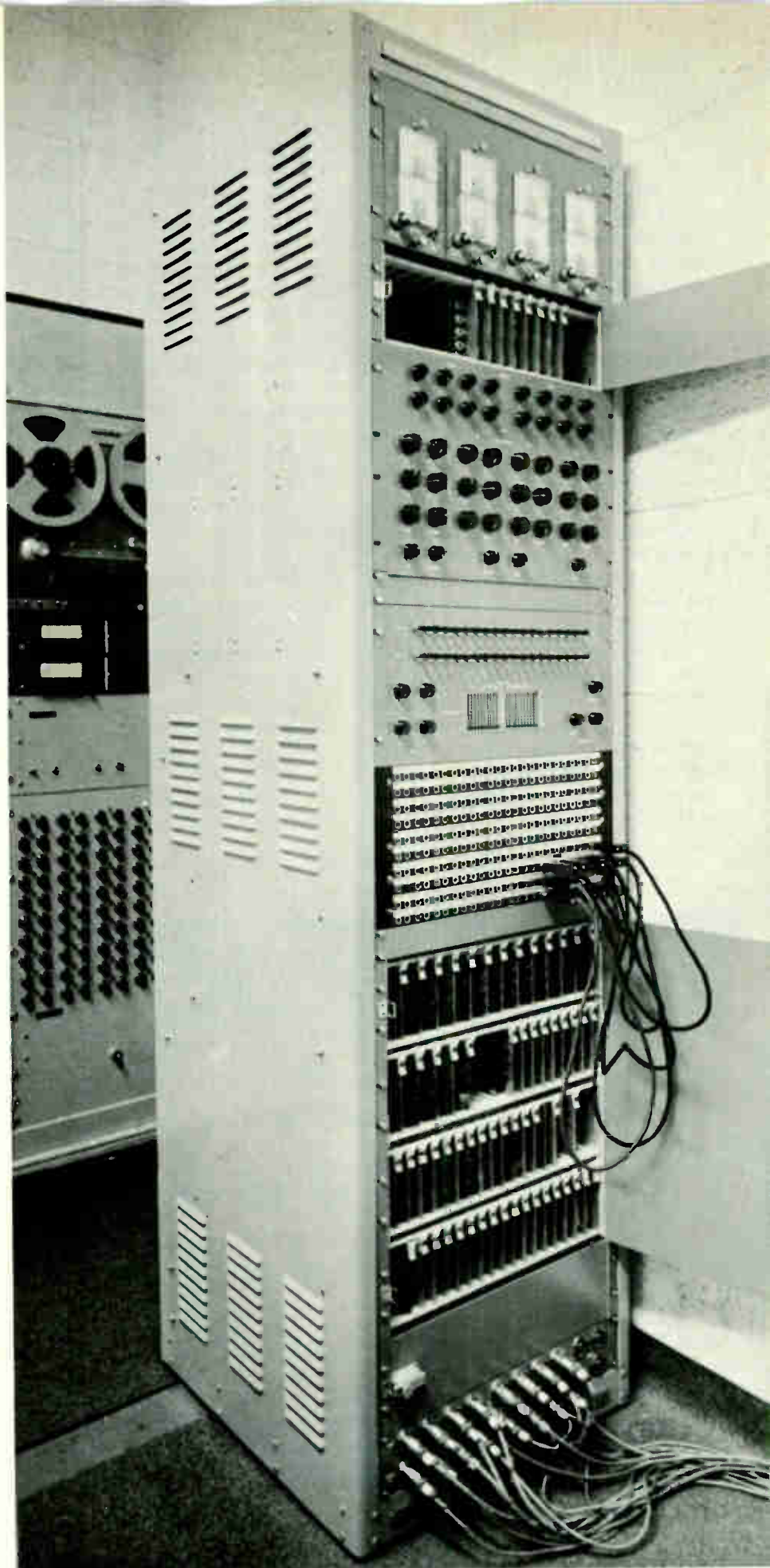

Fig. 3. Equipment rack with various power supplies at top. Note the placement of printed circuit amplifier cards in lower section of rack.

The rack also contains 4 echo "chambers" of our own design. Each has its own send and return master and a complete set of equalizers for reverb effects. Operational amplifiers are used in all combining networks where separate audio sources must be brought together to feed one of the output channels. As is generally known, the output level of the op-amp does not vary with the number of sources fed to it, so it has become the new standard combining network, especially since it also eliminates the high loss of gain encountered in conventional combining networks.

It has been mentioned earlier that mixing is done by submasters. This is because today's "heavy mikeing" demands that each group be individually pre-set, levelwise, and then the entire group controlled by a single gain control.

On the rack is a 10 x 20 lever switch which permits any of 20 (we use only 18) sources (usually microphones) to be sent to any of the 10 submasters. A maximum of 10 sources may be connected to any one submaster (mixer control). Even if the operator desires to "mix" with the 18 input level-setting faders, he must assign them to one or another submaster, otherwise operating voltage will not be present at the level-setting control, and in such case the appropriate submasters would be set more or less wide open and then not used. Four solid-state stereo amplifiers, housed in the rack and driven by preamplifiers complete the electronic array. Our high impedance, DC-gain-controlled preliminary amplifiers make possible the most versatile monitoring setups imaginable, described later.

Design Features

The console contains the mixing panel, meter/monitor panel and setup panel (Fig. 4). The latter contains the following functions for each of the 18 inputs:

A. Low-frequency equalization—Boost of attenuation of 12 dB in 3 dB steps at 40 Hz. or 100 Hz. An "off" position is also provided.

B. High-frequency equalization—Boost or attenuation of 12 dB 2.5, 5 and 19 KHz.

C. Cueing gain — Whatever source is connected to the input may be fed to the cue circuit so that a performer may synchronize to any previous recording, or whatever. By adjusting the Cue Gain controls of any of the 18 inputs desired, cue from anything to everything may be fed, in proper balance, to the performers via headphones or a cueing amplifier/speaker located in the studio.

D. Channel selection — Any source may be connected to any of the 4 output channels or any two channels simultaneously; the latter permits a featured performer to be split to both of the final two stereo channels during original recording or later transfer or dubdown.

E. Panning—Once it has been decided to split a source between a pair of output channels, the panning control associated with that source determines the proportions of signal being divided between the two selected channels. There are six steps possible . . . from 90% x 10% to 10%

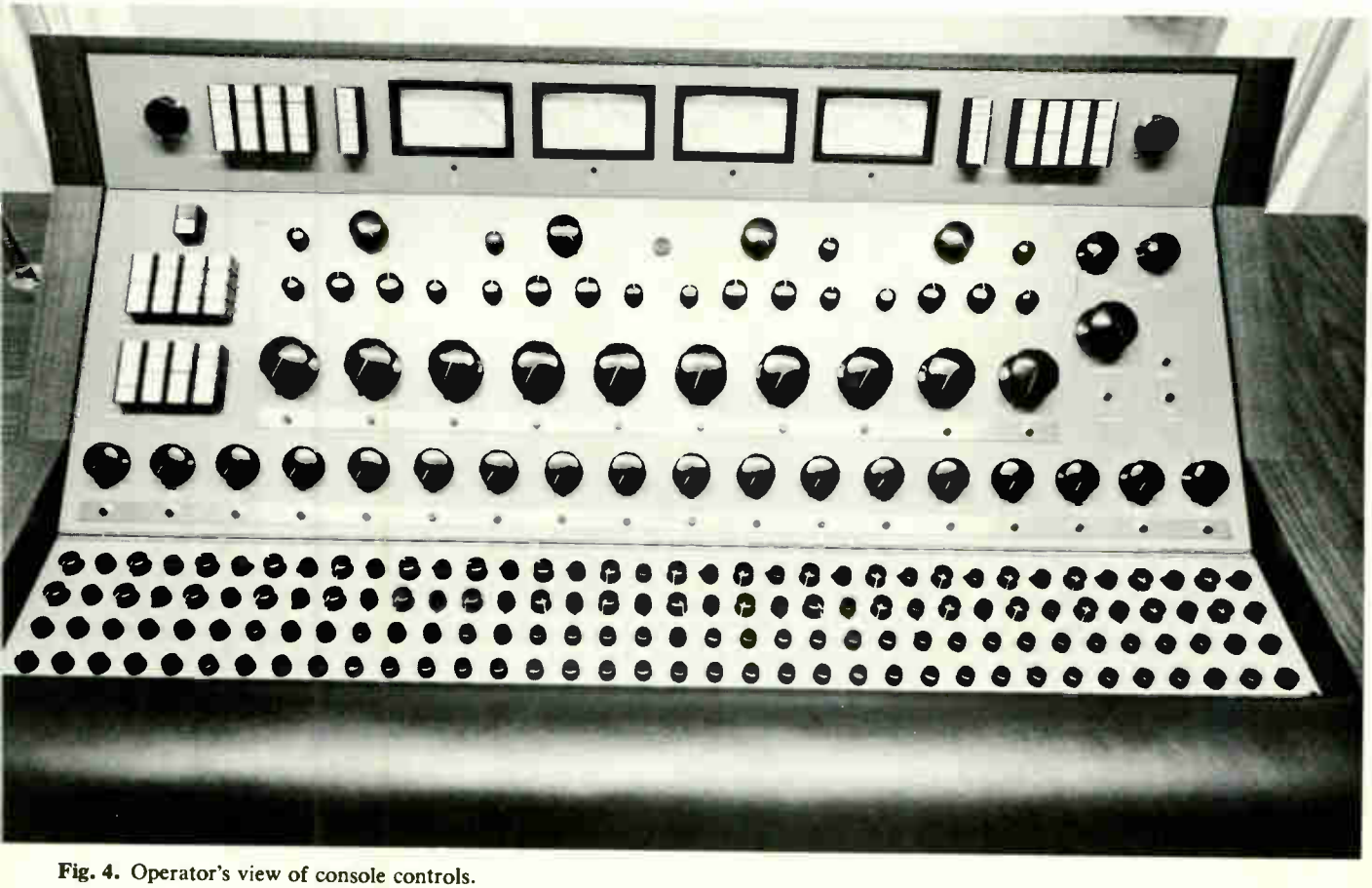

Fig. 4. Operator's view of console controls.

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Video Color Phasing Amplifier

a simple and automatic way to phase synchronous color signals

Take a look at a really new product. It's impressive. And not just because it reeks of quality manufacturing. It's impressive in performance, too. For the first time, you can now automatically phase one color signal to match the phase of other synchronous color signals—even if the other signals originate in different studio locations. Impressed?

Operationally Tested by Major Network

We managed to impress one of the major networks with our new Video Color Phasing Amplifier. It must have convinced them too. After a thorough evaluation of one of our prototypes, we were pleased to hear their report. No breakdowns. No failures. Perfect performance. Happy network.
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Tartan

TARTAN ELECTRONICS CORPORATION

44 Broadway, Greenlawn, N.Y. 11740 (516) 757-4800

EASTERN REPRESENTATIVE FOR ALMA ENGINEERING: SWITCHERS, AUDIO CONSOLES, DISTRIBUTION AMPLIFIERS

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x 90%, relative intensity. The critical observer may note that since there are an even number of panning positions, there is no "center" position where the source is split equally between the two channels. This is correct.

An equally split source will become 3 dB too loud when the 2-track stereo recording is played monophonically, due to the addative effect. In our splitting system a source must be 3 dB down on one of the two channels. This effectively eliminates the addative effect in mono usage, yet the soloist or split source is slightly lower in level on one of the two channels. All 18 inputs have this panning.

F. Echo proportioning—We used a reverb method, created some years ago by Charles Broneer, which has not received the acclaim to which it is entitled. Instead of merely tapping some audio off of the source, as is customary, we divide the source between its main channel and the echo (reverberation) channel. It is thus possible to change from one extreme of all direct signal and no echo, to the opposite extreme of all echo and no direct signal. . . or anything in between.

Metering/Monitoring

The uppermost panel contains the VU meters and gain controls for control rooms monitoring and playback loudspeakers in the studio. Contrary to the practice of many cost-conscious studios, we have full 4 channel playback for the musicians in the studio, not just in the control room. As in the case of the two tape recorders, any speaker in the studio or in the control room can hear any one, any combination, or all of the four available channels.

Frequently, it is necessary to combine the channels in the monitor (only) in order to observe the overall orchestral balance. This can be done at any time, including during recording, without disturbing the separation of the four tape tracks. Beside each 4 x 4 switchbank is a group of four illuminated push buttons which select for their respective loudspeakers the source of audio . . . console, tape-1, tape-2, off.

All switches on the console, and the VU meters, are illuminated; however, the switches light up only when depressed, for quicker identification. Five volts are applied to 6-volt bulbs which not only prolongs their life but makes them less obtrusive when the operator does not wish to look at them.

At the producer's desk, accommodating two to three persons, are an electric timer and two microphones. One is less accessible than the other, to minimize accidental use. This is the slating and talkback mike. The other is an intercommunication microphone. A conductor, leader or key performer may be equipped with headphones and can receive instructions or other messages from the control room without interfering with the recording. Should such a person be using the headphones for cueing purposes, the intercom overrides the cut signals.

In concluding the discussion of the electronic features it must be again pointed out that there are no switches or controls in any audio circuits! Not only is gain changed by Direct Current control of LDR's, but equalization—including frequency selection and extent of attenuation or boost—is similarly controlled. Furthermore, all tape recorder amplifiers and monitor amplifiers are driven by our own preliminary amplifiers. They maintain uniformity in the control method but permit the desired combining of channels without disturbing balance, levels or channel separation.

Fig. 5. Looking into the control room from hallway. Curtains can be drawn when visitors cause distractions.

Special Features

As much attention was given to features of the studio as was given the console. First consideration went to the creation of a foolproof studio warning light system. When the studio is in use for live recording, the operator depresses the "in use" button on the console's monitor panel. This turns on a light in the hallway near the studio door. It is not necessary to do so when live recording is not taking place. When the "in use" button is depressed, it lights a "silence-recording" sign in the hallway when the "record" button on either of the two recorders or their remote control units is de-

STANTON 681EE CALIBRATION STANDARD

"The tracking was excellent and distinctly better in this respect than any other cartridge we have tested....The frequency response of the Stanton 681EE was the flattest of the cartridges tested, within ±1 dB over most of the audio range."

From the laboratory tests of eleven cartridges, conducted by Julian D. Hirsch and Gladden B. Houck, as reported in HiFi/Stereo Review, July, 1968.

To anyone not familiar with the Stanton 681, this might seem to be an extraordinary statement. But to anyone else, such as professional engineers, these results simply confirm what they already know.

Your own 681 will perform exactly the same as the one tested by Hirsch-Houck. That is a guarantee. Every 681 is tested and measured against the laboratory standard for frequency response, channel separation, output, etc. The results are written by hand on the specifications enclosed with every 681.

You don't have to be a professional to hear the difference a Stanton 681 will make in your system, especially with the "Longhair" brush that provides the clean grooves so essential for flawless tracking and clear reproduction.

The 681EE, with elliptical stylus, is $60.00. The 681T, at $75.00, includes both an elliptical stylus (for your records) and an interchangeable conical stylus (for anyone else's records). For free literature, write to Stanton Magnetics, Inc., Plainview, L.I., N.Y.

Circle Item 24 on Tech Data Card

pressed. During playback only, the "silence" light will not go on. Furthermore, when the recorder is stopped or put in any mode other than "record", the warning light will not come on. Consequently, it is impossible to leave the "silence" light on or off, accidentally.

Most studios are plagued by visitors who are either just curious and wish to watch a recording session, or those who (supposedly) have business with some of the performers. In order to satisfy the curious and minimize the disruption by visitors looking for a specific performer or producer, we placed windows between the hallway and the studio, and between hallway and control room (Fig 5). This also makes the control room seem larger. Curtains can be drawn to prevent onlookers from seeing into the studio, if desired.

The producer's comfort is further enhanced by an operating platform some eight inches above studio floor level, which permits five visitors to sit comfortably at floor level between the platform and the control room window without blocking the producer's or operator's view. A dimmer adjusts control room illumination to suit the producer.

The window between studio and control is actually a wall of glass—three pieces thick, with no parallel panes and no adjacent pieces of the same thickness. The glass wall stretches some six feet from the floor. Although expensive and difficult acoustically, it enhances the "viewability" between studio and control room (Fig. 6).

All of the necessary precautions were taken in the acoustic design of the studio, space permitting. There are no parallel surfaces of any consequence. Inner and outer walls are on different studs. Outlet boxes are filled with sound absorbent compounds. Storage cabinets have gasketed doors. The air conditioning is acoustically separated with diffusers to minimize air noise and motor noise. The hallway is heavily carpeted to eliminate noise, and the studio and control room floors are one of the first to use a new absorbent tile developed by Armstrong Cork Company.

We believe that the painstaking planning of the studio, its control room and console have made it the pacesetting facility. It truly provides tomorrow's features today. ▲

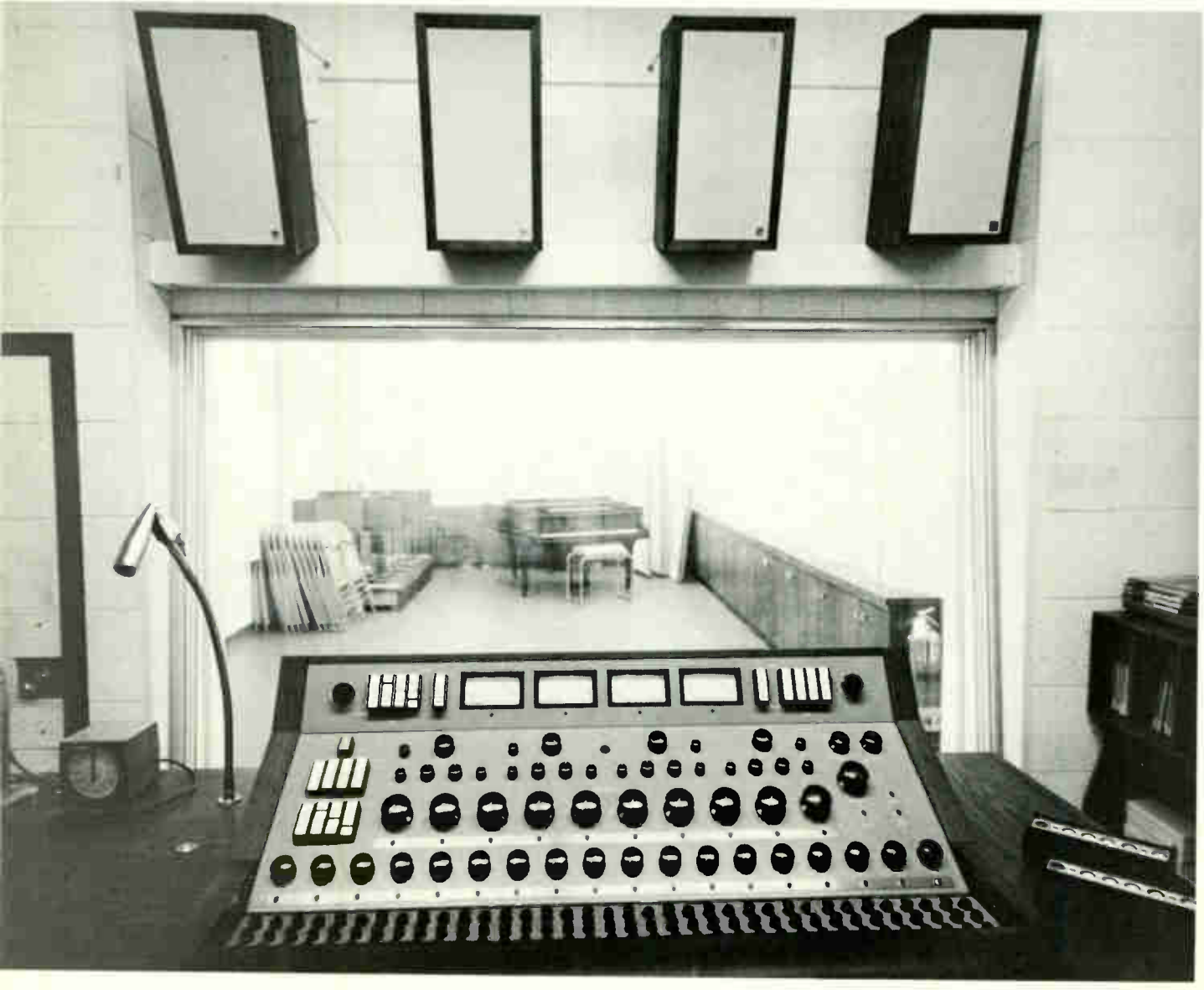

Fig. 6. Operator view from control room into studio. Note placement of microphone and overhead speakers.

Send us your name, and we'll add an impressive performance chart to this list of reasons for you to specify the Sony C55-FET microphone.

1. We have replaced the conventional, fragile vacuum tube with a field-effect transistor for rugged dependability and elimination of bulky external cables and power supply.

2. Completely self-contained, the C55-FET has an internal 9-volt battery. We think it's a big improvement over the whole power station you used to have to hook up with all the cords and wires!

3. Permits use of standard Cannon XLR-3-12C output connector for battery operation. Now a condenser mike can have the same connector as any dynamic or ribbon mike, providing complete compatibility among all your studio equipment.

4. For ease of operation in a permanent studio location, the C55-FET can be externally powered by an optional AC power supply (AC109).

5. By the use of a field-effect transistor, Sony eliminates overload problems commonly associated with tube-type mikes because of grid blocking.

6. The C55-FET's low current draw permits at least 800 hours of battery life. A pilot light indicates battery condition at the flick of a switch.

7. Movable capsule can be positioned vertically, horizontally, or anywhere between, making the C55-FET unusually convenient for hand-held operation.

8. Ring switch for battery check, flat or two low-cut modes.

These are just a few of the reasons that Sony professional microphones are so popular with studio engineers and sound experts. For more reasons and more information, please write to Harold Watson, Sony/Superscope, 8150 Vineland Avenue, Sun Valley, California 91352.

SONY SUPERSCOPE

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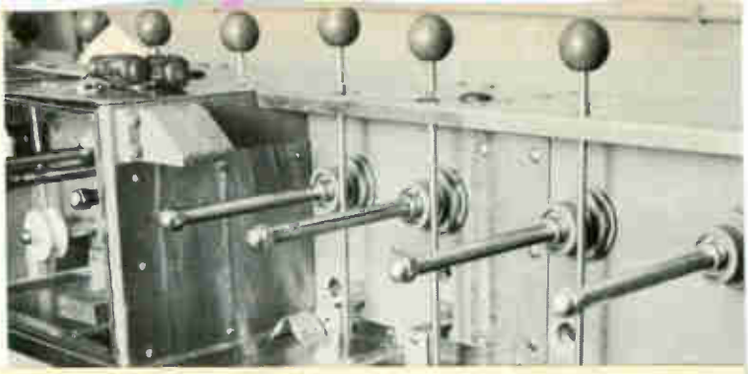
ment system was also installed.

The cost for the complete conversion, including heating and replenishment, was $3,000—less than half that of the prepared conversion kit.

Why did he decide to use the Anscochrome film process? "Anscochrome is a versatile film," Brown

Though the color processing at WCYB-TV can be done by any of several people at the station, it is normally assigned to a trainee in the news department. Brown, who is in charge of keeping the process in control and maintaining the chemicals and replenishment, attended a

before the 6:00 PM news), the convenience of the processor is important to Brown, who shoots all of the station's commercials. Where it formerly took a week to have his footage processed and returned to him, he now has it back in slightly over an hour. ▲



Processor

Understanding transistor audio circuits

By Norman H. Crowhurst

Part III of a six-part series

After working through some theory in Part 2, it will now be necesary to purchase the parts and do some checking. The circuit of Fig. 2-6, repeated here as Fig. 3-1, will be used for this purpose. A dozen or so transistors will be needed. They must have an average current gain of 150, with limits of 120 and 180.

A transistor type number for this is not given, because transistor technology advances so rapidly that this article won't have been in print a year before someone will want to know where that archaic type number can be obtained. For the present purpose, the important parameter is current gain. The transistor will be named by its gain figures. The whole circuit could be set up and then decisions made on various parts of it. It could be set up by parts and values developed for the parts. The whole would then be integrated, making further adjustments as necessary. The first method will be used here.

To start to work, bypass C_1, C_2 and C_4 with large electrolytics, so they will not contribute anything to the response in the frequency range in which we are interested, and go to work on C_3. The feedback resistor (shown as 12K from the output stage emitter to the input side of C_2) should be disconnected.

To calculate the value of C_3 we need to know the input impedance of the last stage. The base input impedance is 50K. When paralleled with the 10K and 12K bias resistor "pot" the result will be 5K.

This can be checked by measuring the input impedance as part of a voltage divider (Fig. 3-2). When the calibrated resistor is set to equal the input impedance, the signal voltage at the output from the oscillator will be precisely halved at the base of the transistor. Reading off the resistance value (or measuring it, if the resistance used wasn't calibrated) will tell the value of base input impedance. In this case, it checked the calculated 5K closely.

Now we assume the source resistance of the middle stage, as input for C_3, is 1.2K (the collector resistor), placing the total resistance associated in series with C_3 at 6.2K. The reactance of C_3 should be 6.2K at 141.4 Hz. This would be 0.18 mfd. A capacitor assembly with this measured value can be inserted in the circuit.

Testing for Response

It should have a 45° point, with 3 db loss, at precisely 141.4 Hz (Fig. 3-3). Note the shape of the loop needed to indicate this. Use a scope with a graticule and set the vertical and horizontal traces to be of identical amplitude, so you have a 45°

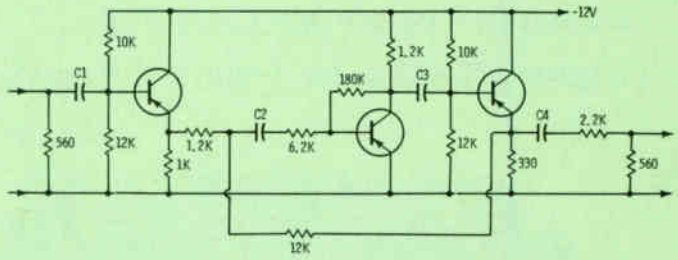


Fig. 3-1. The first transistor circuit discussed. The problem is to align it to give the response described in the previous article.

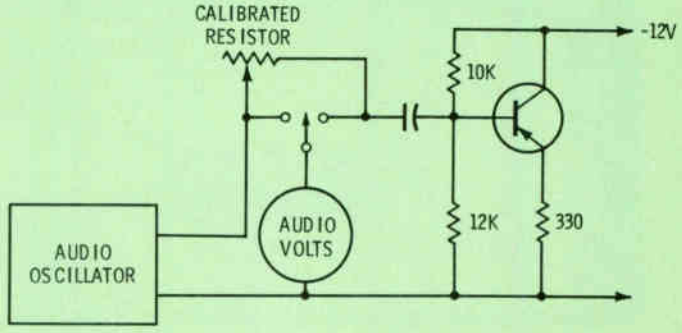


Fig. 3-2. Checking the base input impedance of the third stage in Fig. 3-1.

line trace, located between definite markings on the graticule, using a mid frequency from the oscillator, where the capacitor has no effect and phase shift is zero.

Now lower the oscillator frequency to 141.4 Hz. If necessary, the oscillator input should be adjusted so the horizontal dimension of the trace is the same as it was at mid-frequency. Don't adjust traces by the oscilloscope controls after the true 45° line trace has been set up at a mid-band frequency where there is no phase shift.

At 141.4 Hz, the vertical height should go to 0.707 of its previous value, as well as the trace opening out from a straight line at 45° to form an ellipse. The shape and disposition of the ellipse tell whether the attenuation and phase shift are correct.

The maximum height of the ellipse should be 0.707. It should cut the vertical axis at 0.5 of the original height (above and below origin) and the horizontal axis at 0.707 of the original width. Thus all three dimensions, or pairs of points on the graticule, can be checked for true 3 db drop with 45° phase shift, after the width is set correctly by the oscillator input control.

Phase Shift Problem

Here we encounter our first surprise. All the calculations were made carefully and the values measured and checked, but the 3 db, 45° phase shift does not come at 141.4 Hz. Instead, it is at about 154 Hz.

This discrepancy can be explained in two ways: (1) we assumed the collector source impedance was 1.2 K; had we assumed it was 700 ohms, we would have been correct. Or (2), the gain of the middle stage changes as C_3 goes into its roll-off, effectively shifting its turnover point.

In mid-range, where C_3 couples the 5K load across the 1.2K collector resistor (signal-wise), the feedback factor (assuming a current gain of 150) is 1.83, yielding a working gain of 82. But below the cut-off frequency, where C_3 decouples this parallel load from the collector resistor, the feedback factor rises to 2, yielding a working gain of 75. This drop in gain, accompanying cut-off, is equivalent to accentuating or increasing the cut-off.

This can be solved by increasing the value of C_3 to a reactance of 5.7K at 141.4 Hz, which requires a value of 0.198 mfd. So we install this value and bypass it with the electrolytic we remove from C_2.

Capacitor C_2 works into a load resistance of 6.2K (the base input resistance being negligible in comparison) and from a source resistance of 1.2K. The feedback resis-

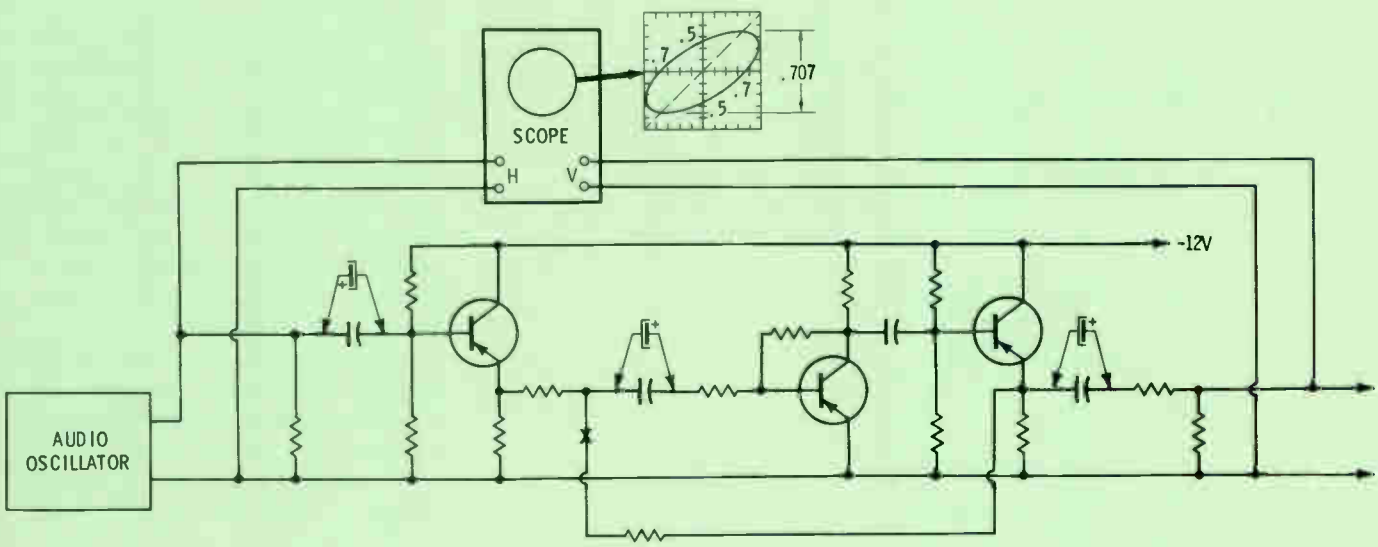


Fig. 3-3. The test set-up for aligning the circuit of Fig. 3-1. The trace shown represents –3 db with 45° phase shift, after the scope has been calibrated by setting the trace to a 45° closed line (dashed line) at a midfrequency where there is no phase shift. Electrolytics bypassing the coupling capacitors swamp their low frequency cut-off while individual values are worked on.

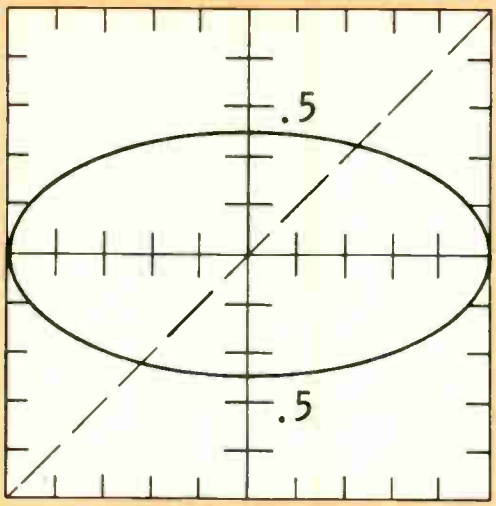


Fig. 3-4. The trace to represent –6 db with 90° phase shift, which should be given when two roll-offs are combined without interaction due to feedback.

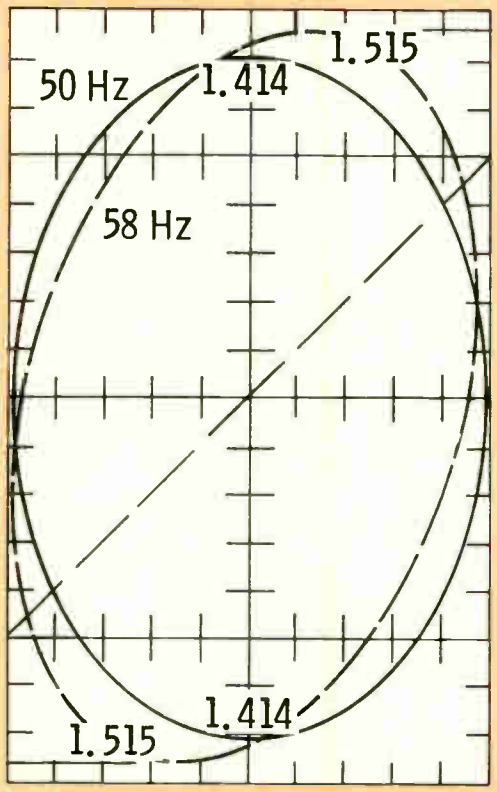


Fig. 3-5. The required traces when proper feedback is applied to the two roll-offs within the feedback loop. This represents +3 db at the 90° phase shift point, with a peak of +3.6 db at a slightly higher frequency.

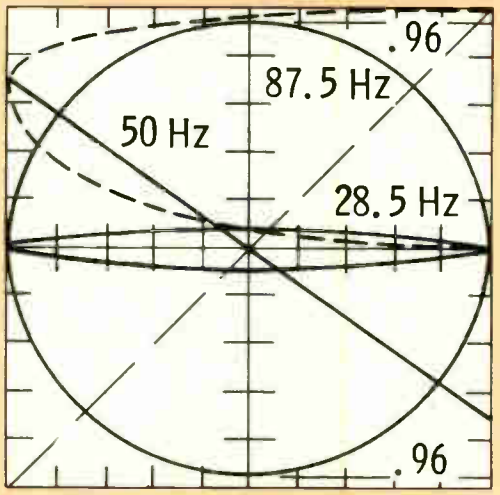


Fig. 3-6. The traces associated with the final completed response, when correctly aligned.

tor is not connected. The source resistance of the input emitter follower is very low, so the total resistance associated in series with C_2 is 7.4K.

A C_2 value of 0.153 mfd. will have a reactance of 7.4K at 141.4 Hz. This checks quite closely, giving the -3 db, 45° trace at 141.4 Hz.

Now remove the electrolytic from paralleling C_3 to check the two capacitors, C_2 and C_3, in the circuit together. This works well, giving the –6db, 90° trace at 141.4 Hz (Fig. 3-4).

The best way to identify the 90° trace is to look for the ellipse to be "on the square"—major axes vertical and horizontal. The highest and lowest points are precisely on the vertical center line when this happens. And the left and right extremes also are on the horizontal center line. The 6 db loss is indicated by the height of the ellipse being precisely half the height of the original sloping line trace.

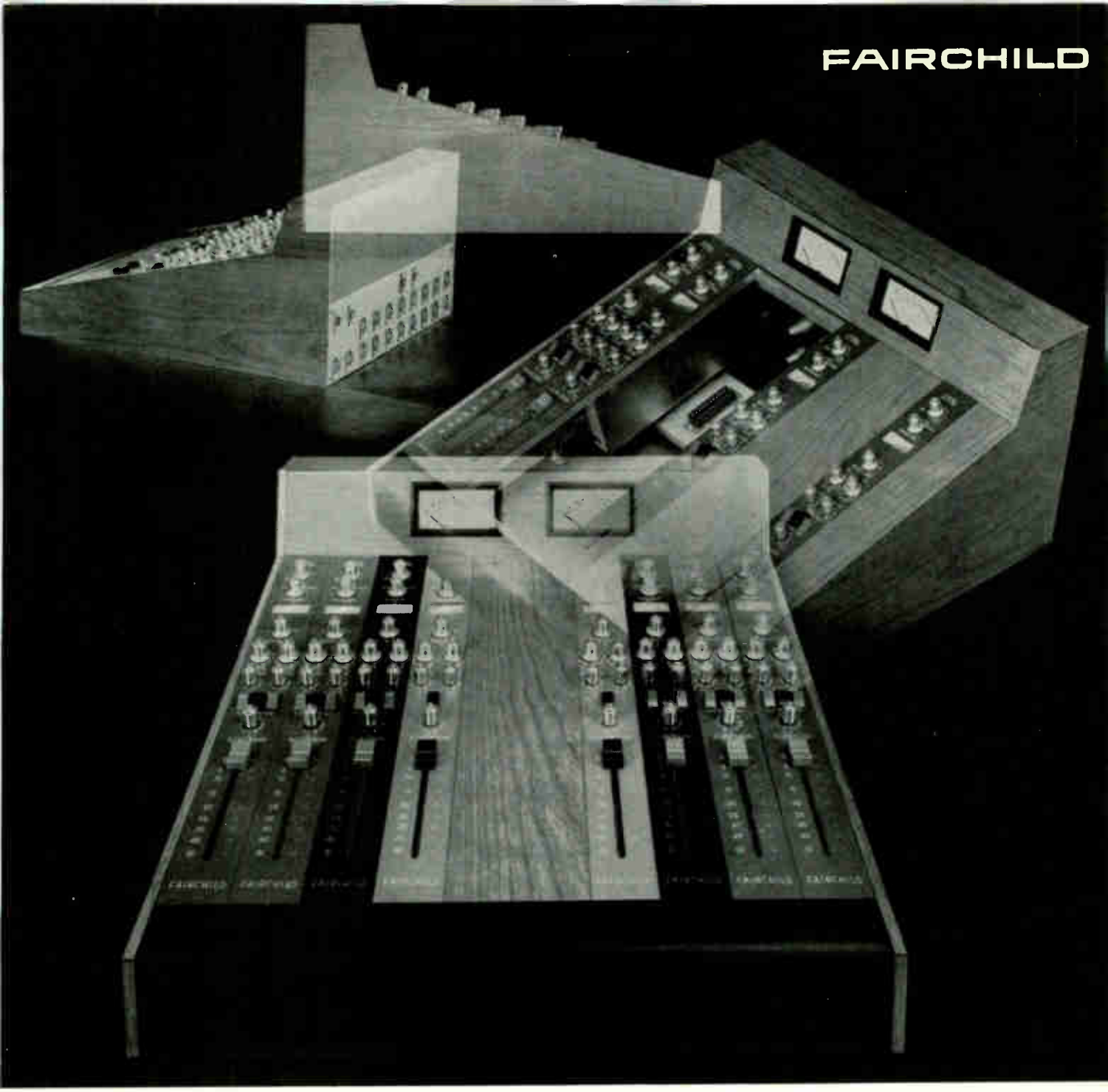
Checking for Gain

Connect the feedback (12K) resistor for the next check. The first thing is to check the gain drop in mid-band (where no phase shift occurs). It proves to be very slightly more than the calculated 18 db, or 8:1. This can be corrected by using a slightly larger value in place of the 12K resistor.

Whether the difference is accounted for by values being off center value within their rated tolerance, or by having overlooked something, adjustments can be made to maintain circuit balance and proper gain. Possibly a 15K resistor could be used and then various higher-value shunts could be connected across it, until a precise 8:1 reduction in gain is obtained.

Before this is done, we should check to see how the feedback affects the response. It should produce a peak a little above 50 Hz, so that a 90° point, with amplitude +3 db instead of -3 db, occurs at precisely 50 Hz (Fig. 3-5).

This will be shown by the maximum height of the ellipse occurring at about 58 Hz. But the major axes will be vertical and horizontal at 50 Hz, and the amplitude should be precisely 1.414 times that at mid-band, after adjusting oscillator input, if necessary, so the horizontal dimension of the trace is the same.



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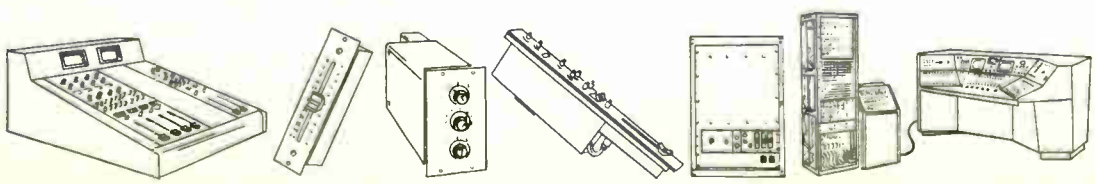


DESKTOP MODULE CONSOLE / LUMITEN / REVERBERTRON 658B / INTEGRATED CONTROL MODULE / REVERBERTRON 658A / REMOTE AUDIO CONSOLE

Since the feedback seemed a little too high on the gain-change check, we would expect more than this amount of boost at a frequency slightly lower than those predicted.

Adjusting for Gain

Here comes another surprise. The boost is slightly less than 3 db at the 90° point, which is slightly above 50 Hz. This suggests the need for more feedback, rather than less. Larger resistor values can be used in a parallel combination with the 12K resistor already connected in the feedback position.

As we juggle the values, we find the 90° point does not precisely coincide with +3 db. So, adjust the resistance values to get +3 db at 50 Hz, with the ellipse slightly "off" the perfect 90°, and with maximum boost at about 58 Hz, which is important for combining with the other responses to get the correct shape.

If we wanted to, we could adjust the values of C_2 and C_3 so as to get both the +3 db and the 90° phase shift at precisely 50 Hz, using a suitable amount of feedback. But to do this, we find ourselves juggling many variables. Why did this happen?

As we have already seen, current gain changes on its way through roll-off. Now that we've moved from 141.4 Hz down to 50 Hz, the gain has changed to a different value. Although we measure 8:1 (or slightly more) gain reduction at a mid-band frequency, we're getting less than the equivalent amount of feedback at 50 Hz. Also, the injection of feedback at the output end of the 1.2K resistor changes the effective source resistance from which C_2 works. This effect is similar to that causing us to change the value of C_3 earlier. Slightly increasing C_2 will help correct the condition.

Had the gain change been adjusted at midband frequency to precisely 8:1, the equivalent gain reduction at 50 Hz would be about 7.3:1. This is partly why the results don't add up.

If the design had been such that C_3 produced a bigger effect on the middle stage stabilizing feedback from collector to base, which it does by coupling its output load in parallel with that stage's collector, there would have been more trouble. This is why the base input impedance of the output stage was made relatively high.

Also keeping the resistor before C_2 relatively smaller than the one following it (in this case, values are 1.2K and 6.2K) prevents the effect of feedback from too seriously invalidating the effective roll-off of C_2.

Final Checking

The final stage of checking consists of again bypassing C_2 and C_3 with electrolytics and removing the bypass from C_1 and C_4, one at a time, to get their roll-offs at 50 Hz.

The input capacitor, C_1, works from the 560 ohm resistor into an output load (the first stage input impedance) of 5.3K. If the external circuit is 500 ohms, the source for C_1 is about 280 ohms. This means C_1 should have a reactance of 5.6K at 50 Hz., requiring 0.57mfd. The output capacitor, C_4 works from almost zero impedance (the emitter follower) into 2.2K plus 560 ohms in parallel with an assumed 500 ohms external impedance, making the output load for C_4 about 2.5K. A reactance of 2.5K at 50 Hz requires 1.37 mfd.

These values are made up and checked, one at a time, with the other bypassed with a fat electrolytic. Each should give -3 db 45° ellipse at 50 Hz. The relevant trace was shown at Fig. 3-3, but the frequency at which it is obtained should be 50 Hz instead of 141.4 Hz. If either capacitor fails to give the correct trace, its value should be adjusted until it does.

Having checked C_2 and C_4 separately, they should be checked together, with C_2 and C_3 still bypassed with electrolytics. The pattern is the same as at Fig. 3-4, but again the frequency is different. Finally, if no adjustment is needed here, the bypasses are removed from C_2 and C_3 and the overall response checked.

This should now show phase reversal with 3 db drop at 50 Hz, with 90° and 270° phase shift frequencies at 87.5 Hz and 28.5 Hz respectively (Fig. 3-6). Phase reversal is where the loop closes to a line sloping the opposite way from the midband trace. Its height should be 0.707 of the height of the first sloping line.

The 90° frequency will show little loss, being about 0.96 of full amplitude, while the 270° may be so small a trace the quadrature point (major axes on the square) is difficult to recognize with precision. The amplitude at this point should be almost exactly one tenth the original.

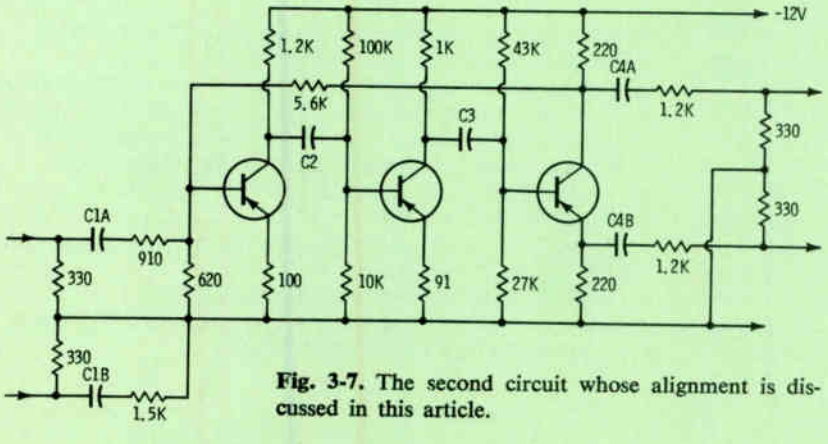
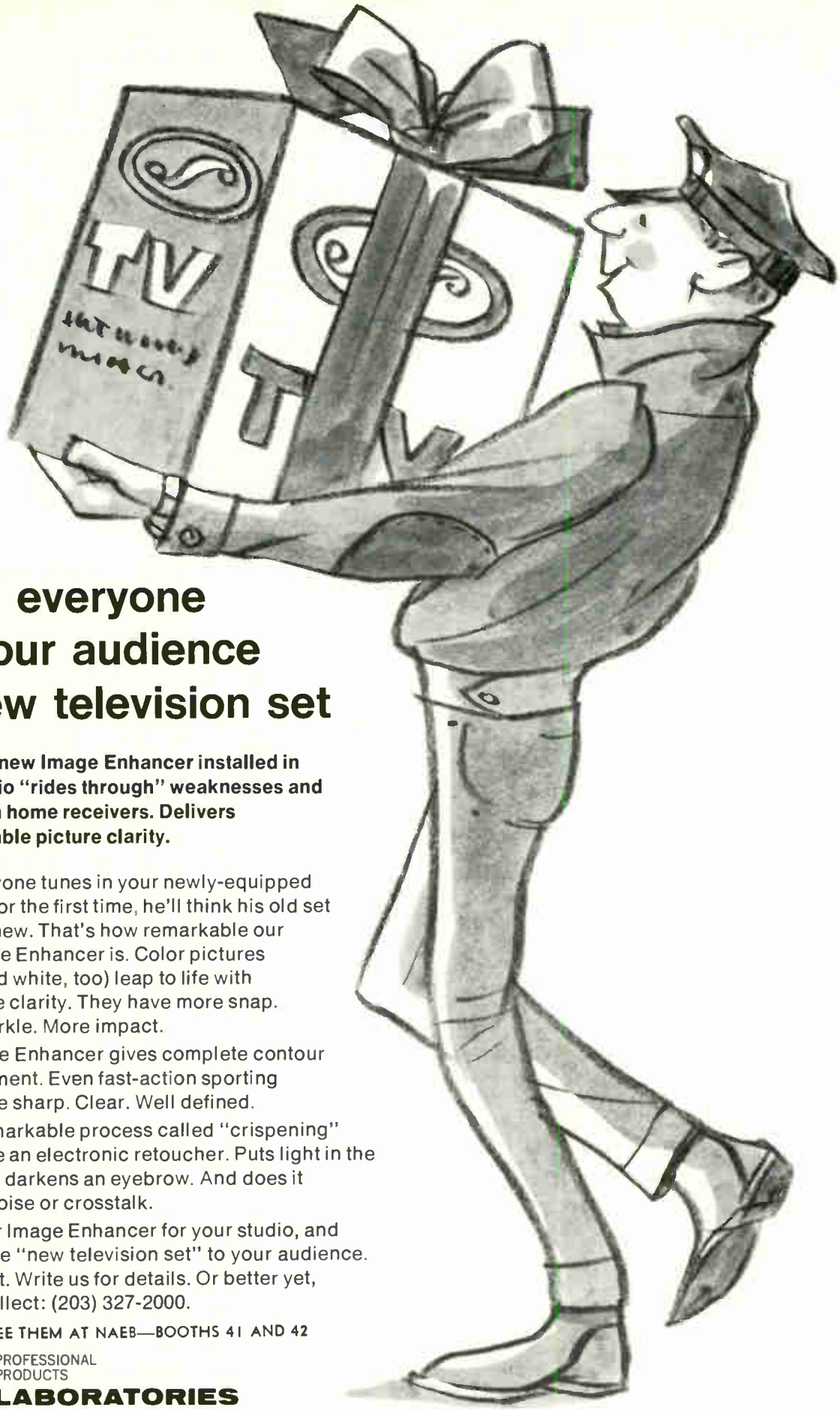


Fig. 3-7. The second circuit whose alignment is discussed in this article.

Second Method

So much for checking the first kind of circuit. Now we'll go over the second variation described in the previous article (Fig. 2-8) repeated here (Fig. 3-7). Again we'll build the whole thing and check through piece by piece. But here we cannot "disconnect" the feedback, because the same resistor (the 5.6K from collector of stage 3 to base of stage 1) serves for both feedback and bias for the first stage.

A fairly simple way to overcome this is to break this resistor into two parts—two of 2.7K will be close



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enough—and proceed from there, decoupling the center point to remove feedback (Fig. 3-8). With all the capacitors bypassed with electrolytics and the feedback bypass capacitor in place, we can start checking gain, stage by stage. Input is connected from top side of input to ground, because the bottom side of input is a "dummy" to pad out impedance matching on a balanced circuit.

Balance of this input circuit should be checked with the feedback bypass removed, because the 2.7K paralleling the 620 ohm will change the reflected value slightly. If you're using a single-ended output oscillator, you can check the input impedance one side at a time, as one is only a dummy (Fig. 3-9).

Checking the Circuit

Now with input connected to top side (Fig. 3-8) and feedback bypassed, check levels through the unit, using 50 mV. input. At base of first transistor, the signal is 18 mV^V. At the collector of first and base of second transistor, signal is 180mV^V. At collector of second and base of third transistor, as well as emitter and collector of the third transistor, all sensibly the same audio voltage, 1.8 volts. Then at each output terminal, 390 mV^V. The overall gain is close to 8 times: 50 mV^V in, 390 mV^V out.

Now open the bypass across C_3, which should be adjusted so its value is 12 K at 141.4 Hz, or 0.095 mfd. Check that the 3 db, 45° point is at 141.4 Hz, as at Fig. 3-3. Now close the bypass across C_3 and open the one across C_2 with its value adjusted to 6.7K at 141.4 Hz, which is 0.17 mfd. Check that its 3 db, 45° point is also at 141.4 Hz.

The next step is to open both these bypasses and check the response without feedback. It should be -6 db, 90° at 141.4 Hz, as at Fig. 3-4. Since this circuit provides good isolation, this is close. In this circuit, instead of gain dropping as cut-off is approaching, as it did with the current feedback of the other circuit, gain rises a little, because the collector load rises. But the effect is small and more easily compensated, because other interaction does not occur.

Now remove the bypass from the feedback point. Gain will drop by slightly less than 8:1, because removing the bypass also affects the input stage attenuation, as well as allowing feedback to come in. The important thing to check is whether or not the response changes to show +3 db, 90° at 50 Hz, as at Fig. 3-5. If the other checks came close to predictions, this one will too.

Some slight adjustments may be necessary, either because values are off their center values (within the tolerances used) or because of the slight gain shift mentioned.

Final Adjustments

Remove the bypasses from capacitors C_1 and C_4, one at a time, to check that each of these yields its -3 db, 45° at the 50 Hz frequency. This can be done with the feedback bypassed and C_2 and C_3 bypassed, or each can be checked with the central portion fully operating (C_3 and C_2 providing their roll-offs and the feedback active).

Since this is different from the method we used for the first circuit, the relevant pattern is shown at Fig. 3-10. The 3 db 45° shift can be checked directly on the output side of the "dummy" half of the input (Fig. 3-11). For the action half, keep C_4s bypassed and check C_1 with C_2, C_3 and the feedback operative.

The turnover point is now checked by a trace representing a 135° phase shift and zero attenuation at 50 Hz, as measured on either output (Fig. 3-8). The 135° phase

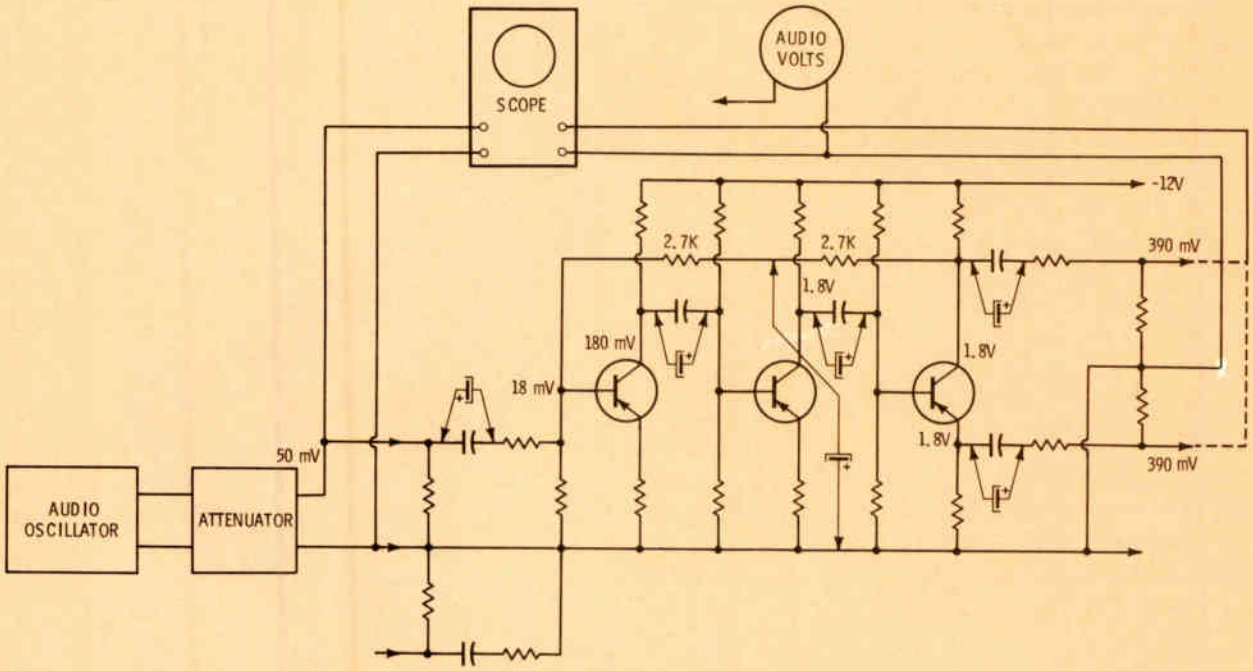


Fig. 3-8. The method of setting up the circuit of Fig. 3-7 up for alignment.

shift ellipse is similar to the 45° ellipse, but sloping the opposite way. Zero attenuation is shown by the height being the same as that of the slanting line, instead of 0.707 as in Fig. 3-3.

The theoretical 90° phase shift is at about 65 Hz with +1.3 db, an amplitude 1.16 times midfrequency level. The theoretical frequency of peak is slightly different, about 64 Hz, but the level is not noticeably different. Thus the easiest to spot on the trace is the 90° point, which should correspond with 65 Hz.

Now remove the bypasses from C_4s and bypass C_1, to check C_4s in the same manner. Note that C_4s should always be both bypassed or both unbypassed and that checks should be made on both, because the last stage is virtually a phase splitter, depending on symmetrical loads in emitter and collector.

Finally, remove the bypass from C_1 which should bring the 50 Hz response to phase reversal (180°) at 3db loss, as in the other circuit (Fig. 3-6).

Working with the two circuits we have discussed will show how much more freedom from interaction the second arrangement has than the first. The only interaction in the second circuit is between the feedback and the first stage bias.

If adjustments need to be made for any reason, it may be better not to change the feedback resistor, if this happens to give the correct bias for the first stage, but to change the second stage gain, which can be achieved by altering its emitter resistor. If this change throws the collector voltage too far from a suitable midpoint, it can be brought back by changing this stage's bias, preferably the upper resistor, which will not change base circuit impedance materially.

If any voltages are off, they can be brought back by similar means. If the first stage does not have a suitable operating point, the feedback resistor may need changing, in which case the base to ground resistor will need changing to bring feedback to its correct value. Then the input attenuator may need changing to bring attenuation back to the desired figure.

Due to the problem of component value selection to maintain circuit balance, this circuit makes changes easier to handle than the first, because there is much less two-way (or even more-way) interaction.

One of the useful transistor applications is the development of special tone generators for various purposes. Their compact size and inexpensive cost make them very attractive for building devices that would have been prohibitive, even if possible, using tubes. The fact that they are obtainable in two polarities and have complete freedom of connection (no heaters to think about) makes them infinitely more flexible in design application.

A surprising amount can be accomplished by various adaptations to the basic multivibrator circuit. In the next article of this series, we will show how frequency can be controlled and special waveforms developed, using voltage controls. ▲

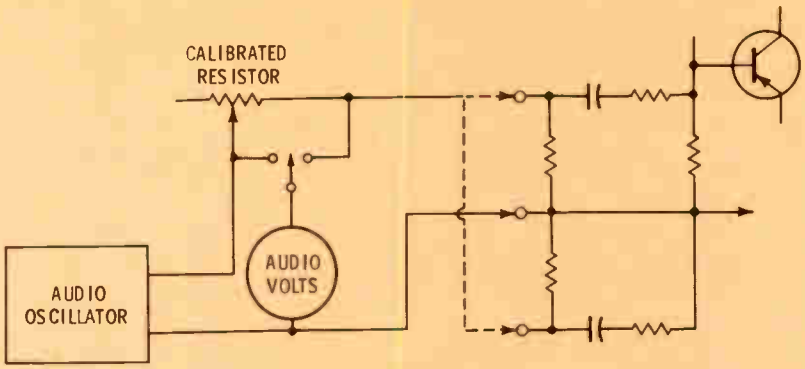


Fig. 3-9. Method of checking the dummy balanced input circuit for balance.

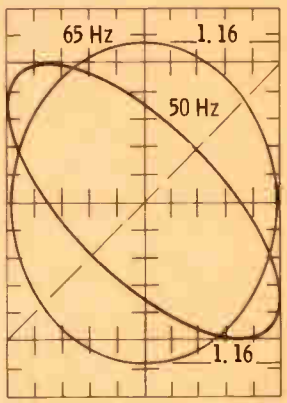
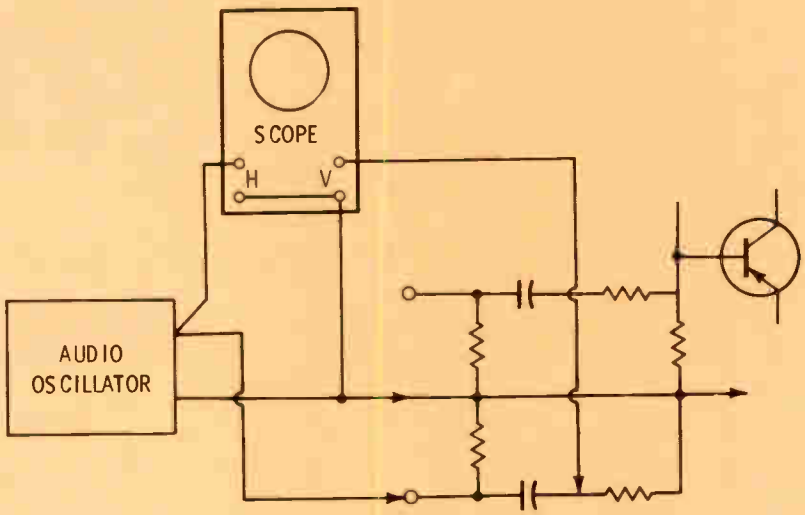
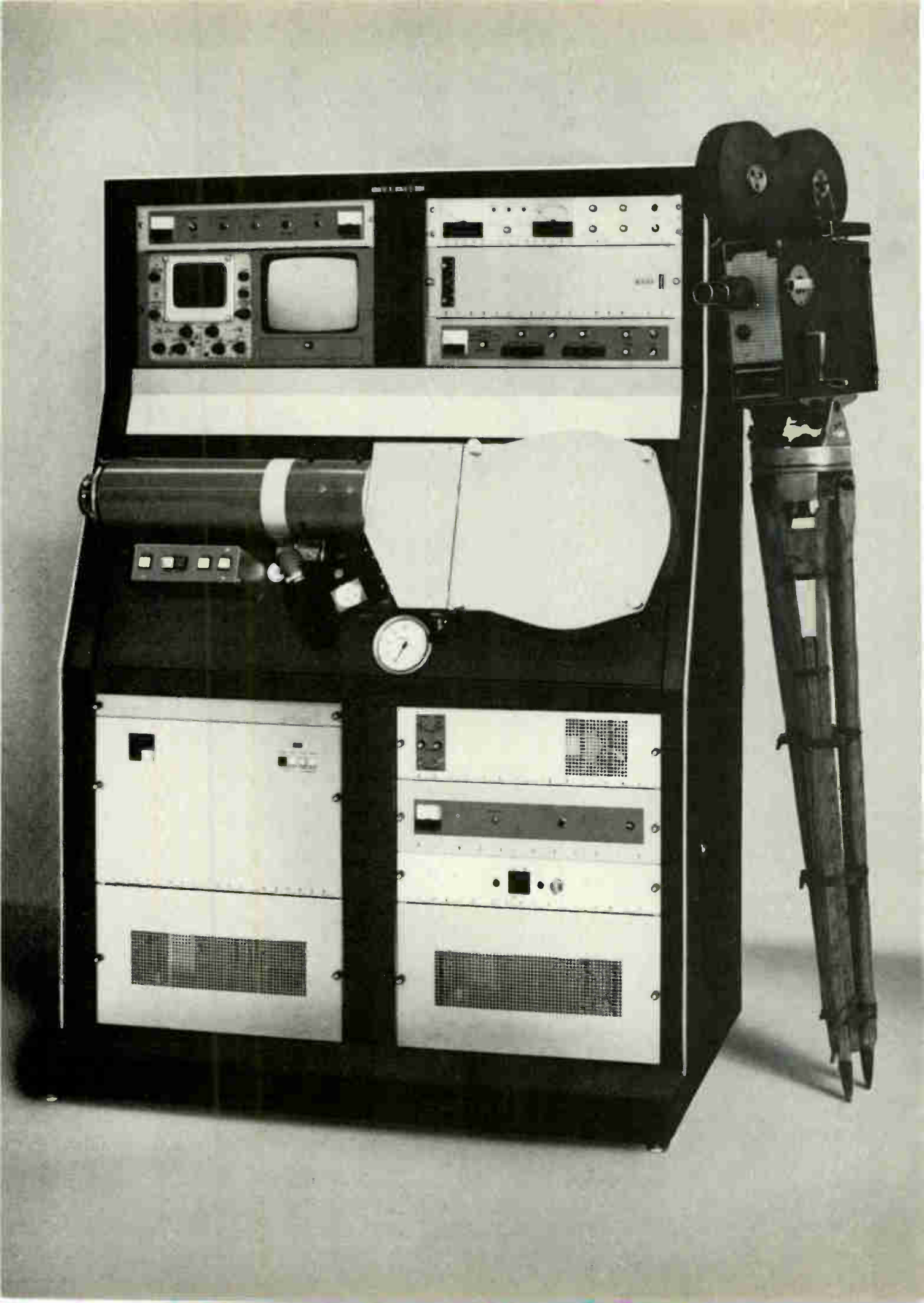


Fig. 3-10. The traces associated with checking one of the 3 db, 45° roll-offs with the middle part, including feedback, active in response. It represents zero attenuation with 135° phase shift at 50 Hz, with a 1.3 db peak at about 65 Hz. See text.

Fig. 3-11. How to check the value of C_1 used in the dummy part of the input circuit.





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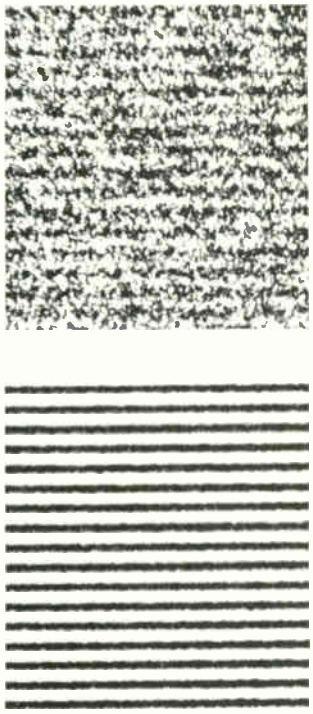

Television raster lines (right) enlarged from 16mm film frames. Lower: EBR-100 recording on 3M fine-grain (less than 0.1 micron) electron recording film. Top: kinescope recording on television recording film. Line-to-line spacing in both pictures is approximately 0.00058 inches or 14.7 microns.

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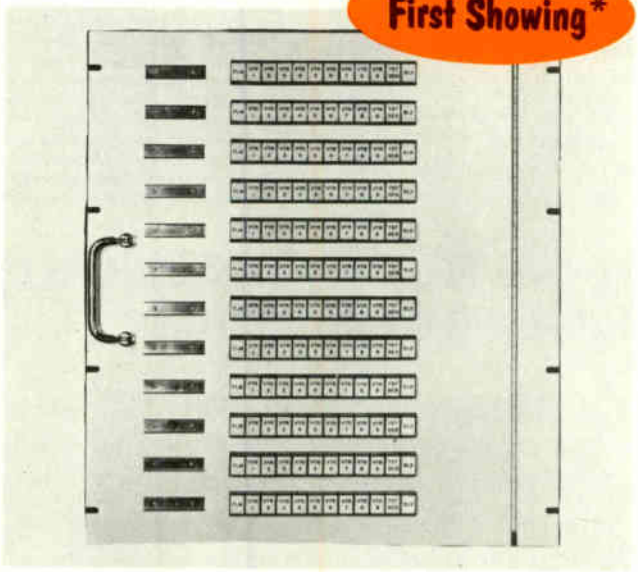

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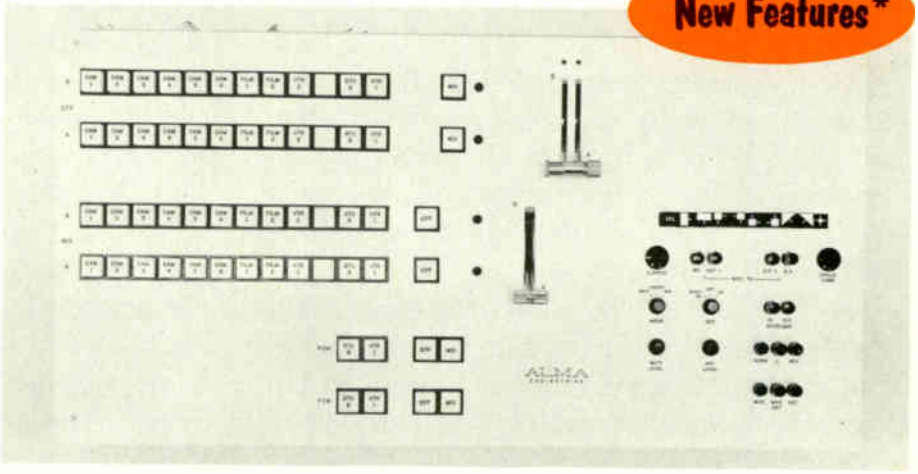

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Circle Item 34 on Tech Data Card

November 1968

Late Bulletin from Washington

by Howard T. Head

Commission Taking A Closer Look At Operating AM Directionals

The Commission's field inspectors and the Washington Engineering Staff are paying increasingly closer attention to the performance of operating standard broadcast directional antennas. As a consequence, more and more AM directionals are being found operating outside of licensed limits. An increasing number of directional antenna licensees are being directed by the Commssion to take corrective action, and in some flagrant cases fines are being levied by the Commission.

Contributing to the problem is the fact that the licenses for many of the older directional antenna systems, including most of those built prior to 1947, do not require that field strengths at the monitoring points be measured on a regular basis. However, this does not relieve the licensee of the requirement for maintaining the monitoring point fields within the license values.

Chief engineers of directional antenna stations should institute a program to assure, first, that the monitoring point fields do not regularly exceed the values specified in the license and, second, that the operating directional antenna parameters are within limits. The Commission's Technical Standards specify a 5% tolerance on antenna currents, but no tolerance is specified on phase angle deviations. The Commission's field inspectors, however, generally consider deviations of more than 2° or 3° from the licensed phase angle relationships to be excessive. Actually, many directional antenna systems cannot tolerate variations of as much as 5% in current ratio and 2° in phase without exceeding permissible pattern values.

Deviations from the licensed operating parameters and monitor point field strengths do not necessarily mean that the directional antenna pattern is out of adjustment. They do mean, however, that the cause for the deviation should be investigated promptly, and any needed corrective action taken.

Canadian Television Receiver Industry Going All UHF

The Canadian Department of Transport (DOT), FCC's opposite number in Canada, is preparing new technical regulations which will require that all television receivers manufactured in or imported into Canada after June 1, 1969, be capable of receiving all UHF, as well as VHF, channels. Similar requirements have been in effect in the United States since April 30, 1964.

The new DOT regulations will set standards for Canadian UHF receiver performance similar to those set by the FCC for the performance of American

all-channel receivers. In both countries, the noise figure at the UHF tuners must be no worse than 18 db, and in Canada the VHF noise figure is also specified, to be no worse than 10 db. A comparable U.S. requirement specifies that the sensitivity of the UHF portion of the receiver shall not be more than 8 db poorer than at VHF.

Canada's Board of Broadcast Governors (BBG) opened up the UHF band in 1966, when it was apparent that most of the VHF television channel assignments, especially in the large Metropolitan areas, had been taken. The Canadian Broadcasting Corporation (CBC) maintains both English and French language television stations in the province of Quebec and other French-speaking portions of Canada, producing an added demand for channel assignments. There also is an increasing demand in Canada for television licenses by independent operators and for ETV stations.

FM Mileage Shortages on the Increase

The Commission is granting an increasing number of FM applications proposing the operation of new stations or transmitter moves of authorized stations at locations failing to meet the minimum mileage separations established by the FM Technical Standards. Most of the cases are characterized by special circumstances, such as the desire of an FM permittee to combine AM and FM operations at an existing AM transmitter location, the unavailability of sites meeting mileage requirements, or the inability to provide the required principal city coverage from a site meeting the mileage requirements. Additionally, there are a few FM assignments provided by the Commission's table on a "grandfather" basis which are not expected to meet the minimum mileages.

To date, all of the waivers which have been granted were for the purpose of permitting the use of particular transmitter locations, and no mileage shortages have been authorized in order to permit the making of completely new FM channel assignments. The demand for new assignments continues to be heavy, although few, if any, unused assignments remain in the more populous regions of the country.

CATV Operators Press Commercial Program Origination

The Commission has denied a petition by three television broadcast stations in Greensboro-High Point, N.C. to prohibit a CATV system in Greensboro from carrying locally-originated CATV programs which included commercials. Plans for the carriage of commercials were made by the CATV system after the City Council modified the local franchise so as to permit commercial originations.

The Commission, in denying the relief requested by the television stations, stated that one of the reasons for the denial was the Commission's reluctance to establish overall policy on the basis of the situation in a single market. The Commission announced its intention, however, to shortly investigate the implications of commercial carriage by CATV systems on an over-all basis, with a view toward establishing nationwide policy.

Howard T. Head...in Washington

TV Octopus:

Hair in the Gate

By Robert A. Corley*

America's greatest force for eliminating dirty movies from television is an unseen and unknown star, compressed air. Most TV viewers have watched this invisible worker without knowing it and with no reaction other than perhaps appreciation for a consistently good performance. Relatively few people outside the broadcasting industry know how widespread is the use of compressed air in providing a clearer picture.

The tremendous amount of program material on 16mm film keeps movie projectors in almost constant operation at most TV stations and compressed air is put to good use in TV projection rooms. The intense light and strong lenses used in film projection magnify the tiniest thread, dust particle or emulsion silver into a huge, dirty blemish which threatens to engulf the picture. When these trash particles enter the film gate of a projector and lodge there, they hang on with the seeming tenacity of an octopus, all the while waving hairy tentacles around the edges or across the center of the picture.

When the director sees such trash on the picture monitor he advises the projectionist with the phrase, "Hair in the gate!" The projectionist may have already noted the problem before being told. He then begins his efforts to dislodge the foreign matter without either stopping the projector or delaying the program presentation by even a second.

The earliest uses of compressed air for this purpose came when a projectionist, using nothing but sheer lung power, would huff and puff and blow mightily into the projector's innards. If this failed to remove the obstructing matter, he would try the use of moisture; wetting the film with water or saliva by moistening his fingers and letting the film slide between them prior to entering the gate. Unsanitary as the practice might be, it worked often enough to earn a permanent place in the projectionists' bag of tricks—for frequently the offending trash would stick to the wet surface of the film and be pulled clear of the gate.

In extremely stubborn cases where all else fails it may be necessary to switch to a commercial on another projector or to show a **ONE MOMENT PLEASE** slide while the projector is stopped and the film gate is physically cleaned to eliminate the obstruction.

Experience has proved that air does the cleaning trick better than most other methods. Thus, early in TV history, an air compressor found its way into many broadcast projection rooms. Initially, it probably consisted of a hose and hand-held nozzle. It was used not only for clearing film gates, but also in routine maintenance and cleaning, where it was found to be superb for blowing accumulated dust from almost inaccessible nooks and crannies of equipment racks.

The development of VTR, or Video Tape Recorders, brought the use of compressed air in television broadcasting into a more refined state of development wherein provision for compressed air supply is built into equipment at the time of manufacture.

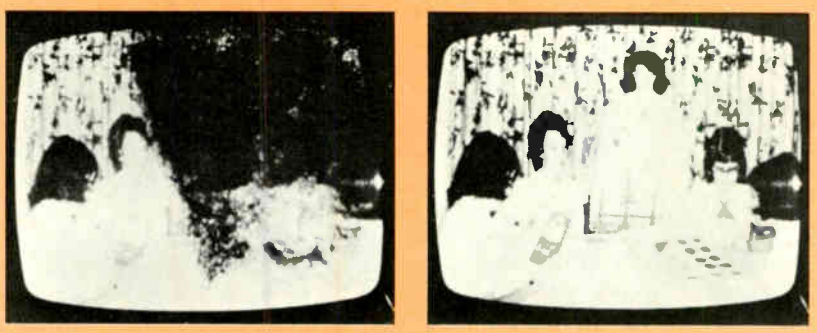
In video tape recorders, however, compressed air serves a quite different function from the one it performs for film projectors. In VTR usage, compressed air actually serves as an air bearing, providing much less friction or drag for video tape than would a roller or ball bearing.

It was a logical step, therefore, that film projectors for TV have built-in provision for compressed air supply. At WQXI-TV in Atlanta, RCA film projectors which incorporate this feature are in use and have proved exceptionally effective in solving the film gate problem.

In this installation compressed air flows into a T-junction which provides controllable air flow to either of the two film projectors normally installed with each multiplex chain. The projectionist can usually clear trash from the gates without leaving his operating position and with merely a press of the appropriate push-button valve.

While by no means is this use of compressed air an exclusive use or development by WQXI-TV, it nevertheless reveals another way in which compressed air serves broadcasting directly and is of indirect benefit to everyone who watches television.

*WQXI-TV, Atlanta, assisted by Compressed Air & Gas Institute.



Before-and-after simulated photo of "hair in the gate" on TV screen shows effectiveness of compressed air gate cleaning during film projection.

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This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Opportunities in Plants

And there are other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

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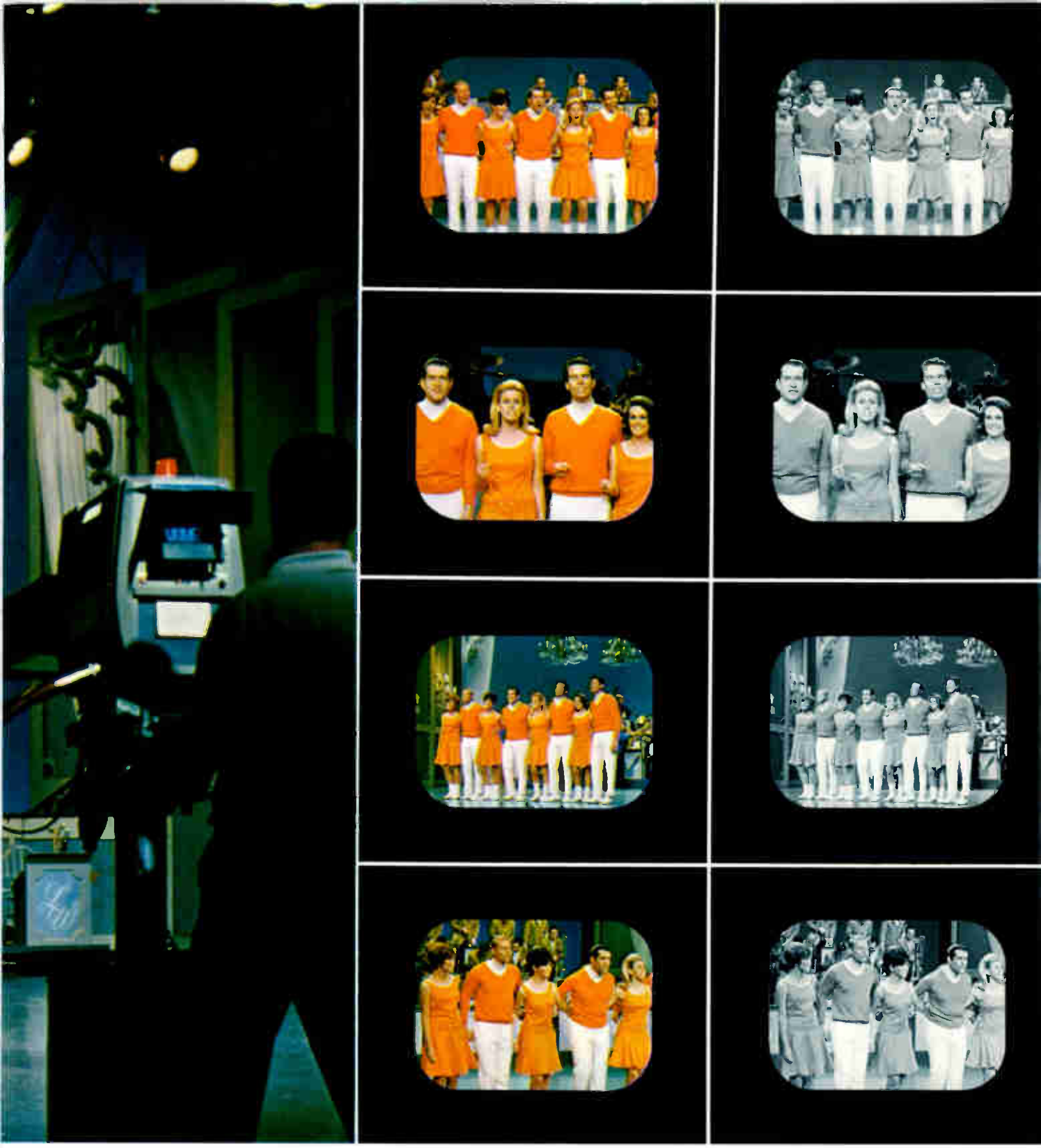

the tape must not fail.

If it does, you have trouble. Time and money trouble.

Think what your actors, singers, dancers and directors are costing you. Not to mention cameramen, lighting men, sound technicians, floormen, and all the other people who put your show together.

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MEMOREX

Reviewing Video Clamp Circuits

By Roy K. Brandt

■ Clamp circuits have been used in video equipment since the early days of television, and their basic function has not changed. Complex equipment in use today requires clamping of the video signal at many points between the camera pickup tube and the visual transmitter. Before discussing actual circuits, it might be well to review some reasons for clamping.

A video signal contains both AC and DC components. When the signal passes through a coupling capacitor the DC component is lost, and the signal centers itself about its AC axis. Fig. 1 shows 2 lines of white followed by 2 lines of black, then 2 more lines of white. Sync tip and blanking levels follow a straight line when the DC component is present, however after passing through a capacitor the signal is centered about its AC axis and the sync tip and blanking levels no longer follow a straight line.

During normal programming, the video is constantly changing from black to white, and the relation of sync tip and blanking baselines to some fixed reference is also constantly changing. It may be said that the sync tip and blanking baselines are modulated by the DC video information. The purpose of the clamp circuit is to pull or "clamp" each sync pulse to some reference level so that the sync tip and blanking baselines follow a straight line and are not affected by the video content of the signal.

Clamps are sometimes employed to remove baseline ripple or hum, and are normally used whenever the signal is modified during a specific part of its duty cycle such as: clipping of whites and/or blacks, sync and setup level adjust, or white stretch and gamma correction. The video signal also must be clamped prior to modulating the visual carrier in the transmitter because the DC component must be represented in the transmitted signal so that it may be recovered in the home receiver.

*Cedar Rapids, Iowa.

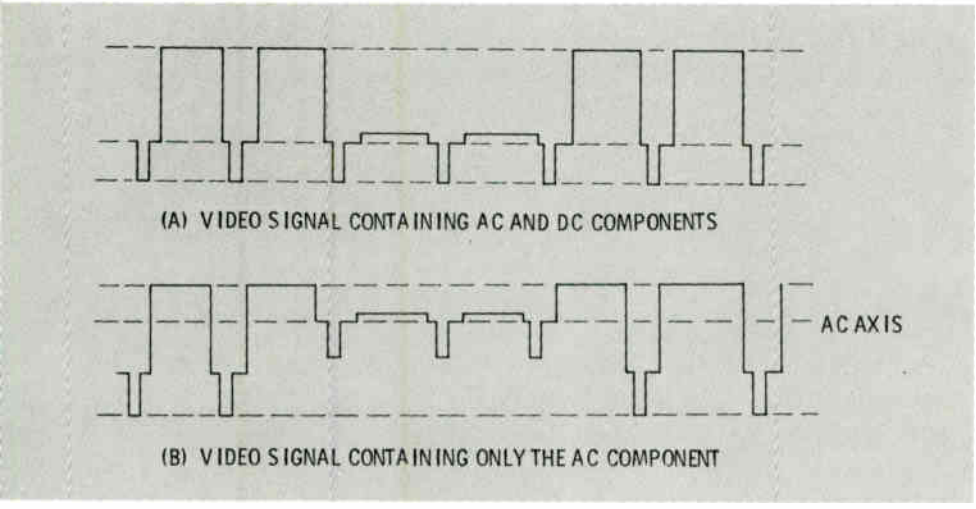


Figure 1

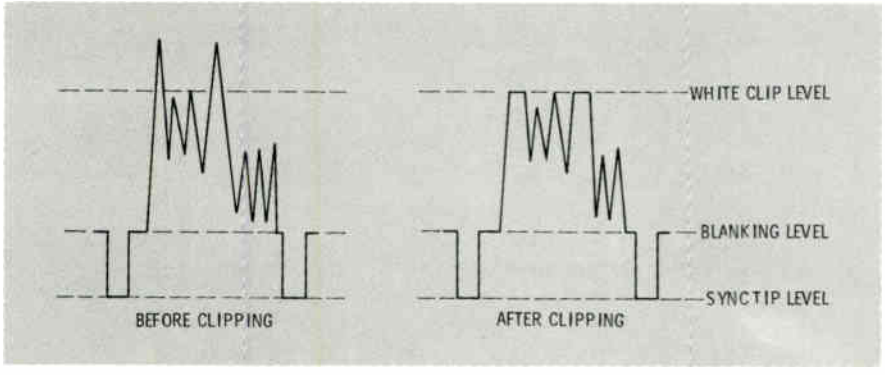


Figure 2

White Clipping

The only part of the signal affected is that part going white that exceeds the white clip reference level. Fig. 2. The white clip level is set at some point above blanking, and for this reason blanking must occur at a known level regardless of the picture content. This is the function of the clamp—to establish a reference level for blanking.

Line by line clamping establishes a DC bias, or reference, at the beginning of each horizontal line. The clamped stage then operates for the remaining duration of the line with the same DC bias as that established during clamping time. Line by line clamping may occur anytime during the horizontal blanking period, ie: during front porch sync, or back porch times. Short time duration and tendency for tilt make the front porch an undesirable place to clamp. Back porch and sync tip clamping are both in use, however back porch clamping will be the method referred to unless otherwise noted.

Transistor Clamp Circuit

Video is applied to Q1 base

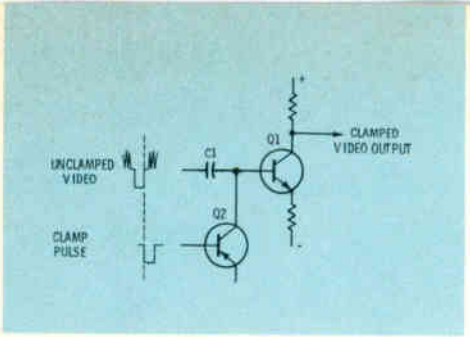


Figure 3

through C1, and the negative clamp pulse is applied to Q2 base in Fig. 30. The clamp pulse (2 usec. nominal) is coincident with back porch, which means that during this time Q2 saturates and holds the base of Q1 at ground potential for the duration of the clamp pulse. Between pulses, Q2 presents an open circuit to Q1 base. The base of Q1 remains at the DC level established during clamp time for a period determined by the RC time constant of C1 and the input resistance of Q1. This constant is longer than one horizontal line (63.5 usec.) thus the bias established during clamp time will remain unchanged until the next clamp pulse occurs.

This circuit is commonly used for hum removal and is sometimes called a "hum clamp". To change this circuit to sync tip clamping, it is only necessary to make the clamp pulse coincident with the sync tip.

Double Diode Clamp

This is a vacuum tube circuit (Fig. 4) and requires push-pull clamp pulses. A negative clamp pulse is applied to the grid of V3 which operates as a phase inverter with a negative pulse developed at the cathode and a positive pulse at the plate. R1=R2, therefore the pulses are of equal amplitude. During clamp time D1 and D2 conduct heavily, clamping the grid of V2 to the top ends of R3 and R4.

Between pulses, capacitors C3 and C4 discharge through R3 and R4 respectively, creating voltage drops of equal amplitude but opposite polarity. The net potential between V2 grid and point (A) is zero during clamp time. The grid of V2 is in effect clamped to point (A), which in this case is ground. It should be noted that point (A) may be some reference other than ground, and often is. The grid of V2 is clamped to whatever potential exists at point (A) during clamp time.

C1 retains this potential for the remainder of the line as in the transistor circuit of Fig. 3. One difference exists. The input resistance of V2 is very high and C1 may be much smaller in value than in the transistor circuit. With this high input resistance, the circuit is very sensitive to a gassy V2, which will develop a horizontal shading signal added to the video at V2 plate. (The cure, of course, is to replace V2.) Clamping occurs during the same time that burst is present on the back porch, and precautions must be taken to prevent distortion or phase shift of the burst.

The parallel circuit of L1—R5 isolates the 3.58 MHz burst from the clamp diodes D1 and D2. Between clamp pulses the circuit is effectively disconnected from point (A) by the diodes, and therefore does not effect the response of clamped stage V2. This is an early attempt at isolating burst from the clamping action. More sophisticated methods have been devised, as will be seen later.

Bridge Clamp

The bridge clamp in Fig. 5 employs 4 diodes and requires push-pull clamp pulses. Q1 base is clamped to point (A) by the diodes for a period of time determined by the duration of the clamp pulse. The diodes conduct heavily during this time and all four legs of the bridge are in effect, tied together. Between pulses the bridge presents an open circuit between Q1 base and point (A). C1 therefore functions the same as in the previous circuits discussed, being charged during pulse time to the potential existing at point (A), and holding this charge until the next pulse occurs. The voltage at point (A) then becomes the bias for the clamped stage Q1. The versatile bridge clamp is found in vacuum tube and transistor equipment.

Methods used to prevent burst distortion when clamping fall into two general categories: (1) Burst and chroma are separated from the luminance information, then recombined with it after separate processing. In this method burst cannot be

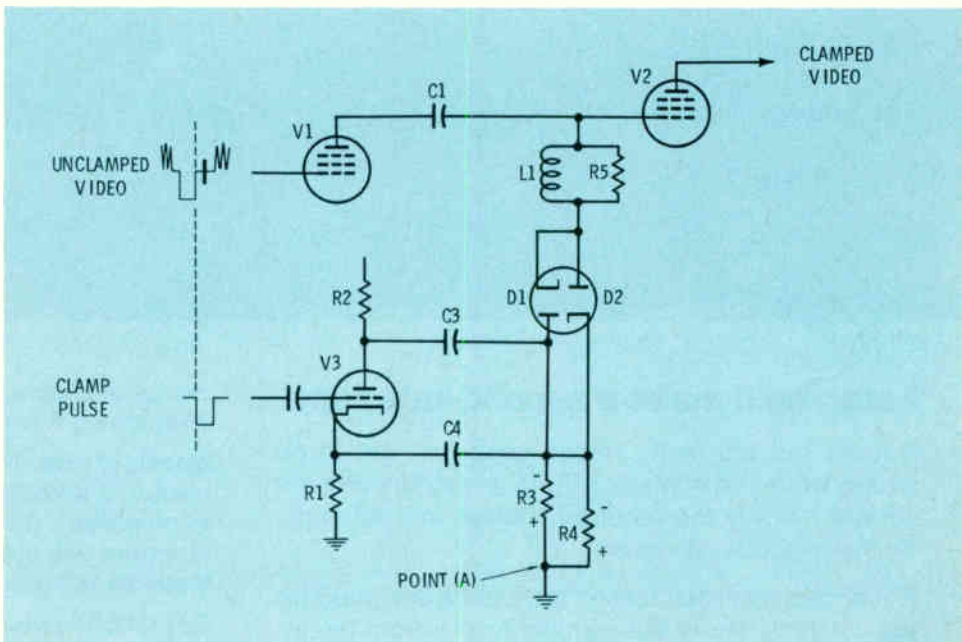
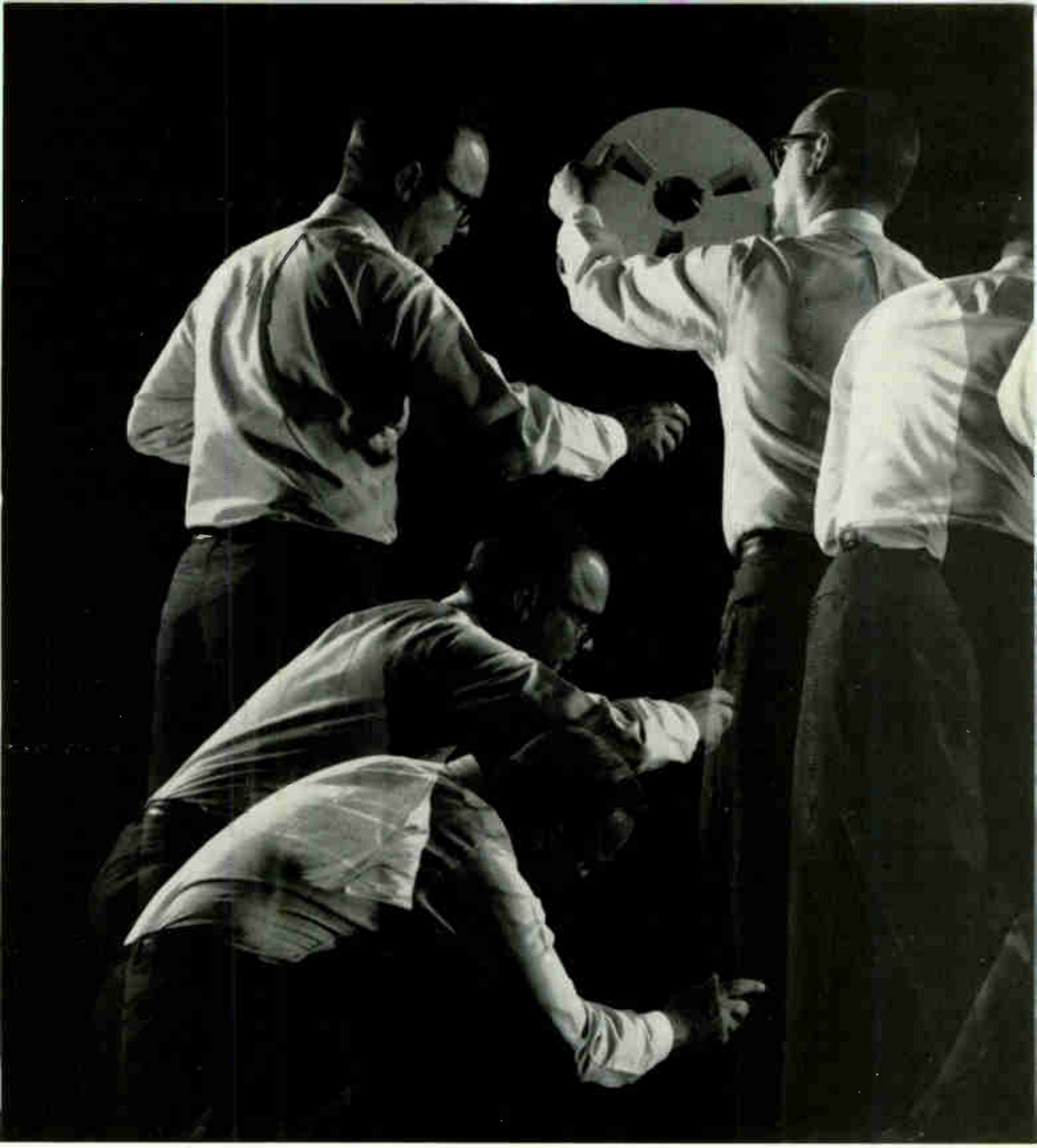


Figure 4



Later, he'll make a second-rate tape.

But it's not his fault. Things have just got to go wrong when the controls for any given function are spread all over the recorder. Delays and retaping. Or make-goods. Or worse.

But a tape recorder doesn't have to be designed for the convenience of the manufacturer—from the inside out. At RCA it's got to be designed strictly for the convenience of the user—from the outside in—for absolute simplicity of operation and maintenance. A simple truth . . . but we seem to be the only ones doing it that way.

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But what we're really talking about here is the clearly visible, unquestionable superiority of tapes made on the TR-70.

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To arrange it, call your RCA Field Man. Or write RCA Broadcast and Television Equipment, Bldg. 15-5, Camden, N. J. 08102.

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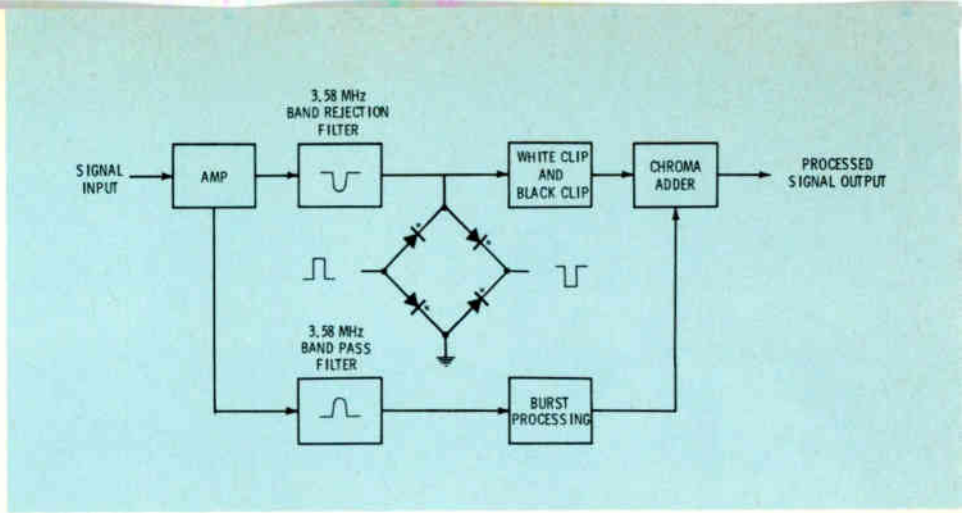


Figure 6

distorted by the clamping action because it is not present when the signal is clamped. (2) The color signal is left intact, but the clamping action is isolated from the burst. One approach was shown in Fig. 4, another is through the use of feedback clamp circuitry.

Separate Processing

A band rejection filter removes chroma and burst information around 3.58 MHz so that a luminance-only signal is acted upon by the clamping and processing circuitry where white and black clipping is performed (Fig. 6). A 3.58 MHz bandpass filter removes the luminance information from the chroma and burst which are later recombined with the processed luminance signal in the chroma adder. The function of the burst processing circuitry is to clean up the burst, and provide adjustments to vary its amplitude and phase with respect to chroma.

Separate processing allows "hard" clamping of the luminance signal. A bridge clamp is shown in Fig. 6; however, any of the other circuits discussed might be used. A feature of this method is that luminance whites and blacks may be clipped without clipping chroma which often exceeds peak white and peak black levels.

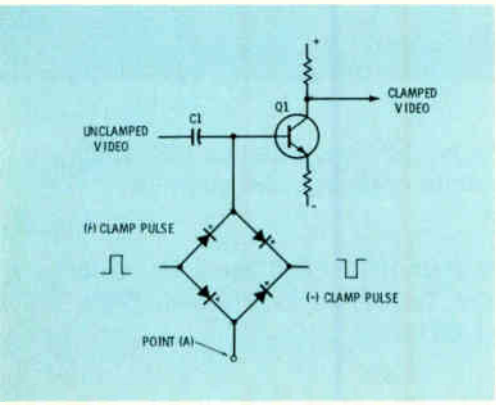


Figure 5

Feedback Clamp

The circuit in Fig. 7 produces a somewhat "softer" clamp action than the separate channel method just discussed. However, there is no need for the bandpass and band rejection filters. Even though clamping takes place during back porch time, burst is not affected because of the inherent isolation from the clamp action.

Video is applied to the base of common emitter stage Q1. Q1 is DC coupled to emitter follower Q2, which provides a low output impedence for driving Q3. Q3 samples the video signal during back porch time. Q4 saturates between clamp pulses because of the forward bias on its base and holds Q3 emitter positive with respect to its base, thus cutting off Q3. The negative clamp pulse cuts off Q4, which allows Q3 to be gated open for the duration of the clamp pulse. The voltage at Q3 collector is a series of pulses whose peak values are dependent on the DC value of the video signal at Q2 emitter during back porch time. These pulses become the bias for Q5. Between clamp pulses, C1 partially charges through R1.

During clamp time, C1 discharges through Q5 to a value determined by the amplitude of the pulse at its base. The average charge held by C1 is then dependent on the DC level of the back porch. The sawtooth voltage across C1, after filtering by R2 and C2, becomes the bias for Q6 which functions as a series regulator for the collector of video amplifier Q1. A negative feedback loop therefore exists, with the video being sampled during back porch time and the R2-C2 time constant exceeding one horizontal line. (Refer to Fig. 1B where the third line is black following two lines of white.) During the transition from white to black, the collector of Q1 will attempt to go more negative.

This will result in increased bias on the base of Q6, reducing its emitter to collector voltage and raising the collector voltage of Q1. The result is that the blacking level of the video signal at Q1 collector remains at a constant DC value regardless of picture content. And operations such as black clipping, white clipping, and sync level adjust may be performed at this point.

Clamp Pulse Generation

The simplified block diagram in Fig. 8A shows a conventional sync stripper providing composite sync to drive the clamp pulse generator. Two commonly used circuits for generating the pulse are shown. In Fig. 8B, positive sync is applied to the base of Q1, which is normally at cutoff. Between sync pulses, Q2 base is forward biased through R1 and the stage is saturated. The positive sync pulse arriving at Q1 base drives Q1 into saturation, charging C1 with the polarity shown. When the trailing edge of sync cuts off Q1, the charge on C1 quickly cuts off Q2 for a period determined by the time constant of R1 and C1. After C1 has discharged sufficiently, Q2 once again saturates.

The clamp pulse width is determined by the length of time that Q2 remains cutoff which is dependent on the values of R1 and C1. The clamp pulse should occur during back porch time because it is triggered by the trailing edge of sync.

Fig. 8C shows a different method of generating the clamp pulse. Positive sync is applied to Q1 base through differentiating network C1-

R1. The negative spike, which is coincident with the trailing edge of sync, cuts off normally saturated stage Q1. When Q1 collector voltage drops to zero, ringing circuit L1-C2 oscillates. CR1 stops the oscillation as it attempts to go in the negative direction so that a positive pulse is generated which is coincident with the back porch of sync.

The pulse duration is dependent on the resonant frequency of L1-C2. The half sine wave pulse is subsequently amplified and clipped to shorten the rise and fall times. During the vertical blanking interval, the trailing edges of the equalizing pulses will also generate clamp pulses as will the trailing edge of each vertical sync pulse. There is ample time between equalizing pulses and during the vertical pulse serrations to allow the 2 usec. pulse to clamp the signal at blanking level.

Inhibiting of the clamp pulse during the vertical interval is not required as would be the case if the clamp pulse duration exceeded that of the vertical serrations.

Other Clamp Circuits

Clamping of non-composite video is often found in color cameras ahead of the matrix networks—where the signal is always monochrome, whether it is in the green, red, blue, or mono channels. Clamping of this type of video is less complex than that of a composite color signal because of the absence of burst and sync. The entire blanking period may be utilized, and the clamp pulse may be of most any duration as long as it does not exceed that of horizontal blanking. In fact, horizontal blanking may be used as the clamp pulse, making separate clamp pulse generation unnecessary.

The transistor clamp (Fig. 3), and the bridge clamp (Fig. 5) are well suited for this purpose.

Waveform monitors require a special clamp circuit that does **not** remove baseline ripple. It is desirable to stabilize the blanking baseline so that the scope presentation does not move vertically with changes in video content. Any ripple or signal defects must not be removed, because, after all, that is the purpose of the waveform monitor—to see the signal as it is. ▲

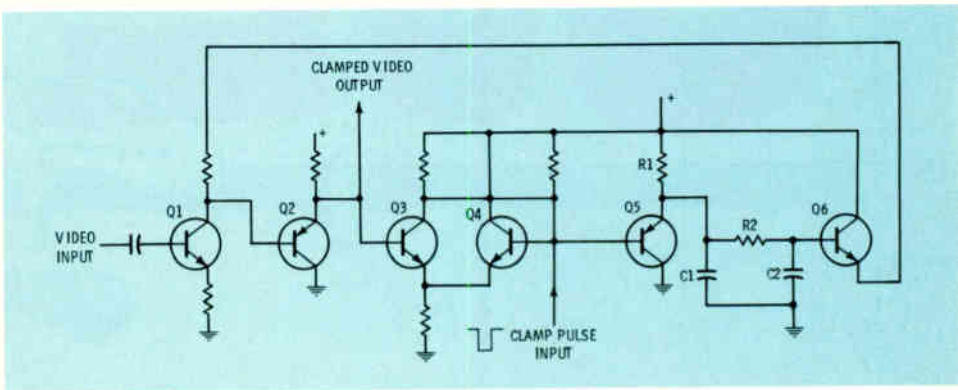


Figure 7

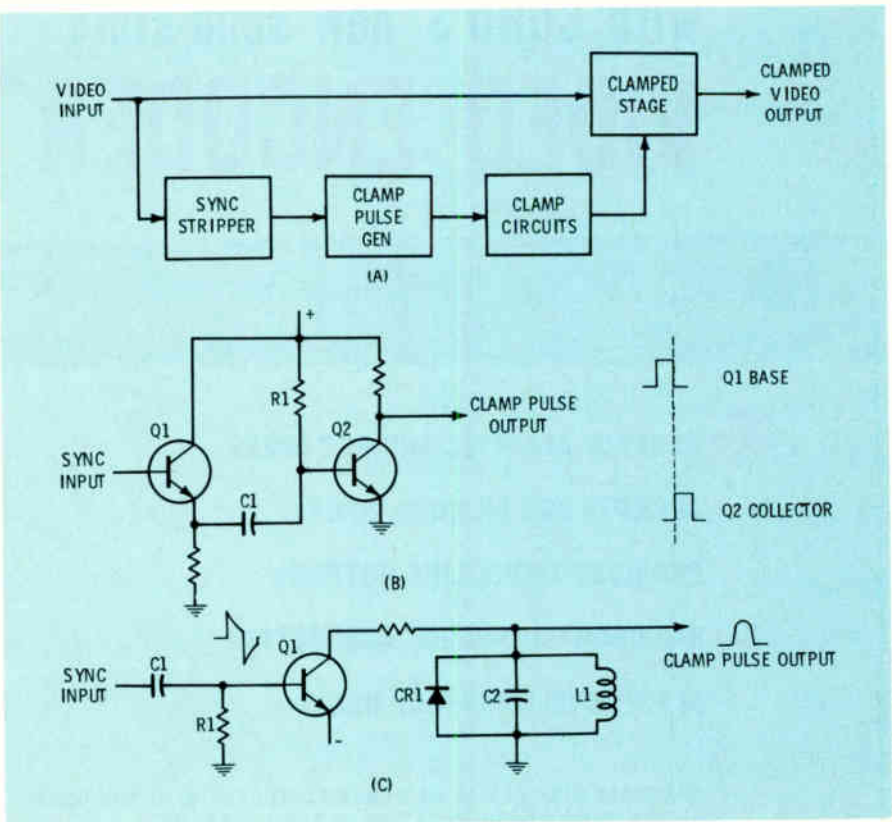


Figure 8

KOB AM, FM, TV: It all began in college

By Harry A. Etkin*

A great many things begin in college. And today there are many schools offering glancing blows at broadcasting, while a few are excelling. A look at school stations wouldn't excite many people, but perhaps this is so because we don't often recall the birthplace of some of our leading commercial stations.

On October 11, 1919, the Campus Radio Club was created at New Mexico State College in Las Cruces for the advancement of wireless radio telegraphy.

The station building housed a 500 watt marconi spark transmitter which broadcast time signals and weather reports. Fabrication and construction of a 50 watt CW transmitter began in 1920 and was licensed under the call letters 5XD. A commercial license was granted to KOB in April of 1922. Agreements were made with a phonograph company to furnish the latest hits in recorded music, and local newspapers supplied press releases. By December, a 500 watt CW transmitter was placed in operation.

In 1927 the foundation was laid for a new radio house to provide room for new motor generators. That same year the Federal Radio Commission granted KOB a temporary permit for 5000 watts with a requested increase of power for 10,000 watts. This power increase made KOB one of the six largest of 685 licensed stations in the nation.

KOB was considered by the college as a personal hobby and no allocation of funds was made. However, space was furnished and utilities paid.

*Consulting Engineer, Levittown, Pa.

It was in 1929 that several local merchants expressed an interest in advertising at rates which would sustain KOB operating costs. Three years later the college decided to transfer the station to Albuquerque to more adequately serve the whole state from a central location. At that time the station was managed by The Albuquerque Journal but owned by the New Mexico State College. This arrangement continued until 1936 when the college sold the station to the Albuquerque Broadcasting Company, and in 1937 the station joined the NBC network. Another achievement was KOB-TV, the first television station in the area in 1948.

KOB Television

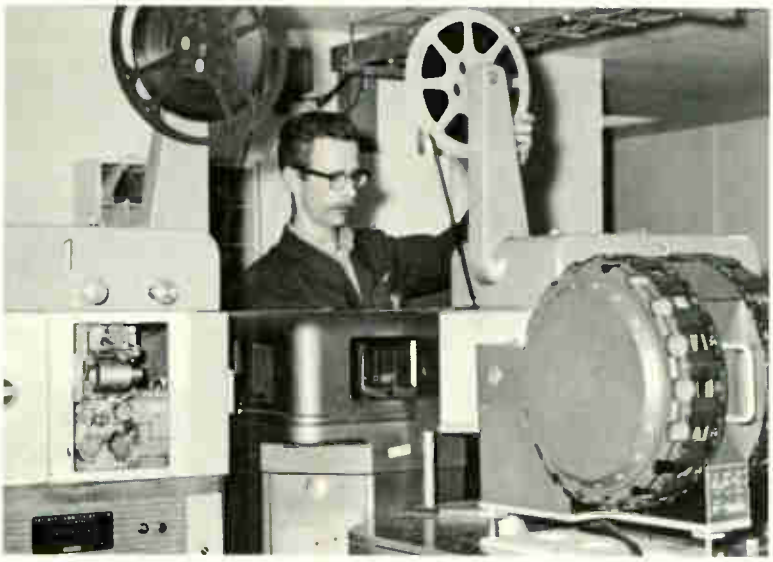
In 1948 when few in the nation were willing to make the necessary financial investment, the owners of KOB radio filed an application with the FCC for a permit to establish a television station in Albuquerque. The grant was obtained and KOB-TV telecast its first programs to the television viewers on September 13th of that year.

Network kinescopes brought many of the top shows to the Albuquerque market area, along with locally, originated shows, special events and sports coverage, which quickly increased the size of the viewing audience. KOB-TV followed its radio tradition by building a reputation for public service.

After take-over by Hubbard Broadcasting in 1957, the following ten years saw considerable investment to improve facilities for better programming and service. It was during this time that the station installed a new, modern transmitting plant on Sandia Crest, doubling the coverage.

New studio and plant facilities

Production director David Wilkins (foreground) and T. D. Austin at the studio controls of KOB-TV.



Studio technician Sam Tikkanen readies B&W film for the projection system.

Austin prepares video tape on one of several KOB-TV VTR's.

were required which completely converted the station with the addition of color cameras, color lighting, tape recorders and TV film equipment. No doubt, KOB's success over the years is due to the emphasis placed on modern techniques, equipment and public service.

Studio Additions

An ambitious achievement was realized in 1967 when the studio was remodeled and the plant enlarged. A new wing added 600 square feet to the building to permit complete conversion for full color operation. This made the KOB building the largest, most complete broadcasting facility in the state.

The addition houses a chemical mixing and analysis room for the recently acquired color processing equipment, expanded newsroom space, engineering shop quarters, art department, carpenter shop, talent dressing room and TV audio record center.

Advertisers are provided facilities in the conference room for viewing slides, film, video tape recordings, programs in progress, or for listening to AM, FM, or sound tape. New productions and master TV control centers are available so that production may proceed without interruption to on-air crews.

Color Facilities

The 45 by 60 foot main studio "A" shown has been completely converted to color operation using Colortran Sky Pan and Century Incandescent Lighting systems. Lighting has been increased to 300-400 foot candles in order to stop down to f/11. Seven monochrome cameras are used mainly for remote telecasts. Two RCA TK-42 fully transistorized color cameras have been acquired, and new sets and props have been created and designed.

The television news department can view, edit, and write copy for film shortly after return of the cameraman. This is possible because KOB has its own high speed processor, which is located near the chemical mixing and analysis room. A technician on the staff controls quality by frequent chemical analyses and densitometer readings. All filming is done in color; normally 30,000 feet of color film is processed each month.

The KOB-TV remote 34-foot mobile van houses four monochrome or two color cameras, a portable video tape recorder, and a complete director's console. A full technical crew is available to handle production of commercials on location or live remote telecasts. It is air-conditioned for all seasons and carries its own generator capable of supplying all power needed for equipment operation.

All locally produced programs, commercials and daily news programs are in color. Color-coordinated backdrops and props have been designed for use by advertisers, and there is a separate area for production control of tape recordings. Due to the large amount of local commercial production, KOB has won the Albuquerque Advertising Club Annual Award.

KOB-TV's staff produces commercials for American Furniture Company, Montgomery Ward, Richford, local RCA Dealers Association, Piggly Wiggly supermarkets

KOB-FM's circularly polarized antenna.

and Fred Harvey Western Division. The station offers its clients two full time staff copywriters, complete art department, both film and still photographers, engineering crew of 17 men and a nine man production crew. All KOB advertisers may utilize the station's promotion and merchandising department. It is organized to handle direct mail, transit, outdoor, on premise, dealer contests, sales incentive programs, in store and market survey work and specialized promotional activities tailored to suit the individual client's campaign.

Plant And Antenna

The KOB-TV transmitter and antenna are located atop 10,660 foot Sandia Crest, making it one of the highest transmitting sites in the world.

From the studio located in downtown Albuquerque, the TV signal is beamed via microwave, a distance of 15 miles to the Sandia Crest transmitter a TT-6 AL 6 kw TV transmitter combined with a gain of 6 superturnstile antenna provides 27 kW ERP of radiated power.

The TV tower is 175 feet high, making the total antenna height 10,835 feet. The average terrain is 4200 feet above sea level.

The transmitter building on Sandia Crest houses both transmitting equipment for TV, FM and living quarters for the engineers and technicians. The microwave receiving equipment is located at the highest part of the building. In addition to the TV tower there is a tower for the FM antenna. Both towers are built to withstand a wind velocity of 150 MPH, and a two-inch coating of ice.

Since the transmitter site is somewhat isolated and without water service, each shift of engineers brings with it 300 gallons of water to be put into a 6000 gallon tank. Two 6000 gallon tanks are for diesel fuel and one for water. The men are assigned work rotations of 48 hours first week, 48 hours second week, 72 hours third week and then the cycle is repeated.

There are two 100 kVA and one 50 kVA emergency power diesel generators included. These date back to the time when commercial power was not available and they powered the transmitting plant for five years.

Am, FM Facilities

Long a pioneer in AM, KOB added FM as a part of its expansion program. The FM facility has the transmitter, antenna and fully automated programming equipment located at Sandia Crest. The 50,000 watt AM transmitter is located in Alameda, which is near Albuquerque.

The main studios and control rooms for KOB radio are in the downtown Albuquerque Building. The main control room uses cartridge tape and turntable equipment to provide quality sound reproductions. A production room with patch panel arrangement can provide recording facilities for several network or local programs while feeding a remote broadcast at the same time.

Located in Alameda, the AM 50 kW type 5E RCA transmitter feeds a phased two-tower antenna system which operates omnidirectional during daylight and directional at night.

The transmitter exciter is a pioneer RCA-5C, a water cooled relic of the old days that still operates 24 hours daily, 7 days a week. This unit has been converted to a 10 kW unit by the addition of more water cooled tubes and power equipment.

KOB's 50 kW amplifier and modulator is an RCA 50 E. An outstanding feature of this unit is that a type 5671 tube in the final amplifier was installed in 1955 and is still operating with over 90,000 hours recorded at this writing.

To provide the listeners with compatible FM monophonic and stereophonic sound, KOB utilizes an RCA BTF-5E FM transmitter. Compatibility is required because the transmitted stereo signal must be capable of being received not only by the stereo FM receiver but by the existing monaural receivers as well. The FM transmitter combined with a circularly polarized antenna provides complete radiating patterns for better FM reception by all types of portable, auto, or home receivers.

For a number of years KOB-TV was the only television station between St. Louis and the West coast. In November, 1948 they began telecasting network programs. Growth of KOB has been matched by the area it serves. Albuquerque itself sets the pace as a dynamic metropolitan center.

Public service has been the keynote of KOB. Its long record of service, together with dedicated personnel, the finest of facilities, modern color equipment, places the station in a position to provide even better performance for its clients and viewers.

(The author is indebted to RCA Broadcast News and KOB Radio and Television whose cooperation in supplying photographs and information has made the foregoing article possible.) ▲

PEOPLE IN THE NEWS

Editor's note: Broadcast Engineering depends on the individual stations to send in news for this section and for News of the Industry. Send your copy to the editorial office, located at 1014 Wyandotte, Kansas City, Mo., 64105.

Angelo Vaccaro, vice president of Columbia Controls Research Corp., has received the 1968 Rietzke Achievement Award from **Mr. Lattie Upchurch,** president of Capitol Radio Engineering Institute, Home Study Division of McGraw-Hill Book Company. Five such awards are granted annually by the correspondence institute. The Rietzke Award, named for the founder of CREI, recognizes Vaccaro, "for his excellent study record and exceptional career progress in electronic engineering technology."

Prior to his immigration to the United States fifteen years ago, Vaccaro studied advanced electronics at the Italian Institute of Technology, in Rome. He has been with Columbia for thirteen years, and has several patents in electronics: (1) an electronic optical scanner that will detect flaws in film, paper and certain fabrics at speeds up to 1500 feet per minute in continuous web and sheet operation; (2) a magnetic character reader; (3) a special intercom telephone system; (4) an electrostatic web tension control unit used in the manufacture of carbon

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PEOPLE
IN THE NEWS

paper and carbon film products.

Abram E. Patlove, a cable television systems development expert, has been named executive vice president of International Telemeter Corporation. The CATV subsidiary of Gulf + Western is substantially increasing its penetration of the U.S. CATV market and exploring ways to offer additional services on the cable," **James J. Shaw,** G+W vice president, announced. "In line with these objectives, Patlove will provide direction to G+W's CATV franchise acquisition, development and operation programs."

Patlove has been active in the cable television industry for the past nine years, first with the Jerrold Corporation as systems development manager and most recently with Vikoa, Inc., as vice president of CATV operations. He is the author of numerous articles on CATV promotion and operation. In 1966, he received second prize in the national advertising competition sponsored by the National Cable Television Association and this year won first award in NCTA's national public relations competition.

Frederick Stevens, Northrup Corporation vice president and general manager of the company's Nortronics Division, has been named general chairman of the 1969 Winter Convention on Aerospace and Electronics Systems (WINCON) meeting slated for February 11-13, at the Biltmore Hotel, Los Angeles.

WINCON has become the West's leading forum for progress in areas of research and development vital to the nation's future needs. The 10th annual conference is designed to provide top aerospace, education and government managers a forum for exchange of ideas on current technical developments, problems and solutions.

Stevens, prominent in the field of inertial guidance and engineering management, joined Northrop in 1947 where he was one of the inventors of America's first successful intercontinental missile guidance system, the Mark I for the Snark missile. In his capacity as Nortronics general manager, he directs the engineering and production of many advanced, defense-priority projects in the fields of opto-mechanics, electronics and electro-mechanics.

A native of Burbank, Calif., Stevens received his bachelor's degree from Whitman College, and a M.S. from the California Institute of Technology in 1947.

Paul Ehrlich has been appointed News Director for WABC Radio, according to Vice President and General Manager **Don B. Curran.** Ehrlich has been with ABC since May, 1961.

He formerly served as a Network Radio News writer and operations man, until attached to local news in the spring of 1964. He was named WABC News Editor in the fall of 1966. Ehrlich also worked as Channel 7 free-lance reporter and spent a year with WNTA, Newark, in the news department.

Ehrlich has a B.A. in History from Harvard University, and an M.A. in International Politics from

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PEOPLE IN THE NEWS

Johns Hopkins. He has wide experience in the area of political reporting, having covered New York's John V. Lindsay since the fall of 1965 when Lindsay was still campaigning for the job. He was WABC's permanent City Hall reporter when WABC opened its City Hall Bureau in January of 1966.

Most recently Ehrlich covered both political conventions in Miami and Chicago exclusively for WABC. He has covered the 1968 campaign travels of both former Vice President Richard M. Nixon and Governor Nelson A. Rockefeller.

Dr. William J. Pickering, director, Jet Propulsion Lab, Pasadena, California, has been named to receive the Golden Omega Award of the Electrical Insulation Conference, which will be held in Los Angeles, December 9-12. The award recognizes his work in devising, developing and supervising significant space and satellite programs for military and civilian agencies of the government.

Dr. Pickering came from New Zealand to the U.S. where he took his degrees at Caltech, Pasadena, and worked with the famed Robert A. Millikan. Going into missile work as early as World War II, he was responsible for the development of early missiles such as CORPORAL and SERGEANT. Made Director of JPL in 1954, he headed a team with many successful satellite missions including the EXPLORERS, and in the sixties, the RANGER, MARRINER and SURVEYOR SERIES. He sits on various Defense Department panels, and is active with various university panels on astronautics. He is past president, American Institute of Aeronautics and Astronautics, and is a Fellow of the IEEE.

Robert Mott, executive director of the National Educational Radio Division of the National Association of Educational Broadcasters today presented an NER Certificate of

Recognition to **Morris Squire,** president, Forest Hospital Foundation, Des Plaines, Ill., for a radio series produced by the Foundation and selected for distribution by the National Educational Radio Network. The presentation was made at a luncheon meeting of the American Psychiatric Association which is holding its annual meeting here at the Mayflower Hotel.

The series attempts to inform laymen about the problems of mental illness. It is heard nationwide on more than 80 educational radio stations including outlets in all major urban areas of the country.

Arthur L. Freeman, Jr., director, has been promoted to assistant production manager at Kaiser Broadcasting's WKBF-TV Cleveland. Freeman was producer-director at KDKA-TV Pittsburgh and director at KSD-TV St. Louis. He is a member of Sigma Delta Chi, professional journalism fraternity, and Radio-TV News Directors Association. Freeman is a radio-TV graduate of Indiana University.

N. William Faun, engineering technician, has been promoted to engineering supervisor at Kaiser's WKBF-TV Cleveland. Previously, Faun was a senior engineer with WKTR-TV Kettering-Dayton and a studio supervisor for nine years with Avco's WLW-D, Dayton.

Bill Crawford, veteran television meteorologist, has died of cancer at the age of 51. Crawford was weatherman for The WFBM Stations from 1950 until he was initially stricken in 1964. During his early television career, Crawford attended Dental School at the Indianapolis Campus of Indiana University.

Crawford was a veteran of World War II and had served in the China-Burma Theatre as Executive Weather Officer. When he left service, he was Operations Officer for the Continental Weather Wing, which included all air force bases in the United States.

Crawford was among the first weathermen in television to receive the seal of approval from the American Meteorological Society. Just prior to his departure in 1964, a special survey revealed Crawford to be the most popular personality in

PEOPLE IN THE NEWS

Indianapolis television.

James B. Mathis has been appointed Commercial Manager of WFBM-TV, according to a recent announcement by Eldon Campbell, Vice-President and General Manager of the Indianapolis-based Time-Life stations.

Mathis had been Assistant Sales Manager since July of 1966. He has been with WFBM-TV since 1959. He is a native of Indianapolis and a graduate of Butler University. His previous broadcast experience was with WAJC-FM, Butler, Indiana, WASK and WFAM, Lafayette, Indiana.

Donald A. Littleton has been named transmitter engineering supervisor for the Kentucky Educational Television Network. In his new position Littleton will be responsible for 12 UHF transmitting facilities and interconnections throughout the state. His office will be in Lexington.

Donald A. Littleton

Prior to this position, he was the studio technical director for the Delaware Educational Television Network. He is an active member of the SMPTE.

William C. Hunter was named Director of Engineering for WHAS, Inc., Effective July 15, 1968. He succeeds **Orrin W. Towner,** who retired July 13 after 30 years with the Louisville stations.

Hunter was born and raised in Johnson City, Tenn., and has a Bachelor of Science degree, in physics, from East Tennessee State University. From 1951 to 1965, he was on the technical staff of WJHL AM-FM-TV, Johnson City. He was technical director there from 1958 until joining WHAS as assistant to the Director of Engineering in May, 1965. During that time, he supervised moves of both studios and transmitter for WJHL-TV.

At WHAS, Hunter has been involved with the plans for the just-completed facilities at 520 West Chestnut Street and the start of operations for WHAS-FM. He is a member of the Institute of Electrical and Electronics Engineers, the Society of Broadcast Engineers, and the Society of Motion Picture and Television Engineers.

William C. Miller has been appointed program coordinator at WPSX-TV, Division of Broadcasting, Continuing Education of The Pennsylvania State University. Miller was formerly the director of music at the State Correctional Institute at Rockview.

A native of Bellefonte, he attended Villanova University, graduating in 1952 with a Bachelor of Arts degree. He is also a veteran of the Korean War with three years' service as an officer in the U.S. Navy.

Miller has had a varied career in the performing arts which includes serving as director of music of St. John the Evangelist Catholic Church of Bellefonte, music consultant of the Catholic Diocese of Altoona-Johnstown, and choral director of the Johnstown Symphony for 1965-66.

The National Association of Broadcasters announced recently the designation of **Robert R. Pauley,** newly-elected President of the Mutual Broadcasting System, as the network's representative on NAB's Radio Board of Directors.

Pauley replaces **Matthew J. Culligan** who recently resigned as President of the Mutual network. A former president of the American Broadcasting Company Radio Network, Mr. Pauley previously served on the NAB Radio Board as the ABC representative.

Leonard R. Harris has been named chief engineer of Channel 51, WSMS-TV, it was announced by **Barney Kobres,** Channel 51 general manager. A native of Columbia, Tenn., Harris came to Channel 51 from WJKS-TV, Jacksonville, Fla. where he had been chief engineer.

C. D. "Derk" Zimmerman, program director WLM-TV, Cincinnati, joins Kaiser-Globe Broadcasting as program manager at WKBG-TV, Boston.

Before going to Avco, Zimmerman was producer-director at Westinghouse Broadcasting's KPIX TV, San Francisco and KDKA-TV, Pittsburgh where he developed the John Bartholomew Tucker and John Reed King shows. Earlier he was a producer-director at WEWS, Cleveland.

EIA SURVEY: Future Uses of Spectrum

Results of a survey undertaken by a subcommittee of the Joint Technical Advisory Committee of the Electronic Industries Association and the Institute of Electrical and Electronics Engineers on "Future Needs and Uses of the RF Spectrum" indicate that the spectrum cannot accommodate many industry-sponsored developments even without government activities included.

A report on the survey, begun in 1967, has been submitted to the Director of Telecommunications Management and Federal Communications Commission. Purpose of the survey was to determine the impact of new techniques and indicated requirements for spectrum allocations.

A recommendation of the subcommittee conducting the survey is the establishment of a spectrum engineering entity to serve FCC and DTM. This recommendation was also part of another JTAC subcommittee report entitled "Spectrum Engineering—The Key to Progress."

The survey on "Future Needs and Uses of the RF Spectrum" was sent to some 100 companies that had developments entailing prospective spectrum allocations. These companies returned more than 200 completed questionnaires. Following is the breakdown of replies (because of multiple or missing checks on the questionnaires, only the answer to question four adds to the total of 144 usable responses):

Will the new technology create:
(1) New services (68 Yes, 54 No)
(2) Improvement of existing services(s) (120 Yes, 37 No)
(3) Replacement of existing service(s) (46 Yes, 67 No)

Service(s) in question:
(1) Safety of life (44 Yes, 62 No)
(2) National defense (92 Yes, 30 No)
(3) Meeting a public need (96 Yes, 14 No)
(4) Meeting a private need (56 Yes, 58 No)

Do you foresee such service in the:
(1) Near term (less than about 5 years) (100 Yes, 22 No)
(2) Longer term (beyond about 5 years) (77 Yes, 4 No)

Is an exclusive assignment required:
(80 Yes, 59 No, 5 Qualified)

Is frequency selection based primarily on:
(1) Propagation characteristics (99 Yes, 32 No)
(2) Equipment considerations (79 Yes, 33 No)
(3) Other (49 Yes, 53 No)

Is spectrum allocation presently established:
(75 Yes, 53 No)

If not, to be established by:
FCC (56 Yes, 15 No)
IRAC (37 Yes, 28 No)
International regulation (35 Yes, 28 No)

NEW PRODUCTS

For further information about any item, circle the associated number on the Tech Data Card.

Sylvania Electric Products Inc. has developed a technique for stabilizing the beam of a carbon dioxide laser, making reliable laser communications between earth and satellites practical for the first time. Sylvania is a subsidiary of General Telephone & Electronics Corporation.

Dr. Burton J. McMurtry, Director of the Electro-Optics Organization of Sylvania Electronic Systems, an operating group of the company, said that by using a carbon dioxide laser Sylvania has achieved a significantly greater power output, possibly 50 times greater than other lasers used for optical transmission.

Space Communications

The combination of higher power, plus beam stability, make the new Sylvania laser transmitter ideally suited for space communications, according to Dr. McMurtry. Developed under a National Aeronautics and Space Adminstration contract, Sylvania has delivered a highly stabilized, 20-watt carbon dioxide laser transmitter to NASA. The device will be used by NASA to send a beam through a telescope to Echo II, a balloon-type satellite orbiting 1,100 miles above the earth. The telescope focuses the laser so that there is less spreading of the beam as it is projected through space.

Dr. McMurtry explained, "This 20-watt carbon dioxide laser transmitter was specially designed to produce a very stable, single frequency. The beam's stability allows transmission and reception of a signal with very little distortion. Most other lasers are poor signal carriers because they generate many fluctuating frequencies which garble the transmitted signal."

"A carbon dioxide laser produces the highest continuous power output of any laser, which makes it highly suitable for transmission over the great distances involved in space communications," Dr. McMurtry stated.

Sylvania's Electric-Optics Organization, which Dr. McMurtry heads, was established in December. It is the focal center for laser and electro-optical developments in General Telephone & Electronics Corporation.

Limiting Amplifier

True limiting without peak clipping is achieved in the new **Gates** M-6543 limiting amplifier with a 3 to 5 microsecond attack time. This eliminates several milliseconds of clipping found in most limiters while limiting action catches up; it also eliminates associated distortion.

(120)

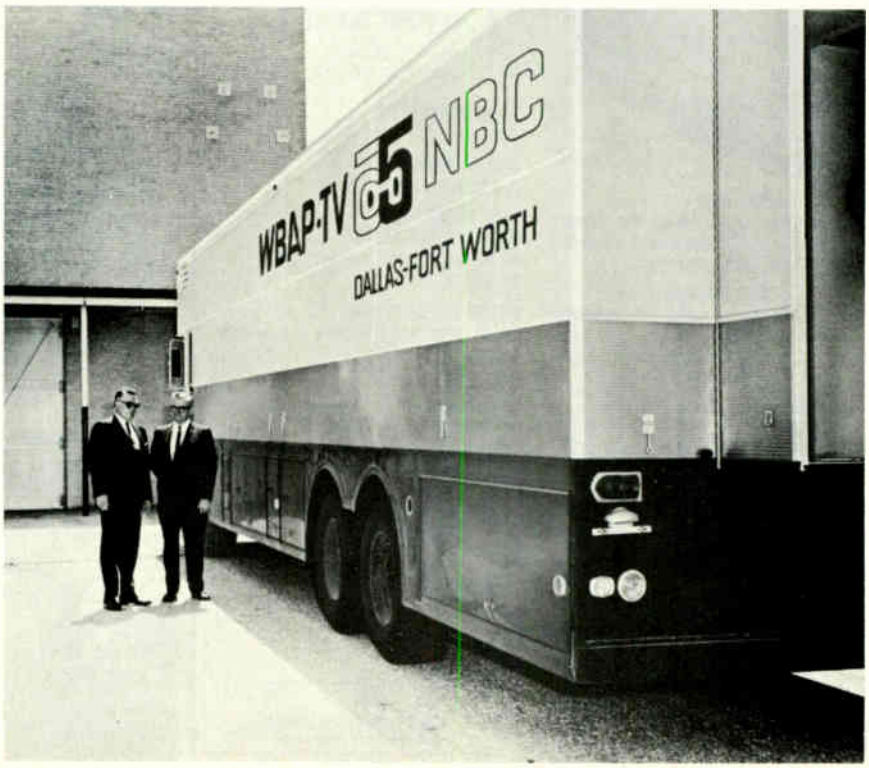
A choice of asymmetrical or symmetrical limiting is available for AM, FM, and TV operation. Asymmetrical limiting permits AM stations to run positive peak modulation levels of 110 to 120% with negative peak limited to 100%. According to Gates, distortion is typically 0.2% at 30 Hz and 0.3% at 16 kHz with 10 db of limiting, and it is less than 1.0% with up to 30 db of limiting. Frequency response remains uniform with or without limiting.

Fast attack time (in microseconds) and variable release time provide complete freedom from "thum-

Color TV Mobile Van

A Texas-style color TV bus has been delivered to WBAP-TV, Channel 5, Dallas-Fort Worth by **RCA Commercial Electronic Systems Division.** Shown with the 40-foot mobile TV unit are Robert M. Macrae (left), RCA Staff Vice President for the Southwestern Region, and Rupert Bogan, WBAP-TV Director of Engineering.

The bus is being equipped for operation this fall with a custom-built TS-40 switching system and two TR-70 high-band color TV recording systems, among other gear. It will carry up to six RCA color TV cameras and is capable of 65-mile-per-hour speeds in moving to the scene of a remote color pickup.



ping" with limiting of 15 to 30 db on most program content. A 30:1 compression ratio allows 99.5% negative AM modulation without overmodulation.

Only 3½" of standard rack space is required for the M-6543 limiter which has all operating controls located behind the front access panel.

Loop Tape Machine

Tapecaster TCM announces its new all silicon solid-state Series 700 professional broadcast-type continuous loop tape cartridge machines. According to Tapecaster, these units exceed NAB standards and offer considerable systems flexibility in the recording and reproduction of audio and digital information. The Series 700 units have been designed for applications in broadcasting, entertainment, automation, exhibiting, medical research, education, communications, and industrial fields.

As the laser-borne information is reflected off the satellite and returned to earth, a receiver attached to a telescope will recover the data. Scientists at NASA's Goddard Space Flight Center, Greenbelt, Md., will

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compare the transmitted and returned signals to determine the effects of the atmosphere on laser communications. This will be invaluable for the design of advanced space communications systems.

In addition to the information tracks on the tape, an auxiliary track is provided for the control and sequencing of the unit itself, other tape machines, slide projectors, lights, displays, or other equipment. The Series 700 machines are available in reproduce only, record reproduce, stereo, and delayed programming models.

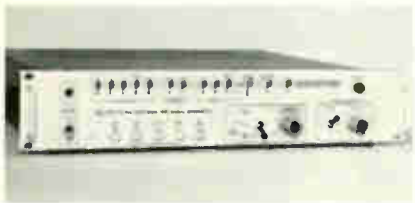
Test Signal Generator

Tektronix, Inc. has announced the availability of the Type 141 PAL television test signal generator, designed to provide high-quality television test signals for 625-line, 50-cycle field standard PAL color TV systems.

According to Tektronics, the all solid-state Type 141 utilizes digital integrated circuits to achieve the stability, accuracy and reliability expected of an instrument which generates test signals against which system performance can be evaluated.

Three operating models provide PAL color bars, a 5-step staircase with fixed Average Picture Level (APL), and the same staircase with variable APL. The color bar output is a full-field test signal appearing on every active line and consists of EBU 75% amplitude, 100% saturated color bars in descending luminance order, with white on the left and black on the right, PAL Color Burst with 4-field blanking sequence per CCIR specifications and composite sync blanking.

The staircase signal is keyed on during a selected line of the vertical blanking interval (line 11-22 on field 1, or line 324-335 on field 2) and is particularly useful with a Tektronix Type 520 PAL Vectorscope to measure differential phase, differential gain, and luminance channel linearity (with Tektronix video staircase differentiator part #015-0075-00). The last step (at white level) is double width for viewing with and without subcarrier to detect clipping in the white direction. Normal PAL color burst is provided on the stairstep and color bar signals. The complex 4-field burst blanking sequence during vertical interval is provided and may be switched off if desired.

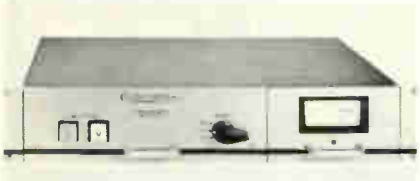


(122)

A 1-MHz reference signal which is frequency "locked" to the 4.4336-1875-MHz PAL subcarrier oscillator is provided at the rear of the instrument. The accuracy of the internal subcarrier oscillator may be conveniently verified by comparing the 1-MHz reference with known frequencies, such as the Droitwich 200-kHz radio transmissions in Europe.

Stereo Generator

A new solid-state stereo generator employing IC's is available now from **Moseley Associates, Inc.**, Santa Barbara, Calif. Although the generator is compatible with most direct FM exciters, the SCG-3T has been designed primarily for use with their new Model PCL-303/C single link stereo STL announced earlier this year.



(123)

Requiring only 3½" of standard rack space, the SRG-3T has a peak reading modulation meter, self-

Circle Item 51 on Tech Data Card →

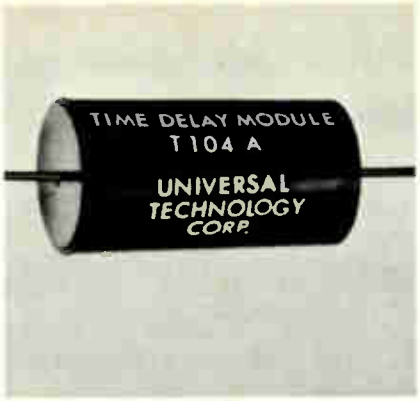
contained power supply and features excellent response, distortion and separation characteristics.

Time Delay Module

An electronic time delay module developed by **Universal Technology Corp.,** 107 New Street, Pittston. Penn., is a departure from the conventional concept of time delay relays. The new module, called the Series T, completely separates the timing circuit from the relay.

With the new Series T module, the circuit designer can often add time delay to his circuitry without adding the space required for relay. In most cases, the time delay module can be added without any modifications to the chassis or printed circuit layout. It can be wired into the circuit just like a capacitor or resistor. Because of its small size, the module will fit into almost any available space.

The Series T modules are all solid-state devices encapsulated and packaged in an epoxy case to give the ultimate in reliability and operating life. In spite of their inherent economy, the modules are compatible with circuits having the most demanding requirements on reliability and ultimate life. They are designed for use with most standard 12 or 24V DC relays drawing between 15 and 170 MA coil current.



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Portable Boom Stand

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A portable boom microphone stand, designed for all studio applications and easy transportability "on location," is now available from **Atlas Sound,** a division of **American Trading** and **Production Corporation.**

Porto-Boom Model BS-37 extends to a maximum of 18 feet, but is collapsible to seven feet for easy transportation by car. Maximum height extension is nine feet, collapsible to 5¼ feet. The Porto-Boom can be "knocked down" or reassembled in just a few minutes without tools. Atlas says all controls are noise-free, absolutely smooth in action and balanced for finger-tip control.

A unique feature of the Porto-Boom Model BS-37 is a 2-position, dual control microphone "gunning device," which rotates the mike through a 360 degree arc. This "gunning device" has an internal telescoping linkage which functions continuously at any boom extension.

A base guide handle is also standard equipment on the Porto-Boom. This offers the operator a positive means of moving the base on the large, 4-inch ball-bearing rubber casters.

All castings on the Porto-Boom are carefully machined, aircraft quality aluminum alloy. All tubular sections are of aluminum, electrochemically processed in "Alumilite" to prevent discoloration. The Porto-Boom weighs 73 pounds, this includes the 22-pound removeable counterweight.

Low-Light Camera

The STV-614 SEC television camera, especially designed to record transient events at very low-light levels, is available for commercial, industrial, scientific, and medical television applications.

Westinghouse says the SEC camera is more sensitive and has faster response (lower lag) than standard vidicons. It also has wide dynamic range, high signal-to-noise ratio, and fast response at low-light levels.

Small in size and designed to be extremely stable over long periods of time, the SEC camera provides

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essentially hands-off operation. The automatic gain control permits operation over light levels from 5 x 10^{-7} footcandles to 5 x 10^{2} footcandles—a total dynamic range of 20,000 to 1—with no manual adjustments necessary.

The camera features automatic light-level control, solid-state circuitry, field effect transistor, low noise preamplifier, card file circuitry mounting, low lag, low power consumption, broad spectral sensitivity, regulated power supplies, AFC pull-in range of 45 hertz to 70 hertz meeting American and European standards, portable generator outputs, transistorized sweep failure protection, and integrated circuit binary sync generator.

The STV-614 provides 450 line resolution (at a 525 line rate). Scan linearity are better than 2 percent. The camera is available with scan rates of 525, 625, or 405. A number of options like special lens adapters and rack-mounting control unit are available at no extra cost.

Video Switching System
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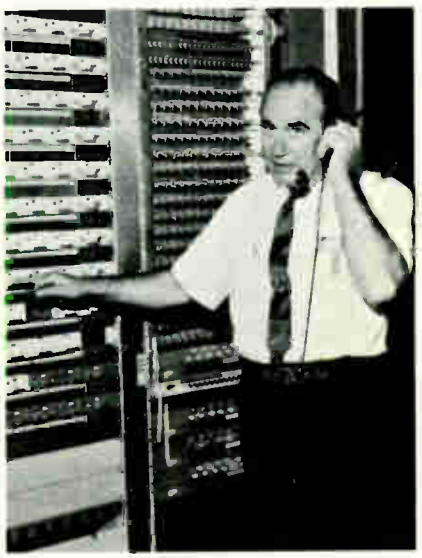
The completed installation of a network-type "Isolated Switching System" is announced by Curt Thielemann, Chief of Engineering Maintenance for **Acme Film & Videotape Laboratories.**

The system provides complete and rapid switching ability at each videotape recording machine, remote locations, and in the control room. It eliminates "patching" to distribute the signals and increases signal-to-noise ratio.

The entire system utilizes the latest electronic switches, relays, and integrated circuitry. It is a relay cross-circuit switching system that includes 360 four-double-contact-relays. Each is capable of interconnecting each signal source to every other one in the plant.

The system is similar to those used by the major networks. It originated with Marconi and the BCC in England—was developed further at Canada's CBC—improved even more at NBC in this country. Thielemann was formerly with CBC and NBC where he familiarized himself with this kind of a system.

According to Thielemann, the new installation used 6500 feet of color coax cable and 7200 feet of audio cable . . . and will improve the transmission of color signals in Acme's Videotape Laboratory. The distribution amplifiers for audio and video were redesigned for even truer reproduction of both sound and color.



A unique feature of the system is a "lock-out system" that gives the laboratory a capability of providing private viewing of audio alone . . . video alone . . . or special routing of any signals.

Switching Matrix

Trompeter Electronics, Inc. announces VHF and UHF switching matrices featuring a new stub cutoff design. Complete compatibility is maintained both in 50 ohm or 75 ohm configurations.

The built-in stub cutoff feature provides relatively low VSWR of 1.05 at 100MHz and less than 1.5:1 at 3 GHz. Crosstalk of better

than —90db at 3GHz and isolation better than —48db at 3GHz is realized with power-handling capability of up to 50 watts RF.

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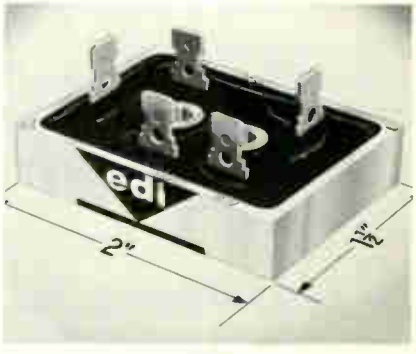
Additional design features include switchable parallel output connectors that permit on-site expansion to any additional number of crosspoints without performance degradation or reduced RF switching capability.

Remote control of the switching matrices can be performed by lighted pushbutton panels, pre-programmed sources or automatic computer outputs. Switch and matrix configurations available range from simple single-pole double-throw to complex 20 X 20 versions.

Silicon Bridge

A 50 to 1,000 PIV, 3 phase silicon rectifier bridge carrying 30 amps at 100° case temperature is the first in a new series designated PBT and available from **Electronic Devices, Inc.,** Yonkers, New York. Dimensions are 2″ x 1½″ x 1″, including terminal, with size and rugged construction making the PBT suitable for motor controls, computer power supplies, transistor circuitry and instrumentation.



(129)

The PBT is the latest develop-

NEW PRODUCTS

For further information about any item, circle the associated number on the Tech Data Card.

ment in the EDI "Minibridge" series featuring the new beam-lead "sandwich" construction. Replacing discrete diodes, the "sandwich" is mounted in an insulated metallic case to provide maximum thermal conductivity.

Stereo Console

Wilkinson Electronics, Inc., announces the introduction of a new solid-state console Model TACS-3 for stereo or dual channel operation. It features two high level inputs and four low level inputs to provide three stereo channels or six mono channels and incorporates high quality attenuators as faders, and each fader has a cue position. Wilkinson says less than ½% distortion is introduced at +8 dbm from 20 Hz to 20 KHz with frequency response of ±1 db from 20 Hz to 15 KHz.

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All channels can be switched to output A, output B, output A and B and off. The unit is 18" wide, 12¼" deep and 9¼" high and weighs approximately 20 lbs. Thus it can be used as a portable console for remote work or as a main console for automated stations. It also can be used for a production console since two programs can be produced simultaneously. ▲

TECHNICAL DATA

81. ACHESON COLLOIDS CO.—A 12-page brochure describes the company's full line of Emralon dry-film lubricants. The brochure is fully illustrated and includes specifications of the full product line plus application suggestions.

82. ALLIED RADIO—General catalog No. 280, "Electronics for Everyone" is now available on request from the company. The 536-page catalog presents the latest in major brands of high fidelity components and tape recorders, plus a multitude of TV, stereo equipment, and electronic products.

83. AMPEX CORP.—Specifications and uses of the Ampex CC-327 closed circuit studio television camera are described in a brochure, available from Ampex Corp. Also, a guide to pre-recorded video tape libraries has recently been made available.

84. B and K INSTRUMENTS, INC.—The new B and K Model 123 Graphic Spectrum Shaper is presented in an 8-page bulletin just released.

85. BOSTON INSULATED WIRE—A new brochure describes Silicone High Voltage cables, including all variations on cores, shields and jackets.

86. CBS LABS—A 4-page brochure tells about the Audimax III solid-state automatic level control. Also, Model 600 wide range program monitor is featured. Specifications are given for both items.

87. COHU—Seven major accessories for broadcast television are covered in a five-unit series of technical data sheets (2610 Series). Specifications

and photos are included for the black burst generator, dot-bar generator, color bar generator and color bar encoder, chroma detector, drive generator and colorlock.

88. **DAVEN**—Precision R.F. attenuators and special devices are the subject of a 16-page catalog just released. The catalog describes and illustrates devices that operate over the frequency range to 500 MHz and higher. R.F. attenuators covered include: rotary; miniature rotary (single, dual); multi-dial assemblies; precision coaxial multi-dial rotary; fixed pad; remote programmable; high impedance step; electronic attenuator and switch.
89. **DICKSON ELECTRONICS CORP.**—A new and revised product literature binder insert covers chip zener diodes and assemblies, Z Series solid tantalum capacitors, and Dickson reference amplifier.
90. **ELCO**—A wide range of low-cost rack-and-panel connectors are described in a 28-page booklet. An illustrated connector index, which shows basic characteristics of each connector, permits immediate identification of the connector best suited for the application.
91. **ENDEVCO LABS**—Operating characteristics and capabilities of a new broad line of Pixie Transducers, designed for low-cost physical measurements, are described in a 4-page brochure and application notes.
92. **HIPOTRONICS INC.**—A 4-page, 2-color brochure is now available which explains the use of the series resonant principal in AC dielectric testing. The brochure stresses the inherent safety and simplicity of operation and details the manner in which the disadvantages of typical regulator/transformers, especially the high power demands, are overcome by means of a variable inductor design which is a complete design departure from conventional equipment.
93. **INTEGRATED CIRCUIT ELECTRONICS, INC.**—The company announces a new catalog describing the comprehensive line of numerical displays, counters, memories, tubes and accessories. The 6-page brochure provides complete specifications, line drawings and complete ordering information and pricing.
94. **I-TEL, INC.**—The company's R and D Division has developed new products which are described in a 4-page catalog, No. 1929-22. Three new basic groups of products are introduced: "New Filters," "Ferrimagnetic Components" and "Microwave Components."
95. **IT&T**—To assist in the selection of coaxial cables and CATV cables for specific electronic applications, a new catalog has been announced by the **Wire** and **Cable Division** of ITT. The 16-page catalog details the design considerations, conductor selection, and properties of dielectric in-

sulating materials. An RG/U table illustrates all the cable constructions and gives used military and governmental wire specifications.

96. **INTERNATIONAL INSTRUMENTS**—New control products literature has been revised, updated and repackaged on electronic control meters, electronic pyrometer/controllers, and their associated power supplies, signal-output modules, and accessories. Comprising seven individual bulletins in all, the new literature can be obtained complete in file folder Bulletin 403, 20 pages. Each bulletin is complete, containing operating principles, specifications, application data and dimension drawings on the products covered.

97. **INTEGRATED CIRCUIT ELECTRONICS, INC.**—A new data sheet completely describes the company's Module, Model CS-100. CS-100 features include; interchangeability, compact arrays, high speed and reliability with TTL monolithic integrated circuits and high output drive which sinks a full 16 MA.

98. **JONARD INDUSTRIES**—Catalog 200A, 24 pages, has been printed. Included are: over 500 various spring adjusters, gauges, burnishers and miscellaneous precision hand tools, essential for telephone, relays, central office equipment, precision instruments and business machines. Illustrations, detailed drawings with dimensions and specifications are provided.

99. **JULIE RESEARCH LABS, INC.**—Modern DC techniques and instrumentation for production, test and calibration, including manual and automated operation are covered in detail in the latest catalog from Julie. The 16-page brochure features detailed descriptions and specifications of a wide range of instruments, systems and components utilizing Julie's Ratiometric techniques, a unique ratio concept for measuring and controlling DC resistance, voltage, current and ratio with accuracies of the order of a few parts-per-million.

100. **KURMAN INSTRUMENTS**—A new comprehensive illustrated catalog of relays is now offered by the company. The 28-page catalog includes all the in-stock and standard relays available from its extensive general purpose, sensitive and military lines. Styles, tables and dimensional drawings are included.

101. **METROPOLITAN SUPPLY CO.**—An extensive electronic tube purchasing directory has been published by the company.

102. **NATIONAL SEMICONDUCTOR CORP.**—Now available from National Semiconductor is an application note on the MM420/MM520, a 256 bit serial character generator. Operation and general applications are described.

103. **OHMITE MFG. CO.**—Catalog 750 was recently released which describes unique features of Ohmite SSA solid-state relays, such as inherent contact isolation and universal operating voltage range. Also included are electrical and mechanical specifications.

104. **POWER/MATE CORP.**—A new 16-page, 2-color General Catalog describes the company's broad line of regulated power supply modules. Listed are specifications of thousands of models with outputs from 0 to 400 volts, 50MA to 25 amperes. The back pages present mechanical data, connections, output impedance, options, accessories and a complete price listing.

105. **ROME CABLE**—The selection, installation and maintenance of electrical mining cables is the topic of a new manual, Rome Mining Cables, published by Rome Cable. The publication is designed to aid engineers involved in specifying and purchasing electrical mining cable. Containing 98 pages, the heavily illustrated manual describes a wide vari-

ety of electrical mining cable and discusses their installation. More than 50 charts, diagrams and specifications make the publication an important reference source.

106. SIMPSON ELECTRIC CO.—A new line of precision industrial instruments is shown in their recently released 12-page illustrated catalog. Quoted are prices and specifications of Simpson's new solid-state digital equipment, including a VOM, and a new electronic counter.

107. SAN FERNANDO ELECTRIC MFG. CO.—Operating characteristics of West-Cap Polycarbonate Capacitors for application in Precision RC Circuits, High Q Tuned Circuits, A.C. Circuitry or Capacitance Standards are detailed in a 12-page brochure. Features highlighted are: operating temperature, low dielectric absorption, low temperature coefficient over wide temperature range, excellent capacitance stability over wide frequency range. Also included are three charts showing capacitance change, insulation resistance and dissipation factor versus temperature.

108. SCAM INSTRUMENT CORP.—A new bulletin describes accessories for the Panagard continuous temperature monitor. The 6-page fold-out brochure contains drawings and specifications of resistance temperature detectors (RTD) used as sensors for Panagard devices. The booklet details mounting equipment and diagrams typical industrial and commercial installations.

109. SEALECTRO CORP.—Technical data and applications information on Sealectro's subminiature ConheXR, and MicroheXR R.F. connectors are contained in a new 12-page product handbook. Also included are information on Press-Fit[R] Teflon-insulated terminals and circuit hardware, Sealectroboard™ and Sealectroswitch™ programming boards and switches and Sealectrocard™ state-of-the-art card readers.

110. SODECO—Bulletin No. 371 contains complete technical information on the Sodeco line of printing impulse counters. Complete specifications, model designations, readout and drum options, and basic element availability are provided.

111. SPRAGUE ELECTRIC CO. A revised, comprehensive engineering bulletin on subminiature Vitamin Q® and stabilized wax metal-clad paper capacitors is now available. Engineering Bulletin No. 2110C includes in its 24 pages, complete standard ratings, performance characteristics and size information. In addition, a double-spread monogram for determining AC ratings is included.

112. TELEMATION INC.—A new brochure describes features of the new TeleMation TMC-2100 vidicon camera. A separate sheet details specifications.

113. TPI—The method of use and specifications for the three TPI Converters of TPI are described in a new brochure now available.

114. TENOR CO., INC.—Announcement has been made of a 6-page bulletin on a new economical stepping drum programmer, designed to meet the requirements of original equipmanufacturers and system builders. The bulletin, on the new Model 250, explains how an OEM or system builder can purchase the basic stepping drum system and specify with it the types of switches, drives, and other accessories necessary to tailor the programmer to a particular application.

115. 3-M CO.—A complete how-to-do-it guide for television videotape production is now available to audio-visual directors and educators from 3M. The 42-page, illustrated book called the Producers Manual is being offered by the Magnetic Products division. The book takes the reader through each step from the planning of the television facility itself to the handling of the finished tape. A complete glossary of terms used in television videotape production is included.

" WHAT DO YOU MEAN - 'YOU'VE HOOKED IT UP WITH LOS VEGAS' ?!!"

Advertisers' Index

Industry Calendar

Nov. 10-15. Society of Motion Picture and Television Engineers will hold their 104th technical conference at the l'Enfant Plaza Communications Center in Washington, D.C.

Nov. 11-15. The Illinois Institute of Technology and the IIT Research Institute will sponsor the 14th annual Holm seminar. It will deal with electrical contact phenomena and will be held in the Sherman House in Chicago.

Nov. 19. Deadline for filing replies on the FCC's proposed rulemaking that would permit stations licensed in the community antenna relay service to transmit program material originated by CATV systems.

Nov. 19-22. The 44th annual convention of the National Association of Educational Broadcasters. Will feature ghetto coverage and chairman of the Corporation for Public Broadcasting. Will be held in the Sheraton-Park Hotel in Washington, D.C.

Nov. 19-23. National convention of the Radio and Television News Directors Association will be held in the Beverly-Hilton in Beverly Hills, Calif.

Nov. 22. Kansas Association of Radio Broadcasters autumn managers seminar at the Ramada Inn in Manhattan, Kansas.

Dec. 9. Latest deadline for filing of comments on the FCC's proposed rulemaking on television programs produced by non-network suppliers and not made available to certain television stations.

Dec. 16. The oral argument before the FCC concerning its proposed rulemaking to prohibit networks from owning or controlling more than 50 per cent of their non-news prime-time programming and to limit their taking part in syndication activities.

Jan. 16-18. The Florida CATV Association will meet at Marco Island.

Jan. 17. The Cable Television Association of New England will meet at the New Hampshire Highway Hotel in Concord, N.H.

Jan. 24-25. The Georgia Cable Television Association will hold its first annual convention in Macon, Ga.

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Help Wanted

RADIO AND TV Engineering openings with stations in every state East of the Mississippi. We want applicants who are under 35 years of age, who are willing to relocate for more money and greater opportunity. Openings exist for Chief Engineers with electrical engineering degrees, studio and transmitter maintenance engineers, video tape technicians and CATV chief technicians. Send resume in confidence to Nationwide Broadcast Personnel Consultants, 645 N. Michigan Avenue, Chicago, Illinois 60611. No fee to applicant. 11-68-tf

Experienced Television Engineers wanted for expanding mid-west station originating Big 10 Sports. Opportunity to advance to supervisory post. FCC first phone license required. $500.00 up depending on experience with VT, color, microwave, and transmitter maintenance. Send resume to: Broadcast Engineering, Dept. 223, 1014 Wyandotte St., Kansas City, Mo. 64105. 11-68-1t

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Transmitter-Studio Engineer needed with good maintenance background in both color and black and white operations. Some switching required. Good opportunity for advancement in near future. Salary based on experience and ability with overtime should gross 10K per year. G.E. Transmitter. RCA Color Film. GE. Live color. Contact Chief Engineer KLYD-TV Bakersfield, Calif. Permanent position. 11-68-1t

Wanted: Engineer, 1st class with two way radio experience, minimum two years; studio and transmitter maintenance experience, no DJ's. The man we want must be neat appearing, public relations oriented, efficient, sober and dependable!! Central California, Coastal area. Broadcast oriented Communications Co. Send resume, references, salary requirements to Service Manager, Broadcast Engineering, Dept. 224, 1014 Wyandotte, Kansas City, Mo. 64105. 11-68-1t

Senior Applications Engineer

With thorough knowledge of video distribution and switching equipment and experience in closed-circuit TV system layout. Broadcasting and CATV system experience also desirable. See us at Booth 49—NAEB convention, Washington, D. C.—or send your resume to: R. L. Paullus, Vice-President Marketing, DYNAIR ELECTRONICS, INC., 6360 Federal Blvd., San Diego, California 92114.

Employment Wanted

Supervisor mountain top TV, FM plant wishes to get off mountain. Have ten years TV FM broadcast transmitter experience. Married, 4 children will relocate a reasonable distance. Want Supervisor or asst. chief position. Broadcast Engineering, Dept. 225, 1014 Wyandotte, Kansas City, Mo. 64105. 11-68-1t

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EQUIPMENT FOR SALE

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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:

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TDA5 BALANCED/UNBALANCED VIDEO/PULSE DISTRIBUTION AMPLIFIER

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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:

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INTERNATIONAL NUCLEAR CORPORATION

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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:

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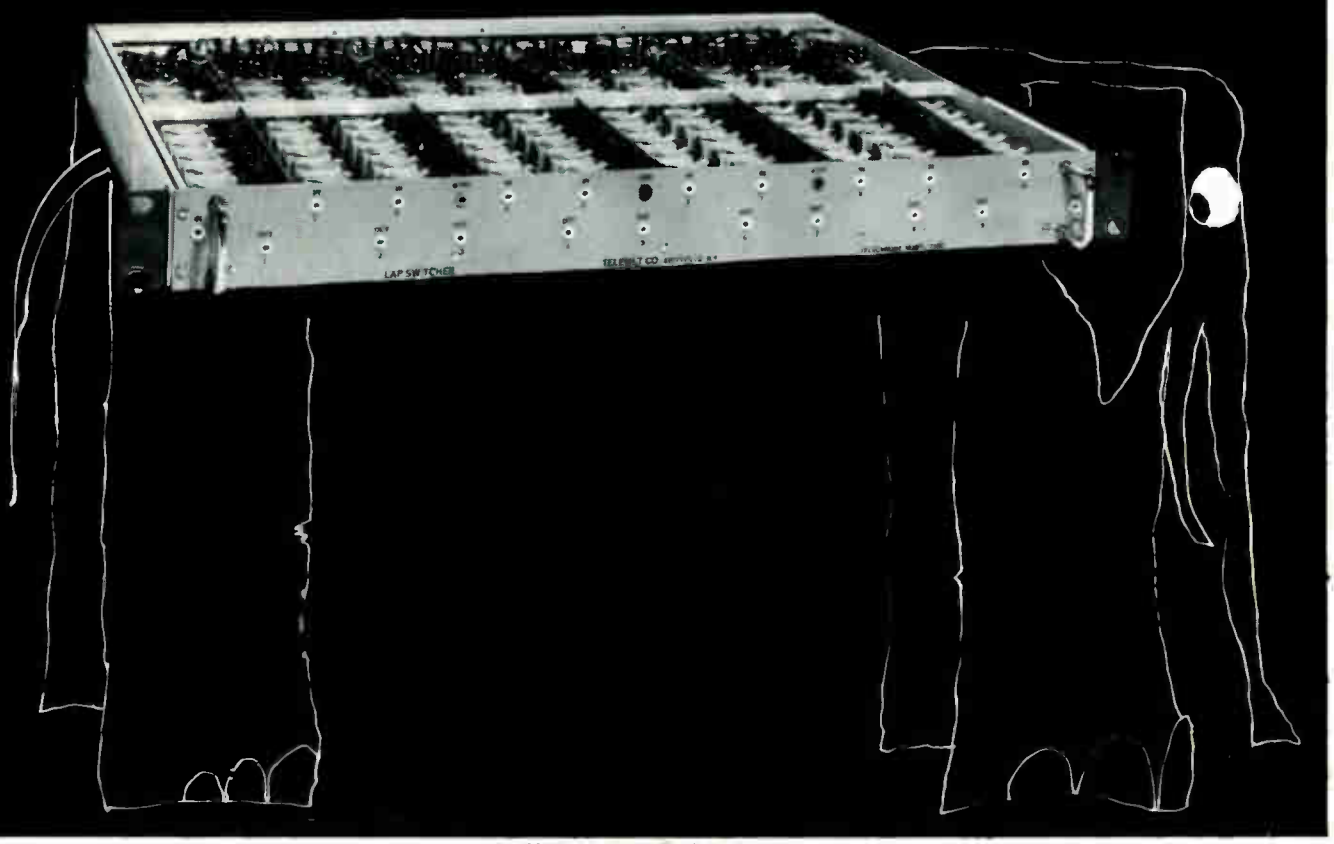

Circle Item 3 on Tech Data Card